UNISYS

TPC Benchmark™ H Full Disclosure Report

Unisys ES7000 Orion 440 Enterprise Server

using

Microsoft SQL Server 2005 Enterprise Itanium Edition

on

Microsoft Windows Server 2003 Datacenter Edition for Itanium-based Systems

November 2005

First Printing - November, 2005

Unisys believes that the information in this document is accurate as of the publication date. The information in this document is subject to change without notice. Unisys Corporation assumes no responsibility for any errors that may appear in this document.

The pricing information in this document is believed to reflect accurately the current prices as of the publication date. However, Unisys Corporation and Microsoft Corporation provide no warranty on the pricing information in this document.

Benchmark results are highly dependent upon workload, specific application requirements, and systems' design and implementation. Relative system performance will vary as a result of these and other factors. Therefore, TPC Benchmark™ H should not be used as a substitute for a specific customer application benchmark when critical capacity planning and/or product evaluation decisions are contemplated.

All performance data contained in this report was obtained in a rigorously controlled environment, and therefore results obtained in other operating environments may vary significantly. Unisys Corporation and Microsoft Corporation do not warrant or represent that a user can or will achieve similar performance expressed in composite query-per-hour ratings. No warranty of system performance or price/performance is expressed or implied with this document.

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Printed in USA, November 2005

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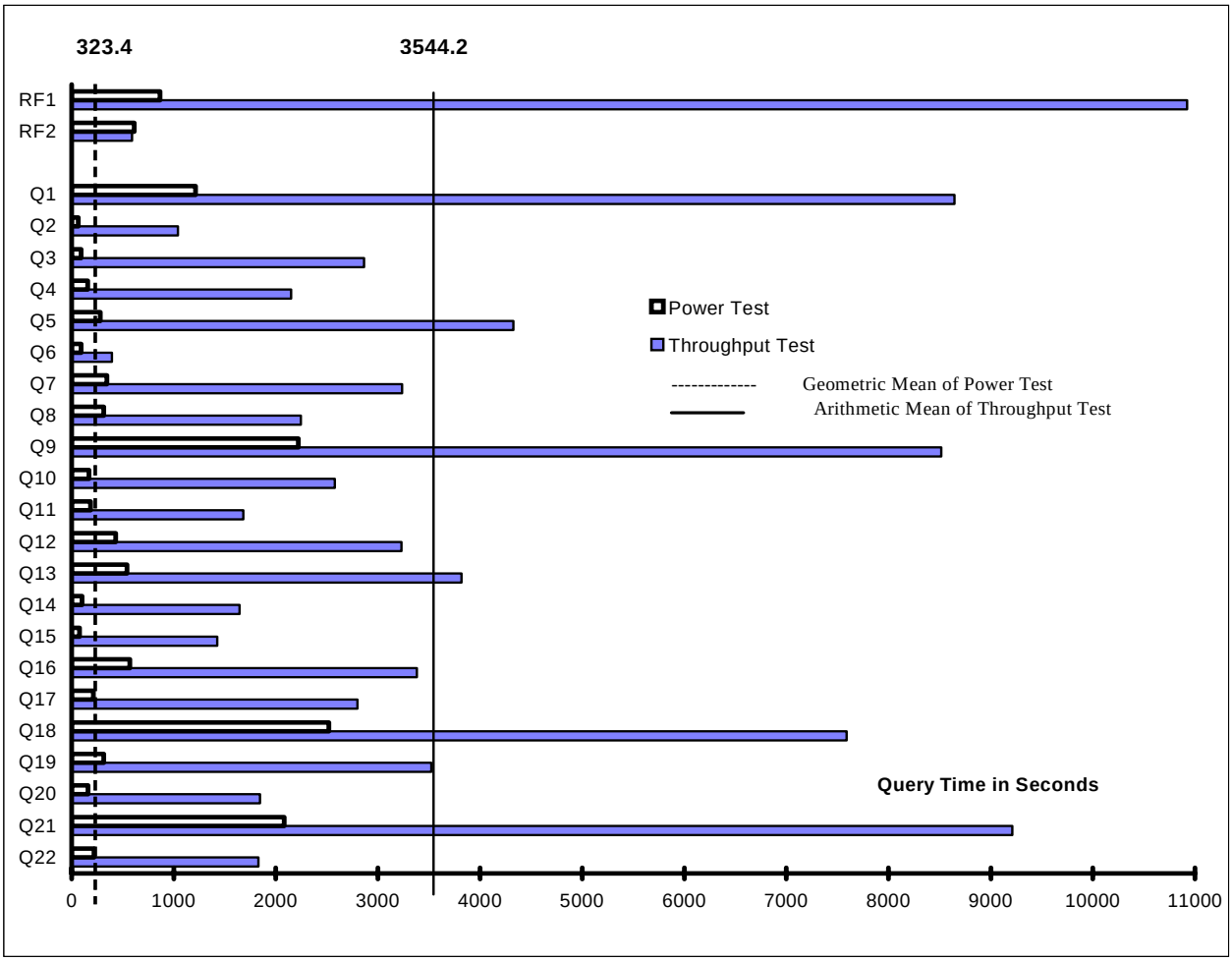
UNISYS	ES7000 Orion 440 Enterprise Server	TPC-H Rev. 2.3.0 Report Date November 16, 2005

Total System Cost	Composite Query per Hour Rating	Price Performance
$1,169,880 USD	26,246.1 QphH @ 3000GB	$44.58 / QphH @ 3000GB

Database Size	Database Manager	Operating System	Other Software	Availability Date
3000 GB*	Microsoft SQL Server 2005 Enterprise Itanium Edition	Microsoft Windows Server 2003, Datacenter Itanium Edition (SP1)	Microsoft Visual Studio .NET 2003	May 5, 2006 **



Database Load Time = 60:20:38 **Load included backup: Y** **Total Data Storage / Database Size = 8.13**
RAID (Base tables): N **RAID (Base tables and Auxilieary Data Structures): N** **RAID (All): N**

System Configuration		
Processors	32 x 1.6 GHz Intel® Itanium2™ with 6MB Level 3 Cache	
Memory	256 GB Main Memory	
Disk Controllers	33	PCI Fibre Channel
	1	PCI SCSI
Disk Drives	448	36GB FC 15Krpm
	98	73GB FC 15Krpm
	30	73GB FC 15Krpm
	2	36GB SCSI 15Krpm (boot media)
Total Disk Storage		24,398 GB

* Database size includes only raw data (eg, no temp, index, redundant storage space, etc.)

** All hardware available now

UNISYS

ES7000 Orion 440 Enterprise Server

TPC-H Rev. 2.3.0
TPC Pricing 1.0.1
Report Date
November 16, 2005

Description	Part Number	Price Source	Unit Price	Qty.	Extended Price	3-yr.Maint. Price
Server Hardware:						
SYS: ES7000-440, 32x 1.6GHz/6MB, 64GB Mem.	ES7440327-110	1	$399,952	1	$399,952	$13,968
1x RAID Controller, 2x 36GB Disk (boot media)	Included					
Sentinel System Management S/W and Media	Included					
36Ux19"x34" cabinet and skins	Included					
MEM: 32GB Memory Package, 16x 2GB DIMMs	MEM162-32G	1	$31,065	6	$186,390	
MOD: I/F, 2-Slot IO Module, 133MHz	MOD3133-PCI	1	$1,805	12	$21,660	
CTRL: Fibre Channel HBA, 2-Port, 64-bit PCI	FCH752323-PCX	1	$2,138	33	$70,554	
CTRL: Ethernet, 1000Mb, 1-Port Cu, PCI	ETH33312-PCX	1	$152	1	$152	
CBL: Ethernet, Cat5e, RJ45 Conn's, 4m	DSH600004-TBT	1	$19	1	$19	
I/F: Monitor, 17-inch LCD, Kybrd, Mse & Cable	ES70004-UIF	1	$665	1	$665	
			Server Subtotal		**$679,392**	**$13,968**
Storage Hardware:						
DISK: 73GB, 15Krpm, 2Gb FC	CXR7310-2GF	1	$827	30	$24,810	
CTRL: DPE, 2 RAID Cntrl, 1GB cache ea., 0 Disk	CX300-DPE	1	$13,300	1	$13,300	$1,404
RCK: DAE Storage Enclosure, FC 2Gb Optical I/F	CXP2-FD	1	$5,890	1	$5,890	
SYS MGT: Storage, Navisphere Manager	CXN300-WRK	1	$2,138	1	$2,138	$1,008
DISK: 3.0TB Pkg, 84x 36GB, 15Krpm FC *	JBD203615-P84	1	$36,086	6	$216,516	Spared
DISK: 6.0TB Pkg, 84x 73GB, 15Krpm FC *	JBD207315-P84	1	$63,503	1	$63,503	Spared
DISK: 1.0TB Pkg, 14x 73GB, 15Krpm FC *	JBD207315-P14	1	$14,772	1	$14,772	Spared
DISK: 73GB Drive, 15Krpm FC *	JBD207315-2F	1	$1,088	10	$10,880	Spared
RCK: Storage Enclosure, FC 2Gb Optcl/Optcl I/F	JBD2020-SA	1	$3,958	45	$178,110	$28,080
RCK: Rack Mount Kit, Disk Enclosure	JBD2001-RMK	1	$190	45	$8,550	
CBL: FC, Optical, LC->LC Conn's, 10m *	GCFAZLL10	3	$29	66	$1,914	Spared
PWR: Distribution Strip, 9-Plug, 220V	SFR9-PWR	1	$162	12	$1,944	
CBL: Power, U.S. (Domestic), C20 - L6-20P	USE1936-LC6	1	$86	12	$1,032	
CAB: 36U x 19" x 41" Open Front Cabinet	HRT361941-OFT	1	$1,425	4	$5,700	
			Storage Subtotal		**$549,059**	**$30,492**
Server Software:						
O/S: Windows Srvr 2003, DC Edtn., 32P, 1yr Lsub.	WND6432-TSP	1	$70,224	1	$70,224	$31,644
O/S: Windows Server 2003, DC Lmtd Sbscrptn, 1yr.	DUS200332-TSP	1	$6,346	2	$12,692	
APP: Microsoft SQL Srvr 2005 Ent. Itanium Edtn.	810-04793	2	$8,487	1	$8,487	** Inc. below
APP: Microsoft SQL Server 2005 Client License	359-01911	2	$156	55	$8,580	** Inc. below
ACC: Microsoft Visual Studio .Net 2003 Professional	659-00390	2	$799	1	$799	** Inc. below
SRVC: Microsoft Problem Resolution Services **		2	$245	1		$245
			Software Subtotal		**$100,782**	**$31,889**
Computer Resolutions Inc. 18% Volume Cash Discount (Ext.Price where Price Source=1)					($235,702)	
			Total USD		**$1,093,531**	**$76,349**

Notes:

1. * 10% or minimum 2 spares are added in place of onsite service.
2. HW & SW maintenance at 24 x 7 w/ 4 hr. max. respon 3 = GoCables
3. Price Source: 1 = CRI Product Price, Unisys Maintenance Price
   2 = Microsoft 3 = GoCables

Three Year Cost of Ownership: **$1,169,880** **USD**
QphH @ 3TB: **26,246.1**
$ / QphH@3TB: **$44.58** **USD**

Benchmark results and test methodology audited by Lorna Livingtree of Performance Metrics, Inc.

Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated components. Individually negotiated discounts are not permitted. Special prices based on assumption about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details, see the pricing sections of the TPC benchmarks specifications. If you find that the stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org. Thank You.

Numerical Quantities Summary

Measurement Results

Scale Factor	3000 GB
Total Data Storage / Database Size	8.13
Start of Database Load	11/4/2005 9:21:01
End of Database Load	11/6/2005 21:41:39
Database Load Time	60:20:38
Query Streams for Throughput Test	8
TPC-H Power	33,415.8
TPC-H Throughput	20,614.7
Composite Query per Hour Rating (QphH@3000GB)	26,246.1
Total System Price Over 3 Years	$1,169,880 USD
TPC-H Price Performance Metric	$44.58 USD

Measurement Intervals

Measurement Interval in Throughput Test (Ts)	92,206.0 seconds

Duration of Stream Execution:

	Seed	Query Start Date/Time Query End Date/Time	RF1 Start Date/Time RF1 End Date/Time	RF2 Start Date/Time RF2 End Date/Time	Duration
Stream 0	1106214139	11/8/05 7:18:35 11/8/05 10:45:01	11/8/05 7:04:09 11/8/05 7:18:35	11/8/05 10:45:02 11/8/05 10:55:17	03:51:08
Stream 1	1106214140	11/8/05 10:55:19 11/9/05 8:46:58	11/8/05 10:55:18 11/9/05 9:32:57	11/9/05 9:32:58 11/9/05 9:42:07	22:46:48
Stream 2	1106214141	11/8/05 10:55:20 11/9/05 9:14:43	11/9/05 9:42:11 11/9/05 9:55:35	11/9/05 9:55:37 11/9/05 10:04:32	23:09:13
Stream 3	1106214142	11/8/05 10:55:20 11/9/05 8:08:48	11/9/05 10:04:37 11/9/05 10:18:06	11/9/05 10:18:08 11/9/05 10:27:09	23:31:49
Stream 4	1106214143	11/8/05 10:55:21 11/9/05 8:45:47	11/9/05 10:27:15 11/9/05 10:40:56	11/9/05 10:40:58 11/9/05 10:50:10	23:54:50
Stream 5	1106214144	11/8/05 10:55:21 11/9/05 8:01:36	11/9/05 10:50:17 11/9/05 11:03:42	11/9/05 11:03:45 11/9/05 11:13:17	24:17:55
Stream 6	1106214145	11/8/05 10:55:22 11/9/05 8:38:05	11/9/05 11:13:26 11/9/05 11:28:04	11/9/05 11:28:07 11/9/05 11:38:32	24:43:09
Stream 7	1106214146	11/8/05 10:55:23 11/9/05 7:42:16	11/9/05 11:38:41 11/9/05 11:53:34	11/9/05 11:53:38 11/9/05 12:04:32	25:09:09
Stream 8	1106214147	11/8/05 10:55:24 11/9/05 9:21:00	11/9/05 12:05:01 11/9/05 12:20:25	11/9/05 12:20:30 11/9/05 12:32:04	25:36:40

TPC-H Timing Intervals (in seconds):

Query	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Stream 0	1215.4	66.0	93.4	156.7	280.0	92.6	346.5	316.5
Stream 1	7048.7	2017.9	1033.7	4629.9	2693.0	340.0	5137.3	2857.9
Stream 2	10043.5	728.7	1065.1	1995.7	3071.0	489.7	3508.1	2676.6
Stream 3	8193.4	248.7	5459.3	1449.2	7183.2	393.3	2896.8	980.6
Stream 4	8974.7	735.6	5974.7	3303.8	7135.7	287.9	1973.9	2592.3
Stream 5	9754.8	2060.4	2395.5	937.7	3329.5	495.1	4514.8	2596.6
Stream 6	10020.6	470.0	973.3	2088.0	3071.2	411.3	1808.8	2434.9
Stream 7	7778.3	1502.6	5170.4	1287.1	1907.6	405.5	1960.7	2059.8
Stream 8	7340.0	577.1	819.9	1493.2	6212.7	333.7	4096.6	1769.5
Min Qi	7048.7	248.7	819.9	937.7	1907.6	287.9	1808.8	980.6
Max Qi	10043.5	2060.4	5974.7	4629.9	7183.2	495.1	5137.3	2857.9
Avg Qi	8644.3	1042.6	2861.5	2148.1	4325.5	394.6	3237.1	2246.0
Query	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**
Stream 0	2221.9	168.7	183.0	433.6	544.8	103.6	79.4	572.0
Stream 1	14616.5	2732.7	1500.0	3262.3	4631.7	1076.4	1445.5	3170.8
Stream 2	6671.5	2331.4	1156.6	3194.3	3874.3	1035.8	798.5	2294.7
Stream 3	7534.3	2073.5	1190.3	2604.0	4087.6	2211.8	765.7	3255.0
Stream 4	7797.2	1014.0	1980.6	1842.4	2506.0	1857.9	4092.4	3235.5
Stream 5	6625.0	1500.1	2084.4	2277.0	5085.7	1215.1	716.2	2666.7
Stream 6	8727.6	7438.2	3166.5	3497.6	3499.4	2537.9	955.1	3994.0
Stream 7	7297.9	1453.0	2199.4	5161.1	3425.3	973.1	625.8	3298.4
Stream 8	8857.5	2091.8	176.1	4023.6	3430.6	2249.8	2005.0	5127.2
Min Qi	6625.0	1014.0	176.1	1842.4	2506.0	973.1	625.8	2294.7
Max Qi	14616.5	7438.2	3166.5	5161.1	5085.7	2537.9	4092.4	5127.2
Avg Qi	8515.9	2579.3	1681.7	3232.8	3817.6	1644.7	1425.5	3380.3
Query	**Q17**	**Q18**	**Q19**	**Q20**	**Q21**	**Q22**	**RF1**	**RF2**
Stream 0	213.9	2521.5	316.8	160.6	2080.8	218.1	866.0	614.9
Stream 1	1117.4	6987.8	2362.0	1318.0	6721.9	1997.4	81458.8	548.7
Stream 2	7081.0	9278.3	4822.2	1258.1	10566.4	2422.2	804.5	535.7
Stream 3	4679.9	6141.4	2847.8	2090.5	8036.2	2085.2	809.3	540.3
Stream 4	1236.2	6440.9	2265.5	2443.3	9484.9	1451.1	821.2	551.8
Stream 5	1885.5	10967.5	3481.5	1978.5	7321.5	2086.1	804.3	571.9
Stream 6	1536.9	7206.4	1502.2	2891.0	8579.6	1351.5	878.2	624.2
Stream 7	3665.8	6314.7	2429.2	1108.6	13650.2	1138.2	892.8	654.0
Stream 8	1176.4	7375.6	8480.2	1654.6	9340.6	2103.9	924.7	694.2
Min Qi	1117.4	6141.4	1502.2	1108.6	6721.9	1138.2	804.3	535.7
Max Qi	7081.0	10967.5	8480.2	2891.0	13650.2	2422.2	81458.8	694.2
Avg Qi	2797.4	7589.1	3523.8	1842.8	9212.7	1829.5	10924.2	590.1

PERFORMANCE METRICS INC.
TPC Certified Auditors

November 15 2005

Jerrold Buggert
Director of Modeling and Measurement
Unisys Corporation
25725 Jeronimo Road
Mission Viejo, CA 92691

I have verified the TPC Benchmark™ H for the following configuration:

Platform: ES7000-440 32x
Database Manager: Microsoft SQL Server 2005 Enterprise Edition (64bit)
Operating System: Microsoft Windows 2003 Server Datacenter Edition

CPU's	Memory	Total Disks	Qpph@ 3000GB	QthH@3000GB	QphH@3000GB
32 Intel Itanium2 @ 1.6 Ghz	256 GB	450 @ 36 GB 128 @ 73GB	**33,415.8**	**20,614.7**	**26,246.1**

In my opinion, these performance results were produced in compliance with the TPC requirements for the benchmark. The following attributes of the benchmark were given special attention:

- The database tables were defined with the proper columns, layout and sizes.
- The tested database was correctly scaled and populated for 3,000GB using DBGEN. The version of DBGEN was 2.1.1b.
- The qualification database layout was identical to the tested database except for the number and size of the files.
- The query text was verified to use only compliant variants and minor modifications.
- The executable query text was generated by QGEN and submitted through Microsoft's standard interactive interface. The version of QGEN was 1.3.0.

PO Box 984 Klamath CA, 95548-0984
(707) 482-0115 fax: (707) 482-0575

email: Lorna@PerfMetrics.com

- The validation of the query text against the qualification database produced compliant results.
- The refresh functions were properly implemented and executed the correct number of inserts and deletes.
- The load timing was properly measured and reported.
- The execution times were correctly measured and reported.
- The performance metrics were correctly computed and reported.
- The repeatability of the measurement was verified.
- The ACID properties were successfully demonstrated and verified.
- The system pricing was checked for major components and maintenance.
- The executive summary pages of the FDR were verified for accuracy.

Auditor's Notes:

None.

Sincerely,

Lorna Livingtree
Auditor

PO Box 984 Klamath CA, 95548
(707) 482-0523 fax: (707) 482-0575

email: LornaL@PerfMetrics.com

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399

Tel 425 882 8080
Fax 425 936 7329
http://www.microsoft.com/

Microsoft

October 24, 2005

Unisys Corporation
Bob Murphy
M/S 4683
PO Box 64942
St. Paul, MN 55113

Mr. Murphy:

Here is the information you requested regarding pricing for several Microsoft products to be used in conjunction with your TPC-H benchmark testing.

All pricing shown is in US Dollars ($).

Part Number	Description	Unit Price	Quantity	Price
810-04793	**SQL Server 2005 Enterprise Itanium Edition** *Server License with 25 CALs* *Discount Schedule: Open Program - No Level* *Unit Price reflects a 39% discount from the retail unit price of $13,969.*	$8,487	1	$8,487
359-01911	**SQL Server 2005 Client License** *Discount Schedule: Open Program - No Level* *Unit Price reflects a 4% discount from the retail unit price of $163.*	$156	55	$8,580
659-00390	**Visual Studio .Net 2003 Professional** *No Discount Applied*	$799	1	$799
N/A	**Microsoft Problem Resolution Services** *Professional Support* *(1 Incident)*	$245	1	$245

Some products may not be currently orderable but will be available through Microsoft's normal distribution channels by November 7, 2005.

Defect support is included in the purchase price. Additional support is available from Microsoft PSS on an incident by incident basis at $245 per call.

This quote is valid for the next 90 days.

If we can be of any further assistance, please contact Jamie Reding at (425) 703-0510 or jamiere@microsoft.com.

Reference ID: PHbomu0524100630.
Please include this Reference ID in any correspondence regarding this price quote.

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Fax: 203-384-0473
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SALES QUOTE

SQ-20730	Nov 02,2005

Customer	Contact	Ship To
UNISYS CORPORATION UNISYS CORPORATION 2470 HIGHCREST ROAD ROSEVILLE MN 55113 UNITED STATES		UNISYS CORPORATION UNISYS CORPORATION 2470 HIGHCREST ROAD ROSEVILLE MN 55113 UNITED STATES

Account	Terms	Due Date	Account Rep	Schedule Date
UNISYS-R	NET 30	Dec 02, 2005	John Palmieri	

Quotation	PO #	Reference	Ship VIA	Page	Printed
SQ-20730			UPS GROUND	1	11/10/05 15:53

L	Item	Description	Qty	Ship	Price	M	Discount	Amount
1		ES7000-440 SERVER						
2	ES7440327-110	ES7000-440, 32X 1.6GH/6MB, 64GB MEM	1		399952.00	EA		399952.00
3	MEM162-32G	MEM:16X2GB DIMMS, 32GB	6		31065.00	EA		186390.00
4	MOD3133-PCI	MOD: I/F, 2-PORT 1O MODUEL, 133 MHZ	12		1805.00	EA		21660.00
5	FCH752323-PCX	CTRL: FIBRE CHANNEL HBA, 2-PORT, 6 BIT	33		2138.00	EA		70554.00
6	ETH33312-PCX	LAN HW: GBIT ETH CPR	1		152.00	EA		152.00
7	DSH600004-TBT	CABLE:TW PAR 10BAST,4M	1		19.00	EA		19.00
8	ES70004-UIP	I/F: MONITOR, 17-INCH LDC, KYBRD, MSE	1		665.00	EA		665.00
9	WND6432-TSP	O/S: WINDOWS SRVR 2003, DATACENTER EDTN,	1		70224.00	EA		70224.00
10	DUS200332-TSP	O/S:WIN 2003 SRVR, DC LMID SBSCRPTN, 1YR	2		6346.00	EA		12692.00
11		Storage						
12	CXR7310-2GP	EMC DISK:73 GB, 10K DRIVE, FACT INSTAL	30		827.00	EA		24810.00
13	CX300-DPE	DPE:2RAID CNTRL, 1GB CACHE EA	1		13300.00	EA		13300.00
14	CXP2-FD	EMCDISK: CX DAE FC 2GB EXPANSION	1		5890.00	EA		5890.00
15	CXN300-WRK	SYS MGT: STORAGE, NAVISPHERE MANAGER	1		2138.00	EA		2138.00
16	JBD203615-P84	6 RACKS - 84 X 36GB 15K RPM	6		36086.00	EA		216516.00
17	JBD207315-P84	DISK: 6.0TB PKG , 84X 72GB, 15KRPM	1		63503.00	EA		63503.00
18	JBD207315-P14	DISK: 1.0TB PKG, 14X 72GB, 15KRPM	1		14772.00	EA		14772.00
19	JBD207315-2P	DISK: 73GB 15K RPM: 2 GB FC SCA	10		1088.00	EA		10880.00
20	JBD2020-SA	RCK, FC2GB STORAGE, OPTIACAL/OPTICAL I/F	45		3958.00	EA		178110.00
21	JBD2001-RMK	DISK:ENCLOSURE RACK MOUNT KIT FOR 36U RA	45		190.00	EA		8550.00
22	SFR9-PWR	ACC: 9-PLUG POWER STRIP	12		162.00	EA		1944.00
23	USE1936-LC6	PWR CORD:C20/NEMA L6-20P	12		86.00	EA		1032.00
24	HRT361941-OFT	ACC:36U 19X41 OPEN FRT CAB, HRT COLOR	4		1425.00	EA		5700.00
25								
26	DISCOUNT	DISCOUNT	1		-235702.00	EA		-235702.00
27		similiar configurations and						
28		quantities.						
29		Disks come with a 3 year						

	Page 1	
	SubTotal	1073751.00

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SALES QUOTE

SQ-20730	Nov 02,2005

Customer	Contact	Ship To
UNISYS CORPORATION UNISYS CORPORATION 2470 HIGHCREST ROAD ROSEVILLE MN 55113 UNITED STATES		UNISYS CORPORATION UNISYS CORPORATION 2470 HIGHCREST ROAD ROSEVILLE MN 55113 UNITED STATES

Account	Terms	Due Date	Account Rep	Schedule Date
UNISYS-R	NET 30	Dec 02, 2005	John Palmieri	

Quotation	PO #	Reference	Ship VIA	Page	Printed
SQ-20730			UPS GROUND	2	11/10/05 15:53

L	Item	Description	Qty	Ship	Price	M	Discount	Amount
30 31 32 33		return-to-factory warranty, 7 day replenishment. Quote valid for 90 days.						

Taxable	0.00
Tax	0.00
Exempt	1073751.00
Total	1073751.00
Paid	0.00
Tr Disc	0.00
Balance	1073751.00

Amount shown in
Rate :0.00 of

CAT 5e/6 Patch Cords
Cisco Type
Components
Computer Cables
Fiber Optics
Fibre Channel
Fire Wire
IEEE-488
Line Cords
Media Converters
SFP Transceivers
KVM Switches & Cables
Printer Cables
SCSI Cables
USB Cables

Multimode Duplex Fiber Optic Patch Cables

GoCables stocks an exceptional selection and inventory of Fiber Optic Patch Cables. We also offer customization on our fiber optic cables to any length you specify. Fiber Optic Patch Cables in Multimode are available in 50µm and 62.5µm. SC, ST, LC, FC, MT-RJ, E2000 and MU connectors have polished ceramic ferrules for precision and durability. The SC and LC Duplex Patch Cables come equipped with a clip to maintain polarity.

GCFAZLL

More Information>>

LC to LC - Multimode Duplex Fiber Optic Patch Cable. LC cables are avaliable in 50µ and 62.5µ (62.5 is Standard) and in *any cable length.*

The LC fiber optic connector interface is based on a 1.25mm ceramic ferrule and the familiar latching mechanism of the RJ-45 modular plug and jack. The LC connector is a small-form-factor connector that offers a port density equal to the modular jack

Available Lengths				Add to Cart
Part #	Cable Length	Unit Price	10 or more	
GCFAZLL01	1 m	26.42	19.82	
GCFAZLL02	2 m	27.68	20.76	
GCFAZLL03	3 m	28.94	21.71	
GCFAZLL05	5 m	31.46	23.60	
GCFAZLL10	10 m	37.76	28.32	
GCFAZLL15	15 m	44.06	33.05	
GCFAZLL20	20 m	50.36	37.77	
GCFAZLL25	25 m	56.66	42.50	
Custom Length Cable Pricing				Click Here

PREFACE

Document Overview

This report documents the methodology and results of the TPC Benchmark™ H (TPC-H) test conducted on the Unisys ES7000 Orion 440 using Microsoft SQL Server 2005 Enterprise Itanium Edition, in conformance with the requirements of the TPC Benchmark™H Standard Specification Revision 2.3. The tests documented in this report were sponsored by Unisys Corporation. The operating system used for the benchmark was Microsoft Windows Server 2003, Datacenter Edition for Itanium-based Systems with Service Pack 1.

The Transaction Processing Performance Council (TPC) developed the TPC-H Benchmark. The TPC Benchmark™ H Standard represents an effort by Unisys Corporation and other members of the Transaction Processing Performance Council (TPC) to create an industry-wide benchmark for evaluating the performance and price/performance of decision support systems, and to disseminate objective, verifiable performance data to the data processing industry.

A certified audit of these measurements and the reported results was performed by Lorna Livingtree of Performance Metrics Inc. (Klamath, CA). She has verified compliance with the relevant TPC Benchmark™ H specifications; audited the benchmark configuration, environment, and methodology used to produce and validate the test results; and audited the pricing model used to calculate the price/performance. The auditor's letter of attestation is attached to the Executive Summary and precedes this section.

TPC Benchmark™H Overview

The TPC Benchmark™H (TPC-H) is a decision support benchmark. It consists of a suite of business oriented ad-hoc queries and concurrent updates. The queries and the data populating the database have been chosen to have broad industry-wide relevance while maintaining a sufficient degree of ease of implementation. This benchmark illustrates decision support systems that:

- Examine large volumes of data;
- Execute queries with a high degree of complexity;
- Give answers to critical business questions.

TPC-H evaluates the performance of various decision support systems by the execution of sets of queries against a standard database under controlled conditions. The TPC-H queries:

- Give answers to real-world business questions;
- Simulate generated ad-hoc queries (e.g., via a point and click GUI interface);
- Are far more complex than most OLTP transactions;
- Include a rich breadth of operators and selectivity constraints;
- Generate intensive activity on the part of the database server component of the system under test;
- Are executed against a database complying to specific population and scaling requirements;
- Are implemented with constraints derived from staying closely synchronized with an on-line production database.

The TPC-H operations are modeled as follows:

- The database is continuously available 24 hours a day, 7 days a week, for ad-hoc queries from multiple end users and updates against all tables, except possibly during infrequent (e.g., once a month) maintenance sessions;
- The TPC-H database tracks, possibly with some delay, the state of the OLTP database through on-going updates which batch together a number of modifications impacting some part of the decision support database;
- Due to the world-wide nature of the business data stored in the TPC-H database, the queries and the updates may be executed against the database at any time, especially in relation to each other. In addition, this mix of queries and updates is subject to specific ACIDity requirements, since queries and updates may execute concurrently;
- To achieve the optimal compromise between performance and operational requirements the database administrator can set, once and for all, the locking levels and the concurrent scheduling rules for queries and updates.

The minimum database required to run the benchmark holds business data from 10,000 suppliers. It contains almost ten million rows representing a raw storage capacity of about 1 gigabyte. Compliant benchmark implementations may also use one of the larger permissible database populations (e.g., 3000 gigabytes), as defined in Clause 4.1.3.

The performance metric reported by TPC-H is called the TPC-H Composite Query-per-Hour Performance Metric (QphH@Size), and reflects multiple aspects of the capability of the system to process queries. These aspects include the selected database size against which the queries are executed, the query processing power when queries are submitted by a single stream, and the query throughput when queries are submitted by multiple concurrent users. The TPC-H Price/Performance metric is expressed as $/QphH@Size. To be compliant with the TPC-H standard, all references to TPC-H results for a given configuration must include all required reporting components. *The TPC believes that comparisons of TPC-H results measured against different database sizes are misleading and discourages such comparisons.*

The TPC-H database must be implemented using a commercially available database management system (DBMS) and the queries executed via an interface using dynamic SQL. The specification provides for variants of SQL, as implementers are not required to have implemented a specific SQL standard in full. TPC-H uses terminology and metrics that are similar to other benchmarks, originated by the TPC and others. Such similarity in terminology does not in any way imply that TPC-H results are comparable to other benchmarks. The only benchmark results comparable to TPC-H are other TPC-H results compliant with the same revision.

Despite the fact that this benchmark offers a rich environment representative of many decision support systems, this benchmark does not reflect the entire range of decision support requirements. In addition, the extent to which a customer can achieve the results reported by a vendor is highly dependent on how closely TPC-H approximates the customer application. The relative performance of systems derived from this benchmark does not necessarily hold for other workloads or environments. Extrapolations to any other environment are not recommended.

Benchmark results are highly dependent upon workload, specific application requirements, and systems design and implementation. Relative system performance will vary as a result of these and other factors. Therefore, TPC-H should not be used as a substitute for a specific customer application benchmarking when critical capacity planning and/or product evaluation decisions are contemplated.

Benchmark sponsors are permitted several possible system designs, provided that they adhere to the model described in Clause 6. A full disclosure report (FDR) of the implementation details, as specified in Clause 8, must be made available along with the reported results.

General Implementation Guidelines

The purpose of TPC benchmarks is to provide relevant, objective performance data to industry users. To achieve that purpose, TPC benchmark specifications require that benchmark tests be implemented with systems, products, technologies and pricing that:

- Are generally available to users;
- Are relevant to the market segment that the individual TPC benchmark models or represents (e.g. TPC-H models and represents complex, high data volume, decision support environments);
- Would plausibly be implemented by a significant number of users in the market segment the benchmark models or represents.

A Table of Contents follows after this page.

Related Product Information

The TPC Benchmark™ H Standard requires that test sponsors provide a Full Disclosure Report in addition to published results. You can obtain copies of the test results as well as additional copies of this full disclosure report by sending a request to the following address:

Unisys Corporation
TPC Benchmark Administrator, MS 4683
Systems Analysis Modeling & Measurement
PO Box 64942
Saint Paul, MN 55164-0942

End Table of Contents

[To omit Appendixes E, F and G, print only the first 111 pages.]

1. GENERAL ITEMS

1.1 Benchmark Sponsor

A statement identifying the benchmark sponsor(s) and other participating companies must be provided.

This TPC benchmark H was sponsored by Unisys Corporation. The benchmark test was developed by Microsoft and Unisys. The benchmark was conducted at Unisys in Roseville, Minnesota.

1.2 Parameter Settings

Settings must be provided for all customer-tunable parameters and options which have been changed from the defaults found in actual products, including but not limited to:

- *Data Base tuning options;*
- *Optimizer/Query execution options;*
- *Query Processing tool/language configuration parameters;*
- *Recovery/commit options;*
- *Consistency/locking options;*
- *Operating system and configuration parameters;*
- *Configuration parameters and options for any other software component incorporated into the pricing structure;*
- *Compiler optimization options.*

Comment 1: In the event that some parameters and options are set multiple times, it must be easily discernible by an interested reader when the parameter or option was modified and what new value it received each time.

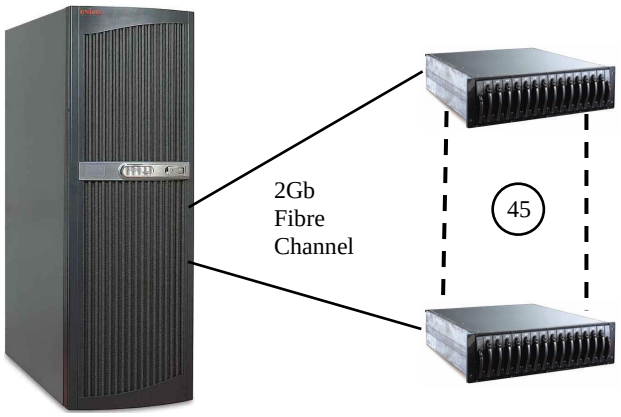
Comment 2: This requirement can be satisfied by providing a full list of all parameters and options, as long as all those that have been modified from their default values have been clearly identified and these parameters and options are only set once.

Details of system and database configurations and parameters are provided in Appendixes A and B.

1.3 Configuration Diagrams

Diagrams of both measured and priced configurations must be provided, accompanied by a description of the differences. This includes, but is not limited to:

- *Number and type of processors;*
- *Size of allocated memory, and any specific mapping/partitioning of memory unique to the test;*
- *Number and type of disk units (and controllers, if applicable);*
- *Number of channels or bus connections to disk units, including their protocol type;*
- *Number of LAN (e.g. Ethernet) connections, including routers, work stations, terminals, etc., that were physically used in the test or are incorporated into the pricing structure;*
- *Type and run-time execution location of software components (e.g., DBMS, query processing tools/languages, middle-ware components, software drivers, etc.).*



Server
ES7000 Orion 440
32 x 1.6GHz Intel® Itanium® 2
w/ 6MB L3 cache,
256 GB memory,
45 x PCI Fibre Channel cntrls,
1 x PCI 1Gb Ethernet cntrl.
1 x PCI SCSI RAID cntrl,
2 x 36GB SCSI disks (boot),
30 x 73GB SCSI disks (Log)

Storage
JBD2000
Database External Fibre
Channel disks:
448 x 36GB disks,
98 x 73GB disks

Figure 1.1 Priced Configuration for ES7000 Orion 440

The benchmarked system is identical to the priced system in all components, with the exception of storage used exclusively for flat files. 84 36GB disks, eight 72GB disks, and one PCI SCSI RAID controller were used exclusively for the flat files and were present on the benchmarked system. These disks and HBA did not hold any database data. See Appendix F for details
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2. CLAUSE 1: LOGICAL DATA BASE DESIGN

2.1 Table Definitions

Listings must be provided for all table definition statements and all other statements used to setup the test and qualification databases.

Appendix B contains the scripts that define, create, and analyze the tables and indexes for the TPC-H database.

2.2 Database Organization

The physical organization of tables and indices, within the test and qualification databases, must be disclosed. If the column ordering of any table is different from that specified in Clause 1.4, it must be noted.

Clustered indexes were used. See Appendix B, which contains the database and table creation statements.

2.3. Horizontal Partitioning

Horizontal partitioning of base tables or auxiliary structures created by database directives is allowed. Groups of rows from a table or auxiliary structure may be assigned to different files, disks, or areas. If this assignment is a function of data in the table or auxiliary structure, the assignment must be based on the value of a partitioning field. A partitioning field must be one and only one of the following:

- *A primary*
- *A foreign*
- *A single date column*

Some partitioning schemes require the use of directives that specify explicit values for the partitioning field. If such directives are used they must satisfy the following conditions:

- *They may not rely on any knowledge of the data stored in the table except the minimum and maximum values of columns used for the partitioning field.*
- *Within the limitations of integer division, they must define each partition to accept an equal portion of the range between the minimum and maximum values of the partitioning column(s).*
- *The directives must allow the insertion of values of the partitioning column(s) outside the range covered by the minimum and maximum values.*

Multiple-level partitioning of base tables or auxiliary structures is allowed only if each level of partitioning satisfies the conditions stated above and each level references only one partitioning field as defined above. If implemented, the details of such partitioning must be disclosed.

Horizontal partitioning was not used. See Appendix B, which contains the database and table creation statements.

2.4 Vertical Partitioning

Vertical partitioning of tables is not allowed. For example, groups of columns of one row shall not be assigned to files, disks, or areas different from those storing the other columns of that row. The row must be processed as an atomic series of contiguous columns.

Comment*: The effect of vertical partitioning is to reduce the effective row size accessed by the system. Given the synthetic nature of this benchmark, the effect of vertical partitioning is achieved by the choice of row sizes. No further vertical partitioning of the data set is allowed. Specifically, the above Clause prohibits assigning one or more of the columns not accessed by the TPC-H query set to a vertical partition.*

Vertical partitioning was not used. See Appendix B, which contains the database and table creation statements.

2.5 Replication

Any replication of physical objects must be disclosed and must conform to the requirements of Clause1.5.6.

No replication was used. See Appendix B, which contains the database and table creation statements.

3. CLAUSE 2: QUERIES AND UPDATE FUNCTIONS

3.1 Query Language

The query language used to implement the queries must be identified.

SQL was the query language used to implement all queries.

3.2 Random Number Generation

The method of verification for the random number generation must be described unless the supplied DBGEN and QGEN were used.

DBGEN Version 2.1.1b with modifications (see Appendix G) and QGEN version 1.3.0 were used to generate all database populations.

3.3 Substitution Parameters

The method used to generate values for substitution parameters must be disclosed. If QGEN is not used for this purpose, then the source code of any non-commercial tool used must be disclosed. If QGEN is used, the version number, release number, modification number and patch level of QGEN must be disclosed.

The supplied QGEN version 1.3.0 was used.

3.4 Query Text and Output Data from Qualification Database

The executable query text used for query validation must be disclosed along with the corresponding output data generated during the execution of the query text against the qualification database. If minor modifications (see Clause 2.2.3) have been applied to any functional query definitions or approved variants in order to obtain executable query text, these modifications must be disclosed and justified. The justification for a particular minor query modification can apply collectively to all queries for which it has been used. The output data for the power and throughput tests must be made available electronically upon request.

Appendix C contains the query text and query output. The following allowed minor query modifications were used in this implementation:

- The “dateadd” function is used to perform date arithmetic in Q1, Q4, Q5, Q6, Q10, Q12, Q14, Q15 and Q20.
- The “datepart” function is used to extract part of a date (“YY”) in Q7, Q8 and Q9.
- The “top” function is used to restrict the number of output rows in Q2, Q3, Q10, Q18 and Q21.
- The “count_big” function is used in place of the “count” function in Q1.

3.5 Query Substitution Parameters and Seeds

All the query substitution parameters used during the performance test must be disclosed in tabular format, along with the seeds used to generate these parameters.

Appendix D contains the seed and query substitution parameters.

3.6 Query Isolation Level

The isolation level used to run the queries must be disclosed. If the isolation level does not map closely to one of the isolation levels defined in Clause 3.4, additional descriptive detail must be provided.

The queries and transactions were run with the isolation level "Level 1."

3.7 Source Code of Refresh Functions

The details of how the refresh functions were implemented must be disclosed (including source code of any non-commercial program used).

The refresh function is part of the implementation-specific driver code included in Appendix E.

3.8 Database Maintenance Option

The details of the database maintenance option selected (i.e., reset or evolve) must be disclosed (including source code of any non-commercial program used).

This implementation of the TPC-H benchmark uses the reset option.

4. CLAUSE 3: DATABASE SYSTEM PROPERTIES

4.1 Atomicity

The results of the ACID tests must be disclosed along with a description of how the ACID requirements were met. This includes disclosing the code written to implement the Acid transaction and Query.

4.1.1 Completed Transaction

Perform the Acid transaction for a randomly selected set of input data and verify that the appropriate rows have been changed in the ORDER, LINEITEM, and HISTORY tables.

1. The total price from the ORDER table and the extended price from the LINEITEM table were retrieved for a randomly selected order key.
2. The Acid transaction was performed using the order key from Step 1.
3. The Acid transaction was committed.
4. The total price from the ORDER table and the extended price from the LINEITEM table were retrieved for the same order key used in Step 1. It was verified that the appropriate rows had been inserted.

4.1.2 Aborted Transaction

Perform the Acid transaction for a randomly selected set of input data, substituting a ROLLBACK of the transaction for the COMMIT of the transaction. Verify that the appropriate rows have not been changed in the ORDER, LINEITEM, and HISTORY tables.

1. The total price from the ORDER table and the extended price from the LINEITEM table were retrieved for a randomly selected order key.
2. The Acid transaction was performed using the order key from Step 1. The transaction was stopped prior to the commit.
3. The Acid transaction was ROLLED BACK.
4. The total price from the ORDER table and the extended price from the LINEITEM table were retrieved for the same order key used in Step 1. It was verified that the appropriate rows had not been changed.

4.2 Consistency

Consistency is the property of the application that requires any execution of transactions to take the database from one consistent state to another.

4.2.1 Consistency Test

Verify that ORDER and LINEITEM tables are initially consistent, submit the required number of Acid transactions with randomly selected input parameters, and re-verify the consistency of the ORDER and LINEITEM tables.

The consistency of the ORDER and LINEITEM tables was verified based on randomly selected values of the column O_ORDERKEY.

1. Acid queries were executed to verify the initial consistent state of the ORDER and LINEITEM tables.
2. More than 100 Acid transactions were submitted from each of two execution streams.
3. Acid queries were re-executed to verify the consistent state of the ORDER and LINEITEM tables after the Acid transaction streams.
4. The consistency of the ORDER and LINEITEM tables was re-verified.

To guarantee arithmetic function portability and consistency of results, the following query was executed to verify the consistency between the ORDER and LINEITEM tables:

```
SELECT  DISTINCT(o.O_ORDERKEY),
cast(o.O_TOTALPRICE as decimal(20,3)),
l.L_ORDERKEY,
cast(sum(cast( cast( cast(cast(cast(cast(L_EXTENDEDPRICE as decimal(20,3))*100 as integer) as
decimal(20,3)) * (1- cast(L_DISCOUNT as decimal(20,3))) as integer)
 * (1 + cast(L_TAX as decimal(20,3)))  as integer) as decimal(20,3))/100) as decimal(20,3))
```

4.3 Isolation

Operations of concurrent transactions must yield results which are indistinguishable from the results which would be obtained by forcing each transaction to be serially executed to completion in some order.

4.3.1 Read-Write Conflict with Commit

Demonstrate isolation for the read-write conflict of a read-write transaction and a read-only transaction when the read-write transaction is committed.

1. An Acid transaction was started for a randomly selected O_KEY, L_KEY, and DELTA. The Acid transaction was suspended prior to COMMIT.

2. An ACID query was started for the same O_KEY used in Step 1. The ACID query completed and did not see the uncommitted changes made by the Acid transaction.

3. The Acid transaction was COMMITTED.

4.3.2 Read-Write Conflict with Rollback

Demonstrate isolation for the read-write conflict of a read-write transaction and a read-only transaction when the read-write transaction is rolled back.

1. An ACID transaction was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID transaction was suspended prior to ROLLBACK.

2. An ACID query was started for the same O_KEY used in Step 1. The ACID query did not see the uncommitted changes made by the ACID transaction.

3. The ACID transaction was ROLLED BACK.

4. The ACID query completed.

4.3.3 Write-Write Conflict with Commit

Demonstrate isolation for the write-write conflict of two update transactions when the first transaction is committed.

1. An ACID transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID transaction was suspended prior to COMMIT.

2. Another ACID transaction, T2, was started using the same O_KEY and L_KEY and a randomly selected DELTA.

3. T2 waited.

4. T1 was allowed to COMMIT and T2 completed.

5. It was verified that T2.L_EXTENDEDPRICE was calculated correctly.
   T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE +(DELTA1*(T1.L_EXTENDEDPRICE/T1.L_QUANTITY))

4.3.4 Write-Write Conflict with Rollback

Demonstrate isolation for the write-write conflict of two update transactions when the first transaction is rolled back.

1. An Acid transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. The Acid transaction was suspended prior to ROLLBACK.

2. Another Acid transaction, T2, was started using the same O_KEY and L_KEY and a different randomly selected DELA.

3. T2 waited

4. T1 was allowed to ROLLBACK and T2 completed

5. It was verified that T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE.

4.3.5 Concurrent Progress of Read and Write on Different Tables

Demonstrate the ability of read and write transactions affecting different database tables to make progress concurrently.

1. An ACID Transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. T1 was suspended prior to COMMIT.

2. Another ACID transaction, T2 was started using random values for PS_PARTKEY and PS_SUPPKEY.

3. ACID Transaction T2 completed.

4. ACID transaction T1 completed and the appropriate rows in the ORDER, LINEITEM, and HISTORY tables were changed.

4.3.6 Updates not Indefinitely Delayed by Reads on Same Table

Demonstrate that the continuous submission of arbitrary (read-only) queries against one or more tables of the database does not indefinitely delay update transactions affecting those tables from making progress.

1. An ACID transaction, T1, was started, executing Q1 against the qualification database. The substitution parameter was chosen from the interval [0..2159] so that the query ran for a sufficient length of time.

2. Before T1 completed, an ACID transaction, T2, was started using randomly selected values of O_KEY, L_KEY and DELTA.

3. T2 completed before T1 completed. Verified that the appropriate rows in ORDER, LINEITEM and HISTORY tables have been changed.

4.4 Durability

The tested system must guarantee durability: the ability to preserve the effects of committed transactions and insure database consistency after recovery from any one of the failures listed in Clause 3.5.2

4.4.1 Failure of a Durable Medium and System Crash

Guarantee the database and committed updates are preserved across a permanent irrecoverable failure of any single durable medium containing TPC-H database tables or recovery log tables.

The database logs were placed on raid-10 volumes.

The tables for the database were stored on raw partitions. The partitions were placed on two drives of the same characteristics as the drives used for the test database, and the two drives were on two separate controllers.

1. The datafiles were backed up to an alternate disk media.

2. Nine streams of ACID transactions were started.

3. After at least 100 transactions had occurred on each stream and the streams were still running, one of the raid-10 set of log disks was removed.

4. After it was determined that the test would still run with the loss of a log disk, and after running at least another 100 transactions on each stream, a data disk was removed.

5. The nine streams of ACID transactions failed and recorded their numbers of committed transactions in success files.

6. The database was brought down.

7. Two new drives were used to replace the removed log and data disks.

8. The datafiles were restored to their state prior to the ACID transaction streams.

9. The database ran through its recovery mode.

10. The counts in the success files and the HISTORY table count were compared and the counts matched.

4.4.2 System Crash

Guarantee the database and committed updates are preserved across an instantaneous interruption (system crash/system hang) in processing which requires the system to reboot to recover.

The system crash and memory failure tests were combined.

1. Nine streams of ACID transactions were started.

2. After at least 100 transactions had occurred on each stream and the streams of ACID transactions were still running, the system was powered off.

3. When power was restored the system rebooted and the database was restarted.

4. The database went through a recovery period.

5. The success file and the HISTORY table counts were compared, and they matched.

4.4.3 Memory Failure

Guarantee the database and committed updates are preserved across failure of all or part of memory (loss of contents).

The system crash and memory failure tests were combined. See the previous section.

5. CLAUSE 4: SCALING AND DATABASE POPULATION

5.1 Cardinality of Tables

The cardinality (e.g., the number of rows) of each table of the test database, as it existed at the completion of the database load (see Clause 4.2.5), must be disclosed.

TABLE	# of ROWS
Orders	4,500,000,000
Lineitem	18,000,048,306
Customer	450,000,000
Parts	600,000,000
Supplier	30,000,000
Partsupp	2,400,000,000
Nation	25
Region	5

5.2 Distribution of Tables and Logs Across Media

The distribution of tables and logs across all media must be explicitly described using a format similar to that shown in the following example for both the tested and priced systems.

The SUT had 665 external drives, 2 internal drives. The priced system has 665 external drives.

Utilization of the drives. Test database components:

- 448 physical drives for the 3000GB database. See Appendix F for exact disk configuration. These drives were also used for page file.
- Data and Load file groups, consisting of 448 logical single volumes each, mounted as junction points.
- Tempdb group, consisting of 448 logical single volumes, mounted as junction points.
- 8 logical drives used for the backup devices of the 3000GB database, formatted as Raid-5. The database backup files were not stored on the same physical drives as the database.
- 4 logical drives used for Flat Files and 1 for UF's data.
- The Tpch3000g log was placed on 2 logical drives, 749GB total, hardware mirrored.
- 1 logical drive used for tempdb log with 333GB.
- The operating system, Microsoft Windows Server 2003, Datacenter Edition, and Microsoft SQL Server 2005 Enterprise Edition 64-bit, as well as part of the operating system page file, were installed on the internal drive.

			Disk Partition Description (See App. F)			
Cntrl	**Port#**	**# Drives**	**Data_FG**	**Tempdb_FG**	**Load_FG**	**Other allocation (*)**
LSI-320	Internal	2	Operating System, Database Manager, Page File			
LSI-320	0	8	Flat Files			

LP 10000	1	29	3TB and Acid db log Raid-10			Temp db log Raid-0
LP 10000	2	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
	3	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
LP 10000	4	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
	5	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
LP 10000	6	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
	7	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
LP 10000	8	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
	9	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
LP 10000	10	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
	11	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
LP 10000	12	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
	13	7 db 7 Bkup	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup Files
LP 10000	14	7 db 6 Bkup 1 Acid	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup & Acid Files
	15	7 db 6 Bkup 1 Acid	15GB/drive	7.5GB/drive	8.6GB /drive	Bkup & Acid Files
LP 10000	16	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
	17	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
LP 10000	18	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
	19	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
LP 10000	20	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
	21	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
LP 10000	22	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
	23	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
LP 10000	24	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
	25	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files

LP 10000	26	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
	27	7 db 7 Flat Files	15GB/drive	7.5GB/drive	8.6GB /drive	Flat Files
LP 10000	28	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	29	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	30	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	31	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	32	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	33	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	34	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	35	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	36	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	37	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	38	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	39	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	40	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	41	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	42	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	43	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	44	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	45	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	46	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	47	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	48	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	49	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	50	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	51	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	52	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	53	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	54	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	55	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	56	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	57	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	58	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	59	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP	60	7	15GB/drive	7.5GB/drive	8.6GB /drive	

10000						
	61	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	62	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	63	7	15GB/drive	7.5GB/drive	8.6GB /drive	
LP 10000	64	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	65	7	15GB/drive	7.5GB/drive	8.6GB /drive	
	(*)	448 physical drives for Test and ACID databases				
		2 logical disks for 3TB db log and Acid db log				
		1 logical disk for Tempdb log				
		4 logical drives formatted as RAID-5 for 16 backup devices				
		1 logical drive, mirrored, used for mount/junction points				
		1 logical striped drive used for UF's data				
		8 logical striped drive used for Flat Files				

5.3 Partitions/Replications Mapping

The mapping of data base partitions/replications must be explicitly described.

***Comment**: The intent is to provide sufficient detail about partitioning and replication to allow independent reconstruction of the test database.*

Database partitioning and replication were not used.

5.4 Use of RAID

Implementations may use some form of RAID . The RAID level used must be disclosed for each device.

No hardware RAID was used in the implementation, except for the database log file, which was stored on two logical drivs, which were hardware mirrored.

5.5 DBGEN Modifications

The version number, release number, modification number, and patch level of DBGEN must be disclosed. Any modifications to the DBGEN source code must be disclosed. In the event that a program other than DBGEN was used to populate the database, it must be disclosed in its entirety.

DBGen version 2.1.1b was used. Modifications made are listed in Appendix G.

5.6 Database Load Time

The database load time for the test database (see Clause 4.3) must be disclosed

The Numerical Quantities summary (pp. v) contains the database load time, which was 60:20:38

5.7 Data Storage Ratio

The data storage ratio must be disclosed. It is computed by dividing the total data storage of the priced configuration (expressed in GB) by the size chosen for the test database. The ratio must be reported to the nearest 1/100th, rounded up. For example, a system configured with 96 disks of 2.1 GB capacity for a 100GB test database has a data storage ratio of 2.02.

***Comment**: For the reporting of configured disk capacity, gigabyte (GB) is defined to be 2^30 bytes. Since disk manufacturers typically report disk size using base ten (i.e., GB = 10^9), it may be necessary to convert the advertised size from base ten to base two.*

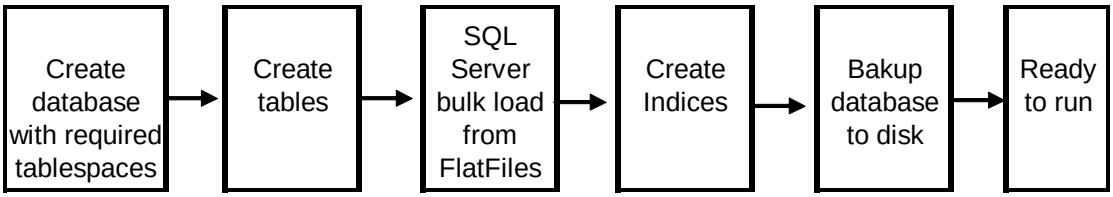
The Numerical Quantities summary (pp. v) contains the data storage ratio (8.13) for the system used.

5.8 Database Loading

The details of the database load must be disclosed, including a block diagram illustrating the overall process. Disclosure of the load procedure includes all steps, scripts, input and configuration files required to completely reproduce the test and qualification databases.

The following steps were used to load the database:

1) DBGEN version 2.1.1b was used to create flat files.
2) SQL Server 2005 was used to define the database, to define tables, and to load the tables via a "bulk insert" command.
3) Clustered indexes were created using SQL Server 2005.
4) Non clustered indexes, foreign keys and primary keys were created using SQL Server 2005.
5) A database backup was performed to 8 logical devices
6) Rows were inserted into the database by running 64 concurrent threads, each of which performed a "bulk insert" operation that loaded one sixteenth of each of the LINEITEM, ORDERS, PART, PARTSUPP, SUPPLIER and CUSTOMER tables. The NATION and REGION tables were loaded sequentially, each by a single thread.



5.9 Qualification Database Configuration

Any differences between the configuration of the qualification database and the test database must be disclosed. .

The qualification database was created using scripts identical to those of the test database, except for variances due to the sizes of the two databases.

6. Clause 5: Performance Metrics and Execution Rules

6.1 System Activity Between Load and Performance Tests

Any system activity on the SUT which takes place between the conclusion of the load test and the beginning of the performance test must be fully disclosed including listings of scripts or command logs.

Auditor requested queries were run against the database to verify the completeness and correctness of the database load.

6.2 Power Test Implementation

The details of the steps followed to implement the power test (e.g., system boot, database restart, etc.) must be disclosed.

The following steps were followed to run the power test.

1. SQL Server 2005 was started.
2. RF1 refresh transactions were run
3. Stream 00 execution was run
4. RF2 refresh transactions were run.

6.3 Timing Intervals and Reporting

The timing intervals for each query and for both refresh functions must be reported for the power test.

This information is contained in the Numerical Quantities Summary page in the Executive Summary at the beginning of this report. For convenience, it is repeated in Section 6.10.

6.4 Number of Streams in the Throughput Test

The number of query streams used for the throughput test must be disclosed

Eight streams were run for the throughput test

6.5 Start and End Date/Time for Each Query Stream

The start time and finish time for each query stream must be reported for the throughput test

This information is contained in the Numerical Quantities Summary page in the Executive Summary at the beginning of this report. For convenience, it is repeated in Section 6.10.

6.6 Total Elapsed Time for the Measurement Interval

The total elapsed time of the measurement interval must be reported for the throughput test.

This information is contained in the Numerical Quantities Summary page in the Executive Summary at the beginning of this report. For convenience, it is repeated in Section 6.10.

6.7 Refresh Function Start Date/Time and Finish Date/Time

The start time and finish time for each refresh function in the refresh stream must be reported for the throughput test.

This information is contained in the Numerical Quantities Summary page in the Executive Summary at the beginning of this report. For convenience, it is repeated in Section 6.10.

6.8 Timing Intervals for Each Query and Each Refresh Function for Each Stream

The timing intervals for each query of each stream and for each refresh function must be reported for the throughput test.

This information is contained in the Numerical Quantities Summary page in the Executive Summary at the beginning of this report. For convenience, it is repeated in Section 6.10.

6.9 Performance Metrics

The computed performance metric, related numerical quantities and the price performance metric must be reported.

This information is contained in the Numerical Quantities Summary section of the Executive Summary (p. v in front). For convenience, it is repeated in Section 6.10.

6.10 The Performance Metric and Numerical Quantities from Both Runs

The performance metric (QphH) and the numerical quantities (TPC-H Power@Size and TPC-H Throughput@Size) from both of the runs must be disclosed.

	QphH@3000GB	QthH@3000GB	QphH@3000GB
Run 1	36,878.7	21,440.5	28,119.3
Run 2	33,415.8	20,614.7	26,246.1
% Difference	-9.39%	-3.85%	-6.66%

(Run 2 was reported.)

Tables from Numerical Quantities pages in the front of this report:

Numerical Quantities Summary

Measurement Results

Scale Factor	3000 GB
Total Data Storage / Database Size	8.13
Start of Database Load	11/4/2005 9:21:01
End of Database Load	11/6/2005 21:41:39
Database Load Time	60:20:38
Query Streams for Throughput Test	8
TPC-H Power	33,415.8
TPC-H Throughput	20,614.7
Composite Query per Hour Rating (QphH@3000GB)	26,246.1
Total System Price Over 3 Years	$1,169,880 USD
TPC-H Price Performance Metric	$44.58 USD

Measurement Intervals

Measurement Interval in Throughput Test (Ts)	92,206.0 seconds

Duration of Stream Execution:

	Seed	Query Start Date/Time Query End Date/Time	RF1 Start Date/Time RF1 End Date/Time	RF2 Start Date/Time RF2 End Date/Time	Duration
Stream 0	1106214139	11/8/05 7:18:35 11/8/05 10:45:01	11/8/05 7:04:09 11/8/05 7:18:35	11/8/05 10:45:02 11/8/05 10:55:17	03:51:08
Stream 1	1106214140	11/8/05 10:55:19 11/9/05 8:46:58	11/8/05 10:55:18 11/9/05 9:32:57	11/9/05 9:32:58 11/9/05 9:42:07	22:46:48
Stream 2	1106214141	11/8/05 10:55:20 11/9/05 9:14:43	11/9/05 9:42:11 11/9/05 9:55:35	11/9/05 9:55:37 11/9/05 10:04:32	23:09:13
Stream 3	1106214142	11/8/05 10:55:20 11/9/05 8:08:48	11/9/05 10:04:37 11/9/05 10:18:06	11/9/05 10:18:08 11/9/05 10:27:09	23:31:49
Stream 4	1106214143	11/8/05 10:55:21 11/9/05 8:45:47	11/9/05 10:27:15 11/9/05 10:40:56	11/9/05 10:40:58 11/9/05 10:50:10	23:54:50
Stream 5	1106214144	11/8/05 10:55:21 11/9/05 8:01:36	11/9/05 10:50:17 11/9/05 11:03:42	11/9/05 11:03:45 11/9/05 11:13:17	24:17:55
Stream 6	1106214145	11/8/05 10:55:22 11/9/05 8:38:05	11/9/05 11:13:26 11/9/05 11:28:04	11/9/05 11:28:07 11/9/05 11:38:32	24:43:09
Stream 7	1106214146	11/8/05 10:55:23 11/9/05 7:42:16	11/9/05 11:38:41 11/9/05 11:53:34	11/9/05 11:53:38 11/9/05 12:04:32	25:09:09
Stream 8	1106214147	11/8/05 10:55:24 11/9/05 9:21:00	11/9/05 12:05:01 11/9/05 12:20:25	11/9/05 12:20:30 11/9/05 12:32:04	25:36:40

TPC-H Timing Intervals (in seconds):

Query	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Stream 0	1215.4	66.0	93.4	156.7	280.0	92.6	346.5	316.5
Stream 1	7048.7	2017.9	1033.7	4629.9	2693.0	340.0	5137.3	2857.9
Stream 2	10043.5	728.7	1065.1	1995.7	3071.0	489.7	3508.1	2676.6
Stream 3	8193.4	248.7	5459.3	1449.2	7183.2	393.3	2896.8	980.6
Stream 4	8974.7	735.6	5974.7	3303.8	7135.7	287.9	1973.9	2592.3
Stream 5	9754.8	2060.4	2395.5	937.7	3329.5	495.1	4514.8	2596.6
Stream 6	10020.6	470.0	973.3	2088.0	3071.2	411.3	1808.8	2434.9
Stream 7	7778.3	1502.6	5170.4	1287.1	1907.6	405.5	1960.7	2059.8
Stream 8	7340.0	577.1	819.9	1493.2	6212.7	333.7	4096.6	1769.5
Min Qi	7048.7	248.7	819.9	937.7	1907.6	287.9	1808.8	980.6
Max Qi	10043.5	2060.4	5974.7	4629.9	7183.2	495.1	5137.3	2857.9
Avg Qi	8644.3	1042.6	2861.5	2148.1	4325.5	394.6	3237.1	2246.0

Query	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Stream 0	2221.9	168.7	183.0	433.6	544.8	103.6	79.4	572.0
Stream 1	14616.5	2732.7	1500.0	3262.3	4631.7	1076.4	1445.5	3170.8
Stream 2	6671.5	2331.4	1156.6	3194.3	3874.3	1035.8	798.5	2294.7
Stream 3	7534.3	2073.5	1190.3	2604.0	4087.6	2211.8	765.7	3255.0
Stream 4	7797.2	1014.0	1980.6	1842.4	2506.0	1857.9	4092.4	3235.5
Stream 5	6625.0	1500.1	2084.4	2277.0	5085.7	1215.1	716.2	2666.7
Stream 6	8727.6	7438.2	3166.5	3497.6	3499.4	2537.9	955.1	3994.0
Stream 7	7297.9	1453.0	2199.4	5161.1	3425.3	973.1	625.8	3298.4
Stream 8	8857.5	2091.8	176.1	4023.6	3430.6	2249.8	2005.0	5127.2
Min Qi	6625.0	1014.0	176.1	1842.4	2506.0	973.1	625.8	2294.7
Max Qi	14616.5	7438.2	3166.5	5161.1	5085.7	2537.9	4092.4	5127.2
Avg Qi	8515.9	2579.3	1681.7	3232.8	3817.6	1644.7	1425.5	3380.3

Query	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
Stream 0	213.9	2521.5	316.8	160.6	2080.8	218.1	866.0	614.9
Stream 1	1117.4	6987.8	2362.0	1318.0	6721.9	1997.4	81458.8	548.7
Stream 2	7081.0	9278.3	4822.2	1258.1	10566.4	2422.2	804.5	535.7
Stream 3	4679.9	6141.4	2847.8	2090.5	8036.2	2085.2	809.3	540.3
Stream 4	1236.2	6440.9	2265.5	2443.3	9484.9	1451.1	821.2	551.8
Stream 5	1885.5	10967.5	3481.5	1978.5	7321.5	2086.1	804.3	571.9
Stream 6	1536.9	7206.4	1502.2	2891.0	8579.6	1351.5	878.2	624.2
Stream 7	3665.8	6314.7	2429.2	1108.6	13650.2	1138.2	892.8	654.0
Stream 8	1176.4	7375.6	8480.2	1654.6	9340.6	2103.9	924.7	694.2
Min Qi	1117.4	6141.4	1502.2	1108.6	6721.9	1138.2	804.3	535.7
Max Qi	7081.0	10967.5	8480.2	2891.0	13650.2	2422.2	81458.8	694.2
Avg Qi	2797.4	7589.1	3523.8	1842.8	9212.7	1829.5	10924.2	590.1

6.11 System Activity Between Tests

Any activity on the SUT that takes place between the conclusion of Run1 and the beginning of Run2 must be fully disclosed including listings of scripts or command logs along with any system reboots or database restarts.

No activities took place on the SUT between the conclusion of Run 1 and the beginning of Run 2

7. Clause 6: SUT and Driver Implementation Related Items

7.1 Driver

A detailed textual description of how the driver performs its functions, how its various components interact and any product functionalities or environmental setting on which it relies must be provided. All related source code, scripts and configuration files must be disclosed. The information provided should be sufficient for an independent reconstruction of the driver.

The TPC-H benchmark was implemented using a Microsoft internal tool called StepMaster. StepMaster is a general purpose test harness which can drive ODBC and shell commands. Within StepMaster, the user designs a workspace corresponding to the sequence of operations (or steps) to be executed. When the workspace is executed, StepMaster records information about the run into a database for post-processing.

StepMaster provides a mechanism for creating parallel streams of execution. This is used in the throughput tests to drive the query and refresh streams.

Each step is timed using a millisecond resolution timer. A timestamp T1 is taken before beginning the operation and a timestamp T2 is taken after completing the operation. These times are recorded in a database for post-processing.

Two types of ODBC connections are supported: static and dynamic. A dynamic connection is used to execute a single operation and is closed when the operation finishes. A static connection is held open until the run completes and may be used to execute more than one step. A connection (either static or dynamic) can only have one outstanding operation at any time.

In TPC-H, static connections are used for the query streams in the power and throughput tests.

StepMaster reads an Access database to determine the sequence of steps to execute. These commands are represented as the Implementation Specific Layer. StepMaster records its execution history, including all timings, in the Access database. Additionally, StepMaster writes a textual log file of execution for each run.

SQL Server operations executed from StepMaster do not gain any performance advantage compared to osql, the command prompt utility for ad hoc, interactive execution of Transact-SQL statements and scripts. Rather, StepMaster simplifies the task of benchmark execution, event timing, and reporting. This was confirmed during the audit.

7.2 Implementation-Specific Layer (ISL)

If an implementation specific layer is used, then a detailed description of how it performs its functions, how its various components interact and any product functionalities or environmental setting on which it relies must be provided. All related source code, scripts and configuration files must be disclosed. The information provided should be sufficient for an independent reconstruction of the implementation specific layer.

StepMaster program is used to control and track the execution of queries, via commands stored in an external Microsoft Access database. The source of this program is contained in Appendix E. The following steps are performed, to accomplish the Power and Throughput Runs:

1. Power Run
Execute 96 concurrent RF1 threads, each of which will apply a segment of a refresh set generated by dbgen. Each thread submits multiple transactions, where a transaction spans a set of orders and their associated line items.

- Execute the Stream 0 queries, in the prescribed order.
- Execute 96 concurrent RF2 threads, each of which will apply a segment of a refresh set generated by dbgen. Each thread submits multiple transactions, where a transaction spans a set of orders and their associated line items.

2. Throughput Run

- Execute eight concurrent query streams. Each stream executes queries in the prescribed order for the appropriate Stream Id (01-08). Upon completion of each stream, a semaphore is set to indication completion.
- Execute eight consecutive RF1/RF2 transactions, against ascending Refresh sets produced by dbgen. The first RF1 waits on a semaphore prior to beginning its insert operations.

Each step is timed by StepMaster. The timing information, together with an activity log, is stored for later analysis. The inputs and results of steps are stored in text files for later analysis.

8. Clause 7: Pricing Related Items

8.1 Hardware and Software Used

A detailed list of hardware and software used in the priced system must be reported. Each item must have a vendor part number, description, and release/revision level, and indicate General Availability status or committed delivery date. If package pricing is used, contents of the package must be disclosed. Pricing source(s) and effective date(s) of price(s) must also be reported.

The pricing summary sheet is given on page *iv* in the Executive Summary at the front of this report. The source for all prices is indicated. The Unisys ES7000 Orion 440, system memory, additional processors, disk controllers, and hard drives are available at the time of p[publication. See page x for the quote from CRI for the hardware used. The pricing and availability of the Microsoft software used is given in a quote from Microsoft, which is included in this report on page ix of this report.

8.2 Three-Year Cost of System Configuration

The total 3-year price of the entire configuration must be reported, including: hardware, software, and maintenance charges. Separate component pricing is required.

The pricing summary sheet on page iv in the front of this report contains all details.

8.3 Availability Dates

The committed delivery date for general availability (availability date) of products used in the priced calculations must be reported. When the priced system includes products with different availability dates, the single availability date reported on the first page of the executive summary must be the date by which all components are committed to being available. The full disclosure report must report availability dates individually for at least each of the categories for which a pricing subtotal must be provided (see Clause 7.3.1.4). All availability dates, whether for individual components or for the SUT as a whole, must be disclosed to a precision of 1 day, but the precise format is left to the test sponsor.

Summary by category from the measured and priced configuration:

Category	**Available**
Server Hardware	Now (date of publication)
Storage	Now (date of publication)
Server Software	May 05, 2006

9. Clause 8: Audit Related Items

The auditor's agency name, address, phone number, and Attestation letter with a brief audit summary report indicating compliance must be included in the full disclosure report. A statement should be included specifying who to contact in order to obtain further information regarding the audit process.

Lorna Livingtree of Performance, a certified TPC-H auditor, audited this benchmark

Lorna Livingtree

Performance Metrics Inc.

P O Box 984

Klamath, CA 95584

(707) 482-0523

See pages vii-viii in the front of this paper for a copy of the auditor's attestation letter.

Further information regarding the audit process may be obtained from Ms. Livingtree.

APPENDIX A: System and Database Tunable Parameters

Software levels:

Microsoft Windows Server 2003, Datacenter Edition + Service Pack 1.

Microsoft SQL Server 2005 Enterprise Edition for Itanium-based Systems, build 1399.02. Portions of the measured SQL Server binary will be available in Service Pack 1.

User Rights Assignment

The Group Policy Editor was used to modify an entry under “Computer Configuration” -> “Windows Settings” -> “Security Settings” -> “Local Policies” -> “User Rights Assignment”. The right of “Lock pages in memory” was assigned to the Administrator so that SQL Server could use large amounts of physical memory.

System Information:

```
OS Name     Microsoft(R) Windows(R) Server 2003, Datacenter Edition for 64-Bit
Itanium-based Systems
Version     5.2.3790 Service Pack 1 Build 3790
Other OS Description    Not Available
OS Manufacturer   Microsoft Corporation
System Name LE374P0
System Manufacturer     UNISYS
System Model      ES7000
System Type Itanium (TM) -based System
Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
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Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
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Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
Processor   ia64 Family 31 Model 2 Stepping 1 GenuineIntel ~1600 Mhz
BIOS Version/Date Phoenix Technologies LTD BIOS Release 3.1.088 No I/O, 7/28/2005
SMBIOS Version    2.3
Windows Directory C:\WINDOWS
System Directory  C:\WINDOWS\system32
Boot Device \Device\HarddiskVolume1
Locale      United States
Hardware Abstraction Layer    Version = "5.2.3790.1830 (srv03_sp1_rtm.050324-1447)"
User Name   LE374P0\samm-nl
Time Zone   Central Standard Time
Total Physical Memory   262,130.05 MB
Available Physical Memory     6.79 GB
Total Virtual Memory    371.62 GB
Available Virtual Memory      123.12 GB
Page File Space   118.02 GB
Page File   C:\pagefile.sys
```

SQL Server 2005 Enterprise Edition 64-bit Installation

Microsoft SQL Server 2005 Enterprise Edition 64-bit was installed on the SUT. All default options were selected during the install except:

- "Custom installation" was selected. The SQL Server Development tools were not installed.
- Latin1_General binary sort order was used. (Collation Settings > Collation Designator > Latin1_General Binary)
- Services Accounts > Customized > SQL Server > Use Local System Account Authentication Mode > Mixed > Blank Password allowed

SQL Server 2005 Enterprise Itanium Edition Startup Parameters

SQLSERVR –c –x –E –T834 –T2301
Where:

- -c Start SQL Server independently of the Windows Service Control Manager
- -x Disable the keeping of CPU time and cache-hit ratio statistics
- -E increase the number of consecutive extents allocated per file to 64
- -T834 On systems with 8GB or more, this traceflag causes the buffer pool to use large pages. These are allocated at startup and are kept throughout the lifetime of the process. This trace flag can only be set on 64-bit installations of SQL Server.
- -T2301 Trace flag to enable more accurate query run-time behavior modeling in the SQL Server query optimizer typically only needed for large data set decision support processing.

SQL Server 2005 Enterprise Edition 64-bit Configuration Parameters:

name	minimum	maximum	config_value	run_value
Ad Hoc Distributed Queries	0	1	0	0
affinity I/O mask	-2147483648	2147483647	0	0
affinity mask	-2147483648	2147483647	-1	-1
affinity64 I/O mask	-2147483648	2147483647	0	0
affinity64 mask	-2147483648	2147483647	0	0
Agent XPs	0	1	0	0
allow updates	0	1	1	1
awe enabled	0	1	0	0
blocked process threshold	0	86400	0	0
c2 audit mode	0	1	0	0
clr enabled	0	1	0	0
cost threshold for parallelism	0	32767	0	0
cross db ownership chaining	0	1	0	0
cursor threshold	-1	2147483647	-1	-1
Database Mail XPs	0	1	0	0
default full-text language	0	2147483647	1033	1033
default language	0	9999	0	0
default trace enabled	0	1	1	1
disallow results from triggers	0	1	0	0

fill factor (%)	0	100	0	0
ft crawl bandwidth (max)	0	32767	100	100
ft crawl bandwidth (min)	0	32767	0	0
ft notify bandwidth (max)	0	32767	100	100
ft notify bandwidth (min)	0	32767	0	0
in-doubt xact resolution	0	2	0	0
index create memory (KB)	704	2147483647	0	0
lightweight pooling	0	1	1	1
locks	5000	2147483647	0	0
max degree of parallelism	0	64	0	0
max full-text crawl range	0	256	4	4
max server memory (MB)	16	2147483647	120000	120000
max text repl size (B)	0	2147483647	65536	65536
max worker threads	128	32767	2000	2000
media retention	0	365	0	0
min memory per query (KB)	512	2147483647	512	512
min server memory (MB)	0	2147483647	116000	116000
nested triggers	0	1	1	1
network packet size (B)	512	32767	4096	4096
Ole Automation Procedures	0	1	0	0
open objects	0	2147483647	0	0
PH timeout (s)	1	3600	60	60
precompute rank	0	1	0	0
priority boost	0	1	0	0
query governor cost limit	0	2147483647	0	0
query wait (s)	-1	2147483647	-1	-1
recovery interval (min)	0	32767	32767	32767
remote access	0	1	1	1
remote admin connections	0	1	0	0
remote login timeout (s)	0	2147483647	20	20
remote proc trans	0	1	0	0
remote query timeout (s)	0	2147483647	600	600
Replication XPs	0	1	0	0
RPC parameter data validation	0	1	0	0
scan for startup procs	0	1	0	0
server trigger recursion	0	1	1	1
set working set size	0	1	0	0
show advanced options	0	1	1	1
SMO and DMO XPs	0	1	1	1
SQL Mail XPs	0	1	0	0
transform noise words	0	1	0	0
two digit year cutoff	1753	9999	2049	2049
user connections	0	32767	0	0
user options	0	32767	0	0
Web Assistant Procedures	0	1	0	0
xp_cmdshell	0	1	0	0

APPENDIX B: Database, Tables, and Indexes Creation

Create database

```
-- CreateDatabase
-- for use with StepMaster
-- Uses FileGroups

--
--              Drop the existing database
--                              3TB db

if exists (select name from sysdatabases where name = '%DBNAME%')
              drop database %DBNAME%

CREATE DATABASE %DBNAME%
ON PRIMARY
(NAME= %DBNAME%_root,
              FILENAME    = "C:\%DBNAME%_root.mdf",
              SIZE                          = 70MB,
              FILEGROWTH                    = 10 MB),

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                FILEGROWTH= 0)
```

Create Tables

```
-- File:    CREATETABLES.SQL
--          Microsoft TPC-H Benchmark Kit Ver. 1.00
--          Copyright Microsoft, 1999
--

create table PART
                (P_PARTKEY              int                     not null,
                 P_NAME                 varchar(55)     not null,
                 P_MFGR                 char(25)        not null,
                 P_BRAND    char(10)    not null,
                 P_TYPE                 varchar(25)     not null,
                 P_SIZE                 int                     not null,
                 P_CONTAINER            char(10)        not null,
                 P_RETAILPRICE          float                   not null,
                 P_COMMENT              varchar(23)     not null)
on LOAD_FG

create table SUPPLIER
                (S_SUPPKEY int                          not null,
                 S_NAME                 char(25)        not null,
                 S_ADDRESS varchar(40)  not null,
                 S_NATIONKEY            int                     not null,
                 S_PHONE    char(15)    not null,
                 S_ACCTBAL float                         not null,
                 S_COMMENT              varchar(101)    not null)
on LOAD_FG
```

```
create table PARTSUPP
                (PS_PARTKEY             int                     not null,
                 PS_SUPPKEY             int                     not null,
                 PS_AVAILQTY            int                     not null,
                 PS_SUPPLYCOST          float                   not null,
                 PS_COMMENT             varchar(199)    not null)
on LOAD_FG

create table CUSTOMER
                (C_CUSTKEY              int                     not null,
                 C_NAME                 varchar(25)     not null,
                 C_ADDRESSvarchar(40)   not null,
                 C_NATIONKEY            int                     not null,
                 C_PHONE    char(15)    not null,
                 C_ACCTBAL              float                   not null,
                 C_MKTSEGMENT           char(10)        not null,
                 C_COMMENT              varchar(117)    not null)
on LOAD_FG

create table ORDERS
                (O_ORDERKEY             bigint                  not null,
                 O_CUSTKEY              int                     not null,
                 O_ORDERSTATUS          char(1)                 not null,
                 O_TOTALPRICE           float                   not null,
                 O_ORDERDATE            datetime        not null,
                 O_ORDERPRIORITY char(15)               not null,
                 O_CLERK    char(15)    not null,
                 O_SHIPPRIORITY         int                     not null,
                 O_COMMENT              varchar(79)     not null)
on LOAD_FG

create table LINEITEM
                (L_ORDERKEY             bigint                  not null,
                 L_PARTKEYint                           not null,
                 L_SUPPKEY int                          not null,
                 L_LINENUMBER           int                     not null,
                 L_QUANTITY             float                   not null,
                 L_EXTENDEDPRICE float                  not null,
                 L_DISCOUNT             float                   not null,
                 L_TAX                  float                   not null,
                 L_RETURNFLAG           char(1)                 not null,
                 L_LINESTATUS           char(1)                 not null,
                 L_SHIPDATE             datetime        not null,
                 L_COMMITDATE           datetime        not null,
                 L_RECEIPTDATE          datetime        not null,
                 L_SHIPINSTRUCT         char(25)        not null,
                 L_SHIPMODE             char(10)        not null,
                 L_COMMENT              varchar(44)     not null)
on LOAD_FG

create table NATION
                (N_NATIONKEY            int                     not null,
                 N_NAME                 char(25)        not null,
                 N_REGIONKEY            int                     not null,
                 N_COMMENT              varchar(152)    not null)
on LOAD_FG

create table REGION
                (R_REGIONKEY            int                     not null,
                 R_NAME                 char(25)        not null,
                 R_COMMENT              varchar(152)    not null)
on LOAD_FG
```

Create Indexes

```
alter table NATION add constraint PK_N_NATIONKEY primary key (N_NATIONKEY)
ON DATA_FG

alter table REGION add constraint PK_R_REGIONKEY primary key (R_REGIONKEY)
ON DATA_FG

create index N_REGIONKEY_IDX
    on NATION(N_REGIONKEY)
    with fillfactor=100, SORT_IN_TEMPDB
    on DATA_FG

alter table PART add constraint PK_P_PARTKEY primary key (P_PARTKEY)
ON DATA_FG

alter table SUPPLIER add constraint PK_S_SUPPKEY primary key (S_SUPPKEY)
ON DATA_FG

create index S_NATIONKEY_IDX
                on SUPPLIER(S_NATIONKEY)
                with fillfactor=100, SORT_IN_TEMPDB
                on DATA_FG

alter table CUSTOMER add constraint PK_C_CUSTKEY primary key (C_CUSTKEY)
ON DATA_FG
```

```
alter table PARTSUPP add constraint PK_PS_PARTKEY_PS_SUPPKEY primary key (PS_PARTKEY, PS_SUPPKEY)
ON DATA_FG

create clustered index O_ORDERDATE_CLUIDX
        on ORDERS(O_ORDERDATE)
        with FILLFACTOR=95,SORT_IN_TEMPDB
        on DATA_FG

alter table ORDERS add constraint PK_O_ORDERKEY primary key (O_ORDERKEY)
WITH (FILLFACTOR = 95)
ON DATA_FG



-- create FK
alter table SUPPLIER add constraint FK_S_NATIONKEY foreign key (S_NATIONKEY) references NATION(N_NATIONKEY)

alter table PARTSUPP add constraint FK_PS_PARTKEY foreign key (PS_PARTKEY) references PART(P_PARTKEY)

alter table PARTSUPP add constraint FK_PS_SUPPKEY foreign key (PS_SUPPKEY) references SUPPLIER(S_SUPPKEY)

alter table CUSTOMER add constraint FK_C_NATIONKEY foreign key (C_NATIONKEY) references NATION (N_NATIONKEY)

alter table ORDERS add constraint FK_O_CUSTKEY foreign key (O_CUSTKEY)  references CUSTOMER (C_CUSTKEY)

alter table NATION add constraint FK_N_REGIONKEY foreign key (N_REGIONKEY)  references REGION (R_REGIONKEY)

alter table LINEITEM add constraint FK_L_ORDERKEY foreign key (L_ORDERKEY)  references ORDERS (O_ORDERKEY)

alter table LINEITEM add constraint FK_L_PARTKEY foreign key (L_PARTKEY)  references PART (P_PARTKEY)

alter table LINEITEM add constraint FK_L_SUPPKEY foreign key (L_SUPPKEY)  references SUPPLIER (S_SUPPKEY)

alter table LINEITEM add constraint FK_L_PARTKEY_SUPPKEY foreign key (L_PARTKEY,L_SUPPKEY) references PARTSUPP(PS_PARTKEY, PS_SUPPKEY)



-- Create indexes

 create index PS_SUPPKEY_IDX
      on PARTSUPP(PS_SUPPKEY)
      with fillfactor=100, SORT_IN_TEMPDB
      on DATA_FG

execute sp_configure 'affinity mask'                    ,0xFFFF

reconfigure with override


 create clustered index L_SHIPDATE_CLUIDX
        on LINEITEM(L_SHIPDATE)
        with FILLFACTOR=95,SORT_IN_TEMPDB
        on DATA_FG

execute sp_configure 'affinity mask'                    ,0xFFFFFFFF

reconfigure with override


 create index L_ORDERKEY_IDX
        on LINEITEM(L_ORDERKEY)
        with FILLFACTOR=95,SORT_IN_TEMPDB
        on DATA_FG

 create index L_PARTKEY_IDX
        on LINEITEM(L_PARTKEY)
        with FILLFACTOR=95,SORT_IN_TEMPDB
        on DATA_FG
```

APPENDIX C: Query Text & Output

-- using 1106214139 as a seed to the RNG

/* TPC_H Query 1 - Pricing Summary Report */

```
SELECT  L_RETURNFLAG,
        L_LINESTATUS,
        SUM(L_QUANTITY)                                 AS SUM_QTY,
        SUM(L_EXTENDEDPRICE)                            AS SUM_BASE_PRICE,
        SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT))             AS SUM_DISC_PRICE,
        SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT)*(1+L_TAX))   AS SUM_CHARGE,
        AVG(L_QUANTITY)                                 AS AVG_QTY,
```

```
        AVG(L_EXTENDEDPRICE)                                    AS AVG_PRICE,
        AVG(L_DISCOUNT)                                         AS AVG_DISC,
        COUNT_BIG(*)                                            AS COUNT_ORDER
FROM    LINEITEM
WHERE   L_SHIPDATE      <= dateadd(dd, -63, '1998-12-01')
GROUP   BY      L_RETURNFLAG,
                L_LINESTATUS
ORDER   BY      L_RETURNFLAG,
                L_LINESTATUS

-----------
-----------
L_RETURNFLAG L_LINESTATUS SUM_QTY              SUM_BASE_PRICE        SUM_DISC_PRICE        SUM_CHARGE            AVG_QTY
AVG_PRICE            AVG_DISC             COUNT_ORDER
------------ ----------- ---------------------- ---------------------- ---------------------- ---------------------- ----------------------- ---
-----------------
A            F           113383938885.000000     170018153216836.280000   161517034929299.750000   167977648601676.620000   25.499814             38236.732415
0.050001             4446461360
N            F           2959911484.000000       4438231735157.834000     4216311756463.420400     4384977884956.036600     25.500387             38236.490192
0.050005             116073199
N            O           226549983418.000000     339711406595838.620000   322725953227291.940000   335635101374191.310000   25.500053             38237.296747
0.049999             8884294537
R            F           113383359689.000000     170018012228625.160000   161517146341996.690000   167977776008351.970000   25.499831             38236.921557
0.050000             4446435678

(4 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 2 - Minimum Cost Supplier */

SELECT  TOP 100
        S_ACCTBAL,
        S_NAME,
        N_NAME,
        P_PARTKEY,
        P_MFGR,
        S_ADDRESS,
        S_PHONE,
        S_COMMENT
FROM    PART,
        SUPPLIER,
        PARTSUPP,
        NATION,
        REGION
WHERE   P_PARTKEY       = PS_PARTKEY AND
        S_SUPPKEY       = PS_SUPPKEY AND
        P_SIZE          = 46 AND
        P_TYPE          LIKE '%STEEL' AND
        S_NATIONKEY     = N_NATIONKEY AND
        N_REGIONKEY     = R_REGIONKEY AND
        R_NAME          = 'MIDDLE EAST' AND
        PS_SUPPLYCOST   = (     SELECT  MIN(PS_SUPPLYCOST)
                                FROM    PARTSUPP,
                                        SUPPLIER,
                                        NATION,
                                        REGION
                                WHERE   P_PARTKEY       = PS_PARTKEY AND
                                        S_SUPPKEY       = PS_SUPPKEY AND
                                        S_NATIONKEY     = N_NATIONKEY AND
                                        N_REGIONKEY     = R_REGIONKEY AND
                                        R_NAME          = 'MIDDLE EAST'
                          )
ORDER   BY      S_ACCTBAL DESC,
                N_NAME,
                S_NAME,
                P_PARTKEY
-----------
-----------
```

```
S_ACCTBAL       S_NAME          N_NAME          P_PARTKEY   P_MFGR          S_ADDRESS                       S_PHONE
S_COMMENT
--------------- --------------- --------------- ----------- --------------- ------------------------------- --------------- ------------------------------
------------------------------------------------------------------------
9999.980000     Supplier#015509530      EGYPT           135509529   Manufacturer#1      iq6TkwkuroleoSm7lnVDBJA4SRFJfmgQODX     14-543-
249-8843 unusual, regular foxes nag. furiously regular requests snooze. dolphins along the final packages use
9999.980000     Supplier#024057917      EGYPT           451557871   Manufacturer#3      a6jY1PHOx8UpWfBCf9UwE7vFZgtfi7qw8p7qkN8 14-339-
500-5886 ironic ideas engage. evenly bold requests sleep carefully according to the regular accounts. stealth
9999.970000     Supplier#023343711      EGYPT           495843694   Manufacturer#1      Y8icbRuGK69ZH3jihMmMXKL i4lUYOMP9q3gL   14-
627-585-9885 even, final theodolites alongside of the final, bold accounts boost about the bold courts. slyly ex
9999.970000     Supplier#015595172      SAUDI ARABIA        150595161   Manufacturer#2      HO4q0mAv ,yO7y8WOGKT            30-398-437-
9452 ironic, ironic platelets breach furiously bold dolphins. express requests mus
9999.970000     Supplier#024808117      SAUDI ARABIA        264808116   Manufacturer#5      1uO, exeAKzZN7pA                30-521-314-2159
furiously final ideas are furi

.
.
.
9999.330000     Supplier#020816477      JORDAN          448316434   Manufacturer#5      SxksKzg7jRs3anlij9hPV3Bx2fR     23-123-975-7867
carefully ironic foxes haggle furiously. slyly ironic deposits haggle slyly special theodolites--
9999.320000     Supplier#003031974      EGYPT           415531960   Manufacturer#3      WgD5p8BNgldCTm                  14-438-156-5562
furiously final accounts are slyly blithely pending ideas. slyly even theodolites haggle. sl
9999.320000     Supplier#003068894      JORDAN          235568886   Manufacturer#1      00pt,BWcg,l                     23-723-992-2102 quickly
ironic packages boost furiously. final pinto beans wake slyly against the fl
9999.310000     Supplier#020119213      IRAN            192619206   Manufacturer#4      ZRbJdlEcHrk,SHOF0hzd6J18DHTJWj7 20-528-902-
1660 final accounts sleep acros

(100 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 3 - Shipping Priority */

SELECT  TOP 10
        L_ORDERKEY,
        SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT))     AS REVENUE,
        O_ORDERDATE,
        O_SHIPPRIORITY
FROM    CUSTOMER,
        ORDERS,
        LINEITEM
WHERE   C_MKTSEGMENT    = 'HOUSEHOLD' AND
        C_CUSTKEY       = O_CUSTKEY AND
        L_ORDERKEY      = O_ORDERKEY AND
        O_ORDERDATE     < '1995-03-26' AND
        L_SHIPDATE      > '1995-03-26'
GROUP   BY      L_ORDERKEY,
                O_ORDERDATE,
                O_SHIPPRIORITY
ORDER   BY      REVENUE DESC,
                O_ORDERDATE
-----------
-----------
L_ORDERKEY          REVENUE                 O_ORDERDATE             O_SHIPPRIORITY
------------------- ----------------------- ----------------------- --------------
6783327621          513221.829100           1995-03-01 00:00:00.000 0
15373262211         513221.829100           1995-03-01 00:00:00.000 0
12644355877         510678.441300           1995-03-14 00:00:00.000 0
4054421287          510678.441300           1995-03-14 00:00:00.000 0
131698920           507524.133800           1995-03-09 00:00:00.000 0
13282498022         505629.915400           1995-02-25 00:00:00.000 0
4692563456          505629.915400           1995-02-25 00:00:00.000 0
1056849411          503896.410300           1995-03-16 00:00:00.000 0
9646784001          503896.410300           1995-03-16 00:00:00.000 0
17882946660         503331.871900           1995-03-12 00:00:00.000 0

(10 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG
```

```
/* TPC_H  Query 4 - Order Priority Checking */

SELECT   O_ORDERPRIORITY,
         COUNT(*)                    AS ORDER_COUNT
FROM     ORDERS
WHERE    O_ORDERDATE     >= '1997-01-01' AND
         O_ORDERDATE     < dateadd (mm, 3, '1997-01-01') AND
         EXISTS          (       SELECT   *
                                 FROM     LINEITEM
                                 WHERE    L_ORDERKEY       = O_ORDERKEY AND
                                          L_COMMITDATE     < L_RECEIPTDATE
                         )
GROUP    BY       O_ORDERPRIORITY
ORDER    BY       O_ORDERPRIORITY
-----------
-----------
O_ORDERPRIORITY ORDER_COUNT
--------------- -----------
1-URGENT        30903415
2-HIGH          30902135
3-MEDIUM        30898752
4-NOT SPECIFIED 30900614
5-LOW           30903456

(5 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 5 - Local Supplier Volume */

SELECT   N_NAME,
         SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT))       AS REVENUE
FROM     CUSTOMER,
         ORDERS,
         LINEITEM,
         SUPPLIER,
         NATION,
         REGION
WHERE    C_CUSTKEY          = O_CUSTKEY AND
         L_ORDERKEY         = O_ORDERKEY AND
         L_SUPPKEY          = S_SUPPKEY AND
         C_NATIONKEY        = S_NATIONKEY AND
         S_NATIONKEY        = N_NATIONKEY AND
         N_REGIONKEY        = R_REGIONKEY AND
         R_NAME             = 'EUROPE' AND
         O_ORDERDATE        >= '1996-01-01' AND
         O_ORDERDATE        < DATEADD(YY, 1, '1996-01-01')
GROUP    BY       N_NAME
ORDER    BY       REVENUE DESC
-----------
-----------
N_NAME                    REVENUE
------------------------- -------------------------
ROMANIA                   159290652828.471130
UNITED KINGDOM            159229851901.388890
GERMANY                   159139541130.984370
RUSSIA                    158927915399.860380
FRANCE                    158886812261.905300

(5 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 6 - Forecasting Revenue Change */

SELECT   SUM(L_EXTENDEDPRICE*L_DISCOUNT)           AS REVENUE
FROM     LINEITEM
WHERE    L_SHIPDATE         >= '1996-01-01' AND
```

```
            L_SHIPDATE      < dateadd (yy, 1, '1996-01-01') AND
            L_DISCOUNT      BETWEEN 0.04 - 0.01 AND 0.04 + 0.01 AND
            L_QUANTITY      < 25
-----------
-----------
REVENUE
------------------------
269056701718.393980

(1 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 7 - Volume Shipping */

SELECT  SUPP_NATION,
        CUST_NATION,
        L_YEAR,
        SUM(VOLUME)     AS REVENUE
FROM    (       SELECT  N1.N_NAME                       AS SUPP_NATION,
                        N2.N_NAME                       AS CUST_NATION,
                        datepart(yy,L_SHIPDATE)         AS L_YEAR,
                        L_EXTENDEDPRICE*(1-L_DISCOUNT)  AS VOLUME
                FROM    SUPPLIER,
                        LINEITEM,
                        ORDERS,
                        CUSTOMER,
                        NATION N1,
                        NATION N2
                WHERE   S_SUPPKEY       = L_SUPPKEY AND
                        O_ORDERKEY      = L_ORDERKEY AND
                        C_CUSTKEY       = O_CUSTKEY AND
                        S_NATIONKEY     = N1.N_NATIONKEY AND
                        C_NATIONKEY     = N2.N_NATIONKEY AND
                        (       (N1.N_NAME      = 'FRANCE'      AND N2.N_NAME   = 'PERU')
                                OR
                                (N1.N_NAME      = 'PERU'   AND N2.N_NAME   = 'FRANCE')
                        ) AND
                        L_SHIPDATE      BETWEEN '1995-01-01' AND '1996-12-31'
        )       AS SHIPPING
GROUP   BY      SUPP_NATION,
                CUST_NATION,
                L_YEAR
ORDER   BY      SUPP_NATION,
                CUST_NATION,
                L_YEAR
-----------
-----------
SUPP_NATION          CUST_NATION          L_YEAR     REVENUE
-------------------------- -------------------------- ----------- -------------------------
FRANCE               PERU                 1995       158673469840.781980
FRANCE               PERU                 1996       159317706050.347810
PERU                 FRANCE               1995       158928551586.295900
PERU                 FRANCE               1996       159319637265.019040

(4 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 8 - National Market Share */

SELECT  O_YEAR,
        SUM(CASE        WHEN    NATION  = 'PERU'
                        THEN    VOLUME
                        ELSE    0
                        END) / SUM(VOLUME)      AS MKT_SHARE
FROM    (       SELECT  datepart(yy,O_ORDERDATE)        AS O_YEAR,
                        L_EXTENDEDPRICE * (1-L_DISCOUNT)AS VOLUME,
                        N2.N_NAME                               AS NATION
```

```
                FROM    PART,
                        SUPPLIER,
                        LINEITEM,
                        ORDERS,
                        CUSTOMER,
                        NATION N1,
                        NATION N2,
                        REGION
                WHERE   P_PARTKEY       = L_PARTKEY AND
                        S_SUPPKEY       = L_SUPPKEY AND
                        L_ORDERKEY      = O_ORDERKEY AND
                        O_CUSTKEY       = C_CUSTKEY AND
                        C_NATIONKEY     = N1.N_NATIONKEY AND
                        N1.N_REGIONKEY  = R_REGIONKEY AND
                        R_NAME          = 'AMERICA' AND
                        S_NATIONKEY     = N2.N_NATIONKEY AND
                        O_ORDERDATE     BETWEEN '1995-01-01' AND '1996-12-31' AND
                        P_TYPE          = 'STANDARD POLISHED NICKEL'
        )       AS      ALL_NATIONS
GROUP   BY      O_YEAR
ORDER   BY      O_YEAR
-----------
-----------
O_YEAR      MKT_SHARE
----------- ------------------------
1995        0.040126
1996        0.040394

(2 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 9 - Product Type Profit Measure */

SELECT  NATION,
        O_YEAR,
        SUM(AMOUNT)     AS SUM_PROFIT
FROM    (       SELECT  N_NAME                                                  AS NATION,
                        datepart(yy, O_ORDERDATE)                               AS O_YEAR,
                        L_EXTENDEDPRICE*(1-L_DISCOUNT)-PS_SUPPLYCOST*L_QUANTITY AS AMOUNT
                FROM    PART,
                        SUPPLIER,
                        LINEITEM,
                        PARTSUPP,
                        ORDERS,
                        NATION
                WHERE   S_SUPPKEY       = L_SUPPKEY AND
                        PS_SUPPKEY      = L_SUPPKEY AND
                        PS_PARTKEY      = L_PARTKEY AND
                        P_PARTKEY       = L_PARTKEY AND
                        O_ORDERKEY      = L_ORDERKEY AND
                        S_NATIONKEY     = N_NATIONKEY AND
                        P_NAME          LIKE '%brown%'
        )       AS PROFIT
GROUP   BY      NATION,
                O_YEAR
ORDER   BY      NATION,
                O_YEAR  DESC
-----------
-----------
NATION                    O_YEAR      SUM_PROFIT
------------------------- ----------- ------------------------
ALGERIA                    1998       104604599306.765260
ALGERIA                    1997       178726243045.541530
ALGERIA                    1996       179070391298.362430
ALGERIA                    1995       178564879136.255490

.
.
.
```

```
VIETNAM         1996    179438826574.850040
VIETNAM         1995    178994828005.929290
VIETNAM         1994    178904119409.997070
VIETNAM         1993    179058358818.246400
VIETNAM         1992    179287973447.418820

(175 row(s) affected)


++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 10 - Returned Item Reporting */

SELECT  TOP 20
        C_CUSTKEY,
        C_NAME,
        SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT))     AS REVENUE,
        C_ACCTBAL,
        N_NAME,
        C_ADDRESS,
        C_PHONE,
        C_COMMENT
FROM    CUSTOMER,
        ORDERS,
        LINEITEM,
        NATION
WHERE   C_CUSTKEY       = O_CUSTKEY                 AND
        L_ORDERKEY      = O_ORDERKEY                AND
        O_ORDERDATE     >= '1993-12-01'                     AND
        O_ORDERDATE     < dateadd(mm, 3, '1993-12-01')  AND
        L_RETURNFLAG    = 'R'                       AND
        C_NATIONKEY     = N_NATIONKEY
GROUP   BY      C_CUSTKEY,
                C_NAME,
                C_ACCTBAL,
                C_PHONE,
                N_NAME,
                C_ADDRESS,
                C_COMMENT
ORDER   BY      REVENUE         DESC
-----------
-----------
C_CUSTKEY   C_NAME              REVENUE             C_ACCTBAL           N_NAME              C_ADDRESS                           C_PHONE
C_COMMENT
----------- ------------------------- --------------------- ---------- ------------------------- ---------------------------------------- --------------- ----------------------------------------
----------------------------------------------------------------------------------
206742466   Customer#206742466      1792964.331000      8092.820000         VIETNAM             tzgGcoGc8PijiUkf02Qfk0axKoynaHXz        31-797-564-
6776 quickly final accounts nag carefully ironic accounts. furious
392432275   Customer#392432275      1739187.927200      4873.870000         IRAN                9nH62wYJGG                              20-219-307-1188 regular
instructions along the carefully silent platelets hang slyly final courts. quickly u
101806432   Customer#101806432      1713220.998600      -375.420000         ALGERIA             LJycYwUyPDYiETZBbJ dqYyrB6,DUbuidVdxtGS  10-
694-184-2678 carefully regular packages among the furiously ironic deposits aff
405376399   Customer#405376399      1706468.502900      2146.670000         EGYPT               4FgTVXQlucSQ5VOqy0ksEgapaIdkllUcpKgNG6   14-129-
693-6578 express, even accounts are fluffily furiously q
443909815   Customer#443909815      1693248.928800      2966.270000         UNITED KINGDOM      BM5qs9Exy7F6ULWCO0 b                    33-834-
950-9188 bold, regular asymptotes are furiously along the blithely unusual ideas. quickly idle accounts
205594990   Customer#205594990      1678669.971900      2320.900000         CHINA               IroOkwFfl1XTv4NHPuiWR1ssN7LC4           28-686-895-
1260 furiously pending requests use fluffily carefully even pinto beans.
305313146   Customer#305313146      1658350.531800      9984.180000         IRAQ                M20ffxFikHskoM4g8rE3XAhjOe              21-315-507-2973
carefully regular deposits among the regular, express deposits solve car
440893729   Customer#440893729      1656890.190400      3454.590000         CHINA               yV51xaScTAxICU9P2uGVNqPuIbnynT3VN0IT     28-200-
563-6086 furiously express accounts haggle. daringly ironic ideas sleep slyly final sentiments: d
24877540    Customer#024877540      1645703.847700      7442.060000         ETHIOPIA            hjrl50tuPYyBh                           15-674-113-2900 fluffily
bold deposits cajole. fluffily close platelets wake slyly after the
119039677   Customer#119039677      1645677.596400      9504.770000         CANADA              5mCGPywkEE                              13-361-625-6371
furiously final packages are along the requests. blithely final courts engag
188423287   Customer#188423287      1637269.613300      1887.360000         JORDAN              r1ufjEY5l3eqVgoJYSq1mS                  23-382-647-1150
fluffily regular packages sleep along the furiously thin deposits. blithely f
357235615   Customer#357235615      1637016.779200      6458.370000         KENYA               NiWOFIpZnFL8d4ZjMPl2NNUkM474lDTVpFOQ     24-
213-455-1714 slyly unusual foxes wake atop the fluffily ev
```

```
117566932  Customer#117566932  1633531.483200  3817.970000  ALGERIA  kI50pTbWqBFFFHDv8ATEynmv9BJUF7j6StjW  10-
891-294-2503 doggedly stealthy requests after the slyly silent requests are carefully final pinto beans. slyl
131500687  Customer#131500687  1604487.483000  4818.110000  UNITED STATES  IgEbi8Tt0LMoWAajZy  34-561-471-
2882 final multipliers hinder against the slyly dogged
429959435  Customer#429959435  1603812.817800  4503.900000  ETHIOPIA  1HoEYNQei,1sdScpuPER4  15-582-749-4973
furiously express instructions haggle quickly ironic requests. blithely silent packages
179679196  Customer#179679196  1600314.199500  8627.630000  UNITED STATES  vHoBqbP8vmfsU3byVzx  34-731-496-
2701 furiously regular tithes of the regular, pending accounts boost above the carefully bold foxes. stealthily regul
252779959  Customer#252779959  1596898.605000  7841.850000  JORDAN  l1ndfpaqoYTAuZk UDjzMuxpVoam  23-541-996-
6143 deposits wake. bold deposits detect according to the fluffily unusual
285854759  Customer#285854759  1596292.837900  7611.950000  INDIA  o7zO86Wxap  18-212-186-7075 slyly
express somas cajole blithely excuses. quickly unusual packag
239597600  Customer#239597600  1594906.026800  9599.470000  MOROCCO  dw92JMdAdRv  25-254-925-8956
furiously final pinto beans run carefully furiously bold accounts. blithely even p
326976166  Customer#326976166  1594846.827900  9092.210000  ROMANIA  RoGR3xh7Xbk67qnCn7Z9Wj71n  29-898-744-
1294 daringly silent pinto beans use furiously. quickly special instructions at the blithely final d

(20 row(s) affected)



++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 11 - Important Stock Indentification */

SELECT   PS_PARTKEY,
         SUM(PS_SUPPLYCOST*PS_AVAILQTY)          AS VALUE
FROM     PARTSUPP,
         SUPPLIER,
         NATION
WHERE    PS_SUPPKEY      = S_SUPPKEY      AND
         S_NATIONKEY     = N_NATIONKEY    AND
         N_NAME          = 'SAUDI ARABIA'
GROUP    BY       PS_PARTKEY
HAVING   SUM(PS_SUPPLYCOST*PS_AVAILQTY) >
                  (        SELECT   SUM(PS_SUPPLYCOST*PS_AVAILQTY) * 0.0000000333
                           FROM     PARTSUPP,
                                    SUPPLIER,
                                    NATION
                           WHERE    PS_SUPPKEY      = S_SUPPKEY      AND
                                    S_NATIONKEY     = N_NATIONKEY    AND
                                    N_NAME          = 'SAUDI ARABIA'
                  )
ORDER    BY       VALUE    DESC
-----------
-----------
PS_PARTKEY  VALUE
----------- ------------------------
71021964    27575732.860000
292085955   27062456.240000
106980001   26969961.600000
461162156   26460212.830000
238375199   25988130.200000
226519083   25546120.840000

.
.
.
357344737   7998228.270000
164397320   7998228.120000
316069769   7998227.840000
436257742   7998227.840000
198526728   7998227.320000

(2829947 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG
```

```
/* TPC_H  Query 12 - Shipping Modes and Order Priority */

SELECT   L_SHIPMODE,
         SUM(     CASE     WHEN O_ORDERPRIORITY  = '1-URGENT'          OR
                              O_ORDERPRIORITY  = '2-HIGH'
                           THEN 1
                           ELSE 0
                  END)     AS HIGH_LINE_COUNT,
         SUM(     CASE     WHEN O_ORDERPRIORITY <> '1-URGENT'          AND
                              O_ORDERPRIORITY <> '2-HIGH'
                           THEN 1
                           ELSE 0
                  END)     AS LOW_LINE_COUNT
FROM     ORDERS,
         LINEITEM
WHERE    O_ORDERKEY       = L_ORDERKEY                AND
         L_SHIPMODE       IN ('SHIP','TRUCK')         AND
         L_COMMITDATE     < L_RECEIPTDATE             AND
         L_SHIPDATE       < L_COMMITDATE              AND
         L_RECEIPTDATE    >= '1995-01-01'                          AND
         L_RECEIPTDATE    < dateadd(yy, 1, '1995-01-01')
GROUP    BY       L_SHIPMODE
ORDER    BY       L_SHIPMODE
-----------
-----------
L_SHIPMODE HIGH_LINE_COUNT LOW_LINE_COUNT
---------- --------------- --------------
SHIP      18723298       28076716
TRUCK     18715859       28075486

(2 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 13 - Customer Distribution */

SELECT   C_COUNT,
         COUNT(*)            AS CUSTDIST
FROM     (        SELECT     C_CUSTKEY,
                            COUNT(O_ORDERKEY)
                  FROM       CUSTOMER left outer join ORDERS on
                             C_CUSTKEY          = O_CUSTKEY                AND
                             O_COMMENT          not like '%pending%accounts%'
                  GROUP      BY          C_CUSTKEY
         )        AS C_ORDERS (C_CUSTKEY, C_COUNT)
GROUP    BY       C_COUNT
ORDER    BY       CUSTDIST            DESC,
                  C_COUNT                         DESC
-----------
-----------
C_COUNT     CUSTDIST
----------- -----------
0          150000000
10          66888162
20          38976345
11          33543677
19          29911305
21          29678857
18          27728874
8          21935218
9          17426874
22          12842817
12          7027514
17          5941421
23          3493242
7          2285241
13          743341
16          653744
24          636284
6          106788
```

```
25        80562
15        47339
14        41847
26        7155
5         2904
27        422
4         50
28        16
29        1

(27 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 14 - Promotion Effect */

SELECT   100.00 * SUM         (            CASE      WHEN P_TYPE LIKE 'PROMO%'
                                                     THEN L_EXTENDEDPRICE*(1-L_DISCOUNT)
                                                     ELSE 0
                                           END) / SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT))          AS PROMO_REVENUE
FROM     LINEITEM,
         PART
WHERE    L_PARTKEY        = P_PARTKEY       AND
         L_SHIPDATE       >= '1995-12-01'                 AND
         L_SHIPDATE       < dateadd(mm, 1, '1995-12-01')
-----------
-----------
PROMO_REVENUE
-----------------------
16.672183

(1 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 15 - Create View for Top Supplier Query */

CREATE  VIEW REVENUE0 (SUPPLIER_NO, TOTAL_REVENUE)
AS
SELECT   L_SUPPKEY,
         SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT))
FROM     LINEITEM
WHERE    L_SHIPDATE       >= '1994-07-01' AND
         L_SHIPDATE       < dateadd(mm, 3, '1994-07-01')
GROUP    BY       L_SUPPKEY
GO


/* TPC_H  Query 15 - Top Supplier */

SELECT   S_SUPPKEY,
         S_NAME,
         S_ADDRESS,
         S_PHONE,
         TOTAL_REVENUE
FROM     SUPPLIER,
         REVENUE0
WHERE    S_SUPPKEY        = SUPPLIER_NO AND
         TOTAL_REVENUE  = (         SELECT   MAX(TOTAL_REVENUE)
                                    FROM     REVENUE0
                           )
ORDER    BY       S_SUPPKEY

DROP VIEW REVENUE0
-----------
-----------
S_SUPPKEY   S_NAME               S_ADDRESS                      S_PHONE        TOTAL_REVENUE
----------- ---------------------- ---------------------------------------- --------------- ---------------------
11853945    Supplier#011853945       v9jd75PrvQcP61i,sM wDwKRoMktRf5         23-382-973-8965 3862222.498800
```

(1 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H Query 16 - Parts/Supplier Relationship */

```
SELECT  P_BRAND,
        P_TYPE,
        P_SIZE,
        COUNT(DISTINCT PS_SUPPKEY)      AS SUPPLIER_CNT
FROM    PARTSUPP,
        PART
WHERE   P_PARTKEY       = PS_PARTKEY                                    AND
        P_BRAND                 <> 'Brand#13'                                   AND
        P_TYPE          NOT LIKE 'PROMO BRUSHED%'                               AND
        P_SIZE          IN (7, 4, 35, 44, 33, 1, 22, 2)     AND
        PS_SUPPKEY      NOT IN  (       SELECT  S_SUPPKEY
                                        FROM    SUPPLIER
                                        WHERE   S_COMMENT       LIKE '%Customer%Complaints%'
                                )
GROUP   BY      P_BRAND,
                P_TYPE,
                P_SIZE
ORDER   BY      SUPPLIER_CNT    DESC,
                P_BRAND,
                P_TYPE,
                P_SIZE
```


C_COUNT	CUSTDIST
0	150000000
10	66888162
20	38976345
11	33543677
19	29911305
.	
.	
.	
5	2904
27	422
4	50
28	16
29	1

(27 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H Query 17 - Small-Quantity-Order Revenue */

```
SELECT  SUM(L_EXTENDEDPRICE)/7.0        AS AVG_YEARLY
FROM    LINEITEM,
        PART
WHERE   P_PARTKEY       = L_PARTKEY     AND
        P_BRAND                 = 'Brand#35'                    AND
        P_CONTAINER     = 'LG BOX'                      AND
        L_QUANTITY      <       (       SELECT  0.2 * AVG(L_QUANTITY)
                                        FROM    LINEITEM
                                        WHERE   L_PARTKEY       = P_PARTKEY
                                )
```


AVG_YEARLY
689271587.987145

(1 row(s) affected)

```
++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 18 - Large Volume Customer */

SELECT   TOP 100
         C_NAME,
         C_CUSTKEY,
         O_ORDERKEY,
         O_ORDERDATE,
         O_TOTALPRICE,
         SUM(L_QUANTITY)
FROM     CUSTOMER,
         ORDERS,
         LINEITEM
WHERE    O_ORDERKEY      IN       (        SELECT   L_ORDERKEY
                                          FROM     LINEITEM
                                          GROUP    BY       L_ORDERKEY HAVING SUM(L_QUANTITY) > 315
                                 )        AND
         C_CUSTKEY       = O_CUSTKEY      AND
         O_ORDERKEY      = L_ORDERKEY
GROUP    BY       C_NAME,
                  C_CUSTKEY,
                  O_ORDERKEY,
                  O_ORDERDATE,
                  O_TOTALPRICE
ORDER    BY       O_TOTALPRICE     DESC,
                  O_ORDERDATE
-----------
-----------
C_NAME               C_CUSTKEY   O_ORDERKEY         O_ORDERDATE           O_TOTALPRICE
------------------------ ----------- -------------------- ----------------------- ------------------------ ------------------------
Customer#158137696       158137696   7351434629         1994-05-21 00:00:00.000 601034.190000          322.000000
Customer#158137696       158137696   15941369219        1994-05-21 00:00:00.000 601034.190000          322.000000
Customer#357399533       357399533   2882403394         1994-12-01 00:00:00.000 594606.240000          336.000000
Customer#357399533       357399533   11472337984        1994-12-01 00:00:00.000 594606.240000          336.000000
Customer#093583247       93583247    8167674722         1997-04-12 00:00:00.000 594369.660000          320.000000
.
.
.
Customer#246996451       246996451   16577579557        1994-02-24 00:00:00.000 568770.470000          335.000000
Customer#411549016       411549016   13962717281        1996-07-09 00:00:00.000 568015.020000          326.000000
Customer#411549016       411549016   5372782691         1996-07-09 00:00:00.000 568015.020000          326.000000
Customer#053126278       53126278    8130580263         1992-11-20 00:00:00.000 567630.690000          316.000000
Customer#053126278       53126278    16720514853        1992-11-20 00:00:00.000 567630.690000          316.000000

(100 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 19 - Discounted Revenue */

SELECT   SUM(L_EXTENDEDPRICE* (1 - L_DISCOUNT))     AS REVENUE
FROM     LINEITEM,
         PART
WHERE    (        P_PARTKEY        = L_PARTKEY                                                    AND
                  P_BRAND                  = 'Brand#24'                                                                AND
                  P_CONTAINER      IN ( 'SM CASE', 'SM BOX', 'SM PACK', 'SM PKG')          AND
                  L_QUANTITY       >= 1                                                           AND
                  L_QUANTITY       <= 1 + 10                                              AND
                  P_SIZE           BETWEEN 1 AND 5                                                AND
                  L_SHIPMODE       IN ('AIR', 'AIR REG')                                  AND
                  L_SHIPINSTRUCT   = 'DELIVER IN PERSON'
         )
         OR
         (        P_PARTKEY        = L_PARTKEY                                                    AND
                  P_BRAND                  = 'Brand#45'                                                                AND
                  P_CONTAINER      IN ( 'MED BAG', 'MED BOX', 'MED PKG', 'MED PACK')      AND
                  L_QUANTITY       >= 14                                                          AND
```

```
                L_QUANTITY      <= 14 + 10                                      AND
                P_SIZE          BETWEEN 1 AND 10                                        AND
                L_SHIPMODE      IN ('AIR', 'AIR REG')                           AND
                L_SHIPINSTRUCT  = 'DELIVER IN PERSON'
        )
        OR
        (       P_PARTKEY       = L_PARTKEY                                             AND
                P_BRAND                 = 'Brand#52'                                                    AND
                P_CONTAINER     IN ( 'LG CASE', 'LG BOX', 'LG PACK', 'LG PKG')  AND
                L_QUANTITY      >= 29                                                   AND
                L_QUANTITY      <= 29 + 10                                      AND
                P_SIZE          BETWEEN 1 AND 15                                        AND
                L_SHIPMODE      IN ('AIR', 'AIR REG')                           AND
                L_SHIPINSTRUCT  = 'DELIVER IN PERSON'
        )
-----------
-----------
REVENUE
------------------------
11726382936.580017

(1 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 20 - Potential Part Promotion */

SELECT  S_NAME,
        S_ADDRESS
FROM    SUPPLIER,
        NATION
WHERE   S_SUPPKEY       IN      (       SELECT  PS_SUPPKEY
                                        FROM    PARTSUPP
                                        WHERE   PS_PARTKEY in   (       SELECT  P_PARTKEY
                                                                        FROM    PART
                                                                        WHERE   P_NAME like 'rosy%'
                                                                )       AND
                                        PS_AVAILQTY     >       (       SELECT  0.5 * sum(L_QUANTITY)
                                                                        FROM    LINEITEM
                                                                        WHERE   L_PARTKEY       = PS_PARTKEY    AND
                                                                                L_SUPPKEY       = PS_SUPPKEY    AND
                                                                                L_SHIPDATE      >= '1996-01-01'
        AND
                                                                                L_SHIPDATE      < dateadd(yy,1,'1996-01-01')
                                                                )
                                )       AND
        S_NATIONKEY     = N_NATIONKEY   AND
        N_NAME          = 'VIETNAM'
ORDER   BY      S_NAME
-----------
-----------
S_NAME                  S_ADDRESS
------------------------- ----------------------------------------
Supplier#000000035      QymmGXxjVVQ5OuABCXVVsu,4eF gU0Qc6
Supplier#000000098      ogHn8dpXB5Q
Supplier#000000251      Uqi3s, iqzLxI4duoRfgkciiN4XuCvITGIUf
Supplier#000000823       gC0DrEG5U,v893fp3nj mmXa6rYhJ0tjpJ
.
.
.
Supplier#029999311      rz2LJ5 zJ9qFjYwSeyR38iFnB0WVwffmohePjO
Supplier#029999554      A8csj9hvRfqHadJ3TgO32tFkb
Supplier#029999572      ryTbpQgmH,oaranzdZyNr3l,YmzQM1
Supplier#029999766      iPo3 EE8FQuQH5cNJb1IyAEKhQ

(191699 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG
```

```
/* TPC_H  Query 21 - Suppliers Who Kept Orders Waiting */

SELECT   TOP 100
         S_NAME,
         COUNT(*)          AS NUMWAIT
FROM     SUPPLIER,
         LINEITEM L1,
         ORDERS,
         NATION
WHERE    S_SUPPKEY                 = L1.L_SUPPKEY            AND
         O_ORDERKEY                = L1.L_ORDERKEY           AND
         O_ORDERSTATUS             = 'F'                     AND
         L1.L_RECEIPTDATE          > L1.L_COMMITDATE         AND
         EXISTS   (          SELECT *
                             FROM   LINEITEM L2
                             WHERE  L2.L_ORDERKEY  = L1.L_ORDERKEY AND
                                    L2.L_SUPPKEY   <> L1.L_SUPPKEY
                  )          AND
         NOT EXISTS          (      SELECT *
                                    FROM   LINEITEM L3
                                    WHERE  L3.L_ORDERKEY      = L1.L_ORDERKEY      AND
                                           L3.L_SUPPKEY       <> L1.L_SUPPKEY      AND
                                           L3.L_RECEIPTDATE   > L3.L_COMMITDATE
                             )      AND
         S_NATIONKEY       = N_NATIONKEY  AND
         N_NAME            = 'PERU'
GROUP    BY       S_NAME
ORDER    BY       NUMWAIT          DESC,
                  S_NAME
-----------
-----------
S_NAME                    NUMWAIT
------------------------- -----------
Supplier#007191050        53
Supplier#017699460        52
Supplier#029162465        52
Supplier#007436114        51
Supplier#019049212        51
.
.
.
Supplier#003823956        43
Supplier#004060595        43
Supplier#004873875        43
Supplier#005618897        43
Supplier#005727909        43

(100 row(s) affected)

++++++++++++++++++++++++++
-- using 1106214139 as a seed to the RNG

/* TPC_H  Query 22 - Global Sales Opportunity */

SELECT   CNTRYCODE,
         COUNT(*)          AS NUMCUST,
         SUM(C_ACCTBAL)    AS TOTACCTBAL
FROM     (          SELECT  SUBSTRING(C_PHONE,1,2)   AS CNTRYCODE,
                            C_ACCTBAL
                   FROM    CUSTOMER
                   WHERE   SUBSTRING(C_PHONE,1,2)   IN       ('30', '32', '18', '28', '22', '29', '19') AND
                           C_ACCTBAL                >        (          SELECT   AVG(C_ACCTBAL)
                                                                       FROM     CUSTOMER
                                                                       WHERE    C_ACCTBAL         > 0.00     AND
                                                                                SUBSTRING(C_PHONE,1,2)  IN  ('30', '32', '18', '28',
'22', '29', '19')
                                                                       )        AND
                           NOT EXISTS               (          SELECT   *
                                                               FROM     ORDERS
                                                               WHERE    O_CUSTKEY         = C_CUSTKEY
                                                    )
```

```
            )           AS CUSTSALE
GROUP   BY      CNTRYCODE
ORDER   BY      CNTRYCODE
-----------
-----------
CNTRYCODE NUMCUST     TOTACCTBAL
--------- ----------- ------------------------
18        2727927     20456479171.830009
19        2727514     20448470350.619976
22        2726909     20452812781.730026
28        2725029     20438041790.419991
29        2727989     20460500942.330048
30        2728536     20463286489.800045
32        2725721     20442760264.959946

(7 row(s) affected)
```

APPENDIX D: Seed & Query Substitution Parameters

Substitution Parameters for Stream 00

++++++++++++++++++++++++++++++

-- using 1106214139 as a seed to the RNG

1 63

2 46 STEEL MIDDLE EAST

3 HOUSEHOLD 1995-03-26

4 1997-01-01

5 EUROPE 1996-01-01

6 1996-01-01 0.04 25

7 FRANCE PERU

8 PERU AMERICA STANDARD POLISHED NICKEL

9 brown

10 1993-12-01

11 SAUDI ARABIA 0.0000000333

12 SHIP TRUCK 1995-01-01

13 pending accounts

14 1995-12-01

15 1994-07-01

16 Brand#13 PROMO BRUSHED 7 4 35 44 33 1 22 2

17 Brand#35 LG BOX

18 315

19 Brand#24 Brand#45 Brand#52 1 14 29

20 rosy 1996-01-01 VIETNAM

Substitution Parameters for Stream 01

++++++++++++++++++++++++++++++

-- using 1106214140 as a seed to the RNG

21 PERU

22 30 32 18 28 22 29 19

21 INDONESIA

3 BUILDING 1995-03-11

18 313

5 MIDDLE EAST 1996-01-01

11 INDIA 0.0000000333

7 UNITED KINGDOM INDONESIA

6 1996-01-01 0.09 24

20 cornsilk 1994-01-01 IRAQ

17 Brand#32 LG JAR

12 FOB TRUCK 1996-01-01

16 Brand#43 MEDIUM ANODIZED 15 10 2 23 6 43 27 20

15 1997-02-01

13 unusual accounts

10 1994-10-01

2 34 NICKEL AMERICA

8 INDONESIA ASIA STANDARD BURNISHED BRASS

14 1996-04-01

19 Brand#21 Brand#23 Brand#51 6 15 25

9 beige

22 21 30 16 17 14 18 29

1 71

4 1994-10-01

Substitution Parameters for Stream 02

++++++++++++++++++++++++++++++

-- using 1106214141 as a seed to the RNG

6 1996-01-01 0.07 24

17 Brand#34 LG CAN

14 1996-07-01

16 Brand#23 ECONOMY PLATED 18 31 33 25 39 28 20 40

19 Brand#24 Brand#11 Brand#45 1 16 21

10 1993-07-01

9 white

2 22 TIN MIDDLE EAST

15 1994-10-01

8 ARGENTINA AMERICA PROMO BRUSHED BRASS

5 AMERICA 1996-01-01

22 11 13 14 22 16 25 21

12 TRUCK MAIL 1994-01-01

7 MOROCCO ARGENTINA

13 unusual accounts

18 314

1 79

4 1997-05-01

20 navy 1993-01-01 ARGENTINA

3 HOUSEHOLD 1995-03-28

11 VIETNAM 0.0000000333

21 ARGENTINA

Substitution Parameters for Stream 03

++++++++++++++++++++++++++++++

-- using 1106214142 as a seed to the RNG

```
8	CHINA	ASIA	PROMO PLATED BRASS
5	ASIA	1996-01-01
4	1995-02-01
6	1996-01-01	0.04	25
17	Brand#31	MED BOX
7	GERMANY	CHINA
1	87
18	312
22	25	27	29	26	32	12	10
14	1996-10-01
9	tan
10	1994-04-01
15	1997-05-01
11	INDONESIA	0.0000000333
20	aquamarine	1996-01-01	MOROCCO
2	10	COPPER	ASIA
21	CHINA
19	Brand#31	Brand#44	Brand#44	6	17	28
13	unusual	accounts
16	Brand#13	STANDARD POLISHED	22	2	40	32	36	39	6	25
12	RAIL	MAIL	1996-01-01
3	AUTOMOBILE	1995-03-14
```

Substitution Parameters for Stream 04

++++++++++++++++++++++++++++++

-- using 1106214143 as a seed to the RNG

```
5	EUROPE	1997-01-01
21	IRAN
14	1997-01-01
19	Brand#33	Brand#32	Brand#44	2	18	25
15	1995-02-01
17	Brand#33	MED JAR
12	AIR	MAIL	1996-01-01
```

6 1997-01-01 0.09 24

4 1997-09-01

9 sky

8 IRAN MIDDLE EAST PROMO ANODIZED BRASS

16 Brand#43 LARGE ANODIZED 37 10 29 12 44 20 3 41

11 RUSSIA 0.0000000333

2 47 STEEL MIDDLE EAST

10 1995-01-01

18 314

1 95

13 unusual deposits

7 UNITED STATES IRAN

22 16 25 26 28 23 24 19

3 HOUSEHOLD 1995-03-30

20 lavender 1995-01-01 ETHIOPIA

Substitution Parameters for Stream 05

++++++++++++++++++++++++++++++

-- using 1106214144 as a seed to the RNG

21 CANADA

15 1997-08-01

4 1995-06-01

6 1997-01-01 0.07 24

7 MOZAMBIQUE BRAZIL

16 Brand#33 PROMO BURNISHED 1 35 7 41 29 20 43 18

19 Brand#35 Brand#15 Brand#33 7 19 21

18 315

14 1997-04-01

22 34 24 13 22 32 25 18

11 IRAN 0.0000000333

13 unusual deposits

3 AUTOMOBILE 1995-03-16

1 103

2 35 BRASS ASIA

5 MIDDLE EAST 1997-01-01

8 BRAZIL AMERICA ECONOMY POLISHED BRASS

20 slate 1993-01-01 SAUDI ARABIA

12 REG AIR MAIL 1997-01-01

17 Brand#35 MED CAN

10 1993-10-01

9 royal

Substitution Parameters for Stream 06

++++++++++++++++++++++++++++++

-- using 1106214145 as a seed to the RNG

10 1994-08-01

3 FURNITURE 1995-03-01

15 1995-05-01

13 unusual deposits

6 1997-01-01 0.04 25

8 ROMANIA EUROPE ECONOMY BURNISHED STEEL

9 powder

7 INDIA ROMANIA

4 1993-03-01

11 UNITED KINGDOM 0.0000000333

22 20 22 26 12 18 29 27

18 313

12 SHIP MAIL 1997-01-01

1 111

5 AFRICA 1997-01-01

16 Brand#13 SMALL POLISHED 32 15 41 42 25 20 38 50

2 23 TIN AFRICA

14 1997-08-01

19 Brand#42 Brand#53 Brand#32 2 20 28

20 firebrick 1997-01-01 IRAN

17 Brand#32 JUMBO BOX

21 SAUDI ARABIA

Substitution Parameters for Stream 07

++++++++++++++++++++++++++++++

-- using 1106214146 as a seed to the RNG

18 314

8 IRAQ MIDDLE EAST LARGE BRUSHED STEEL

20 pink 1995-01-01 UNITED STATES

21 JAPAN

2 11 COPPER ASIA

4 1995-09-01

22 34 20 30 19 13 11 10

17 Brand#34 JUMBO JAR

1 119

11 IRAQ 0.0000000333

9 pale

19 Brand#44 Brand#35 Brand#31 8 11 24

3 MACHINERY 1995-03-18

13 unusual deposits

5 AMERICA 1997-01-01

7 ALGERIA IRAQ

10 1993-05-01

16 Brand#43 LARGE BRUSHED 35 36 25 50 34 16 15 43

6 1997-01-01 0.02 24

14 1997-11-01

15 1993-02-01

12 MAIL FOB 1997-01-01

Substitution Parameters for Stream 08

++++++++++++++++++++++++++++++

-- using 1106214147 as a seed to the RNG

19 Brand#41 Brand#13 Brand#21 3 12 20

1 66

15 1995-09-01

17 Brand#31 JUMBO CAN

5 ASIA 1997-01-01

8 CANADA AMERICA LARGE PLATED STEEL

9 moccasin

12 TRUCK FOB 1993-01-01

14 1993-02-01

7 PERU CANADA

4 1993-06-01

3 FURNITURE 1995-03-03

20 brown 1993-01-01 KENYA

16 Brand#33 STANDARD BURNISHED 27 48 10 13 20 22 12 3

6 1997-01-01 0.07 24

22 33 20 10 15 14 24 27

10 1994-02-01

13 express packages

2 49 STEEL AFRICA

21 EGYPT

18 312

11 UNITED STATES 0.0000000333

APPENDIX E: StepMaster Code

This section lists VB code for StepMaster.

cArrConstraints.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cArrConstraints"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cArrConstraints.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Implements an array of cConstraint objects.
'              Type-safe wrapper around cNodeCollections.
'              Also contains additional functions that determine all the
'              constraints for a step, all constraints in a workspace,
'              validation functions, etc.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mcarrConstraints As cNodeCollections

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cArrConstraints."
Public Sub SaveWspConstraints(ByVal lngWorkspace As Long)
    ' Calls a procedure to commit all changes to the constraints
    ' in the passed in workspace.
```

```
    Call mcarrConstraints.Save(lngWorkspace)

End Sub
Public Property Set ConstraintDB(vdata As Database)

    Set mcarrConstraints.NodeDB = vdata

End Property
Public Property Get ConstraintDB() As Database

    Set ConstraintDB = mcarrConstraints.NodeDB

End Property

Public Sub Modify(cConsToUpdate As cConstraint)

    ' Modify the constraint record
    Call mcarrConstraints.Modify(cConsToUpdate)

End Sub
Public Sub CreateNewConstraintVersion(ByVal lngStepId As Long, _
        ByVal strNewVersion As String, _
        ByVal strOldVersion As String, _
        ByVal intStepType As Integer)

    ' Does all the processing needed to create new versions of
    ' all the constraints for a given step
    ' It inserts new constraint records in the database with
    ' the new version numbers on them
    ' It also updates the version number on all constraints
    ' for the step in the array to the new version passed in
    ' Since it handles both global and manager/worker steps,
    ' it checks for the step_id or global_step_id fields,
    ' depending on the type of step

    Dim lngIndex As Long
    Dim cUpdateConstraint As cConstraint

    On Error GoTo CreateNewConstraintVersionErr
    mstrSource = mstrModuleName & "CreateNewConstraintVersion"

    ' Update the version/global version on Constraint with the
    ' passed in step/global step id
    For lngIndex = 0 To mcarrConstraints.Count - 1
        Set cUpdateConstraint = mcarrConstraints(lngIndex)
        If intStepType = gintGlobalStep Then
            If cUpdateConstraint.GlobalStepId = lngStepId And _
                    cUpdateConstraint.IndOperation <> DeleteOp Then
                cUpdateConstraint.GlobalVersionNo = strNewVersion

                ' Set the operation to indicate an insert
                cUpdateConstraint.IndOperation = InsertOp
            End If
        Else
            If cUpdateConstraint.StepId = lngStepId And _
                    cUpdateConstraint.IndOperation <> DeleteOp Then
                cUpdateConstraint.VersionNo = strNewVersion

                ' Set the operation to indicate an insert
                cUpdateConstraint.IndOperation = InsertOp
            End If
        End If
    Next lngIndex

    Exit Sub

CreateNewConstraintVersionErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "CreateNewConstraintVersion"
    On Error GoTo 0
    Err.Raise vbObjectError + errCreateNewConstraintVersionFailed, _
        mstrSource, _
        LoadResString(errCreateNewConstraintVersionFailed)

End Sub
Private Sub Class_Initialize()

    Set mcarrConstraints = New cNodeCollections
    BugMessage "cArrConstraints: Initialize event - setting Constraint count to 0"

End Sub

Private Sub Class_Terminate()

    Set mcarrConstraints = Nothing
    BugMessage "cArrConstraints: Terminate event triggered"

End Sub

Public Sub Add(ByVal cConstraintToAdd As cConstraint)

    Set cConstraintToAdd.NodeDB = mcarrConstraints.NodeDB

    ' Retrieve a unique constraint identifier
    cConstraintToAdd.ConstraintId = cConstraintToAdd.NextIdentifier

    ' Call a procedure to load the constraint record in the array
    Call mcarrConstraints.Add(cConstraintToAdd)

End Sub
Public Sub Delete(ByVal cOldConstraint As cConstraint)

    Dim lngDeleteElement As Long
    Dim cConsToDelete As cConstraint

    lngDeleteElement = QueryConstraintIndex(cOldConstraint.ConstraintId)
    Set cConsToDelete = mcarrConstraints(lngDeleteElement)

    Call mcarrConstraints.Delete(cConsToDelete.Position)

    Set cConsToDelete = Nothing

End Sub
Private Function QueryConstraintIndex(lngConstraintId As Long) _
        As Long

    Dim lngIndex As Integer

    ' Find the element in the array to be deleted
    For lngIndex = 0 To mcarrConstraints.Count - 1

        ' Note: The constraint id is not a primary key field in
        ' the database - there can be multiple records with the
        ' same constraint_id but for different versions of a step
        ' However, since we'll always load the constraint information
        ' for the latest version of a step, we'll have just one
        ' constraint record with a given constraint_id
        If mcarrConstraints(lngIndex).ConstraintId = lngConstraintId Then
            QueryConstraintIndex = lngIndex
            Exit Function
        End If

    Next lngIndex

    ' Raise error that Constraint has not been found
    ShowError errConstraintNotFound
    On Error GoTo 0
    Err.Raise vbObjectError + errConstraintNotFound, mstrSource, _
        LoadResString(errConstraintNotFound)

End Function
```

```
Public Function QueryConstraint(ByVal lngConstraintId As Long) _
   As cConstraint

   ' Returns a cConstraint object with the property values
   ' corresponding to the Constraint Identifier, lngConstraintId

   Dim lngQueryElement As Long

   lngQueryElement = QueryConstraintIndex(lngConstraintId)

   ' Set the return value to the queried Constraint
   Set QueryConstraint = mcarrConstraints(lngQueryElement)

End Function

Public Sub LoadConstraints(ByVal lngWorkspaceId As Long, rstStepsInWsp As
Recordset)

   ' Loads the constraints array with all the constraints
   ' for the workspace
   Dim recConstraints As Recordset
   Dim qyCons As DAO.QueryDef
   Dim strSql As String
   Dim dtStart As Date

   On Error GoTo LoadConstraintsErr
   mstrSource = mstrModuleName & "LoadConstraints"

   If rstStepsInWsp.RecordCount = 0 Then
      Exit Sub
   End If

   ' First check if the database object has been set
   If mcarrConstraints.NodeDB Is Nothing Then
      On Error GoTo 0
      Err.Raise vbObjectError + errSetDBBeforeLoad, _
            mstrSource, _
            LoadResString(errSetDBBeforeLoad)
   End If

   dtStart = Now

   ' Select based on the global step id since there might
   ' be constraints for a global step that run are executed
   ' for the workspace
   ' This method has the advantage that if the steps are queried right, everything else
follows
   strSql = "Select a.constraint_id, a.step_id, a.version_no, " & _
      " a.constraint_type, a.global_step_id, a.global_version_no, " & _
      " a.sequence_no, b.workspace_id " & _
      " from step_constraints a, att_steps b " & _
      " where a.global_step_id = b.step_id " & _
      " and a.global_version_no = b.version_no " & _
      " and a.global_step_id = [g_s_id] " & _
      " and a.global_version_no = [g_ver_no] " & _
      " and b.archived_flag = [archived] "

   ' Find the highest X-component of the version number
   strSql = strSql & " AND ( a.step_id = 0 or ( cint( mid( a.version_no, 1, instr(
a.version_no, " & gstrDQ & gstrVerSeparator & gstrDQ & " ) - 1 ) ) = " & _
      " ( select max( cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) ) " & _
      " from att_steps AS d " & _
      " WHERE a.step_id = d.step_id " & _
      " and d.archived_flag = [archived] ) "

   ' Find the highest Y-component of the version number for the highest X-component
   strSql = strSql & " AND cint( mid( a.version_no, instr( a.version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) + 1 ) ) = " & _
      " ( select max( cint( mid( version_no, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) + 1 ) ) ) " & _
      " from att_steps AS y " & _
      " Where a.step_id = y.step_id " & _
      " AND cint( mid( version_no, 1, instr( version_no, " & gstrDQ & gstrVerSeparator
& gstrDQ & " ) - 1 ) ) = " & _
      " ( select max( cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) ) " & _
      " from att_steps AS c " & _
      " WHERE y.step_id = c.step_id " & _
      " and c.archived_flag = [archived] ) ) ) ) "

   ' Order the constraints by sequence within a given step
   strSql = strSql & " order by a.sequence_no "

   Set qyCons = mcarrConstraints.NodeDB.CreateQueryDef(gstrEmptyString, strSql)
   qyCons.Parameters("archived").Value = False

   rstStepsInWsp.MoveFirst

   While Not rstStepsInWsp.EOF

      If Not (rstStepsInWsp!global_flag) Then
         qyCons.Close
         BugMessage "Query constraints Read + load took: " & CStr(DateDiff("s",
dtStart, Now))
         Exit Sub
      End If

      qyCons.Parameters("g_s_id").Value = rstStepsInWsp!step_id
      qyCons.Parameters("g_ver_no").Value = rstStepsInWsp!version_no

      Set recConstraints = qyCons.OpenRecordset(dbOpenSnapshot)

      Call LoadRecordsetInConstraintArray(recConstraints)
      recConstraints.Close

      rstStepsInWsp.MoveNext
   Wend

   qyCons.Close
   BugMessage "Query constraints Read + load took: " & CStr(DateDiff("s", dtStart,
Now))

   Exit Sub

LoadConstraintsErr:
   LogErrors Errors
   gstrSource = mstrModuleName & "LoadConstraints"
   On Error GoTo 0
   Err.Raise vbObjectError + errLoadDataFailed, _
         mstrSource, _
         LoadResString(errLoadDataFailed)

End Sub
Public Sub UnloadStepConstraints(ByVal lngStepId As Long)

   ' Unloads all the constraints for the workspace from
   ' the constraints array

   Dim lngIndex As Long

   ' Find all constraints in the array with a matching step id
   ' It is important to step in reverse order through the array,
   ' since we delete constraint records!
   For lngIndex = mcarrConstraints.Count - 1 To 0 Step -1
      If mcarrConstraints(lngIndex).GlobalStepId = lngStepId Then

         ' Unload the constraint from the array
         Call mcarrConstraints.Unload(lngIndex)

      End If
   Next lngIndex
```

```
End Sub
Public Sub UnloadConstraint(cOldConstraint As cConstraint)
    ' Unloads the constraint from the constraints array

    Dim lngDeleteElement As Long

    lngDeleteElement = QueryConstraintIndex(cOldConstraint.ConstraintId)

    Call mcarrConstraints.Unload(lngDeleteElement)

End Sub
Private Sub LoadRecordsetInConstraintArray(ByVal recConstraints As Recordset)
    ' Loads all the constraint records in the passed in
    ' recordset into the array

    Dim cNewConstraint As cConstraint

    On Error GoTo LoadRecordsetInConsArrayErr
    mstrSource = mstrModuleName & "LoadRecordsetInConstraintArray"

    If recConstraints.RecordCount = 0 Then
        Exit Sub
    End If

    recConstraints.MoveFirst
    While Not recConstraints.EOF
        Set cNewConstraint = New cConstraint

        ' Initialize Constraint values
        cNewConstraint.ConstraintId = CLng(ErrorOnNullField(recConstraints,
"Constraint_id"))
        cNewConstraint.StepId = CLng(ErrorOnNullField(recConstraints, "step_id"))
        cNewConstraint.VersionNo = CStr(ErrorOnNullField(recConstraints,
"version_no"))

        cNewConstraint.GlobalStepId = CLng(ErrorOnNullField(recConstraints,
"global_step_id"))
        cNewConstraint.GlobalVersionNo = CStr(ErrorOnNullField(recConstraints,
"global_version_no"))
        cNewConstraint.SequenceNo = CInt(ErrorOnNullField(recConstraints,
"sequence_no"))

        cNewConstraint.WorkspaceId = CLng(ErrorOnNullField(recConstraints,
FLD_ID_WORKSPACE))
        cNewConstraint.ConstraintType = CInt(ErrorOnNullField(recConstraints,
"constraint_type"))

        ' Add this record to the array of Constraints
        mcarrConstraints.Load cNewConstraint

        Set cNewConstraint = Nothing
        recConstraints.MoveNext
    Wend

    Exit Sub

LoadRecordsetInConsArrayErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "LoadRecordsetInConstraintArray"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadRsInArrayFailed, _
        mstrSource, _
        LoadResString(errLoadRsInArrayFailed)

End Sub

Public Function ConstraintsForStep( _
    ByVal lngStepId As Long, _
    ByVal strVersionNo As String, _
    Optional ByVal intConstraintType As ConstraintType = 0, _
    Optional ByVal blnSort As Boolean = True, _
    Optional ByVal blnGlobal As Boolean = False, _
    Optional ByVal blnGlobalConstraintsOnly As Boolean = False) _
    As Variant

' Returns a variant containing an array of cConstraint objects,
' containing all the constraints that have been defined for the
' given step. If the Global flag is set to true, the
' search will be made for all the constraints that have
' a matching global_step_id

Dim lngIndex As Long
Dim cStepConstraint() As cConstraint
Dim lngConstraintCount As Long
Dim cTempConstraint As cConstraint

On Error GoTo ConstraintsForStepErr
mstrSource = mstrModuleName & "ConstraintsForStep"

lngConstraintCount = 0

' Find each element in the constraints array
For lngIndex = 0 To mcarrConstraints.Count - 1
    ' If a constraint type has been specified then check
    ' if the constraint type for the record matches the
    ' passed in type
    Set cTempConstraint = mcarrConstraints(lngIndex)
    If Not blnGlobal Then
        If cTempConstraint.StepId = lngStepId And _
            cTempConstraint.VersionNo = strVersionNo And _
            cTempConstraint.IndOperation <> DeleteOp And _
            (intConstraintType = 0 Or _
            cTempConstraint.ConstraintType = intConstraintType) Then
            ' We have a matching constraint for the given step
            AddArrayElement cStepConstraint, _
                cTempConstraint, lngConstraintCount
        End If
    Else
        If cTempConstraint.GlobalStepId = lngStepId And _
            cTempConstraint.GlobalVersionNo = strVersionNo And _
            cTempConstraint.IndOperation <> DeleteOp Then
            If blnGlobalConstraintsOnly = False Or _
                (blnGlobalConstraintsOnly And _
                cTempConstraint.StepId = 0 And _
                cTempConstraint.VersionNo = gstrMinVersion) Then

                ' We have a matching constraint for the global step
                AddArrayElement cStepConstraint, _
                    cTempConstraint, lngConstraintCount
            End If
        End If
    End If

Next lngIndex

' Set the return value of the function to the array of
' constraints that has been built above
If lngConstraintCount = 0 Then
    ConstraintsForStep = Empty
Else
    ConstraintsForStep = cStepConstraint()
End If

' Sort the constraints
If blnSort Then
    Call QuickSort(ConstraintsForStep)
End If

    Exit Function

ConstraintsForStepErr:
```

```
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errConstraintsForStepFailed, _
        mstrSource, _
        LoadResString(errConstraintsForStepFailed)

End Function
Private Sub AddArrayElement(ByRef arrNodes() As cConstraint, _
    ByVal objToAdd As cConstraint, _
    ByRef lngCount As Long)
  ' Adds the passed in object to the array

  ' Increase the array dimension and add the object to it
  ReDim Preserve arrNodes(lngCount)
  Set arrNodes(lngCount) = objToAdd
  lngCount = lngCount + 1

End Sub

Public Function ConstraintsForWsp( _
    ByVal lngWorkspaceId As Long, _
    Optional ByVal intConstraintType As Integer = 0, _
    Optional ByVal blnSort As Boolean = True, _
    Optional ByVal blnGlobalConstraintsOnly As Boolean = False) _
    As Variant

  ' Returns a variant containing an array of cConstraint objects,
  ' containing all the constraints that have been defined for the
  ' given workspace.

  Dim lngIndex As Long
  Dim cWspConstraint() As cConstraint
  Dim lngConstraintCount As Long
  Dim cTempConstraint As cConstraint

  On Error GoTo ConstraintsForWspErr
  mstrSource = mstrModuleName & "ConstraintsForWsp"

  lngConstraintCount = 0

  ' Find each element in the constraints array
  For lngIndex = 0 To mcarrConstraints.Count - 1
    ' If a constraint type has been specified then check
    ' if the constraint type for the record matches the
    ' passed in type
    Set cTempConstraint = mcarrConstraints(lngIndex)
    If cTempConstraint.WorkspaceId = lngWorkspaceId And _
        cTempConstraint.IndOperation <> DeleteOp And _
        (intConstraintType = 0 Or _
        cTempConstraint.ConstraintType = intConstraintType) Then

      If blnGlobalConstraintsOnly = False Or _
          (blnGlobalConstraintsOnly And _
          cTempConstraint.StepId = 0 And _
          cTempConstraint.VersionNo = gstrMinVersion) Then

        ' We have a matching constraint for the workspace
        AddArrayElement cWspConstraint, _
            cTempConstraint, lngConstraintCount
      End If
    End If
  Next lngIndex

  ' Set the return value of the function to the array of
  ' constraints that has been built above
  If lngConstraintCount = 0 Then
    ConstraintsForWsp = Empty
  Else
    ConstraintsForWsp = cWspConstraint()
  End If

  ' Sort the constraints
  If blnSort Then
    Call QuickSort(ConstraintsForWsp)
  End If

  Exit Function

ConstraintsForWspErr:
  LogErrors Errors
  On Error GoTo 0
  Err.Raise vbObjectError + errConstraintsForWspFailed, _
      mstrSource, _
      LoadResString(errConstraintsForWspFailed)

End Function
Public Function PreConstraintsForStep( _
    ByVal lngStepId As Long, _
    ByVal strVersionNo As String, _
    Optional ByVal blnSort As Boolean) As Variant

  ' Returns a variant containing an array of cConstraint objects,
  ' containing all the pre-execution constraints that have
  ' been defined for the given step_id and version

  ' Call a function that will return a variant containing
  ' all the constraints of the passed in type
  PreConstraintsForStep = ConstraintsForStep(lngStepId, _
      strVersionNo, gintPreStep, blnSort)

End Function
Public Function PostConstraintsForStep( _
    ByVal lngStepId As Long, _
    ByVal strVersionNo As String, _
    Optional ByVal blnSort As Boolean) As Variant

  ' Returns a variant containing an array of cConstraint objects,
  ' containing all the Post-execution constraints that have
  ' been defined for the given step_id and version

  ' Call a function that will return a variant containing
  ' all the constraints of the passed in type
  PostConstraintsForStep = ConstraintsForStep(lngStepId, _
      strVersionNo, gintPostStep, blnSort)

End Function
Public Function PostConstraintsForWsp( _
    ByVal lngWorkspaceId As Long, _
    Optional ByVal blnSort As Boolean) As Variant

  ' Returns a variant containing an array of cConstraint objects,
  ' containing all the Post-execution globals that have
  ' been defined for the workspace

  ' Call a function that will return a variant containing
  ' all the constraints of the passed in type
  PostConstraintsForWsp = ConstraintsForWsp(lngWorkspaceId, _
      gintPostStep, blnSort, True)

End Function
Public Function PreConstraintsForWsp( _
    ByVal lngWorkspaceId As Long, _
    Optional ByVal blnSort As Boolean) As Variant

  ' Returns a variant containing an array of cConstraint objects,
  ' containing all the Pre-execution globals that have
  ' been defined for the workspace

  ' Call a function that will return a variant containing
  ' all the constraints of the passed in type
  PreConstraintsForWsp = ConstraintsForWsp(lngWorkspaceId, _
      gintPreStep, blnSort, True)
```

```
End Function
Public Property Get ConstraintCount() As Long

    ConstraintCount = mcarrConstraints.Count

End Property
```

cArrParameters.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cArrParameters"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cArrParameters.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Implements an array of cParameter objects.
'              Type-safe wrapper around cNodeCollections.
'              Also contains additional functions to determine parameter
'              values, validation functions, etc.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mcarrParameters As cNodeCollections

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cArrParameters."

Public Property Set ParamDatabase(vdata As Database)

    Set mcarrParameters.NodeDB = vdata

End Property
Public Sub Modify(cModifiedParam As cParameter)

    ' First check if the parameter record is valid
    Call CheckDupParamName(cModifiedParam)

    Call mcarrParameters.Modify(cModifiedParam)

End Sub
Public Sub Load(ByRef cParamToAdd As cParameter)

    Call mcarrParameters.Load(cParamToAdd)

End Sub
Public Sub Add(ByRef cParamToAdd As cParameter)

    Set cParamToAdd.NodeDB = mcarrParameters.NodeDB

    ' First check if the parameter record is valid
    Call Validate(cParamToAdd)

    ' Retrieve a unique parameter identifier
    cParamToAdd.ParameterId = cParamToAdd.NextIdentifier

    Call mcarrParameters.Add(cParamToAdd)

End Sub
Public Sub Unload(lngParamToDelete As Long)

    Dim lngDeleteElement As Long

    lngDeleteElement = QueryIndex(lngParamToDelete)

    Call mcarrParameters.Unload(lngDeleteElement)

End Sub

Public Sub SaveParametersInWsp(ByVal lngWorkspace As Long)
    ' Calls a procedure to commit all changes to the parameters
    ' for the passed in workspace.

    ' Call a procedure to save all parameter records for the
    ' workspace
    Call mcarrParameters.Save(lngWorkspace)

End Sub
Public Function GetParameterValue(ByVal lngWorkspace As Long, _
        ByVal strParamName As String) As cParameter
    ' Returns the value for the passed in workspace parameter

    Dim cParamRec As cParameter
    Dim lngIndex As Long

    On Error GoTo GetParameterValueErr

    ' Find all parameters in the array with a matching workspace id
    For lngIndex = 0 To mcarrParameters.Count - 1
        Set cParamRec = mcarrParameters(lngIndex)
        If cParamRec.WorkspaceId = lngWorkspace And _
              cParamRec.ParameterName = strParamName Then

            Set GetParameterValue = cParamRec
            Exit For
        End If
    Next lngIndex

    If lngIndex > mcarrParameters.Count - 1 Then
        ' The parameter has not been defined for the workspace
        ' Raise an error
        On Error GoTo 0
        Err.Raise vbObjectError + errParamNameInvalid, _
              mstrModuleName & "GetParameterValue", _
              LoadResString(errParamNameInvalid)
    End If

    Exit Function

GetParameterValueErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "GetParameterValue"
    On Error GoTo 0
    Err.Raise vbObjectError + errGetParamValueFailed, _
          gstrSource, _
          LoadResString(errGetParamValueFailed)

End Function
Public Sub Delete(lngParamToDelete As Long)
    ' Delete the passed in parameter

    Dim lngDeleteElement As Long

    lngDeleteElement = QueryIndex(lngParamToDelete)
    Call mcarrParameters.Delete(lngDeleteElement)

End Sub
Private Function QueryIndex(lngParameterId As Long) As Long
```

```
    Dim lngIndex As Long

    ' Find the matching parameter record in the array
    For lngIndex = 0 To mcarrParameters.Count - 1
        If mcarrParameters(lngIndex).ParameterId = lngParameterId And _
            mcarrParameters(lngIndex).IndOperation <> DeleteOp Then
            QueryIndex = lngIndex
            Exit Function
        End If
    Next lngIndex

    ' Raise error that parameter has not been found
    On Error GoTo 0
    Err.Raise vbObjectError + errParamNotFound, "cArrParameters.QueryIndex", _
        LoadResString(errParamNotFound)

End Function

Public Function QueryParameter(lngParameterId As Long) _
        As cParameter

    Dim lngQueryElement As Long

    lngQueryElement = QueryIndex(lngParameterId)

    ' Return the queried parameter object
    Set QueryParameter = mcarrParameters(lngQueryElement)

End Function
Public Property Get ParameterCount() As Long

    ParameterCount = mcarrParameters.Count

End Property
Public Property Get Item(lngIndex As Long) As cParameter
Attribute Item.VB_UserMemId = 0

    Set Item = mcarrParameters(lngIndex)

End Property

Public Sub Validate(ByVal cParamToValidate As cParameter)
    ' This procedure is necessary since the class cannot validate
    ' all the parameter properties on it's own. This is 'coz we
    ' might have created new parameters in the workspace, but not
    ' saved them to the database yet - hence the duplicate check
    ' has to be repeated in the array

    Dim lngIndex As Long
    Dim cTempParam As cParameter

    On Error GoTo ValidateErr

    ' Check if the parameter name already exists in the workspace
    For lngIndex = 0 To mcarrParameters.Count - 1
        Set cTempParam = mcarrParameters(lngIndex)
        If cTempParam.WorkspaceId = cParamToValidate.WorkspaceId And _
            cTempParam.ParameterName = cParamToValidate.ParameterName And _
            cTempParam.IndOperation <> DeleteOp Then
            On Error GoTo 0
            Err.Raise vbObjectError + errDuplicateParameterName, _
                mstrSource, LoadResString(errDuplicateParameterName)
        End If
    Next lngIndex

    Exit Sub

ValidateErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Validate"
    On Error GoTo 0
    Err.Raise vbObjectError + errValidateFailed, _
        mstrSource, LoadResString(errValidateFailed)

End Sub
Public Sub CheckDupParamName(ByVal cParamToValidate As cParameter)

    Dim lngIndex As Long
    Dim cTempParam As cParameter

    ' Check if the parameter name already exists in the workspace
    For lngIndex = 0 To mcarrParameters.Count - 1
        Set cTempParam = mcarrParameters(lngIndex)
        If cTempParam.WorkspaceId = cParamToValidate.WorkspaceId And _
            cTempParam.ParameterName = cParamToValidate.ParameterName And _
            cTempParam.ParameterId <> cParamToValidate.ParameterId And _
            cTempParam.IndOperation <> DeleteOp Then
            ShowError errDuplicateParameterName
            On Error GoTo 0
            Err.Raise vbObjectError + errDuplicateParameterName, _
                mstrSource, LoadResString(errDuplicateParameterName)
        End If
    Next lngIndex

End Sub

Private Sub Class_Initialize()

    'bugmessage "cArrParameters: Initialize event - setting parameter count to 0"
    Set mcarrParameters = New cNodeCollections

End Sub


Private Sub Class_Terminate()

    Set mcarrParameters = Nothing

End Sub
```

cArrSteps.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cArrSteps"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:      cArrSteps.cls
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    Implements an array of cStep objects.
'             Type-safe wrapper around cNodeCollections.
'             Also contains additional functions to update parent version
'             on substeps, validation functions, etc.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mcarrSteps As cNodeCollections

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cArrSteps."

Public Sub Unload(lngStepToDelete As Long)
```

```
    Dim lngDeleteElement As Long
    Dim cUnloadStep As cStep

    lngDeleteElement = QueryStepIndex(lngStepToDelete)
    Set cUnloadStep = QueryStep(lngStepToDelete)

    ' First unload all iterators for the step
    Call cUnloadStep.UnloadIterators

    ' Unload the step from the collection
    Call mcarrSteps.Unload(lngDeleteElement)

End Sub
Public Sub Modify(cModifiedStep As cStep)

    Validate cModifiedStep

    Call mcarrSteps.Modify(cModifiedStep)

End Sub
Public Sub UpdateParentVersion(ByVal lngStepId As Long, _
        ByVal strNewVersion As String, _
        ByVal strOldVersion As String, _
        ByVal intStepType As Integer)

    ' Does all the processing needed to update the parent version
    ' number on all the sub-steps for a given step
    ' It updates the parent version no in the database for all
    ' sub-steps of the passed in step id
    ' It also updates the parent version number on all sub-steps
    ' in the array to the new version passed in

    Dim lngIndex As Long
    Dim cUpdateStep As cStep

    On Error GoTo UpdateParentVersionErr

    If intStepType <> gintManagerStep Then
        ' Only a manager can have sub-steps - if the passed
        ' in step is not a manager, exit
        Exit Sub
    End If

    ' For all steps in the array
    For lngIndex = 0 To mcarrSteps.Count - 1

        Set cUpdateStep = mcarrSteps(lngIndex)

        ' If the current step is a sub-step of the passed in step
        If cUpdateStep.ParentStepId = lngStepId And _
              cUpdateStep.ParentVersionNo = strOldVersion And _
              Not cUpdateStep.ArchivedFlag Then

            ' Update the parent version number for the sub-step
            ' in the array
            cUpdateStep.ParentVersionNo = strNewVersion

            ' Update the parent version number for the sub-step
            ' in the array
            Call Modify(cUpdateStep)

        End If
    Next lngIndex

    Exit Sub

UpdateParentVersionErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "UpdateParentVersion"
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateParentVersionFailed, _
          mstrSource, _
          LoadResString(errUpdateParentVersionFailed)

End Sub
Private Sub Validate(cCheckStep As cStep)

    ' Step validations that depend on other steps in the collection

    Dim lngIndex As Long

    ' Ensure that the step label is unique in the workspace
    For lngIndex = 0 To mcarrSteps.Count - 1

        ' If the current step is a sub-step of the passed in step
        If mcarrSteps(lngIndex).WorkspaceId = cCheckStep.WorkspaceId And _
              mcarrSteps(lngIndex).StepLabel = cCheckStep.StepLabel And _
              mcarrSteps(lngIndex).StepId <> cCheckStep.StepId Then
            ShowError errStepLabelUnique
            On Error GoTo 0
            Err.Raise vbObjectError + errValidateFailed, _
                  mstrModuleName & "Validate", _
                  LoadResString(errValidateFailed)
        End If
    Next lngIndex

End Sub

Private Sub Class_Initialize()

    BugMessage "cArrSteps: Initialize event - setting step count to 0"
    Set mcarrSteps = New cNodeCollections

End Sub

Private Sub Class_Terminate()

    BugMessage "cArrSteps: Terminate event triggered"
    Set mcarrSteps = Nothing

End Sub

Public Sub Add(ByVal cStepToAdd As cStep)

    Validate cStepToAdd

    Set cStepToAdd.NodeDB = mcarrSteps.NodeDB

    ' Retrieve a unique step identifier
    cStepToAdd.StepId = cStepToAdd.NextStepId

    ' Call a procedure to add the step record
    Call mcarrSteps.Add(cStepToAdd)

End Sub
Public Sub Load(cStepToLoad As cStep)

    Call mcarrSteps.Load(cStepToLoad)

End Sub
Public Sub SaveStepsInWsp(ByVal lngWorkspace As Long)
    ' Calls a procedure to commit all changes to the steps
    ' in the passed in workspace.

    Dim lngIndex As Integer

    ' Find all steps in the array with a matching workspace id
    ' It is important to step in reverse order through the array,
    ' since we delete step records sometimes!
    For lngIndex = mcarrSteps.Count - 1 To 0 Step -1
        If mcarrSteps(lngIndex).WorkspaceId = lngWorkspace Then
```

```
            ' Call a procedure to commit all changes to the
            ' Step record, if any
            Call CommitStep(mcarrSteps(lngIndex), lngIndex)

        End If
    Next lngIndex

End Sub
Private Sub CommitStep(ByVal cCommitStep As cStep, _
        ByVal intIndex As Integer)
    ' This procedure checks if any changes have been made to the
    ' passed in Step. If so, it calls the step methods to commit
    ' the changes.

    ' First commit all changes to the iterator records for
    ' the step
    cCommitStep.SaveIterators

    Call mcarrSteps.Commit(cCommitStep, intIndex)

End Sub
Public Sub Delete(lngStepToDelete As Long)

    Dim lngDeleteElement As Long

    lngDeleteElement = QueryStepIndex(lngStepToDelete)
    Call mcarrSteps.Delete(lngDeleteElement)

End Sub
Public Function QueryStepIndex(lngStepId As Long) As Long

    Dim lngIndex As Long

    ' Find the element in the array that corresponds to the
    ' passed in step id - note that while there will be multiple
    ' versions of a step in the database, only one version will
    ' be currently loaded in the array - meaning that the stepid
    ' is enough to uniquely identify a step
    For lngIndex = 0 To mcarrSteps.Count - 1
        If mcarrSteps(lngIndex).StepId = lngStepId Then
            QueryStepIndex = lngIndex
            Exit Function
        End If
    Next lngIndex

    ' Raise error that step has not been found
    On Error GoTo 0
    Err.Raise vbObjectError + errStepNotFound, mstrSource, _
        LoadResString(errStepNotFound)

End Function

Public Function QueryStep(ByVal lngStepId As Long) As cStep

    ' Populates the passed in cStep object with the property
    ' values corresponding to the Step Identifier, lngStepId

    Dim lngQueryElement As Integer

    lngQueryElement = QueryStepIndex(lngStepId)

    ' Initialize the passed in step object to the queried step
    Set QueryStep = mcarrSteps(lngQueryElement)

End Function
Public Property Get Item(ByVal Position As Long) As cStep
Attribute Item.VB_UserMemId = 0

    ' Returns the element at the passed in position in the array
    If Position >= 0 And Position < mcarrSteps.Count Then
        Set Item = mcarrSteps(Position)
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
            LoadResString(errItemDoesNotExist)
    End If

End Property
Public Property Set Item(ByVal Position As Long, _
        ByVal cStepRec As cStep)

    ' Returns the element at the passed in position in the array
    If Position >= 0 And Position < mcarrSteps.Count Then
        Set mcarrSteps(Position) = cStepRec
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
            LoadResString(errItemDoesNotExist)
    End If

End Property
Public Property Set StepDB(vdata As Database)

    Set mcarrSteps.NodeDB = vdata

End Property
Public Function SubSteps(ByVal lngStepId As Long, _
        ByVal strVersionNo As String) As Variant

    ' Returns a variant containing an array of all the substeps
    ' for the passed in step

    Dim intIndex As Integer
    Dim cSubSteps() As cStep
    Dim lngStepCount As Long
    Dim cQueryStep As cStep

    On Error GoTo SubStepsErr

    lngStepCount = 0

    Set cQueryStep = QueryStep(lngStepId)

    ' Only a manager can have sub-steps
    If cQueryStep.StepType = gintManagerStep Then

        ' For each element in the Steps array
        For intIndex = 0 To mcarrSteps.Count - 1
            ' Check if the parent step id and parent version number
            ' match the passed in step
            If mcarrSteps(intIndex).ParentStepId = lngStepId And _
                    mcarrSteps(intIndex).ParentVersionNo = strVersionNo And _
                    mcarrSteps(intIndex).IndOperation <> DeleteOp Then

                ' Increase the array dimension and add the step
                ' to it
                ReDim Preserve cSubSteps(lngStepCount)
                Set cSubSteps(lngStepCount) = mcarrSteps(intIndex)
                lngStepCount = lngStepCount + 1

            End If
        Next intIndex

    End If

    ' Set the return value of the function to the array of
    ' Steps that has been built above
    If lngStepCount = 0 Then
        SubSteps = Empty
    Else
        SubSteps = cSubSteps()
```

```
    End If

    Exit Function

SubStepsErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "SubSteps"
    On Error GoTo 0
    Err.Raise vbObjectError + errSubStepsFailed, _
          mstrSource, _
          LoadResString(errSubStepsFailed)

End Function

Public Property Get StepCount() As Integer

    StepCount = mcarrSteps.Count

End Property

VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cAsyncShell"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'--------------------------------------------------------------------------------
' Copyright © 1997 Microsoft Corporation. All rights reserved.
'
' You have a royalty-free right to use, modify, reproduce and distribute the
' Sample Application Files (and/or any modified version) in any way you find
' useful, provided that you agree that Microsoft has no warranty, obligations or
' liability for any Sample Application Files.
'--------------------------------------------------------------------------------

Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cAsyncShell."

Public Event Terminated()

Private WithEvents moTimer As cTimerSM
Attribute moTimer.VB_VarHelpID = -1
Private proc As PROCESS_INFORMATION
Private mfShelling As Boolean


'--------------------------------------------------------------------------------
'Initialization and cleanup:

Private Sub Class_Initialize()
    Set moTimer = New cTimerSM
End Sub

Private Sub Class_Terminate()
    If mfShelling Then CloseHandle proc.hProcess
End Sub

'--------------------------------------------------------------------------------
'Shelling:

Public Sub Shell(CommandLine As String, Optional PollingInterval As Long = 1000)
    Dim Start As STARTUPINFO

    If mfShelling Then
        On Error GoTo 0
        Err.Raise vbObjectError + errInstanceInUse, _
              mstrSource, _
              LoadResString(errInstanceInUse)
    End If
    mfShelling = True

    ' Initialize the STARTUPINFO structure:
    Start.cb = Len(Start)
    Start.dwFlags = STARTF_USESHOWWINDOW
    Start.wShowWindow = SW_SHOWMINNOACTIVE

    ' Start the shelled application:
    CreateProcessA 0&, CommandLine, 0&, 0&, 1&, _
        NORMAL_PRIORITY_CLASS, 0&, 0&, Start, proc

    With moTimer
        If PollingInterval > 0 Then
            .Interval = PollingInterval
        Else
            .Interval = 1000
        End If
        .Enabled = True
    End With
End Sub
'--------------------------------------------------------------------------------
'Aborting:
Public Sub Abort()
    Dim nCode As Long
'    Dim X As Integer
'    Dim ReturnVal As Integer

    On Error GoTo AbortErr

    If Not mfShelling Then
        Call WriteError(errProgramError, mstrSource)
    Else
'        If IsWindow(proc.hProcess) = False Then Exit Sub
'
'        If (GetWindowLong(proc.hProcess, GWL_STYLE) And WS_DISABLED) Then
Exit Sub
'
'        If IsWindow(proc.hProcess) Then
'            If Not (GetWindowLong(proc.hProcess, GWL_STYLE) And WS_DISABLED)
Then
'                X = PostMessage(proc.hProcess, WM_CANCELMODE, 0, 0&)
'                X = PostMessage(proc.hProcess, WM_CLOSE, 0, 0&)
'            End If
'        End If

        If TerminateProcess(proc.hProcess, 0&) = 0 Then
            Debug.Print "Unable to terminate process: " & proc.hProcess
            Call WriteError(errTerminateProcessFailed, mstrSource, _
                  ApiError(GetLastError()))
        Else
            ' Should always come here!
            GetExitCodeProcess proc.hProcess, nCode
            If nCode = STILL_ACTIVE Then
                ' Write an error and close the handles to the
                ' process anyway
                Call WriteError(errTerminateProcessFailed, mstrSource)
            End If
        End If

        ' Close all open handles to the shelled process, even
        ' if any of the above calls error out
        CloseHandle proc.hProcess
        moTimer.Enabled = False
        mfShelling = False
        RaiseEvent Terminated
```

```
    End If

    Exit Sub

AbortErr:
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "Abort"
    On Error GoTo 0
    Err.Raise vbObjectError + errProgramError, _
        mstrSource, _
        LoadResString(errProgramError)

End Sub
Private Sub moTimer_Timer()
    Dim nCode As Long

    GetExitCodeProcess proc.hProcess, nCode
    If nCode <> STILL_ACTIVE Then
        CloseHandle proc.hProcess
        moTimer.Enabled = False
        mfShelling = False
        RaiseEvent Terminated
    End If
End Sub
```

cConnDtl.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cConnDtl"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cConnDtl.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a connection.
'              Contains functions to insert, update and delete
'              connection_dtls records from the database.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit
Option Base 0

' Local variable(s) to hold property value(s)
Public WorkspaceId As Long
Public ConnNameId As Long
Public ConnName As String
Public ConnectionString As String
Public ConnType As ConnectionType
Public Position As Long
Public NodeDB As Database

Private mintOperation As Operation

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cConnDtl."

' The cSequence class is used to generate unique Connection identifiers
Private mConnectionSeq As cSequence

' The StringSM class is used to carry out string operations
Private mFieldValue As cStringSM

Private Sub AssignParameters(qyExec As DAO.QueryDef)
    ' Assigns values to the parameters in the querydef object
    ' The parameter names are cryptic to differentiate them from the field names.
    ' When the parameter names are the same as the field names, parameters in the
where
    ' clause do not get created.

    Dim prmParam As DAO.Parameter

    On Error GoTo AssignParametersErr

    For Each prmParam In qyExec.Parameters
        Select Case prmParam.Name
            Case "[w_id]"
                prmParam.Value = WorkspaceId

            Case "[c_id]"
                prmParam.Value = ConnNameId

            Case "[c_name]"
                prmParam.Value = ConnName

            Case "[c_str]"
                prmParam.Value = ConnectionString

            Case "[c_type]"
                prmParam.Value = ConnType

            Case Else
                ' Write the parameter name that is faulty
                WriteError errInvalidParameter, mstrSource, prmParam.Name
                On Error GoTo 0
                Err.Raise errInvalidParameter, mstrModuleName & "AssignParameters", _
                    LoadResString(errInvalidParameter)
        End Select
    Next prmParam

    Exit Sub

AssignParametersErr:

    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errAssignParametersFailed, _
        mstrModuleName & "AssignParameters",
LoadResString(errAssignParametersFailed)

End Sub

Public Function Clone() As cConnDtl

    ' Creates a copy of a given Connection

    Dim cCloneConn As cConnDtl

    On Error GoTo CloneErr

    Set cCloneConn = New cConnDtl

    ' Copy all the Connection properties to the newly created Connection
    cCloneConn.WorkspaceId = WorkspaceId
    cCloneConn.ConnNameId = ConnNameId
    cCloneConn.ConnName = ConnName
    cCloneConn.ConnectionString = ConnectionString
    cCloneConn.ConnType = ConnType
    cCloneConn.IndOperation = mintOperation
    cCloneConn.Position = Position

    ' And set the return value to the newly created Connection
    Set Clone = cCloneConn
    Set cCloneConn = Nothing
```

```
    Exit Function

CloneErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Clone"
    On Error GoTo 0
    Err.Raise vbObjectError + errCloneFailed, mstrSource,
LoadResString(errCloneFailed)

End Function
Private Sub CheckDupConnectionName()
    ' Check if the Connection name already exists in the workspace

    Dim rstConnection As Recordset
    Dim strSql As String
    Dim qy As DAO.QueryDef

    On Error GoTo CheckDupConnectionNameErr
    mstrSource = mstrModuleName & "CheckDupConnectionName"

    ' Create a recordset object to retrieve the count of all Connections
    ' for the workspace with the same name
    strSql = "Select count(*) as Connection_count " & _
        " from " & TBL_CONNECTION_DTLS & _
        " where " & FLD_ID_WORKSPACE & " = [w_id]" & _
        " and " & FLD_CONN_DTL_CONNECTION_NAME & " = [c_name]" & _
        " and " & FLD_ID_CONN_NAME & " <> [c_id]"

    Set qy = dbsAttTool.CreateQueryDef(gstrEmptyString, strSql)
    Call AssignParameters(qy)

    Set rstConnection = qy.OpenRecordset(dbOpenForwardOnly)

    If rstConnection![Connection_count] > 0 Then
        rstConnection.Close
        qy.Close
        ShowError errDupConnDtlName
        On Error GoTo 0
        Err.Raise vbObjectError + errDupConnDtlName, _
            mstrSource, LoadResString(errDupConnDtlName)
    End If

    rstConnection.Close
    qy.Close

    Exit Sub

CheckDupConnectionNameErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "CheckDupConnectionName"
    On Error GoTo 0
    Err.Raise vbObjectError + errProgramError, _
        mstrSource, LoadResString(errProgramError)

End Sub
Public Property Let IndOperation(ByVal vdata As Operation)

    ' The valid operations are define in the cOperations
    ' class. Check if the operation is valid
    Select Case vdata
        Case QueryOp, InsertOp, UpdateOp, DeleteOp
            mintOperation = vdata

        Case Else
            BugAssert True
    End Select

End Property
Public Sub Validate()
    ' Each distinct object will have a Validate method which
    ' will check if the class properties are valid. This method
    ' will be used to check interdependant properties that
    ' cannot be validated by the let procedures.
    ' It should be called by the add and modify methods of the class

    If ConnName = gstrEmptyString Then

        ShowError errConnectionNameMandatory
        On Error GoTo 0
        ' Propogate this error back to the caller
        Err.Raise vbObjectError + errConnectionNameMandatory, _
            mstrSource, LoadResString(errConnectionNameMandatory)
    End If

    ' Raise an error if the Connection name already exists in the workspace
    Call CheckDupConnectionName

End Sub
Public Sub Add()

    Dim strInsert As String
    Dim qy As DAO.QueryDef

    On Error GoTo AddErr

    ' Validate the record before trying to insert the record
    Call Validate

    ' Create a temporary querydef object
    strInsert = "insert into " & TBL_CONNECTION_DTLS & _
            "( " & FLD_ID_WORKSPACE & _
            ", " & FLD_ID_CONN_NAME & _
            ", " & FLD_CONN_DTL_CONNECTION_NAME & _
            ", " & FLD_CONN_DTL_CONNECTION_STRING & _
            ", " & FLD_CONN_DTL_CONNECTION_TYPE & " ) " & _
            " values ( [w_id], [c_id], " & _
            " [c_name], [c_str], [c_type] ) "

    Set qy = dbsAttTool.CreateQueryDef(gstrEmptyString, strInsert)

    ' Call a procedure to assign the Connection values
    Call AssignParameters(qy)

    qy.Execute dbFailOnError
    qy.Close

    Exit Sub

AddErr:

    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errInsertFailed, _
        mstrModuleName & "Add", LoadResString(errInsertFailed)

End Sub
Public Sub Delete()

    Dim strDelete As String
    Dim qy As DAO.QueryDef

    On Error GoTo DeleteErr

    strDelete = "delete from " & TBL_CONNECTION_DTLS & _
            " where " & FLD_ID_CONN_NAME & " = [c_id]"
    Set qy = dbsAttTool.CreateQueryDef(gstrEmptyString, strDelete)

    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    qy.Close
```

```
    Exit Sub

DeleteErr:
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errDeleteFailed, _
        mstrModuleName & "Delete", LoadResString(errDeleteFailed)

End Sub

Public Sub Modify()

    Dim strUpdate As String
    Dim qy As QueryDef

    On Error GoTo ModifyErr

    ' Validate the updated values before trying to modify the db
    Call Validate

    ' Create a temporary querydef object with the modify string
    strUpdate = "update " & TBL_CONNECTION_DTLS & _
        " set " & FLD_ID_WORKSPACE & " = [w_id], " & _
        FLD_CONN_DTL_CONNECTION_NAME & " = [c_name], " & _
        FLD_CONN_DTL_CONNECTION_STRING & " = [c_str], " & _
        FLD_CONN_DTL_CONNECTION_TYPE & " = [c_type] " & _
        " where " & FLD_ID_CONN_NAME & " = [c_id]"
    Set qy = dbsAttTool.CreateQueryDef(gstrEmptyString, strUpdate)

    ' Call a procedure to assign the Connection values to the
    ' querydef object
    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    qy.Close

    Exit Sub

ModifyErr:

    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errModifyFailed, _
      mstrModuleName & "Modify", LoadResString(errModifyFailed)

End Sub
Public Property Get NextIdentifier() As Long

    Dim lngNextId As Long

    On Error GoTo NextIdentifierErr

    ' Retrieve the next identifier using the sequence class
    Set mConnectionSeq = New cSequence
    Set mConnectionSeq.IdDatabase = dbsAttTool
    mConnectionSeq.IdentifierColumn = FLD_ID_CONN_NAME
    lngNextId = mConnectionSeq.Identifier
    Set mConnectionSeq = Nothing

    NextIdentifier = lngNextId
    Exit Property

NextIdentifierErr:
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errIdGetFailed, _
      mstrModuleName & "NextIdentifier", LoadResString(errIdGetFailed)

End Property
Public Property Get IndOperation() As Operation

    IndOperation = mintOperation

End Property

Private Sub Class_Initialize()

    Set mFieldValue = New cStringSM

    ' Initialize the operation indicator variable to Query
    ' It will be modified later by the collection class when
    ' inserts, updates or deletes are performed
    mintOperation = QueryOp

    ConnType = giDefaultConnType

End Sub

Private Sub Class_Terminate()

    Set mFieldValue = Nothing

End Sub
```

cConnDtls.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cConnDtls"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:      cConnDtls.cls
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    Implements an array of cConnDtl objects.
'              Type-safe wrapper around cNodeCollections.
'              Also contains additional functions to determine the connection
'              string value, validation functions, etc.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mcarrConnDtls As cNodeCollections

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cConnDtls."

Public Property Set ConnDb(vdata As Database)

    Set mcarrConnDtls.NodeDB = vdata

End Property
Public Sub Modify(cModifiedConn As cConnDtl)

    ' First check if the parameter record is valid
    Call CheckDupConnName(cModifiedConn)

    Call mcarrConnDtls.Modify(cModifiedConn)

End Sub
Public Sub Load(ByRef cConnToAdd As cConnDtl)

    Call mcarrConnDtls.Load(cConnToAdd)
```

```
End Sub
Public Sub Add(ByRef cConnToAdd As cConnDtl)

    ' First check if the record is valid
    Call Validate(cConnToAdd)

    ' Retrieve a unique identifier
    cConnToAdd.ConnNameId = cConnToAdd.NextIdentifier

    Call mcarrConnDtls.Add(cConnToAdd)

End Sub

Public Sub Unload(lConnNameId As Long)

    Dim lngDeleteElement As Long

    lngDeleteElement = QueryIndex(lConnNameId)

    Call mcarrConnDtls.Unload(lngDeleteElement)

End Sub

Public Sub SaveConnDtlsInWsp(ByVal lngWorkspace As Long)
    ' Call a procedure to save all connection details records for the workspace
    Call mcarrConnDtls.Save(lngWorkspace)

End Sub
Public Function GetConnectionDtl(ByVal lngWorkspace As Long, _
        ByVal strConnectionName As String) As cConnDtl
    ' Returns the connection dtl for the passed in connection name

    Dim lngIndex As Long

    ' Find all parameters in the array with a matching workspace id
    For lngIndex = 0 To mcarrConnDtls.Count - 1
        If mcarrConnDtls(lngIndex).WorkspaceId = lngWorkspace And _
              mcarrConnDtls(lngIndex).ConnName = strConnectionName Then

            Set GetConnectionDtl = mcarrConnDtls(lngIndex)
            Exit For
        End If
    Next lngIndex

    If lngIndex > mcarrConnDtls.Count - 1 Then
        ' The parameter has not been defined for the workspace
        ' Raise an error
        On Error GoTo 0
        Err.Raise vbObjectError + errConnNameInvalid, mstrModuleName &
"GetConnection", _
              LoadResString(errConnNameInvalid)
    End If

End Function
Public Sub Delete(lConnNameId As Long)
    ' Delete the passed in parameter

    Dim lngDeleteElement As Long

    lngDeleteElement = QueryIndex(lConnNameId)
    Call mcarrConnDtls.Delete(lngDeleteElement)

End Sub
Private Function QueryIndex(lConnNameId As Long) As Long

    Dim lngIndex As Long

    ' Find the matching parameter record in the array
    For lngIndex = 0 To mcarrConnDtls.Count - 1
        If mcarrConnDtls(lngIndex).ConnNameId = lConnNameId And _
              mcarrConnDtls(lngIndex).IndOperation <> DeleteOp Then
            QueryIndex = lngIndex
            Exit Function
        End If
    Next lngIndex

    ' Raise error that parameter has not been found
    On Error GoTo 0
    Err.Raise vbObjectError + errQueryIndexFailed, "cArrParameters.QueryIndex", _
        LoadResString(errQueryIndexFailed)

End Function

Public Function QueryConnDtl(lConnNameId As Long) As cConnDtl

    Dim lngQueryElement As Long

    lngQueryElement = QueryIndex(lConnNameId)

    ' Return the queried connection object
    Set QueryConnDtl = mcarrConnDtls(lngQueryElement)

End Function
Public Property Get Count() As Long

    Count = mcarrConnDtls.Count

End Property
Public Property Get Item(lngIndex As Long) As cConnDtl
Attribute Item.VB_UserMemId = 0

    Set Item = mcarrConnDtls(lngIndex)

End Property

Private Sub Validate(ByVal cConnToValidate As cConnDtl)
    ' This procedure is necessary since the class cannot validate
    ' all the connection_dtl properties on it's own. This is 'coz we
    ' might have created new connections in the workspace, but not
    ' saved them to the database yet - hence the duplicate check
    ' has to be repeated in the array

    Dim lngIndex As Long
    Dim cTempParam As cConnDtl

    ' Check if the parameter name already exists in the workspace
    For lngIndex = 0 To mcarrConnDtls.Count - 1
        Set cTempParam = mcarrConnDtls(lngIndex)
        If cTempParam.WorkspaceId = cConnToValidate.WorkspaceId And _
              cTempParam.ConnName = cConnToValidate.ConnName And _
              cTempParam.IndOperation <> DeleteOp Then
            On Error GoTo 0
            Err.Raise vbObjectError + errDupConnDtlName, _
                mstrSource, LoadResString(errDupConnDtlName)
        End If
    Next lngIndex

End Sub
Private Sub CheckDupConnName(ByVal cConnToValidate As cConnDtl)

    Dim lngIndex As Long
    Dim cTempParam As cConnDtl

    ' Check if the parameter name already exists in the workspace
    For lngIndex = 0 To mcarrConnDtls.Count - 1
        Set cTempParam = mcarrConnDtls(lngIndex)
        If cTempParam.WorkspaceId = cConnToValidate.WorkspaceId And _
              cTempParam.ConnName = cConnToValidate.ConnName And _
              cTempParam.ConnNameId <> cConnToValidate.ConnNameId And _
              cTempParam.IndOperation <> DeleteOp Then
            ShowError errDupConnDtlName
```

```
        On Error GoTo 0
        Err.Raise vbObjectError + errDupConnDtlName, _
           mstrSource, LoadResString(errDupConnDtlName)
      End If
   Next lngIndex

End Sub

Private Sub Class_Initialize()

   Set mcarrConnDtls = New cNodeCollections

End Sub

Private Sub Class_Terminate()

   Set mcarrConnDtls = Nothing

End Sub
```

cCONNECTION.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cConnection"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cConnection.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a connection string.
'              Contains functions to insert, update and delete
'              workspace_connections records from the database.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit
Option Base 0

' Local variable(s) to hold property value(s)
Public WorkspaceId As Long
Public ConnectionId As Long
Public ConnectionValue As String
Public Description As String
Public NodeDB As Database
Public Position As Long
Public NoCountDisplay As Boolean
Public NoExecute As Boolean
Public ParseQueryOnly As Boolean
Public QuotedIdentifiers As Boolean
Public AnsiNulls As Boolean
Public ShowQueryPlan As Boolean
Public ShowStatsTime As Boolean
Public ShowStatsIO As Boolean
Public ParseOdbcMsg As Boolean
Public RowCount As Long
Public TsqlBatchSeparator As String
Public QueryTimeOut As Long
Public ServerLanguage As String
Public CharacterTranslation As Boolean
Public RegionalSettings As Boolean

Private mstrConnectionName As String
Private mintOperation As Operation

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cConnection."

' The cSequence class is used to generate unique Connection identifiers
Private mConnectionSeq As cSequence

' The StringSM class is used to carry out string operations
Private mFieldValue As cStringSM

Private Sub AssignParameters(qyExec As DAO.QueryDef)
   ' Assigns values to the parameters in the querydef object
   ' The parameter names are cryptic to differentiate them from the field names.
   ' When the parameter names are the same as the field names, parameters in the
where
   ' clause do not get created.

   Dim prmParam As DAO.Parameter

   On Error GoTo AssignParametersErr

   For Each prmParam In qyExec.Parameters
      Select Case prmParam.Name
         Case "[w_id]"
            prmParam.Value = WorkspaceId

         Case "[c_id]"
            prmParam.Value = ConnectionId

         Case "[c_name]"
            prmParam.Value = mstrConnectionName

         Case "[c_value]"
            prmParam.Value = ConnectionValue

         Case "[desc]"
            prmParam.Value = Description

         Case "[no_count]"
            prmParam.Value = NoCountDisplay

         Case "[no_exec]"
            prmParam.Value = NoExecute

         Case "[parse_only]"
            prmParam.Value = ParseQueryOnly

         Case "[quoted_id]"
            prmParam.Value = QuotedIdentifiers

         Case "[a_nulls]"
            prmParam.Value = AnsiNulls

         Case "[show_qp]"
            prmParam.Value = ShowQueryPlan

         Case "[stats_tm]"
            prmParam.Value = ShowStatsTime

         Case "[stats_io]"
            prmParam.Value = ShowStatsIO

         Case "[parse_odbc]"
            prmParam.Value = ParseOdbcMsg

         Case "[row_cnt]"
            prmParam.Value = RowCount

         Case "[batch_sep]"
            prmParam.Value = TsqlBatchSeparator
```

```
        Case "[qry_tmout]"
            prmParam.Value = QueryTimeOut

        Case "[lang]"
            prmParam.Value = ServerLanguage

        Case "[char_trans]"
            prmParam.Value = CharacterTranslation

        Case "[reg_settings]"
            prmParam.Value = RegionalSettings

        Case Else
            ' Write the parameter name that is faulty
            WriteError errInvalidParameter, mstrSource, prmParam.Name
            On Error GoTo 0
            Err.Raise errInvalidParameter, mstrModuleName & "AssignParameters", _
                LoadResString(errInvalidParameter)
    End Select
  Next prmParam

  Exit Sub

AssignParametersErr:

  Call LogErrors(Errors)
  On Error GoTo 0
  Err.Raise vbObjectError + errAssignParametersFailed, _
    mstrModuleName & "AssignParameters",
LoadResString(errAssignParametersFailed)

End Sub

Public Function Clone() As cConnection

  ' Creates a copy of a given Connection

  Dim cCloneConn As cConnection

  On Error GoTo CloneErr

  Set cCloneConn = New cConnection

  ' Copy all the Connection properties to the newly
  ' created Connection
  Set cCloneConn.NodeDB = NodeDB
  cCloneConn.WorkspaceId = WorkspaceId
  cCloneConn.ConnectionId = ConnectionId
  cCloneConn.ConnectionName = mstrConnectionName
  cCloneConn.ConnectionValue = ConnectionValue
  cCloneConn.Description = Description
  cCloneConn.IndOperation = mintOperation
  cCloneConn.Position = Position
  cCloneConn.NoCountDisplay = NoCountDisplay
  cCloneConn.NoExecute = NoExecute
  cCloneConn.ParseQueryOnly = ParseQueryOnly
  cCloneConn.QuotedIdentifiers = QuotedIdentifiers
  cCloneConn.AnsiNulls = AnsiNulls
  cCloneConn.ShowQueryPlan = ShowQueryPlan
  cCloneConn.ShowStatsTime = ShowStatsTime
  cCloneConn.ShowStatsIO = ShowStatsIO
  cCloneConn.ParseOdbcMsg = ParseOdbcMsg
  cCloneConn.RowCount = RowCount
  cCloneConn.TsqlBatchSeparator = TsqlBatchSeparator
  cCloneConn.QueryTimeOut = QueryTimeOut
  cCloneConn.ServerLanguage = ServerLanguage
  cCloneConn.CharacterTranslation = CharacterTranslation
  cCloneConn.RegionalSettings = RegionalSettings

  ' And set the return value to the newly created Connection
  Set Clone = cCloneConn
  Set cCloneConn = Nothing

  Exit Function

CloneErr:
  LogErrors Errors
  mstrSource = mstrModuleName & "Clone"
  On Error GoTo 0
  Err.Raise vbObjectError + errCloneFailed, mstrSource,
LoadResString(errCloneFailed)

End Function
Private Sub CheckDupConnectionName()
  ' Check if the Connection name already exists in the workspace

  Dim rstConnection As Recordset
  Dim strSql As String
  Dim qy As DAO.QueryDef

  On Error GoTo CheckDupConnectionNameErr
  mstrSource = mstrModuleName & "CheckDupConnectionName"

  ' Create a recordset object to retrieve the count of all Connections
  ' for the workspace with the same name
  strSql = "Select count(*) as Connection_count " & _
    " from workspace_connections " & _
    " where workspace_id = [w_id]" & _
    " and connection_name = [c_name]" & _
    " and connection_id <> [c_id]"

  Set qy = NodeDB.CreateQueryDef(gstrEmptyString, strSql)
  Call AssignParameters(qy)

  Set rstConnection = qy.OpenRecordset(dbOpenForwardOnly)

  If rstConnection![Connection_count] > 0 Then
    rstConnection.Close
    qy.Close
    ShowError errDuplicateConnectionName
    On Error GoTo 0
    Err.Raise vbObjectError + errDuplicateConnectionName, _
      mstrSource, LoadResString(errDuplicateConnectionName)
  End If

  rstConnection.Close
  qy.Close

  Exit Sub

CheckDupConnectionNameErr:
  LogErrors Errors
  mstrSource = mstrModuleName & "CheckDupConnectionName"
  On Error GoTo 0
  Err.Raise vbObjectError + errProgramError, _
    mstrSource, LoadResString(errProgramError)

End Sub
Private Sub CheckDB()
  ' Check if the database object has been initialized

  If NodeDB Is Nothing Then
    On Error GoTo 0
    Err.Raise vbObjectError + errInvalidDB, _
      mstrModuleName & "CheckDB", LoadResString(errInvalidDB)
  End If

End Sub
Public Property Let ConnectionName(vdata As String)

  If vdata = gstrEmptyString Then
```

```
        ShowError errConnectionNameMandatory
        On Error GoTo 0
        ' Propogate this error back to the caller
        Err.Raise vbObjectError + errConnectionNameMandatory, _
            mstrSource, LoadResString(errConnectionNameMandatory)
    Else
        mstrConnectionName = vdata
    End If

End Property

Public Property Let IndOperation(ByVal vdata As Operation)

    ' The valid operations are define in the cOperations
    ' class. Check if the operation is valid
    Select Case vdata
        Case QueryOp, InsertOp, UpdateOp, DeleteOp
            mintOperation = vdata

        Case Else
            BugAssert True
    End Select

End Property
Public Sub Validate()
    ' Each distinct object will have a Validate method which
    ' will check if the class properties are valid. This method
    ' will be used to check interdependant properties that
    ' cannot be validated by the let procedures.
    ' It should be called by the add and modify methods of the class

    ' Check if the db object is valid
    Call CheckDB

    ' Raise an error if the Connection name already exists in the workspace
    Call CheckDupConnectionName

End Sub
Public Sub Add()

    Dim strInsert As String
    Dim qy As DAO.QueryDef

    On Error GoTo AddErr

    ' Validate the record before trying to insert the record
    Call Validate

    ' Create a temporary querydef object
    strInsert = "insert into workspace_connections " & _
            "( workspace_id, connection_id, " & _
            "connection_name, connection_value, " & _
            "description, no_count_display, " & _
            "no_execute, parse_query_only, " & _
            "ANSI_quoted_identifiers, ANSI_nulls, " & _
            "show_query_plan, show_stats_time, " & _
            "show_stats_io, parse_odbc_msg_prefixes, " & _
            "row_count, tsql_batch_separator, " & _
            "query_time_out, server_language, " & _
            "character_translation, regional_settings ) " & _
           " values ( [w_id], [c_id], [c_name], [c_value], " & _
           " [desc], [no_count], [no_exec], [parse_only], " & _
           " [quoted_id], [a_nulls], [show_qp], [stats_tm], " & _
           " [stats_io], [parse_odbc], [row_cnt], [batch_sep], " & _
           " [qry_tmout], [lang], [char_trans], [reg_settings] ) "

    Set qy = NodeDB.CreateQueryDef(gstrEmptyString, strInsert)

    ' Call a procedure to assign the Connection values
    Call AssignParameters(qy)

    qy.Execute dbFailOnError
    qy.Close

    Exit Sub

AddErr:

    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errInsertFailed, _
        mstrModuleName & "Add", LoadResString(errInsertFailed)

End Sub
Public Sub Delete()

    Dim strDelete As String
    Dim qy As DAO.QueryDef

    On Error GoTo DeleteErr

    ' Check if the db object is valid
    Call CheckDB

    strDelete = "delete from workspace_connections " & _
            " where connection_id = [c_id]"
    Set qy = NodeDB.CreateQueryDef(gstrEmptyString, strDelete)

    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    qy.Close

    Exit Sub

DeleteErr:
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errDeleteFailed, _
            mstrModuleName & "Delete", LoadResString(errDeleteFailed)

End Sub

Public Sub Modify()

    Dim strUpdate As String
    Dim qy As QueryDef

    On Error GoTo ModifyErr

    ' Validate the updated values before trying to modify the db
    Call Validate

    ' Create a temporary querydef object with the modify string
    strUpdate = "update workspace_connections " & _
            " set workspace_id = [w_id], " & _
            "connection_name = [c_name], " & _
            "connection_value = [c_value], " & _
            "description = [desc], " & _
            "no_count_display = [no_count], " & _
            "no_execute = [no_exec], " & _
            "parse_query_only = [parse_only], " & _
            "ANSI_quoted_identifiers = [quoted_id], " & _
            "ANSI_nulls = [a_nulls], " & _
            "show_query_plan = [show_qp], " & _
            "show_stats_time = [stats_tm], " & _
            "show_stats_io = [stats_io], " & _
            "parse_odbc_msg_prefixes = [parse_odbc], " & _
            "row_count = [row_cnt], " & _
            "tsql_batch_separator = [batch_sep], " & _
            "query_time_out = [qry_tmout], " & _
            "server_language = [lang], " & _
```

```
        "character_translation = [char_trans], " & _
        "regional_settings = [reg_settings] " & _
        " where connection_id = [c_id]"
    Set qy = NodeDB.CreateQueryDef(gstrEmptyString, strUpdate)

    ' Call a procedure to assign the Connection values to the
    ' querydef object
    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    qy.Close

    Exit Sub

ModifyErr:

    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errModifyFailed, _
        mstrModuleName & "Modify", LoadResString(errModifyFailed)

End Sub
Public Property Get ConnectionName() As String

    ConnectionName = mstrConnectionName

End Property

Public Property Get NextIdentifier() As Long

    Dim lngNextId As Long

    On Error GoTo NextIdentifierErr

    ' First check if the database object is valid
    Call CheckDB

    ' Retrieve the next identifier using the sequence class
    Set mConnectionSeq = New cSequence
    Set mConnectionSeq.IdDatabase = NodeDB
    mConnectionSeq.IdentifierColumn = "connection_id"
    lngNextId = mConnectionSeq.Identifier
    Set mConnectionSeq = Nothing

    NextIdentifier = lngNextId
    Exit Property

NextIdentifierErr:
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errIdGetFailed, _
        mstrModuleName & "NextIdentifier", LoadResString(errIdGetFailed)

End Property
Public Property Get IndOperation() As Operation

    IndOperation = mintOperation

End Property

Private Sub Class_Initialize()

    Set mFieldValue = New cStringSM

    ' Initialize the operation indicator variable to Query
    ' It will be modified later by the collection class when
    ' inserts, updates or deletes are performed
    mintOperation = QueryOp

    ' Initialize connection properties to their default values
    NoCountDisplay = DEF_NO_COUNT_DISPLAY
    NoExecute = DEF_NO_EXECUTE
    ParseQueryOnly = DEF_PARSE_QUERY_ONLY
    QuotedIdentifiers = DEF_ANSI_QUOTED_IDENTIFIERS
    AnsiNulls = DEF_ANSI_NULLS
    ShowQueryPlan = DEF_SHOW_QUERY_PLAN
    ShowStatsTime = DEF_SHOW_STATS_TIME
    ShowStatsIO = DEF_SHOW_STATS_IO
    ParseOdbcMsg = DEF_PARSE_ODBC_MSG_PREFIXES
    RowCount = DEF_ROW_COUNT
    TsqlBatchSeparator = DEF_TSQL_BATCH_SEPARATOR
    QueryTimeOut = DEF_QUERY_TIME_OUT
    ServerLanguage = DEF_SERVER_LANGUAGE
    CharacterTranslation = DEF_CHARACTER_TRANSLATION
    RegionalSettings = DEF_REGIONAL_SETTINGS

End Sub

Private Sub Class_Terminate()

    Set NodeDB = Nothing
    Set mFieldValue = Nothing

End Sub
```

cConnections.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cConnections"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:      cConnections.cls
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    Implements an array of cConnection objects.
'             Type-safe wrapper around cNodeCollections.
'             Also contains validation functions, etc.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mcarrConnections As cNodeCollections

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cConnections."

Public Property Set ConnDb(vdata As Database)

    Set mcarrConnections.NodeDB = vdata

End Property
Public Sub Modify(cModifiedConn As cConnection)

    ' First check if the parameter record is valid
    Call CheckDupConnName(cModifiedConn)

    Call mcarrConnections.Modify(cModifiedConn)

End Sub
Public Sub Load(ByRef cConnToAdd As cConnection)

    Call mcarrConnections.Load(cConnToAdd)
```

```
End Sub
Public Sub Add(ByRef cConnToAdd As cConnection)

    Set cConnToAdd.NodeDB = mcarrConnections.NodeDB

    ' First check if the record is valid
    Call Validate(cConnToAdd)

    ' Retrieve a unique identifier
    cConnToAdd.ConnectionId = cConnToAdd.NextIdentifier

    Call mcarrConnections.Add(cConnToAdd)

End Sub

Public Sub Unload(lngConnId As Long)

    Dim lngDeleteElement As Long

    lngDeleteElement = QueryIndex(lngConnId)

    Call mcarrConnections.Unload(lngDeleteElement)

End Sub

Public Sub SaveConnectionsInWsp(ByVal lngWorkspace As Long)
    ' Call a procedure to save all connection records for the workspace
    Call mcarrConnections.Save(lngWorkspace)

End Sub
Public Function GetConnection(ByVal lngWorkspace As Long, _
        ByVal strConnectionName As String) As cConnection
    ' Returns the connection string for the passed in connection name

    Dim lngIndex As Long

    ' Find all parameters in the array with a matching workspace id
    For lngIndex = 0 To mcarrConnections.Count - 1
        If mcarrConnections(lngIndex).WorkspaceId = lngWorkspace And _
                mcarrConnections(lngIndex).ConnectionName = strConnectionName Then

            Set GetConnection = mcarrConnections(lngIndex)
            Exit For
        End If
    Next lngIndex

    If lngIndex > mcarrConnections.Count - 1 Then
        ' The parameter has not been defined for the workspace
        ' Raise an error
        On Error GoTo 0
        Err.Raise vbObjectError + errConnNameInvalid, mstrModuleName &
"GetConnection", _
            LoadResString(errConnNameInvalid)
    End If

End Function
Public Sub Delete(lngConnId As Long)
    ' Delete the passed in parameter

    Dim lngDeleteElement As Long

    lngDeleteElement = QueryIndex(lngConnId)
    Call mcarrConnections.Delete(lngDeleteElement)

End Sub
Private Function QueryIndex(lngConnId As Long) As Long

    Dim lngIndex As Long

    ' Find the matching parameter record in the array
    For lngIndex = 0 To mcarrConnections.Count - 1
        If mcarrConnections(lngIndex).ConnectionId = lngConnId And _
                mcarrConnections(lngIndex).IndOperation <> DeleteOp Then
            QueryIndex = lngIndex
            Exit Function
        End If
    Next lngIndex

    ' Raise error that parameter has not been found
    On Error GoTo 0
    Err.Raise vbObjectError + errQueryIndexFailed, "cArrParameters.QueryIndex", _
        LoadResString(errQueryIndexFailed)

End Function

Public Function QueryConnection(lngConnId As Long) As cConnection

    Dim lngQueryElement As Long

    lngQueryElement = QueryIndex(lngConnId)

    ' Return the queried connection object
    Set QueryConnection = mcarrConnections(lngQueryElement)

End Function
Public Property Get Count() As Long

    Count = mcarrConnections.Count

End Property
Public Property Get Item(lngIndex As Long) As cConnection
Attribute Item.VB_UserMemId = 0

    Set Item = mcarrConnections(lngIndex)

End Property

Public Sub Validate(ByVal cConnToValidate As cConnection)
    ' This procedure is necessary since the class cannot validate
    ' all the parameter properties on it's own. This is 'coz we
    ' might have created new parameters in the workspace, but not
    ' saved them to the database yet - hence the duplicate check
    ' has to be repeated in the array

    Dim lngIndex As Long
    Dim cTempParam As cConnection

    ' Check if the parameter name already exists in the workspace
    For lngIndex = 0 To mcarrConnections.Count - 1
        Set cTempParam = mcarrConnections(lngIndex)
        If cTempParam.WorkspaceId = cConnToValidate.WorkspaceId And _
                cTempParam.ConnectionName = cConnToValidate.ConnectionName And _
                cTempParam.IndOperation <> DeleteOp Then
            On Error GoTo 0
            Err.Raise vbObjectError + errDuplicateConnectionName, _
                mstrSource, LoadResString(errDuplicateConnectionName)
        End If
    Next lngIndex

End Sub
Public Sub CheckDupConnName(ByVal cConnToValidate As cConnection)

    Dim lngIndex As Long
    Dim cTempParam As cConnection

    ' Check if the parameter name already exists in the workspace
    For lngIndex = 0 To mcarrConnections.Count - 1
        Set cTempParam = mcarrConnections(lngIndex)
        If cTempParam.WorkspaceId = cConnToValidate.WorkspaceId And _
                cTempParam.ConnectionName = cConnToValidate.ConnectionName And _
                cTempParam.ConnectionId <> cConnToValidate.ConnectionId And _
                cTempParam.IndOperation <> DeleteOp Then
```

```
        ShowError errDuplicateConnectionName
        On Error GoTo 0
        Err.Raise vbObjectError + errDuplicateConnectionName, _
           mstrSource, LoadResString(errDuplicateConnectionName)
      End If
   Next lngIndex

End Sub

Private Sub Class_Initialize()

   Set mcarrConnections = New cNodeCollections

End Sub

Private Sub Class_Terminate()

   Set mcarrConnections = Nothing

End Sub
```

cCONSTRAINT.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cConstraint"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cConstraint.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a constraint.
'              Contains functions to insert, update and delete
'              step_constraints records from the database.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Module level variables to store the property values
Private mlngConstraintId As Long
Private mlngStepId As Long
Private mstrVersionNo As String
Private mintConstraintType As Integer
Private mlngGlobalStepId As Long
Private mstrGlobalVersionNo As String
Private mintSequenceNo As Integer
Private mdbsConstraintDB As Database
Private mlngWorkspaceId As Integer
Private mintOperation As Operation
Private mlngPosition As Long

' The cSequence class is used to generate unique step identifiers
Private mConstraintSeq As cSequence

Private Const mstrModuleName As String = ".cConstraint."
Private mstrSource As String

Public Enum ConstraintType
   gintPreStep = 1
   gintPostStep = 2
End Enum

Private Const mstrSQ As String = """
Public Property Get WorkspaceId() As Long
   WorkspaceId = mlngWorkspaceId
End Property
Public Property Let WorkspaceId(ByVal vdata As Long)
   mlngWorkspaceId = vdata
End Property

Public Property Get IndOperation() As Operation

   IndOperation = mintOperation

End Property
Public Property Let IndOperation(ByVal vdata As Operation)

   On Error GoTo IndOperationErr
   mstrSource = mstrModuleName & "IndOperation"

   ' The valid operations are define in the cOperations
   ' class. Check if the operation is valid
   Select Case vdata
      Case QueryOp, InsertOp, UpdateOp, DeleteOp
         mintOperation = vdata

      Case Else
         On Error GoTo 0
         Err.Raise vbObjectError + errInvalidOperation, _
               mstrSource, LoadResString(errInvalidOperation)
   End Select

   Exit Property

IndOperationErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "IndOperation"
   On Error GoTo 0
   Err.Raise vbObjectError + errLetOperationFailed, _
      mstrSource, LoadResString(errLetOperationFailed)

End Property

Public Function Clone() As cConstraint

   ' Creates a copy of a given constraint

   Dim cConsClone As cConstraint

   On Error GoTo CloneErr
   mstrSource = mstrModuleName & "Clone"

   Set cConsClone = New cConstraint

   ' Copy all the workspace properties to the newly
   ' created workspace
   cConsClone.ConstraintId = mlngConstraintId
   cConsClone.StepId = mlngStepId
   cConsClone.VersionNo = mstrVersionNo
   cConsClone.ConstraintType = mintConstraintType
   cConsClone.GlobalStepId = mlngGlobalStepId
   cConsClone.GlobalVersionNo = mstrGlobalVersionNo
   cConsClone.SequenceNo = mintSequenceNo
   cConsClone.WorkspaceId = mlngWorkspaceId
   cConsClone.IndOperation = mintOperation

   ' And set the return value to the newly created constraint
   Set Clone = cConsClone

   Exit Function

CloneErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "Clone"
   On Error GoTo 0
   Err.Raise vbObjectError + errCloneFailed, _
```

```
        mstrSource, LoadResString(errCloneFailed)

End Function

Public Property Get SequenceNo() As Integer

    SequenceNo = mintSequenceNo

End Property

Public Property Let SequenceNo(ByVal vdata As Integer)
    mintSequenceNo = vdata
End Property

Public Sub Add()
    ' Inserts a new step constraint into the database

    Dim strInsert As String
    Dim qy As DAO.QueryDef

    On Error GoTo AddErr

    ' First check if the database object is valid
    Call CheckDB

    ' Any record validations
    Call Validate

    ' Create a temporary querydef object
    strInsert = "insert into step_constraints " & _
          "( constraint_id, step_id, version_no, " & _
          " constraint_type, global_step_id, global_version_no, sequence_no ) " & _
          " values ( [cons_id], [s_id], [ver_no], " & _
          " [cons_type], [g_step_id], [g_ver_no], " & _
          " [seq_no] )"
    Set qy = mdbsConstraintDB.CreateQueryDef(gstrEmptyString, strInsert)

    ' Call a procedure to execute the Querydef object
    Call AssignParameters(qy)

    qy.Execute dbFailOnError
    qy.Close

'    strInsert = "insert into step_constraints " & _
'        "( constraint_id, step_id, version_no, " & _
'        " constraint_type, global_step_id, global_version_no, sequence_no ) " & _
'        " values ( " & _
'        Str(mlngConstraintId) & ", " & Str(mlngStepId) & ", " & _
'        mstrSQ & mstrVersionNo & mstrSQ & ", " & Str(mintConstraintType) & ", " & _
'        Str(mlngGlobalStepId) & ", " & mstrSQ & mstrGlobalVersionNo & mstrSQ & ", " &
_
'        Str(mintSequenceNo) & " ) "
'
'    BugMessage strInsert
'    mdbsConstraintDB.Execute strInsert, dbFailOnError
    Exit Sub

AddErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Add"
    On Error GoTo 0
    Err.Raise vbObjectError + errAddConstraintFailed, _
          mstrSource, _
          LoadResString(errAddConstraintFailed)
End Sub
Private Sub AssignParameters(qyExec As DAO.QueryDef)
    ' Assigns values to the parameters in the querydef object
    ' The parameter names are cryptic to make them different
    ' from the field names. When the parameter names are
    ' the same as the field names, parameters in the where
    ' clause do not get created.
    Dim prmParam As DAO.Parameter

    On Error GoTo AssignParametersErr
    mstrSource = mstrModuleName & "AssignParameters"

    For Each prmParam In qyExec.Parameters
        Select Case prmParam.Name
            Case "[cons_id]"
                prmParam.Value = mlngConstraintId

            Case "[s_id]"
                prmParam.Value = mlngStepId

            Case "[ver_no]"
                prmParam.Value = mstrVersionNo

            Case "[cons_type]"
                prmParam.Value = mintConstraintType

            Case "[g_step_id]"
                prmParam.Value = mlngGlobalStepId

            Case "[g_ver_no]"
                prmParam.Value = mstrGlobalVersionNo

            Case "[seq_no]"
                prmParam.Value = mintSequenceNo

            Case Else
                ' Write the parameter name that is faulty
                WriteError errInvalidParameter, mstrSource, _
                      prmParam.Name
                On Error GoTo 0
                Err.Raise errInvalidParameter, mstrSource, _
                      LoadResString(errInvalidParameter)
        End Select
    Next prmParam

    Exit Sub

AssignParametersErr:

    mstrSource = mstrModuleName & "AssignParameters"
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errAssignParametersFailed, _
        mstrSource, LoadResString(errAssignParametersFailed)

End Sub
Public Property Get NextIdentifier() As Long

    Dim lngNextId As Long

    On Error GoTo NextIdentifierErr

    ' First check if the database object is valid
    Call CheckDB

    ' Retrieve the next constraint identifier using the
    ' sequence class
    Set mConstraintSeq = New cSequence
    Set mConstraintSeq.IdDatabase = mdbsConstraintDB
    mConstraintSeq.IdentifierColumn = "constraint_id"
    lngNextId = mConstraintSeq.Identifier
    Set mConstraintSeq = Nothing

    NextIdentifier = lngNextId
    Exit Property

NextIdentifierErr:
```

```
    LogErrors Errors
    mstrSource = mstrModuleName & "NextIdentifier"
    On Error GoTo 0
    Err.Raise vbObjectError + errStepIdGetFailed, _
       mstrSource, LoadResString(errStepIdGetFailed)

End Property

Private Sub CheckDB()
    ' Check if the database object has been initialized

    If mdbsConstraintDB Is Nothing Then
       ShowError errInvalidDB
       On Error GoTo 0
       Err.Raise vbObjectError + errInvalidDB, _
          mstrModuleName, LoadResString(errInvalidDB)
    End If

End Sub

Public Sub Delete()
    ' Deletes the step constraint record from the database

    Dim strDelete As String
    Dim qy As DAO.QueryDef

    On Error GoTo DeleteErr
    mstrSource = mstrModuleName & "Delete"

    ' There can be multiple constraints for a step,
    ' meaning that there can be multiple constraint records
    ' with the same constraint_id. Only a combination
    ' of the step_id, version and constraint_id will be
    ' unique
    strDelete = "delete from step_constraints " & _
          " where constraint_id = [cons_id]" & _
          " and step_id = [s_id] " & _
          " and version_no = [ver_no] "
    Set qy = mdbsConstraintDB.CreateQueryDef(gstrEmptyString, strDelete)

    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    qy.Close

'    strDelete = "Delete from step_constraints " & _
'          " where constraint_id = " & Str(mlngConstraintId) & _
'          " and step_id = " & Str(mlngStepId) & _
'          " and version_no = " & mstrSQ & mstrVersionNo & mstrSQ
'
'    'BugMessage strDelete
'    mdbsConstraintDB.Execute strDelete, dbFailOnError

    Exit Sub

DeleteErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Delete"
    On Error GoTo 0
    Err.Raise vbObjectError + errDeleteConstraintFailed, _
          mstrSource, _
          LoadResString(errDeleteConstraintFailed)
End Sub
Public Sub Modify()
    ' Updates the sequence no of the step constraint record
    ' in the database

    Dim strUpdate As String
    Dim qy As QueryDef

    On Error GoTo Modify

    ' First check if the database object is valid
    Call CheckDB

    ' Any record validations
    Call Validate

    ' There can be multiple constraints for a step,
    ' meaning that there can be multiple constraint records
    ' with the same constraint_id. Only a combination
    ' of the step_id, version and constraint_id will be
    ' unique
    ' Create a temporary querydef object with the modify string
    strUpdate = "Update step_constraints " & _
          " set sequence_no = [seq_no] " & _
          " where constraint_id = [cons_id] " & _
          " and step_id = [s_id] " & _
          " and version_no = [ver_no] "
    Set qy = mdbsConstraintDB.CreateQueryDef(gstrEmptyString, strUpdate)

    ' Call a procedure to assign the parameter values to the
    ' querydef object
    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    qy.Close

'    strUpdate = "Update step_constraints " & _
'          " set sequence_no = " & Str(mintSequenceNo) & _
'          " where constraint_id = " & Str(mlngConstraintId) & _
'          " and step_id = " & Str(mlngStepId) & _
'          " and version_no = " & mstrSQ & mstrVersionNo & mstrSQ
'
'    'BugMessage strUpdate
'    mdbsConstraintDB.Execute strUpdate, dbFailOnError
    Exit Sub

Modify:
    LogErrors Errors
    mstrSource = mstrModuleName & "Modify"
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateConstraintFailed, _
          mstrSource, _
          LoadResString(errUpdateConstraintFailed)
End Sub
Public Property Get Position() As Long

    Position = mlngPosition

End Property
Public Property Let Position(ByVal RHS As Long)

    mlngPosition = RHS

End Property

Public Sub Validate()
    ' Each distinct object will have a Validate method which
    ' will check if the class properties are valid. This method
    ' will be used to check interdependant properties that
    ' cannot be validated by the let procedures.
    ' It should be called by the add and modify methods of the class

    ' No validations are necessary for the constraint object

End Sub

Public Property Set NodeDB(vdata As Database)

    Set mdbsConstraintDB = vdata
```

```
End Property

Public Property Get NodeDB() As Database

    Set NodeDB = mdbsConstraintDB

End Property

Public Property Get GlobalVersionNo() As String

    GlobalVersionNo = mstrGlobalVersionNo

End Property

Public Property Let GlobalVersionNo(ByVal vdata As String)

    mstrGlobalVersionNo = vdata

End Property

Public Property Get GlobalStepId() As Long

    GlobalStepId = mlngGlobalStepId

End Property

Public Property Get ConstraintId() As Long

    ConstraintId = mlngConstraintId

End Property

Public Property Get VersionNo() As String

    VersionNo = mstrVersionNo

End Property

Public Property Get StepId() As Long

    StepId = mlngStepId

End Property

Public Property Let VersionNo(ByVal vdata As String)

    mstrVersionNo = vdata

End Property

Public Property Let StepId(ByVal vdata As Long)

    mlngStepId = vdata

End Property

Public Property Let ConstraintId(ByVal vdata As Long)
    On Error GoTo ConstraintIdErr
    mstrSource = mstrModuleName & "ConstraintId"

    If (vdata > 0) Then
        mlngConstraintId = vdata
    Else
        ' Propogate this error back to the caller
        On Error GoTo 0
        Err.Raise vbObjectError + errConstraintIdInvalid, _
            mstrSource, LoadResString(errConstraintIdInvalid)
    End If

    Exit Property

ConstraintIdErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "ConstraintId"
    On Error GoTo 0
    Err.Raise vbObjectError + errConstraintIdSetFailed, _
        mstrSource, LoadResString(errConstraintIdSetFailed)

End Property

Public Property Let GlobalStepId(ByVal vdata As Long)

    On Error GoTo GlobalStepIdErr
    mstrSource = mstrModuleName & "GlobalStepId"

    If (vdata > 0) Then
        mlngGlobalStepId = vdata
    Else
        ' Propogate this error back to the caller
        On Error GoTo 0
        Err.Raise vbObjectError + errGlobalStepIdInvalid, _
            mstrSource, LoadResString(errGlobalStepIdInvalid)
    End If

    Exit Property

GlobalStepIdErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "GlobalStepId"
    On Error GoTo 0
    Err.Raise vbObjectError + errGlobalStepIdSetFailed, _
        mstrSource, LoadResString(errGlobalStepIdSetFailed)

End Property

Public Property Let ConstraintType(ByVal vdata As ConstraintType)

    On Error GoTo ConstraintTypeErr

    ' A global step can be either a pre- or a post-execution step.
    ' These constants have been defined in the enumeration,
    ' ConstraintType, which is exposed
    Select Case vdata
        Case gintPreStep, gintPostStep
            mintConstraintType = vdata

        Case Else
            On Error GoTo 0
            Err.Raise vbObjectError + errConstraintTypeInvalid, _
                mstrSource, LoadResString(errConstraintTypeInvalid)
    End Select

    Exit Property

ConstraintTypeErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "ConstraintType"
    On Error GoTo 0
    Err.Raise vbObjectError + errConstraintTypeLetFailed, _
        mstrSource, LoadResString(errConstraintTypeLetFailed)

End Property

Public Property Get ConstraintType() As ConstraintType

    ConstraintType = mintConstraintType

End Property

Private Sub Class_Initialize()

    ' Initialize the operation indicator variable to Query
```

```
    ' It will be modified later by the collection class when
    ' inserts, updates or deletes are performed
    mintOperation = QueryOp

End Sub
```

cFailedStep.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cFailedStep"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cFailedStep.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Properties of a step execution failure.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Public InstanceId As Long
Public StepId As Long
Public ParentStepId As Long
Public ContCriteria As ContinuationCriteria
Public EndTime As Currency
Public AskResponse As Long
```

cFailedSteps.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cFailedSteps"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cFailedSteps.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This module encapsulates a collection of failed steps. It
'              also determines whether sub-steps of a passed in step need
'              to be skipped due to a failure.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mcFailedSteps As cVector
Public Function ExecuteSubStep(lParentStepId As Long) As Boolean
    ' Returns False if there is any condition that prevents sub-steps of the passed
    ' in instance from being executed
    Dim lIndex As Long

    ExecuteSubStep = True

    For lIndex = 0 To Count() - 1
        If mcFailedSteps(lIndex).ContCriteria = gintOnFailureCompleteSiblings And _
              lParentStepId <> mcFailedSteps(lIndex).ParentStepId Then
            ExecuteSubStep = False
            Exit For
        End If

        If mcFailedSteps(lIndex).ContCriteria = gintOnFailureAbortSiblings And _
              lParentStepId = mcFailedSteps(lIndex).ParentStepId Then
            ExecuteSubStep = False
            Exit For
        End If

        If mcFailedSteps(lIndex).ContCriteria = gintOnFailureSkipSiblings And _
              lParentStepId = mcFailedSteps(lIndex).ParentStepId Then
            ExecuteSubStep = False
            Exit For
        End If

        If mcFailedSteps(lIndex).ContCriteria = gintOnFailureAbort Then
            ExecuteSubStep = False
            Exit For
        End If

    Next lIndex

End Function
Public Sub Add(ByVal objItem As cFailedStep)

    mcFailedSteps.Add objItem

End Sub
Public Function Delete(ByVal lPosition As Long) As cFailedStep

    Set Delete = mcFailedSteps.Delete(lPosition)

End Function

Public Sub Clear()

    mcFailedSteps.Clear

End Sub
Public Function Count() As Long

    Count = mcFailedSteps.Count

End Function
Public Property Get Item(ByVal Position As Long) As cFailedStep
Attribute Item.VB_UserMemId = 0

    Set Item = mcFailedSteps.Item(Position)

End Property

Public Function StepFailed(lStepId As Long) As Boolean

    ' Returns True if a failure record already exists for the passed in step
    Dim lIndex As Long

    StepFailed = False

    For lIndex = 0 To Count() - 1
        If mcFailedSteps(lIndex).StepId = lStepId Then
            StepFailed = True
            Exit For
        End If
    Next lIndex

End Function

Private Sub Class_Initialize()

    Set mcFailedSteps = New cVector

End Sub
```

```
Private Sub Class_Terminate()

    Set mcFailedSteps = Nothing

End Sub
```

cFileInfo.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cFileInfo"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cFileInfo.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:     File Properties viz. name, handle, etc.
'  Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mstrFileName As String
Private mintFileHandle As Integer
Private mdbsNodeDb As Database ' Since it is used to form a cNodeCollection
Private mlngPosition As Long ' Since it is used to form a cNodeCollection
Public Property Get FileName() As String

    FileName = mstrFileName

End Property
Public Property Let FileName(ByVal vdata As String)

    mstrFileName = vdata

End Property
Public Property Let FileHandle(ByVal vdata As Integer)

    mintFileHandle = vdata

End Property
Public Property Set NodeDB(vdata As Database)

    Set mdbsNodeDb = vdata

End Property

Public Property Get NodeDB() As Database

    Set NodeDB = mdbsNodeDb

End Property
Public Property Get Position() As Long

    Position = mlngPosition

End Property
Public Property Let Position(ByVal vdata As Long)

    mlngPosition = vdata

End Property

Public Property Get FileHandle() As Integer

    FileHandle = mintFileHandle

End Property
```

cFileSM.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cFileSM"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
Attribute VB_Ext_KEY = "SavedWithClassBuilder" ,"Yes"
Attribute VB_Ext_KEY = "Top_Level" ,"Yes"
'  FILE:       cFileSM.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:     Encapsulates functions to open a file and write to it.
'  Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cFileSM."
Private mstrSource As String

Private mstrFileName As String
Private mintHFile As Integer
Private mstrFileHeader As String
Private mstrProjectName As String

Public Sub CloseFile()

    ' Close the file
    If mintHFile > 0 Then
        Call CloseFileSM(mstrFileName)
        mintHFile = 0
    End If

End Sub

Public Property Let ProjectName(ByVal vdata As String)
    ' An optional field - will be appended to the file
    ' header string if specified

    Const strProjectHdr As String = "Project Name:"

    mstrProjectName = vdata
    mstrFileHeader = mstrFileHeader & _
          Space$(1) & strProjectHdr & Space$(1) & _
          gstrSQ & vdata & gstrSQ

End Property
Public Property Get ProjectName() As String

    ProjectName = mstrProjectName

End Property
Public Property Get FileName() As String

    FileName = mstrFileName

End Property
Public Property Let FileName(ByVal vdata As String)

    mstrFileName = vdata
```

```
End Property
Public Sub WriteLine(strMsg As String)

    ' Writes the passed in string to the file
    Call WriteToFile(strMsg, False)

End Sub

Public Sub WriteField(strMsg As String)

    ' Writes the passed in string to the file
    Call WriteToFile(strMsg, True)

End Sub

Private Sub WriteToFile(strMsg As String, _
        blnContinue As Boolean)
    ' Writes the passed in string to the file - the
    ' Continue flag indicates whether the next line will
    ' be continued on the same line or printed on a new one

    On Error GoTo WriteToFileErr

    ' Open the file if it hasn't been already
    If mintHFile = 0 Then

        ' If the filename has not been initialized, do not
        ' attempt to open it
        If mstrFileName <> gstrEmptyString Then

            mintHFile = OpenFileSM(mstrFileName)

            If mintHFile = 0 Then
                ' The Open File command failed for some reason
                ' No point in trying to write the file header
            Else
                ' Print a file header, if a header string has been
                ' initialized
                If mstrFileHeader <> gstrEmptyString Then
                    Print #mintHFile,
                    Print #mintHFile, mstrFileHeader
                    Print #mintHFile,
                End If
            End If
        End If
    End If

    If mintHFile <> 0 Then
        If strMsg = gstrEmptyString Then
            Print #mintHFile,
        Else
            If blnContinue Then
                ' Write the message to the file - continue
                ' all subsequent characters on the same line
                Print #mintHFile, strMsg;
            Else
                ' Write the message to the file
                Print #mintHFile, strMsg
            End If
        End If
    Else
        ' Display the string to the user instead of
        ' trying to write it to the file
        ' This could be the project error log that we were
        ' trying to open! Play it safe and display errors - do
        ' not try to log them.
        MsgBox strMsg, vbOKOnly
    End If

    Exit Sub

WriteToFileErr:
    ' Log the error code raised by Visual Basic
    Call DisplayErrors(Errors)

    ' Display the string to the user instead of
    ' trying to write it to the file
    MsgBox strMsg, vbOKOnly

End Sub
Public Property Let FileHeader(ByVal vdata As String)

    mstrFileHeader = vdata

End Property
Public Property Get FileHeader() As String

    FileHeader = mstrFileHeader

End Property

Private Sub Class_Terminate()

    ' Close the file opened by this instance
    Call CloseFile

End Sub
```

cGlobalStep.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cGlobalStep"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cGlobalStep.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a global step.
'              Implements the cStep class - carries out initializations
'              and validations that are specific to global steps.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Implements cStep

' Object variable to keep the reference in
Private mcStep As cStep

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cGlobalStep."

Private Sub cStep_AddIterator(cItRecord As cIterator)

    Call mcStep.AddIterator(cItRecord)

End Sub

Private Property Let cStep_ArchivedFlag(ByVal RHS As Boolean)

    mcStep.ArchivedFlag = RHS
```

```
End Property

Private Property Get cStep_ArchivedFlag() As Boolean

    cStep_ArchivedFlag = mcStep.ArchivedFlag

End Property

Private Sub Class_Initialize()

    ' Create the object
    Set mcStep = New cStep

    ' Initialize the object with valid values for a global step
    ' The global flag should be the first field to be initialized
    ' since subsequent validations might try to check if the
    ' step being created is global
    mcStep.GlobalFlag = True
    mcStep.StepType = gintGlobalStep

    ' A global step cannot have any sub-steps associated with it
    ' Hence, it will always be at Step Level 0
    mcStep.ParentStepId = 0
    mcStep.ParentVersionNo = gstrMinVersion
    mcStep.StepLevel = 0

    ' The enabled flag must be False for all global steps
    ' Global steps can be of two types
    ' a. Those that are run globally within a workspace either
    '    before every step, after every step or during the entire
    '    run, depending on the global run method
    ' b. Those that are not run globally, but qualify to be either
    '    pre or post-execution steps for other steps in the workspace.
    '    Whether or not such a step will be executed depends on
    '    whether the step for which it is defined as a pre/post
    '    step will be executed
    mcStep.EnabledFlag = False

    mcStep.ContinuationCriteria = gintNoOption
    mcStep.DegreeParallelism = gstrGlobalParallelism

End Sub
Private Sub Class_Terminate()

    ' Remove the step object
    Set mcStep = Nothing

End Sub

Private Sub cStep_Add()

    ' Call a private procedure to see if the step text has been
    ' entered - since a global step actually executes a step, entry
    ' of the text is mandatory
    Call StepTextOrFileEntered

    ' Call the Add method of the step class to carry out the insert
    mcStep.Add

End Sub

Private Function cStep_Clone(Optional cCloneStep As cStep) As cStep

    Dim cNewGlobal As cGlobalStep

    Set cNewGlobal = New cGlobalStep
    Set cStep_Clone = mcStep.Clone(cNewGlobal)

End Function

Private Property Get cStep_ContinuationCriteria() As ContinuationCriteria

    cStep_ContinuationCriteria = mcStep.ContinuationCriteria

End Property

Private Property Let cStep_ContinuationCriteria(ByVal RHS As ContinuationCriteria)

    ' The continuation criteria field will always be empty for a
    ' global step
    mcStep.ContinuationCriteria = 0

End Property

Private Property Let cStep_DegreeParallelism(ByVal RHS As String)

    ' Will always be zero for a global step
    mcStep.DegreeParallelism = gstrGlobalParallelism

End Property

Private Property Get cStep_DegreeParallelism() As String

    cStep_DegreeParallelism = mcStep.DegreeParallelism

End Property

Private Sub cStep_DeleteIterator(cItRecord As cIterator)

    Call mcStep.DeleteIterator(cItRecord)

End Sub

Private Sub cStep_Delete()

    mcStep.Delete

End Sub

Private Property Get cStep_EnabledFlag() As Boolean

    cStep_EnabledFlag = mcStep.EnabledFlag

End Property

Private Property Let cStep_EnabledFlag(ByVal RHS As Boolean)

    ' The enabled flag must be False for all global steps
    ' Global steps can be of two types
    ' a. Those that are run globally within a workspace either
    '    before every step, after every step or during the entire
    '    run, depending on the global run method
    ' b. Those that are not run globally, but qualify to be either
    '    pre or post-execution steps for other steps in the workspace.
    '    Whether or not such a step will be executed depends on
    '    whether the step for which it is defined as a pre/post
    '    step will be executed
    mcStep.EnabledFlag = False

End Property

Private Property Let cStep_ErrorFile(ByVal RHS As String)

    mcStep.ErrorFile = RHS

End Property

Private Property Get cStep_ErrorFile() As String

    cStep_ErrorFile = mcStep.ErrorFile
```

```
End Property

Private Property Let cStep_ExecutionMechanism(ByVal RHS As ExecutionMethod)

    ' Whether or not the Execution Mechanism is valid will be
    ' checked by the Step class
    mcStep.ExecutionMechanism = RHS

End Property

Private Property Get cStep_ExecutionMechanism() As ExecutionMethod

    cStep_ExecutionMechanism = mcStep.ExecutionMechanism

End Property

Private Property Let cStep_FailureDetails(ByVal RHS As String)

    ' Whether or not the Failure Details are valid for the
    ' selected failure criteria will be checked by the Step class
    mcStep.FailureDetails = RHS

End Property

Private Property Get cStep_FailureDetails() As String

    cStep_FailureDetails = mcStep.FailureDetails

End Property

Private Property Get cStep_GlobalFlag() As Boolean

    cStep_GlobalFlag = mcStep.GlobalFlag

End Property

Private Property Let cStep_GlobalFlag(ByVal RHS As Boolean)

    ' Set the global flag to true
    mcStep.GlobalFlag = True

End Property

Private Function cStep_IncVersionX() As String

    cStep_IncVersionX = mcStep.IncVersionX

End Function

Private Function cStep_IncVersionY() As String

    cStep_IncVersionY = mcStep.IncVersionY

End Function


'Private Property Let cStep_GlobalRunMethod(ByVal RHS As Integer)
'
'    ' Whether or not the Global Run Method is valid for the step
'    ' will be checked by the Step class
'    mcStep.GlobalRunMethod = RHS
'
'End Property
'
'Private Property Get cStep_GlobalRunMethod() As Integer
'
'    cStep_GlobalRunMethod = mcStep.GlobalRunMethod
'
'End Property
'
Private Property Get cStep_IndOperation() As Operation

    cStep_IndOperation = mcStep.IndOperation

End Property

Private Property Let cStep_IndOperation(ByVal RHS As Operation)

    mcStep.IndOperation = RHS

End Property

Private Sub cStep_InsertIterator(cItRecord As cIterator)

    Call mcStep.InsertIterator(cItRecord)

End Sub

Private Function cStep_IsNewVersion() As Boolean
    cStep_IsNewVersion = mcStep.IsNewVersion
End Function

Private Function cStep_IteratorCount() As Long

    cStep_IteratorCount = mcStep.IteratorCount

End Function

Private Property Let cStep_IteratorName(ByVal RHS As String)

    mcStep.IteratorName = RHS

End Property

Private Property Get cStep_IteratorName() As String

    cStep_IteratorName = mcStep.IteratorName

End Property

Private Function cStep_Iterators() As Variant

    cStep_Iterators = mcStep.Iterators

End Function

Private Sub cStep_LoadIterator(cItRecord As cIterator)

    Call mcStep.LoadIterator(cItRecord)

End Sub

'Private Property Let cStep_LogFile(ByVal RHS As String)
'
'    mcStep.LogFile = RHS
'
'End Property
'
'Private Property Get cStep_LogFile() As String
'
'    cStep_LogFile = mcStep.LogFile
'
'End Property

Private Sub cStep_ModifyIterator(cItRecord As cIterator)

    Call mcStep.ModifyIterator(cItRecord)

End Sub

Private Sub cStep_Modify()
```

```
    ' Call a private procedure to see if the step text has been
    ' entered - since a global step actually executes a step,
    ' entry of the text is mandatory
    Call StepTextOrFileEntered

    ' Call the Modify method of the step class to carry out the update
    mcStep.Modify

End Sub

Private Property Get cStep_NextStepId() As Long

    cStep_NextStepId = mcStep.NextStepId

End Property

Private Property Set cStep_NodeDB(RHS As DAO.Database)

    Set mcStep.NodeDB = RHS

End Property

Private Property Get cStep_NodeDB() As DAO.Database

    Set cStep_NodeDB = mcStep.NodeDB

End Property

Private Function cStep_OldVersionNo() As String
    cStep_OldVersionNo = mcStep.OldVersionNo
End Function

Private Property Let cStep_OutputFile(ByVal RHS As String)

    mcStep.OutputFile = RHS

End Property

Private Property Get cStep_OutputFile() As String

    cStep_OutputFile = mcStep.OutputFile

End Property

Private Property Let cStep_ParentStepId(ByVal RHS As Long)

    ' A global step cannot have any sub-steps associated with it
    ' Hence, the parent step id and parent version number will be zero
    mcStep.ParentStepId = 0

End Property

Private Property Get cStep_ParentStepId() As Long

    cStep_ParentStepId = mcStep.ParentStepId

End Property

Private Property Let cStep_ParentVersionNo(ByVal RHS As String)

    ' A global step cannot have any sub-steps associated with it
    ' Hence, the parent step id and parent version number will be zero
    mcStep.ParentVersionNo = gstrMinVersion

End Property

Private Property Get cStep_ParentVersionNo() As String

    cStep_ParentVersionNo = mcStep.ParentVersionNo

End Property

Private Property Let cStep_Position(ByVal RHS As Long)

    mcStep.Position = RHS

End Property

Private Property Get cStep_Position() As Long

    cStep_Position = mcStep.Position

End Property

Private Sub cStep_RemoveIterator(cItRecord As cIterator)

    Call mcStep.RemoveIterator(cItRecord)

End Sub

Private Sub cStep_SaveIterators()

    Call mcStep.SaveIterators

End Sub

Private Property Let cStep_SequenceNo(ByVal RHS As Integer)

    mcStep.SequenceNo = RHS

End Property

Private Property Get cStep_SequenceNo() As Integer

    cStep_SequenceNo = mcStep.SequenceNo

End Property

Private Property Let cStep_StepId(ByVal RHS As Long)

    mcStep.StepId = RHS

End Property
Private Property Get cStep_StepId() As Long

    cStep_StepId = mcStep.StepId

End Property


Private Property Let cStep_StepLabel(ByVal RHS As String)

    mcStep.StepLabel = RHS

End Property

Private Property Get cStep_StepLabel() As String

    cStep_StepLabel = mcStep.StepLabel

End Property

Private Property Let cStep_StartDir(ByVal RHS As String)

    mcStep.StartDir = RHS

End Property

Private Property Get cStep_StartDir() As String

    cStep_StartDir = mcStep.StartDir
```

```
End Property

Private Property Let cStep_StepLevel(ByVal RHS As Integer)

    ' A global step cannot have any sub-steps associated with it
    ' Hence, it will always be at step level 0
    mcStep.StepLevel = 0

End Property

Private Property Get cStep_StepLevel() As Integer

    cStep_StepLevel = mcStep.StepLevel

End Property

Private Property Let cStep_StepText(ByVal RHS As String)

    mcStep.StepText = RHS

End Property

Private Property Get cStep_StepText() As String

    cStep_StepText = mcStep.StepText

End Property

Private Property Let cStep_StepTextFile(ByVal RHS As String)

    mcStep.StepTextFile = RHS

End Property

Private Property Get cStep_StepTextFile() As String

    cStep_StepTextFile = mcStep.StepTextFile

End Property

Private Property Let cStep_StepType(RHS As gintStepType)

    mcStep.StepType = gintGlobalStep

End Property

Private Property Get cStep_StepType() As gintStepType

    cStep_StepType = mcStep.StepType

End Property

Private Sub cStep_UnloadIterators()

    Call mcStep.UnloadIterators

End Sub

Private Sub cStep_UpdateIterator(cItRecord As cIterator)

    Call mcStep.UpdateIterator(cItRecord)

End Sub

Private Sub cStep_UpdateIteratorVersion()

    Call mcStep.UpdateIteratorVersion

End Sub

Private Sub cStep_Validate()

    ' The validate routines for each of the steps will
    ' carry out the specific validations for the type and
    ' call the generic validation routine

    On Error GoTo cStep_ValidateErr
    mstrSource = mstrModuleName & "cStep_Validate"

    ' Validations specific to global steps

    ' Check if the step text or a file name has been
    ' specified
    Call StepTextOrFileEntered

    ' The step level must be zero for all globals
    If mcStep.StepLevel <> 0 Then
        ShowError errStepLevelZeroForGlobal
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
            gstrSource, _
            LoadResString(errValidateFailed)
    End If

    If mcStep.EnabledFlag Then
        ShowError errEnabledFlagFalseForGlobal
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
            gstrSource, _
            LoadResString(errValidateFailed)
    End If

    If mcStep.DegreeParallelism > 0 Then
        ShowError errDegParallelismNullForGlobal
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
            gstrSource, _
            LoadResString(errValidateFailed)
    End If

    If mcStep.ContinuationCriteria > 0 Then
        ShowError errContCriteriaNullForGlobal
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
            gstrSource, _
            LoadResString(errValidateFailed)
    End If

    mcStep.Validate

    Exit Sub

cStep_ValidateErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "cStep_Validate"
    On Error GoTo 0
    Err.Raise vbObjectError + errValidateFailed, _
        mstrSource, _
        LoadResString(errValidateFailed)
End Sub
Private Sub StepTextOrFileEntered()
    ' Checks if either the step text or the name of the file containing
    ' the text has been entered
    ' If both of them are null or both of them are not null,
    ' the global step is invalid and an error is raised

    If StringEmpty(mcStep.StepText) And StringEmpty(mcStep.StepTextFile) Then
        ShowError errStepTextAndFileNull
        On Error GoTo 0
        Err.Raise vbObjectError + errStepTextAndFileNull, _
            mstrSource, LoadResString(errStepTextAndFileNull)
    ElseIf Not StringEmpty(mcStep.StepText) And Not
StringEmpty(mcStep.StepTextFile) Then
```

```
        ShowError errStepTextOrFile
        On Error GoTo 0
        Err.Raise vbObjectError + errStepTextOrFile, _
            mstrSource, LoadResString(errStepTextOrFile)
    End If

End Sub

Private Property Let cStep_VersionNo(ByVal RHS As String)

    mcStep.VersionNo = RHS

End Property

Private Property Get cStep_VersionNo() As String

    cStep_VersionNo = mcStep.VersionNo

End Property

Private Property Let cStep_WorkspaceId(ByVal RHS As Long)

    mcStep.WorkspaceId = RHS

End Property

Private Property Get cStep_WorkspaceId() As Long

    cStep_WorkspaceId = mcStep.WorkspaceId

End Property
```

cINSTANCE.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cInstance"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cInstance.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of an instance.
'              An instance is created when a step is executed for a
'              particular iterator value (if applicable) at 'run' time.
'              Contains functions to determine if an instance is running,
'              complete, and so on.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cInstance."
Private mstrSource As String

Private mcStep As cStep
Public Key As String ' Node key for the step being executed
Public InstanceId As Long
Public ParentInstanceId As Long ' The parent instance
Private mblnNoMoreToStart As Boolean
Private mblnComplete As Boolean
Public StartTime As Currency
Public EndTime As Currency
Public ElapsedTime As Currency
Private mintStatus As InstanceStatus
Public DegreeParallelism As Integer
Private mcIterators As cRunColIt

' A collection of all the sub-steps for this step
Private mcSubSteps As cSubSteps
Public Sub UpdateStartTime(lStepId As Long, Optional ByVal StartTm As Currency =
gdtmEmpty, _
        Optional ByVal EndTm As Currency = gdtmEmpty, _
        Optional ByVal Elapsed As Currency = 0)
    ' We do not maintain start and end timestamps for the constraint
    ' of a step. Hence we check if the process that just started/
    ' terminated is the worker step that is being executed. If so,
    ' we update the start/end time and status on the instance record.

    BugAssert (StartTm <> gdtmEmpty) Or (EndTm <> gdtmEmpty), "Mandatory
parameter missing."

    ' Make sure that we are executing the actual step and not
    ' a pre or post-execution constraint
    If mcStep.StepId = lStepId Then
        If StartTm <> 0 Then
            StartTime = StartTm
            mintStatus = gintRunning
        Else
            EndTime = EndTm
            ElapsedTime = Elapsed
            mintStatus = gintComplete
        End If
    End If

End Sub
Public Function ValidForIteration(cParentInstance As cInstance, _
        ByVal intConsType As ConstraintType) As Boolean
    ' Returns true if the instance passed in is the first or
    ' last iteration for the step, depending on the constraint type

    Dim cSubStepRec As cSubStep
    Dim vntIterators As Variant

    On Error GoTo ValidForIterationErr

    If cParentInstance Is Nothing Then
        ' This will only be true for the dummy instance, which
        ' cannot have any iterators defined for it
        ValidForIteration = True
        Exit Function
    End If

    vntIterators = mcStep.Iterators

    If Not StringEmpty(mcStep.IteratorName) And Not IsEmpty(vntIterators) Then

        Set cSubStepRec = cParentInstance.QuerySubStep(mcStep.StepId)

        If intConsType = gintPreStep Then
            ' Pre-execution constraints will only be executed
            ' before the first iteration
            If cSubStepRec.LastIterator.IteratorType = gintValue Then
                ValidForIteration = (cSubStepRec.LastIterator.Sequence = _
                    gintMinIteratorSequence)
            Else
                ValidForIteration = (cSubStepRec.LastIterator.Value = _
                    cSubStepRec.LastIterator.RangeFrom)
            End If
        Else
            ' Post-execution constraints will only be executed
            ' after the last iteration - check if there are any
            ' pending iterations
            ValidForIteration = cSubStepRec.NextIteration(mcStep) Is Nothing
        End If
```

```
    Else
        ValidForIteration = True
    End If

    Exit Function

ValidForIterationErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "ValidForIteration"
    Err.Raise vbObjectError + errExecInstanceFailed, _
          mstrSource, LoadResString(errExecInstanceFailed)

End Function

Public Sub CreateSubStep(cSubStepDtls As cStep, RunParams As cArrParameters)

    Dim cNewSubStep As cSubStep

    On Error GoTo CreateSubStepErr

    Set cNewSubStep = New cSubStep

    cNewSubStep.StepId = cSubStepDtls.StepId
    cNewSubStep.TasksComplete = 0
    cNewSubStep.TasksRunning = 0

    ' Initialize the iterator for the instance
    Set cNewSubStep.LastIterator = New cRunItDetails
    Call cNewSubStep.InitializeIt(cSubStepDtls, RunParams)

    ' Add add the substep to the collection
    mcSubSteps.Add cNewSubStep

    Set cNewSubStep = Nothing

    Exit Sub

CreateSubStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "CreateSubStep"
    Err.Raise vbObjectError + errProgramError, mstrSource, _
        LoadResString(errProgramError)

End Sub

Public Function QuerySubStep(ByVal SubStepId As Long) As cSubStep
    ' Retrieves the sub-step record for the passed in sub-step id

    Dim lngIndex As Long

    On Error GoTo QuerySubStepErr

    ' Find the sub-step node with the matching step id
    For lngIndex = 0 To mcSubSteps.Count - 1
        If mcSubSteps(lngIndex).StepId = SubStepId Then
            Set QuerySubStep = mcSubSteps(lngIndex)
            Exit For
        End If
    Next lngIndex

    Exit Function

QuerySubStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "QuerySubStep"
    Err.Raise vbObjectError + errNavInstancesFailed, _
          mstrSource, LoadResString(errNavInstancesFailed)

End Function
Public Property Let AllStarted(ByVal vdata As Boolean)

    'bugmessage "Set All Started to " & vData & " for : " & _
        mstrKey

    mblnNoMoreToStart = vdata

End Property
Public Property Get AllStarted() As Boolean

    AllStarted = mblnNoMoreToStart

End Property
Public Property Let AllComplete(ByVal vdata As Boolean)

    'bugmessage "Set All Complete to " & vData & " for : " & _
        mstrKey

    mblnComplete = vdata

End Property

Public Property Get AllComplete() As Boolean

    AllComplete = mblnComplete

End Property

Public Sub ChildExecuted(mlngStepId As Long)
    ' This procedure is called when a sub-step executes.

    Dim lngIndex As Long

    On Error GoTo ChildExecutedErr

    BugAssert mcStep.StepType = gintManagerStep

    For lngIndex = 0 To mcSubSteps.Count - 1
        If mcSubSteps(lngIndex).StepId = mlngStepId Then
            mcSubSteps(lngIndex).TasksRunning = _
                mcSubSteps(lngIndex).TasksRunning + 1
'           BugMessage "Tasks Running for Step Id : " & _
'                CStr(mcSubSteps(lngIndex).StepId) & _
'                " Instance Id: " & InstanceId & _
'                " = " & mcSubSteps(lngIndex).TasksRunning
            Exit For
        End If
    Next lngIndex

    If lngIndex > mcSubSteps.Count - 1 Then
        ' The child step wasn't found - raise an error
        On Error GoTo 0
        Err.Raise vbObjectError + errInvalidChild, mstrModuleName, _
            LoadResString(errInvalidChild)
    End If

    Exit Sub

ChildExecutedErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errInstanceOpFailed, mstrModuleName &
"ChildExecuted", _
        LoadResString(errInstanceOpFailed)

End Sub
```

```
Public Sub ChildTerminated(mlngStepId As Long)
    ' This procedure is called when any sub-step process
    ' terminates. Note: The TasksComplete field will be
    ' updated only when all the instances for a sub-step
    ' complete execution.
    Dim lngIndex As Long

    On Error GoTo ChildTerminatedErr

    BugAssert mcStep.StepType = gintManagerStep

    For lngIndex = 0 To mcSubSteps.Count - 1

        If mcSubSteps(lngIndex).StepId = mlngStepId Then
            mcSubSteps(lngIndex).TasksRunning = _
                mcSubSteps(lngIndex).TasksRunning - 1
'           BugMessage "Tasks Running for Step Id : " & _
'                CStr(mcSubSteps(lngIndex).StepId) & _
'                " Instance Id: " & InstanceId & _
'                " = " & mcSubSteps(lngIndex).TasksRunning

            BugAssert mcSubSteps(lngIndex).TasksRunning >= 0, _
                "Tasks running for " & CStr(mlngStepId) & _
                " Instance Id " & InstanceId & " is less than 0."
            Exit For
        End If
    Next lngIndex

    If lngIndex > mcSubSteps.Count - 1 Then
        ' The child step wasn't found - raise an error
        On Error GoTo 0
        Err.Raise errInvalidChild, mstrModuleName & "ChildTerminated", _
            LoadResString(errInvalidChild)
    End If

    Exit Sub

ChildTerminatedErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "ChildTerminated"
    Err.Raise vbObjectError + errInstanceOpFailed, mstrSource, _
        LoadResString(errInstanceOpFailed)

End Sub
Public Sub ChildCompleted(mlngStepId As Long)
    ' This procedure is called when any a sub-step completes
    ' execution. Note: The TasksComplete field will be
    ' incremented.
    Dim lngIndex As Long

    On Error GoTo ChildCompletedErr

    BugAssert mcStep.StepType = gintManagerStep

    For lngIndex = 0 To mcSubSteps.Count - 1
        BugAssert mcSubSteps(lngIndex).TasksComplete >= 0, _
            "Tasks complete for " & CStr(mcSubSteps(lngIndex).StepId) & _
            " Instance Id " & InstanceId & " is less than 0."

        If mcSubSteps(lngIndex).StepId = mlngStepId Then
            mcSubSteps(lngIndex).TasksComplete = _
                mcSubSteps(lngIndex).TasksComplete + 1
'           BugMessage "Tasks Complete for Step Id : " & _
'                CStr(mcSubSteps(lngIndex).StepId) & _
'                " Instance Id: " & InstanceId & _
'                " = " & mcSubSteps(lngIndex).TasksComplete
            Exit For
        End If
    Next lngIndex

    If lngIndex > mcSubSteps.Count - 1 Then
        ' The child step wasn't found - raise an error
        On Error GoTo 0
        Err.Raise errInvalidChild, mstrModuleName, _
            LoadResString(errInvalidChild)
    End If

    Exit Sub

ChildCompletedErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errInstanceOpFailed, mstrModuleName &
"ChildCompleted", _
        LoadResString(errInstanceOpFailed)

End Sub
Public Sub ChildDeleted(mlngStepId As Long)
    ' This procedure is called when a sub-step needs to be re-executed
    ' Note: The TasksComplete field is decremented. We needn't worry about
    ' the TasksRunning field since no steps are currently running.
    Dim lngIndex As Long

    On Error GoTo ChildDeletedErr

    BugAssert mcStep.StepType = gintManagerStep

    For lngIndex = 0 To mcSubSteps.Count - 1

        If mcSubSteps(lngIndex).StepId = mlngStepId Then
            mcSubSteps(lngIndex).TasksRunning = _
                mcSubSteps(lngIndex).TasksRunning - 1

            BugAssert mcSubSteps(lngIndex).TasksRunning >= 0, _
                "Tasks running for " & CStr(mcSubSteps(lngIndex).StepId) & _
                " Instance Id " & InstanceId & " is less than 0."
            Exit For
        End If
    Next lngIndex

    If lngIndex > mcSubSteps.Count - 1 Then
        ' The child step wasn't found - raise an error
        On Error GoTo 0
        Err.Raise errInvalidChild, mstrModuleName, _
            LoadResString(errInvalidChild)
    End If

    Exit Sub

ChildDeletedErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errInstanceOpFailed, mstrModuleName & "ChildDeleted",
_
        LoadResString(errInstanceOpFailed)

End Sub
Private Sub RaiseErrForWorker()

    If mcStep.StepType <> gintManagerStep Then
        On Error GoTo 0
        mstrSource = mstrModuleName & "RaiseErrForWorker"
        Err.Raise vbObjectError + errInvalidForWorker, _
            mstrSource, _
            LoadResString(errInvalidForWorker)
    End If

End Sub
```

```
Public Property Get Step() As cStep

    Set Step = mcStep

End Property
Public Property Get Iterators() As cRunCollt

    Set Iterators = mcIterators

End Property
Public Property Get SubSteps() As cSubSteps

    Call RaiseErrForWorker

    Set SubSteps = mcSubSteps

End Property
Public Property Set Step(cRunStep As cStep)

    Set mcStep = cRunStep

End Property

Public Property Set Iterators(cIts As cRunCollt)

    Set mcIterators = cIts

End Property
Public Property Get IsPending() As Boolean
    ' Returns true if the step has any substeps that need
    ' execution
    Dim lngIndex As Long
    Dim lngRunning As Long

    Call RaiseErrForWorker

    If Not mblnComplete And Not mblnNoMoreToStart Then
        ' Get a count of all the substeps that are already being
        ' executed
        lngRunning = 0
        For lngIndex = 0 To mcSubSteps.Count - 1
            lngRunning = lngRunning + mcSubSteps(lngIndex).TasksRunning
        Next lngIndex

        IsPending = (lngRunning < DegreeParallelism)
    Else
        ' This should be sufficient to prove that there r no
        ' more sub-steps to be executed.
        ' mblnComplete: Handles the case where all steps have
        ' been executed
        ' mblnNoMoreToStart: Handles the case where the step
        ' has a degree of parallelism greater than the total
        ' number of sub-steps available to execute
        IsPending = False
    End If

End Property
Public Property Get IsRunning() As Boolean
    ' Returns true if the any one of the substeps is still
    ' executing
    Dim lngIndex As Long

    Call RaiseErrForWorker

    IsRunning = False

    ' If a substep has no currently executing tasks and
    ' the tasks completed is greater than zero, then we can
    ' assume that it has completed execution (otherwise we
    ' would've run a new task the moment one completed!)
    For lngIndex = 0 To mcSubSteps.Count - 1
        If mcSubSteps(lngIndex).TasksRunning > 0 Then
            IsRunning = True
            Exit For
        End If
    Next lngIndex

End Property
Public Property Get TotalRunning() As Long
    ' Returns the total number of substeps that are executing
    Dim lngTotalProcesses As Long
    Dim lngIndex As Long

    Call RaiseErrForWorker

    lngTotalProcesses = 0
    For lngIndex = 0 To mcSubSteps.Count - 1
        BugAssert mcSubSteps(lngIndex).TasksRunning >= 0, _
            "Tasks running for " & CStr(mcSubSteps(lngIndex).StepId) & _
            " is less than 0."
        lngTotalProcesses = lngTotalProcesses + mcSubSteps(lngIndex).TasksRunning
    Next lngIndex

    TotalRunning = lngTotalProcesses
End Property
Public Property Get RunningForStep(lngSubStepId As Long) As Long
    ' Returns the total number of instances of the substep
    ' that are executing
    Dim lngIndex As Long

    Call RaiseErrForWorker

    For lngIndex = 0 To mcSubSteps.Count - 1
        BugAssert mcSubSteps(lngIndex).TasksRunning >= 0, _
            "Tasks running for " & CStr(mcSubSteps(lngIndex).StepId) & _
            " is less than 0."

        If mcSubSteps(lngIndex).StepId = lngSubStepId Then
            RunningForStep = mcSubSteps(lngIndex).TasksRunning
            Exit For
        End If
    Next lngIndex

    If lngIndex > mcSubSteps.Count - 1 Then
        ' The child step wasn't found - raise an error
        On Error GoTo 0
        Err.Raise errInvalidChild, mstrSource, _
            LoadResString(errInvalidChild)
    End If

End Property

Public Property Let Status(ByVal vdata As InstanceStatus)

    mintStatus = vdata

End Property

Public Property Get Status() As InstanceStatus

    Status = mintStatus

End Property
Private Sub Class_Initialize()

    Set mcSubSteps = New cSubSteps

    mblnNoMoreToStart = False
    mblnComplete = False
    StartTime = gdtmEmpty
    EndTime = gdtmEmpty
```

```
End Sub

Private Sub Class_Terminate()

    mcSubSteps.Clear
    Set mcSubSteps = Nothing

End Sub
```

CINSTANCES.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cInstances"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cInstances.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Implements a collection of cInstance objects.
'              Type-safe wrapper around cVector.
'              Also contains additional functions to query an instance, etc.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cInstance."
Private mstrSource As String

Private mcInstances As cVector

Public Function QueryInstance(ByVal InstanceId As Long) As cInstance
    ' Retrieves the record for the passed in instance from
    ' the collection

    Dim lngIndex As Long

    On Error GoTo QueryInstanceErr

    ' Check for valid values of the instance id
    If InstanceId > 0 Then
        ' Find the run node with the matching step id
        For lngIndex = 0 To Count() - 1
            If mcInstances(lngIndex).InstanceId = InstanceId Then
                Set QueryInstance = mcInstances(lngIndex)
                Exit For
            End If
        Next lngIndex

        If lngIndex > mcInstances.Count - 1 Then
            On Error GoTo 0
            Err.Raise vbObjectError + errQueryFailed, mstrSource, _
                LoadResString(errQueryFailed)
        End If
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errQueryFailed, mstrSource, _
            LoadResString(errQueryFailed)
    End If

    Exit Function

QueryInstanceErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "QueryInstance"
    Err.Raise vbObjectError + errQueryFailed, _
        mstrSource, LoadResString(errQueryFailed)

End Function

Public Function QueryPendingInstance(ByVal ParentInstanceId As Long, _
    ByVal lngSubStepId As Long) As cInstance
    ' Retrieves a pending instance for the passed in substep
    ' and the given parent instance id.

    Dim lngIndex As Long

    On Error GoTo QueryPendingInstanceErr

    ' Find the run node with the matching step id
    For lngIndex = 0 To Count() - 1
        If mcInstances(lngIndex).ParentInstanceId = ParentInstanceId And _
            mcInstances(lngIndex).Step.StepId = lngSubStepId Then
            ' Put in a separate if condition since the IsPending
            ' property is valid only for manager steps. If the
            ' calling procedure does not pass a manager step
            ' identifier, the procedure will error out.
            If mcInstances(lngIndex).IsPending Then
                Set QueryPendingInstance = mcInstances(lngIndex)
                Exit For
            End If
        End If
    Next lngIndex

    Exit Function

QueryPendingInstanceErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "QueryPendingInstance"
    Err.Raise vbObjectError + errQueryFailed, _
        mstrSource, LoadResString(errQueryFailed)

End Function
Public Function InstanceAborted(cSubStepRec As cSubStep) As Boolean

    Dim lIndex As Long

    InstanceAborted = False

    For lIndex = 0 To Count() - 1
        If mcInstances(lIndex).Step.StepId = cSubStepRec.StepId And _
            mcInstances(lIndex).Status = gintAborted Then
            InstanceAborted = True
            Exit For
        End If
    Next lIndex

End Function
Public Function CompletedInstanceExists(lParentInstance As Long, _
    cSubStepDtls As cStep) As Boolean
    ' Checks if there is a completed instance of the passed in step

    Dim lngIndex As Long

    CompletedInstanceExists = False

    If cSubStepDtls.StepType = gintManagerStep Then
        ' Find the run node with the matching step id
        For lngIndex = 0 To Count() - 1
```

```
        If mcInstances(lngIndex).ParentInstanceId = lParentInstance And _
             mcInstances(lngIndex).Step.StepId = cSubStepDtls.StepId Then
          ' Put in a separate if condition since the IsPending
          ' property is valid only for manager steps.
          BugAssert (Not mcInstances(lngIndex).IsPending), "Pending instance
exists!"

          CompletedInstanceExists = True
          Exit Function
        End If
      Next lngIndex
   End If

End Function
Public Sub Add(ByVal objItem As cInstance)

   mcInstances.Add objItem

End Sub


Public Sub Clear()

   mcInstances.Clear

End Sub


Public Function Count() As Long

   Count = mcInstances.Count

End Function


Public Function Delete(ByVal lngDelete As Long) As cInstance

   Set Delete = mcInstances.Delete(lngDelete)

End Function


Public Property Set Item(Optional ByVal Position As Long, _
      RHS As cInstance)

   If Position = -1 Then
      Position = 0
   End If
   Set mcInstances(Position) = RHS

End Property

Public Property Get Item(Optional ByVal Position As Long = -1) _
      As cInstance
Attribute Item.VB_UserMemId = 0

   If Position = -1 Then
      Position = 0
   End If
   Set Item = mcInstances.Item(Position)

End Property

Private Sub Class_Initialize()

   Set mcInstances = New cVector

End Sub


Private Sub Class_Terminate()

   Set mcInstances = Nothing

End Sub
```

cIterator.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cIterator"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cIterator.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of an iterator.
'              Contains functions to insert, update and delete
'              iterator_values records from the database.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Implements cNode

' Module level variables to store the property values
Private mintType As Integer
Private mintSequenceNo As Integer
Private mstrValue As String
Private mdbsIteratorDB As Database
Private mintOperation As Integer
Private mlngPosition As Long

Private Const mstrModuleName As String = "cIterator."
Private mstrSource As String

Public Enum ValueType
   gintFrom = 1
   gintTo
   gintStep
   gintValue
End Enum
Public Property Get Value() As String

   Value = mstrValue

End Property
Public Property Let Value(ByVal vdata As String)

   mstrValue = vdata

End Property

Public Property Get IndOperation() As Operation

   IndOperation = mintOperation

End Property
Public Property Let IndOperation(ByVal vdata As Operation)

   On Error GoTo IndOperationErr
   mstrSource = mstrModuleName & "IndOperation"

   ' The valid operations are define in the cOperations
   ' class. Check if the operation is valid
   Select Case vdata
```

```
        Case QueryOp, InsertOp, UpdateOp, DeleteOp
            mintOperation = vdata

        Case Else
            On Error GoTo 0
            Err.Raise vbObjectError + errInvalidOperation, _
                mstrSource, LoadResString(errInvalidOperation)
    End Select

    Exit Property

IndOperationErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "IndOperation"
    On Error GoTo 0
    Err.Raise vbObjectError + errLetOperationFailed, _
        mstrSource, LoadResString(errLetOperationFailed)

End Property

Public Function Clone() As cIterator

    ' Creates a copy of a given Iterator

    Dim cItClone As cIterator

    On Error GoTo CloneErr

    Set cItClone = New cIterator

    ' Copy all the iterator properties to the newly
    ' created object
    cItClone.IteratorType = mintType
    cItClone.SequenceNo = mintSequenceNo
    cItClone.IndOperation = mintOperation
    cItClone.Value = mstrValue

    ' And set the return value to the newly created Iterator
    Set Clone = cItClone

    Exit Function

CloneErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Clone"
    On Error GoTo 0
    Err.Raise vbObjectError + errCloneFailed, _
        mstrSource, LoadResString(errCloneFailed)

End Function
Public Property Get SequenceNo() As Integer

    SequenceNo = mintSequenceNo

End Property

Public Property Let SequenceNo(ByVal vdata As Integer)
    mintSequenceNo = vdata
End Property

Public Sub Add(ByVal lngStepId As Long, _
        strVersion As String)
    ' Inserts a new iterator values record into the database

    Dim strInsert As String
    Dim qy As DAO.QueryDef

    On Error GoTo AddIteratorErr

    ' First check if the database object is valid
    Call CheckDB

    ' Create a temporary querydef object
    strInsert = "insert into iterator_values " & _
            "( step_id, version_no, type, " & _
            " iterator_value, sequence_no ) " & _
            " values ( [st_id], [ver_no], [it_typ], " & _
            " [it_val], [seq_no] )"
    Set qy = mdbsIteratorDB.CreateQueryDef(gstrEmptyString, strInsert)

    ' Call a procedure to execute the Querydef object
    Call AssignParameters(qy, lngStepId, strVersion)

    qy.Execute dbFailOnError
    qy.Close

    Exit Sub

AddIteratorErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "AddIterator"
    On Error GoTo 0
    Err.Raise vbObjectError + errInsertIteratorFailed, _
            mstrSource, _
            LoadResString(errInsertIteratorFailed)
End Sub

Private Sub AssignParameters(qyExec As DAO.QueryDef, _
        ByVal lngStepId As Long, _
        strVersion As String)
    ' Assigns values to the parameters in the querydef object
    ' The parameter names are cryptic to make them different
    ' from the field names. When the parameter names are
    ' the same as the field names, parameters in the where
    ' clause do not get created.

    Dim prmParam As DAO.Parameter

    On Error GoTo AssignParametersErr
    mstrSource = mstrModuleName & "AssignParameters"

    For Each prmParam In qyExec.Parameters
        Select Case prmParam.Name
            Case "[st_id]"
                prmParam.Value = lngStepId

            Case "[ver_no]"
                prmParam.Value = strVersion

            Case "[it_typ]"
                prmParam.Value = mintType

            Case "[it_val]"
                prmParam.Value = mstrValue

            Case "[seq_no]"
                prmParam.Value = mintSequenceNo

            Case Else
                ' Write the parameter name that is faulty
                WriteError errInvalidParameter, mstrSource, _
                        prmParam.Name
                On Error GoTo 0
                Err.Raise errInvalidParameter, mstrSource, _
                        LoadResString(errInvalidParameter)
        End Select
    Next prmParam

    Exit Sub

AssignParametersErr:
```

```
    mstrSource = mstrModuleName & "AssignParameters"
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errAssignParametersFailed, _
        mstrSource, LoadResString(errAssignParametersFailed)

End Sub
Private Sub CheckDB()
    ' Check if the database object has been initialized

    If mdbsIteratorDB Is Nothing Then
        ShowError errInvalidDB
        On Error GoTo 0
        Err.Raise vbObjectError + errInvalidDB, _
            mstrModuleName, LoadResString(errInvalidDB)
    End If

End Sub

Public Sub Delete(ByVal lngStepId As Long, _
        strVersion As String)
    ' Deletes the step iterator record from the database

    Dim strDelete As String
    Dim qy As DAO.QueryDef

    On Error GoTo DeleteIteratorErr
    mstrSource = mstrModuleName & "DeleteIterator"

    ' There can be multiple iterators for a step.
    ' However the values that an iterator for a step can
    ' assume will be unique, meaning that a combination of
    ' the iterator_id and value will be unique.
    strDelete = "delete from iterator_values " & _
          " where step_id = [st_id]" & _
          " and version_no = [ver_no]" & _
          " and iterator_value = [it_val] "
    Set qy = mdbsIteratorDB.CreateQueryDef(gstrEmptyString, strDelete)

    Call AssignParameters(qy, lngStepId, strVersion)
    qy.Execute dbFailOnError

    qy.Close

    Exit Sub

DeleteIteratorErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "DeleteIterator"
    On Error GoTo 0
    Err.Raise vbObjectError + errDeleteIteratorFailed, _
          mstrSource, _
          LoadResString(errDeleteIteratorFailed)
End Sub
Public Sub Update(ByVal lngStepId As Long, strVersion As String)
    ' Updates the sequence no of the step iterator record
    ' in the database

    Dim strUpdate As String
    Dim qy As QueryDef

    On Error GoTo UpdateErr

    ' First check if the database object is valid
    Call CheckDB

    If mintType = gintValue Then
        ' If the iterator is of type value, only the sequence of the values can get updated
        strUpdate = "Update iterator_values " & _
              " set sequence_no = [seq_no] " & _
              " where step_id = [st_id]" & _
              " and version_no = [ver_no]" & _
              " and iterator_value = [it_val] "
    Else
        ' If the iterator is of type range, only the values can get updated
        strUpdate = "Update iterator_values " & _
              " set iterator_value = [it_val] " & _
              " where step_id = [st_id]" & _
              " and version_no = [ver_no]" & _
              " and type = [it_typ] "
    End If

    Set qy = mdbsIteratorDB.CreateQueryDef(gstrEmptyString, strUpdate)

    ' Call a procedure to assign the parameter values to the
    ' querydef object
    Call AssignParameters(qy, lngStepId, strVersion)
    qy.Execute dbFailOnError

    qy.Close

    Exit Sub

UpdateErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Update"
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateConstraintFailed, _
          mstrSource, _
          LoadResString(errUpdateConstraintFailed)

End Sub
Public Property Set NodeDB(vdata As Database)

    Set mdbsIteratorDB = vdata

End Property

Public Property Get NodeDB() As Database

    Set NodeDB = mdbsIteratorDB

End Property
Public Property Get Position() As Long

    Position = mlngPosition

End Property
Public Property Let Position(ByVal vdata As Long)

    mlngPosition = vdata

End Property

Public Property Let IteratorType(ByVal vdata As ValueType)

    On Error GoTo TypeErr
    mstrSource = mstrModuleName & "Type"

    ' These constants have been defined in the enumeration,
    ' Type, which is exposed
    Select Case vdata
        Case gintFrom, gintTo, gintStep, gintValue
            mintType = vdata

        Case Else
            On Error GoTo 0
            Err.Raise vbObjectError + errTypeInvalid, _
                mstrSource, LoadResString(errTypeInvalid)
    End Select

    Exit Property
```

```
TypeErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "Type"
   On Error GoTo 0
   Err.Raise vbObjectError + errTypeInvalid, _
      mstrSource, LoadResString(errTypeInvalid)

End Property

Public Property Get IteratorType() As ValueType

   IteratorType = mintType

End Property
Public Sub Validate()

   ' No validations necessary for the iterator class

End Sub

Private Sub Class_Initialize()

   ' Initialize the operation indicator variable to Query
   ' It will be modified later by the collection class when
   ' inserts, updates or deletes are performed
   mintOperation = QueryOp

End Sub


Private Property Let cNode_IndOperation(ByVal vdata As Operation)

   On Error GoTo IndOperationErr
   mstrSource = mstrModuleName & "IndOperation"

   ' The valid operations are define in the cOperations
   ' class. Check if the operation is valid
   Select Case vdata
      Case QueryOp, InsertOp, UpdateOp, DeleteOp
         mintOperation = vdata

      Case Else
         On Error GoTo 0
         Err.Raise vbObjectError + errInvalidOperation, _
               mstrSource, LoadResString(errInvalidOperation)
   End Select

   Exit Property

IndOperationErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "IndOperation"
   On Error GoTo 0
   Err.Raise vbObjectError + errLetOperationFailed, _
      mstrSource, LoadResString(errLetOperationFailed)

End Property

Private Property Get cNode_IndOperation() As Operation

   IndOperation = mintOperation

End Property

Private Property Set cNode_NodeDB(RHS As DAO.Database)

   Set mdbsIteratorDB = RHS

End Property

Private Property Get cNode_NodeDB() As DAO.Database

   Set cNode_NodeDB = mdbsIteratorDB

End Property


Private Property Let cNode_Position(ByVal vdata As Long)

   mlngPosition = vdata

End Property


Private Property Get cNode_Position() As Long

   cNode_Position = mlngPosition

End Property


Private Sub cNode_Validate()

   ' No validations necessary for the iterator class

End Sub


Private Property Let cNode_Value(ByVal vdata As String)

   mstrValue = vdata

End Property

Private Property Get cNode_Value() As String

   Value = mstrValue

End Property
```

cMANAGER.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cManager"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cManager.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a manager step.
'              Implements the cStep class - carries out initializations
'              and validations that are specific to manager steps.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Implements cStep

' Object variable to keep the step reference in
Private mcStep As cStep

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
```

```
Private Const mstrModuleName As String = "cManager."

Private Property Let cStep_StartDir(ByVal RHS As String)

    mcStep.StartDir = RHS

End Property

Private Property Get cStep_StartDir() As String

    cStep_StartDir = mcStep.StartDir

End Property
Private Sub cStep_Delete()

    Call mcStep.Delete

End Sub

Private Property Set cStep_NodeDB(RHS As DAO.Database)

    Set mcStep.NodeDB = RHS

End Property

Private Function cStep_IncVersionY() As String

    cStep_IncVersionY = mcStep.IncVersionY

End Function
Private Function cStep_IsNewVersion() As Boolean
    cStep_IsNewVersion = mcStep.IsNewVersion
End Function
Private Function cStep_OldVersionNo() As String
    cStep_OldVersionNo = mcStep.OldVersionNo
End Function

Private Function cStep_IncVersionX() As String

    cStep_IncVersionX = mcStep.IncVersionX

End Function
Private Sub cStep_UpdateIteratorVersion()

    Call mcStep.UpdateIteratorVersion

End Sub

Private Function cStep_IteratorCount() As Long

    cStep_IteratorCount = mcStep.IteratorCount

End Function

Private Sub cStep_UnloadIterators()

    Call mcStep.UnloadIterators

End Sub

Private Sub cStep_DeleteIterator(cItRecord As cIterator)

    Call mcStep.DeleteIterator(cItRecord)

End Sub
Private Property Get cStep_IteratorName() As String

    cStep_IteratorName = mcStep.IteratorName

End Property
Private Property Let cStep_IteratorName(ByVal RHS As String)
    mcStep.IteratorName = RHS

End Property

Private Sub cStep_SaveIterators()

    Call mcStep.SaveIterators

End Sub
Private Sub cStep_LoadIterator(cItRecord As cIterator)

    Call mcStep.LoadIterator(cItRecord)

End Sub

Private Property Let cStep_Position(ByVal RHS As Long)

    mcStep.Position = RHS

End Property
Private Sub cStep_InsertIterator(cItRecord As cIterator)

    Call mcStep.InsertIterator(cItRecord)

End Sub
Private Function cStep_Iterators() As Variant

    cStep_Iterators = mcStep.Iterators

End Function
Private Sub cStep_ModifyIterator(cItRecord As cIterator)

    Call mcStep.ModifyIterator(cItRecord)

End Sub
Private Sub cStep_RemoveIterator(cItRecord As cIterator)

    Call mcStep.RemoveIterator(cItRecord)

End Sub
Private Sub cStep_UpdateIterator(cItRecord As cIterator)

    Call mcStep.UpdateIterator(cItRecord)

End Sub
Private Sub cStep_AddIterator(cItRecord As cIterator)

    Call mcStep.AddIterator(cItRecord)

End Sub

Private Property Get cStep_Position() As Long

    cStep_Position = mcStep.Position

End Property

Private Function cStep_Clone(Optional cCloneStep As cStep) As cStep

    Dim cNewManager As cManager

    Set cNewManager = New cManager
    Set cStep_Clone = mcStep.Clone(cNewManager)

End Function

Private Property Get cStep_IndOperation() As Operation

    cStep_IndOperation = mcStep.IndOperation
```

```
End Property

Private Property Let cStep_IndOperation(ByVal RHS As Operation)

    mcStep.IndOperation = RHS

End Property

Private Property Get cStep_NextStepId() As Long

    cStep_NextStepId = mcStep.NextStepId

End Property
Private Property Let cStep_ErrorFile(ByVal RHS As String)

    mcStep.ErrorFile = RHS

End Property

Private Property Get cStep_ErrorFile() As String

    cStep_ErrorFile = mcStep.ErrorFile

End Property
'Private Property Let cStep_LogFile(ByVal RHS As String)
'
'    mcStep.LogFile = RHS
'
'End Property
'
'Private Property Get cStep_LogFile() As String
'
'    cStep_LogFile = mcStep.LogFile
'
'End Property

Private Property Let cStep_ArchivedFlag(ByVal RHS As Boolean)

    mcStep.ArchivedFlag = RHS

End Property

Private Property Get cStep_ArchivedFlag() As Boolean

    cStep_ArchivedFlag = mcStep.ArchivedFlag

End Property

Private Property Get cStep_NodeDB() As DAO.Database

    Set cStep_NodeDB = mcStep.NodeDB

End Property

Private Sub Class_Initialize()

    ' Create the object
    Set mcStep = New cStep

    ' Initialize the object with valid values for a manager step
    ' The global flag should be the first field to be initialized
    ' since subsequent validations might try to check if the
    ' step being created is global
    mcStep.GlobalFlag = False
'    mcStep.GlobalRunMethod = gintNoOption
    mcStep.StepType = gintManagerStep

    ' Since the manager step does not take any action, the step
    ' text and file name will always be empty
    mcStep.StepText = gstrEmptyString
    mcStep.StepTextFile = gstrEmptyString

Private Property Let cStep_OutputFile(ByVal RHS As String)

    mcStep.OutputFile = RHS

End Property

Private Property Get cStep_OutputFile() As String

    cStep_OutputFile = mcStep.OutputFile

End Property


    ' Since the manager step does not take any action, execution
    ' properties for the step will be empty
    mcStep.ExecutionMechanism = gintNoOption
    mcStep.FailureDetails = gstrEmptyString
    mcStep.ContinuationCriteria = gintNoOption

End Sub
Private Sub Class_Terminate()

    ' Remove the step object
    Set mcStep = Nothing

End Sub
Private Sub cStep_Add()

    ' Call the Add method of the step class to carry out the insert
    mcStep.Add

End Sub
Private Property Get cStep_ContinuationCriteria() As ContinuationCriteria

    cStep_ContinuationCriteria = mcStep.ContinuationCriteria

End Property

Private Property Let cStep_ContinuationCriteria(ByVal RHS As ContinuationCriteria)

    ' Since a manager step cannot take any action, the continuation
    ' criteria property does not apply to it
    mcStep.ContinuationCriteria = gintNoOption

End Property

Private Property Let cStep_DegreeParallelism(ByVal RHS As String)

    mcStep.DegreeParallelism = RHS

End Property

Private Property Get cStep_DegreeParallelism() As String

    cStep_DegreeParallelism = mcStep.DegreeParallelism

End Property

Private Sub cStep_DeleteStep()

    On Error GoTo cStep_DeleteStepErr
    mstrSource = mstrModuleName & "cStep_DeleteStep"

    mcStep.Delete
    Exit Sub

cStep_DeleteStepErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "cStep_DeleteStep"
    On Error GoTo 0
```

```
    Err.Raise vbObjectError + errDeleteStepFailed, _
        mstrSource, _
        LoadResString(errDeleteStepFailed)

End Sub

Private Property Get cStep_EnabledFlag() As Boolean

    cStep_EnabledFlag = mcStep.EnabledFlag

End Property

Private Property Let cStep_EnabledFlag(ByVal RHS As Boolean)

    mcStep.EnabledFlag = RHS

End Property

Private Property Let cStep_ExecutionMechanism(ByVal RHS As ExecutionMethod)

    ' Since a manager step cannot take any action, the Execution
    ' Mechanism property does not apply to it
    mcStep.ExecutionMechanism = gintNoOption

End Property

Private Property Get cStep_ExecutionMechanism() As ExecutionMethod

    cStep_ExecutionMechanism = mcStep.ExecutionMechanism

End Property

Private Property Let cStep_FailureDetails(ByVal RHS As String)

    ' Since a manager step cannot take any action, the Failure
    ' Details property does not apply to it
    mcStep.FailureDetails = gstrEmptyString

End Property

Private Property Get cStep_FailureDetails() As String

    cStep_FailureDetails = mcStep.FailureDetails

End Property

Private Property Get cStep_GlobalFlag() As Boolean

    cStep_GlobalFlag = mcStep.GlobalFlag

End Property

Private Property Let cStep_GlobalFlag(ByVal RHS As Boolean)

    ' Set the global flag to false - this flag is initialized when
    ' an instance of the class is created. Just making sure that
    ' nobody changes the value inadvertently
    mcStep.GlobalFlag = False

End Property
Private Sub cStep_Modify()

    ' Call the Modify method of the step class to carry out the update
    mcStep.Modify

End Sub

Private Property Let cStep_ParentStepId(ByVal RHS As Long)

    mcStep.ParentStepId = RHS

End Property

Private Property Get cStep_ParentStepId() As Long

    cStep_ParentStepId = mcStep.ParentStepId

End Property

Private Property Let cStep_ParentVersionNo(ByVal RHS As String)

    mcStep.ParentVersionNo = RHS

End Property

Private Property Get cStep_ParentVersionNo() As String

    cStep_ParentVersionNo = mcStep.ParentVersionNo

End Property

Private Property Let cStep_SequenceNo(ByVal RHS As Integer)

    mcStep.SequenceNo = RHS

End Property

Private Property Get cStep_SequenceNo() As Integer

    cStep_SequenceNo = mcStep.SequenceNo

End Property

Private Property Let cStep_StepId(ByVal RHS As Long)

    mcStep.StepId = RHS

End Property

Private Property Get cStep_StepId() As Long

    cStep_StepId = mcStep.StepId

End Property


Private Property Let cStep_StepLabel(ByVal RHS As String)

    mcStep.StepLabel = RHS

End Property

Private Property Get cStep_StepLabel() As String

    cStep_StepLabel = mcStep.StepLabel

End Property


Private Property Let cStep_StepLevel(ByVal RHS As Integer)

    mcStep.StepLevel = RHS

End Property

Private Property Get cStep_StepLevel() As Integer

    cStep_StepLevel = mcStep.StepLevel

End Property

Private Property Let cStep_StepText(ByVal RHS As String)
```

```
    ' Since the manager step does not take any action, the step
    ' text and file name will always be empty
    mcStep.StepText = gstrEmptyString

End Property

Private Property Get cStep_StepText() As String

    cStep_StepText = mcStep.StepText

End Property

Private Property Let cStep_StepTextFile(ByVal RHS As String)

    ' Since the manager step does not take any action, the step
    ' text and file name will always be empty
    mcStep.StepTextFile = gstrEmptyString

End Property

Private Property Get cStep_StepTextFile() As String

    cStep_StepTextFile = mcStep.StepTextFile

End Property

Private Property Let cStep_StepType(RHS As gintStepType)

    mcStep.StepType = gintManagerStep

End Property

Private Property Get cStep_StepType() As gintStepType

    cStep_StepType = mcStep.StepType

End Property

Private Sub cStep_Validate()
    ' The validate routines for each of the steps will
    ' carry out the specific validations for the type and
    ' call the generic validation routine

    On Error GoTo cStep_ValidateErr
    mstrSource = mstrModuleName & "cStep_Validate"

    ' Validations specific to manager steps

    ' Check if the step text or a file name has been
    ' specified
    If Not StringEmpty(mcStep.StepText) Or Not StringEmpty(mcStep.StepTextFile)
Then
        ShowError errTextAndFileNullForManager
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
              gstrSource, _
              LoadResString(errValidateFailed)
    End If

    If mcStep.ExecutionMechanism <> gintNoOption Then
        ShowError errExecutionMechanismInvalid
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
              gstrSource, _
              LoadResString(errValidateFailed)
    End If

    If mcStep.FailureDetails <> gstrEmptyString Then
        ShowError errFailureDetailsNullForMgr
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
              gstrSource, _
              LoadResString(errValidateFailed)
    End If

    If mcStep.ContinuationCriteria <> gintNoOption Then
        ShowError errContCriteriaInvalid
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
              gstrSource, _
              LoadResString(errValidateFailed)
    End If

    mcStep.Validate

    Exit Sub

cStep_ValidateErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "cStep_Validate"
    On Error GoTo 0
    Err.Raise vbObjectError + errValidateFailed, _
          mstrSource, _
          LoadResString(errValidateFailed)
End Sub

Private Property Let cStep_VersionNo(ByVal RHS As String)

    mcStep.VersionNo = RHS

End Property

Private Property Get cStep_VersionNo() As String

    cStep_VersionNo = mcStep.VersionNo

End Property

Private Property Let cStep_WorkspaceId(ByVal RHS As Long)

    mcStep.WorkspaceId = RHS

End Property

Private Property Get cStep_WorkspaceId() As Long

    cStep_WorkspaceId = mcStep.WorkspaceId

End Property
```

cNode.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cNode"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cNode.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Defines the properties that an object has to implement.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit
```

```
Public Property Get IndOperation() As Operation
End Property
Public Property Let IndOperation(ByVal vdata As Operation)
End Property
Public Sub Validate()
End Sub
Public Property Get Value() As String
End Property
Public Property Let Value(ByVal vdata As String)
End Property

Public Property Get NodeDB() As Database
End Property
Public Property Set NodeDB(vdata As Database)
End Property

Public Property Get Position() As Long
End Property
Public Property Let Position(ByVal vdata As Long)
End Property
```

cNodeCollections.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cNodeCollections"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cNodeCollections.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Implements an array of objects.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Node counter
Private mlngNodeCount As Long
Private mdbsNodeDb As Database
Private mcarrNodes() As Object

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cNodeCollections."

Public Property Set Item(ByVal Position As Long, _
       ByVal objNode As Object)

    ' Returns the element at the passed in position in the array
    If Position >= 0 And Position < mlngNodeCount Then
        Set mcarrNodes(Position) = objNode
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
            LoadResString(errItemDoesNotExist)
    End If

End Property
Public Property Get Item(ByVal Position As Long) As Object
Attribute Item.VB_UserMemId = 0

    ' Returns the element at the passed in position in the array
    If Position >= 0 And Position < mlngNodeCount Then
        Set Item = mcarrNodes(Position)
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
            LoadResString(errItemDoesNotExist)
    End If

End Property

Public Sub Commit(ByVal cSaveObj As Object, _
       ByVal lngIndex As Long)
    ' This procedure checks if any changes have been made to the
    ' passed in object. If so, it calls the corresponding method
    ' to commit the changes.

    On Error GoTo CommitErr
    mstrSource = mstrModuleName & "Commit"

    Select Case cSaveObj.IndOperation
        Case QueryOp
            ' No changes were made to the queried parameter.
            ' Do nothing

        Case InsertOp
            cSaveObj.Add
            cSaveObj.IndOperation = QueryOp

        Case UpdateOp
            cSaveObj.Modify
            cSaveObj.IndOperation = QueryOp

        Case DeleteOp
            cSaveObj.Delete
            ' Now we can remove the record from the array
            Call Unload(lngIndex)

    End Select

    Exit Sub

CommitErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Commit"
    On Error GoTo 0
    Err.Raise vbObjectError + errCommitFailed, _
          mstrSource, _
          LoadResString(errCommitFailed)

End Sub
Public Sub Save(ByVal lngWorkspace As Long)
    ' Calls a procedure to commit all changes for the passed
    ' in workspace.

    Dim lngIndex As Long

    On Error GoTo SaveErr

    ' Find all parameters in the array with a matching workspace id
    ' It is important to step backwards through the array, since
    ' we delete parameter records as we go along!
    For lngIndex = mlngNodeCount - 1 To 0 Step -1
        If mcarrNodes(lngIndex).WorkspaceId = lngWorkspace Then

            ' Call a procedure to commit all changes to the
            ' parameter record, if any
            Call Commit(mcarrNodes(lngIndex), lngIndex)

        End If
    Next lngIndex

    Exit Sub
```

```
SaveErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "Save"
   On Error GoTo 0
   Err.Raise vbObjectError + errSaveFailed, _
         mstrSource, _
         LoadResString(errSaveFailed)

End Sub
Public Property Get Count() As Long

   Count = mlngNodeCount

End Property

Public Property Get NodeDB() As Database

   Set NodeDB = mdbsNodeDb

End Property
Public Property Set NodeDB(vdata As Database)

   Set mdbsNodeDb = vdata

End Property

Public Sub Load(cNodeToLoad As Object)
   ' Adds the passed in object to the array

   On Error GoTo LoadErr

   ' If this procedure is called by the add to array procedure,
   ' the database object has already been initialized
   If cNodeToLoad.NodeDB Is Nothing Then

      ' All the Nodes will be initialized with the database
      ' objects before being added to the array
      Set cNodeToLoad.NodeDB = mdbsNodeDb

   End If

   ReDim Preserve mcarrNodes(mlngNodeCount)

   ' Set the newly added element in the array to the passed in Node
   cNodeToLoad.Position = mlngNodeCount
   Set mcarrNodes(mlngNodeCount) = cNodeToLoad

   mlngNodeCount = mlngNodeCount + 1

   Exit Sub

LoadErr:
   LogErrors Errors
   On Error GoTo 0
   Err.Raise vbObjectError + errLoadFailed, mstrModuleName & "Load", _
         LoadResString(errLoadFailed)

End Sub
Public Sub Unload(lngDeletePosition As Long)
   ' Unloads the passed in object from the array

   On Error GoTo UnloadErr

   If lngDeletePosition < (mlngNodeCount - 1) Then

      ' Set the Node at the position being deleted to
      ' the last Node in the Node array
      Set mcarrNodes(lngDeletePosition) = mcarrNodes(mlngNodeCount - 1)
      mcarrNodes(lngDeletePosition).Position = lngDeletePosition
   End If

   ' Delete the last Node from the array
   mlngNodeCount = mlngNodeCount - 1
   If mlngNodeCount > 0 Then
      ReDim Preserve mcarrNodes(0 To mlngNodeCount - 1)
   Else
      ReDim mcarrNodes(0)
   End If

   Exit Sub

UnloadErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "Unload"
   On Error GoTo 0
   Err.Raise vbObjectError + errUnloadFailed, _
         mstrSource, _
         LoadResString(errUnloadFailed)

End Sub
Public Sub Delete(lngDeletePosition As Long)
   ' Deletes the object at the specified position in the
   ' array

   Dim cDeleteObj As Object

   On Error GoTo DeleteErr
   mstrSource = mstrModuleName & "Delete"

   Set cDeleteObj = mcarrNodes(lngDeletePosition)

   If cDeleteObj.IndOperation = InsertOp Then
      ' If we are deleting a record that has just been inserted,
      ' blow it away
      Call Unload(lngDeletePosition)
   Else
      ' Set the operation for the deleted object to indicate a
      ' delete - we actually delete the element only at the time
      ' of a save operation
      cDeleteObj.IndOperation = DeleteOp
   End If

   Exit Sub

DeleteErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "Delete"
   On Error GoTo 0
   Err.Raise vbObjectError + errDeleteFailed, _
         mstrSource, _
         LoadResString(errDeleteFailed)

End Sub
Public Sub Modify(cModifiedNode As Object)
   ' Sets the object at the passed in position to the
   ' modified object passed in

   On Error GoTo ModifyErr

   ' First check if the record is valid - all objects that
   ' use this collection class must have a Validate routine
   cModifiedNode.Validate

   ' If we are updating a record that hasn't yet been inserted,
   ' do not change the operation indicator - or we try to update
   ' a non-existant record
   If cModifiedNode.IndOperation <> InsertOp Then
      ' Set the operations to indicate an update
      cModifiedNode.IndOperation = UpdateOp
   End If

   ' Modify the object at the queried position - the Position
```

```
    ' will be maintained by this class
    Set mcarrNodes(cModifiedNode.Position) = cModifiedNode

    Exit Sub

ModifyErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Modify"
    On Error GoTo 0
    Err.Raise vbObjectError + errModifyFailed, _
          mstrSource, _
          LoadResString(errModifyFailed)

End Sub
Public Sub Add(cNodeToAdd As Object)

    On Error GoTo AddErr

    Set cNodeToAdd.NodeDB = mdbsNodeDb

    ' First check if the record is valid
    cNodeToAdd.Validate

    ' Set the operation to indicate an insert
    cNodeToAdd.IndOperation = InsertOp

    ' Call a procedure to load the record in the array
    Call Load(cNodeToAdd)

    Exit Sub

AddErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Add"
    On Error GoTo 0
    Err.Raise vbObjectError + errAddFailed, _
          mstrSource, _
          LoadResString(errAddFailed)

End Sub

Private Sub Class_Terminate()

    ReDim mcarrNodes(0)
    mlngNodeCount = 0

End Sub
```

COMMON.BAS

```
Attribute VB_Name = "Common"
'  FILE:       Common.bas
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Module containing common functionality throughout
'              StepMaster
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private Const mstrModuleName As String = "Common."

' Used to separate the variable data from the constant error
' message being raised when a context-sensitive error is displayed
Private Const mintDelimiter As String = " : "
Private Const mstrFormatString = "mmddyy"

' Identifiers for the different labels that need to be loaded
' into the tree view for each workspace
Public Const mstrWorkspacePrefix = "W"
Public Const mstrParameterPrefix = "P"
Public Const mstrParamConnectionPrefix = "C"
Public Const mstrConnectionDtlPrefix = "N"
Public Const mstrParamExtensionPrefix = "E"
Public Const mstrParamBuiltInPrefix = "B"
Public Const gstrGlobalStepPrefix = "G"
Public Const gstrManagerStepPrefix = "M"
Public Const gstrWorkerStepPrefix = "S"
Public Const gstrDummyPrefix = "D"
Public Const mstrLabelPrefix = "L"
Public Const mstrInstancePrefix = "I"
Public Function LabelStep(lngWorkspaceIdentifier As Long) As String
    ' Returns the step label for the workspace identifier passed in
    ' Basically this is a wrapper around the MakeKeyValid function

    LabelStep = MakeKeyValid(gintStepLabel, gintStepLabel, lngWorkspaceIdentifier)

End Function


Public Function JulianDateToString(dt64Bit As Currency) As String

    Dim lYear As Long
    Dim lMonth As Long
    Dim lDay As Long
    Dim lHour As Long
    Dim lMin As Long
    Dim lSec As Long
    Dim lMs As Long

    Call JulianToTime(dt64Bit, lYear, lMonth, lDay, lHour, lMin, lSec, lMs)
    JulianDateToString = Format$(lYear, gsYearFormat) & gsDateSeparator & _
          Format$(lMonth, gsDtFormat) & gsDateSeparator & _
          Format$(lDay, gsDtFormat) & gstrBlank & _
          Format$(lHour, gsTmFormat) & gsTimeSeparator & _
          Format$(lMin, gsTmFormat) & gsTimeSeparator & _
          Format$(lSec, gsTmFormat) & gsMsSeparator & _
          Format$(lMs, gsMSecondFormat)

End Function
Public Sub DeleteFile(strFile As String, Optional ByVal bCheckIfEmpty As Boolean =
False)

    ' Ensure that there is only a single file of the name before delete, since
    ' Kill supports wildcards and can potentially delete a number of files
    Dim strTemp As String

    If CheckFileExists(strFile) Then
       If bCheckIfEmpty Then
          If FileLen(strFile) = 0 Then
             Kill strFile
          End If
       Else
          Kill strFile
       End If
    End If

End Sub
Public Function CheckFileExists(strFile As String) As Boolean

    ' Returns true if the passed in file exists
    ' Raises an error if multiple files are found (filename contains a wildcard)
    CheckFileExists = False

    If Not StringEmpty(Dir(strFile)) Then
       If Not StringEmpty(Dir()) Then
          On Error GoTo 0
          Err.Raise vbObjectError + errDeleteSingleFile, _
             mstrModuleName & "DeleteFile", LoadResString(errDeleteSingleFile)
       End If
```

```
        CheckFileExists = True
    End If

End Function

Public Function GetVersionString() As String
GetVersionString = "Version " & gsVersion
End Function

Function IsLabel(strKey As String) As Boolean

    ' The tree view control on frmMain can contain two types of
    ' nodes -
    ' 1. Nodes that contain data for the workspace - this could
    ' be data for the different types of steps or parameters
    ' 2. Nodes that display static data - these kind of nodes
    ' are referred to as label nodes e.g. "Global Steps" is a
    ' label node
    ' This function returns True if the passed in key corresponds
    ' to a label node

    IsLabel = InStr(strKey, mstrLabelPrefix) > 0

End Function

Function MakeKeyValid(lngIdentifier As Long, _
    intTypeOfNode As Integer, _
    Optional ByVal WorkspaceId As Long = 0, _
    Optional ByVal InstanceId As Long = 0) As String

    ' We use a numbering scheme while loading the tree view with
    ' all node data, since it needs a unique key and we want to
    ' use the key to identify the data it contains.
    ' Moreover, add a character to the beginning of the identifier
    ' so that the tree view control accepts it as a valid string,
    ' viz. "456" doesn't work, so change it to "W456"
    ' The general scheme is to concatenate a Label with the Identifier
    ' e.g A Global Step Node will have the Label, G and the Step Id
    ' concatenated to form the unique key
    ' The list of all such node types is given below
    ' 1. "W" + Workspace_Id for Workspace nodes
    ' 2. "P" + Parameter_Id for Parameter nodes
    ' 3. "M" + Step_Id for Manager Step nodes
    ' 4. "S" + Step_Id for Worker Step nodes
    ' 5. "G" + Step_Id for Global Step nodes
    ' 6. Instance_id + "I" + Step_Id for Instance nodes
    ' 7. Workspace_id + "L" + the label identifier = node type for all Label nodes
    ' Since the manager, worker and global steps are stored in the
    ' same table and the step identifiers will always be unique, we
    ' can use the same character as the prefix, but this is a
    ' convenient way to know the type of step being processed.
    ' The workspace id is appended to the label identifier to make
    ' it unique, since multiple workspaces may be open during a session
    ' Strip the prefix characters off while saving the Ids to the db

    Dim strPrefixChar As String

    On Error GoTo MakeKeyValidErr
    gstrSource = mstrModuleName & "MakeKeyValid"

    Select Case intTypeOfNode
        Case gintWorkspace
            strPrefixChar = mstrWorkspacePrefix
        Case gintGlobalStep
            strPrefixChar = gstrGlobalStepPrefix
        Case gintManagerStep
            strPrefixChar = gstrManagerStepPrefix
        Case gintWorkerStep
            strPrefixChar = gstrWorkerStepPrefix
        Case gintRunManager, gintRunWorker
            If InstanceId = 0 Then
                On Error GoTo 0
                Err.Raise vbObjectError + errMandatoryParameterMissing, _
                    gstrSource, _
                    LoadResString(errMandatoryParameterMissing)
            End If
            ' Concatenate the instance identifier and the step
            ' identifier to form a unique key
            strPrefixChar = Trim$(Str$(InstanceId)) & mstrInstancePrefix
        Case gintParameter
            strPrefixChar = mstrParameterPrefix
        Case gintNodeParamConnection
            strPrefixChar = mstrParamConnectionPrefix
        Case gintConnectionDtl
            strPrefixChar = mstrConnectionDtlPrefix
        Case gintNodeParamExtension
            strPrefixChar = mstrParamExtensionPrefix
        Case gintNodeParamBuiltIn
            strPrefixChar = mstrParamBuiltInPrefix
        Case gintGlobalsLabel, gintParameterLabel, gintParamConnectionLabel, _
                gintConnDtlLabel, _
                gintParamExtensionLabel, gintParamBuiltInLabel, gintGlobalStepLabel, _
                gintStepLabel
            If WorkspaceId = 0 Then
                ' The Workspace Id has to be specified for a label node
                ' Otherwise it will not be possible to generate unique label
                ' identifiers if multiple workspaces are open
                On Error GoTo 0
                Err.Raise vbObjectError + errWorkspaceIdMandatory, _
                    gstrSource, _
                    LoadResString(errWorkspaceIdMandatory)
            End If
            ' For all labels, the workspace identifier and the
            ' label prefix are concatenated to form the key
            strPrefixChar = Trim$(Str$(WorkspaceId)) & mstrLabelPrefix
        Case Else
                On Error GoTo 0
                Err.Raise vbObjectError + errInvalidNodeType, _
                    gstrSource, _
                    LoadResString(errInvalidNodeType)
    End Select

    MakeKeyValid = strPrefixChar & Trim$(Str$(lngIdentifier))

    Exit Function

MakeKeyValidErr:
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errMakeKeyValidFailed, _
        gstrSource, _
        LoadResString(errMakeKeyValidFailed)

End Function

Function MakeIdentifierValid(strKey As String) As Long

    ' Returns the Identifier corresponding to the passed in key
    ' (Reverse of what was done in MakeKeyValid)

    On Error GoTo MakeIdentifierValidErr

    If IsLabel(strKey) Then
        ' If the key corresponds to a label node, the identifier
        ' appears to the right of the label prefix
        MakeIdentifierValid = Val(Mid(strKey, InStr(strKey, mstrLabelPrefix) + 1))
    ElseIf InStr(strKey, mstrInstancePrefix) = 0 Then
        ' For all other nodes, stripping the first character off
        ' returns a valid Id
        MakeIdentifierValid = Val(Mid(strKey, 2))
    Else
```

```
        ' Instance node - strip of all characters till the
        ' instance prefix
        MakeIdentifierValid = Val(Mid(strKey, InStr(strKey, mstrInstancePrefix) + 1))
    End If

    Exit Function

MakeIdentifierValidErr:
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errMakeIdentifierValidFailed, _
          mstrModuleName & "MakeIdentifierValid", _
          LoadResString(errMakeIdentifierValidFailed)

End Function
Public Function IsInstanceNode(strNodeKey As String) As Boolean

    ' Returns true if the passed in node key corresponds to a step instance
    IsInstanceNode = InStr(strNodeKey, mstrInstancePrefix) > 0

End Function
Public Function IsBuiltInLabel(strNodeKey As String) As Boolean

    ' Returns true if the passed in node key corresponds to a step instance
    IsBuiltInLabel = (IsLabel(strNodeKey) And _
       (MakeIdentifierValid(strNodeKey) = gintParamBuiltInLabel))

End Function

Public Sub ShowBusy()
    ' Modifies the mousepointer to indicate that the
    ' application is busy

    On Error Resume Next

    Screen.MousePointer = vbHourglass

End Sub
Public Sub ShowFree()
    ' Modifies the mousepointer to indicate that the
    ' application has finished processing and is ready
    ' to accept user input

    On Error Resume Next

    Screen.MousePointer = vbDefault

End Sub

Public Function InstrR(strMain As String, _
       strSearch As String) As Integer
    ' Finds the last occurrence of the passed in string

    Dim intPos As Integer
    Dim intPrev As Integer

    On Error GoTo InstrRErr

    intPrev = intPos
    intPos = InStr(1, strMain, strSearch)

    Do While intPos > 0
       intPrev = intPos
       intPos = InStr(intPos + 1, strMain, strSearch)
    Loop
    InstrR = intPrev

    Exit Function

InstrRErr:
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "InstrR"
    On Error GoTo 0
    Err.Raise vbObjectError + errInstrRFailed, _
       gstrSource, _
       LoadResString(errInstrRFailed)

End Function

Public Function GetDefaultDir(lWspId As Long, WspParameters As cArrParameters)
As String

    Dim sDir As String
    sDir = SubstituteParameters( _
          gstrEnvVarSeparator & PARAM_DEFAULT_DIR & gstrEnvVarSeparator, _
          lWspId, WspParameters:=WspParameters)
    MakePathValid (sDir & gstrFileSeparator & "a.txt")
    GetDefaultDir = GetShortName(sDir)
    If StringEmpty(GetDefaultDir) Then
       GetDefaultDir = App.Path
    End If

End Function

Public Sub AddArrayElement(ByRef arrNodes() As Object, _
       ByVal objToAdd As Object, _
       ByRef lngCount As Long)
    ' Adds the passed in object to the array

    On Error GoTo AddArrayElementErr

    ' Increase the array dimension and add the object to it
    ReDim Preserve arrNodes(lngCount)
    Set arrNodes(lngCount) = objToAdd
    lngCount = lngCount + 1

    Exit Sub

AddArrayElementErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "AddArrayElement"
    On Error GoTo 0
    Err.Raise vbObjectError + errAddArrayElementFailed, _
          gstrSource, _
          LoadResString(errAddArrayElementFailed)

End Sub


Public Function CheckForNullField(rstRecords As Recordset, strFieldName As String)
As String

    ' Returns an empty string if a given field is null
    On Error GoTo CheckForNullFieldErr

    If IsNull(rstRecords.Fields(strFieldName)) Then
       CheckForNullField = gstrEmptyString
    Else
       CheckForNullField = rstRecords.Fields(strFieldName)
    End If
    Exit Function

CheckForNullFieldErr:
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errCheckForNullFieldFailed, _
          mstrModuleName & "CheckForNullField", _
          LoadResString(errCheckForNullFieldFailed)

End Function
```

```
Public Function ErrorOnNullField(rstRecords As Recordset, strFieldName As String)
As Variant

    ' If a given field is null, raises an error
    ' Else, returns the field value in a variant
    ' The calling function must convert the return value to the
    ' appropriate type
    On Error GoTo ErrorOnNullFieldErr
    gstrSource = mstrModuleName & "ErrorOnNullField"

    If IsNull(rstRecords.Fields(strFieldName)) Then
       On Error GoTo 0
       Err.Raise vbObjectError + errMandatoryFieldNull, _
          gstrSource, _
          strFieldName & mintDelimiter & LoadResString(errMandatoryFieldNull)
    Else
       ErrorOnNullField = rstRecords.Fields(strFieldName)
    End If
    Exit Function

ErrorOnNullFieldErr:
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errUnableToCheckNull, _
       gstrSource, _
       strFieldName & mintDelimiter & LoadResString(errUnableToCheckNull)

End Function
Public Function StringEmpty(strCheckString As String) As Boolean

    StringEmpty = (strCheckString = gstrEmptyString)

End Function
Public Function GetIteratorValue(cStepIterators As cRunColIt, _
       ByVal strItName As String)

    Dim lngIndex As Long
    Dim strValue As String

    On Error GoTo GetIteratorValueErr
    gstrSource = mstrModuleName & "GetIteratorValue"

    ' Find the iterator in the Iterators collection
    For lngIndex = 0 To cStepIterators.Count - 1
       If cStepIterators(lngIndex).IteratorName = strItName Then
          strValue = cStepIterators(lngIndex).Value
          Exit For
       End If
    Next lngIndex

    If lngIndex > cStepIterators.Count - 1 Then
       ' The iterator has not been defined for the branch
       ' Raise an error
       On Error GoTo 0
       Err.Raise vbObjectError + errParamNameInvalid, _
             gstrSource, _
             LoadResString(errParamNameInvalid)
    End If

    GetIteratorValue = strValue
    Exit Function

GetIteratorValueErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "GetIteratorValue"
    On Error GoTo 0
    Err.Raise vbObjectError + errGetParamValueFailed, _
          gstrSource, _
          LoadResString(errGetParamValueFailed)
End Function
Public Function SubstituteParameters(ByVal strComString As String, _
       ByVal lngWorkspaceId As Long, _
       Optional StepIterators As cRunColIt = Nothing, _
       Optional WspParameters As cArrParameters = Nothing) As String
    ' This function substitutes all parameter names and
    ' environment variables in the passed in string with
    ' their values. It also substitutes the value for the
    ' iterators, if any.
    ' Since the syntax is to enclose parameter names and
    ' environment variables in "%", we check if a given
    ' variable is a parameter - if so, we substitute the
    ' parameter value - else we try to get the value from
    ' the environment

    Dim intPos As Integer
    Dim intEndPos As Integer
    Dim strEnvVariable As String
    Dim strValue As String
    Dim strCommand As String
    Dim cTempStr As cStringSM

    ' Initialize the return value of the function to the
    ' passed in command
    strCommand = strComString

    If WspParameters Is Nothing Then Set WspParameters = gcParameters

    Set cTempStr = New cStringSM

    intPos = InStr(strCommand, gstrEnvVarSeparator)
    Do While intPos <> 0
       If Mid(strCommand, intPos + 1, 1) = gstrEnvVarSeparator Then
          ' Wildcard character - to be substituted by a single % - later!
          intPos = intPos + 2
          If intPos > Len(strCommand) Then Exit Do
       Else
          ' Extract the environment variable from the passed
          ' in string
          intEndPos = InStr(intPos + 1, strCommand, gstrEnvVarSeparator)

          If intEndPos > 0 Then
             strEnvVariable = Mid(strCommand, intPos + 1, intEndPos - intPos - 1)
          Else
             On Error GoTo 0
             Err.Raise vbObjectError + errParamSeparatorMissing, _
                   gstrSource, _
                   LoadResString(errParamSeparatorMissing)
          End If
          strValue = gstrEmptyString

          ' Get the value of the variable and call a function
          ' to replace the variable with it's value
          strValue = GetValue(strEnvVariable, lngWorkspaceId, StepIterators,
WspParameters)
          ' The function raises an error if the variable is
          ' not found
          strCommand = cTempStr.ReplaceSubString(strCommand, _
                gstrEnvVarSeparator & strEnvVariable & gstrEnvVarSeparator, _
                strValue)
       End If

       intPos = InStr(intPos, strCommand, gstrEnvVarSeparator)
    Loop

    strCommand = cTempStr.ReplaceSubString(strCommand, _
          gstrEnvVarSeparator & gstrEnvVarSeparator, gstrEnvVarSeparator)

    Set cTempStr = Nothing
    SubstituteParameters = strCommand
```

```
End Function
Private Function GetValue(ByVal strParameter As String, _
      ByVal lngWorkspaceId As Long, _
      cStepIterators As cRunColIt, _
      WspParameters As cArrParameters) As String
   ' This function returns the value for the passed in
   ' parameter - it may be a workspace parameter, an
   ' environment variable or an iterator

   Dim intPos As Integer
   Dim intEndPos As Integer
   Dim strVariable As String
   Dim strValue As String
   Dim cParamRec As cParameter

   On Error GoTo GetValueErr

   ' Initialize the return value of the function to the
   ' empty
   strValue = gstrEmptyString

   intPos = InStr(strParameter, gstrEnvVarSeparator)
   If intPos > 0 Then
      ' Extract the variable from the passed in string
      intEndPos = InStr(intPos + 1, strParameter, gstrEnvVarSeparator)
      If intEndPos = 0 Then
         intEndPos = Len(strParameter)
      End If

      strVariable = Mid(strParameter, intPos + 1, intEndPos - intPos - 1)
   Else
      ' The separator charactor has not been passed in -
      ' try to find the value of the passed in parameter
      strVariable = strParameter
   End If

   If Not StringEmpty(strVariable) Then
      ' Check if this is the timestamp parameter first
      If strVariable = gstrTimeStamp Then
         strValue = Format$(Now, mstrFormatString, _
               vbUseSystemDayOfWeek, vbUseSystem)
      Else
         ' Try to find a parameter for the workspace with
         ' the same name
         Set cParamRec = WspParameters.GetParameterValue(lngWorkspaceId, _
               strVariable)
         If cParamRec Is Nothing Then
            If Not cStepIterators Is Nothing Then
               ' If the string is not a parameter, then check
               ' if it is an iterator
               strValue = GetIteratorValue(cStepIterators, strVariable)
            End If

            If StringEmpty(strValue) Then
               ' Neither - Check if it is an environment variable
               strValue = Environ$(strVariable)
               If StringEmpty(strValue) Then
                  On Error GoTo 0
                  WriteError errSubValuesFailed, _
                        OptArgs:="Invalid parameter: " & gstrSQ & strVariable & gstrSQ
                  Err.Raise vbObjectError + errSubValuesFailed, _
                        mstrModuleName & "GetValue", _
                        LoadResString(errSubValuesFailed) & "Invalid parameter: " &
gstrSQ & strVariable & gstrSQ
               End If
            End If
         Else
            strValue = cParamRec.ParameterValue
         End If
      End If
   End If

   GetValue = strValue

   Exit Function

GetValueErr:
   If Err.Number = vbObjectError + errParamNameInvalid Then
      ' If the parameter has not been defined for the
      ' workspace then check if it is an environment
      ' variable
      Resume Next
   End If

   ' Log the error code raised by Visual Basic
   Call LogErrors(Errors)
   gstrSource = mstrModuleName & "GetValue"
   WriteError errSubValuesFailed, gstrSource, "Parameter: " & gstrSQ & strVariable &
gstrSQ
   On Error GoTo 0
   Err.Raise vbObjectError + errSubValuesFailed, _
         gstrSource, _
         LoadResString(errSubValuesFailed) & "Parameter: " & gstrSQ & strVariable &
gstrSQ

End Function
Public Function SQLFixup(strField As String) As String
   ' Returns a string that can be executed by SQL Server

   Dim cMyStr As New cStringSM
   Dim strTemp As String

   On Error GoTo SQLFixupErr

   strTemp = strField
   SQLFixup = strTemp

   ' Single-quotes have to be replaced by two single-quotes,
   ' since a single-quote is the identifier delimiter
   ' character - call a procedure to do the replace
'    SQLFixup = cMyStr.ReplaceSubString(strTemp, gstrDQ, "\" & gstrDQ)

   ' Replace pipe characters with the corresponding chr function
   ' SQLFixup = cMyStr.ReplaceSubString(strTemp, gstrDQ, gstrDQ & gstrDQ)

   Exit Function

SQLFixupErr:
   gstrSource = mstrModuleName & "SQLFixup"
   LogErrors Errors
   On Error GoTo 0
   Err.Raise vbObjectError + errMakeFieldValidFailed, _
         gstrSource, LoadResString(errMakeFieldValidFailed)

End Function
Public Function TranslateStepLabel(sLabel As String) As String
   ' Translates the passed in step label to a valid file name
   ' All characters in the label that are invalid for filenames (viz. \ / : * ? " < > |)
   ' and spaces are substituted with underscores - also ensure that the resulting
filename
   ' is not greater than 255 characters
   Dim cTempStr As New cStringSM
   TranslateStepLabel = cTempStr.ReplaceSubString(sLabel, gstrFileSeparator, "_")
   TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, "/",
gstrUnderscore)
   TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, ":",
gstrUnderscore)
   TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, "*",
gstrUnderscore)
   TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, "?",
gstrUnderscore)
```

```
    TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, gstrDQ,
gstrUnderscore)
    TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, "<",
gstrUnderscore)
    TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, ">",
gstrUnderscore)
    TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, "|",
gstrUnderscore)
    TranslateStepLabel = cTempStr.ReplaceSubString(TranslateStepLabel, gstrBlank,
gstrUnderscore)

    If Len(TranslateStepLabel) > MAX_PATH Then
        TranslateStepLabel = Mid(TranslateStepLabel, 1, MAX_PATH)
    End If

End Function

Public Function TypeOfObject(ByVal objNode As Object) As Integer
    ' Determines the type of object that is passed in

    On Error GoTo TypeOfObjectErr
    gstrSource = mstrModuleName & "TypeOfObject"

    Select Case TypeName(objNode)
        Case "cWorkspace"
            TypeOfObject = gintWorkspace

        Case "cParameter"
            TypeOfObject = gintParameter

        Case "cConnection"
            TypeOfObject = gintParameterConnect

        Case "cConnDtl"
            TypeOfObject = gintConnectionDtl

        Case "cGlobalStep"
            TypeOfObject = gintGlobalStep

        Case "cManager"
            TypeOfObject = gintManagerStep

        Case "cWorker"
            TypeOfObject = gintWorkerStep

        Case "cStep"
            ' If a step record is passed in, call a function
            ' to determine the type of step
            TypeOfObject = TypeOfStep(StepClass:=objNode)

        Case Else
            WriteError errTypeOfObjectFailed, gstrSource, _
                TypeName(objNode)
            On Error GoTo 0
            Err.Raise vbObjectError + errTypeOfObjectFailed, _
                gstrSource, _
                LoadResString(errTypeOfObjectFailed)
    End Select

    Exit Function

TypeOfObjectErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errTypeOfObjectFailed, _
        gstrSource, _
        LoadResString(errTypeOfObjectFailed)

End Function
```

CONNDTLCOMMON.BAS

```
Attribute VB_Name = "ConnDtlCommon"
'  FILE:      ConnDtlCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    Contains functionality common across StepMaster and
'              SMRunOnly, pertaining to connections
'              Specifically, functions to load connections in an array
'              and so on.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "ConnDtlCommon."

Public Sub LoadRSInConnDtlArray(rstConns As Recordset, cConns As cConnDtls)

    Dim cNewConnDtl As cConnDtl

    On Error GoTo LoadRSInConnDtlArrayErr

    If rstConns.RecordCount = 0 Then
        Exit Sub
    End If

    rstConns.MoveFirst
    While Not rstConns.EOF

        Set cNewConnDtl = New cConnDtl

        ' Initialize ConnDtl values
        ' Call a procedure to raise an error if mandatory fields are null.
        cNewConnDtl.ConnNameId = ErrorOnNullField(rstConns,
FLD_ID_CONN_NAME)
        cNewConnDtl.WorkspaceId = ErrorOnNullField(rstConns,
FLD_ID_WORKSPACE)
        cNewConnDtl.ConnName = CStr(ErrorOnNullField(rstConns,
FLD_CONN_DTL_CONNECTION_NAME))
        cNewConnDtl.ConnectionString = CheckForNullField(rstConns,
FLD_CONN_DTL_CONNECTION_STRING)
        cNewConnDtl.ConnType = CheckForNullField(rstConns,
FLD_CONN_DTL_CONNECTION_TYPE)

        cConns.Load cNewConnDtl

        Set cNewConnDtl = Nothing
        rstConns.MoveNext
    Wend

    Exit Sub

LoadRSInConnDtlArrayErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "LoadRSInConnDtlArray"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadRsInArrayFailed, gstrSource, _
        LoadResString(errLoadRsInArrayFailed)
End Sub
```

CONNNECTIONCOMMON.BAS

```
Attribute VB_Name = "ConnectionCommon"
'  FILE:      ConnnectionCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
```

```
'
'
'  PURPOSE:    Contains functionality common across StepMaster and
'              SMRunOnly, pertaining to connection strings
'              Specifically, functions to load connections strings
'              in an array and so on.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "ConnectionCommon."

Public Sub LoadRecordsetInConnectionArray(rstConns As Recordset, cConns As
cConnections)

    Dim cNewConnection As cConnection

    On Error GoTo LoadRecordsetInConnectionArrayErr

    If rstConns.RecordCount = 0 Then
        Exit Sub
    End If

    rstConns.MoveFirst
    While Not rstConns.EOF

        Set cNewConnection = New cConnection

        ' Initialize Connection values
        ' Call a procedure to raise an error if mandatory fields are null.
        cNewConnection.ConnectionId = ErrorOnNullField(rstConns, "connection_id")
        cNewConnection.WorkspaceId = CStr(ErrorOnNullField(rstConns,
FLD_ID_WORKSPACE))
        cNewConnection.ConnectionName = CStr(ErrorOnNullField(rstConns,
"connection_name"))
        cNewConnection.ConnectionValue = CheckForNullField(rstConns,
"connection_value")
        cNewConnection.Description = CheckForNullField(rstConns, "description")

        cNewConnection.NoCountDisplay = CheckForNullField(rstConns,
"no_count_display")
        cNewConnection.NoExecute = CheckForNullField(rstConns, "no_execute")
        cNewConnection.ParseQueryOnly = CheckForNullField(rstConns,
"parse_query_only")
        cNewConnection.QuotedIdentifiers = CheckForNullField(rstConns,
"ANSI_quoted_identifiers")
        cNewConnection.AnsiNulls = CheckForNullField(rstConns, "ANSI_nulls")
        cNewConnection.ShowQueryPlan = CheckForNullField(rstConns,
"show_query_plan")
        cNewConnection.ShowStatsTime = CheckForNullField(rstConns,
"show_stats_time")
        cNewConnection.ShowStatsIO = CheckForNullField(rstConns, "show_stats_io")
        cNewConnection.ParseOdbcMsg = CheckForNullField(rstConns,
"parse_odbc_msg_prefixes")
        cNewConnection.RowCount = CheckForNullField(rstConns, "row_count")
        cNewConnection.TsqlBatchSeparator = CheckForNullField(rstConns,
"tsql_batch_separator")
        cNewConnection.QueryTimeOut = CheckForNullField(rstConns,
"query_time_out")
        cNewConnection.ServerLanguage = CheckForNullField(rstConns,
"server_language")
        cNewConnection.CharacterTranslation = CheckForNullField(rstConns,
"character_translation")
        cNewConnection.RegionalSettings = CheckForNullField(rstConns,
"regional_settings")

        cConns.Load cNewConnection

        Set cNewConnection = Nothing

        rstConns.MoveNext
    Wend

    Exit Sub

LoadRecordsetInConnectionArrayErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "LoadRecordsetInConnectionArray"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadRsInArrayFailed, gstrSource, _
        LoadResString(errLoadRsInArrayFailed)
End Sub
```

cPARAMETER.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cParameter"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cParameter.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a parameter.
'              Contains functions to insert, update and delete
'              workspace_parameters records from the database.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit
Option Base 0

' Local variable(s) to hold property value(s)
Private mlngWorkspaceId As Long
Private mlngParameterId As Long
Private mstrParameterName As String
Private mstrParameterValue As String
Private mstrDescription As String
Private mintParameterType As Integer
Private mdbsStepMaster As Database
Private mintOperation As Operation
Private mlngPosition As Long

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cParameter."

' The cSequence class is used to generate unique parameter identifiers
Private mParameterSeq As cSequence

' The StringSM class is used to carry out string operations
Private mFieldValue As cStringSM

' Parameter types
Public Enum ParameterType
    gintParameterGeneric = 0
    gintParameterConnect
    gintParameterApplication
    gintParameterBuiltIn
End Enum


Private Sub AssignParameters(qyExec As DAO.QueryDef)
    ' Assigns values to the parameters in the querydef object
    ' The parameter names are cryptic to make them different
```

```
    ' from the field names. When the parameter names are
    ' the same as the field names, parameters in the where
    ' clause do not get created.

    Dim prmParam As DAO.Parameter

    On Error GoTo AssignParametersErr

    For Each prmParam In qyExec.Parameters
        Select Case prmParam.Name
            Case "[w_id]"
                prmParam.Value = mlngWorkspaceId

            Case "[p_id]"
                prmParam.Value = mlngParameterId

            Case "[p_name]"
                prmParam.Value = mstrParameterName

            Case "[p_value]"
                prmParam.Value = mstrParameterValue

            Case "[desc]"
                prmParam.Value = mstrDescription

            Case "[p_type]"
                prmParam.Value = mintParameterType

            Case Else
                ' Write the parameter name that is faulty
                WriteError errInvalidParameter, mstrSource, _
                    prmParam.Name
                On Error GoTo 0
                Err.Raise errInvalidParameter, mstrModuleName & "AssignParameters", _
                    LoadResString(errInvalidParameter)
        End Select
    Next prmParam

'    qyExec.Parameters("w_id").Value = mlngWorkspaceId
'    qyExec.Parameters("p_id").Value = mlngParameterId
'    qyExec.Parameters("p_name").Value = mstrParameterName
'    qyExec.Parameters("p_value").Value = mstrParameterValue
'

    Exit Sub

AssignParametersErr:

    mstrSource = mstrModuleName & "AssignParameters"
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errAssignParametersFailed, _
        mstrSource, LoadResString(errAssignParametersFailed)

End Sub

Public Property Let Position(ByVal RHS As Long)

    mlngPosition = RHS

End Property

Public Property Get Position() As Long

    Position = mlngPosition

End Property

Public Function Clone() As cParameter

    ' Creates a copy of a given parameter

    Dim cCloneParam As cParameter

    On Error GoTo CloneErr
    mstrSource = mstrModuleName & "Clone"

    Set cCloneParam = New cParameter

    ' Copy all the parameter properties to the newly
    ' created parameter
    Set cCloneParam.NodeDB = mdbsStepMaster
    cCloneParam.WorkspaceId = mlngWorkspaceId
    cCloneParam.ParameterId = mlngParameterId
    cCloneParam.ParameterName = mstrParameterName
    cCloneParam.ParameterValue = mstrParameterValue
    cCloneParam.Description = mstrDescription
    cCloneParam.ParameterType = mintParameterType
    cCloneParam.IndOperation = mintOperation
    cCloneParam.Position = mlngPosition

    ' And set the return value to the newly created parameter
    Set Clone = cCloneParam
    Set cCloneParam = Nothing

    Exit Function

CloneErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Clone"
    On Error GoTo 0
    Err.Raise vbObjectError + errCloneFailed, _
        mstrSource, LoadResString(errCloneFailed)

End Function
Public Property Set NodeDB(vdata As Database)

    Set mdbsStepMaster = vdata

End Property
Public Property Get NodeDB() As Database

    Set NodeDB = mdbsStepMaster

End Property

Private Sub CheckDupParameterName()
    ' Check if the parameter name already exists in the workspace

    Dim rstParameter As Recordset
    Dim strSql As String
    Dim qy As DAO.QueryDef

    On Error GoTo CheckDupParameterNameErr
    mstrSource = mstrModuleName & "CheckDupParameterName"

    ' Create a recordset object to retrieve the count of all parameters
    ' for the workspace with the same name
    strSql = "Select count(*) as parameter_count " & _
        " from workspace_parameters " & _
        " where workspace_id = [w_id]" & _
        " and parameter_name = [p_name]" & _
        " and parameter_id <> [p_id]"

    Set qy = mdbsStepMaster.CreateQueryDef(gstrEmptyString, strSql)
    Call AssignParameters(qy)

    Set rstParameter = qy.OpenRecordset(dbOpenForwardOnly)

    If rstParameter![parameter_count] > 0 Then
        rstParameter.Close
        qy.Close
```

```
        ShowError errDuplicateParameterName
        On Error GoTo 0
        Err.Raise vbObjectError + errDuplicateParameterName, _
            mstrSource, LoadResString(errDuplicateParameterName)
    End If

    rstParameter.Close
    qy.Close

    Exit Sub

CheckDupParameterNameErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "CheckDupParameterName"
    On Error GoTo 0
    Err.Raise vbObjectError + errCheckDupParameterNameFailed, _
        mstrSource, LoadResString(errCheckDupParameterNameFailed)

End Sub
Private Sub CheckDB()
    ' Check if the database object has been initialized

    If mdbsStepMaster Is Nothing Then
        On Error GoTo 0
        Err.Raise vbObjectError + errInvalidDB, _
            mstrModuleName & "CheckDB", LoadResString(errInvalidDB)
    End If

End Sub
Public Property Let ParameterValue(vdata As String)

    mstrParameterValue = vdata

End Property
Public Property Let Description(vdata As String)

    mstrDescription = vdata

End Property
Public Property Let ParameterType(vdata As ParameterType)

    mintParameterType = vdata

End Property

Public Property Let ParameterName(vdata As String)

    If vdata = gstrEmptyString Then

        ShowError errParameterNameMandatory
        On Error GoTo 0
        ' Propogate this error back to the caller
        Err.Raise vbObjectError + errParameterNameMandatory, _
            mstrSource, LoadResString(errParameterNameMandatory)
    Else
        mstrParameterName = vdata
    End If

End Property

Public Property Let ParameterId(vdata As Long)
    mlngParameterId = vdata
End Property

Public Property Let IndOperation(ByVal vdata As Operation)

    ' The valid operations are define in the cOperations
    ' class. Check if the operation is valid
    Select Case vdata
        Case QueryOp, InsertOp, UpdateOp, DeleteOp
            mintOperation = vdata
        Case Else
            On Error GoTo 0
            Err.Raise vbObjectError + errInvalidOperation, _
                mstrSource, LoadResString(errInvalidOperation)
    End Select

End Property
Public Sub Validate()
    ' Each distinct object will have a Validate method which
    ' will check if the class properties are valid. This method
    ' will be used to check interdependant properties that
    ' cannot be validated by the let procedures.
    ' It should be called by the add and modify methods of the class

    On Error GoTo ValidateErr

    ' Check if the db object is valid
    Call CheckDB

    ' Call procedure to raise an error if the parameter name
    ' already exists in the workspace -
    ' if there are duplicates, we don't know what value for the
    ' parameter to use at runtime
    Call CheckDupParameterName

    Exit Sub

ValidateErr:

    mstrSource = mstrModuleName & "Validate"
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errValidateFailed, _
        mstrSource, LoadResString(errValidateFailed)

End Sub
Public Property Let WorkspaceId(vdata As Long)

    mlngWorkspaceId = vdata

End Property

Public Sub Add()

    Dim strInsert As String
    Dim qy As DAO.QueryDef

    On Error GoTo AddErr

    ' Validate the record before trying to insert the record
    Call Validate

    ' Create a temporary querydef object
    strInsert = "insert into workspace_parameters " & _
            "( workspace_id, parameter_id, " & _
            " parameter_name, parameter_value, " & _
            " description, parameter_type ) " & _
            " values ( [w_id], [p_id], [p_name], [p_value], [desc], [p_type] ) "
    Set qy = mdbsStepMaster.CreateQueryDef(gstrEmptyString, strInsert)

    ' Call a procedure to assign the parameter values
    Call AssignParameters(qy)

    qy.Execute dbFailOnError
    qy.Close

'    strInsert = "insert into workspace_parameters " & _
'            "( workspace_id, parameter_id, " & _
'            " parameter_name, parameter_value ) " & _
'            " values ( " & _
```

```
'           Str(mlngWorkspaceId) & ", " & Str(mlngParameterId) & _
'           ", " & mFieldValue.MakeStringFieldValid(mstrParameterName) & _
'           ", " & mFieldValue.MakeStringFieldValid(mstrParameterValue) & " ) "
'    mdbsStepMaster.Execute strInsert, dbFailOnError + dbSQLPassThrough

    Exit Sub

AddErr:

    mstrSource = mstrModuleName & "Add"
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errParameterInsertFailed, _
        mstrSource, LoadResString(errParameterInsertFailed)

End Sub
Public Sub Delete()

    Dim strDelete As String
    Dim qy As DAO.QueryDef

    On Error GoTo DeleteErr

    ' Check if the db object is valid
    Call CheckDB

    strDelete = "delete from workspace_parameters " & _
          " where parameter_id = [p_id]"
    Set qy = mdbsStepMaster.CreateQueryDef(gstrEmptyString, strDelete)

    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    qy.Close

    Exit Sub

DeleteErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Delete"
    On Error GoTo 0
    Err.Raise vbObjectError + errDeleteParameterFailed, _
          mstrSource, _
          LoadResString(errDeleteParameterFailed)

End Sub

Public Sub Modify()

    Dim strUpdate As String
    Dim qy As QueryDef

    On Error GoTo ModifyErr

    ' Validate the updated values before trying to modify the db
    Call Validate

    ' Create a temporary querydef object with the modify string
    strUpdate = "update workspace_parameters " & _
          " set workspace_id = [w_id], " & _
          "parameter_name = [p_name], " & _
          "parameter_value = [p_value], " & _
          "description = [desc], " & _
          "parameter_type = [p_type] " & _
          " where parameter_id = [p_id]"
    Set qy = mdbsStepMaster.CreateQueryDef(gstrEmptyString, strUpdate)

    ' Call a procedure to assign the parameter values to the
    ' querydef object
    Call AssignParameters(qy)
    qy.Execute dbFailOnError
    qy.Close

'    mdbsStepMaster.Execute strUpdate, dbFailOnError
'
    Exit Sub

ModifyErr:

    mstrSource = mstrModuleName & "Modify"
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errParameterUpdateFailed, _
        mstrSource, LoadResString(errParameterUpdateFailed)

End Sub
Public Property Get ParameterName() As String

    ParameterName = mstrParameterName

End Property

Public Property Get ParameterId() As Long

    ParameterId = mlngParameterId

End Property
Public Property Get NextIdentifier() As Long

    Dim lngNextId As Long

    On Error GoTo NextIdentifierErr

    ' First check if the database object is valid
    Call CheckDB

    ' Retrieve the next identifier using the sequence class
    Set mParameterSeq = New cSequence
    Set mParameterSeq.IdDatabase = mdbsStepMaster
    mParameterSeq.IdentifierColumn = "Parameter_id"
    lngNextId = mParameterSeq.Identifier
    Set mParameterSeq = Nothing

    NextIdentifier = lngNextId
    Exit Property

NextIdentifierErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "NextIdentifier"
    On Error GoTo 0
    Err.Raise vbObjectError + errIdGetFailed, _
        mstrSource, LoadResString(errIdGetFailed)

End Property
Public Property Get IndOperation() As Operation

    IndOperation = mintOperation

End Property

Public Property Get WorkspaceId() As Long

    WorkspaceId = mlngWorkspaceId

End Property

Public Property Get ParameterValue() As String

    ParameterValue = mstrParameterValue

End Property
```

```
Public Property Get Description() As String

    Description = mstrDescription

End Property
Public Property Get ParameterType() As ParameterType

    ParameterType = mintParameterType

End Property


Private Sub Class_Initialize()

    Set mFieldValue = New cStringSM

    ' Initialize the operation indicator variable to Query
    ' It will be modified later by the collection class when
    ' inserts, updates or deletes are performed
    mintOperation = QueryOp

End Sub

Private Sub Class_Terminate()

    Set mdbsStepMaster = Nothing
    Set mFieldValue = Nothing

End Sub
```

cRunColIt.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cRunColIt"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cRunColIt.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This module implements a stack of Iterator nodes.
'              Ensures that only cRunItNode objects are stored in the stack.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cRunColIt."
Private mstrSource As String

Private mcIterators As cStack
Public Sub Clear()

    mcIterators.Clear

End Sub

Private Sub Class_Initialize()

    Set mcIterators = New cStack

End Sub

Private Sub Class_Terminate()

    Set mcIterators = Nothing

End Sub


Public Function Value(strItName As String) As String

    Dim lngIndex As Long

    For lngIndex = 0 To mcIterators.Count - 1
        If mcIterators(lngIndex).IteratorName = strItName Then
            Value = mcIterators(lngIndex).Value
            Exit For
        End If
    Next lngIndex

End Function

Public Property Get Item(ByVal Position As Long) As cRunItNode
Attribute Item.VB_UserMemId = 0

    Set Item = mcIterators(Position)

End Property


Public Function Count() As Long

    Count = mcIterators.Count

End Function

Public Function Pop() As cRunItNode

    Set Pop = mcIterators.Pop

End Function

Public Sub Push(objToPush As cRunItNode)

    Call mcIterators.Push(objToPush)

End Sub
```

cRunColIt.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cRunInst"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cRunColIt.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This module controls the run processing. It runs a branch
'              at a time and raises events when each step completes execution.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cRunInst."
Private mstrSource As String
```

```
' Local variable(s) to hold property value(s)
Private mstrRootKey As String
Public WspId As Long
Private mcParameters As cArrParameters
Private mcRunSteps As cArrSteps
Private mcRunConstraints As cArrConstraints
Public RunConnections As cConnections
Public RunConnDtls As cConnDtls
Private mcvntWspPreCons As Variant
Private mcvntWspPostCons As Variant
Private mcNavSteps As cStepTree

Private mcInstances As cInstances
Private mcFreeSteps As cVectorLng
Private mcFailures As cFailedSteps
Private mblnAsk As Boolean   ' Set to True when the a step with continuation
criteria=Ask fails
Private mblnAbort As Boolean ' Set to True when the run is aborted
Private msAbortDtls As String
Private mbarrFree() As Byte
Private WithEvents mcTermSteps As cTermSteps
Attribute mcTermSteps.VB_VarHelpID = -1
Public RunId As Long
Public CreateInputFiles As Boolean

Private Enum WspLogEvents
   mintRunStart
   mintRunComplete
   mintStepStart
   mintStepComplete
End Enum

Private mcWspLog As cFileSM

Private mstrCurBranchRoot As String
Private mcDummyRootInstance As cInstance

' Key for the dummy root instance - Should be a key that is invalid for an actual step
record
Private Const mstrDummyRootKey As String = "D"

' Public events to notify the calling function of the
' start and end time for each step
Public Event RunStart(dtmStartTime As Currency, strWspLog As String)
Public Event RunComplete(dtmEndTime As Currency)
Public Event StepStart(cStepRecord As cStep, dtmStartTime As Currency, _
      lngInstanceId As Long, lParentInstanceId As Long, sPath As String, _
      sIts As String, sItValue As String)
Public Event StepComplete(cStepRecord As cStep, dtmEndTime As Currency,
lngInstanceId As Long, lElapsed As Long)
Public Event ProcessStart(cStepRecord As cStep, strCommand As String, _
      dtmStartTime As Currency, lngInstanceId As Long, lParentInstanceId As Long, _
      sItValue As String)
Public Event ProcessComplete(cStepRecord As cStep, dtmEndTime As Currency,
lngInstanceId As Long, lElapsed As Long)

' The class that will execute each step - we trap the events
' that are raised by it when a step starts/completes
' execution
Private WithEvents cExecStep1 As cRunStep
Attribute cExecStep1.VB_VarHelpID = -1
Private WithEvents cExecStep2 As cRunStep
Attribute cExecStep2.VB_VarHelpID = -1
Private WithEvents cExecStep3 As cRunStep
Attribute cExecStep3.VB_VarHelpID = -1
Private WithEvents cExecStep4 As cRunStep
Attribute cExecStep4.VB_VarHelpID = -1
Private WithEvents cExecStep5 As cRunStep
Attribute cExecStep5.VB_VarHelpID = -1
Private WithEvents cExecStep6 As cRunStep
Attribute cExecStep6.VB_VarHelpID = -1
Private WithEvents cExecStep7 As cRunStep
Attribute cExecStep7.VB_VarHelpID = -1
Private WithEvents cExecStep8 As cRunStep
Attribute cExecStep8.VB_VarHelpID = -1
Private WithEvents cExecStep9 As cRunStep
Attribute cExecStep9.VB_VarHelpID = -1
Private WithEvents cExecStep10 As cRunStep
Attribute cExecStep10.VB_VarHelpID = -1
Private WithEvents cExecStep11 As cRunStep
Attribute cExecStep11.VB_VarHelpID = -1
Private WithEvents cExecStep12 As cRunStep
Attribute cExecStep12.VB_VarHelpID = -1
Private WithEvents cExecStep13 As cRunStep
Attribute cExecStep13.VB_VarHelpID = -1
Private WithEvents cExecStep14 As cRunStep
Attribute cExecStep14.VB_VarHelpID = -1
Private WithEvents cExecStep15 As cRunStep
Attribute cExecStep15.VB_VarHelpID = -1
Private WithEvents cExecStep16 As cRunStep
Attribute cExecStep16.VB_VarHelpID = -1

Private Const msIt As String = " Iterator: "
Private Const msItValue As String = " Value: "
Public Sub Abort()

   On Error GoTo AbortErr

   ' Make sure that we don't execute any more steps
   Call StopRun

   If cExecStep1 Is Nothing And cExecStep2 Is Nothing And _
         cExecStep3 Is Nothing And cExecStep4 Is Nothing And _
         cExecStep5 Is Nothing And cExecStep6 Is Nothing And _
         cExecStep7 Is Nothing And cExecStep8 Is Nothing And _
         cExecStep9 Is Nothing And cExecStep10 Is Nothing And _
         cExecStep11 Is Nothing And cExecStep12 Is Nothing And _
         cExecStep13 Is Nothing And cExecStep14 Is Nothing And _
         cExecStep15 Is Nothing And cExecStep16 Is Nothing Then
      WriteToWspLog (mintRunComplete)
      RaiseEvent RunComplete(Determine64BitTime())
   Else
      ' Abort each of the steps that is currently executing.
      If Not cExecStep1 Is Nothing Then
         cExecStep1.Abort
      End If

      If Not cExecStep2 Is Nothing Then
         cExecStep2.Abort
      End If

      If Not cExecStep3 Is Nothing Then
         cExecStep3.Abort
      End If

      If Not cExecStep4 Is Nothing Then
         cExecStep4.Abort
      End If

      If Not cExecStep5 Is Nothing Then
         cExecStep5.Abort
      End If

      If Not cExecStep6 Is Nothing Then
         cExecStep6.Abort
      End If

      If Not cExecStep7 Is Nothing Then
         cExecStep7.Abort
      End If
```

```
      If Not cExecStep8 Is Nothing Then
         cExecStep8.Abort
      End If

      If Not cExecStep9 Is Nothing Then
         cExecStep9.Abort
      End If

      If Not cExecStep10 Is Nothing Then
         cExecStep10.Abort
      End If

      If Not cExecStep11 Is Nothing Then
         cExecStep11.Abort
      End If

      If Not cExecStep12 Is Nothing Then
         cExecStep12.Abort
      End If

      If Not cExecStep13 Is Nothing Then
         cExecStep13.Abort
      End If

      If Not cExecStep14 Is Nothing Then
         cExecStep14.Abort
      End If

      If Not cExecStep15 Is Nothing Then
         cExecStep15.Abort
      End If

      If Not cExecStep16 Is Nothing Then
         cExecStep16.Abort
      End If
   End If

   Exit Sub

AbortErr:
   Call LogErrors(Errors)
   On Error GoTo 0
   ShowError errAbortFailed
   ' Try to abort the remaining steps, if any
   Resume Next

End Sub
Public Sub AbortSiblings(cTermInstance As cInstance)

   On Error GoTo AbortSiblingsErr

   ' Abort each of the steps that is currently executing.
   If Not cExecStep1 Is Nothing Then
      If cExecStep1.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep1.Abort
      End If
   End If

   If Not cExecStep2 Is Nothing Then
      If cExecStep2.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep2.Abort
      End If
   End If

   If Not cExecStep3 Is Nothing Then
      If cExecStep3.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep3.Abort
      End If
   End If

   If Not cExecStep4 Is Nothing Then
      If cExecStep4.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep4.Abort
      End If
   End If

   If Not cExecStep5 Is Nothing Then
      If cExecStep5.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep5.Abort
      End If
   End If

   If Not cExecStep6 Is Nothing Then
      If cExecStep6.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep6.Abort
      End If
   End If

   If Not cExecStep7 Is Nothing Then
      If cExecStep7.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep7.Abort
      End If
   End If

   If Not cExecStep8 Is Nothing Then
      If cExecStep8.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep8.Abort
      End If
   End If

   If Not cExecStep9 Is Nothing Then
      If cExecStep9.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep9.Abort
      End If
   End If

   If Not cExecStep10 Is Nothing Then
      If cExecStep10.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep10.Abort
      End If
   End If

   If Not cExecStep11 Is Nothing Then
      If cExecStep11.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep11.Abort
      End If
   End If

   If Not cExecStep12 Is Nothing Then
      If cExecStep12.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep12.Abort
      End If
   End If

   If Not cExecStep13 Is Nothing Then
      If cExecStep13.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep13.Abort
      End If
   End If
```

```
    If Not cExecStep14 Is Nothing Then
        If cExecStep14.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep14.Abort
        End If
    End If

    If Not cExecStep15 Is Nothing Then
        If cExecStep15.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep15.Abort
        End If
    End If

    If Not cExecStep16 Is Nothing Then
        If cExecStep16.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep16.Abort
        End If
    End If

    Exit Sub

AbortSiblingsErr:
    Call LogErrors(Errors)
    On Error GoTo 0
    ShowError errAbortFailed
    ' Try to abort the remaining steps, if any
    Resume Next

End Sub
Private Sub ExecutionFailed(cTermStep As cRunStep)
    ' Called when execution of a step fails for any reason - ensure that execution
    ' continues

    On Error GoTo ExecutionFailedErr

    Call AddFreeProcess(cTermStep.Index)

    Call RunBranch(mstrCurBranchRoot)

    Exit Sub

ExecutionFailedErr:
    ' Log the error code raised by Visual Basic - do not raise an error here!
    Call LogErrors(Errors)

End Sub
Private Sub FreeExecStep(lngIndex As Long)
    ' Frees an instance of a cExecuteSM object depending on the index
    On Error GoTo FreeExecStepErr

    Select Case lngIndex
        Case 0
            Set cExecStep1 = Nothing
        Case 1
            Set cExecStep2 = Nothing
        Case 2
            Set cExecStep3 = Nothing
        Case 3
            Set cExecStep4 = Nothing
        Case 4
            Set cExecStep5 = Nothing
        Case 5
            Set cExecStep6 = Nothing
        Case 6
            Set cExecStep7 = Nothing
        Case 7
            Set cExecStep8 = Nothing
        Case 8
            Set cExecStep9 = Nothing
        Case 9
            Set cExecStep10 = Nothing
        Case 10
            Set cExecStep11 = Nothing
        Case 11
            Set cExecStep12 = Nothing
        Case 12
            Set cExecStep13 = Nothing
        Case 13
            Set cExecStep14 = Nothing
        Case 14
            Set cExecStep15 = Nothing
        Case 15
            Set cExecStep16 = Nothing
        Case Else
            BugAssert False, "FreeExecStep: Invalid index value!"
    End Select

    Exit Sub

FreeExecStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)

End Sub
Private Sub ProcessAskFailures()
    ' This procedure is called when a step with a continuation criteria = Ask has failed.
    ' Wait for all running processes to complete before displaying an Abort/Retry/Fail
    ' message to the user. We process every Ask step that has failed and use a simple
    ' algorithm to determine what to do next.
    ' 1. An abort response to any failure results in an immediate abort of the run
    ' 2. A continue means the run continues - this failure is popped off the failure list.
    ' 3. A retry means that the execution details for the instance are cleared and the
    '    step is re-executed.
    Dim lIndex As Long
    Dim cStepRec As cStep
    Dim cNextInst As cInstance
    Dim cFailureRec As cFailedStep

    On Error GoTo ProcessAskFailuresErr

    ' Display a popup message for all steps that have failed with a continuation
    ' criteria of Ask
    For lIndex = mcFailures.Count - 1 To 0 Step -1

        Set cFailureRec = mcFailures(lIndex)

        If cFailureRec.ContCriteria = gintOnFailureAsk Then
            Set cStepRec = mcRunSteps.QueryStep(cFailureRec.StepId)
            ' Ask the user whether to abort/retry/continue
            #If RUN_ONLY Then
                cFailureRec.AskResponse = ShowMessageBox(0, _
                    "Step '" & GetStepNodeText(cStepRec) & "' failed. " & _
                    "Select Abort to abort run and Ignore to continue. " & _
                    "Select Retry to re-execute the failed step.", _
                    "Step Failure", _
                    MB_ABORTRETRYIGNORE + MB_APPLMODAL +
MB_ICONEXCLAMATION)
            #Else
                cFailureRec.AskResponse = ShowMessageBox(frmRunning.hWnd, _
                    "Step '" & GetStepNodeText(cStepRec) & "' failed. " & _
                    "Select Abort to abort run and Ignore to continue. " & _
                    "Select Retry to re-execute the failed step.", _
                    "Step Failure", _
                    MB_ABORTRETRYIGNORE + MB_APPLMODAL +
MB_ICONEXCLAMATION)
            #End If

            ' Process an abort response immediately
            If cFailureRec.AskResponse = IDABORT Then
```

```
            mblnAbort = True
            Set cNextInst = mcInstances.QueryInstance(cFailureRec.InstanceId)
            Call RunPendingSiblings(cNextInst, cFailureRec.EndTime)
            Exit For
        End If
    End If

Next lIndex

' Process all failed steps for which we have Ignore and Retry responses.
If Not mblnAbort Then
    ' Navigate in reverse order since we'll be deleting items from the collection
    For lIndex = mcFailures.Count - 1 To 0 Step -1
        If mcFailures(lIndex).ContCriteria = gintOnFailureAsk Then
            mblnAsk = False
            Set cFailureRec = mcFailures.Delete(lIndex)

            Select Case cFailureRec.AskResponse
                Case IDABORT
                    BugAssert True

                Case IDRETRY
                    ' Delete all instances for the failed step and re-try
                    ' Returns a parent instance reference
                    Set cNextInst = ProcessRetryStep(cFailureRec)
                    Call RunPendingStepInBranch(mstrCurBranchRoot, cNextInst)

                Case IDIGNORE
                    Set cNextInst = mcInstances.QueryInstance(cFailureRec.InstanceId)
                    Call RunPendingSiblings(cNextInst, cFailureRec.EndTime)

            End Select
        End If
    Next lIndex
End If

Exit Sub

ProcessAskFailuresErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errExecuteBranchFailed, mstrModuleName, _
        LoadResString(errExecuteBranchFailed)

End Sub
Private Function ProcessRetryStep(cFailureRec As cFailedStep) As cInstance
    ' This procedure is called when a step with a continuation criteria = Ask has failed
    ' and the user wants to re-execute the step.
    ' We delete all existing instances for the step and reset the iterator, if
    ' any on the parent instance - this way we ensure that the step will be executed
    ' in the next pass.
    Dim lIndex As Long
    Dim cParentInstance As cInstance
    Dim cSubStepRec As cSubStep
    Dim cStepRec As cStep

    On Error GoTo ProcessRetryStepErr

    ' Navigate in reverse order since we'll be deleting items from the collection
    For lIndex = mcInstances.Count - 1 To 0 Step -1

        If mcInstances(lIndex).Step.StepId = cFailureRec.StepId Then
            Set cParentInstance =
mcInstances.QueryInstance(mcInstances(lIndex).ParentInstanceId)
            Set cSubStepRec = cParentInstance.QuerySubStep(cFailureRec.StepId)
            Set cStepRec = mcRunSteps.QueryStep(cFailureRec.StepId)

            ' Decrement the child count on the parent instance and reset the
            ' step iterators on the sub-step record, if any -
            ' all the iterations of the step will be re-executed.
            cParentInstance.ChildDeleted cFailureRec.StepId
            cParentInstance.AllComplete = False
            cParentInstance.AllStarted = False

            cSubStepRec.InitializeIt cStepRec, mcParameters

            ' Now delete the current instance
            Set ProcessRetryStep = mcInstances.Delete(lIndex)
        End If
    Next lIndex

    Exit Function

ProcessRetryStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errExecuteBranchFailed, mstrModuleName, _
        LoadResString(errExecuteBranchFailed)

End Function


Private Sub RunNextStep(ByVal dtmCompleteTime As Currency, ByVal lngIndex As
Long, _
    ByVal InstanceId As Long, ByVal ExecutionStatus As InstanceStatus)
    ' Checks if there are any steps remaining to be
    ' executed in the current branch. If so, it executes
    ' the step.
    Dim cTermInstance As cInstance
    Dim cFailure As cFailedStep

    On Error GoTo RunNextStepErr

    BugMessage "RunNextStep: cExecStep" & CStr(lngIndex + 1) & " has completed."

    Call mcTermSteps.Delete
    Call FreeExecStep(lngIndex)

    ' Call a procedure to add the freed up object to the list
    Call AddFreeProcess(lngIndex)

    Set cTermInstance = mcInstances.QueryInstance(InstanceId)
    cTermInstance.Status = ExecutionStatus

    If ExecutionStatus = gintFailed Then
        If cTermInstance.Step.ContinuationCriteria = gintOnFailureAbortSiblings Then
            Call AbortSiblings(cTermInstance)
        End If

        If Not mcFailures.StepFailed(cTermInstance.Step.StepId) Then
            Set cFailure = New cFailedStep
            cFailure.InstanceId = cTermInstance.InstanceId
            cFailure.StepId = cTermInstance.Step.StepId
            cFailure.ParentStepId = cTermInstance.Step.ParentStepId
            cFailure.ContCriteria = cTermInstance.Step.ContinuationCriteria
            cFailure.EndTime = dtmCompleteTime
            mcFailures.Add cFailure
            Set cFailure = Nothing
        End If
    End If

    If ExecutionStatus = gintFailed And cTermInstance.Step.ContinuationCriteria =
gintOnFailureAbort Then
        If StringEmpty(msAbortDtls) Then
            ' Initialize the abort message
            msAbortDtls = "Step '" & GetStepNodeText(cTermInstance.Step) & "' failed. " &
_
                "Aborting execution. Please check the error file for details."
        End If
        Call Abort
    ElseIf ExecutionStatus = gintFailed And cTermInstance.Step.ContinuationCriteria =
gintOnFailureAsk Then
```

```
        mblnAsk = True

        ' If the step failed due to a Cancel operation (Abort), abort the run
        If mblnAbort Then
            Call RunPendingSiblings(cTermInstance, dtmCompleteTime)
        End If
    Else
        Call RunPendingSiblings(cTermInstance, dtmCompleteTime)
    End If

    If mblnAbort Then
        If Not AnyStepRunning(mcFreeSteps, mbarrFree) And Not
StringEmpty(msAbortDtls) Then
            ' Display an error only if the abort is due to a failure
            ' We had to abort since a step failed - since no other steps are currently
            ' running, we can display a message to the user saying that we had to abort
            #If RUN_ONLY Then
                Call ShowMessageBox(0, msAbortDtls, "Run Aborted", _
                    MB_APPLMODAL + MB_OK + MB_ICONEXCLAMATION)
            #Else
                Call ShowMessageBox(frmRunning.hWnd, msAbortDtls, "Run Aborted", _
                    MB_APPLMODAL + MB_OK + MB_ICONEXCLAMATION)
            #End If
'           MsgBox msAbortDtls, vbOKOnly, "Run Aborted"
        End If
    ElseIf mblnAsk Then
        If Not AnyStepRunning(mcFreeSteps, mbarrFree) Then
            ' Ask the user whether to abort/retry/ignore failed steps
            Call ProcessAskFailures
        End If
    End If

    Exit Sub

RunNextStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errExecuteBranchFailed, mstrSource
    Call ResetForm(lngIndex)

End Sub
Public Sub StopRun()

    ' Setting the Abort flag to True will ensure that we
    ' don't execute any more steps
    mblnAbort = True

End Sub

Private Sub CreateDummyInstance(strRootKey As String)

    Dim cNewInstance As cInstance
    Dim cSubStepDtls  As cStep
    Dim lngSubStepId As Long

    On Error GoTo CreateDummyInstanceErr

    ' Create a new instance of the step
    ' initialize substeps for the step
    Set cNewInstance = New cInstance

    ' There can be multiple iterations of the top level nodes
    ' running at the same time, but only one branch at any
    ' time - so enforce a degree of parallelism of 1 on this
    ' node!
    Set cNewInstance.Step = New cStep
    cNewInstance.DegreeParallelism = 1
    cNewInstance.Key = mstrDummyRootKey

    cNewInstance.InstanceId = NewInstanceId
    cNewInstance.ParentInstanceId = 0
    lngSubStepId = MakeIdentifierValid(strRootKey)

    Set cSubStepDtls = mcRunSteps.QueryStep(lngSubStepId)
    If cSubStepDtls.EnabledFlag Then
        ' Create a child node for the step corresponding to
        ' the root node of the branch being currently executed,
        ' only if it has been enabled
        Call cNewInstance.CreateSubStep(cSubStepDtls, mcParameters)
    End If

    mcInstances.Add cNewInstance
    Set cNewInstance.Iterators = DetermineIterators(cNewInstance)

    ' Set a reference to the newly created dummy instance
    Set mcDummyRootInstance = cNewInstance

    Set cNewInstance = Nothing

    Exit Sub

CreateDummyInstanceErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "CreateDummyInstance"
    Err.Raise vbObjectError + errCreateInstanceFailed, _
        mstrSource, LoadResString(errCreateInstanceFailed)

End Sub
Private Function CreateInstance(cExecStep As cStep, _
    cParentInstance As cInstance) As cInstance
    ' Creates a new instance of the passed in step. Returns
    ' a reference to the newly created instance object.

    Dim cNewInstance As cInstance
    Dim nodChild As cStep
    Dim lngSubStepId As Long

    On Error GoTo CreateInstanceErr

    ' Create a new instance of the step
    ' initialize substeps for the step
    Set cNewInstance = New cInstance
    Set cNewInstance.Step = cExecStep
    cNewInstance.Key = MakeKeyValid(cExecStep.StepId, cExecStep.StepType)
    cNewInstance.ParentInstanceId = cParentInstance.InstanceId
    cNewInstance.InstanceId = NewInstanceId
    ' Validate the degree of parallelism field before assigning it to the instance -
    ' (the parameter value might have been set to an invalid value at runtime)
    Call ValidateParallelism(cExecStep.DegreeParallelism, _
        cExecStep.WorkspaceId, ParamsInWsp:=mcParameters)
    cNewInstance.DegreeParallelism =
SubstituteParameters(cExecStep.DegreeParallelism, _
        cExecStep.WorkspaceId, WspParameters:=mcParameters)

    If mcNavSteps.HasChild(StepKey:=cNewInstance.Key) Then
        Set nodChild = mcNavSteps.ChildStep(StepKey:=cNewInstance.Key)
        Do
            If nodChild.EnabledFlag Then
                ' Create nodes for all it's substeps only
                ' if the substeps have been enabled
                Call cNewInstance.CreateSubStep(nodChild, mcParameters)
            End If

            Set nodChild = mcNavSteps.NextStep(StepId:=nodChild.StepId)
        Loop While (Not nodChild Is Nothing)
    End If

    mcInstances.Add cNewInstance
    Set cNewInstance.Iterators = DetermineIterators(cNewInstance)
```

```
    ' Increment the number of executing steps on the parent
    cParentInstance.ChildExecuted (cExecStep.StepId)

    Set CreateInstance = cNewInstance

    Exit Function

CreateInstanceErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "CreateInstance"
    Err.Raise vbObjectError + errCreateInstanceFailed, _
          mstrSource, LoadResString(errCreateInstanceFailed)

End Function
Private Function DetermineIterators(cInstanceRec As cInstance) As cRunColIt
    ' Returns a collection of all the iterator values for this
    ' instance - since an iterator that is defined at a
    ' particular level can be used in all it's substeps, we
    ' need to navigate the step tree all the way to the root

    Dim cRunIts As cRunColIt
    Dim cRunIt As cRunItNode
    Dim cStepIt As cIterator
    Dim cParentInst As cInstance
    Dim cSubStepRec As cSubStep
    Dim cSubStepDtls As cStep
    Dim lngSubStepId As Long
    Dim lngIndex As Long

    On Error GoTo DetermineIteratorsErr

    Set cRunIts = New cRunColIt

    If cInstanceRec.ParentInstanceId > 0 Then
        ' The last iterator for an instance of a step is stored
        ' on it's parent! So navigate up before beginning the
        ' search for iterator values.
        Set cParentInst = mcInstances.QueryInstance(cInstanceRec.ParentInstanceId)

        ' Get the sub-step record for the current step
        ' on it's parent's instance!
        lngSubStepId = cInstanceRec.Step.StepId
        Set cSubStepRec = cParentInst.QuerySubStep(lngSubStepId)
        Set cSubStepDtls = mcRunSteps.QueryStep(lngSubStepId)

        ' And determine the next iteration value for the
        ' substep in this instance
        Set cStepIt = cSubStepRec.NewIteration(cSubStepDtls)

        If Not cStepIt Is Nothing Then
            ' Add the iterator details to the collection since
            ' an iterator has been defined for the step
            Set cRunIt = New cRunItNode
            cRunIt.IteratorName = cSubStepDtls.IteratorName
            cRunIt.Value = SubstituteParameters(cStepIt.Value,
cSubStepDtls.WorkspaceId, WspParameters:=mcParameters)
            cRunIt.StepId = cSubStepRec.StepId
            cRunIts.Push cRunIt
        End If

        ' Since the parent instance has all the iterators upto
        ' that level, read them and push them on to the stack for
        ' this instance
        For lngIndex = 0 To cParentInst.Iterators.Count - 1
            Set cRunIt = cParentInst.Iterators(lngIndex)
            cRunIts.Push cRunIt
        Next lngIndex
    End If

    Set DetermineIterators = cRunIts

    Exit Function

DetermineIteratorsErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "DetermineIterators"
    Err.Raise vbObjectError + errExecInstanceFailed, _
          mstrSource, LoadResString(errExecInstanceFailed)

End Function
Private Function DetermineConstraints(cInstanceRec As cInstance, _
      intConsType As ConstraintType) As Variant
    ' Returns a collection of all the constraints for this
    ' instance of the passed in type - all the constraints defined
    ' for the manager are executed first, followed by those defined
    ' for the step. If a step has an iterator defined for it, each
    ' constraint is executed only once.

    Dim cParentInst As cInstance
    Dim cTempInst As cInstance
    Dim vntConstraints As Variant
    Dim vntTempCons As Variant
    Dim cColConstraints() As Variant
    Dim lngConsCount As Long

    On Error GoTo DetermineConstraintsErr

    Set cTempInst = cInstanceRec
    lngConsCount = 0

    ' Go all the way to the root
    Do
        If cTempInst.ParentInstanceId > 0 Then
            Set cParentInst = mcInstances.QueryInstance(cTempInst.ParentInstanceId)
        Else
            Set cParentInst = Nothing
        End If

        ' Check if the step has an iterator defined for it
        If cTempInst.ValidForIteration(cParentInst, intConsType) Then
            vntTempCons = mcRunConstraints.ConstraintsForStep( _
                  cTempInst.Step.StepId, cTempInst.Step.VersionNo, _
                  intConsType, blnSort:=True, _
                  blnGlobal:=False, blnGlobalConstraintsOnly:=False)

            If Not IsEmpty(vntTempCons) Then
                ReDim Preserve cColConstraints(lngConsCount)
                cColConstraints(lngConsCount) = vntTempCons
                lngConsCount = lngConsCount + 1
            End If
        End If

        Set cTempInst = cParentInst

    Loop While Not cTempInst Is Nothing

    If lngConsCount > 0 Then
        vntTempCons = OrderConstraints(cColConstraints, intConsType)
    End If

    DetermineConstraints = vntTempCons

    Exit Function

DetermineConstraintsErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
```

```
    On Error GoTo 0
    mstrSource = mstrModuleName & "DetermineConstraints"
    Err.Raise vbObjectError + errExecInstanceFailed, _
          mstrSource, LoadResString(errExecInstanceFailed)

End Function
Private Function GetInstanceToExecute(cParentNode As cInstance, _
       cSubStepRec As cSubStep, _
       cSubStepDtls As cStep) As cInstance

    Dim cSubStepInst As cInstance

    On Error GoTo GetInstanceToExecuteErr

    BugAssert Not (cParentNode Is Nothing Or _
          cSubStepRec Is Nothing Or _
          cSubStepDtls Is Nothing), _
          "GetInstanceToExecute: Input invalid"

    ' Check if it has iterators
    If cSubStepDtls.IteratorCount = 0 Then
       ' Check if the step has been executed
       If cSubStepRec.TasksRunning = 0 And cSubStepRec.TasksComplete = 0 And _
             Not mcInstances.CompletedInstanceExists(cParentNode.InstanceId,
cSubStepDtls) Then
          ' The sub-step hasn't been executed yet.
          ' Create an instance for it and exit
          Set cSubStepInst = CreateInstance(cSubStepDtls, cParentNode)
       Else
          Set cSubStepInst = Nothing
       End If
    Else
       ' Check if there are pending iterations for the sub-step
       If Not cSubStepRec.NextIteration(cSubStepDtls) Is Nothing Then
          ' Pending iterations exist - create an instance for the sub-step and exit
          Set cSubStepInst = CreateInstance(cSubStepDtls, cParentNode)
       Else
          ' No more iterations - continue with the next substep
          Set cSubStepInst = Nothing
       End If
    End If

    Set GetInstanceToExecute = cSubStepInst
    Exit Function

GetInstanceToExecuteErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "GetInstanceToExecute"
    Err.Raise vbObjectError + errNavInstancesFailed, _
          mstrSource, LoadResString(errNavInstancesFailed)

End Function

Public Function InstancesForStep(lngStepId As Long, ByRef StepStatus As
InstanceStatus) As cInstances
    ' Returns an array of all the instances for a step
    Dim lngIndex As Long
    Dim cTempInst As cInstance
    Dim cStepInstances As cInstances
    Dim cStepRec As cStep

    On Error GoTo InstancesForStepErr

    Set cStepInstances = New cInstances

    For lngIndex = 0 To mcInstances.Count - 1
       Set cTempInst = mcInstances(lngIndex)

       If cTempInst.Step.StepId = lngStepId Then
          cStepInstances.Add cTempInst
       End If
    Next lngIndex

    If cStepInstances.Count = 0 Then
       Set cStepRec = mcRunSteps.QueryStep(lngStepId)
       If Not mcFailures.ExecuteSubStep(cStepRec.ParentStepId) Then
          StepStatus = gintAborted
       End If
       Set cStepRec = Nothing
    End If

    ' Set the return value of the function to the array of
    ' constraints that has been built above
    Set InstancesForStep = cStepInstances

    Set cStepInstances = Nothing
    Exit Function

InstancesForStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "InstancesForStep"
    Err.Raise vbObjectError + errNavInstancesFailed, mstrSource, _
          LoadResString(errNavInstancesFailed)

End Function
Private Sub RemoveFreeProcess(lngRunningProcess As Long)
    ' Removes the passed in element from the collection of
    ' free objects

    ' Confirm that the last element in the array is the one
    ' we need to delete
    If mcFreeSteps(mcFreeSteps.Count - 1) = lngRunningProcess Then
       mcFreeSteps.Delete Position:=mcFreeSteps.Count - 1
    Else
       ' Ask the class to find the element and delete it
       mcFreeSteps.Delete Item:=lngRunningProcess
    End If

End Sub
Private Sub AddFreeProcess(lngTerminatedProcess As Long)
    ' Adds the passed in element to the collection of
    ' free objects

    mcFreeSteps.Add lngTerminatedProcess

End Sub

Private Sub ResetForm(Optional ByVal lngIndex As Long)

    Dim lngTemp As Long

    On Error GoTo ResetFormErr

    ' Check if there are any running instances to wait for
    If mcFreeSteps.Count <> glngNumConcurrentProcesses Then

       For lngTemp = 0 To mcFreeSteps.Count - 1
          If mcFreeSteps(lngTemp) = lngIndex Then
             Exit For
          End If
       Next lngTemp

       If lngTemp <= mcFreeSteps.Count - 1 Then
          ' This process that just completed did not exist in the list of
          ' free processes
          Call AddFreeProcess(lngIndex)
       End If
```

```
      If Not AnyStepRunning(mcFreeSteps, mbarrFree) Then
         WriteToWspLog (mintRunComplete)
         ' All steps are complete
         RaiseEvent RunComplete(Determine64BitTime())
      End If
   Else
      WriteToWspLog (mintRunComplete)
      RaiseEvent RunComplete(Determine64BitTime())
   End If

   Exit Sub

ResetFormErr:

End Sub
Private Function NewInstanceId() As Long
   ' Will return new instance id's - uses a static counter
   ' that it increments each time
   Static lngInstance As Long

   lngInstance = lngInstance + 1
   NewInstanceId = lngInstance

End Function

Private Function RunPendingStepInBranch(strCurBranchRoot As String, _
      Optional cExecInstance As cInstance = Nothing) As cInstance
   ' Runs a worker step in the branch being executed, if
   ' there are any pending execution
   ' This function is also called when a step has just completed
   ' execution - in which case the terminated instance is
   ' passed in as the optional parameter. When that happens,
   ' we first try to execute the siblings of the terminated
   ' step if any are pending execution.
   ' If the terminated instance has not been passed in, we
   ' start with the dummy root instance and navigate down,
   ' trying to find a pending worker step.

   Dim cExecSubStep As cStep
   Dim cParentInstance As cInstance
   Dim cNextInst As cInstance

   On Error GoTo RunPendingStepInBranchErr

   If Not cExecInstance Is Nothing Then
      ' Called when an instance has terminated
      ' When a worker step terminates, then we need to
      ' decremement the number of running steps on it's
      ' manager
      Set cParentInstance = _
            mcInstances.QueryInstance(cExecInstance.ParentInstanceId)

   Else
      If StringEmpty(strCurBranchRoot) Or mcDummyRootInstance Is Nothing Then
         ' Run complete - event raised by Run method
         Set RunPendingStepInBranch = Nothing
         Exit Function
      End If

      ' If there are no pending steps on the root instance,
      ' then there are no steps within the branch that need
      ' to be executed
      If mcDummyRootInstance.AllComplete Or mcDummyRootInstance.AllStarted
Then
         Set RunPendingStepInBranch = Nothing
         Exit Function
      End If

      Set cParentInstance = mcDummyRootInstance
   End If

   Do
      Set cNextInst = GetSubStepToExecute(cParentInstance)
      If cNextInst Is Nothing Then
         ' There are no steps within the branch that can
         ' be executed - If we are at the dummy instance,
         ' this branch has completed executing
         If cParentInstance.Key = mstrDummyRootKey Then
            Set cNextInst = Nothing
            Exit Do
         Else
            ' Go to the parent instance and try to find
            ' some other sibling is pending execution
            Set cNextInst =
mcInstances.QueryInstance(cParentInstance.ParentInstanceId)

            If cParentInstance.SubSteps.Count = 0 Then
               cNextInst.ChildTerminated cParentInstance.Step.StepId
            End If
         End If
      End If

      BugAssert Not cNextInst Is Nothing
      Set cParentInstance = cNextInst

   Loop While cNextInst.Step.StepType <> gintWorkerStep

   If Not cNextInst Is Nothing Then
      Call ExecuteStep(cNextInst)
   End If

   Set RunPendingStepInBranch = cNextInst

   Exit Function

RunPendingStepInBranchErr:
   ' Log the error code raised by Visual Basic
   Call LogErrors(Errors)
   On Error GoTo 0
   Err.Raise vbObjectError + errNavInstancesFailed, _
         mstrModuleName & "RunPendingStepInBranch",
LoadResString(errNavInstancesFailed)

End Function
Private Function RunPendingSibling(cTermInstance As cInstance, _
      dtmCompleteTime As Currency) As cInstance
   ' This process is called when a step terminates. Tries to
   ' run a sibling of the terminated step, if one is pending
   ' execution.

   Dim cParentInstance As cInstance
   Dim cNextInst As cInstance

   On Error GoTo RunPendingSiblingErr

   If StringEmpty(mstrCurBranchRoot) Or mcDummyRootInstance Is Nothing Then
      ' Run complete - event raised by Run method
      Set RunPendingSibling = Nothing
      Exit Function
   End If

   BugAssert cTermInstance.ParentInstanceId > 0, "Orphaned instance in array!"

   ' When a worker step terminates, then we need to
   ' decremement the number of running steps on it's
   ' manager
   Set cParentInstance =
mcInstances.QueryInstance(cTermInstance.ParentInstanceId)

   ' Decrement the number of running processes on the
   ' parent by 1
   Call cParentInstance.ChildTerminated(cTermInstance.Step.StepId)
```

```
    ' The first step that terminates has to be a worker
    ' If it is complete, update the completed steps on the
    ' parent by 1.
    Call cParentInstance.ChildCompleted(cTermInstance.Step.StepId)
    cParentInstance.AllStarted = False

    Do
        Set cNextInst = GetSubStepToExecute(cParentInstance, dtmCompleteTime)
        If cNextInst Is Nothing Then
            If cParentInstance.Key = mstrDummyRootKey Then
                Set cNextInst = Nothing
                Exit Do
            Else
                ' Go to the parent instance and try to find
                ' some other sibling is pending execution
                Set cNextInst =
mcInstances.QueryInstance(cParentInstance.ParentInstanceId)
                If cParentInstance.IsRunning Then
                    cNextInst.AllStarted = True
                Else
                    ' No more sub-steps to execute
                    Call cNextInst.ChildCompleted(cParentInstance.Step.StepId)
                    Call cNextInst.ChildTerminated(cParentInstance.Step.StepId)
                    cNextInst.AllStarted = False
                End If
            End If
        End If

        BugAssert Not cNextInst Is Nothing
        Set cParentInstance = cNextInst

    Loop While cNextInst.Step.StepType <> gintWorkerStep

    If Not cNextInst Is Nothing Then
        Call ExecuteStep(cNextInst)
    End If

    Set RunPendingSibling = cNextInst

    Exit Function

RunPendingSiblingErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "RunPendingSibling"
    Err.Raise vbObjectError + errNavInstancesFailed, mstrSource, _
        LoadResString(errNavInstancesFailed)

End Function
Private Sub RunPendingSiblings(cTermInstance As cInstance, _
        dtmCompleteTime As Currency)
    ' This process is called when a step terminates. Tries to
    ' run siblings of the terminated step, if they are pending
    ' execution.

    Dim cExecInst As cInstance

    On Error GoTo RunPendingSiblingsErr
    BugMessage "In RunPendingSiblings"

    ' Call a procedure to run the sibling of the terminated
    ' step, if any. This procedure will also update the
    ' number of complete/running tasks on the manager steps.
    Set cExecInst = RunPendingSibling(cTermInstance, dtmCompleteTime)

    If Not cExecInst Is Nothing Then
        Do
            ' Execute any other pending steps in the branch.
            ' The step that has just terminated might be
            ' the last one that was executing in a sub-branch.
            ' That would mean that we can execute another
            ' sub-branch that might involve more than 1 step.
            ' Pass the just executed step as a parameter.
            Set cExecInst = RunPendingStepInBranch(mstrCurBranchRoot, cExecInst)
        Loop While Not cExecInst Is Nothing
    Else
        If Not mcDummyRootInstance.IsRunning Then
            ' All steps have been executed in the branch - run
            ' a new branch
            Call RunNewBranch
        Else
            ' There are no more steps to execute in the current
            ' branch but we have running processes.
        End If
    End If

    Exit Sub

RunPendingSiblingsErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "RunPendingSiblings"
    Err.Raise vbObjectError + errNavInstancesFailed, _
        mstrSource, LoadResString(errNavInstancesFailed)

End Sub

Private Sub NoSubStepsToExecute(cMgrInstance As cInstance, Optional
dtmCompleteTime As Currency = gdtmEmpty)
    ' Called when we cannot find any more substeps to run for
    ' manager step - set the allcomplete or allstarted
    ' properties to true

    If cMgrInstance.IsRunning() Then
        cMgrInstance.AllStarted = True
    Else
        cMgrInstance.AllComplete = True
        If dtmCompleteTime <> gdtmEmpty Then
            ' Update the end time on the manager step
            Call TimeCompleteUpdateForStep(cMgrInstance, dtmCompleteTime)
        End If
    End If

End Sub

Private Function GetSubStepToExecute(cParentNode As cInstance, _
        Optional dtmCompleteTime As Currency = 0) As cInstance
    ' Returns the child of the passed in node that is to be
    ' executed next. Checks if we are in the middle of an instance
    ' being executed in which case it returns the pending
    ' instance. Creates a new instance if there are pending
    ' instances for a sub-step.

    Dim lngIndex As Long
    Dim cSubStepRec As cSubStep
    Dim cSubStepDtls As cStep
    Dim cSubStepInst As cInstance

    On Error GoTo GetSubStepToExecuteErr

    ' There are a number of cases that need to be accounted
    ' for here.
    ' 1. While traversing through all enabled nodes for the
    ' first time - instance records may not exist for the
    ' substeps.
    ' 2. Instance records exist, and there are processes
    ' that need to be executed for a sub-step
    ' 3. There are no more processes that need to be currently
    ' executed (till a process completes)
```

```
    ' 4. There are no more processes that need to be executed
    ' (All substeps have completed execution)

    ' This is the only point where we check the Abort flag -
    ' since this is the heart of the navigation routine that
    ' selects processes to execute. Also, when a step terminates
    ' selection of the next process goes through here.
    If mblnAbort Then
        Set GetSubStepToExecute = Nothing
        cParentNode.Status = gintAborted
        Exit Function
    End If

    If mblnAsk Then
        Set GetSubStepToExecute = Nothing
        Exit Function
    End If

    If Not mcFailures.ExecuteSubStep(cParentNode.Step.StepId) Then
        Set GetSubStepToExecute = Nothing
        cParentNode.Status = gintAborted
        Exit Function
    End If

    ' First check if there are pending steps for the parent!
    If cParentNode.IsPending Then
        ' Loop through all the sub-steps for the parent node
        For lngIndex = 0 To cParentNode.SubSteps.Count - 1
            Set cSubStepRec = cParentNode.SubSteps(lngIndex)
            Set cSubStepDtls = mcRunSteps.QueryStep(cSubStepRec.StepId)
            If Not mcInstances.InstanceAborted(cSubStepRec) Then
                ' Check if the sub-step is a worker
                If cSubStepDtls.StepType = gintWorkerStep Then
                    ' Find/create an instance to execute
                    Set cSubStepInst = GetInstanceToExecute( _
                            cParentNode, cSubStepRec, cSubStepDtls)
                    If Not cSubStepInst Is Nothing Then
                        Exit For
                    Else
                        ' Continue w/ the next sub-step
                    End If
                Else
                    ' The sub-step is a manager step
                    ' Check if there are any pending instances for
                    ' the manager
                    Set cSubStepInst = mcInstances.QueryPendingInstance( _
                            cParentNode.InstanceId, cSubStepRec.StepId)
                    If cSubStepInst Is Nothing Then
                        ' Find/create an instance to execute
                        Set cSubStepInst = GetInstanceToExecute( _
                                cParentNode, cSubStepRec, cSubStepDtls)
                        If Not cSubStepInst Is Nothing Then
                            Exit For
                        Else
                            ' Continue w/ the next sub-step
                        End If
                    Else
                        ' We have found a pending instance for the
                        ' sub-step (manager) - exit the loop
                        Exit For
                    End If
                End If
            End If
        Next lngIndex

        If lngIndex > cParentNode.SubSteps.Count - 1 Or cParentNode.SubSteps.Count
= 0 Then
            ' If we could not find any sub-steps to execute,
            ' mark the parent node as complete/all started
            Call NoSubStepsToExecute(cParentNode, dtmCompleteTime)
            Set cSubStepInst = Nothing
        End If
    End If

    Set GetSubStepToExecute = cSubStepInst
    Exit Function

GetSubStepToExecuteErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "GetSubStepToExecute"
    Err.Raise vbObjectError + errNavInstancesFailed, mstrSource, _
        LoadResString(errNavInstancesFailed)

End Function

Private Sub TimeCompleteUpdateForStep(cMgrInstance As cInstance, ByVal
EndTime As Currency)

    ' Called when there are no more sub-steps to execute for
    ' the manager step. It updates the end time and status on
    ' the manager.
    Dim lElapsed As Long

    On Error GoTo TimeCompleteUpdateForStepErr

    If cMgrInstance.Key <> mstrDummyRootKey Then
        cMgrInstance.EndTime = EndTime
        cMgrInstance.Status = gintComplete
        lElapsed = (EndTime - cMgrInstance.StartTime) * 10000
        cMgrInstance.ElapsedTime = lElapsed
        RaiseEvent StepComplete(cMgrInstance.Step, EndTime,
cMgrInstance.InstanceId, lElapsed)
    End If

    Exit Sub

TimeCompleteUpdateForStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errUpdateDisplayFailed, mstrModuleName &
"TimeCompleteUpdateForStep"

End Sub

Private Function GetFreeObject() As Long

    ' Check the array of free objects and retrieve the first one
    If mcFreeSteps.Count > 0 Then
        GetFreeObject = mcFreeSteps(mcFreeSteps.Count - 1)
    Else
        mstrSource = mstrModuleName & "GetFreeObject"
        ShowError errMaxProcessesExceeded
        On Error GoTo 0
        Err.Raise vbObjectError + errMaxProcessesExceeded, _
            mstrSource, _
            LoadResString(errMaxProcessesExceeded)
    End If

End Function
Private Function StepTerminated(cCompleteStep As cStep, ByVal dtmCompleteTime
As Currency, _
        ByVal lngIndex As Long, ByVal InstanceId As Long, ByVal ExecutionStatus As
InstanceStatus) As cStep
    ' This procedure is called whenever a step terminates.
    Dim cTermRec As cTermStep
    Dim cInstRec As cInstance
    Dim cStartInst As cInstance
    Dim lElapsed As Long
    Dim sLogLabel As String
    Dim LogLabels As New cVectorStr
```

```
    Dim iItIndex As Long

    On Error GoTo StepTerminatedErr

    Set cInstRec = mcInstances.QueryInstance(InstanceId)
    If dtmCompleteTime <> 0 And cInstRec.StartTime <> 0 Then
        ' Convert to milliseconds since that is the default precision
        lElapsed = (dtmCompleteTime - cInstRec.StartTime) * 10000
    Else
        lElapsed = 0
    End If

    Set cStartInst = cInstRec
    iItIndex = 0
    Do While cInstRec.Key <> mstrDummyRootKey
        sLogLabel = gstrSQ & cInstRec.Step.StepLabel & gstrSQ

        If iItIndex < cInstRec.Iterators.Count Then
            If cStartInst.Iterators(iItIndex).StepId = cInstRec.Step.StepId Then
                sLogLabel = sLogLabel & msIt & gstrSQ &
cStartInst.Iterators(iItIndex).IteratorName & gstrSQ & _
                    msItValue & gstrSQ & cStartInst.Iterators(iItIndex).Value & gstrSQ
                iItIndex = iItIndex + 1
            End If
        End If

        If cInstRec.Key = cStartInst.Key Then
            ' Append the execution status
            sLogLabel = sLogLabel & " Status: " & gstrSQ &
gsExecutionStatus(ExecutionStatus) & gstrSQ
            If ExecutionStatus = gintFailed Then
                ' Append the continuation criteria for the step since it failed
                sLogLabel = sLogLabel & " Continuation Criteria: " & gstrSQ &
gsContCriteria(cInstRec.Step.ContinuationCriteria) & gstrSQ
            End If
        End If
        LogLabels.Add sLogLabel

        Set cInstRec = mcInstances.QueryInstance(cInstRec.ParentInstanceId)
    Loop

    Call WriteToWspLog(mintStepComplete, LogLabels, dtmCompleteTime)
    Set LogLabels = Nothing

    ' Adds the terminated step details to a queue.
    Set cTermRec = New cTermStep
    cTermRec.ExecutionStatus = ExecutionStatus
    cTermRec.Index = lngIndex
    cTermRec.InstanceId = InstanceId
    cTermRec.TimeComplete = dtmCompleteTime
    Call mcTermSteps.Add(cTermRec)
    Set cTermRec = Nothing

    RaiseEvent StepComplete(cCompleteStep, dtmCompleteTime, InstanceId,
lElapsed)

    Exit Function

StepTerminatedErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errExecuteBranchFailed, mstrSource
    Call ResetForm(lngIndex)

End Function
Public Property Let RootKey(ByVal vdata As String)

    mstrRootKey = vdata

End Property

Public Property Get RootKey() As String
    RootKey = mstrRootKey
End Property

Private Function InitExecStep() As cRunStep
    ' Since arrays of objects cannot be declared as WithEvents,
    ' we use a limited number of objects and set a maximum
    ' on the number of steps that can run in parallel
    ' This is a wrapper that will create an instance of
    ' a cExecuteSM object depending on the index
    Dim lngIndex As Long

    On Error GoTo InitExecStepErr

    lngIndex = GetFreeObject

    Select Case lngIndex
        Case 0
            Set cExecStep1 = New cRunStep
            Set InitExecStep = cExecStep1
        Case 1
            Set cExecStep2 = New cRunStep
            Set InitExecStep = cExecStep2
        Case 2
            Set cExecStep3 = New cRunStep
            Set InitExecStep = cExecStep3
        Case 3
            Set cExecStep4 = New cRunStep
            Set InitExecStep = cExecStep4
        Case 4
            Set cExecStep5 = New cRunStep
            Set InitExecStep = cExecStep5
        Case 5
            Set cExecStep6 = New cRunStep
            Set InitExecStep = cExecStep6
        Case 6
            Set cExecStep7 = New cRunStep
            Set InitExecStep = cExecStep7
        Case 7
            Set cExecStep8 = New cRunStep
            Set InitExecStep = cExecStep8
        Case 8
            Set cExecStep9 = New cRunStep
            Set InitExecStep = cExecStep9
        Case 9
            Set cExecStep10 = New cRunStep
            Set InitExecStep = cExecStep10
        Case 10
            Set cExecStep11 = New cRunStep
            Set InitExecStep = cExecStep11
        Case 11
            Set cExecStep12 = New cRunStep
            Set InitExecStep = cExecStep12
        Case 12
            Set cExecStep13 = New cRunStep
            Set InitExecStep = cExecStep13
        Case 13
            Set cExecStep14 = New cRunStep
            Set InitExecStep = cExecStep14
        Case 14
            Set cExecStep15 = New cRunStep
            Set InitExecStep = cExecStep15
        Case 15
            Set cExecStep16 = New cRunStep
            Set InitExecStep = cExecStep16
        Case Else
            Set InitExecStep = Nothing
    End Select

    BugMessage "Sending cExecStep" & (lngIndex + 1) & "!"
```

```
    If Not InitExecStep Is Nothing Then
        InitExecStep.Index = lngIndex

        ' Remove this element from the collection of free objects
        Call RemoveFreeProcess(lngIndex)
    End If

    Exit Function

InitExecStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Set InitExecStep = Nothing

End Function
Public Sub Run()
    ' Calls procedures to build a list of all the steps that
    ' need to be executed and to execute them
    ' Determines whether the run has started/terminated and
    ' raises the Run Start and Complete events.
    Dim cTempStep As cStep

    On Error GoTo RunErr

    If StringEmpty(mstrRootKey) Then
        Call ShowError(errExecuteBranchFailed)
        On Error GoTo 0
        Err.Raise vbObjectError + errExecuteBranchFailed, mstrModuleName & "Run", _
            LoadResString(errExecuteBranchFailed)
    Else
        ' Execute the first branch
        WriteToWspLog (mintRunStart)
        RaiseEvent RunStart(Determine64BitTime(), mcWspLog.FileName)

        If mcNavSteps.HasChild(StepKey:=mstrRootKey) Then
            Set cTempStep = mcNavSteps.ChildStep(StepKey:=mstrRootKey)
            mstrCurBranchRoot = MakeKeyValid(cTempStep.StepId,
cTempStep.StepType)

            Call CreateDummyInstance(mstrCurBranchRoot)

            ' Run all pending steps in the branch
            If Not RunBranch(mstrCurBranchRoot) Then
                ' Execute a new branch if there aren't any
                ' steps to run
                Call RunNewBranch
            End If
        Else
            WriteToWspLog (mintRunComplete)
            ' No children to execute - the run is complete
            RaiseEvent RunComplete(Determine64BitTime())
        End If
    End If

    Exit Sub

RunErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Call ShowError(errExecuteBranchFailed, OptArgs:=mstrCurBranchRoot)
    Call ResetForm

End Sub
Private Sub RunNewBranch()
    ' We will build a tree of all instances that occur and
    ' the count of the sub-steps that are running will be
    ' stored at each node in the tree (maintained internally
    ' as an array). Since there can be multiple iterations
    ' of the top level nodes running at the same time, we
    ' create a dummy node at the root that keeps a record of
    ' the instances of the top level node.
    ' Determines whether the run has started/terminated and
    ' raises the Run Start and Complete events.
    Dim cNextStep As cStep
    Dim bRunComplete As Boolean

    On Error GoTo RunNewBranchErr

    bRunComplete = False

    Do
        If StringEmpty(mstrCurBranchRoot) Then
            Exit Do
'           On Error GoTo 0
'           Err.Raise vbObjectError + errExecuteBranchFailed, mstrSource, _
'               LoadResString(errExecuteBranchFailed)
        Else
            Set cNextStep = mcNavSteps.NextStep(StepKey:=mstrCurBranchRoot)
            If cNextStep Is Nothing Then
                mstrCurBranchRoot = gstrEmptyString
                bRunComplete = True
                Exit Do
            Else
                ' Starting execution of a new branch - initialize the
                ' module-level variable
                mstrCurBranchRoot = MakeKeyValid(cNextStep.StepId,
cNextStep.StepType)
                Call CreateDummyInstance(mstrCurBranchRoot)
            End If
        End If
        Debug.Print "Running new branch: " & mstrCurBranchRoot

    ' Loop until we find a branch that has steps to execute
    Loop While Not RunBranch(mstrCurBranchRoot)

    If bRunComplete Then
        WriteToWspLog (mintRunComplete)
        ' Run is complete
        RaiseEvent RunComplete(Determine64BitTime())
    End If

    Exit Sub

RunNewBranchErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Call ShowError(errExecuteBranchFailed, OptArgs:=mstrCurBranchRoot)
    On Error GoTo 0
    mstrSource = mstrModuleName & "RunNewBranch"
    Err.Raise vbObjectError + errExecuteBranchFailed, mstrSource, _
        LoadResString(errExecuteBranchFailed)

End Sub
Private Function RunBranch(strRootNode As String) As Boolean
    ' This procedure is called to run all the necessary steps
    ' in a branch. It can also be called when a step terminates,
    ' in which case the terminated step is passed in as the
    ' optional parameter. When a step terminates, we need to
    ' either wait for some other steps to terminate before
    ' we execute more steps or run as many steps as necessary
    ' Returns True if there are steps currently executing
    ' in the branch, else returns False
    Dim cRunning As cInstance

    On Error GoTo RunBranchErr

    If Not StringEmpty(strRootNode) Then
        ' Call a procedure to execute all the enabled steps
        ' in the branch - will return the step node that is
        ' being executed - nothing means 'No more steps to
        ' execute in the branch'.
```

```
        Do
            Set cRunning = RunPendingStepInBranch(strRootNode, cRunning)

        Loop While Not cRunning Is Nothing

        RunBranch = mcDummyRootInstance.IsRunning
    End If

    Exit Function

RunBranchErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "RunBranch"
    Err.Raise vbObjectError + errExecuteBranchFailed, _
        mstrSource, LoadResString(errExecuteBranchFailed)

End Function
Private Sub TimeUpdateForProcess(StepRecord As cStep, _
        ByVal InstanceId As Long, _
        Optional ByVal StartTime As Currency = 0, _
        Optional ByVal EndTime As Currency = 0, _
        Optional ByVal ElapsedTime As Long = 0, _
        Optional Command As String)
    ' We do not maintain start and end timestamps for the constraint
    ' of a step. Hence we check if the process that just started/
    ' terminated is the worker step that is being executed. If so,
    ' we update the start/end time and status on the instance record.

    Dim cInstanceRec As cInstance
    Dim sItVal As String

    On Error GoTo TimeUpdateForProcessErr

    Set cInstanceRec = mcInstances.QueryInstance(InstanceId)

    If StartTime = 0 Then
        RaiseEvent ProcessComplete(StepRecord, EndTime, InstanceId, ElapsedTime)
    Else
        sItVal = GetInstanceItValue(cInstanceRec)
        RaiseEvent ProcessStart(StepRecord, Command, StartTime, InstanceId, _
            cInstanceRec.ParentInstanceId, sItVal)
    End If

    Call cInstanceRec.UpdateStartTime(StepRecord.StepId, StartTime, EndTime,
ElapsedTime)

    Exit Sub

TimeUpdateForProcessErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errUpdateDisplayFailed, mstrModuleName & "TimeUpdateForProcess"

End Sub
Private Sub TimeStartUpdateForStep(StepRecord As cStep, _
        ByVal InstanceId As Long, _
        ByVal StartTime As Currency)

    ' Called when a step starts execution. Checks if this is the
    ' first enabled child of the manager step. If so, updates
    ' the start time and status on the manager.
    ' Also raises the Step Start event for the completed step.

    Dim cStartInst As cInstance
    Dim cInstanceRec As cInstance
    Dim LogLabels As New cVectorStr
    Dim iItIndex As Long
    Dim sLogLabel As String
    Dim sPath As String
    Dim sIt As String
    Dim sItVal As String

    On Error GoTo TimeStartUpdateForStepErr

    Set cStartInst = mcInstances.QueryInstance(InstanceId)

    ' Determine the step path and iterator values for the step and raise a step start event
    Set cInstanceRec = cStartInst
    Do While cInstanceRec.Key <> mstrDummyRootKey
        If Not StringEmpty(sPath) Then
            sPath = sPath & gstrFileSeparator
        End If
        sPath = sPath & gstrSQ & cInstanceRec.Step.StepLabel & gstrSQ
        Set cInstanceRec = mcInstances.QueryInstance(cInstanceRec.ParentInstanceId)
    Loop

    For iItIndex = cStartInst.Iterators.Count - 1 To 0 Step -1
        If Not StringEmpty(sIt) Then
            sIt = sIt & gstrFileSeparator
        End If
        sIt = sIt & gstrSQ & cStartInst.Iterators(iItIndex).Value & gstrSQ
    Next iItIndex

    sItVal = GetInstanceItValue(cStartInst)
    RaiseEvent StepStart(StepRecord, StartTime, InstanceId,
cStartInst.ParentInstanceId, _
        sPath, sIt, sItVal)

    iItIndex = 0
    Set cInstanceRec = cStartInst
    ' Raise a StepStart event for the manager step, if this is it's first sub-step being
executed
    Do While cInstanceRec.Key <> mstrDummyRootKey

        sLogLabel = gstrSQ & cInstanceRec.Step.StepLabel & gstrSQ
        If iItIndex < cStartInst.Iterators.Count Then
            If cStartInst.Iterators(iItIndex).StepId = cInstanceRec.Step.StepId Then
                sLogLabel = sLogLabel & msIt & gstrSQ &
cStartInst.Iterators(iItIndex).IteratorName & gstrSQ & _
                    msItValue & gstrSQ & cStartInst.Iterators(iItIndex).Value & gstrSQ
                iItIndex = iItIndex + 1
            End If
        End If
        LogLabels.Add sLogLabel

        If cInstanceRec.Key <> cStartInst.Key And cInstanceRec.StartTime = 0 Then
            cInstanceRec.StartTime = StartTime
            cInstanceRec.Status = gintRunning
            sItVal = GetInstanceItValue(cInstanceRec)
            ' The step path and iterator values are not needed for manager steps, since
            ' they are primarily used by the run status form
            RaiseEvent StepStart(cInstanceRec.Step, StartTime, cInstanceRec.InstanceId,
_
                cInstanceRec.ParentInstanceId, gstrEmptyString, gstrEmptyString, _
                sItVal)
        End If

        Set cInstanceRec = mcInstances.QueryInstance(cInstanceRec.ParentInstanceId)
    Loop

    Call WriteToWspLog(mintStepStart, LogLabels, StartTime)
    Set LogLabels = Nothing

    Exit Sub

TimeStartUpdateForStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errUpdateDisplayFailed, mstrModuleName & "TimeStartUpdateForStep"
```

```
End Sub
Private Sub WriteToWspLog(iLogEvent As WspLogEvents, Optional StepDtls As
cVectorStr, _
      Optional dtStamp As Currency = gdtmEmpty)

   ' Writes to the workspace log that is generated for the run. The last three
   ' parameters are valid only for Step Start and Step Complete events.
   Static bError As Boolean
   Dim sLabel As String
   Dim lIndex As Long
   Dim bHdr As Boolean
   Dim cTempConn As cConnection

   On Error GoTo WriteToWspLogErr

   Select Case iLogEvent
      Case mintRunStart
         Set mcWspLog = New cFileSM
         mcWspLog.FileName = GetDefaultDir(WspId, mcParameters) &
gstrFileSeparator & _
               Trim(Str(RunId)) & gstrFileSeparator & "SMLog-" & Format(Now,
FMT_WSP_LOG_FILE) & gstrLogFileSuffix
         mcWspLog.WriteLine (JulianDateToString(Determine64BitTime()) & " Start
Run: " & vbTab & gstrSQ & GetWorkspaceDetails(WorkspaceId:=WspId)) & gstrSQ

         ' Write all current parameter values to the log
         bHdr = False
         For lIndex = 0 To mcParameters.ParameterCount - 1
            If mcParameters(lIndex).ParameterType <> gintParameterApplication Then
               If Not bHdr Then
                  mcWspLog.WriteField JulianDateToString(Determine64BitTime()) & "
Parameters: "
                  bHdr = True
               Else
                  mcWspLog.WriteField vbTab & vbTab & vbTab
               End If
               mcWspLog.WriteLine vbTab & gstrSQ &
mcParameters(lIndex).ParameterName & gstrSQ & vbTab & vbTab & gstrSQ &
mcParameters(lIndex).ParameterValue & gstrSQ
            End If
         Next lIndex

         ' Write all connection properties to the log
         For lIndex = 0 To RunConnections.Count - 1
            Set cTempConn = RunConnections(lIndex)
            If lIndex = 0 Then
               mcWspLog.WriteField JulianDateToString(Determine64BitTime()) & "
Connections: "
            Else
               mcWspLog.WriteField vbTab & vbTab & vbTab
            End If
            mcWspLog.WriteLine vbTab & gstrSQ & cTempConn.ConnectionName &
gstrSQ & _
                  vbTab & vbTab & gstrSQ & cTempConn.ConnectionValue & gstrSQ &
_
                  vbTab & "No Count: " & gstrSQ & cTempConn.NoCountDisplay &
gstrSQ & gstrBlank & _
                  "No Execute: " & gstrSQ & cTempConn.NoExecute & gstrSQ &
gstrBlank & _
                  "Parse Query Only: " & gstrSQ & cTempConn.ParseQueryOnly &
gstrSQ & gstrBlank & _
                  "Quoted Identifiers: " & gstrSQ & cTempConn.QuotedIdentifiers &
gstrSQ & gstrBlank & _
                  "ANSI Nulls: " & gstrSQ & cTempConn.AnsiNulls & gstrSQ & gstrBlank
& _
                  "Show Query Plan: " & gstrSQ & cTempConn.ShowQueryPlan &
gstrSQ & gstrBlank & _
                  "Show Stats Time: " & gstrSQ & cTempConn.ShowStatsTime & gstrSQ
& gstrBlank & _
                  "Show Stats IO: " & gstrSQ & cTempConn.ShowStatsIO & gstrSQ &
gstrBlank & _
                  "Row Count" & gstrSQ & cTempConn.RowCount & gstrSQ & gstrBlank
& _
                  "Query Timeout" & gstrSQ & cTempConn.QueryTimeOut & gstrSQ
         Next lIndex

      Case mintRunComplete
         BugAssert Not mcWspLog Is Nothing
         mcWspLog.WriteLine (JulianDateToString(Determine64BitTime()) & " Comp.
Run: " & vbTab & gstrSQ & GetWorkspaceDetails(WorkspaceId:=WspId)) & gstrSQ
         Set mcWspLog = Nothing

      Case mintStepStart
         For lIndex = StepDtls.Count - 1 To 0 Step -1
            sLabel = StepDtls(lIndex)
            If lIndex = StepDtls.Count - 1 Then
               mcWspLog.WriteLine JulianDateToString(dtStamp) & " Start Step: " &
vbTab & sLabel
            Else
               mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & sLabel
            End If
         Next lIndex

      Case mintStepComplete
         For lIndex = StepDtls.Count - 1 To 0 Step -1
            sLabel = StepDtls(lIndex)
            If lIndex = StepDtls.Count - 1 Then
               mcWspLog.WriteLine JulianDateToString(dtStamp) & " Comp. Step: " &
vbTab & sLabel
            Else
               mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & sLabel
            End If
         Next lIndex

   End Select

   Exit Sub

WriteToWspLogErr:
   If Not bError Then
      bError = True
   End If

End Sub
'Private Sub WriteToWspLog(iLogEvent As WspLogEvents, Optional StepDtls As
cVectorStr, _
'      Optional dtStamp As Date = gdtmEmpty)
'
'   This function uses the LogWriter dll - memory corruption problems since the vb exe
'   and the vc Execute Dll both use the same dll to write.
'    ' Writes to the workspace log that is generated for the run. The last three
'    ' parameters are valid only for StepStart and StepComplete events.
'    Static bError As Boolean
'    Static sFile As String
'    Dim sLabel As String
'    Dim lIndex As Long
'    Dim bHdr As Boolean
'
'    On Error GoTo WriteToWspLogErr
'
'    Select Case iLogEvent
'       Case mintRunStart
'          Set mcWspLog = New LOGWRITERLib.SMLog
'          sFile = App.Path & "\" & "SMLog-" & Format(Now, FMT_WSP_LOG_FILE) &
gstrLogFileSuffix
'          mcWspLog.FileName = sFile
'          mcWspLog.Init
'          mcWspLog.WriteLine (Format(Now, FMT_WSP_LOG_DATE) & " Start Run: "
& vbTab & gstrSQ & GetWorkspaceDetails(WorkspaceId:=WspId)) & gstrSQ
'
'          ' Write all current parameter values to the log
'          bHdr = False
```

```
'          For lIndex = 0 To mcParameters.ParameterCount - 1
'             If mcParameters(lIndex).ParameterType <> gintParameterApplication Then
'                If Not bHdr Then
'                   'mcWspLog.WriteLine Format(Now, FMT_WSP_LOG_DATE) & "
Parameters: " & vbTab & gstrSQ & mcParameters(lIndex).ParameterName & gstrSQ &
vbTab & vbTab & gstrSQ & mcParameters(lIndex).ParameterValue & gstrSQ
'                   bHdr = True
'                Else
'                   'mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & gstrSQ &
mcParameters(lIndex).ParameterName & gstrSQ & vbTab & vbTab & gstrSQ &
mcParameters(lIndex).ParameterValue & gstrSQ
'                End If
'             End If
'          Next lIndex
'
'       Case mintRunComplete
'          BugAssert Not mcWspLog Is Nothing
'          mcWspLog.WriteLine (Format(Now, FMT_WSP_LOG_DATE) & " Comp. Run:
" & vbTab & gstrSQ & GetWorkspaceDetails(WorkspaceId:=WspId)) & gstrSQ
'          Set mcWspLog = Nothing
'
'       Case mintStepStart
'          For lIndex = StepDtls.Count - 1 To 0 Step -1
'             sLabel = StepDtls(lIndex)
'             If lIndex = StepDtls.Count - 1 Then
'                mcWspLog.WriteLine Format(dtStamp, FMT_WSP_LOG_DATE) & " Start
Step: " & vbTab & sLabel
'             Else
'                mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & sLabel
'             End If
'          Next lIndex
'
'       Case mintStepComplete
'          For lIndex = StepDtls.Count - 1 To 0 Step -1
'             sLabel = StepDtls(lIndex)
'             If lIndex = StepDtls.Count - 1 Then
'                mcWspLog.WriteLine Format(dtStamp, FMT_WSP_LOG_DATE) & "
Comp. Step: " & vbTab & sLabel
'             Else
'                mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & sLabel
'             End If
'          Next lIndex
'
'    End Select
'
'    Exit Sub
'
'WriteToWspLogErr:
'    If Not bError Then
'       bError = True
'    End If
'
'End Sub
'
Public Property Get WspPreExecution() As Variant
    WspPreExecution = mcvntWspPreCons
End Property
Public Property Let WspPreExecution(ByVal vdata As Variant)
    mcvntWspPreCons = vdata
End Property

Public Property Get WspPostExecution() As Variant
    WspPostExecution = mcvntWspPostCons
End Property
Public Property Let WspPostExecution(ByVal vdata As Variant)
    mcvntWspPostCons = vdata
End Property

Private Sub ExecuteStep(cCurStep As cInstance)
    ' Initializes a cRunStep object with all the properties
    ' corresponding to the step to be executed and calls it's
    ' execute method to execute the step

    Dim cExecStep As cRunStep

    On Error GoTo ExecuteStepErr
    mstrSource = mstrModuleName & "ExecuteStep"

    ' Confirm that the step is a worker
    If cCurStep.Step.StepType <> gintWorkerStep Then
       On Error GoTo 0
       Err.Raise vbObjectError + errExecInstanceFailed, mstrSource, _
             LoadResString(errExecInstanceFailed)
    End If

    Set cExecStep = InitExecStep()
    ' Exceeded the number of processes that we can run simultaneously
    If cExecStep Is Nothing Then
       ' Raise an error
       On Error GoTo 0
       Err.Raise vbObjectError + errProgramError, mstrSource, _
          LoadResString(errProgramError)
    End If
    ' Initialize the instance id - not needed for step execution
    ' but necessary to identify later which instance completed
    cExecStep.InstanceId = cCurStep.InstanceId

    Set cExecStep.ExecuteStep = cCurStep.Step
    Set cExecStep.Iterators = cCurStep.Iterators
    Set cExecStep.Globals = mcRunSteps
    Set cExecStep.WspParameters = mcParameters
    Set cExecStep.WspConnections = RunConnections
    Set cExecStep.WspConnDtls = RunConnDtls

    ' Initialize all the pre and post-execution constraints that
    ' have been defined globally for the workspace
    cExecStep.WspPreCons = mcvntWspPreCons
    cExecStep.WspPostCons = mcvntWspPostCons

    ' Initialize all the pre and post-execution constraints for
    ' the step being executed
    cExecStep.PreCons = DetermineConstraints(cCurStep, gintPreStep)
    cExecStep.PostCons = DetermineConstraints(cCurStep, gintPostStep)

    cExecStep.RunId = RunId
    cExecStep.CreateInputFiles = CreateInputFiles

    ' Call the execute method to execute the step
    cExecStep.Execute

    Set cExecStep = Nothing

    Exit Sub

ExecuteStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Call ExecutionFailed(cExecStep)

End Sub

Public Property Set Steps(cRunSteps As cArrSteps)

    Set mcRunSteps = cRunSteps
    Set mcNavSteps.StepRecords = cRunSteps

End Property
Public Property Set Parameters(cParameters As cArrParameters)
    ' A reference to the parameter array - we use it to
    ' substitute parameter values in the step text
```

```
    Set mcParameters = cParameters

End Property
Public Property Get Steps() As cArrSteps

    Set Steps = mcRunSteps

End Property
Public Property Get Constraints() As cArrConstraints

    Set Constraints = mcRunConstraints

End Property
Public Property Set Constraints(vdata As cArrConstraints)

    Set mcRunConstraints = vdata

End Property


Private Sub cExecStep1_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep1_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep1_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep1.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep1_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep9_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep9_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep9_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep9.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep9_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep10_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep10_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep10_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep10.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep10_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep11_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep11_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep11_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep11.Index, InstanceId,
Status)
```

```
End Sub

Private Sub cExecStep11_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep12_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep12_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep12_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep12.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep12_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep13_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep13_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep13_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep13.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep13_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep14_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep14_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep14_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep14.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep14_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep15_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep15_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep15_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep15.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep15_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep16_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)
```

```
End Sub


Private Sub cExecStep16_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep16_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep16.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep16_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep2_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep2_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep2_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep2.Index, _
         InstanceId, Status)

End Sub

Private Sub cExecStep2_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub


Private Sub cExecStep3_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep3_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep3_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep3.Index, _
         InstanceId, Status)

End Sub

Private Sub cExecStep3_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub


Private Sub cExecStep4_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep4_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep4_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep4.Index, _
         InstanceId, Status)

End Sub


Private Sub cExecStep4_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep5_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep5_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep5_StepComplete(cStepRecord As cStep, _
```

```
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep5.Index, _
      InstanceId, Status)

End Sub

Private Sub cExecStep5_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep6_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep6_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep6_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep6.Index, _
      InstanceId, Status)

End Sub

Private Sub cExecStep6_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep7_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep7_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep7_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep7.Index, _
      InstanceId, Status)

End Sub

Private Sub cExecStep7_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep8_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep8_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep8_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep8.Index, _
      InstanceId, Status)

End Sub

Private Sub cExecStep8_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub Class_Initialize()

  Dim lngCount As Long
  Dim lngTemp As Long

  On Error GoTo InitializeErr

  Set mcFreeSteps = New cVectorLng
  ' Initialize the array of free objects with all elements
  ' for now
  For lngCount = 0 To glngNumConcurrentProcesses - 1 Step 1
    mcFreeSteps.Add lngCount
  Next lngCount

  ' Initialize a byte array with the number of free processes. It will
  ' be used later to determine if any step is running
  ' Each element in the array can represent 8 steps, 1 for each bit
  ReDim mbarrFree(glngNumConcurrentProcesses \ gintBitsPerByte)

  ' Initialize each element in the byte array w/ all 1's
  ' (upto glngNumConcurrentProcesses)
  For lngCount = LBound(mbarrFree) To UBound(mbarrFree) Step 1
    lngTemp = IIf( _
        glngNumConcurrentProcesses - (gintBitsPerByte * lngCount) >
gintBitsPerByte, _
        gintBitsPerByte, _
        glngNumConcurrentProcesses - (gintBitsPerByte * lngCount))

    mbarrFree(lngCount) = (2 ^ lngTemp) - 1
  Next lngCount

  Set mcInstances = New cInstances
  Set mcFailures = New cFailedSteps
  Set mcNavSteps = New cStepTree
  Set mcTermSteps = New cTermSteps
```

```
    ' Initialize the Abort flag to False
    mblnAbort = False
    mblnAsk = False

    Exit Sub

InitializeErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errInitializeFailed, mstrModuleName & "Initialize", _
          LoadResString(errInitializeFailed)

End Sub
Private Sub Class_Terminate()

    On Error GoTo Class_TerminateErr

    mcFreeSteps.Clear
    Set mcFreeSteps = Nothing
    ReDim mbarrFree(0)

    mcInstances.Clear
    Set mcInstances = Nothing

    Set mcFailures = Nothing
    Set mcNavSteps = Nothing
    Set mcTermSteps = Nothing

    Exit Sub

Class_TerminateErr:
    Call LogErrors(Errors)

End Sub

Private Sub mcTermSteps_TermStepExists(cStepDetails As cTermStep)

    Call RunNextStep(cStepDetails.TimeComplete, cStepDetails.Index, _
          cStepDetails.InstanceId, cStepDetails.ExecutionStatus)

End Sub
```

cRunItDetails.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cRunItDetails"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cRunItDetails.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This module encapsulates the properties of iterator values
'              that are used by the step being executed at runtime.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'

Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cRunItDetails."
Private mstrSource As String

Private mstrIteratorName As String
Private mintType As ValueType
Private mlngSequence As Long
Private mlngFrom As Long
Private mlngTo As Long
Private mlngStep As Long
Private mstrValue As String

Public Property Get RangeTo() As Long

    RangeTo = mlngTo

End Property
Public Property Let RangeTo(ByVal vdata As Long)

    mlngTo = vdata

End Property

Public Property Get RangeFrom() As Long

    RangeFrom = mlngFrom

End Property
Public Property Get Sequence() As Long

    Sequence = mlngSequence

End Property

Public Property Get RangeStep() As Long

    RangeStep = mlngStep

End Property
Public Property Let RangeStep(vdata As Long)

    mlngStep = vdata

End Property

Public Property Let RangeFrom(ByVal vdata As Long)

    mlngFrom = vdata

End Property
Public Property Let Sequence(ByVal vdata As Long)

    mlngSequence = vdata

End Property

Public Property Get IteratorType() As ValueType

    IteratorType = mintType

End Property
Public Property Let IteratorType(ByVal vdata As ValueType)

    On Error GoTo TypeErr
    mstrSource = mstrModuleName & "Type"

    ' These constants have been defined in the enumeration,
    ' Type, which is exposed
    Select Case vdata
        Case gintFrom, gintTo, gintStep, gintValue
            mintType = vdata

        Case Else
            On Error GoTo 0
```

```
        Err.Raise vbObjectError + errTypeInvalid, _
           mstrSource, LoadResString(errTypeInvalid)
   End Select

   Exit Property

TypeErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "Type"
   On Error GoTo 0
   Err.Raise vbObjectError + errTypeInvalid, _
      mstrSource, LoadResString(errTypeInvalid)

End Property
Private Sub IsList()

   If mintType <> gintValue Then
      On Error GoTo 0
      Err.Raise vbObjectError + errInvalidProperty, mstrSource, _
           LoadResString(errInvalidProperty)
   End If

End Sub
Private Sub IsRange()

   If mintType = gintValue Then
      On Error GoTo 0
      Err.Raise vbObjectError + errInvalidProperty, mstrSource, _
           LoadResString(errInvalidProperty)
   End If

End Sub

Public Property Get Value() As String

   Value = mstrValue

End Property
Public Property Let Value(vdata As String)

   mstrValue = vdata

End Property


Public Property Get IteratorName() As String

   IteratorName = mstrIteratorName

End Property
Public Property Let IteratorName(ByVal vdata As String)

   mstrIteratorName = vdata

End Property

VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cRunItNode"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
' An iterator class containing the properties that are used
' by the stpe being executed.
' These iterators might actually come from steps that are at
' a higher level than the step actually being executed (viz.
' direct ascendants of the step at any level).

Option Explicit

Public IteratorName As String
Public Value As String
Public StepId As Long

VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cRunOnly"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
Option Explicit

Public Event Done()
Private WithEvents mcRunWsp As cRunWorkspace
Attribute mcRunWsp.VB_VarHelpID = -1

Public WspName As String
Public WorkspaceId As Long
Public WspLog As String

Public Sub RunWsp()

   On Error GoTo RunWspErr

   Set mcRunWsp = New cRunWorkspace
   Set mcRunWsp.LoadDb = dbsAttTool
   mcRunWsp.WorkspaceId = WorkspaceId
   mcRunWsp.RunWorkspace

   Exit Sub

RunWspErr:
   ' Log the VB error code
   LogErrors Errors

End Sub

Private Sub mcRunWsp_RunComplete(dtmEndTime As Currency)

   MsgBox "Completed executing workspace: " & gstrSQ & WspName & gstrSQ & " at
" & _
        JulianDateToString(dtmEndTime) & "." & vbCrLf & vbCrLf & _
        "The log file for the run is: " & gstrSQ & WspLog & gstrSQ & "."
   RaiseEvent Done

End Sub

Private Sub mcRunWsp_RunStart(dtmStartTime As Currency, strWspLog As String)
   WspLog = strWspLog
End Sub
```

cRunStep.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cRunStep"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cRunStep.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
```

```
'
'  PURPOSE:    This class executes the step that is assigned to the
'              ExecuteStep property. It executes the pre-execution constraints
'              in sequence and then the step itself. At the end it executes
'              the post-execution constraints. Since these steps should always
'              be executed in sequence, each step is only fired on the
'              completion of the previous step.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cRunStep."
Private mstrSource As String

' Local variable(s) to hold property value(s)
Private mcStep As cStep
Private mcGlobals As cArrSteps
Private mcvntWspPreCons As Variant
Private mcvntWspPostCons As Variant
Private mcvntPreCons As Variant
Private mcvntPostCons As Variant
Private mcIterators As cRunCollt
Private mlngInstanceId As Long ' Identifier for the current instance
Private mlngIndex As Long ' Index value for the current instance
Private mstrCommand As String ' The command string
Private msRunStepDtl As String ' Step text/file name that will go into the
run_step_details table
Private mbInAbort As Boolean   ' Set to True when the user aborts the run
Private msOutputFile As String
Private msErrorFile As String
Private miStatus As InstanceStatus
Private mcVBErr As cVBErrorsSM
Public WspParameters As cArrParameters
Public WspConnections As cConnections
Public WspConnDtls As cConnDtls

Private WithEvents mcTermProcess As cTermProcess
Attribute mcTermProcess.VB_VarHelpID = -1
Public RunId As Long
Public CreateInputFiles As Boolean
Private msOutputDir As String

' Object that will execute the step
Private WithEvents mcExecObj As EXECUTEDLLLib.Execute
Attribute mcExecObj.VB_VarHelpID = -1

' Holds the step that is currently being executed (constraint or
' worker step)
Private mcExecStep As cStep

Private Const msCompareExe As String = "\diff.exe"

Private Enum NextNodeType
   mintWspPreConstraint = 1
   mintPreConstraint
   mintStep
   mintWspPostConstraint
   mintPostConstraint
End Enum

' Public events to notify the calling function of the
' start and end time for each step
Public Event StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)
Public Event StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)
Public Event ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, _
      InstanceId As Long)
Public Event ProcessComplete(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long, lElapsed As Long)

Private Function AppendDiffErrors(sDiffFile As String)
   ' The file containing the errors generated by the diff utility is passed in
   ' These errors are appended to the error file for the step

   Dim sTemp As String
   Dim InputFile As Integer

   If Not StringEmpty(sDiffFile) Then

      InputFile = FreeFile
      Open sDiffFile For Input Access Read As InputFile

      Do While Not EOF(InputFile)        ' Loop until end of file.
         Line Input #InputFile, sTemp    ' Read line into variable.
         mcVBErr.LogMessage sTemp
      Loop

      Close InputFile
   End If

End Function

Private Sub CreateStepTextFile()
   ' Creates a file containing the step text being executed
   On Error GoTo CreateStepTextFileErr

   Dim sInputFile As String

   If mcExecStep.ExecutionMechanism = gintExecuteShell Then
      sInputFile = GetOutputFile(gsCmdFileSuffix)
   Else
      sInputFile = GetOutputFile(gsSqlFileSuffix)
   End If

   ' Generate a file containing the step text being executed
   If Not StringEmpty(mcExecStep.StepTextFile) Or
mcExecStep.ExecutionMechanism = gintExecuteShell Then
      FileCopy mstrCommand, sInputFile
   Else
      Call WriteCommandToFile(mstrCommand, sInputFile)
   End If

   Exit Sub

CreateStepTextFileErr:

   mcVBErr.LogVBErrors

End Sub
Private Function GetOutputFile(strFileExt As String) As String
   ' This function generates the output file name for the step currently being executed
   ' The value of the built-in parameter 'DefaultDir' is appended with the run identifier
   ' for the file location
   ' The step label is used for the file name and a combination of all iterator values
   ' for the step is used to make the output files unique for each instance
   Dim sFile As String
   Dim sIt As String
   Dim lIt As Long

   On Error GoTo GetOutputFileErr

   sFile = SubstituteParametersIfPossible(mcExecStep.StepLabel)

   sFile = TranslateStepLabel(sFile)

   If mcExecStep Is mcStep Then
      ' Use iterators that have been defined for the worker or any of it's managers
      ' to make the error/log file unique for this instance
```

```
      For lIt = mcIterators.Count - 1 To 0 Step -1
         sIt = sIt & gsExtSeparator & mcIterators(lIt).Value
      Next lIt
   End If
   sIt = sIt & strFileExt

   ' Ensure that the length of the complete path does not exceed 255 characters
   If Len(msOutputDir) + Len(sFile) + Len(sIt) > MAX_PATH Then
      sFile = Mid(sFile, 1, MAX_PATH - Len(sIt) - Len(msOutputDir))
   End If
   GetOutputFile = msOutputDir & sFile & sIt
   Exit Function

GetOutputFileErr:

   ' Does not make sense to log error to the error file yet. Write to the project
   ' log and return the step label as default
   GetOutputFile = mcExecStep.StepLabel & gsExtSeparator & strFileExt

End Function


Private Sub HandleExecutionError()

   On Error GoTo HandleExecutionError

   ' Log the error code raised by Visual Basic
   miStatus = gintFailed
   mcVBErr.LogVBErrors
   Call mcVBErr.WriteError(errExecuteStepFailed, _
        OptArgs:="Continuation criteria for the step is: " &
gsContCriteria(mcStep.ContinuationCriteria))

HandleExecutionError:

   ' Logging failed - return

End Sub

Public Property Get Index() As Long

   Index = mlngIndex

End Property
Public Property Let Index(ByVal vdata As Long)

   mlngIndex = vdata

End Property
Private Function InitializeExecStatus() As InstanceStatus
   Dim sCompareFile As String

   On Error GoTo InitializeExecStatusErr

   InitializeExecStatus = mcExecObj.StepStatus

   If InitializeExecStatus = gintComplete Then
      If Not StringEmpty(mcExecStep.FailureDetails) Then
         ' Compare output to determine whether the step failed
         sCompareFile = GetShortName(SubstituteParameters( _
              mcExecStep.FailureDetails, mcExecStep.WorkspaceId, mcIterators, _
              WspParameters))
         InitializeExecStatus = IIf(CompareOutput(sCompareFile, msOutputFile),
gintComplete, gintFailed)
      End If
   End If

   Exit Function

InitializeExecStatusErr:
   mcVBErr.LogVBErrors
'   Call LogErrors(Errors)
   InitializeExecStatus = mcExecObj.StepStatus

End Function
Private Function CompareOutput(sCompareFile As String, sOutputFile As String) As
Boolean

   Dim sCmpOutput As String
   Dim sDiffOutput As String

   On Error GoTo CompareOutputErr

   ' Create temporary files to store the file compare output and
   ' the errors generated by the compare function
   sCmpOutput = CreateTempFile()
   sDiffOutput = CreateTempFile()

   ' Run the compare utility and redirect it's output and errors
   SyncShell ("cmd /c " & _
        GetShortName(App.Path & msCompareExe) & gstrBlank & _
        sCompareFile & gstrBlank & sOutputFile & _
        " > " & sCmpOutput & " 2> " & sDiffOutput)

   If FileLen(sDiffOutput) > 0 Then
      ' The compare generated errors - append error msgs to the error file
      Call AppendDiffErrors(sDiffOutput)
      CompareOutput = False
   Else
      CompareOutput = (FileLen(sCmpOutput) = 0)
   End If

   If Not CompareOutput Then
      mcVBErr.WriteError errDiffFailed
   End If

   ' Delete the temporary files used to store the output of the compare and
   ' the errors generated by the compare
   Kill sDiffOutput
   Kill sCmpOutput

   Exit Function

CompareOutputErr:
   mcVBErr.LogVBErrors
   CompareOutput = False

End Function
Public Property Get InstanceId() As Long

   InstanceId = mlngInstanceId

End Property
Public Property Let InstanceId(ByVal vdata As Long)

   mlngInstanceId = vdata

End Property

Private Function ExecuteConstraint(vntConstraints As Variant, _
      ByRef intLoopIndex As Integer) As Boolean

   ' Returns True if there is a constraint in the passed in
   ' array that remains to be executed

   If IsArray(vntConstraints) And Not IsEmpty(vntConstraints) Then
      ExecuteConstraint = (LBound(vntConstraints) <= intLoopIndex) And
(intLoopIndex <= UBound(vntConstraints))
   Else
      ExecuteConstraint = False
   End If
```

```
End Function
Private Function NextStep() As cStep

    ' Determines which is the next step to be executed - it could
    ' be either a pre-execution step, the worker step itself
    ' or a post-execution step

    Dim cConsRec As cConstraint
    Dim cNextStepRec As cStep
    Dim vntStepConstraints As Variant

    ' Static variable to remember exactly where we are in the
    ' processing
    Static intIndex As Integer
    Static intNextStepType As NextNodeType

    On Error GoTo NextStepErr

    If mblnAbort = True Then
        ' The user has aborted the run - do not run any more
        ' processes for the step
        Set NextStep = Nothing
        Exit Function
    End If

    If intNextStepType = 0 Then
        ' First time through this function - set the Index and
        ' node type to initial values
        intNextStepType = mintWspPreConstraint
        intIndex = 0
        RaiseEvent StepStart(mcStep, Determine64BitTime(), mlngInstanceId)
    End If

    Do
        Select Case intNextStepType
            Case mintWspPreConstraint
                vntStepConstraints = mcvntWspPreCons

            Case mintPreConstraint
                vntStepConstraints = mcvntPreCons

            Case mintStep
                ' CONS:
                If mcStep.StepType = gintWorkerStep Then
                    Set cNextStepRec = mcStep
                End If

            Case mintWspPostConstraint
                vntStepConstraints = mcvntWspPostCons

            Case mintPostConstraint
                vntStepConstraints = mcvntPostCons

        End Select

        If intNextStepType <> mintStep Then
            ' Check if there is a constraint to be executed
            If ExecuteConstraint(vntStepConstraints, intIndex) Then
                ' Get the corresponding step record to be executed
                ' Query the global step record for the current
                ' constraint
                Set cConsRec = vntStepConstraints(intIndex)

                Set cNextStepRec = mcGlobals.QueryStep(cConsRec.GlobalStepId)
                intIndex = intIndex + 1
            Else
                If intNextStepType = mintPostConstraint Then
                    ' No more stuff to be executed for the step
                    ' Raise a Done event
                    Set cNextStepRec = Nothing
                    ' Set the next step type to an invalid value
                    intNextStepType = -1
                Else
                    Call NextType(intNextStepType, intIndex)
                End If
            End If
        Else
            ' Increment the step type so we look at the post-
            ' execution steps the next time through
            Call NextType(intNextStepType, intIndex)
        End If

    Loop Until (Not cNextStepRec Is Nothing) Or _
        intNextStepType = -1

    Set NextStep = cNextStepRec

    Exit Function

NextStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "NextStep"
    Err.Raise vbObjectError + errNextStepFailed, mstrSource, _
        LoadResString(errNextStepFailed)

End Function
Public Sub Execute()
    ' This procedure is the method that executes the step that
    ' is assigned to the ExecuteStep property. It call a procedure
    ' to determine the next step to be executed.
    ' Then it initializes all the properties of the cExecuteSM object
    ' and calls it's run method to execute it.
    Dim cConn As cConnection
    Dim cRunConnDtl As cConnDtl

    On Error GoTo ExecuteErr

    ' If this procedure is called after a step has completed,
    ' we would have to check if we created any temporary files
    ' while executing that step
    If Not mcExecStep Is Nothing Then
        If Not StringEmpty(mcExecStep.StepTextFile) Or
mcExecStep.ExecutionMechanism = gintExecuteShell Then
            ' Remove the temporary file that we created while
            ' running this command
            Kill mstrCommand
        End If

        Call StepCompleted

        ' The VB errors class stores a reference to the Execute class since it uses
        ' a method of the class to write errors to the error log. Hence,
        ' release all references to the Execute object before destroying it.
        Set mcVBErr.ErrorFile = Nothing
        Set mcExecObj = Nothing

        ' Delete empty output and error files (generated by shell commands)
        ' (Can be done only after cleaning up cExecObj)
        Call DeleteEmptyOutputFiles
    Else
        ' First time through - initialize the location of output files
        msOutputDir = GetDefaultDir(mcStep.WorkspaceId, WspParameters)
        msOutputDir = msOutputDir & gstrFileSeparator & Trim(Str(RunId)) &
gstrFileSeparator
        ' Dummy file since the function expects a file name
        MakePathValid (msOutputDir & "a.txt")
    End If

    ' Call a procedure to determine the next step to be executed
```

```
    ' - could be a constraint or the step itself
    ' Initialize a module-level variable to the step being
    ' executed
    Set mcExecStep = NextStep
    If mcExecStep Is Nothing Then
        RaiseEvent StepComplete(mcStep, Determine64BitTime(), mlngInstanceId,
miStatus)
        ' No more stuff to execute
        Exit Sub
    End If

    Dim sStartDir As String

    Set mcExecObj = New EXECUTEDLLLib.Execute

    ' The VB errors class uses the WriteError method of the Execute class to write
    ' all VB errors to the error file for the step (this prevents a clash when the
    ' VB errors and Execution errors have to be written to the same log). Hence, store
    ' a reference to the Execute object in mcVBErr
    msErrorFile = GetOutputFile(gsErrorFileSuffix)
    mcExecObj.ErrorFile = msErrorFile
    Call DeleteFile(msErrorFile, bCheckIfEmpty:=False)
    Set mcVBErr.ErrorFile = mcExecObj

    If mcExecStep.ExecutionMechanism = gintExecuteShell Then
        sStartDir = Trim$(GetShortName(SubstituteParameters( _
                mcExecStep.StartDir, mcExecStep.WorkspaceId, mcIterators,
WspParameters:=WspParameters)))
        ' Dummy connection object
        Set cConn = New cConnection
        Set cRunConnDtl = New cConnDtl
    Else
        ' Find the connection string value and substitute parameter values in it
        Set cRunConnDtl = WspConnDtls.GetConnectionDtl(mcExecStep.WorkspaceId,
mcExecStep.StartDir)
        Set cConn = WspConnections.GetConnection(mcExecStep.WorkspaceId,
cRunConnDtl.ConnectionString)
        sStartDir = Trim$(SubstituteParameters(cConn.ConnectionValue, _
            mcExecStep.WorkspaceId, mcIterators, WspParameters:=WspParameters))
    End If

    msOutputFile = GetOutputFile(gsOutputFileSuffix)
    Call DeleteFile(msOutputFile, bCheckIfEmpty:=False)
    mcExecObj.OutputFile = msOutputFile
'    mcExecObj.LogFile = GetShortName(SubstituteParameters( _
'            mcExecStep.LogFile, mcExecStep.WorkspaceId, mcIterators,
WspParameters:=WspParameters))
    If mcExecStep.ExecutionMechanism = gintExecuteODBC And _
          cRunConnDtl.ConnType = ConnTypeDynamic Then
        Call mcExecObj.DoExecute(BuildCommandString(), sStartDir,
mcExecStep.ExecutionMechanism, _
              cConn.NoCountDisplay, cConn.NoExecute, cConn.ParseQueryOnly,
cConn.QuotedIdentifiers, _
              cConn.AnsiNulls, cConn.ShowQueryPlan, cConn.ShowStatsTime,
cConn.ShowStatsIO, _
              cConn.RowCount, cConn.QueryTimeOut, gstrEmptyString)
    Else
        Call mcExecObj.DoExecute(BuildCommandString(), sStartDir,
mcExecStep.ExecutionMechanism, _
              cConn.NoCountDisplay, cConn.NoExecute, cConn.ParseQueryOnly,
cConn.QuotedIdentifiers, _
              cConn.AnsiNulls, cConn.ShowQueryPlan, cConn.ShowStatsTime,
cConn.ShowStatsIO, _
              cConn.RowCount, cConn.QueryTimeOut, mcExecStep.StartDir)
    End If

    Exit Sub

ExecuteErr:
    Call HandleExecutionError

    ' We can assume that if we are in this function, a StepStart event has been triggered
already.
    RaiseEvent StepComplete(mcStep, Determine64BitTime(), mlngInstanceId,
miStatus)

End Sub
Private Function BuildCommandString() As String
    ' Process text to be executed - either from the text
    ' field or read it from a file.
    ' This function will always return the command text for ODBC commands
    ' and a file name for Shell commands
    Dim sFile As String
    Dim sCommand As String
    Dim sTemp As String

    On Error GoTo BuildCommandStringErr

    If Not StringEmpty(mcExecStep.StepTextFile) Then
        ' Substitute parameter values and environment variables
        ' in the filename
        msRunStepDtl = SubstituteParameters(mcExecStep.StepTextFile, _
              mcExecStep.WorkspaceId, mcIterators, WspParameters:=WspParameters)

        sFile = GetShortName(msRunStepDtl)

        mstrCommand = SubstituteParametersInText(sFile, mcExecStep.WorkspaceId)

        If mcExecStep.ExecutionMechanism = gintExecuteODBC Then
            ' Read the contents of the file and pass it to ODBC
            BuildCommandString = ReadCommandFromFile(mstrCommand)
        Else
            BuildCommandString = mstrCommand
        End If
    Else
        ' Substitute parameter values and environment variables
        ' in the step text
        msRunStepDtl = SubstituteParameters(mcExecStep.StepText, _
              mcExecStep.WorkspaceId, mcIterators, WspParameters:=WspParameters)
        mstrCommand = msRunStepDtl

        If mcExecStep.ExecutionMechanism = gintExecuteShell Then
            ' Write the command to a temp file (enables us to execute multiple
            ' commands via the command interpreter)
            mstrCommand = WriteCommandToFile(msRunStepDtl)
            BuildCommandString = mstrCommand
        Else
            BuildCommandString = SQLFixup(msRunStepDtl)
        End If
    End If

    If CreateInputFiles Then
        Call CreateStepTextFile
    End If

    Exit Function

BuildCommandStringErr:
    ' Log the error code raised by the Execute procedure
'    Call LogErrors(Errors)
    mcVBErr.LogVBErrors

    On Error GoTo 0
    mstrSource = mstrModuleName & "Execute"
    Err.Raise vbObjectError + errExecuteStepFailed, mstrSource, _
        LoadResString(errExecuteStepFailed) & mstrCommand

End Function
Public Sub Abort()

    On Error GoTo AbortErr
```

```
    ' Setting the Abort flag to True will ensure that we
    ' don't execute any more processes for this step
    mblnAbort = True

    If Not mcExecObj Is Nothing Then
        mcExecObj.Abort
    Else
        ' We are not in the middle of execution yet
    End If

    Exit Sub

AbortErr:
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errProgramError, _
        mstrModuleName & "Abort", _
        LoadResString(errProgramError)

End Sub
Private Sub NextType(ByRef StepType As NextNodeType, _
        ByRef Position As Integer)

    StepType = StepType + 1
    Position = 0

End Sub
Private Sub StepCompleted()

    On Error GoTo StepCompletedErr

    If Not mcExecStep Is Nothing Then
        If mcExecStep Is mcStep Then
            miStatus = InitializeExecStatus
            If miStatus = gintFailed Then
                ' Create input files if the step failed execution and one hasn't been created
already
                If Not CreateInputFiles Then CreateStepTextFile
                Call mcVBErr.WriteError(errExecuteStepFailed, _
                        OptArgs:="Continuation criteria for the step is: " &
gsContCriteria(mcStep.ContinuationCriteria))
            End If
        End If
    End If

    Exit Sub

StepCompletedErr:
    ' Log the error code raised by Visual Basic
    miStatus = gintFailed
    mcVBErr.LogVBErrors
    Call mcVBErr.WriteError(errExecuteStepFailed, _
            OptArgs:="Continuation criteria for the step is: " &
gsContCriteria(mcStep.ContinuationCriteria))

End Sub
Private Sub DeleteEmptyOutputFiles()

    On Error GoTo DeleteEmptyOutputFilesErr

    ' Delete empty output and error files
    If Not mcExecStep Is Nothing Then
        Call DeleteFile(msErrorFile, bCheckIfEmpty:=True)
        Call DeleteFile(msOutputFile, bCheckIfEmpty:=True)
    End If

    Exit Sub

DeleteEmptyOutputFilesErr:
    ' Not a critical error - continue

End Sub
Private Function ReadCommandFromFile(strFileName As String) As String

    ' Returns the contents of the passed in file

    Dim sCommand As String
    Dim sTemp As String
    Dim InputFile As Integer

    On Error GoTo ReadCommandFromFileErr

    If Not StringEmpty(strFileName) Then

        InputFile = FreeFile
        Open strFileName For Input Access Read As InputFile

        Line Input #InputFile, sCommand ' Read line into variable.

        Do While Not EOF(InputFile) ' Loop until end of file.
            Line Input #InputFile, sTemp ' Read line into variable.
            sCommand = sCommand & vbCrLf & sTemp
        Loop

        Close InputFile
    End If

    ReadCommandFromFile = sCommand

    Exit Function

ReadCommandFromFileErr:

    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "ReadCommandFromFile"
    On Error GoTo 0
    Err.Raise vbObjectError + errSubValuesFailed, _
            gstrSource, _
            LoadResString(errSubValuesFailed)

End Function
Private Function SubstituteParametersIfPossible(strLabel As String)

    On Error GoTo SubstituteParametersIfPossibleErr

    SubstituteParametersIfPossible = SubstituteParameters(strLabel, _
            mcExecStep.WorkspaceId, mcIterators, WspParameters:=WspParameters)
    Exit Function

SubstituteParametersIfPossibleErr:
    SubstituteParametersIfPossible = strLabel

End Function
Private Function SubstituteParametersInText(strFileName As String, _
        lngWorkspace As Long) As String

    ' Reads each line in the passed in file, substitutes parameter
    ' values in the line and writes out the modified line to a
    ' temporary file that we create. The temporary file will be
    ' removed once the step completes execution.
    ' Returns the name of the newly created temporary file.

    Dim strTempFile As String
    Dim strTemp As String
    Dim strOutput As String
    Dim InputFile As Integer
    Dim OutputFile As Integer

    On Error GoTo SubstituteParametersInTextErr

    strTempFile = CreateTempFile()
```

```
    If Not StringEmpty(strFileName) Then

        InputFile = FreeFile
        Open strFileName For Input Access Read As InputFile

        OutputFile = FreeFile
        Open strTempFile For Output Access Write As OutputFile

        Do While Not EOF(InputFile) ' Loop until end of file.
            Line Input #InputFile, strTemp ' Read line into variable.
            strOutput = SubstituteParameters(strTemp, lngWorkspace, mcIterators,
WspParameters:=WspParameters)

            If mcExecStep.ExecutionMechanism = gintExecuteODBC Then strOutput =
SQLFixup(strOutput)

            Print #OutputFile, strOutput
            BugMessage strOutput
        Loop

    End If

    Close InputFile
    Close OutputFile

    SubstituteParametersInText = strTempFile

    Exit Function

SubstituteParametersInTextErr:

    ' Log the error code raised by Visual Basic
'    Call LogErrors(Errors)
    mcVBErr.LogVBErrors
    mstrSource = mstrModuleName & "SubstituteParametersInText"
    On Error GoTo 0
    Err.Raise vbObjectError + errSubValuesFailed, _
          gstrSource, _
          LoadResString(errSubValuesFailed)

End Function

Private Function WriteCommandToFile(sCommand As String, Optional sFile As String
= gstrEmptyString) As String

    ' Writes the command text to a temporary file
    ' Returns the name of the temporary file

    Dim OutputFile As Integer

    On Error GoTo WriteCommandToFileErr

    If StringEmpty(sFile) Then
        sFile = CreateTempFile()
    End If

    OutputFile = FreeFile
    Open sFile For Output Access Write As OutputFile

    Print #OutputFile, sCommand

    Close OutputFile

    WriteCommandToFile = sFile

    Exit Function

WriteCommandToFileErr:

    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "WriteCommandToFile"
    On Error GoTo 0
    Err.Raise vbObjectError + errSubValuesFailed, _
          gstrSource, _
          LoadResString(errSubValuesFailed)

End Function


Public Property Get WspPreCons() As Variant
    WspPreCons = mcvntWspPreCons
End Property
Public Property Let WspPreCons(ByVal vdata As Variant)
    mcvntWspPreCons = vdata
End Property

Public Property Get WspPostCons() As Variant
    WspPostCons = mcvntWspPostCons
End Property
Public Property Let WspPostCons(ByVal vdata As Variant)
    mcvntWspPostCons = vdata
End Property

Public Property Get PreCons() As Variant
    PreCons = mcvntPreCons
End Property
Public Property Let PreCons(ByVal vdata As Variant)
    mcvntPreCons = vdata
End Property

Public Property Get PostCons() As Variant
    PostCons = mcvntPostCons
End Property
Public Property Let PostCons(ByVal vdata As Variant)
    mcvntPostCons = vdata
End Property

Public Property Set Globals(cRunSteps As cArrSteps)

    Set mcGlobals = cRunSteps

End Property
Public Property Set ExecuteStep(cRunStep As cStep)

    Set mcStep = cRunStep

End Property
Public Property Get Globals() As cArrSteps

    Set Globals = mcGlobals

End Property
Public Property Get ExecuteStep() As cStep

    Set ExecuteStep = mcStep

End Property
Public Property Set Iterators(vdata As cRunColIt)

    Set mcIterators = vdata

End Property
Private Sub Class_Initialize()

    ' Initialize the Abort flag to False
    mblnAbort = False
    Set mcVBErr = New cVBErrorsSM
    Set mcTermProcess = New cTermProcess

End Sub
```

```
Private Sub Class_Terminate()

    On Error GoTo Class_TerminateErr

    Set mcExecObj = Nothing
    Set mcVBErr = Nothing
    Set mcTermProcess = Nothing

    Exit Sub

Class_TerminateErr:
    Call LogErrors(Errors)

End Sub

Private Sub mcExecObj_Start(ByVal StartTime As Currency)
    ' Raise an event indicating that the step has begun execution
    RaiseEvent ProcessStart(mcExecStep, msRunStepDtl, StartTime, mlngInstanceId)
End Sub

Private Sub mcExecObj_Complete(ByVal EndTime As Currency, ByVal Elapsed As
Long)

    On Error GoTo mcExecObj_CompleteErr

    Debug.Print Elapsed
    RaiseEvent ProcessComplete(mcExecStep, EndTime, mlngInstanceId, Elapsed)
    mcTermProcess.ProcessTerminated

    Exit Sub

mcExecObj_CompleteErr:
    Call LogErrors(Errors)

End Sub

Private Sub mcTermProcess_TermProcessExists()

    On Error GoTo TermProcessExistsErr

    ' Call a procedure to execute the next step, if any
    Call Execute

    Exit Sub

TermProcessExistsErr:
    ' Log the error code raised by the Execute procedure
    Call LogErrors(Errors)

End Sub
```

cRunWorkspace.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cRunWorkspace"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cRunWorkspace.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This class loads all the information necessary to
'              execute a workspace and calls cRunInst to execute the workspace.
'              It also propagates Step start and complete and
'              Run start and complete events.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "cRunWorkspace."
Private mstrSource As String

Private mcRunSteps As cArrSteps
Private mcRunParams As cArrParameters
Private mcRunConstraints As cArrConstraints
Private mcRunConnections As cConnections
Private mcRunConnDtls As cConnDtls
Private mcvntWspPreCons As Variant
Private mcvntWspPostCons As Variant
Private mdbsLoadDb As Database
Private mlngRunId As Long
Private mlngWorkspaceId As Long
Private mField As cStringSM
Public CreateInputFiles As Boolean

Private WithEvents mcRun As cRunInst
Attribute mcRun.VB_VarHelpID = -1

Public Event RunStart(dtmStartTime As Currency, strWspLog As String)
Public Event RunComplete(dtmEndTime As Currency)
Public Event StepStart(cStepRecord As cStep, dtmStartTime As Currency,
lngInstanceId As Long, _
        sPath As String, slts As String)
Public Event StepComplete(cStepRecord As cStep, dtmEndTime As Currency,
lngInstanceId As Long)
Public Event ProcessStart(cStepRecord As cStep, strCommand As String, _
        dtmStartTime As Currency, lngInstanceId As Long)
Public Event ProcessComplete(cStepRecord As cStep, dtmEndTime As Currency,
lngInstanceId As Long)
Public Function InstancesForStep(lngStepId As Long, iStatus As InstanceStatus) As
cInstances
    ' Returns an array of all the instances for a step

    If mcRun Is Nothing Then
        Set InstancesForStep = Nothing
    Else
        Set InstancesForStep = mcRun.InstancesForStep(lngStepId, iStatus)
    End If

End Function
Private Sub InsertRunDetail(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, _
        lngInstanceId As Long, lParentInstanceId As Long, sltValue As String)
    ' Inserts a new run detail record into the database

    Dim strInsert As String
    Dim qy As QueryDef

    On Error GoTo InsertRunDetailErr
    mstrSource = mstrModuleName & "InsertRunDetail"

    strInsert = "insert into run_step_details " & _
            "( run_id, step_id, version_no, instance_id, parent_instance_id, " & _
            " command, start_time, iterator_value ) " & _
            " values ( "

#If USE_JET Then

    strInsert = strInsert & " [r_id], [s_id], [ver_no], [i_id], [p_i_id], " & _
            " [com], [s_date], [it_val] )"

    Set qy = mdbsLoadDb.CreateQueryDef( _
            gstrEmptyString, strInsert)
```

```
    ' Call a procedure to assign the Querydef parameters
    Call AssignParameters(qy, StartTime:=dtmStartTime, _
          StepId:=cStepRecord.StepId, _
          Version:=cStepRecord.VersionNo, _
          InstanceId:=lngInstanceId, _
          Command:=strCommand)

    qy.Execute dbFailOnError
    qy.Close

#Else

    strInsert = strInsert & Str(mlngRunId) _
       & ", " & Str(cStepRecord.StepId) _
       & ", " & mField.MakeStringFieldValid(cStepRecord.VersionNo) _
       & ", " & Str(lngInstanceId) _
       & ", " & Str(lParentInstanceId) _
       & ", " & mField.MakeStringFieldValid(strCommand) _
       & ", " & Str(dtmStartTime) _
       & ", " & mField.MakeStringFieldValid(sItValue)

    strInsert = strInsert & " ) "

    mdbsLoadDb.Execute strInsert, dbFailOnError

#End If

    Exit Sub

InsertRunDetailErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "InsertRunDetail"
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateRunDataFailed, _
          mstrSource, _
          LoadResString(errUpdateRunDataFailed)

End Sub
Private Sub UpdateRunDetail(cStepRecord As cStep, _
       dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)
    ' Updates the run detail record in the database

    Dim strUpdate As String
    Dim qy As QueryDef

    On Error GoTo UpdateRunDetailErr

    strUpdate = "update run_step_details " & _
          " set end_time = [e_date], elapsed_time = [elapsed] " & _
          " where run_id = [r_id] " & _
          " and step_id = [s_id] " & _
          " and version_no = [ver_no] " & _
          " and instance_id = [i_id] "

    Set qy = mdbsLoadDb.CreateQueryDef( _
          gstrEmptyString, strUpdate)

    ' Call a procedure to assign the Querydef parameters
    Call AssignParameters(qy, EndTime:=dtmEndTime, _
          StepId:=cStepRecord.StepId, _
          Version:=cStepRecord.VersionNo, _
          InstanceId:=lngInstanceId, Elapsed:=lElapsed)

    qy.Execute dbFailOnError
    qy.Close

    Exit Sub

UpdateRunDetailErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "UpdateRunDetail"
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateRunDataFailed, _
          mstrSource, _
          LoadResString(errUpdateRunDataFailed)

End Sub
Private Function InsertRunHeader(dtmStartTime As Currency) As Long
    ' Inserts a new run header record into the database
    ' and returns the id for the run

    Dim strInsert As String
    Dim qy As QueryDef

    On Error GoTo InsertRunHeaderErr

    strInsert = "insert into run_header " & _
       "( run_id, workspace_id, start_time ) " & _
       " values ( " & _
       " [r_id], [w_id], [s_date] )"

    Set qy = mdbsLoadDb.CreateQueryDef( _
          gstrEmptyString, strInsert)

    ' Call a procedure to execute the Querydef object
    Call AssignParameters(qy, StartTime:=dtmStartTime)

    qy.Execute dbFailOnError
    qy.Close

    InsertRunHeader = mlngRunId
    Exit Function

InsertRunHeaderErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "InsertRunHeader"
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateRunDataFailed, _
          mstrSource, _
          LoadResString(errUpdateRunDataFailed)

End Function
Private Sub InsertRunParameters(dtmStartTime As Currency)
    ' Inserts a new run header record into the database
    ' and returns the id for the run

    Dim strInsert As String
    Dim qy As QueryDef
    Dim cParamRec As cParameter
    Dim lngIndex As Long

    On Error GoTo InsertRunParametersErr

    strInsert = "insert into run_parameters " & _
       "( run_id, parameter_name, parameter_value ) " & _
       " values ( " & _
       " [r_id], [p_name], [p_value] )"

    Set qy = mdbsLoadDb.CreateQueryDef( _
          gstrEmptyString, strInsert)
    qy.Parameters("r_id").Value = mlngRunId

    For lngIndex = 0 To mcRunParams.ParameterCount - 1
       Set cParamRec = mcRunParams(lngIndex)

       qy.Parameters("p_name").Value = cParamRec.ParameterName
       qy.Parameters("p_value").Value = cParamRec.ParameterValue
       qy.Execute dbFailOnError

    Next lngIndex
```

```
    qy.Close

    Exit Sub

InsertRunParametersErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "InsertRunParameters"
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateRunDataFailed, _
          mstrSource, _
          LoadResString(errUpdateRunDataFailed)

End Sub
Private Sub AssignParameters(qyExec As DAO.QueryDef, _
       Optional StartTime As Currency = 0, _
       Optional EndTime As Currency = 0, _
       Optional StepId As Long = 0, _
       Optional Version As String = gstrEmptyString, _
       Optional InstanceId As Long = 0, _
       Optional ParentInstanceId As Long = 0, _
       Optional Command As String = gstrEmptyString, _
       Optional Elapsed As Long = 0, _
       Optional ItValue As String = gstrEmptyString)
    ' Assigns values to the parameters in the querydef object

    Dim prmParam As DAO.Parameter

    On Error GoTo AssignParametersErr
    mstrSource = mstrModuleName & "AssignParameters"

    For Each prmParam In qyExec.Parameters
       Select Case prmParam.Name
          Case "[w_id]"
             prmParam.Value = mlngWorkspaceId

          Case "[r_id]"
             prmParam.Value = mlngRunId

          Case "[s_id]"
             BugAssert StepId <> 0
             prmParam.Value = StepId

          Case "[ver_no]"
             BugAssert Not StringEmpty(Version)
             prmParam.Value = Version

          Case "[i_id]"
             BugAssert InstanceId <> 0
             prmParam.Value = InstanceId

          Case "[p_i_id]"
             prmParam.Value = ParentInstanceId

          Case "[com]"
             BugAssert Not StringEmpty(Command)
             prmParam.Value = Command

          Case "[s_date]"
             BugAssert StartTime <> 0
             prmParam.Value = StartTime

          Case "[e_date]"
             BugAssert EndTime <> 0
             prmParam.Value = EndTime

          Case "[elapsed]"
             prmParam.Value = Elapsed

          Case "[it_val]"
             prmParam.Value = ItValue

          Case Else
             ' Write the parameter name that is faulty
             WriteError errInvalidParameter, mstrSource, _
                   prmParam.Name
             On Error GoTo 0
             Err.Raise errInvalidParameter, mstrSource, _
                   LoadResString(errInvalidParameter)
       End Select
    Next prmParam

    Exit Sub

AssignParametersErr:

    mstrSource = mstrModuleName & "AssignParameters"
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errAssignParametersFailed, _
          mstrSource, LoadResString(errAssignParametersFailed)

End Sub
Private Sub RunStartProcessing(dtmStartTime As Currency)

    On Error GoTo RunStartProcessingErr

    ' Insert the run header into the database
    Call InsertRunHeader(dtmStartTime)

    ' Insert the run parameters into the database
    Call InsertRunParameters(dtmStartTime)

    Exit Sub

RunStartProcessingErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "RunStartProcessing"
    ShowError errUpdateRunDataFailed
    WriteError errUpdateRunDataFailed, mstrSource

End Sub
Private Sub ProcessStartProcessing(cStepRecord As cStep, _
       strCommand As String, dtmStartTime As Currency, lngInstanceId As Long, _
       lParentInstanceId As Long, sItValue As String)

    On Error GoTo ProcessStartProcessingErr

    ' Insert the run detail into the database
    Call InsertRunDetail(cStepRecord, strCommand, dtmStartTime, lngInstanceId, _
          lParentInstanceId, sItValue)

    Exit Sub

ProcessStartProcessingErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "ProcessStartProcessing"
    ShowError errUpdateRunDataFailed
    WriteError errUpdateRunDataFailed, mstrSource

End Sub
Private Sub StepStartProcessing(cStepRecord As cStep, dtmStartTime As Currency, _
       lngInstanceId As Long, lParentInstanceId As Long, sItValue As String)

    On Error GoTo StepStartProcessingErr

    ' Since ProcessStart events won't be triggered for manager steps
    If cStepRecord.StepType = gintManagerStep Then
       ' Insert the run detail into the database
       Call InsertRunDetail(cStepRecord, cStepRecord.StepLabel, _
             dtmStartTime, lngInstanceId, lParentInstanceId, sItValue)
```

```
    End If

    Exit Sub

StepStartProcessingErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "StepStartProcessing"
    ShowError errUpdateRunDataFailed

End Sub
Private Sub ProcessCompleteProcessing(cStepRecord As cStep, _
        dtmStartTime As Currency, lngInstanceId As Long, lElapsed As Long)

    On Error GoTo ProcessCompleteProcessingErr

    ' Insert the run detail into the database
    Call UpdateRunDetail(cStepRecord, dtmStartTime, lngInstanceId, lElapsed)

    Exit Sub

ProcessCompleteProcessingErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "ProcessCompleteProcessing"
    ShowError errUpdateRunDataFailed

End Sub
Private Sub StepCompleteProcessing(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    On Error GoTo StepCompleteProcessingErr

    ' Since ProcessComplete events won't be triggered for manager steps
    If cStepRecord.StepType = gintManagerStep Then
        ' Update the run detail in the database
        Call UpdateRunDetail(cStepRecord, dtmEndTime, lngInstanceId, lElapsed)
    End If

    Exit Sub

StepCompleteProcessingErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    ShowError errUpdateRunDataFailed

End Sub
Private Sub RunCompleteProcessing(dtmEndTime As Currency)

    On Error GoTo RunCompleteProcessingErr

    ' Update the header record with the end time for the run
    Call UpdateRunHeader(dtmEndTime)

    Exit Sub

RunCompleteProcessingErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    ShowError errUpdateRunDataFailed

End Sub

Private Sub UpdateRunHeader(ByVal dtmEndTime As Currency)
    ' Updates the run header record with the end date

    Dim strUpdate As String
    Dim qy As QueryDef

    On Error GoTo UpdateRunHeaderErr

    strUpdate = "update run_header " & _
            " set end_time = [e_date] " & _
            " where run_id = [r_id] "

    Set qy = mdbsLoadDb.CreateQueryDef( _
            gstrEmptyString, strUpdate)

    ' Call a procedure to execute the Querydef object
    Call AssignParameters(qy, EndTime:=dtmEndTime)

    qy.Execute dbFailOnError
    qy.Close

    Exit Sub

UpdateRunHeaderErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "UpdateRunHeader"
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateRunDataFailed, _
            mstrSource, _
            LoadResString(errUpdateRunDataFailed)

End Sub

Public Property Let WorkspaceId(ByVal vdata As Long)
    mlngWorkspaceId = vdata
End Property
Public Property Get WorkspaceId() As Long
    WorkspaceId = mlngWorkspaceId
End Property
Public Sub RunWorkspace()

    Dim cRunSeq As cSequence

    On Error GoTo RunWorkspaceErr

    ' Call a procedure to load the module-level structures
    ' with all the step and parameter data for the run
    If LoadRunData = False Then
        ' Error handled by the function already
        Exit Sub
    End If

    ' Retrieve the next identifier using the sequence class
    Set cRunSeq = New cSequence
    Set cRunSeq.IdDatabase = dbsAttTool
    cRunSeq.IdentifierColumn = "run_id"
    mlngRunId = cRunSeq.Identifier
    Set cRunSeq = Nothing

    Set mcRun.Constraints = mcRunConstraints
    mcRun.WspPreExecution = mcvntWspPreCons
    mcRun.WspPostExecution = mcvntWspPostCons

    Set mcRun.Steps = mcRunSteps
    Set mcRun.Parameters = mcRunParams
    Set mcRun.RunConnections = mcRunConnections
    Set mcRun.RunConnDtls = mcRunConnDtls

    mcRun.WspId = mlngWorkspaceId
    mcRun.RootKey = LabelStep(mlngWorkspaceId)
    mcRun.RunId = mlngRunId
    mcRun.CreateInputFiles = CreateInputFiles

    mcRun.Run

    Exit Sub

RunWorkspaceErr:
    ' Log the error code raised by Visual Basic
```

```
    Call LogErrors(Errors)

End Sub
Public Property Get LoadDb() As Database

    Set LoadDb = mdbsLoadDb

End Property
Public Property Set LoadDb(vdata As Database)

    Set mdbsLoadDb = vdata

End Property
Private Function LoadRunData() As Boolean

    ' Loads the step, parameter and constraint arrays
    ' with all the data for the workspace. Returns False
    ' if a failure occurs

    Dim strWorkspaceName As String
    Dim recWspSteps As Recordset
    Dim qySteps As DAO.QueryDef
    Dim recWspParams As Recordset
    Dim qyParams As DAO.QueryDef
    Dim recWspConns As Recordset
    Dim qyConns As DAO.QueryDef
    Dim recWspConnDtls As Recordset
    Dim qyConnDtls As DAO.QueryDef

    On Error GoTo LoadRunDataErr

    Set mcRunSteps.StepDB = mdbsLoadDb
    Set mcRunParams.ParamDatabase = mdbsLoadDb
    Set mcRunConstraints.ConstraintDB = mdbsLoadDb
    Set mcRunConnections.ConnDb = mdbsLoadDb
    Set mcRunConnDtls.ConnDb = mdbsLoadDb

    ' Read all the step and parameter data for the workspace
    Call ReadWorkspaceData(mlngWorkspaceId, mcRunSteps, _
          mcRunParams, mcRunConstraints, mcRunConnections, mcRunConnDtls, _
          recWspSteps, qySteps, recWspParams, qyParams, recWspConns, qyConns, _
          recWspConnDtls, qyConnDtls)

    ' Load all the pre- and post-execution constraints that
    ' have been defined for the workspace
    mcvntWspPreCons = mcRunConstraints.ConstraintsForWsp( _
       mlngWorkspaceId, _
       gintPreStep, _
       blnSort:=True, _
       blnGlobalConstraintsOnly:=True)
    mcvntWspPostCons = mcRunConstraints.ConstraintsForWsp( _
       mlngWorkspaceId, _
       gintPostStep, _
       blnSort:=True, _
       blnGlobalConstraintsOnly:=True)

    On Error Resume Next
    recWspSteps.Close
    qySteps.Close
    recWspParams.Close
    qyParams.Close
    recWspConns.Close
    qyConns.Close

    LoadRunData = True

    Exit Function

LoadRunDataErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    ShowError errLoadRunDataFailed
    LoadRunData = False

End Function
Public Sub StopRun()

    On Error GoTo StopRunErr

    If mcRun Is Nothing Then
       ' We haven't been the run yet, so do nothing
    Else
       mcRun.StopRun
    End If

    Exit Sub

StopRunErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    ' Errors would have been displayed by the called process

End Sub
Public Sub AbortRun()

    On Error GoTo AbortRunErr

    If mcRun Is Nothing Then
       ' We haven't been the run yet, so do nothing
    Else
       mcRun.Abort
    End If

    Exit Sub

AbortRunErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    ' Errors would have been displayed by the called process

End Sub

Private Sub Class_Initialize()

    ' Create instances of the step, parameter and constraint arrays
    Set mcRunSteps = New cArrSteps
    Set mcRunParams = New cArrParameters
    Set mcRunConstraints = New cArrConstraints
    Set mcRunConnections = New cConnections
    Set mcRunConnDtls = New cConnDtls
    Set mcRun = New cRunInst
    Set mField = New cStringSM

End Sub
Private Sub Class_Terminate()

    On Error GoTo UnLoadRunDataErr

    ' Clears the step, parameter and constraint arrays
    Set mcRunSteps = Nothing
    Set mcRunParams = Nothing
    Set mcRunConstraints = Nothing
    Set mcRunConnections = Nothing
    Set mcRunConnDtls = Nothing

    Set mcRun = Nothing
    Set mdbsLoadDb = Nothing
    Set mField = Nothing

    Exit Sub

UnLoadRunDataErr:
```

```
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    ' Not a critical error - continue
    Resume Next

End Sub

Private Sub mcRun_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    RaiseEvent ProcessComplete(cStepRecord, dtmEndTime, lngInstanceId)
    Call ProcessCompleteProcessing(cStepRecord, dtmEndTime, lngInstanceId,
lElapsed)

End Sub

Private Sub mcRun_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long, _
        lParentInstanceId As Long, sItValue As String)

    RaiseEvent ProcessStart(cStepRecord, strCommand, dtmStartTime, lngInstanceId)
    Call ProcessStartProcessing(cStepRecord, strCommand, dtmStartTime,
lngInstanceId, _
            lParentInstanceId, sItValue)

End Sub

Private Sub mcRun_RunComplete(dtmEndTime As Currency)

    Debug.Print "Run ended at: " & CStr(dtmEndTime)
    Call RunCompleteProcessing(dtmEndTime)

    RaiseEvent RunComplete(dtmEndTime)

End Sub
Private Sub mcRun_RunStart(dtmStartTime As Currency, strWspLog As String)

    RaiseEvent RunStart(dtmStartTime, strWspLog)
    Debug.Print "Run started at: " & CStr(dtmStartTime)

    Call RunStartProcessing(dtmStartTime)

End Sub
Private Sub mcRun_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    RaiseEvent StepComplete(cStepRecord, dtmEndTime, lngInstanceId)
'    BugMessage "Step: " & cStepRecord.StepLabel & " has completed!"

    Call StepCompleteProcessing(cStepRecord, dtmEndTime, lngInstanceId, lElapsed)

End Sub
Private Sub mcRun_StepStart(cStepRecord As cStep, dtmStartTime As Currency, _
        lngInstanceId As Long, lParentInstanceId As Long, sPath As String, sIts As
String, sItValue As String)

    RaiseEvent StepStart(cStepRecord, dtmStartTime, lngInstanceId, sPath, sIts)
    'bugmessage "Step: " & cStepRecord.StepLabel & " has started."

    Call StepStartProcessing(cStepRecord, dtmStartTime, lngInstanceId,
lParentInstanceId, sItValue)

End Sub
```

CSEQUENCE.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cSequence"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cSequence.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This class uses the att_identifiers table to generate unique
'              identifiers.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mlngIdentifier As Long
Private mstrIdentifierColumn As String
Private mrecIdentifiers As Recordset
Private mdbsDatabase As Database

Private Const mstrEmptyString = ""

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cSequence."

Private Sub CreateIdRecord()
    ' Creates a record with all identifiers having an initial value of 1

    Dim sSql As String
    Dim pId As DAO.Parameter
    Dim qyId As DAO.QueryDef

    sSql = "insert into att_identifiers (" & _
           " workspace_id, parameter_id, step_id, " & _
           " constraint_id, run_id, connection_id ) values ( " & _
           "[w_id], [p_id], [s_id], [c_id], [r_id], [conn_id] )"
    Set qyId = mdbsDatabase.CreateQueryDef(gstrEmptyString, sSql)
    For Each pId In qyId.Parameters
       pId.Value = glMinId
    Next pId
    qyId.Execute dbFailOnError
    qyId.Close

End Sub
Private Sub CreateIdRecordset()

    Dim strSql As String

    ' Initialize the recordset with all identifiers
    strSql = "select * from att_identifiers"
    Set mrecIdentifiers = mdbsDatabase.OpenRecordset(strSql, dbOpenForwardOnly)

    If mrecIdentifiers.RecordCount = 0 Then
       CreateIdRecord
       Set mrecIdentifiers = mdbsDatabase.OpenRecordset(strSql,
dbOpenForwardOnly)
    End If

    BugAssert mrecIdentifiers.RecordCount <> 0

End Sub

Public Property Set IdDatabase(vdata As Database)

    Set mdbsDatabase = vdata

End Property

Public Property Let IdentifierColumn(vdata As String)
```

```
    Dim intIndex As Integer

    On Error GoTo IdentifierColumnErr

    ' Initialize the return value to an empty string
    mstrIdentifierColumn = mstrEmptyString
    Call CreateIdRecordset

    For intIndex = 0 To mrecIdentifiers.Fields.Count - 1

        If LCase(Trim(mrecIdentifiers.Fields(intIndex).Name)) = _
            LCase(Trim(vdata)) Then

            ' Valid column name
            mstrIdentifierColumn = vdata
            Exit Property
        End If

    Next intIndex

    BugAssert True, "Invalid column name!"

    Exit Property

IdentifierColumnErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "IdentifierColumn"
    On Error GoTo 0
    Err.Raise vbObjectError + errIdentifierColumnFailed, _
        mstrSource, _
        LoadResString(errIdentifierColumnFailed)

End Property
Public Property Get Identifier() As Long
    Dim strSql As String

    On Error GoTo GetIdentifierErr

    BugAssert mstrIdentifierColumn <> mstrEmptyString

    ' Increment the identifier column by 1
    strSql = "update att_identifiers " & _
        " set " & mstrIdentifierColumn & _
        " = " & mstrIdentifierColumn & " + 1"
    mdbsDatabase.Execute strSql, dbFailOnError

    ' Refresh the recordset with identifier values
    Call CreateIdRecordset

    mlngIdentifier = mrecIdentifiers.Fields(mstrIdentifierColumn).Value

    Identifier = mlngIdentifier

    Exit Property

GetIdentifierErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Identifier"
    On Error GoTo 0
    Err.Raise vbObjectError + errGetIdentifierFailed, _
        mstrSource, _
        LoadResString(errGetIdentifierFailed)

End Property
Private Sub Class_Terminate()

    mrecIdentifiers.Close

End Sub
```

cSTACK.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cStack"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cStack.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This class implements a stack of objects.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cStack."
Private mstrSource As String

Private mcVector As cVector
Private mlngCount As Long
Public Property Get Item(ByVal Position As Long) As Object
Attribute Item.VB_UserMemId = 0

    Set Item = mcVector(Position)

End Property

Public Sub Push(objToPush As Object)

    mcVector.Add objToPush

End Sub
Public Sub Clear()

    mcVector.Clear

End Sub

Public Function Pop() As Object

    If mcVector.Count > 0 Then
        Set Pop = mcVector.Delete(mcVector.Count - 1)
    Else
        Set Pop = Nothing
    End If

End Function
Public Function Count() As Long

    Count = mcVector.Count

End Function


Private Sub Class_Initialize()

    Set mcVector = New cVector

End Sub


Private Sub Class_Terminate()
```

```
    Set mcVector = Nothing

End Sub
```

cSTEP.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cStep"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
Attribute VB_Ext_KEY = "SavedWithClassBuilder" ,"Yes"
Attribute VB_Ext_KEY = "Top_Level" ,"Yes"
'  FILE:       cStep.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a step.
'              Contains functions to insert, update and delete
'              att_steps records from the database.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Local variable(s) to hold property value(s)
Private mlngStepId As Long
Private mstrVersionNo As String
Private mstrStepLabel As String
Private mstrStepTextFile As String
Private mstrStepText As String
Private mstrStartDir As String
Private mlngWorkspaceId As Integer
Private mlngParentStepId As Integer
Private mstrParentVersionNo As String
Private mintSequenceNo As Integer
Private mintStepLevel As Integer
Private mblnEnabledFlag As Boolean
Private mstrDegreeParallelism As String
Private mintExecutionMechanism As Integer
Private mstrFailureDetails As String
Private mintContinuationCriteria As Integer
Private mblnGlobalFlag As Boolean
Private mblnArchivedFlag As Boolean
Private mstrOutputFile As String
'Private mstrLogFile As String
Private mstrErrorFile As String
Private mdbsDatabase As Database
Private mintStepType As Integer
Private mintOperation As Operation
Private mlngPosition As Long
Private mstrIteratorName As String
Private mcIterators As cNodeCollections
Private mbIsNewVersion As Boolean
Private msOldVersion As String

' The following constants are used throughout the project to
' indicate the different options selected by the user
' The options are presented to the user as control arrays of
' option buttons. These constants have to be in sync with the
' indexes of the option buttons.
' All the control arrays have an lbound of 1. The value 0 is
' used to indicate that the property being represented by the
' control array is not valid for the step
' Public enums are used since we cannot expose public constants
' in class modules. gintNoOption is applicable to all enums,
' but declared in the Execution method enum, since we cannot
' declare it more than once.

' Is here as a comment
' Has been defined in public.bas with the other object types
'Public Enum gintStepType
'    gintGlobalStep = 3
'    gintManagerStep
'    gintWorkerStep
'End Enum

' Execution Method options
Public Enum ExecutionMethod
    gintNoOption = 0
    gintExecuteODBC
    gintExecuteShell
End Enum

' Failure criteria options
Public Enum FailureCriteria
    gintFailureODBC = 1
    gintFailureTextCompare
End Enum

' Continuation criteria options
' Note: Update the initialization of gsContCriteria in Initialize() if the
' continuation criteria are modified
Public Enum ContinuationCriteria
    gintOnFailureAbort = 1
    gintOnFailureContinue
    gintOnFailureCompleteSiblings
    gintOnFailureAbortSiblings
    gintOnFailureSkipSiblings
    gintOnFailureAsk
End Enum

' The initial version #
Private Const mstrMinVersion As String = "0.0"

' End of constants for option button control arrays
' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cStep."

' The cSequence class is used to generate unique step identifiers
Private mStepSeq As cSequence

' The StringSM class is used to carry out string operations
Private mFieldValue As cStringSM
Private Sub NewVersion()

mbIsNewVersion = True
msOldVersion = mstrVersionNo

End Sub
Public Function IsNewVersion() As Boolean
    IsNewVersion = mbIsNewVersion
End Function

Public Function OldVersionNo() As String
    OldVersionNo = msOldVersion
End Function

Public Sub SaveIterators()
    ' This procedure checks if any changes have been made
    ' to the iterators for the step. If so, it calls the
    ' methods of the iterator class to commit the changes
    Dim cItRec As cIterator
    Dim lngIndex As Long
```

```
    On Error GoTo SaveIteratorsErr

    For lngIndex = 0 To mcIterators.Count - 1
        Set cItRec = mcIterators(lngIndex)

        Select Case cItRec.IndOperation
            Case QueryOp
                ' No changes were made to the queried Step.
                ' Do nothing

            Case InsertOp
                cItRec.Add mlngStepId, mstrVersionNo
                cItRec.IndOperation = QueryOp

            Case UpdateOp
                cItRec.Update mlngStepId, mstrVersionNo
                cItRec.IndOperation = QueryOp

            Case DeleteOp
                cItRec.Delete mlngStepId, mstrVersionNo
                ' Remove the record from the collection
                mcIterators.Delete lngIndex

        End Select
    Next lngIndex

    Exit Sub

SaveIteratorsErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "SaveIterators"
    On Error GoTo 0
    Err.Raise vbObjectError + errSaveFailed, _
          mstrSource, _
          LoadResString(errSaveFailed)

End Sub
Public Property Get IndOperation() As Operation

    IndOperation = mintOperation

End Property
Public Property Let IndOperation(ByVal vdata As Operation)

    BugAssert vdata = QueryOp Or vdata = InsertOp Or vdata = UpdateOp Or vdata =
DeleteOp, "Invalid operation"
    mintOperation = vdata

End Property

Public Function Iterators() As Variant
    ' Returns a variant containing all the iterators that
    ' have been defined for the step

    Dim cStepIterators() As cIterator
    Dim cTempIt As cIterator
    Dim lngIndex As Long
    Dim lngItCount As Long

    On Error GoTo IteratorsErr

    lngItCount = 0
    For lngIndex = 0 To mcIterators.Count - 1
        ' Increase the array dimension and add the constraint
        ' to it
        Set cTempIt = mcIterators(lngIndex)

        If cTempIt.IndOperation <> DeleteOp Then
            ReDim Preserve cStepIterators(lngItCount)
            Set cStepIterators(lngItCount) = cTempIt
            lngItCount = lngItCount + 1
        End If

    Next lngIndex

    If lngItCount = 0 Then
        Iterators = Empty
    Else
        Iterators = cStepIterators()
    End If

    Call QuickSort(Iterators)

    Exit Function

IteratorsErr:
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errIteratorsFailed, _
          mstrModuleName & "Iterators", _
          LoadResString(errIteratorsFailed)

End Function
Public Function IteratorCount() As Long
    ' Returns a count of all the iterators for the step

    Dim lngItCount As Long
    Dim lngIndex As Long
    Dim cTempIt As cIterator

    On Error GoTo IteratorsErr

    lngItCount = 0
    For lngIndex = 0 To mcIterators.Count - 1

        If mcIterators(lngIndex).IndOperation <> DeleteOp Then
            lngItCount = lngItCount + 1
        End If

    Next lngIndex

    IteratorCount = lngItCount

    Exit Function

IteratorsErr:
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errIteratorsFailed, _
          mstrSource, _
          LoadResString(errIteratorsFailed)

End Function
Public Sub Validate()
    ' Each distinct object will have a Validate method which
    ' will check if the class properties are valid. This method
    ' will be used to check interdependant properties that
    ' cannot be validated by the let procedures.
    ' It should be called by the add and modify methods of the class

    ' Check if the step label has been specified
    If StringEmpty(mstrStepLabel) Then
        ShowError errStepLabelMandatory
        On Error GoTo 0
        Err.Raise vbObjectError + errValidateFailed, _
              "Validate", LoadResString(errValidateFailed)
    End If

    If Not IsStringEmpty(mstrStepText) And Not IsStringEmpty(mstrStepTextFile) Then
        ShowError errStepTextOrFile
        On Error GoTo 0
        Err.Raise vbObjectError + errStepTextOrFile, _
```

```
        "Validate", LoadResString(errStepTextOrFile)
    End If

End Sub

Public Function IncVersionY() As String
    ' The version number for a step is stored in the x.y
    ' format where x is the parent component and y is the
    ' child component of the step. This function will increment
    ' the y component of the step by 1

    On Error GoTo IncVersionYErr

    ' Store the old version number for the step
    Call NewVersion

    mstrVersionNo = Trim$(Str$(GetX(mstrVersionNo))) & gstrVerSeparator & _
        Trim$(Str(GetY(mstrVersionNo) + 1))
    IncVersionY = mstrVersionNo

    Exit Function

IncVersionYErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "IncVersionY"
    On Error GoTo 0
    Err.Raise vbObjectError + errIncVersionYFailed, _
        gstrSource, _
        LoadResString(errIncVersionYFailed)

End Function
Public Function IncVersionX() As String
    ' The version number for a step is stored in the x.y
    ' format where x is the parent component and y is the
    ' child component of the step. This function will increment
    ' the y component of the step by 1 and reset the x component
    ' to 0

    On Error GoTo IncVersionXErr

    ' Store the old version number for the step
    Call NewVersion

    mstrVersionNo = Trim$(Str$(GetX(mstrVersionNo) + 1)) & gstrVerSeparator & "0"
    IncVersionX = mstrVersionNo

    Exit Function

IncVersionXErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "IncVersionX"
    On Error GoTo 0
    Err.Raise vbObjectError + errIncVersionXFailed, _
        gstrSource, _
        LoadResString(errIncVersionXFailed)

End Function


Private Function GetY(strVersion As String) As Long
    ' The version number for a step is stored in the x.y
    ' format where x is the parent component and y is the
    ' child component of the step. Given an argument of type
    ' x.y, it returns y

    ' Truncate the fractional part to get the parent component
    ' of the version number (x.y)
    GetY = Val(Mid(strVersion, InStr(strVersion, gstrVerSeparator) + 1))
End Function
Private Function GetX(strVersion As String) As Long
    ' The version number for a step is stored in the x.y
    ' format where x is the parent component and y is the
    ' child component of the step. Given an argument of type
    ' x.y, it returns x

    ' Truncate the fractional part to get the parent component
    ' of the version number (x.y)
    GetX = Val(Left(strVersion, InStr(strVersion, gstrVerSeparator) - 1))

End Function

Public Function Clone(Optional cCloneStep As cStep) As cStep

    ' Creates a copy of a given step

    Dim lngIndex As Long
    Dim cItRec As cIterator
    Dim cItClone As cIterator

    On Error GoTo CloneErr

    If cCloneStep Is Nothing Then
        Set cCloneStep = New cStep
    End If

    ' Copy all the step properties to the newly created step
    ' Initialize the global flag first since subsequent
    ' validations might depend on it
    cCloneStep.GlobalFlag = mblnGlobalFlag
'   cCloneStep.GlobalRunMethod = mintGlobalRunMethod

    cCloneStep.StepType = mintStepType
    cCloneStep.StepId = mlngStepId
    cCloneStep.VersionNo = mstrVersionNo
    cCloneStep.StepLabel = mstrStepLabel
    cCloneStep.StepTextFile = mstrStepTextFile
    cCloneStep.StepText = mstrStepText
    cCloneStep.StartDir = mstrStartDir
    cCloneStep.WorkspaceId = mlngWorkspaceId
    cCloneStep.ParentStepId = mlngParentStepId
    cCloneStep.ParentVersionNo = mstrParentVersionNo
    cCloneStep.StepLevel = mintStepLevel
    cCloneStep.SequenceNo = mintSequenceNo
    cCloneStep.EnabledFlag = mblnEnabledFlag
    cCloneStep.DegreeParallelism = mstrDegreeParallelism
    cCloneStep.ExecutionMechanism = mintExecutionMechanism
    cCloneStep.FailureDetails = mstrFailureDetails
    cCloneStep.ContinuationCriteria = mintContinuationCriteria
    cCloneStep.ArchivedFlag = mblnArchivedFlag
    cCloneStep.OutputFile = mstrOutputFile
'   cCloneStep.LogFile = mstrLogFile
    cCloneStep.ErrorFile = mstrErrorFile
    cCloneStep.IteratorName = mstrIteratorName

    cCloneStep.IndOperation = mintOperation
    cCloneStep.Position = mlngPosition

    Set cCloneStep.NodeDB = mdbsDatabase

    ' Clone all the iterators for the step
    For lngIndex = 0 To mcIterators.Count - 1
        Set cItRec = mcIterators(lngIndex)
        Set cItClone = cItRec.Clone
        cCloneStep.LoadIterator cItClone
    Next lngIndex

    ' And set the return value to the newly created step
    Set Clone = cCloneStep
```

```
    Exit Function

CloneErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Clone"
    On Error GoTo 0
    Err.Raise vbObjectError + errCloneFailed, _
          mstrSource, LoadResString(errCloneFailed)

End Function
'End Sub
'
Public Property Let OutputFile(ByVal vdata As String)

    mstrOutputFile = vdata

End Property

Public Property Get OutputFile() As String

    OutputFile = mstrOutputFile

End Property

'Public Property Let LogFile(ByVal vdata As String)
'
'    mstrLogFile = vdata
'
'End Property
'
'Public Property Get LogFile() As String
'
'    LogFile = mstrLogFile
'
'End Property

Public Property Let ErrorFile(ByVal vdata As String)

    mstrErrorFile = vdata

End Property
Public Property Let IteratorName(ByVal vdata As String)

    mstrIteratorName = vdata

End Property

Public Property Get ErrorFile() As String

    ErrorFile = mstrErrorFile

End Property
Public Property Get IteratorName() As String

    IteratorName = mstrIteratorName

End Property

Public Property Set NodeDB(vdata As Database)

    Set mdbsDatabase = vdata
    Set mcIterators.NodeDB = vdata

End Property
Public Property Get NodeDB() As Database

    Set NodeDB = mdbsDatabase

End Property

Private Function IsStringEmpty(strToCheck As String) As Boolean

    IsStringEmpty = (strToCheck = gstrEmptyString)

End Function

Public Property Let EnabledFlag(ByVal vdata As Boolean)

    ' The enabled flag must be False for all global steps.
    ' This check must be made by the global step class. Only
    ' generic step validations will be carried out by this
    ' class
    mblnEnabledFlag = vdata

End Property

Public Property Let GlobalFlag(ByVal vdata As Boolean)

    mblnGlobalFlag = vdata

End Property
Public Property Get EnabledFlag() As Boolean

    EnabledFlag = mblnEnabledFlag

End Property

Public Property Let ArchivedFlag(ByVal vdata As Boolean)

    mblnArchivedFlag = vdata

End Property

Public Property Get ArchivedFlag() As Boolean

    ArchivedFlag = mblnArchivedFlag

End Property

Public Property Get GlobalFlag() As Boolean

    GlobalFlag = mblnGlobalFlag

End Property

Public Sub Add()
    ' Inserts a step record into the database - it initializes
    ' the necessary properties for the step and calls InsertStepRec
    ' to do the database work

    On Error GoTo AddErr

    ' A new record would have the deleted_flag turned off!
    mblnArchivedFlag = False

    Call InsertStepRec

    ' If a new version of a step has been created, reset the old version info, since
    ' it's already been saved to the db
    If IsNewVersion() Then
        mbIsNewVersion = False
        msOldVersion = gstrEmptyString
    End If

    Exit Sub

AddErr:
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errAddStepFailed, _
          mstrModuleName & "Add", LoadResString(errAddStepFailed)
End Sub
```

```
Private Sub InsertStepRec()
    ' Inserts a step record into the database
    ' It first generates the insert statement using the different
    ' step properties and then executes it

    Dim strInsert As String
    Dim qy As DAO.QueryDef

    On Error GoTo InsertStepRecErr

    ' First check if the database object is valid
    Call CheckDB

    ' Check if the step record is valid
    Call Validate

    If IsNewVersion() Then
        Call UpdOldVersionsArchFlg
    End If

    ' Create a temporary querydef object
    strInsert = "insert into att_steps " & _
        "( workspace_id, step_id, version_no, " & _
        " step_label, step_file_name, step_text, start_directory, " & _
        " parent_step_id, parent_version_no, sequence_no, " & _
        " enabled_flag, step_level, " & _
        " degree_parallelism, execution_mechanism, " & _
        " failure_details, " & _
        " continuation_criteria, global_flag, " & _
        " archived_flag, " & _
        " output_file_name, error_file_name, " & _
        " iterator_name ) values ( "

    ' log_file_name,

#If USE_JET Then

    strInsert = strInsert & " [w_id], [s_id], [ver_no], " & _
        " [s_label], [s_file_name], [s_text], [s_start_dir], " & _
        " [p_step_id], [p_version_no], [seq_no], " & _
        " [enabled], [s_level], [deg_parallelism], " & _
        " [exec_mechanism], [fail_dtls], " & _
        " [cont_criteria], [global], [archived], " & _
        " [output_file], [error_file], " & _
        " [it_name] ) "

    ' [log_file],

    Set qy = mdbsDatabase.CreateQueryDef(gstrEmptyString, strInsert)

    ' Call a procedure to execute the Querydef object
    Call AssignParameters(qy)

    qy.Execute dbFailOnError
    qy.Close
#Else

        strInsert = strInsert & Str(mlngWorkspaceId) & ", " & Str(mlngStepId) & _
        ", " & mFieldValue.MakeStringFieldValid(mstrVersionNo)

    ' For fields that may be null, call a function to determine
    ' the string to be appended to the insert statement
    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrStepLabel)
    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrStepTextFile)
    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrStepText)
    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrStartDir)

    strInsert = strInsert & ", " & Str(mlngParentStepId) & _
        ", " & mFieldValue.MakeStringFieldValid(mstrParentVersionNo) & _
        ", " & Str(mintSequenceNo) & _
        ", " & Str(mblnEnabledFlag) & ", " & Str(mintStepLevel)
    strInsert = strInsert & ", " &
mFieldValue.MakeStringFieldValid(mstrDegreeParallelism)
    strInsert = strInsert & ", " & Str(mintExecutionMechanism)

    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrFailureDetails) &
_
        ", " & Str(mintContinuationCriteria) & _
        ", " & Str(mblnGlobalFlag) & _
        ", " & Str(mblnArchivedFlag)

    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrOutputFile)
'    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrLogFile)
    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrErrorFile)
    strInsert = strInsert & ", " & mFieldValue.MakeStringFieldValid(mstrIteratorName)

    strInsert = strInsert & " ) "

    BugMessage strInsert
    mdbsDatabase.Execute strInsert, dbFailOnError

#End If

    Exit Sub

InsertStepRecErr:
    mstrSource = mstrModuleName & "InsertStepRec"
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errInsertStepFailed, _
          mstrSource, LoadResString(errInsertStepFailed)
End Sub
Private Sub UpdOldVersionsArchFlg()
    ' Updates the archived flag on all old version for the step to True

    Dim sUpdate As String
    Dim qy As DAO.QueryDef

    On Error GoTo UpdOldVersionsArchFlgErr
    mstrSource = mstrModuleName & "UpdOldVersionsArchFlg"

#If USE_JET Then

    sUpdate = "update att_steps " & _
        " set archived_flag = True "

    ' Append the Where clause
    sUpdate = sUpdate & " where step_id = [s_id] " & _
        " and version_no <> [ver_no]"

    Set qy = mdbsDatabase.CreateQueryDef(gstrEmptyString, sUpdate)

    ' Call a procedure to execute the Querydef object
    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    If qy.RecordsAffected = 0 Then
        On Error GoTo 0
        Err.Raise vbObjectError + errModifyStepFailed, _
              mstrSource, LoadResString(errModifyStepFailed)
    End If

    qy.Close

#Else

    sUpdate = "update att_steps " & _
        " set archived_flag = True "

    sUpdate = sUpdate & " where step_id = " & Str(mlngStepId) & _
        " and version_no <> " & mFieldValue.MakeStringFieldValid(mstrVersionNo)
```

```
    BugMessage sUpdate
    mdbsDatabase.Execute sUpdate, dbFailOnError
#End If

    Exit Sub

UpdOldVersionsArchFlgErr:
    mstrSource = mstrModuleName & "UpdOldVersionsArchFlg"
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errModifyStepFailed, _
          mstrSource, LoadResString(errModifyStepFailed)
End Sub
Public Sub InsertIterator(cItRecord As cIterator)
    ' Inserts the iterator record into the database

    Call cItRecord.Add(mlngStepId, mstrVersionNo)

End Sub
Public Sub UpdateIterator(cItRecord As cIterator)
    ' Updates the iterator record in the database

    Call cItRecord.Update(mlngStepId, mstrVersionNo)

End Sub
Public Sub UpdateIteratorVersion()
    ' Updates the iterator record in the database

    Dim lngIndex As Long
    Dim cTempIt As cIterator

    On Error GoTo UpdateIteratorVersionErr

    For lngIndex = 0 To mcIterators.Count - 1
        ' Increase the array dimension and add the constraint
        ' to it
        Set cTempIt = mcIterators(lngIndex)

        If cTempIt.IndOperation <> DeleteOp Then
            ' Set the operation to indicate an insert
            cTempIt.IndOperation = InsertOp
        End If

    Next lngIndex

    Exit Sub

UpdateIteratorVersionErr:
    mstrSource = mstrModuleName & "UpdateIteratorVersion"
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errUpdateFailed, _
          mstrSource, LoadResString(errUpdateFailed)

End Sub
Public Sub AddIterator(cItRecord As cIterator)
    ' Adds the iterator record to the collection of iterators
    ' for the step

    Call mcIterators.Add(cItRecord)

End Sub
Public Sub LoadIterator(cItRecord As cIterator)
    ' Adds the iterator record to the collection of iterators
    ' for the step

    Call mcIterators.Load(cItRecord)

End Sub
Public Sub UnloadIterators()
    ' Unloads all iterator records for the step

    Dim lngIndex As Long

    For lngIndex = mcIterators.Count - 1 To 0 Step -1
        ' Calls the collection method to unload the node
        ' from the array
        mcIterators.Unload lngIndex
    Next lngIndex

End Sub
Public Sub ModifyIterator(cItRecord As cIterator)
    ' Modifies the iterator record in the collection

    Call mcIterators.Modify(cItRecord)

End Sub
Public Sub DeleteIterator(cItRecord As cIterator)
    ' Deletes the iterator record from the database

    Call cItRecord.Delete(mlngStepId, mstrVersionNo)

End Sub
Public Sub RemoveIterator(cItRecord As cIterator)
    ' Marks the iterator record in the collection to
    ' indicate a delete

    Call mcIterators.Delete(cItRecord.Position)

End Sub


Private Sub AssignParameters(qyExec As DAO.QueryDef)
    ' Assigns values to the parameters in the querydef object
    ' The parameter names are cryptic to make them different
    ' from the actual field names. When the parameter names
    ' are the same as the field names, parameters in the
    ' where clause do not get created.

    Dim prmParam As DAO.Parameter

    On Error GoTo AssignParametersErr
    mstrSource = mstrModuleName & "AssignParameters"

    For Each prmParam In qyExec.Parameters
        Select Case prmParam.Name
            Case "[w_id]"
                prmParam.Value = mlngWorkspaceId
            Case "[s_id]"
                prmParam.Value = mlngStepId
            Case "[ver_no]"
                prmParam.Value = mstrVersionNo
            Case "[s_label]"
                prmParam.Value = mstrStepLabel
            Case "[s_file_name]"
                prmParam.Value = mstrStepTextFile
            Case "[s_text]"
                prmParam.Value = mstrStepText
            Case "[s_start_dir]"
                prmParam.Value = mstrStartDir
            Case "[p_step_id]"
                prmParam.Value = mlngParentStepId
            Case "[p_version_no]"
                prmParam.Value = mstrParentVersionNo
            Case "[seq_no]"
                prmParam.Value = mintSequenceNo
            Case "[enabled]"
                prmParam.Value = mblnEnabledFlag
            Case "[s_level]"
                prmParam.Value = mintStepLevel
            Case "[deg_parallelism]"
```

```
            prmParam.Value = mstrDegreeParallelism
        Case "[exec_mechanism]"
            prmParam.Value = mintExecutionMechanism
        Case "[fail_dtls]"
            prmParam.Value = mstrFailureDetails
        Case "[cont_criteria]"
            prmParam.Value = mintContinuationCriteria
        Case "[global]"
            prmParam.Value = mblnGlobalFlag
        Case "[archived]"
            prmParam.Value = mblnArchivedFlag
        Case "[output_file]"
            prmParam.Value = mstrOutputFile
'       Case "[log_file]"
'           prmParam.Value = mstrLogFile
        Case "[error_file]"
            prmParam.Value = mstrErrorFile
        Case "[it_name]"
            prmParam.Value = mstrIteratorName
        Case Else
            ' Write the parameter name that is faulty
            WriteError errInvalidParameter, mstrSource, _
                prmParam.Name
            On Error GoTo 0
            Err.Raise errInvalidParameter, mstrSource, _
                LoadResString(errInvalidParameter)
    End Select
  Next prmParam

  If qyExec.Parameters("s_id") = 0 Or StringEmpty(qyExec.Parameters("ver_no"))
Then
    WriteError errInvalidParameter, mstrSource
    On Error GoTo 0
    Err.Raise errInvalidParameter, mstrSource, LoadResString(errInvalidParameter)
  End If

  Exit Sub

AssignParametersErr:

  mstrSource = mstrModuleName & "AssignParameters"
  Call LogErrors(Errors)
  On Error GoTo 0
  Err.Raise vbObjectError + errAssignParametersFailed, _
    mstrSource, LoadResString(errAssignParametersFailed)

End Sub

Public Sub Modify()

  Dim strUpdate As String
  Dim qy As QueryDef

  On Error GoTo ModifyErr
  mstrSource = mstrModuleName & "Modify"

  ' Check if the database object is valid
  Call CheckDB

  ' Check if the step record is valid
  Call Validate

  ' The step_id and version_no will never be updated -
  ' whenever a step is modified a copy of the old step will
  ' be created with an incremented version_no

#If USE_JET Then

  strUpdate = "update att_steps " & _
    " set step_label = [s_label] " & _
    " , step_file_name = [s_file_name] " & _
    " , step_text = [s_text] " & _
    " , start_directory = [s_start_dir] " & _
    " , workspace_id = [w_id] " & _
    " , parent_step_id = [p_step_id] " & _
    " , parent_version_no = [p_version_no] " & _
    " , sequence_no = [seq_no] " & _
    " , step_level = [s_level] " & _
    " , enabled_flag = [enabled] " & _
    " , degree_parallelism = [deg_parallelism] " & _
    " , execution_mechanism = [exec_mechanism] " & _
    " , failure_details = [fail_dtls] " & _
    " , continuation_criteria = [cont_criteria] " & _
    " , global_flag = [global] " & _
    " , archived_flag = [archived] " & _
    " , output_file_name = [output_file] " & _
    " , error_file_name = [error_file] " & _
    " , iterator_name = [it_name] "

    ' " , log_file_name = [log_file] " & _

  ' Append the Where clause
  strUpdate = strUpdate & " where step_id = [s_id] " & _
    " and version_no = [ver_no]"

  Set qy = mdbsDatabase.CreateQueryDef(gstrEmptyString, strUpdate)

  ' Call a procedure to execute the Querydef object
  Call AssignParameters(qy)
  qy.Execute dbFailOnError

  If qy.RecordsAffected = 0 Then
    On Error GoTo 0
    Err.Raise vbObjectError + errModifyStepFailed, _
      mstrSource, LoadResString(errModifyStepFailed)
  End If

  qy.Close

#Else

  strUpdate = "update att_steps " & _
    " set step_label = "

  ' For fields that may be null, call a function to determine
  ' the string to be appended to the update statement
  strUpdate = strUpdate & mFieldValue.MakeStringFieldValid(mstrStepLabel)

  strUpdate = strUpdate & " , step_file_name = " &
mFieldValue.MakeStringFieldValid(mstrStepTextFile)
  strUpdate = strUpdate & " , step_text = " &
mFieldValue.MakeStringFieldValid(mstrStepText)
  strUpdate = strUpdate & " , start_directory = " &
mFieldValue.MakeStringFieldValid(mstrStartDir)

  strUpdate = strUpdate & " , workspace_id = " & Str(mlngWorkspaceId) & _
    " , parent_step_id = " & Str(mlngParentStepId) & _
    " , parent_version_no = " &
mFieldValue.MakeStringFieldValid(mstrParentVersionNo) & _
    " , sequence_no = " & Str(mintSequenceNo) & _
    " , step_level = " & Str(mintStepLevel) & _
    " , enabled_flag = " & Str(mblnEnabledFlag) & _
    " , degree_parallelism = " &
mFieldValue.MakeStringFieldValid(mstrDegreeParallelism) & _
    " , execution_mechanism = " & Str(mintExecutionMechanism) & _
    " , failure_details = " & mFieldValue.MakeStringFieldValid(mstrFailureDetails) & _
    " , continuation_criteria = " & Str(mintContinuationCriteria) & _
    " , global_flag = " & Str(mblnGlobalFlag) & _
    " , archived_flag = " & Str(mblnArchivedFlag) & _
    " , output_file_name = " & mFieldValue.MakeStringFieldValid(mstrOutputFile) & _
    " , error_file_name = " & mFieldValue.MakeStringFieldValid(mstrErrorFile) & _
    " , iterator_name = " & mFieldValue.MakeStringFieldValid(mstrIteratorName)
```

```
'       " , log_file_name = " & mFieldValue.MakeStringFieldValid(mstrLogFile) & _

    strUpdate = strUpdate & " where step_id = " & Str(mlngStepId) & _
        " and version_no = " & mFieldValue.MakeStringFieldValid(mstrVersionNo)

    BugMessage strUpdate
    mdbsDatabase.Execute strUpdate, dbFailOnError
#End If

    Exit Sub

ModifyErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Modify"
    On Error GoTo 0
    Err.Raise vbObjectError + errModifyStepFailed, _
          mstrSource, LoadResString(errModifyStepFailed)
End Sub
Private Sub CheckDB()
    ' Check if the database object has been initialized

    If mdbsDatabase Is Nothing Then
        ShowError errInvalidDB
        On Error GoTo 0
        Err.Raise vbObjectError + errInvalidDB, _
            mstrModuleName, LoadResString(errInvalidDB)
    End If

End Sub

Public Sub Delete()

    Dim strDelete As String
    Dim qy As DAO.QueryDef

    On Error GoTo DeleteErr

    Call CheckDB

    strDelete = "delete from att_steps " & _
          " where step_id = [s_id] " & _
          " and version_no = [ver_no] "
'    mdbsDatabase.Execute strDelete, dbFailOnError
    Set qy = mdbsDatabase.CreateQueryDef(gstrEmptyString, strDelete)

    Call AssignParameters(qy)
    qy.Execute dbFailOnError

    qy.Close

    Exit Sub

DeleteErr:
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errDeleteStepFailed, _
          mstrModuleName & "Delete", LoadResString(errDeleteStepFailed)
End Sub
Public Property Get DegreeParallelism() As String

    DegreeParallelism = mstrDegreeParallelism

End Property
Public Property Get Position() As Long

    Position = mlngPosition

End Property

Public Property Let DegreeParallelism(ByVal vdata As String)
    ' The degree of parallelism must be zero for all global steps
    ' This check must be made by the global step class. Only
    ' generic step validations will be carried out by this
    ' class
    mstrDegreeParallelism = vdata

End Property

Public Property Let ExecutionMechanism(ByVal vdata As ExecutionMethod)

    BugAssert vdata = gintExecuteODBC Or vdata = gintExecuteShell Or vdata =
gintNoOption, _
          "Execution mechanism invalid"
    mintExecutionMechanism = vdata

End Property

Public Property Let FailureDetails(ByVal vdata As String)

    mstrFailureDetails = vdata

End Property
Public Property Let SequenceNo(ByVal vdata As Integer)
    mintSequenceNo = vdata
End Property

Public Property Let Position(ByVal vdata As Long)
    mlngPosition = vdata
End Property

Public Property Let ParentStepId(ByVal vdata As Long)
    mlngParentStepId = vdata
End Property

Public Property Get SequenceNo() As Integer

    SequenceNo = mintSequenceNo

End Property

Public Property Get StepLevel() As Integer
    StepLevel = mintStepLevel
End Property

Public Property Get ParentVersionNo() As String
    ParentVersionNo = mstrParentVersionNo
End Property

Public Property Let ParentVersionNo(ByVal vdata As String)
    mstrParentVersionNo = vdata
End Property

Public Property Get ParentStepId() As Long
    ParentStepId = mlngParentStepId
End Property

Public Property Let WorkspaceId(ByVal vdata As Long)
    mlngWorkspaceId = vdata
End Property

Public Property Let VersionNo(ByVal vdata As String)
    ' The version number of a step is stored in the x.y format where
    ' x represents a change to the step as a result of modifications
    ' to any of the step properties
    ' y represents a change to the step as a result of modifications
    ' to the sub-steps associated with it. Hence the y-component
    ' of the version will be incremented when a sub-step is added,
    ' modified or deleted
    ' x will be referred to throughout this code as the parent
    ' component of the version and y will be referred to as the
```

```
    ' child component of the version
    ' The version information for a step is maintained by the
    ' calling function

    mstrVersionNo = vdata

End Property

Public Property Get StepType() As gintStepType

    On Error GoTo StepTypeErr

    If mintStepType = 0 Then
        ' The step type variable has not been initialized -
        If mblnGlobalFlag Then
            mintStepType = gintGlobalStep
        ElseIf IsStringEmpty(mstrStepText) And _
                IsStringEmpty(mstrStepTextFile) Then
            mintStepType = gintManagerStep
        Else
            mintStepType = gintWorkerStep
        End If
    End If

    StepType = mintStepType

    Exit Property

StepTypeErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "StepType"
    On Error GoTo 0
    Err.Raise vbObjectError + errGetStepTypeFailed, _
            mstrSource, _
            LoadResString(errGetStepTypeFailed)

End Property

Public Property Let StepType(vdata As gintStepType)

    On Error GoTo StepTypeErr

    Select Case vdata
        Case gintGlobalStep, gintManagerStep, gintWorkerStep
            mintStepType = vdata

        Case Else
            On Error GoTo 0
            Err.Raise vbObjectError + errStepTypeInvalid, _
                    mstrModuleName & "StepType", LoadResString(errStepTypeInvalid)
    End Select
    Exit Property

StepTypeErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "StepType"
    On Error GoTo 0
    Err.Raise vbObjectError + errLetStepTypeFailed, _
            mstrSource, _
            LoadResString(errLetStepTypeFailed)

End Property

Public Property Get WorkspaceId() As Long
    WorkspaceId = mlngWorkspaceId
End Property

Public Property Get ContinuationCriteria() As ContinuationCriteria

    ContinuationCriteria = mintContinuationCriteria

End Property

Public Property Let ContinuationCriteria(ByVal vdata As ContinuationCriteria)

    ' The Continuation criteria must be null for all global steps
    ' and non-null for all manager and worker steps
    ' These checks will have to be made by the corresponding
    ' classes - only generic step validations will be made
    ' by this class
    BugAssert vdata = gintOnFailureAbortSiblings Or vdata =
gintOnFailureCompleteSiblings _
            Or vdata = gintOnFailureSkipSiblings Or vdata = gintOnFailureAbort _
            Or vdata = gintOnFailureContinue Or vdata = gintOnFailureAsk _
            Or vdata = gintNoOption, _
            "Invalid continuation criteria"
    mintContinuationCriteria = vdata

End Property
Public Property Get ExecutionMechanism() As ExecutionMethod

    ExecutionMechanism = mintExecutionMechanism

End Property


Public Property Get FailureDetails() As String

    FailureDetails = mstrFailureDetails

End Property

Public Property Let StepText(ByVal vdata As String)
    ' Has to be null for manager steps
    ' The check will have to be made by the user interface or
    ' by the manager step class
    mstrStepText = vdata
End Property
Public Property Let StepLevel(ByVal vdata As Integer)

    ' The step level must be zero for all global steps
    ' This check must be made in the global step class
    mintStepLevel = vdata

End Property
Public Property Get StepText() As String
    StepText = mstrStepText
End Property

Public Property Let StepTextFile(ByVal vdata As String)
    ' Has to be null for manager steps
    ' The check will have to be made by the user interface and
    ' by the manager step class
    mstrStepTextFile = vdata
End Property

Public Property Get StepTextFile() As String
    StepTextFile = mstrStepTextFile
End Property

Public Property Let StepLabel(ByVal vdata As String)
    ' Cannot be null for manager steps
    ' But this check cannot be made here since we do not know
    ' at this point if the step being created is a manager
    ' or a worker step
    ' The check will have to be made by the user interface and
    ' by the manager step class
    mstrStepLabel = vdata
End Property

Public Property Get StepLabel() As String
    StepLabel = mstrStepLabel
```

```
End Property

Public Property Let StartDir(ByVal vdata As String)
   mstrStartDir = vdata
End Property

Public Property Get StartDir() As String
   StartDir = mstrStartDir
End Property

Public Property Get VersionNo() As String
   ' The version number of a step is stored in the x.y format where
   ' x represents a change to the step as a result of modifications
   ' to any of the step properties
   ' y represents a change to the step as a result of modifications
   ' to the sub-steps associated with it. Hence the y-component
   ' of the version will be incremented when a sub-step is added,
   ' modified or deleted
   ' x will be referred to throughout this code as the parent
   ' component of the version and y will be referred to as the
   ' child component of the version
   ' The version information for a step is maintained by the
   ' calling function

   VersionNo = mstrVersionNo

End Property

Public Property Get StepId() As Long

   StepId = mlngStepId

End Property
Public Property Get NextStepId() As Long

   Dim lngNextId As Long

   On Error GoTo NextStepIdErr

   ' First check if the database object is valid
   Call CheckDB

   ' Retrieve the next identifier using the sequence class
   Set mStepSeq = New cSequence
   Set mStepSeq.IdDatabase = mdbsDatabase
   mStepSeq.IdentifierColumn = "step_id"
   lngNextId = mStepSeq.Identifier
   Set mStepSeq = Nothing

   NextStepId = lngNextId
   Exit Property

NextStepIdErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "NextStepId"
   On Error GoTo 0
   Err.Raise vbObjectError + errStepIdGetFailed, _
      mstrSource, LoadResString(errStepIdGetFailed)

End Property
Public Property Let StepId(ByVal vdata As Long)

   mlngStepId = vdata

End Property

Private Sub Class_Initialize()

   ' Initialize the operation indicator variable to Query
   ' It will be modified later by the collection class when
   ' inserts, updates or deletes are performed
   mintOperation = QueryOp
   mbIsNewVersion = False
   msOldVersion = gstrEmptyString

   Set mFieldValue = New cStringSM
   Set mcIterators = New cNodeCollections

End Sub

Private Sub Class_Terminate()

   Set mFieldValue = Nothing
   Set mcIterators = Nothing

End Sub
```

cStepTree.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cStepTree"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cStepTree.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Implements step navigation functions such as determining
'              the child of a step and so on.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cStepTree."
Private mstrSource As String

Public StepRecords As cArrSteps
Public Property Get HasChild(Optional ByVal StepKey As String, _
      Optional ByVal StepId As Long = 0) As Boolean

   Dim lTemp As Long

   HasChild = False
   StepId = GetStepId(StepKey, StepId)

   For lTemp = 0 To StepRecords.StepCount - 1
      If StepRecords(lTemp).StepType <> gintGlobalStep And
StepRecords(lTemp).ParentStepId = StepId Then
         HasChild = True
         Exit For
      End If
   Next lTemp

End Property
Public Property Get ChildStep(Optional ByVal StepKey As String, _
      Optional ByVal StepId As Long = 0) As cStep

   Dim lTemp As Long

   Set ChildStep = Nothing
   StepId = GetStepId(StepKey, StepId)

   For lTemp = 0 To StepRecords.StepCount - 1
```

```
      If StepRecords(lTemp).StepType <> gintGlobalStep And
StepRecords(lTemp).ParentStepId = StepId And _
            StepRecords(lTemp).SequenceNo = gintMinSequenceNo Then
         Set ChildStep = StepRecords(lTemp)
         Exit For
      End If
   Next lTemp

End Property
Public Property Get NextStep(Optional ByVal StepKey As String, _
      Optional ByVal StepId As Long = 0) As cStep

   Dim lTemp As Long
   Dim cChildStep As cStep

   Set NextStep = Nothing
   StepId = GetStepId(StepKey, StepId)
   Set cChildStep = StepRecords.QueryStep(StepId)

   For lTemp = 0 To StepRecords.StepCount - 1
      If StepRecords(lTemp).StepType <> gintGlobalStep And _
            StepRecords(lTemp).ParentStepId = cChildStep.ParentStepId And _
            StepRecords(lTemp).SequenceNo = cChildStep.SequenceNo + 1 Then
         Set NextStep = StepRecords(lTemp)
         Exit For
      End If
   Next lTemp

End Property
Private Function GetStepId(Optional ByVal StepKey As String, _
      Optional ByVal StepId As Long = 0) As Long
   If StepId = 0 Then
      If StringEmpty(StepKey) Then
         Err.Raise vbObjectError + errMandatoryParameterMissing, _
               mstrModuleName & "GetStepId",
LoadResString(errMandatoryParameterMissing)
      Else
         GetStepId = IIf(IsLabel(StepKey), 0, MakeIdentifierValid(StepKey))
      End If
   Else
      GetStepId = StepId
   End If
End Function
```

cStringSM.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cStringSM"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cStringSM.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This module contains common procedures that can be used
'              to manipulate strings
'              It is called StringSM, since String is a Visual Basic keyword
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cStringSM."
Private mstrText As String

Private Const mstrNullValue = "null"
Private Const mstrSQ = """
Private Const mstrEnvVarSeparator = "%"
Public Function InsertEnvVariables( _
      Optional ByVal strComString As String) As String
   ' This function replaces all environment variables in
   ' the passed in string with their values - they are
   ' enclosed by "%"

   Dim intPos As Integer
   Dim intEndPos As Integer
   Dim strEnvVariable As String
   Dim strValue As String
   Dim strCommand As String

   On Error GoTo InsertEnvVariablesErr
   mstrSource = mstrModuleName & "InsertEnvVariables"

   ' Initialize the return value of the function to the
   ' passed in command
   If IsStringEmpty(strComString) Then
      strCommand = mstrText
   Else
      strCommand = strComString
   End If

   intPos = InStr(strCommand, mstrEnvVarSeparator)
   Do While intPos <> 0
      ' Extract the environment variable from the passed
      ' in string
      intEndPos = InStr(intPos + 1, strCommand, mstrEnvVarSeparator)
      strEnvVariable = Mid(strCommand, intPos + 1, intEndPos - intPos - 1)

      ' Get the value of the variable and call a function
      ' to replace the variable with it's value
      strValue = Environ$(strEnvVariable)
      strCommand = ReplaceSubString(strCommand, _
            mstrEnvVarSeparator & strEnvVariable & mstrEnvVarSeparator, _
            strValue)

      intPos = InStr(strCommand, mstrEnvVarSeparator)
   Loop

   InsertEnvVariables = strCommand
   Exit Function

InsertEnvVariablesErr:
   ' Log the error code raised by Visual Basic
   Call LogErrors(Errors)
   ' Return an empty string
   InsertEnvVariables = gstrEmptyString

End Function
Public Function MakeStringFieldValid( _
      Optional strField As String = gstrEmptyString) As String
   ' Returns a string that can be appended to any insert
   ' or modify (sql) statement
   ' If an argument is not passed to this function, the
   ' default text property is used

   Dim strTemp As String

   On Error GoTo MakeStringFieldValidErr

   If IsStringEmpty(strField) Then
      strTemp = mstrText
   Else
      strTemp = strField
```

```
    End If

    ' It checks whether the text is empty
    ' If so, it returns the string, "null"
    If IsStringEmpty(strTemp) Then
        MakeStringFieldValid = mstrNullValue
    Else
        ' Single-quotes have to be replaced by two single-quotes,
        ' since a single-quote is the identifier delimiter
        ' character - call a procedure to do the replace
        strTemp = ReplaceSubString(strTemp, mstrSQ, mstrSQ & mstrSQ)

        ' Replace pipe characters with the corresponding chr function
        strTemp = ReplaceSubString(strTemp, "|", "' & Chr(124) & "')

        ' Enclose the string in single quotes
        MakeStringFieldValid = mstrSQ & strTemp & mstrSQ

    End If

    Exit Function

MakeStringFieldValidErr:
    mstrSource = mstrModuleName & "MakeStringFieldValid"
    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errMakeFieldValidFailed, _
          mstrSource, LoadResString(errMakeFieldValidFailed)

End Function
Public Function MakeDateFieldValid( _
        Optional dtmField As Date = gdtmEmpty) As String
    ' Returns a string that can be appended to any insert
    ' or modify (sql) statement

    ' Enclose the date in single quotes
    MakeDateFieldValid = mstrSQ & dtmField & mstrSQ

End Function

Private Function IsStringEmpty(strToCheck As String) As Boolean

    If strToCheck = gstrEmptyString Then
        IsStringEmpty = True
    Else
        IsStringEmpty = False
    End If

End Function
Public Function ReplaceSubString(ByVal MainString As String, _
        ByVal ReplaceString As String, _
        ByVal ReplaceWith As String) As String

    ' Replaces all occurrences of ReplaceString in MainString with ReplaceWith

    Dim intPos As Integer
    Dim strTemp As String

    On Error GoTo ReplaceSubStringErr

    strTemp = MainString

    intPos = InStr(strTemp, ReplaceString)
    Do While intPos <> 0
        strTemp = Left(strTemp, intPos - 1) & ReplaceWith & _
              Mid(strTemp, intPos + Len(ReplaceString))
        intPos = InStr(intPos + Len(ReplaceString) + 1, strTemp, ReplaceString)
    Loop
    ReplaceSubString = strTemp

    Exit Function

ReplaceSubStringErr:
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "ReplaceSubString"
    On Error GoTo 0
    Err.Raise vbObjectError + errParseStringFailed, _
        mstrSource, _
        LoadResString(errParseStringFailed)

End Function

Public Property Get Text() As String
Attribute Text.VB_UserMemId = 0
    Text = mstrText
End Property

Public Property Let Text(ByVal vdata As String)
    mstrText = vdata
End Property
```

cSubStep.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cSubStep"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cSubStep.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This module encapsulates the properties of sub-steps
'              that are used during the execution of a workspace.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cSubStep"

Private mlngStepId As Long
Private mintRunning As Integer ' Number of running tasks
Private mintComplete As Integer ' Number of completed tasks
' The last iterator for this sub-step
Private mcLastIterator As cRunItDetails

Public Function NewIteration(cStepRec As cStep) As cIterator
    ' Calls a procedure to determine the next iterator value
    ' for the passed in step - returns the value to be used
    ' in the iteration.
    ' It updates the instance node with the new iteration
    ' for the step.

    Dim cItRec As cIterator

    On Error GoTo NewIterationErr

    ' Call a function that will populate an iterator record
    ' with the iterator values
    Set cItRec = NextIteration(cStepRec)

    ' Initialize the run node with the new iterator
    ' values
    If Not mcLastIterator Is Nothing Then
        If cItRec Is Nothing Then
```

```
            mcLastIterator.Value = gstrEmptyString
        Else
            mcLastIterator.Value = cItRec.Value

            ' And if the iterator is a list of values, then update
            ' the sequence number as well
            If mcLastIterator.IteratorType = gintValue Then
                mcLastIterator.Sequence = cItRec.SequenceNo
            End If
        End If
    End If

    Set NewIteration = cItRec
    Set cItRec = Nothing

    Exit Function

NewIterationErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errIterateFailed, mstrModuleName, _
        LoadResString(errIterateFailed)

End Function
Public Function NextIteration(cStepRec As cStep) As cIterator

    ' Retrieves the next iterator value for the passed in step -
    ' returns an iterator record with the new iterator values

    Dim cItRec As cIterator
    Dim vntIterators As Variant
    Dim lngValue As String

    On Error GoTo NextIterationErr

    vntIterators = cStepRec.Iterators

    If Not mcLastIterator Is Nothing Then
'       ' This procedure depends on the fact that the iterator type
'       ' hasn't been initialized - it may well have been, though
'       ' Try to modify the check later.
'       If mcLastIterator.IteratorType = 0 Then
'           ' The iterator details have not been initialized on the
'           ' run node for the step - call a procedure to carry out
'           ' the initialization
'           BugMessage "Initialize later happens!!!"
'           Call InitializeIt(cStepRec, RunParams, vntIterators)
'       End If
'
'       ' mcLastIterator will be set to Nothing if no iterators
'       ' have been defined for the step
'       If Not mcLastIterator Is Nothing Then

            ' The run node contains the iterator details
            ' Get the next value for the iterator
            If mcLastIterator.IteratorType = gintValue Then
                ' Find the next iterator that appears in the list of
                ' iterator values
                Set cItRec = NextInSequence(vntIterators, mcLastIterator.Sequence)
            Else
                lngValue = CLng(Trim$(mcLastIterator.Value))
                ' Determine whether the new iterator value falls in the
                ' range between From and To
                If (mcLastIterator.RangeStep > 0 And _
                    (mcLastIterator.RangeFrom <= mcLastIterator.RangeTo) And _
                    (mcLastIterator.RangeStep + lngValue) <= mcLastIterator.RangeTo) Or
_
                    (mcLastIterator.RangeStep < 0 And _
                    (mcLastIterator.RangeFrom >= mcLastIterator.RangeTo) And _
                    (mcLastIterator.RangeStep + lngValue) >= mcLastIterator.RangeTo)
Then
                    Set cItRec = New cIterator
                    cItRec.Value = Trim$(CStr(mcLastIterator.RangeStep + lngValue))
                Else
                    Set cItRec = Nothing
                End If
            End If

'       End If
    Else
        Set cItRec = Nothing
    End If

    Set NextIteration = cItRec
    Exit Function

NextIterationErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errIterateFailed, mstrModuleName, _
        LoadResString(errIterateFailed)

End Function
Public Sub InitializeIt(cPendingStep As cStep, _
        ColParameters As cArrParameters, _
        Optional vntIterators As Variant)

    ' Initializes the LastIteration structure with the iterator details for the
    ' passed in step

    On Error GoTo InitializeItErr

    If IsMissing(vntIterators) Then
        vntIterators = cPendingStep.Iterators
    End If

    If IsArray(vntIterators) And Not IsEmpty(vntIterators) Then
        mcLastIterator.IteratorName = cPendingStep.IteratorName
        If vntIterators(LBound(vntIterators)).IteratorType = _
                gintValue Then
            mcLastIterator.IteratorType = gintValue
            ' Since the sequence numbers begin at 0
            mcLastIterator.Sequence = gintMinIteratorSequence - 1
        Else
            mcLastIterator.IteratorType = gintFrom
            Call InitializeItRange(vntIterators, cPendingStep.WorkspaceId, _
                    ColParameters)
        End If
    Else
        Set mcLastIterator = Nothing
    End If

    Exit Sub

InitializeItErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errIterateFailed, mstrModuleName, _
        LoadResString(errIterateFailed)

End Sub

Private Sub InitializeItRange(vntIterators As Variant, ByVal lWorkspace As Long, _
        ColParameters As cArrParameters)

    ' Initializes the LastIteration structure for range iterators from the
    ' passed in variant containing the iterator records
```

```
    Dim lngIndex As Long
    Dim cItrRec As cIterator

    On Error GoTo InitializeItRangeErr

    If IsArray(vntIterators) And Not IsEmpty(vntIterators) Then

        ' Check if the iterator range has been completely initialized
        RangeComplete (vntIterators)

        ' Initialize the Run node with the values for the From,
        ' To and Step boundaries
        For lngIndex = LBound(vntIterators) To UBound(vntIterators)
            Set cItrRec = vntIterators(lngIndex)
            Select Case cItrRec.IteratorType
                Case gintFrom
                    mcLastIterator.RangeFrom = SubstituteParameters(cItrRec.Value,
lWorkspace, WspParameters:=ColParameters)
                Case gintTo
                    mcLastIterator.RangeTo = SubstituteParameters(cItrRec.Value,
lWorkspace, WspParameters:=ColParameters)
                Case gintStep
                    mcLastIterator.RangeStep = SubstituteParameters(cItrRec.Value,
lWorkspace, WspParameters:=ColParameters)
                Case Else
                    On Error GoTo 0
                    Err.Raise vbObjectError + errTypeInvalid, mstrModuleName, _
                        LoadResString(errTypeInvalid)
            End Select
        Next lngIndex

        mcLastIterator.Value = Trim$(CStr(mcLastIterator.RangeFrom -
mcLastIterator.RangeStep))
    End If

    Exit Sub

InitializeItRangeErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errIterateFailed, mstrModuleName, _
        LoadResString(errIterateFailed)

End Sub
Private Function NextInSequence(vntIterators As Variant, _
        lngOldSequence As Long) As cIterator

    Dim lngIndex As Long
    Dim cItrRec As cIterator

    On Error GoTo NextInSequenceErr

    If IsArray(vntIterators) And Not IsEmpty(vntIterators) Then
        For lngIndex = LBound(vntIterators) To UBound(vntIterators)
            Set cItrRec = vntIterators(lngIndex)
            If cItrRec.IteratorType <> gintValue Then
                On Error GoTo 0
                Err.Raise vbObjectError + errTypeInvalid, mstrModuleName, _
                    LoadResString(errTypeInvalid)
            End If
            If cItrRec.SequenceNo = lngOldSequence + 1 Then
                Exit For
            End If

        Next lngIndex

        If cItrRec.SequenceNo <> lngOldSequence + 1 Then
            Set cItrRec = Nothing
        End If
    Else
        Set cItrRec = Nothing
    End If

    Set NextInSequence = cItrRec

    Exit Function

NextInSequenceErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errIterateFailed, mstrModuleName, _
        LoadResString(errIterateFailed)

End Function

Public Property Get LastIterator() As cRunItDetails

    Set LastIterator = mcLastIterator

End Property
Public Property Set LastIterator(vdata As cRunItDetails)

    Set mcLastIterator = vdata

End Property

Public Property Get TasksRunning() As Integer

    TasksRunning = mintRunning

End Property

Public Property Let TasksRunning(ByVal vdata As Integer)

    mintRunning = vdata

End Property

Public Property Get TasksComplete() As Integer

    TasksComplete = mintComplete

End Property
Public Property Let TasksComplete(ByVal vdata As Integer)

    mintComplete = vdata

End Property
Public Property Get StepId() As Long

    StepId = mlngStepId

End Property
Public Property Let StepId(ByVal vdata As Long)

    mlngStepId = vdata

End Property
```

cSubSteps.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cSubSteps"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cSubSteps.cls
```

```
'               Microsoft TPC-H Kit Ver. 1.00
'               Copyright Microsoft, 1999
'               All Rights Reserved
'
'
' PURPOSE:     This module provides a type-safe wrapper around cVector to
'               implement a collection of cSubStep objects.
' Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mcSubSteps As cVector

Public Sub Add(ByVal objItem As cSubStep)

    mcSubSteps.Add objItem

End Sub


Public Sub Clear()

    mcSubSteps.Clear

End Sub


Public Function Count() As Long

    Count = mcSubSteps.Count

End Function


Public Function Delete(ByVal lngDelete As Long) As cSubStep

    Set Delete = mcSubSteps.Delete(lngDelete)

End Function


Public Property Get Item(ByVal Position As Long) As cSubStep
Attribute Item.VB_UserMemId = 0

    Set Item = mcSubSteps.Item(Position)

End Property

Private Sub Class_Initialize()

    Set mcSubSteps = New cVector

End Sub

Private Sub Class_Terminate()

    Set mcSubSteps = Nothing

End Sub
```

cTermProcess.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cTermProcess"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
' FILE:       cTermProcess.cls
'               Microsoft TPC-H Kit Ver. 1.00
'               Copyright Microsoft, 1999
'               All Rights Reserved
'
'
' PURPOSE:     This module raises an event if a completed step exists.
' Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private WithEvents moTimer As cTimerSM
Attribute moTimer.VB_VarHelpID = -1
Private bTermProcessExists As Boolean
Public Event TermProcessExists()

Public Sub ProcessTerminated()

    bTermProcessExists = True
    moTimer.Enabled = True

End Sub

Private Sub Class_Initialize()

    bTermProcessExists = False

    Set moTimer = New cTimerSM
    moTimer.Enabled = False

End Sub

Private Sub Class_Terminate()

    Set moTimer = Nothing

End Sub

Private Sub moTimer_Timer()

    On Error GoTo moTimer_TimerErr

    If bTermProcessExists Then
        RaiseEvent TermProcessExists
    End If

    moTimer.Enabled = False
    bTermProcessExists = False

    Exit Sub

moTimer_TimerErr:
    LogErrors Errors

End Sub
```

cTermStep.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cTermStep"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
' FILE:       cTermStep.cls
'               Microsoft TPC-H Kit Ver. 1.00
'               Copyright Microsoft, 1999
'               All Rights Reserved
'
'
```

```
' PURPOSE:     This module encapsulates the properties of steps that
'              have completed execution such as status and time of completion.
' Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Public TimeComplete As Currency
Public Index As Long
Public InstanceId As Long
Public ExecutionStatus As InstanceStatus
```

cTermSteps.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cTermSteps"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
' FILE:        cTermSteps.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
' PURPOSE:     This module provides a type-safe wrapper around cVector to
'              implement a collection of cTermStep objects. Raises an
'              event if a step that has completed execution exists.
' Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Private mcTermSteps As cVector
Private WithEvents moTimer As cTimerSM
Attribute moTimer.VB_VarHelpID = -1
Public Event TermStepExists(cStepDetails As cTermStep)

Public Sub Add(ByVal citem As cTermStep)

    Call mcTermSteps.Add(citem)
    moTimer.Enabled = True

End Sub

Public Sub Clear()

    mcTermSteps.Clear

End Sub

Public Function Delete()

    Call mcTermSteps.Delete(0)
    ' Disable the timer if there are no more pending events
    If mcTermSteps.Count = 0 Then moTimer.Enabled = False

End Function

Public Property Get Item(ByVal Position As Long) As cTermStep

    Set Item = mcTermSteps(Position)

End Property

Public Function Count() As Long

    Count = mcTermSteps.Count

End Function

Private Sub Class_Initialize()

    Set mcTermSteps = New cVector

    Set moTimer = New cTimerSM
    moTimer.Enabled = False

End Sub

Private Sub Class_Terminate()

    Set mcTermSteps = Nothing
    Set moTimer = Nothing

End Sub

Private Sub moTimer_Timer()

    On Error GoTo moTimer_TimerErr

    If mcTermSteps.Count > 0 Then
        ' Since items are appended to the end of the array
        RaiseEvent TermStepExists(mcTermSteps(0))
    Else
        moTimer.Enabled = False
    End If
    Exit Sub

moTimer_TimerErr:
    LogErrors Errors

End Sub
```

cTimer.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cTimerSM"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
' FILE:        cTimer.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
' PURPOSE:     This module implements a timer.
' Contact:     Reshma Tharamal (reshmat@microsoft.com)
'

Option Explicit

Public Event Timer()

Private Const mnDefaultInterval As Long = 1

Private mnTimerID As Long
Private mnInterval As Long
Private mfEnabled As Boolean

Public Property Get Interval() As Long
    Interval = mnInterval
End Property
Public Property Let Interval(Value As Long)
    If mnInterval <> Value Then
        mnInterval = Value
        If mfEnabled Then
```

```
            SetInterval mnInterval, mnTimerID
        End If
    End If
End Property

Public Property Get Enabled() As Boolean
    Enabled = mfEnabled
End Property
Public Property Let Enabled(Value As Boolean)
    If mfEnabled <> Value Then
        If Value Then
            mnTimerID = StartTimer(mnInterval)
            If mnTimerID <> 0 Then
                mfEnabled = True
                'Storing Me in the global would add a reference to Me, which
                '   would prevent Me from being released, which in turn would
                '   prevent my Class_Terminate code from running. To prevent
                '   this, I store a "soft reference" - the collection holds a
                '   pointer to me without incrementing my reference count.
                gcTimerObjects.Add ObjPtr(Me), Str$(mnTimerID)
            End If
        Else
            StopTimer mnTimerID
            mfEnabled = False
            gcTimerObjects.Remove Str$(mnTimerID)
        End If
    End If
End Property

Private Sub Class_Initialize()
    If gcTimerObjects Is Nothing Then Set gcTimerObjects = New Collection
    mnInterval = mnDefaultInterval
End Sub

Private Sub Class_Terminate()
    Enabled = False
End Sub

Friend Sub Tick()
    RaiseEvent Timer
End Sub
```

cVBErrors.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cVBErrorsSM"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
Attribute VB_Ext_KEY = "SavedWithClassBuilder" ,"Yes"
Attribute VB_Ext_KEY = "Top_Level" ,"Yes"
'  FILE:       cVBErrors.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This module encapsulates the handling of Visual Basic errors.
'              This module does not do any error handling - any error handler
'              will erase the errors object!
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' The Execute class exposes a method, WriteError through which we can write to the
' error log that is currently being used by the Execute object. Store a reference to
' Execute object locally.
Private mcExecObjRef As EXECUTEDLLLib.Execute

Public Sub WriteError(ByVal ErrorCode As errErrorConstants, _
        Optional ByVal ErrorSource As String = gstrEmptyString, _
        Optional ByVal OptArgs As String = gstrEmptyString)

    Dim sError As String

    sError = "StepMaster Error:" & ErrorCode & vbCrLf & LoadResString(ErrorCode) &
vbCrLf

    If Not StringEmpty(ErrorSource) Then
        sError = sError & "(Source: " & ErrorSource & ")" & vbCrLf
    End If
    sError = sError & OptArgs

    Call LogMessage(sError)

End Sub
Private Function InitErrorString() As String
    ' Initializes a string with all the properties of the
    ' Err object

    Dim strError As String
    Dim errCode As Long

    If Err.Number = 0 Then
        InitErrorString = gstrEmptyString
    Else
    With Err
        If Err.Number > vbObjectError And Err.Number < (vbObjectError + 65536) Then
            errCode = .Number - vbObjectError
        Else
            errCode = .Number
        End If
        strError = "Error #: " & errCode & vbCrLf
        strError = strError & "Description: " & .Description & vbCrLf
        strError = strError & "Source: " & Err.Source & vbCrLf
    End With

    Debug.Print strError
    InitErrorString = strError
    End If

End Function
Public Sub LogVBErrors()

    Dim strErr As String

    strErr = InitErrorString

    On Error GoTo LogVBErrorsErr

    If Not StringEmpty(strErr) Then
        ' Write an error using the WriteError method of the Execute object.
        If Not mcExecObjRef Is Nothing Then
            mcExecObjRef.WriteError strErr
        Else
            WriteMessage strErr
        End If
    End If

    Err.Clear

    Exit Sub

LogVBErrorsErr:
    Call LogErrors(Errors)
    ' Since write to the error file for the step has failed, write to the project log
    Call WriteMessage(strErr)

End Sub
Public Sub DisplayErrors()
```

```
    Dim strErr As String

    strErr = InitErrorString

    If Not StringEmpty(strErr) Then
        ' Display the error message
        MsgBox strErr
    End If

    Err.Clear

End Sub
Public Sub LogMessage(strMsg As String)

    On Error GoTo LogMessageErr

    ' Write an error using the WriteError method of the Execute object.
    If Not mcExecObjRef Is Nothing Then
        mcExecObjRef.WriteError strMsg
    Else
        WriteMessage strMsg
    End If

    Exit Sub

LogMessageErr:
    Call LogErrors(Errors)
    ' Since write to the error file for the step has failed, write to the project log
    Call WriteMessage(strMsg)

End Sub
Public Property Set ErrorFile(vdata As EXECUTEDLLLib.Execute)

    Set mcExecObjRef = vdata

End Property
Private Sub Class_Terminate()

    Set mcExecObjRef = Nothing

End Sub
```

cVECTOR.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cVector"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cVector.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:     This class implements an array of objects.
'  Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cVector."

' Array counter
Private mlngCount As Long
Private mcarrItems() As Object

Public Sub Add(ByVal objItem As Object)
    ' Adds the passed in Object variable to the array

    On Error GoTo AddErr

    ReDim Preserve mcarrItems(mlngCount)

    ' Set the newly added element in the array to the
    ' passed in variable
    Set mcarrItems(mlngCount) = objItem
    mlngCount = mlngCount + 1

    Exit Sub

AddErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "Add"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadInArrayFailed, _
          mstrSource, _
          LoadResString(errLoadInArrayFailed)

End Sub
Public Sub Clear()

    ' Clear the array
    ReDim mcarrItems(0)
    mlngCount = 0

End Sub

Public Function Delete(ByVal lngDelete As Long) As Object

    Dim lngIndex As Long

    On Error GoTo DeleteErr

    If lngDelete < (mlngCount - 1) Then

        ' We want to maintain the order of all items in the
        ' array - so move all remaining elements in the array
        ' up by 1
        For lngIndex = lngDelete To mlngCount - 2
            MoveDown lngIndex
        Next lngIndex

    End If

    ' Return the deleted node
    Set Delete = mcarrItems(mlngCount - 1)

    ' Delete the last Node from the array
    mlngCount = mlngCount - 1
    If mlngCount > 0 Then
        ReDim Preserve mcarrItems(0 To mlngCount - 1)
    Else
        ReDim mcarrItems(0)
    End If

    Exit Function

DeleteErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Delete"
    On Error GoTo 0
    Err.Raise vbObjectError + errDeleteArrayElementFailed, _
          mstrSource, _
          LoadResString(errDeleteArrayElementFailed)
```

```
End Function
Public Property Get Item(ByVal Position As Long) As Object
Attribute Item.VB_UserMemId = 0

    ' Returns the element at the passed in position in the array
    If Position >= 0 And Position < mlngCount Then
        Set Item = mcarrItems(Position)
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
            LoadResString(errItemDoesNotExist)
    End If

End Property
Public Property Set Item(ByVal Position As Long, _
        ByVal Value As Object)

    ' Returns the element at the passed in position in the array
    If Position >= 0 Then
        ' If the passed in position is outside the array
        ' bounds, then resize the array
        If Position >= mlngCount Then
            ReDim Preserve mcarrItems(Position)
            mlngCount = Position + 1
        End If

        ' Set the newly added element in the array to the
        ' passed in variable
        Set mcarrItems(Position) = Value
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
            LoadResString(errItemDoesNotExist)
    End If

End Property
Public Sub MoveUp(ByVal Position As Long)
    ' Moves the element at the passed in position up by 1

    Dim cTemp As Object

    If Position > 0 And Position < mlngCount Then
        Set cTemp = mcarrItems(Position)

        Set mcarrItems(Position) = mcarrItems(Position - 1)
        Set mcarrItems(Position - 1) = cTemp
    End If

End Sub
Public Sub MoveDown(ByVal Position As Long)
    ' Moves the element at the passed in position down by 1

    Dim cTemp As Object

    If Position >= 0 And Position < mlngCount - 1 Then
        Set cTemp = mcarrItems(Position)

        Set mcarrItems(Position) = mcarrItems(Position + 1)
        Set mcarrItems(Position + 1) = cTemp
    End If

End Sub

Public Function Count() As Long

    Count = mlngCount

End Function


Private Sub Class_Initialize()
    mlngCount = 0

End Sub


Private Sub Class_Terminate()

    Call Clear

End Sub
```

cVectorLng.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cVectorLng"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:        cVectorLng.cls
'               Microsoft TPC-H Kit Ver. 1.00
'               Copyright Microsoft, 1999
'               All Rights Reserved
'
'
'  PURPOSE:     This class implements an array of longs.
'  Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cVectorLng."

' Array counter
Private mlngCount As Long
Private mcarrItems() As Long

Public Sub Add(ByVal lngItem As Long)
    ' Adds the passed in long variable to the array

    On Error GoTo AddErr

    ReDim Preserve mcarrItems(mlngCount)

    ' Set the newly added element in the array to the
    ' passed in variable
    mcarrItems(mlngCount) = lngItem
    mlngCount = mlngCount + 1

    Exit Sub

AddErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "Add"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadInArrayFailed, _
          mstrSource, _
          LoadResString(errLoadInArrayFailed)

End Sub
Public Sub Clear()

    ' Clear the array
    ReDim mcarrItems(0)

End Sub
```

```
Public Sub Delete(Optional ByVal Position As Long = -1, _
      Optional ByVal Item As Long = -1)
   ' The user can opt to delete either a specific item in
   ' the list or the item at a specified position. If no
   ' parameters are passed in, we delete the element at
   ' position 0!

   Dim lngDelete As Long
   Dim lngIndex As Long

   On Error GoTo DeleteErr

   If Position = -1 Then
      ' Since we can never store an element at position -1,
      ' we can be sure that the user is trying to delete
      ' a given item
      lngDelete = Find(Item)
   Else
      lngDelete = Position
   End If

   If lngDelete < (mlngCount - 1) Then

      ' We want to maintain the order of all items in the
      ' array - so move all remaining elements in the array
      ' up by 1
      For lngIndex = lngDelete To mlngCount - 2
         MoveDown lngIndex
      Next lngIndex

   End If

   ' Delete the last Node from the array
   mlngCount = mlngCount - 1
   If mlngCount > 0 Then
      ReDim Preserve mcarrItems(0 To mlngCount - 1)
   Else
      ReDim mcarrItems(0)
   End If

   Exit Sub

DeleteErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "Delete"
   On Error GoTo 0
   Err.Raise vbObjectError + errDeleteArrayElementFailed, _
         mstrSource, _
         LoadResString(errDeleteArrayElementFailed)

End Sub
Public Function Find(ByVal Item As Long) As Long

   ' Returns the position at which the passed in value occurs
   ' in the array

   Dim lngIndex As Long

   On Error GoTo FindErr

   ' Find the element in the array to be deleted
   For lngIndex = 0 To mlngCount - 1

      If mcarrItems(lngIndex) = Item Then
         Find = lngIndex
         Exit Function
      End If

   Next lngIndex

   Find = -1

   Exit Function

FindErr:
   LogErrors Errors
   mstrSource = mstrModuleName & "Find"
   On Error GoTo 0
   Err.Raise vbObjectError + errItemNotFound, mstrSource, _
      LoadResString(errItemNotFound)

End Function
Public Property Get Item(ByVal Position As Long) As Long
Attribute Item.VB_UserMemId = 0

   ' Returns the element at the passed in position in the array
   If Position >= 0 And Position < mlngCount Then
      Item = mcarrItems(Position)
   Else
      On Error GoTo 0
      Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
         LoadResString(errItemDoesNotExist)
   End If

End Property
Public Property Let Item(ByVal Position As Long, _
      ByVal Value As Long)

   ' Returns the element at the passed in position in the array
   If Position >= 0 Then
      ' If the passed in position is outside the array
      ' bounds, then resize the array
      If Position >= mlngCount Then
         ReDim Preserve mcarrItems(Position)
         mlngCount = Position + 1
      End If

      ' Set the newly added element in the array to the
      ' passed in variable
      mcarrItems(Position) = Value
   Else
      On Error GoTo 0
      Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
         LoadResString(errItemDoesNotExist)
   End If

End Property
Public Sub MoveUp(ByVal Position As Long)
   ' Moves the element at the passed in position up by 1

   Dim lngTemp As Long

   If Position > 0 And Position < mlngCount Then
      lngTemp = mcarrItems(Position)

      mcarrItems(Position) = mcarrItems(Position - 1)
      mcarrItems(Position - 1) = lngTemp
   End If

End Sub
Public Sub MoveDown(ByVal Position As Long)
   ' Moves the element at the passed in position down by 1

   Dim lngTemp As Long

   If Position >= 0 And Position < mlngCount - 1 Then
      lngTemp = mcarrItems(Position)

      mcarrItems(Position) = mcarrItems(Position + 1)
      mcarrItems(Position + 1) = lngTemp
   End If
```

```
End Sub

Public Function Count() As Long

    Count = mlngCount

End Function


Private Sub Class_Initialize()

    mlngCount = 0

End Sub


Private Sub Class_Terminate()

    Call Clear

End Sub
```

cVectorStr.cls

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cVectorStr"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cVectorStr.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    This class implements an array of strings.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cVectorStr."

' Array counter
Private mlngCount As Long
Private mcarrItems() As String

Public Sub Add(ByVal strItem As String)
    ' Adds the passed in string variable to the array

    On Error GoTo AddErr

    ReDim Preserve mcarrItems(mlngCount)

    ' Set the newly added element in the array to the
    ' passed in variable
    mcarrItems(mlngCount) = strItem
    mlngCount = mlngCount + 1

    Exit Sub

AddErr:
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "Add"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadInArrayFailed, _
          mstrSource, _
          LoadResString(errLoadInArrayFailed)

End Sub
Public Sub Clear()

    ' Clear the array
    ReDim mcarrItems(0)

End Sub

Public Sub Delete(Optional ByVal Position As Long = -1, _
       Optional ByVal Item As String = -1)
    ' The user can opt to delete either a specific item in
    ' the list or the item at a specified position. If no
    ' parameters are passed in, we delete the element at
    ' position 0!

    Dim lngDelete As Long
    Dim lngIndex As Long

    On Error GoTo DeleteErr
    mstrSource = mstrModuleName & "Delete"

    If Position = -1 Then
       ' Since we can never store an element at position -1,
       ' we can be sure that the user is trying to delete
       ' a given item
       lngDelete = Find(Item)
    Else
       lngDelete = Position
    End If

    If lngDelete < (mlngCount - 1) Then

       ' We want to maintain the order of all items in the
       ' array - so move all remaining elements in the array
       ' up by 1
       For lngIndex = lngDelete To mlngCount - 2
          MoveDown lngIndex
       Next lngIndex

    End If

    ' Delete the last Node from the array
    mlngCount = mlngCount - 1
    If mlngCount > 0 Then
       ReDim Preserve mcarrItems(0 To mlngCount - 1)
    Else
       ReDim mcarrItems(0)
    End If

    Exit Sub

DeleteErr:
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "Delete"
    On Error GoTo 0
    Err.Raise vbObjectError + errDeleteArrayElementFailed, _
          mstrSource, _
          LoadResString(errDeleteArrayElementFailed)

End Sub
Public Function Find(ByVal Item As String) As Long

    ' Returns the position at which the passed in value occurs
    ' in the array

    Dim lngIndex As Long
```

```
    On Error GoTo FindErr
    mstrSource = mstrModuleName & "Find"

    ' Find the element in the array to be deleted
    For lngIndex = 0 To mlngCount - 1

        If mcarrItems(lngIndex) = Item Then
            Find = lngIndex
            Exit Function
        End If

    Next lngIndex

    Find = -1

    Exit Function

FindErr:
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "Find"
    On Error GoTo 0
    Err.Raise vbObjectError + errItemNotFound, mstrSource, _
        LoadResString(errItemNotFound)

End Function
Public Property Get Item(ByVal Position As Long) As String
Attribute Item.VB_UserMemId = 0

    ' Returns the element at the passed in position in the array
    If Position >= 0 And Position < mlngCount Then
        Item = mcarrItems(Position)
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
            LoadResString(errItemDoesNotExist)
    End If

End Property
Public Property Let Item(ByVal Position As Long, _
        ByVal Value As String)

    ' Returns the element at the passed in position in the array
    If Position >= 0 Then
        ' If the passed in position is outside the array
        ' bounds, then resize the array
        If Position >= mlngCount Then
            ReDim Preserve mcarrItems(Position)
            mlngCount = Position + 1
        End If

        ' Set the newly added element in the array to the
        ' passed in variable
        mcarrItems(Position) = Value
    Else
        On Error GoTo 0
        Err.Raise vbObjectError + errItemDoesNotExist, mstrSource, _
            LoadResString(errItemDoesNotExist)
    End If

End Property
Public Sub MoveUp(ByVal Position As Long)
    ' Moves the element at the passed in position up by 1

    Dim strTemp As String

    If Position > 0 And Position < mlngCount Then
        strTemp = mcarrItems(Position)

        mcarrItems(Position) = mcarrItems(Position - 1)
        mcarrItems(Position - 1) = strTemp
    End If

End Sub
Public Sub MoveDown(ByVal Position As Long)
    ' Moves the element at the passed in position down by 1

    Dim strTemp As String

    If Position >= 0 And Position < mlngCount - 1 Then
        strTemp = mcarrItems(Position)

        mcarrItems(Position) = mcarrItems(Position + 1)
        mcarrItems(Position + 1) = strTemp
    End If

End Sub

Public Function Count() As Long

    Count = mlngCount

End Function


Private Sub Class_Initialize()

    mlngCount = 0

End Sub
Private Sub Class_Terminate()

    Call Clear

End Sub
```

cWORKER.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cWorker"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cWorker.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a worker step.
'              Implements the cStep class - carries out initializations
'              and validations that are specific to worker steps.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Implements cStep

' Object variable to keep the step reference in
Private mcStep As cStep

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cWorker."
Private Property Let cStep_StartDir(ByVal RHS As String)

    mcStep.StartDir = RHS

End Property
```

```
Private Property Get cStep_StartDir() As String

    cStep_StartDir = mcStep.StartDir

End Property

Private Property Set cStep_NodeDB(RHS As DAO.Database)

    Set mcStep.NodeDB = RHS

End Property

Private Property Get cStep_NodeDB() As DAO.Database

    Set cStep_NodeDB = mcStep.NodeDB

End Property

Private Function cStep_IncVersionY() As String

    cStep_IncVersionY = mcStep.IncVersionY

End Function
Private Function cStep_IsNewVersion() As Boolean
    cStep_IsNewVersion = mcStep.IsNewVersion
End Function
Private Function cStep_OldVersionNo() As String
    cStep_OldVersionNo = mcStep.OldVersionNo
End Function

Private Function cStep_IncVersionX() As String

    cStep_IncVersionX = mcStep.IncVersionX

End Function
Private Sub cStep_UpdateIteratorVersion()

    Call mcStep.UpdateIteratorVersion

End Sub

Private Function cStep_IteratorCount() As Long

    cStep_IteratorCount = mcStep.IteratorCount

End Function

Private Sub cStep_UnloadIterators()

    Call mcStep.UnloadIterators

End Sub

Private Sub cStep_SaveIterators()

    Call mcStep.SaveIterators

End Sub
Private Property Get cStep_IteratorName() As String

    cStep_IteratorName = mcStep.IteratorName

End Property
Private Property Let cStep_IteratorName(ByVal RHS As String)

    mcStep.IteratorName = RHS

End Property

Private Sub cStep_LoadIterator(cItRecord As cIterator)

    Call mcStep.LoadIterator(cItRecord)

End Sub
Private Sub cStep_DeleteIterator(cItRecord As cIterator)

    Call mcStep.DeleteIterator(cItRecord)

End Sub

Private Sub cStep_InsertIterator(cItRecord As cIterator)

    Call mcStep.InsertIterator(cItRecord)

End Sub
Private Function cStep_Iterators() As Variant

    cStep_Iterators = mcStep.Iterators

End Function
Private Sub cStep_ModifyIterator(cItRecord As cIterator)

    Call mcStep.ModifyIterator(cItRecord)

End Sub
Private Sub cStep_RemoveIterator(cItRecord As cIterator)

    Call mcStep.RemoveIterator(cItRecord)

End Sub
Private Sub cStep_UpdateIterator(cItRecord As cIterator)

    Call mcStep.UpdateIterator(cItRecord)

End Sub
Private Sub cStep_AddIterator(cItRecord As cIterator)

    Call mcStep.AddIterator(cItRecord)

End Sub

Private Property Let cStep_Position(ByVal RHS As Long)

    mcStep.Position = RHS

End Property

Private Property Get cStep_Position() As Long

    cStep_Position = mcStep.Position

End Property

Private Function cStep_Clone(Optional cCloneStep As cStep) As cStep

    Dim cNewWorker As cWorker

    Set cNewWorker = New cWorker
    Set cStep_Clone = mcStep.Clone(cNewWorker)

End Function

Private Sub StepTextOrFileEntered()
    ' Checks if either the step text or the name of the file containing
    ' the text has been entered
    ' If both of them are null or both of them are not null,
    ' the worker step is invalid and an error is raised
    If StringEmpty(mcStep.StepText) And StringEmpty(mcStep.StepTextFile) Then
        ShowError errStepTextAndFileNull
        On Error GoTo 0
        Err.Raise vbObjectError + errStepTextAndFileNull, _
```

```
        mstrSource, LoadResString(errStepTextAndFileNull)
    End If

End Sub

Private Property Get cStep_IndOperation() As Operation

    cStep_IndOperation = mcStep.IndOperation

End Property

Private Property Let cStep_IndOperation(ByVal RHS As Operation)

    mcStep.IndOperation = RHS

End Property

Private Property Get cStep_NextStepId() As Long

    cStep_NextStepId = mcStep.NextStepId

End Property

Private Property Let cStep_OutputFile(ByVal RHS As String)

    mcStep.OutputFile = RHS

End Property

Private Property Get cStep_OutputFile() As String

    cStep_OutputFile = mcStep.OutputFile

End Property

Private Property Let cStep_ErrorFile(ByVal RHS As String)

    mcStep.ErrorFile = RHS

End Property

Private Property Get cStep_ErrorFile() As String

    cStep_ErrorFile = mcStep.ErrorFile

End Property
'Private Property Let cStep_LogFile(ByVal RHS As String)
'
'    mcStep.LogFile = RHS
'
'End Property
'
'Private Property Get cStep_LogFile() As String
'
'    cStep_LogFile = mcStep.LogFile
'
'End Property

Private Property Let cStep_ArchivedFlag(ByVal RHS As Boolean)

    mcStep.ArchivedFlag = RHS

End Property

Private Property Get cStep_ArchivedFlag() As Boolean

    cStep_ArchivedFlag = mcStep.ArchivedFlag

End Property

Private Sub Class_Initialize()

    ' Create the object
    Set mcStep = New cStep

    ' Initialize the object with valid values for a Worker step
    ' The global flag should be the first field to be initialized
    ' since subsequent validations might try to check if the
    ' step being created is global
    mcStep.GlobalFlag = False
'    mcStep.GlobalRunMethod = gintNoOption
    mcStep.StepType = gintWorkerStep

End Sub
Private Sub Class_Terminate()

    ' Remove the step object
    Set mcStep = Nothing

End Sub
Private Sub cStep_Add()

    ' Call a private procedure to see if the step text has been
    ' entered - since a worker step actually executes a step, entry
    ' of the text is mandatory
    Call StepTextOrFileEntered

    ' Call the Add method of the step class to carry out the insert
    mcStep.Add

End Sub

Private Property Get cStep_ContinuationCriteria() As ContinuationCriteria

    cStep_ContinuationCriteria = mcStep.ContinuationCriteria

End Property

Private Property Let cStep_ContinuationCriteria(ByVal RHS As ContinuationCriteria)

    ' The Continuation criteria must be non-null for all worker steps.
    ' Check if the Continuation Criteria is valid
    Select Case RHS
        Case gintOnFailureAbortSiblings, gintOnFailureCompleteSiblings, _
             gintOnFailureSkipSiblings, gintOnFailureAbort, _
             gintOnFailureContinue, gintOnFailureAsk
           mcStep.ContinuationCriteria = RHS

        Case Else
           On Error GoTo 0
           Err.Raise vbObjectError + errContCriteriaInvalid, _
                mstrModuleName, LoadResString(errContCriteriaInvalid)
    End Select

End Property

Private Property Let cStep_DegreeParallelism(ByVal RHS As String)

    mcStep.DegreeParallelism = RHS

End Property

Private Property Get cStep_DegreeParallelism() As String

    cStep_DegreeParallelism = mcStep.DegreeParallelism

End Property

Private Sub cStep_Delete()

    mcStep.Delete
```

```
End Sub

Private Property Get cStep_EnabledFlag() As Boolean

    cStep_EnabledFlag = mcStep.EnabledFlag

End Property

Private Property Let cStep_EnabledFlag(ByVal RHS As Boolean)

    mcStep.EnabledFlag = RHS

End Property

Private Property Let cStep_ExecutionMechanism(ByVal RHS As ExecutionMethod)

    On Error GoTo ExecutionMechanismErr
    mstrSource = mstrModuleName & "cStep_ExecutionMechanism"

    Select Case RHS
        Case gintExecuteShell, gintExecuteODBC
            mcStep.ExecutionMechanism = RHS

        Case Else
            On Error GoTo 0
            Err.Raise vbObjectError + errExecutionMechanismInvalid, _
                mstrSource, LoadResString(errExecutionMechanismInvalid)
    End Select

    Exit Property

ExecutionMechanismErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "cStep_ExecutionMechanism"
    On Error GoTo 0
    Err.Raise vbObjectError + errExecutionMechanismLetFailed, _
        mstrSource, LoadResString(errExecutionMechanismLetFailed)

End Property

Private Property Get cStep_ExecutionMechanism() As ExecutionMethod

    cStep_ExecutionMechanism = mcStep.ExecutionMechanism

End Property

Private Property Let cStep_FailureDetails(ByVal RHS As String)

    mcStep.FailureDetails = RHS

End Property

Private Property Get cStep_FailureDetails() As String

    cStep_FailureDetails = mcStep.FailureDetails

End Property

Private Property Get cStep_GlobalFlag() As Boolean

    cStep_GlobalFlag = mcStep.GlobalFlag

End Property

Private Property Let cStep_GlobalFlag(ByVal RHS As Boolean)

    ' Set the global flag to false - this flag is initialized when
    ' an instance of the class is created. Just making sure that
    ' nobody changes the value inadvertently
    mcStep.GlobalFlag = False

End Property
Private Sub cStep_Modify()

    ' Call a private procedure to see if the step text has been
    ' entered - since a worker step actually executes a step, entry
    ' of the text is mandatory
    Call StepTextOrFileEntered

    ' Call the Modify method of the step class to carry out the update
    mcStep.Modify

End Sub

Private Property Let cStep_ParentStepId(ByVal RHS As Long)

    mcStep.ParentStepId = RHS

End Property

Private Property Get cStep_ParentStepId() As Long

    cStep_ParentStepId = mcStep.ParentStepId

End Property

Private Property Let cStep_ParentVersionNo(ByVal RHS As String)

    mcStep.ParentVersionNo = RHS

End Property

Private Property Get cStep_ParentVersionNo() As String

    cStep_ParentVersionNo = mcStep.ParentVersionNo

End Property

Private Property Let cStep_SequenceNo(ByVal RHS As Integer)

    mcStep.SequenceNo = RHS

End Property

Private Property Get cStep_SequenceNo() As Integer

    cStep_SequenceNo = mcStep.SequenceNo

End Property

Private Property Let cStep_StepId(ByVal RHS As Long)

    mcStep.StepId = RHS

End Property

Private Property Get cStep_StepId() As Long

    cStep_StepId = mcStep.StepId

End Property


Private Property Let cStep_StepLabel(ByVal RHS As String)

    mcStep.StepLabel = RHS

End Property

Private Property Get cStep_StepLabel() As String

    cStep_StepLabel = mcStep.StepLabel
```

```
End Property


Private Property Let cStep_StepLevel(ByVal RHS As Integer)

    mcStep.StepLevel = RHS

End Property

Private Property Get cStep_StepLevel() As Integer

    cStep_StepLevel = mcStep.StepLevel

End Property

Private Property Let cStep_StepText(ByVal RHS As String)

    mcStep.StepText = RHS

End Property

Private Property Get cStep_StepText() As String

    cStep_StepText = mcStep.StepText

End Property

Private Property Let cStep_StepTextFile(ByVal RHS As String)

    mcStep.StepTextFile = RHS

End Property

Private Property Get cStep_StepTextFile() As String

    cStep_StepTextFile = mcStep.StepTextFile

End Property

Private Property Let cStep_StepType(RHS As gintStepType)

    mcStep.StepType = gintWorkerStep

End Property

Private Property Get cStep_StepType() As gintStepType

    cStep_StepType = mcStep.StepType

End Property

Private Sub cStep_Validate()
    ' The validate routines for each of the steps will
    ' carry out the specific validations for the type and
    ' call the generic validation routine

    On Error GoTo cStep_ValidateErr

    ' Validations specific to worker steps

    ' Check if the step text or a file name has been
    ' specified
    Call StepTextOrFileEntered

    mcStep.Validate

    Exit Sub

cStep_ValidateErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "cStep_Validate"
    On Error GoTo 0
    Err.Raise vbObjectError + errValidateFailed, _
          mstrSource, _
          LoadResString(errValidateFailed)
End Sub

Private Property Let cStep_VersionNo(ByVal RHS As String)

    mcStep.VersionNo = RHS

End Property

Private Property Get cStep_VersionNo() As String

    cStep_VersionNo = mcStep.VersionNo

End Property

Private Property Let cStep_WorkspaceId(ByVal RHS As Long)

    mcStep.WorkspaceId = RHS

End Property

Private Property Get cStep_WorkspaceId() As Long

    cStep_WorkspaceId = mcStep.WorkspaceId

End Property
```

cWORKSPACE.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
END
Attribute VB_Name = "cWorkspace"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:       cWorkspace.cls
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Encapsulates the properties and methods of a workspace.
'              Contains functions to insert, update and delete
'              att_workspaces records from the database.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Local variable(s) to hold property value(s)
Private mlngWorkspaceId As Long
Private mstrWorkspaceName As String
Private mblnArchivedFlag As Boolean
Private mdbsStepMaster As Database

' Used to indicate the source module name when errors
' are raised by this class
Private mstrSource As String
Private Const mstrModuleName As String = "cWorkspace."

' The cSequence class is used to generate unique workspace identifiers
Private mWorkspaceSeq As cSequence

' The StringSM class is used to carry out string operations
Private mFieldValue As cStringSM
```

```
Public Function Clone() As cWorkspace

    ' Creates a copy of a given workspace

    Dim cCloneWsp As cWorkspace

    On Error GoTo CloneErr

    Set cCloneWsp = New cWorkspace

    ' Copy all the workspace properties to the newly
    ' created workspace
    cCloneWsp.WorkspaceId = mlngWorkspaceId
    cCloneWsp.WorkspaceName = mstrWorkspaceName
    cCloneWsp.ArchivedFlag = mblnArchivedFlag

    ' And set the return value to the newly created workspace
    Set Clone = cCloneWsp

    Exit Function

CloneErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "Clone"
    On Error GoTo 0
    Err.Raise vbObjectError + errCloneFailed, _
          mstrSource, LoadResString(errCloneFailed)

End Function

Public Property Let ArchivedFlag(ByVal vdata As Boolean)

    mblnArchivedFlag = vdata

End Property

Public Property Get ArchivedFlag() As Boolean

    ArchivedFlag = mblnArchivedFlag

End Property

Public Property Set WorkDatabase(vdata As Database)

    Set mdbsStepMaster = vdata

End Property

Private Sub WorkspaceNameDuplicate()
    ' Check if the workspace name already exists in the workspace

    Dim rstWorkspace As Recordset
    Dim strSql As String
    Dim qy As DAO.QueryDef

    On Error GoTo WorkspaceNameDuplicateErr
    mstrSource = mstrModuleName & "WorkspaceNameDuplicate"

    ' Create a recordset to retrieve the count of records
    ' having the same workspace name
    strSql = " Select count(*) as workspace_count " & _
        " from att_workspaces " & _
        " where workspace_name = [w_name] " & _
        " and workspace_id <> [w_id] "
    Set qy = mdbsStepMaster.CreateQueryDef(gstrEmptyString, strSql)

    ' Call a procedure to assign the parameter values
    Call AssignParameters(qy)

    Set rstWorkspace = qy.OpenRecordset(dbOpenForwardOnly)

'       mFieldValue.MakeStringFieldValid (mstrWorkspaceName) & _
'       " and workspace_id <> " & _
'       Str(mlngWorkspaceId)
'
'    Set rstWorkspace = mdbsStepMaster.OpenRecordset( _
'       strSQL, dbOpenForwardOnly)

    If rstWorkspace![workspace_count] > 0 Then
       rstWorkspace.Close
       qy.Close
       ShowError errDuplicateWorkspaceName
       On Error GoTo 0
       Err.Raise vbObjectError + errDuplicateWorkspaceName, _
          mstrSource, LoadResString(errDuplicateWorkspaceName)
    End If
    rstWorkspace.Close
    qy.Close

    Exit Sub

WorkspaceNameDuplicateErr:
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "WorkspaceNameDuplicate"
    On Error GoTo 0
    Err.Raise vbObjectError + errWorkspaceNameDuplicateFailed, _
       mstrSource, LoadResString(errWorkspaceNameDuplicateFailed)

End Sub
Public Property Let WorkspaceName(vdata As String)

    On Error GoTo WorkspaceNameErr
    mstrSource = mstrModuleName & "WorkspaceName"

    If vdata = gstrEmptyString Then

       On Error GoTo 0
       ' Propogate this error back to the caller
       Err.Raise vbObjectError + errWorkspaceNameMandatory, _
          mstrSource, LoadResString(errWorkspaceNameMandatory)
    Else
       mstrWorkspaceName = vdata
    End If
    Exit Property

WorkspaceNameErr:
    LogErrors Errors
    mstrSource = mstrModuleName & "WorkspaceName"
    On Error GoTo 0
    Err.Raise vbObjectError + errWorkspaceNameSetFailed, _
       mstrSource, LoadResString(errWorkspaceNameSetFailed)

End Property

Public Property Let WorkspaceId(vdata As Long)

    On Error GoTo WorkspaceIdErr
    mstrSource = mstrModuleName & "WorkspaceId"

    If (vdata > 0) Then
       mlngWorkspaceId = vdata
    Else
       ' Propogate this error back to the caller
       On Error GoTo 0
       Err.Raise vbObjectError + errWorkspaceIdInvalid, _
          mstrSource, LoadResString(errWorkspaceIdInvalid)
    End If

    Exit Property

WorkspaceIdErr:
    LogErrors Errors
```

```
    mstrSource = mstrModuleName & "WorkspaceId"
    On Error GoTo 0
    Err.Raise vbObjectError + errWorkspaceIdSetFailed, _
        mstrSource, LoadResString(errWorkspaceIdSetFailed)

End Property

Public Sub AddWorkspace()

    Dim strInsert As String
    Dim qy As DAO.QueryDef

    On Error GoTo AddWorkspaceErr

    ' Retrieve the next identifier using the sequence class
    Set mWorkspaceSeq = New cSequence
    Set mWorkspaceSeq.IdDatabase = mdbsStepMaster
    mWorkspaceSeq.IdentifierColumn = FLD_ID_WORKSPACE
    mlngWorkspaceId = mWorkspaceSeq.Identifier
    Set mWorkspaceSeq = Nothing

    ' Call procedure to raise an error if the Workspace name
    ' already exists in the db
    Call WorkspaceNameDuplicate

    ' A new record will have the archived_flag turned off
    mblnArchivedFlag = False

    ' Create a temporary querydef object
    strInsert = "insert into att_workspaces " & _
          "( workspace_id, workspace_name, " & _
          " archived_flag ) " & _
          " values ( [w_id], [w_name], [archived] ) "
    Set qy = mdbsStepMaster.CreateQueryDef(gstrEmptyString, strInsert)

    ' Call a procedure to assign the parameter values
    Call AssignParameters(qy)

    qy.Execute dbFailOnError
    qy.Close

'    strInsert = "insert into att_workspaces " & _
'          "( workspace_id, workspace_name, " & _
'          " archived_flag ) " & _
'          " values ( " & _
'          Str(mlngWorkspaceId) & _
'          ", " & mFieldValue.MakeStringFieldValid(mstrWorkspaceName) & _
'          ", " & Str(mblnArchivedFlag) & _
'          " ) "
'    mdbsStepMaster.Execute strInsert, dbFailOnError
'
    Exit Sub

AddWorkspaceErr:

    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "AddWorkspace"
    On Error GoTo 0
    Err.Raise vbObjectError + errWorkspaceInsertFailed, _
        mstrSource, LoadResString(errWorkspaceInsertFailed)

End Sub
Private Sub AssignParameters(qyExec As DAO.QueryDef)
    ' Assigns values to the parameters in the querydef object
    ' The parameter names are cryptic to make them different
    ' from the field names. When the parameter names are
    ' the same as the field names, parameters in the where
    ' clause do not get created.

    Dim prmParam As DAO.Parameter

    On Error GoTo AssignParametersErr
    mstrSource = mstrModuleName & "AssignParameters"

    For Each prmParam In qyExec.Parameters
        Select Case prmParam.Name
            Case "[w_id]"
                prmParam.Value = mlngWorkspaceId

            Case "[w_name]"
                prmParam.Value = mstrWorkspaceName

            Case "[archived]"
                prmParam.Value = mblnArchivedFlag

            Case Else
                ' Write the parameter name that is faulty
                WriteError errInvalidParameter, mstrSource, _
                    prmParam.Name
                On Error GoTo 0
                Err.Raise errInvalidParameter, mstrSource, _
                    LoadResString(errInvalidParameter)
        End Select
    Next prmParam

    Exit Sub

AssignParametersErr:

    mstrSource = mstrModuleName & "AssignParameters"
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errAssignParametersFailed, _
        mstrSource, LoadResString(errAssignParametersFailed)

End Sub
Public Sub DeleteWorkspace()

    Dim strDelete As String
    Dim qy As DAO.QueryDef

    On Error GoTo DeleteWorkspaceErr

    strDelete = "delete from att_workspaces " & _
        " where workspace_id = [w_id]"
    Set qy = mdbsStepMaster.CreateQueryDef(gstrEmptyString, strDelete)

    ' Call a procedure to assign the parameter values
    Call AssignParameters(qy)

    qy.Execute dbFailOnError
    qy.Close

'    mdbsStepMaster.Execute strDelete, dbFailOnError
'        " where workspace_id = " & _
'        Str(mlngWorkspaceId)

    Exit Sub

DeleteWorkspaceErr:
    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "DeleteWorkspace"
    On Error GoTo 0
    Err.Raise vbObjectError + errWorkspaceDeleteFailed, _
        mstrSource, LoadResString(errWorkspaceDeleteFailed)
End Sub

Public Sub ModifyWorkspace()

    Dim strUpdate As String
    Dim qy As DAO.QueryDef
```

```
    On Error GoTo ModifyWorkspaceErr

    ' Call procedure to raise an error if the Workspace name
    ' already exists in the db
    Call WorkspaceNameDuplicate

    strUpdate = "update att_workspaces " & _
        " set workspace_name = [w_name] " & _
        ", archived_flag = [archived] " & _
        " where workspace_id = [w_id] "
    Set qy = mdbsStepMaster.CreateQueryDef(gstrEmptyString, strUpdate)

    ' Call a procedure to assign the parameter values
    Call AssignParameters(qy)

    qy.Execute dbFailOnError
    qy.Close

'    strUpdate = "update att_workspaces " & _
'        " set workspace_name = " & _
'        mFieldValue.MakeStringFieldValid(mstrWorkspaceName) & _
'        ", archived_flag = " & _
'        Str(mblnArchivedFlag) & _
'        " where workspace_id = " & _
'        Str(mlngWorkspaceId)
'
'    mdbsStepMaster.Execute strUpdate, dbFailOnError
'
    Exit Sub

ModifyWorkspaceErr:

    Call LogErrors(Errors)
    mstrSource = mstrModuleName & "ModifyWorkspace"
    On Error GoTo 0
    Err.Raise vbObjectError + errWorkspaceUpdateFailed, _
        mstrSource, LoadResString(errWorkspaceUpdateFailed)

End Sub
Public Property Get WorkspaceName() As String

    WorkspaceName = mstrWorkspaceName

End Property

Public Property Get WorkspaceId() As Long

    WorkspaceId = mlngWorkspaceId

End Property

Private Sub Class_Initialize()

    ' Each function will append it's own name to this
    ' variable
    mstrSource = "cWorkspace."

    Set mFieldValue = New cStringSM

End Sub

Private Sub Class_Terminate()

    Set mdbsStepMaster = Nothing
    Set mFieldValue = Nothing

End Sub
```

DATABASESM.BAS

```
Attribute VB_Name = "DatabaseSM"
'  FILE:       DatabaseSM.bas
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Contains all the database initialization/cleanup
'              procedures for the project. Also contains upgrade
'              database upgrade functions.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
' This module is called DatabaseSM, since Database is a standard
' Visual Basic object and we want to avoid any confusion with it.

Option Explicit

Public wrkJet As Workspace
Public dbsAttTool As Database
Public gblnDbOpen As Boolean
Public gRunEngine As rdoEngine

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "DatabaseSM."
Public Const gsDefDBFileExt As String = ".stp"
Private Const msDefDBFile As String = "\SMData" & gsDefDBFileExt

Private Const merrFileNotFound As Integer = 3024
Private Const merrDaoTableMissing As Integer = 3078

Private Const STEPMASTER_SETTINGS_VAL_NAME_DBFILE As String =
"WorkspaceFile"

Public Const DEF_NO_COUNT_DISPLAY         As Boolean = False
Public Const DEF_NO_EXECUTE               As Boolean = False
Public Const DEF_PARSE_QUERY_ONLY         As Boolean = False
Public Const DEF_ANSI_QUOTED_IDENTIFIERS  As Boolean = False
Public Const DEF_ANSI_NULLS               As Boolean = True
Public Const DEF_SHOW_QUERY_PLAN          As Boolean = False
Public Const DEF_SHOW_STATS_TIME          As Boolean = False
Public Const DEF_SHOW_STATS_IO            As Boolean = False
Public Const DEF_PARSE_ODBC_MSG_PREFIXES  As Boolean = True
Public Const DEF_ROW_COUNT                As Long = 0
Public Const DEF_TSQL_BATCH_SEPARATOR     As String = "GO"
Public Const DEF_QUERY_TIME_OUT           As Long = 0
Public Const DEF_SERVER_LANGUAGE          As String = "(Default)"
Public Const DEF_CHARACTER_TRANSLATION    As Boolean = True
Public Const DEF_REGIONAL_SETTINGS        As Boolean = False

Public Const PARAM_DEFAULT_DIR            As String = "DEFAULT_DIR"
Public Const PARAM_DEFAULT_DIR_DESC       As String = "Default destination
directory " & _
            "for all output and error files. If it is blank, the StepMaster installation
directory will be used."

Public Const CONNECTION_STRINGS_TO_NAME_SUFFIX As String = "_NAME"

Private Const TBL_RUN_STEP_HDR As String = "run_header"
Private Const TBL_RUN_STEP_DTLS As String = "run_step_details"
Public Const TBL_CONNECTION_DTLS As String = "connection_dtls"
Public Const TBL_CONNECTION_STRINGS As String = "workspace_connections"
Public Const TBL_STEPS As String = "att_steps"

Public Const FLD_ID_CONN_NAME As String = "connection_name_id"
Public Const FLD_ID_WORKSPACE As String = "workspace_id"
Public Const FLD_ID_STEP As String = "step_id"

Public Const FLD_CONN_DTL_CONNECTION_NAME As String =
"connection_name"
Public Const FLD_CONN_DTL_CONNECTION_STRING As String =
"connection_string_name"
Public Const FLD_CONN_DTL_CONNECTION_TYPE As String = "connection_type"
```

```
Public Const FLD_CONN_STR_CONNECTION_NAME As String =
"connection_name"

Public Const FLD_STEPS_EXEC_MECHANISM As String = "execution_mechanism"
Public Const FLD_STEPS_EXEC_DTL As String = "start_directory"
Public Const FLD_STEPS_VERSION_NO As String = "version_no"

Public Const DATA_TYPE_CURRENCY As String = "CURRENCY"
Public Const DATA_TYPE_LONG As String = "Long"
Public Const DATA_TYPE_INTEGER As String = "INTEGER"
Public Const DATA_TYPE_TEXT255 As String = "Text(255)"

Public Sub InitRunEngine()

   Set gRunEngine = New rdoEngine
   gRunEngine.rdoDefaultCursorDriver = rdUseServer

End Sub

Public Function DefaultDBFile() As String
   DefaultDBFile = GetSetting(App.Title, "Settings",
STEPMASTER_SETTINGS_VAL_NAME_DBFILE, App.Path & msDefDBFile)
End Function

Public Sub CloseDatabase()

   Dim dbsInstance As Database
   Dim recInstance As Recordset

   On Error GoTo CloseDatabaseErr

   ' Close all open recordsets and databases in the workspace
   For Each dbsInstance In wrkJet.Databases

      For Each recInstance In dbsAttTool.Recordsets
         recInstance.Close
      Next recInstance
      dbsInstance.Close

   Next dbsInstance

   Set dbsAttTool = Nothing

   gblnDbOpen = False
   wrkJet.Close

   Exit Sub

CloseDatabaseErr:

   Call LogErrors(Errors)
   Resume Next

End Sub

Private Function NoDbChanges(sVerTo As String, sVerFrom As String) As Boolean

   If sVerTo = gsVersion242 And sVerFrom = gsVersion241 Then
      NoDbChanges = True
   ElseIf sVerTo = gsVersion242 And sVerFrom = gsVersion24 Then
      NoDbChanges = True
   Else
      NoDbChanges = False
   End If

End Function

Public Function SMOpenDatabase(Optional strDbName As String = gstrEmptyString)
As Boolean
   Dim sVersion As String
   Dim bOpeningDb As Boolean ' This flag is used to check if OpenDatabase failed

   On Error GoTo OpenDatabaseErr

   bOpeningDb = False
   SMOpenDatabase = False

   ' Create Microsoft Jet Workspace object.
   If Not gblnDbOpen Then
      Set wrkJet = CreateWorkspace("att_tool_workspace_setup", "admin",
gstrEmptyString, dbUseJet)
   End If

   ' Prompt the user for the database file if it is not passed in
   If StringEmpty(strDbName) Then
      strDbName = BrowseDBFile
      If StringEmpty(strDbName) Then
         Exit Function
      End If
   End If

   Do
      If gblnDbOpen Then
#If Not RUN_ONLY Then
         CloseOpenWorkspaces
#End If
         Set wrkJet = CreateWorkspace("att_tool_workspace_setup", "admin",
gstrEmptyString, dbUseJet)
      End If

      ' Toggle the bOpeningDb flag around the OpenDatabase method - the value
      ' of this flag will be checked by the error handler to determine if it is
      ' the OpenDatabase that failed.
      BugMessage "DB File: " & strDbName

      bOpeningDb = True
      ' Open the database for exclusive use
      Set dbsAttTool = wrkJet.OpenDatabase(strDbName, Options:=True)
      bOpeningDb = False

      If dbsAttTool Is Nothing Then
         ' If the file is not present in the directory, display
         ' an error and ask the user to enter a new path
         Call ShowError(errOpenDbFailed, OptArgs:=strDbName)

         strDbName = BrowseDBFile
      Else
         sVersion = DBVersion(dbsAttTool)

         ' Make sure the application and db version numbers match
         If sVersion = gsVersion Then
            Call InitializeData(strDbName)
            gblnDbOpen = True
            SMOpenDatabase = True
         Else
            If UpgradeDb(wrkJet, dbsAttTool, gsVersion, sVersion) Then
               Call InitializeData(strDbName)
               gblnDbOpen = True
               SMOpenDatabase = True
            Else
               dbsAttTool.Close
               Set dbsAttTool = Nothing

               ShowError errVersionMismatch, _
                     OptArgs:=" Please install Version '" & gsVersion & "' of the
workspace definition file."
               strDbName = BrowseDBFile
            End If
         End If
      End If
   Loop While gblnDbOpen = False And Not StringEmpty(strDbName)
```

```
    Exit Function

OpenDatabaseErr:
    Call DisplayErrors(Errors)

    ' If the OpenDatabase failed, continue
    If bOpeningDb Then
        Resume Next
    End If

    Call ShowError(errOpenDbFailed, OptArgs:=strDbName)

End Function
Private Sub InitializeData(sDb As String)

    Set gcParameters = New cArrParameters
    Set gcParameters.ParamDatabase = dbsAttTool

    Set gcSteps = New cArrSteps
    Set gcSteps.StepDB = dbsAttTool

    Set gcConstraints = New cArrConstraints
    Set gcConstraints.ConstraintDB = dbsAttTool

    Set gcConnections = New cConnections
    Set gcConnections.ConnDb = dbsAttTool

    Set gcConnDtls = New cConnDtls
    Set gcConnDtls.ConnDb = dbsAttTool

    ' Disable the error handler since this is not a critical step
    On Error GoTo 0
    SaveSetting App.Title, "Settings",
STEPMASTER_SETTINGS_VAL_NAME_DBFILE, sDb
End Sub
Private Sub UpdateContinuationCriteria(dbFile As DAO.Database)

    Dim qyTemp As DAO.QueryDef
    Dim sBuf As String

    On Error GoTo UpdateContinuationCriteriaErr

    sBuf = "Since this version of the executable incorporates failure processing, " & _
           "the upgrade will update the On Failure field for each of the steps " & _
           "to 'Continue' to be compatible with the existing behaviour. " & _
           "Proceed?"
    If Not Confirm(Buttons:=vbYesNo, strMessage:=sBuf, strTitle:="Upgrade database")
Then
        Exit Sub
    End If

    ' Create a recordset object to retrieve all steps for
    ' the given workspace
    sBuf = " update att_steps a " & _
        " set continuation_criteria = " & CStr(gintOnFailureContinue) & _
        " where archived_flag = [archived] "

    ' Find the highest X-component of the version number
    sBuf = sBuf & " AND cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) = " & _
        " ( select max( cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) ) " & _
        " from att_steps AS d " & _
        " WHERE a.step_id = d.step_id ) "

    ' Find the highest Y-component of the version number for the highest X-component
    sBuf = sBuf & " AND cint( mid( version_no, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) + 1 ) ) = " & _
        " ( select max( cint( mid( version_no, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) + 1 ) ) ) " & _
        " from att_steps AS b " & _
        " Where a.step_id = b.step_id " & _
        " AND cint( mid( version_no, 1, instr( version_no, " & gstrDQ & gstrVerSeparator
& gstrDQ & " ) - 1 ) ) = " & _
        " ( select max( cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) ) " & _
        " from att_steps AS c " & _
        " WHERE a.step_id = c.step_id ) ) "

    ' Create a temporary Querydef object
    Set qyTemp = dbFile.CreateQueryDef(gstrEmptyString, sBuf)
    qyTemp.Parameters("archived").Value = False

    qyTemp.Execute dbFailOnError
    qyTemp.Close

    Exit Sub

UpdateContinuationCriteriaErr:
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errModifyStepFailed, mstrModuleName, _
          LoadResString(errModifyStepFailed)

End Sub

Private Sub UpdateDbDtls(dbFile As Database, sNewVersion As String)

    Dim sSql As String
    Dim cTemp As New cStringSM

    On Error GoTo UpdateDbDtlsErr

    sSql = "update db_details " & _
          " set db_version = " & cTemp.MakeStringFieldValid(sNewVersion)

    dbFile.Execute sSql, dbFailOnError

    Exit Sub

UpdateDbDtlsErr:
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errUpgradeFailed, mstrModuleName, _
          LoadResString(errUpgradeFailed)

End Sub

Private Sub Upgrade10to21(UpgradeWsp As DAO.Workspace, dbFile As Database,
sVersion As String)

    Dim sSql As String

    On Error GoTo Upgrade10to21Err

    Call UpdateDbDtls(dbFile, sVersion)

    Call UpdateContinuationCriteria(dbFile)

    Exit Sub

Upgrade10to21Err:
    UpgradeWsp.Rollback
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errUpgradeFailed, mstrModuleName, _
          LoadResString(errUpgradeFailed)

End Sub
Private Sub Upgrade21to23(UpgradeWsp As DAO.Workspace, dbFile As Database,
sVersion As String)

    Dim sBuf As String
    Dim cTempStr As New cStringSM
```

```
    On Error GoTo Upgrade21to23Err

    ' Add a parameter type field and a description field to the parameter table
    sBuf = "alter table workspace_parameters " & _
           " add column description TEXT(255) "
    dbFile.Execute sBuf, dbFailOnError

    sBuf = "alter table workspace_parameters " & _
           " add column parameter_type INTEGER "
    dbFile.Execute sBuf, dbFailOnError

    ' Initialize the parameter type on all parameters to indicate generic parameters
    sBuf = "update workspace_parameters " & _
           " set parameter_type = " & CStr(gintParameterGeneric)
    dbFile.Execute sBuf, dbFailOnError

    sBuf = "Release 2.3 onwards, connection string parameters will be " & _
           "displayed in a separate node. After this upgrade, all connection " & _
           "string parameters will appear under the Globals/Connection Strings " & _
           "node in the workspace. "
    Call MsgBox(sBuf, vbOKOnly + vbApplicationModal, "Upgrade database")

    ' Update the parameter type on all parameters that look like db connection strings
    sBuf = "update workspace_parameters " & _
           " set parameter_type = " & CStr(gintParameterConnect) & _
           " where UCase(parameter_value) like '*DRIVER*' " & _
           " or UCase(parameter_value) like '*DSN*'"
    dbFile.Execute sBuf, dbFailOnError

    ' Add an elapsed time field to the run_step_details table - this field is
    ' needed to store the elapsed time in milliseconds.
    sBuf = "alter table run_step_details " & _
           " add column elapsed_time LONG "
    dbFile.Execute sBuf, dbFailOnError

    ' The failure_details field has some data for the case when an ODBC failure
    ' threshold was specified. Since that's no longer relevant, update the failure_details
    ' field for records with failure_criteria = gintFailureODBC to empty.
    ' failure_criteria = gintFailureODBC = 1
    sBuf = "update att_steps " & _
           " set failure_details = " & cTempStr.MakeStringFieldValid(gstrEmptyString) & _
           " where failure_criteria = '1'"
    dbFile.Execute sBuf, dbFailOnError

    Call UpdateDbDtls(dbFile, sVersion)

    UpgradeWsp.CommitTrans

    On Error GoTo DropColumnErr

    UpgradeWsp.BeginTrans

    ' This ddl cannot be in the same transaction as the failure_details update
    ' But we can do this in a separate transaction since we do not expect this
    ' statement to fail - AND, it doesn't matter if this transaction fails
    ' Drop the failure_criteria column from the att_steps table
    sBuf = "alter table att_steps " & _
           " drop column failure_criteria "
    dbFile.Execute sBuf, dbFailOnError

    Exit Sub

DropColumnErr:
    Call LogErrors(Errors)
    ShowError errDeleteColumnFailed
    Exit Sub

Upgrade21to23Err:
    UpgradeWsp.Rollback
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errUpgradeFailed, mstrModuleName, _
          LoadResString(errUpgradeFailed)

End Sub
Private Sub Upgrade23to24(UpgradeWsp As DAO.Workspace, dbFile As Database,
sVersion As String)

    Dim sBuf As String
    Dim cTempStr As New cStringSM
    Dim lId As Long
    Dim rTemp As DAO.Recordset
    Dim rParam As DAO.Recordset
    Dim cTempSeq As cSequence

    On Error GoTo Upgrade23to24Err

    ' Add a new table for connection properties
    sBuf = CreateConnectionsTableScript()
    ' TODO: Not sure of column sizes for row count, tsql_batch_separator and
server_language
    dbFile.Execute sBuf, dbFailOnError

    ' Move all connection parameters from the parameter table to the connections tables
    ' Insert default values for the newly added connection properties
    sBuf = "select * from workspace_parameters " & _
           "where parameter_type = " & CStr(gintParameterConnect)
    Set rTemp = dbFile.OpenRecordset(sBuf, dbOpenSnapshot)
    lId = 1
    If rTemp.RecordCount <> 0 Then
       rTemp.MoveFirst

       While Not rTemp.EOF
          sBuf = "insert into workspace_connections " & _
           "( workspace_id, connection_id, " & _
           "connection_name, connection_value, " & _
           "description, no_count_display, " & _
           "no_execute, parse_query_only, " & _
           "ANSI_quoted_identifiers, ANSI_nulls, " & _
           "show_query_plan, show_stats_time, " & _
           "show_stats_io, parse_odbc_msg_prefixes, " & _
           "row_count, tsql_batch_separator, " & _
           "query_time_out, server_language, " & _
           "character_translation, regional_settings ) " & _
          " values ( " & _
          Str(rTemp!workspace_id) & ", " & Str(lId) & ", " & _
          cTempStr.MakeStringFieldValid("" & rTemp!parameter_name) & ", " & _
          cTempStr.MakeStringFieldValid("" & rTemp!parameter_value) & ", " & _
          cTempStr.MakeStringFieldValid("" & rTemp!Description) & ", " & _
          Str(DEF_NO_COUNT_DISPLAY) & ", " & _
          Str(DEF_NO_EXECUTE) & ", " & Str(DEF_PARSE_QUERY_ONLY) & ", " & _
          Str(DEF_ANSI_QUOTED_IDENTIFIERS) & ", " & Str(DEF_ANSI_NULLS) & ",
" & _
          Str(DEF_SHOW_QUERY_PLAN) & ", " & Str(DEF_SHOW_STATS_TIME) & ",
" & _
          Str(DEF_SHOW_STATS_IO) & ", " &
Str(DEF_PARSE_ODBC_MSG_PREFIXES) & ", " & _
          Str(DEF_ROW_COUNT) & ", " &
cTempStr.MakeStringFieldValid(DEF_TSQL_BATCH_SEPARATOR) & ", " & _
          Str(DEF_QUERY_TIME_OUT) & ", " &
cTempStr.MakeStringFieldValid(DEF_SERVER_LANGUAGE) & ", " & _
          Str(DEF_CHARACTER_TRANSLATION) & ", " &
Str(DEF_REGIONAL_SETTINGS) & _
          " ) "
          dbFile.Execute sBuf, dbFailOnError

          lId = lId + 1
          rTemp.MoveNext
       Wend
    End If
    rTemp.Close
```

```
    ' Add an identifier column for the connection_id field
    sBuf = "alter table att_identifiers " & _
           " add column connection_id long "
    dbFile.Execute sBuf, dbFailOnError

    ' Initialize the value of the connection identifier, initialized above
    sBuf = "update att_identifiers " & _
           " set connection_id = " & Str(lId)
    dbFile.Execute sBuf, dbFailOnError

    ' Delete all connection strings from the parameter table
    sBuf = "delete from workspace_parameters " & _
            "where parameter_type = " & CStr(gintParameterConnect)
    dbFile.Execute sBuf, dbFailOnError

    ' Create the built-in parameter, default directory, for each workspace in the db
    Set cTempSeq = New cSequence
    Set cTempSeq.IdDatabase = dbFile
    cTempSeq.IdentifierColumn = "parameter_id"

    sBuf = "select * from att_workspaces "
    Set rTemp = dbFile.OpenRecordset(sBuf, dbOpenSnapshot)
    If rTemp.RecordCount <> 0 Then
       rTemp.MoveFirst

       While Not rTemp.EOF
          sBuf = "select * from workspace_parameters " & _
                 " where workspace_id = " & Str(rTemp!workspace_id) & _
                 " and parameter_name = " &
cTempStr.MakeStringFieldValid(PARAM_DEFAULT_DIR)
          Set rParam = dbFile.OpenRecordset(sBuf, dbOpenSnapshot)
          If rParam.RecordCount <> 0 Then
             rParam.MoveFirst
             ' Since the parameter already exists, change it to a built-in type
             sBuf = "update workspace_parameters " & _
                    " set parameter_type = " & CStr(gintParameterBuiltIn) & _
                    " where workspace_id = " & Str(rTemp!workspace_id) & _
                    " and parameter_id = " & Str(rParam!parameter_id)
          Else
             ' Else, insert a parameter record
             lId = cTempSeq.Identifier
             sBuf = "insert into workspace_parameters " & _
                    "( workspace_id, parameter_id, " & _
                    " parameter_name, parameter_value, " & _
                    " description, parameter_type ) " & _
                    " values ( " & _
                    Str(rTemp!workspace_id) & ", " & Str(lId) & ", " & _
                    cTempStr.MakeStringFieldValid(PARAM_DEFAULT_DIR) & ", " & _
                    cTempStr.MakeStringFieldValid(gstrEmptyString) & ", " & _
                    cTempStr.MakeStringFieldValid(PARAM_DEFAULT_DIR_DESC) & ", "
& _
                    CStr(gintParameterBuiltIn) & _
                    " ) "
          End If
          dbFile.Execute sBuf, dbFailOnError
          rParam.Close

          rTemp.MoveNext
       Wend
    End If
    rTemp.Close

    Call UpdateDbDtls(dbFile, sVersion)

    Exit Sub

Upgrade23to24Err:
    UpgradeWsp.Rollback
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errUpgradeFailed, mstrModuleName, _
          LoadResString(errUpgradeFailed)
End Sub
Private Sub Upgrade243to25(UpgradeWsp As DAO.Workspace, dbFile As Database,
sVersion As String)

    Dim sBuf As String
    Dim qy As DAO.QueryDef
    Dim rTemp As DAO.Recordset
    Dim lId As Long
    Dim cTempStr As New cStringSM

    On Error GoTo Upgrade243to25Err

    sBuf = "Release " & gsVersion25 & " onwards, new 'Connections' must be created
for all " & _
           "connection strings. " & vbCrLf & vbCrLf & _
           "Connections will appear under the Globals/Connections " & _
           "node in the workspace. " & vbCrLf & _
           "A list of all 'Connections' (instead of 'Connection Strings') " & _
           "in the workspace will be displayed in the 'Connections' field for " & _
           "ODBC steps on the Step definition screen. " & vbCrLf & vbCrLf & _
           "Each Connection can be marked as static or dynamic. " & vbCrLf & _
           "Dynamic connections will be created when a step starts execution and " & _
           "closed once the step completes. " & vbCrLf & _
           "Static connections will be kept open till the run completes." & vbCrLf & vbCrLf
& _
           "Currently dynamic 'Connections' have been created for all existing
'Connection Strings' " & _
           "with the suffix " & CONNECTION_STRINGS_TO_NAME_SUFFIX
    Call MsgBox(sBuf, vbOKOnly + vbApplicationModal, "Upgrade database")

    ' Add a new table for the connection name entity
    ' This table has been added in order to satisfy the TPC-H requirement that
    ' all the queries in a stream need to be executed on a single connection.
    sBuf = CreateConnectionDtlsTableScript()
    dbFile.Execute sBuf, dbFailOnError

    ' Add an identifier column for the connection_name_id field
    sBuf = "alter table att_identifiers " & _
           " add column " & FLD_ID_CONN_NAME & " long "
    dbFile.Execute sBuf, dbFailOnError

    Call UpdateDbDtls(dbFile, sVersion)

    ' insert connection_dtl records for each of the connection strings
    sBuf = "select * from " & TBL_CONNECTION_STRINGS
    Set rTemp = dbFile.OpenRecordset(sBuf, dbOpenSnapshot)

    sBuf = "insert into " & TBL_CONNECTION_DTLS & _
           "( " & FLD_ID_WORKSPACE & _
           ", " & FLD_ID_CONN_NAME & _
           ", " & FLD_CONN_DTL_CONNECTION_NAME & _
           ", " & FLD_CONN_DTL_CONNECTION_STRING & _
           ", " & FLD_CONN_DTL_CONNECTION_TYPE & " ) " & _
           " values ( [w_id], [c_id], [c_name], [c_str], [c_type] ) "
    Set qy = dbFile.CreateQueryDef("", sBuf)

    lId = glMinId
    If rTemp.RecordCount <> 0 Then
       rTemp.MoveFirst

       While Not rTemp.EOF
          qy.Parameters("w_id").Value = rTemp.Fields(FLD_ID_WORKSPACE)
          qy.Parameters("c_id").Value = lId
          qy.Parameters("c_name").Value =
rTemp.Fields(FLD_CONN_STR_CONNECTION_NAME) &
CONNECTION_STRINGS_TO_NAME_SUFFIX
          qy.Parameters("c_str").Value =
rTemp.Fields(FLD_CONN_STR_CONNECTION_NAME)
          qy.Parameters("c_type").Value = ConnTypeDynamic
```

```
        qy.Execute dbFailOnError

        lId = lId + 1
        rTemp.MoveNext
      Wend
   End If
   qy.Close
   rTemp.Close

   ' Initialize the value of the connection_name_id
   sBuf = "update att_identifiers " & _
         " set " & FLD_ID_CONN_NAME & " = " & Str(lId)
   dbFile.Execute sBuf, dbFailOnError

   ' Update the start_directory field in att_steps to point to the newly
   ' created connections
   Call ReadStepsInWorkspace(rTemp, qy, glInvalidId, dbLoad:=dbFile, _
         bSelectArchivedRecords:=False)

   sBuf = "update " & TBL_STEPS & _
      " set " & FLD_STEPS_EXEC_DTL & " = [c_name] " & _
      " where " & FLD_ID_STEP & " = [s_id] " & _
      " and " & FLD_STEPS_VERSION_NO & " = [ver_no] "
   Set qy = dbFile.CreateQueryDef("", sBuf)

   If rTemp.RecordCount <> 0 Then
      rTemp.MoveFirst

      While Not rTemp.EOF
         If rTemp.Fields(FLD_STEPS_EXEC_MECHANISM).Value =
gintExecuteODBC Then
            If Not (StringEmpty("" & rTemp.Fields(FLD_STEPS_EXEC_DTL))) Then
               sBuf = rTemp.Fields(FLD_STEPS_EXEC_DTL)
               ' Strip the enclosing "%" characters
               sBuf = Mid(sBuf, 2, Len(sBuf) - 2) &
CONNECTION_STRINGS_TO_NAME_SUFFIX

               qy.Parameters("c_name").Value = sBuf
               qy.Parameters("s_id").Value = rTemp.Fields(FLD_ID_STEP)
               qy.Parameters("ver_no").Value =
rTemp.Fields(FLD_STEPS_VERSION_NO)

               qy.Execute dbFailOnError
            End If
         End If
         rTemp.MoveNext
      Wend
   End If

   qy.Close
   rTemp.Close

   Exit Sub

Upgrade243to25Err:
   UpgradeWsp.Rollback
   Call LogErrors(Errors)
   Err.Raise vbObjectError + errUpgradeFailed, mstrModuleName, _
         LoadResString(errUpgradeFailed)

End Sub
Private Sub Upgrade242to243(UpgradeWsp As DAO.Workspace, dbFile As Database,
sVersion As String)

   Dim sBuf As String
   Dim cTempStr As New cStringSM
   Dim iResponse As Integer

   On Error GoTo DeleteHistoryErr

   Call DeleteRunHistory(dbFile)

   On Error GoTo Upgrade242to243Err

   UpgradeWsp.CommitTrans

   UpgradeWsp.BeginTrans

   ' Add a parameter type field and a description field to the parameter table
   sBuf = "alter table run_step_details " & _
         " add column parent_instance_id LONG "

   dbFile.Execute sBuf, dbFailOnError

   sBuf = "alter table run_step_details " & _
         " add column iterator_value TEXT(255) "

   dbFile.Execute sBuf, dbFailOnError

   Call AlterFieldType(dbFile, TBL_RUN_STEP_DTLS, "start_time",
DATA_TYPE_CURRENCY)
   Call AlterFieldType(dbFile, TBL_RUN_STEP_DTLS, "end_time",
DATA_TYPE_CURRENCY)
   Call AlterFieldType(dbFile, TBL_RUN_STEP_HDR, "start_time",
DATA_TYPE_CURRENCY)
   Call AlterFieldType(dbFile, TBL_RUN_STEP_HDR, "end_time",
DATA_TYPE_CURRENCY)

   Call UpdateDbDtls(dbFile, sVersion)

   Exit Sub

DeleteHistoryErr:
   ' This is not a critical error - continue with upgrade
   Call LogErrors(Errors)
   Resume Next

Upgrade242to243Err:
   UpgradeWsp.Rollback
   Call LogErrors(Errors)
   Err.Raise vbObjectError + errUpgradeFailed, mstrModuleName, _
         LoadResString(errUpgradeFailed)

End Sub
'********************************************************************
' The AlterFieldType Sub procedure requires three string
' parameters. The first string specifies the name of the table
' containing the field to be changed. The second string specifies
' the name of the field to be changed. The third string specifies
' the new data type for the field.
'********************************************************************

Private Sub AlterFieldType(dbFile As Database, TblName As String, FieldName As
String, _
            NewDataType As String)
   Dim qdf As DAO.QueryDef
   Dim sSql As String

   ' Add a temporary field to the table.
   sSql = "ALTER TABLE [" & TblName & _
         "] ADD COLUMN AlterTempField " & NewDataType
   Set qdf = dbFile.CreateQueryDef("", sSql)
   qdf.Execute

   ' Copy the data from old field into the new field.
   qdf.SQL = "UPDATE DISTINCTROW [" & TblName & "] SET AlterTempField = [" &
FieldName & "]"
   qdf.Execute

   ' Delete the old field.
   qdf.SQL = "ALTER TABLE [" & TblName & "] DROP COLUMN [" & FieldName & "]"
   qdf.Execute
```

```
    ' Rename the temporary field to the old field's name.
    dbFile.TableDefs("[" & TblName & "]").Fields("AlterTempField").Name = FieldName
    dbFile.TableDefs.Refresh

    ' Clean up.
End Sub
Private Sub Upgrade01to21(UpgradeWsp As DAO.Workspace, dbFile As
DAO.Database, sVersion As String)
    Dim sSql As String

    On Error GoTo Upgrade01to21Err

    sSql = "Create table db_details (" & _
           "db_version              Text(50) " & _
    ");"

    dbFile.Execute sSql, dbFailOnError

    sSql = "insert into db_details " & _
          "( db_version ) values ( '" & sVersion & "' ) "

    dbFile.Execute sSql, dbFailOnError

    Call UpdateContinuationCriteria(dbFile)

    Exit Sub

Upgrade01to21Err:
    Call LogErrors(Errors)
    UpgradeWsp.Rollback
    Err.Raise vbObjectError + errUpgradeFailed, mstrModuleName, _
          LoadResString(errUpgradeFailed)

End Sub
Private Function UpgradeDb(UpgradeWsp As DAO.Workspace, dbFile As Database, _
       sVerTo As String, sVerFrom As String) As Boolean

    Dim sMsg As String

    On Error GoTo UpgradeDbErr

    UpgradeDb = False
    If Not ValidUpgrade(sVerTo, sVerFrom) Then Exit Function

    If NoDbChanges(sVerTo, sVerFrom) Then
       UpgradeDb = True
       Exit Function
    End If

    sMsg = "The database needs to be upgraded from Version " & sVerFrom & _
          " to Version " & sVerTo & "." & vbCrLf & _
          "Proceed?"
    If Not Confirm(Buttons:=vbYesNo, strMessage:=sMsg, strTitle:="Upgrade
database") Then
       Exit Function
    End If

    UpgradeWsp.BeginTrans

    Select Case sVerFrom
       Case gsVersion243
          Call Upgrade243to25(UpgradeWsp, dbFile, gsVersion25)

       Case gsVersion24, gsVersion241, gsVersion242
          sMsg = "After this upgrade, the run history for previous runs will no longer be
available. " & _
                "Continue?"
          If Not Confirm(Buttons:=vbYesNo, strMessage:=sMsg, strTitle:="Upgrade
database") Then
             UpgradeWsp.CommitTrans
             Exit Function
          End If
          Call Upgrade242to243(UpgradeWsp, dbFile, gsVersion243)
          Call Upgrade243to25(UpgradeWsp, dbFile, gsVersion25)

       Case gsVersion23
          Call Upgrade23to24(UpgradeWsp, dbFile, gsVersion24)
          Call Upgrade242to243(UpgradeWsp, dbFile, gsVersion242)
          Call Upgrade243to25(UpgradeWsp, dbFile, gsVersion25)

       Case gsVersion21
          Call Upgrade21to23(UpgradeWsp, dbFile, gsVersion23)
          Call Upgrade23to24(UpgradeWsp, dbFile, gsVersion24)
          Call Upgrade242to243(UpgradeWsp, dbFile, gsVersion242)
          Call Upgrade243to25(UpgradeWsp, dbFile, gsVersion25)

       Case gsVersion10
          Call Upgrade10to21(UpgradeWsp, dbFile, gsVersion21)
          Call Upgrade21to23(UpgradeWsp, dbFile, gsVersion23)
          Call Upgrade23to24(UpgradeWsp, dbFile, gsVersion24)
          Call Upgrade242to243(UpgradeWsp, dbFile, gsVersion242)
          Call Upgrade243to25(UpgradeWsp, dbFile, gsVersion25)

       Case gsVersion01
          Call Upgrade01to21(UpgradeWsp, dbFile, gsVersion21)
          Call Upgrade21to23(UpgradeWsp, dbFile, gsVersion23)
          Call Upgrade23to24(UpgradeWsp, dbFile, gsVersion24)
          Call Upgrade242to243(UpgradeWsp, dbFile, gsVersion242)
          Call Upgrade243to25(UpgradeWsp, dbFile, gsVersion25)

    End Select

    UpgradeWsp.CommitTrans

    UpgradeDb = True
    Exit Function

UpgradeDbErr:
    Call LogErrors(Errors)
    ShowError errUpgradeFailed

End Function
Private Function DBVersion(TestDb As Database) As String
    ' Retrieves the database version
    Dim rVersion As Recordset

    On Error GoTo DBVersionErr

    Set rVersion = TestDb.OpenRecordset("Select db_version from db_details ", _
          dbOpenForwardOnly)

    BugAssert rVersion.RecordCount <> 0
    DBVersion = rVersion!db_version

    rVersion.Close
    Exit Function

DBVersionErr:
    If Err.Number = merrDaoTableMissing Then
       DBVersion = gsVersion01
    Else
       LogErrors Errors
       Err.Raise vbObjectError + errUpgradeFailed, mstrModuleName, _
             LoadResString(errUpgradeFailed)
    End If

End Function

Private Function ValidUpgrade(sVerTo As String, sVerFrom As String) As Boolean

    If sVerTo = gsVersion And sVerFrom = gsVersion243 Then
```

```
    ValidUpgrade = True
  ElseIf sVerTo = gsVersion And sVerFrom = gsVersion242 Then
    ValidUpgrade = True
  ElseIf sVerTo = gsVersion And sVerFrom = gsVersion241 Then
    ValidUpgrade = True
  ElseIf sVerTo = gsVersion And sVerFrom = gsVersion24 Then
    ValidUpgrade = True
  ElseIf sVerTo = gsVersion And sVerFrom = gsVersion23 Then
    ValidUpgrade = True
  ElseIf sVerTo = gsVersion And sVerFrom = gsVersion21 Then
    ValidUpgrade = True
  ElseIf sVerTo = gsVersion And sVerFrom = gsVersion10 Then
    ValidUpgrade = True
  ElseIf sVerTo = gsVersion And sVerFrom = gsVersion01 Then
    ValidUpgrade = True
  Else
    ValidUpgrade = False
  End If

End Function
```

DEBUGSM.BAS

```
Attribute VB_Name = "DebugSM"
'  FILE:      DebugSM.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    Contains all the functions that carry out error/debug
'              processing for the project.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
' Most of the functions in this module that manipulate the
' error object do not have an On Error GoTo statement - this
' is because it will clear the passed in error object - let
' the calling functions handle the errors raised by this
' module, if any
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "DebugSM."

Private mcLogFile As cFileSM
Private mcErrorFile As cFileSM

Private Const FORMAT_MESSAGE_FROM_SYSTEM = &H1000
Private Const FORMAT_MESSAGE_IGNORE_INSERTS = &H200
Private Const pNull = 0

Declare Function FormatMessage Lib "kernel32" Alias "FormatMessageA" (ByVal
dwFlags As Long, lpSource As Any, ByVal dwMessageId As Long, ByVal
dwLanguageId As Long, ByVal lpbuffer As String, ByVal nSize As Long, Arguments As
Long) As Long
Public Function Confirm(Optional lngMessageCode As conConfirmMsgCodes, _
      Optional lngTitleCode As conConfirmMsgTitleCodes, _
      Optional TitleParameter As String, _
      Optional ByVal Buttons As Integer = -1, _
      Optional strMessage As String = gstrEmptyString, _
      Optional strTitle As String = gstrEmptyString) _
      As Boolean
  ' Displays a confirmation message corresponding to the
  ' passed in message code. Returns True if the user says
  ' Ok and False otherwise

  Dim intResponse As Integer
  Dim intButtonStyle As Integer

  On Error GoTo ConfirmErr

  Confirm = False

  ' If the buttons style hasn't been specified, set the
  ' default style to display OK and Cancel buttons
  If Buttons = -1 Then
    intButtonStyle = vbOKCancel
  Else
    intButtonStyle = Buttons
  End If

  ' Find the message string for the passed in code
  If StringEmpty(strMessage) Then
    strMessage = Trim$(LoadResString(lngMessageCode))
  End If

  If StringEmpty(strTitle) Then
    strTitle = Trim$(LoadResString(lngTitleCode))
  End If

  If Not StringEmpty(TitleParameter) Then
    strTitle = strTitle & Chr$(vbKeySpace) & _
        gstrSQ & TitleParameter & gstrSQ
  End If

  ' Display the confirmation message with the Cancel button
  ' set to the default - assume that we are confirming
  ' potentially dangerous operations!
  intResponse = MsgBox(strMessage, _
      intButtonStyle + vbQuestion + vbApplicationModal, _
      strTitle)

  ' Translate the user response into a True/False return code
  If intButtonStyle = vbOKCancel Then
    If intResponse = vbOK Then
      Confirm = True
    Else
      Confirm = False
    End If
  Else
    If intResponse = vbYes Then
      Confirm = True
    Else
      Confirm = False
    End If
  End If

  Exit Function

ConfirmErr:
  ' Log the error code raised by Visual Basic
  Call LogErrors(Errors)
  On Error GoTo 0
  gstrSource = mstrModuleName & "Confirm"
  Err.Raise vbObjectError + errConfirmFailed, _
      gstrSource, _
      LoadResString(errConfirmFailed)

End Function
Public Sub LogSystemError()
  Dim eErrCode As Long

  eErrCode = GetLastError()
  If eErrCode <> 0 Then
    WriteToFile "System Error: " & eErrCode & vbCrLf & ApiError(eErrCode), _
        blnError:=True
  End If

End Sub
Public Function ApiError(ByVal e As Long) As String

  Dim s As String
```

```
    Dim c As Long

    s = String(256, 0)
    c = FormatMessage(FORMAT_MESSAGE_FROM_SYSTEM Or _
          FORMAT_MESSAGE_IGNORE_INSERTS, _
          pNull, e, 0&, s, Len(s), ByVal pNull)
    If c Then ApiError = e & ": " & Left$(s, c)

End Function

' Output flags determine output destination of BugAsserts and messages
#Const afLogfile = 1
#Const afMsgBox = 2
#Const afDebugWin = 4
#Const afAppLog = 8

' Display appropriate error message, and then stop
' program.  These errors should NOT be possible in
' shipping product.
Sub BugAssert(ByVal fExpression As Boolean, _
              Optional sExpression As String)
#If afDebug Then
    If fExpression Then Exit Sub
    BugMessage "BugAssert failed: " & sExpression
    Stop
#End If
End Sub

Sub BugMessage(sMsg As String)

#If afDebug And afLogfile Then
    ' Since we are writing log messages, the error flag is turned off
    Call WriteToFile(sMsg, False)
#End If
#If afDebug And afMsgBox Then
    MsgBox sMsg
#End If
#If afDebug And afDebugWin Then
    Debug.Print sMsg
#End If
#If afDebug And afAppLog Then
    App.LogEvent sMsg
#End If

End Sub
Public Function ProjectLogFile() As String

    ProjectLogFile = mcLogFile.FileName

End Function
Public Function ProjectErrorFile() As String

    ProjectErrorFile = mcErrorFile.FileName

End Function

Private Sub WriteToFile(sMsg As String, Optional ByVal blnError As Boolean)

    ' Calls procedures to write the passed in message to the log -
    ' The blnError flag is used to indicate that the message
    ' should be logged to the error file - by default the log
    ' file is used

    Dim mcFileObj As cFileSM
    Dim strFileName As String
    Dim strFileHdr As String

    On Error GoTo WriteToFileErr

    If blnError Then
        If mcErrorFile Is Nothing Then
            Set mcErrorFile = New cFileSM
        End If
        Set mcFileObj = mcErrorFile
    Else
        If mcLogFile Is Nothing Then
            Set mcLogFile = New cFileSM
        End If
        Set mcFileObj = mcLogFile
    End If

    If StringEmpty(mcFileObj.FileName) Then
        If blnError Then
            strFileName = gstrProjectPath & "\" & App.EXEName & ".ERR"
            strFileHdr = "Stepmaster Errors"
        Else
            strFileName = gstrProjectPath & "\" & App.EXEName & ".DBG"
            strFileHdr = "Stepmaster Log"
        End If

        mcFileObj.FileName = strFileName
        mcFileObj.WriteLine strFileHdr
        mcFileObj.WriteLine "Log start time : " & Now
    End If

    mcFileObj.WriteLine sMsg

    Exit Sub

WriteToFileErr:
    ' Display the error code raised by Visual Basic
    Call DisplayErrors(Errors)
    ' An error message would've been displayed by the called
    ' procedures

End Sub
Public Sub WriteMessage(sMsg As String)

    Call WriteToFile(sMsg, True)

End Sub

Sub BugTerm()
#If afDebug And afLogfile Then
    ' Close log file
    mcLogFile.CloseFile
#End If
End Sub

Public Sub ShowError(ByVal ErrorCode As errErrorConstants, _
        Optional ByVal ErrorSource As String = gstrEmptyString, _
        Optional ByVal OptArgs As String = gstrEmptyString, _
        Optional ByVal DoWriteError As Boolean = True)

    If DoWriteError Then
        ' Call a procedure to write the error to a log file
        Call WriteError(ErrorCode, ErrorSource, OptArgs)
    End If

    ' Re-initialize the values of the Error object before
    ' displaying the error to the user
    Call InitErrObject(ErrorCode, ErrorSource, OptArgs)

    Call DisplayErrors(Errors)

    Err.Clear

End Sub
Public Sub WriteError(ByVal ErrorCode As errErrorConstants, _
        Optional ByVal ErrorSource As String = gstrEmptyString, _
        Optional ByVal OptArgs As String = gstrEmptyString)
```

```
    ' Initialize the values of the Error object before
    ' calling the log function
    Call InitErrObject(ErrorCode, ErrorSource, OptArgs)

    Call LogErrors(Errors)

    Err.Clear

End Sub
Private Sub InitErrObject(ByVal ErrorCode As errErrorConstants, _
        Optional ByVal ErrorSource As String = gstrEmptyString, _
        Optional ByVal OptArgs As String = gstrEmptyString)

    Dim lngError As Long

    lngError = IIf(ErrorCode > vbObjectError And ErrorCode < vbObjectError + 65535, _
          ErrorCode - vbObjectError, ErrorCode)
    Err.Number = lngError + vbObjectError
    Err.Description = LoadResString(lngError) & OptArgs
    Err.Source = App.EXEName & ErrorSource

End Sub
Public Sub ShowMessage(ByVal MessageCode As errErrorConstants, _
        Optional ByVal OptArgs As String)

    Dim strMessage As String

    On Error GoTo ShowMessageErr

    strMessage = LoadResString(MessageCode) & OptArgs

    ' Write the error to a log file
    BugMessage strMessage

    MsgBox strMessage, vbOKOnly

    Exit Sub

ShowMessageErr:
    ' Log the error and exit
    Call DisplayErrors(Errors)

End Sub

Public Sub DisplayErrors(myErrCollection As Errors)
    Dim strError As String
    Dim errLoop As Error
    Dim errCode As Long

    ' Enumerate Errors collection and display properties of
    ' each Error object.
    If Err.Number <> 0 Then
        If Err.Number > vbObjectError And Err.Number < (vbObjectError + 65536) Then
            errCode = Err.Number - vbObjectError
        Else
            errCode = Err.Number
        End If
        strError = "Error # " & Str(errCode) & " was generated by " _
            & Err.Source & Chr(13) & Err.Description
        MsgBox strError, , "Error", Err.HelpFile, Err.HelpContext
    Else
        For Each errLoop In myErrCollection
            With errLoop
                If Err.Number > vbObjectError And Err.Number < (vbObjectError + 65536)
Then
                    errCode = .Number - vbObjectError
                Else
                    errCode = .Number
                End If
                strError = "Error #" & errCode & vbCrLf
                strError = strError & "    " & .Description & vbCrLf
                strError = strError & _
                    "    (Source: " & .Source & ")" & vbCrLf
'               strError = strError & _
'                   "Press F1 to see topic " & .HelpContext & vbCrLf
'               strError = strError & _
'                   "    in the file " & .HelpFile & "."
            End With

            MsgBox strError
        Next
    End If

End Sub
Public Sub LogErrors(myErrCollection As Errors)
    Dim cColErrors As cVectorStr
    Dim strError As String
    Dim errLoop As Error
    Dim errCode As Long
    Dim lngIndex As Long

    Set cColErrors = New cVectorStr

    ' Enumerate Errors collection and display properties of
    ' each Error object.
    If Err.Number <> 0 Then
        If Err.Number > vbObjectError And Err.Number < (vbObjectError + 65536) Then
            errCode = Err.Number - vbObjectError
        Else
            errCode = Err.Number
        End If
        strError = "Error # " & Str(errCode) & " was generated by " _
            & Err.Source & vbCrLf & Err.Description

        cColErrors.Add strError
    End If

    ' Log all database errors, if any
    For Each errLoop In myErrCollection
        With errLoop
            If Err.Number > vbObjectError And Err.Number < (vbObjectError + 65536)
Then
                errCode = .Number - vbObjectError
            Else
                errCode = .Number
            End If
            strError = "Error #" & errCode & vbCrLf
            strError = strError & "    " & .Description & vbCrLf
            strError = strError & _
                "    (Source: " & .Source & ")" & vbCrLf
        End With

        cColErrors.Add strError
    Next

    ' We can have a error handler now that we have stored all
    ' errors away safely! - having an error handler before
    ' enumerating all the errors would have cleared the error
    ' collection
    On Error GoTo LogErrorsErr
    gstrSource = mstrModuleName & "LogErrors"

    For lngIndex = 0 To cColErrors.Count - 1
        strError = cColErrors(lngIndex)
        Debug.Print strError
        Call WriteToFile(strError, True)
    Next lngIndex

    Set cColErrors = Nothing

    Exit Sub
```

```
LogErrorsErr:
    ' Display the error code raised by Visual Basic
    DisplayErrors Errors
    On Error GoTo 0
    ShowError errUnableToWriteError, DoWriteError:=False

End Sub
```

FILECOMMON.BAS

```
Attribute VB_Name = "FileCommon"
'  FILE:      FileCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    This module contains common functionality to display
'             the File Open dialog.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "FileCommon."

Private Enum EOpenFile
    OFN_OVERWRITEPROMPT = &H2
    OFN_HIDEREADONLY = &H4
    OFN_FILEMUSTEXIST = &H1000
    OFN_EXPLORER = &H80000
End Enum

' The locations for the different output files are presented to
' the user in a list box. These constants are used while loading the
' data and while reading the data from the list box.
' These constants also represent the different file types that are
' displayed to the user in File Open dialogs
Public Enum gFileTypes
    gintOutputFile = 0
'    gintLogFile = 1
    gintErrorFile
    gintStepTextFile
    gintOutputCompareFile
    gintDBFile
    gintDBFileNew
    gintImportFile
    gintExportFile
End Enum

Public Const gsSqlFileSuffix = ".sql"
Public Const gsCmdFileSuffix = ".cmd"

Public Const gsOutputFileSuffix = ".out"
Public Const gstrLogFileSuffix = ".log"
Public Const gsErrorFileSuffix = ".err"
Public Function BrowseDBFile() As String
    ' Prompts the user for a database file with the workspace information
    ' Call CallFileDialog to display the open file dialog
    BrowseDBFile = CallFileDialog(gintDBFile)

End Function
Public Function CallFileDialog(intFileType As Integer, _
        Optional ByVal strDefaultFile As String = gstrEmptyString) As String
    ' This function initializes the values of the filter property,
    ' the dialog title and flags for the File Open dialog depending
    ' on the FileType passed in
    ' It then calls ShowFileOpenDialog to set these properties and
    ' display the File Open dialog to the user

    ' All the properties used by the File Open dialog are defined
    ' as constants in this function and passed to ShowFileOpenDialog
    ' as parameters. So if any of the dialog properties need to be
    ' modified, these constants are what need to be changed
    Const s_DLG_TITLE_OPEN = "Open"
    Const s_DLG_TITLE_NEW = "New"
    Const s_DLG_TITLE_IMPORT = "Import From"
    Const s_DLG_TITLE_EXPORT = "Export To"

    Const mlng_FILE_STEP_TEXT_FLAGS = OFN_EXPLORER Or
OFN_FILEMUSTEXIST Or OFN_HIDEREADONLY
    Const mlng_FILE_OUTPUT_COMPARE_FLAGS =
mlng_FILE_STEP_TEXT_FLAGS
    Const mlng_FILE_DB_FLAGS = mlng_FILE_STEP_TEXT_FLAGS
    Const mlng_FILE_OUTPUT_FLAGS = OFN_EXPLORER Or
OFN_HIDEREADONLY Or OFN_OVERWRITEPROMPT
    Const mlng_FILE_LOG_FLAGS = mlng_FILE_OUTPUT_FLAGS
    Const mlng_FILE_ERROR_FLAGS = mlng_FILE_OUTPUT_FLAGS
    Const mlng_FILE_DB_NEW_FLAGS = mlng_FILE_OUTPUT_FLAGS

    Const mstr_FILE_ALL_FILTER = "|All Files (*.*)|*.*"
    Const mstr_FILE_STEP_TEXT_FILTER = "Query Files (*" & gsSqlFileSuffix & _
          ")|*" & gsSqlFileSuffix & "|Command Script Files (*" & gsCmdFileSuffix & _
          ")|*" & gsCmdFileSuffix
    Const mstr_FILE_OUTPUT_COMPARE_FILTER = "Text Files (*.txt)|*.txt"
    Const mstr_FILE_OUTPUT_FILTER = "Output Files (*.out)|*.out"
    Const mstr_FILE_LOG_FILTER = "Log Files (*.log)|*.log"
    Const mstr_FILE_ERROR_FILTER = "Error Files (*.err)|*.err"
    Const mstr_FILE_DB_FILTER = "Stepmaster Workspace Files (*" &
gsDefDBFileExt & ")|*" & gsDefDBFileExt

    Dim strFileName As String

    On Error GoTo CallFileDialogErr

    Select Case intFileType
        Case gintStepTextFile
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_STEP_TEXT_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_OPEN, _
                mlng_FILE_STEP_TEXT_FLAGS, _
                strDefaultFile)

        Case gintOutputCompareFile
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_OUTPUT_COMPARE_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_OPEN, _
                mlng_FILE_OUTPUT_COMPARE_FLAGS, _
                strDefaultFile)

        Case gintOutputFile
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_OUTPUT_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_OPEN, _
                mlng_FILE_OUTPUT_FLAGS, _
                strDefaultFile)

'       Case gintLogFile
'           strFileName = ShowFileOpenDialog( _
'               mstr_FILE_LOG_FILTER & mstr_FILE_ALL_FILTER, _
'               s_DLG_TITLE_OPEN, _
'               mlng_FILE_LOG_FLAGS, _
'               strDefaultFile)
'
        Case gintErrorFile
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_ERROR_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_OPEN, _
                mlng_FILE_ERROR_FLAGS, _
                strDefaultFile)

        Case gintDBFile
```

```
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_DB_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_OPEN, _
                mlng_FILE_DB_FLAGS, _
                strDefaultFile)

        Case gintDBFileNew
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_DB_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_NEW, _
                mlng_FILE_DB_NEW_FLAGS, _
                strDefaultFile)

        Case gintImportFile
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_DB_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_IMPORT, _
                mlng_FILE_DB_FLAGS, _
                strDefaultFile)

        Case gintExportFile
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_DB_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_EXPORT, _
                mlng_FILE_DB_FLAGS, _
                strDefaultFile)

        Case Else
            BugAssert True, "Incorrect file type passed in."
            ' Default processing will be for the output file
            strFileName = ShowFileOpenDialog( _
                mstr_FILE_OUTPUT_FILTER & mstr_FILE_ALL_FILTER, _
                s_DLG_TITLE_OPEN, _
                mlng_FILE_OUTPUT_FLAGS, _
                strDefaultFile)

    End Select
    CallFileDialog = strFileName

    Exit Function

CallFileDialogErr:
    CallFileDialog = gstrEmptyString
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "CallFileDialog"
    Call ShowError(errBrowseFailed)

End Function
```

ITERATORCOMMON.BAS

```
Attribute VB_Name = "IteratorCommon"
'  FILE:       IteratorCommon.bas
'              Microsoft TPC-H Kit Ver. 1.00
'              Copyright Microsoft, 1999
'              All Rights Reserved
'
'
'  PURPOSE:    Contains functionality common across StepMaster and
'              SMRunOnly, pertaining to iterators
'              Specifically, functions to read iterators records
'              in the workspace, load them in an array and so on.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "IteratorCommon."

Public Const gintMinIteratorSequence As Integer = 0

Public Sub RangeComplete(vntIterators As Variant)
    ' This is a debug procedure
    ' Checks if the from, to and step values are present in
    ' the array

    Dim bReset As Byte
    Dim bShift As Byte
    Dim lngIndex As Long

    ' Set the three lowest order bits to 1
    bReset = 7

    BugAssert IsArray(vntIterators) And Not IsEmpty(vntIterators), _
          "Iterators not specified!"

    For lngIndex = LBound(vntIterators) To _
          UBound(vntIterators)
        bShift = 1
        bShift = bShift * (2 ^ (vntIterators(lngIndex).IteratorType - 1))

        bReset = bReset Xor bShift
    Next lngIndex

    ' Assert that all the elements are present
    BugAssert bReset = 0, "Range not completely specified!"

End Sub
Public Sub LoadIteratorsForWsp(cStepsCol As cArrSteps, _
      ByVal lngWorkspaceId As Long, rstStepsInWsp As Recordset)
    ' Initializes the step records in with all the iterator
    ' values for each step

    Dim recIterators As Recordset

    On Error GoTo LoadIteratorsForWspErr

#If QUERY_ALL Then
    Dim dtStart As Date

    dtStart = Now
    Set recIterators = ReadWspIterators(lngWorkspaceId)

    Call LoadIteratorsArray(cStepsCol, recIterators)

    recIterators.Close

    BugMessage "QueryAll Read + load took: " & CStr(DateDiff("s", dtStart, Now))

#Else
    Dim dtStart As Date
    Dim qyIt As DAO.QueryDef
    Dim sSql As String

    dtStart = Now
    If rstStepsInWsp.RecordCount = 0 Then
        Exit Sub
    End If

    ' This method has the advantage that if the steps are queried right, everything else
follows
    sSql = "Select step_id, version_no, type, iterator_value, " & _
        " sequence_no " & _
        " from iterator_values " & _
        " where step_id = [s_id] " & _
        " and version_no = [ver_no] "

    ' Order the iterators by sequence within a step
    sSql = sSql & " order by sequence_no "

    Set qyIt = dbsAttTool.CreateQueryDef(gstrEmptyString, sSql)
```

```
    rstStepsInWsp.MoveFirst

    While Not rstStepsInWsp.EOF

        qyIt.Parameters("s_id").Value = rstStepsInWsp!step_id
        qyIt.Parameters("ver_no").Value = rstStepsInWsp!version_no

        Set recIterators = qyIt.OpenRecordset(dbOpenSnapshot)

        Call LoadIteratorsArray(cStepsCol, recIterators)
        recIterators.Close

        rstStepsInWsp.MoveNext
    Wend

    qyIt.Close

    BugMessage "Query step at a time Read + load took: " & CStr(DateDiff("s", dtStart,
Now))

#End If

    Exit Sub

LoadIteratorsForWspErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "LoadIteratorsForWsp"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadRsInArrayFailed, _
          gstrSource, _
          LoadResString(errLoadRsInArrayFailed)

End Sub
Private Function ReadWspIterators(ByVal lngWorkspaceId As Long) As Recordset

    ' This function will return a recordset that is populated
    ' with the iterators for all the steps in a given workspace

    Dim recIterators As Recordset
    Dim qyIt As DAO.QueryDef
    Dim strSql As String

    On Error GoTo ReadWspIteratorsErr
    gstrSource = mstrModuleName & "ReadWspIterators"

    strSql = "Select i.step_id, i.version_no, " & _
        " i.type, i.iterator_value, " & _
        " i.sequence_no " & _
        " from iterator_values i, att_steps a " & _
        " where i.step_id = a.step_id " & _
        " and i.version_no = a.version_no " & _
        " and a.workspace_id = [w_id] " & _
        " and a.archived_flag = [archived] "

    ' Find the highest X-component of the version number
    strSql = strSql & " AND cint( mid( a.version_no, 1, instr( a.version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) = " & _
        " ( select max( cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) ) " & _
        " from att_steps AS d " & _
        " WHERE a.step_id = d.step_id ) "

    ' Find the highest Y-component of the version number for the highest X-component
    strSql = strSql & " AND cint( mid( a.version_no, instr( a.version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) + 1 ) ) = " & _
        " ( select max( cint( mid( version_no, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) + 1 ) ) ) " & _
        " from att_steps AS b " & _
        " Where a.step_id = b.step_id " & _
        " AND cint( mid( version_no, 1, instr( version_no, " & gstrDQ & gstrVerSeparator
& gstrDQ & " ) - 1 ) ) = " & _
        " ( select max( cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) ) " & _
        " from att_steps AS c " & _
        " WHERE a.step_id = c.step_id ) ) "


    ' Order the iterators by sequence within a step
    strSql = strSql & " order by i.step_id, i.sequence_no "

    Set qyIt = dbsAttTool.CreateQueryDef(gstrEmptyString, strSql)
    qyIt.Parameters("w_id").Value = lngWorkspaceId
    qyIt.Parameters("archived").Value = False

    Set recIterators = qyIt.OpenRecordset(dbOpenSnapshot)

    qyIt.Close
    Set ReadWspIterators = recIterators

    Exit Function

ReadWspIteratorsErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errReadDataFailed, _
          gstrSource, LoadResString(errReadDataFailed)

End Function
Private Sub LoadIteratorsArray(cStepsCol As cArrSteps, _
        recIterators As Recordset)
    ' Initializes the step records with the iterators for
    ' the step

    Dim cNewIt As cIterator
    Dim cStepRec As cStep
    Dim lngStepId As Long

    On Error GoTo LoadIteratorsArrayErr
    gstrSource = mstrModuleName & "LoadIteratorsArray"

    If recIterators.RecordCount = 0 Then
        Exit Sub
    End If

    recIterators.MoveFirst
    While Not recIterators.EOF
        Set cNewIt = New cIterator

        lngStepId = CLng(ErrorOnNullField(recIterators, "step_id"))
        If Not cStepRec Is Nothing Then
            If cStepRec.StepId <> lngStepId Then
                Set cStepRec = cStepsCol.QueryStep(lngStepId)
            End If
        Else
            Set cStepRec = cStepsCol.QueryStep(lngStepId)
        End If

        ' Initialize iterator values
        cNewIt.IteratorType = CInt(ErrorOnNullField(recIterators, "type"))
        cNewIt.Value = CStr(ErrorOnNullField(recIterators, "iterator_value"))
        cNewIt.SequenceNo = CInt(ErrorOnNullField(recIterators, "sequence_no"))

        ' Add this record to the array of iterators
        cStepRec.LoadIterator cNewIt

        Set cNewIt = Nothing
        recIterators.MoveNext
    Wend

    Exit Sub
```

```
LoadIteratorsArrayErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "LoadIteratorsArray"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadRsInArrayFailed, _
          gstrSource, _
          LoadResString(errLoadRsInArrayFailed)

End Sub
```

MSGCONFIRM.BAS

```
Attribute VB_Name = "MsgConfirm"
'  FILE:      MsgConfirm.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:   Contains constants for confirmation messages that
'             will be displayed by StepMaster
'  Contact:   Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' A public enum containing the codes for all the confirmation
' messages that will be used by the project - each of the codes
' has the prefix, con
Public Enum conConfirmMsgCodes
    conWspDelete = 2000
    conSave
    conStopRun
    conSaveConnect
    conSaveDB
End Enum

' A public enum containing the titles for all the confirmation
' messages that will be used by the project - each of the codes
' has the prefix, cont - most confirmation message codes will
' have a corresponding title code in here
Public Enum conConfirmMsgTitleCodes
    contWspDelete = 3000
    contSave
    contStopRun
    contSaveConnect
    contSaveDB
End Enum
```

OPENFILES.BAS

```
Attribute VB_Name = "OpenFiles"
'  FILE:      OpenFiles.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:   This module holds a list of all files that have been
'             opened by the project. This module is needed since there
'             is no way to share static data between different instances
'             of a class.
'             Many procedure in this module do not do any error handling -
'             this is 'coz it is also used by procedures that log error
'             messages and any error handler will erase the collection
'             of errors!

'  Contact:   Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit


' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = ".OpenFiles."

Private mOpenFiles As cNodeCollections

Private Const mstrTempDir As String = "\Temp\"

' The maximum number of temporary files that we can create in a
' session
Private Const mlngMaxFileIndex As Long = 999999
Private Const mstrFileIndexFormat As String = "000000"
Private Const mstrTempFilePrefix As String = "SM"
Private Const mstrTempFileSuffix As String = ".cmd"

Private Const merrFileNotFound As Long = 76
Private Function GetFileHandle(strFileName) As cFileInfo

    Dim lngIndex As Long
    Dim blnFileOpen As Boolean

    If Not mOpenFiles Is Nothing Then

        blnFileOpen = False
        For lngIndex = 0 To mOpenFiles.Count - 1
            If mOpenFiles(lngIndex).FileName = strFileName Then
                blnFileOpen = True
                Exit For
            End If
        Next lngIndex

        If blnFileOpen Then
            Set GetFileHandle = mOpenFiles(lngIndex)
        Else
            Set GetFileHandle = Nothing
        End If
    Else
        Set GetFileHandle = Nothing
    End If

End Function

Private Function GetTempFileDir() As String

    Dim strTempFileDir As String

    On Error GoTo GetTempFileDirErr

    strTempFileDir = gstrProjectPath & mstrTempDir

    If StringEmpty(Dir$(strTempFileDir, vbDirectory)) Then
        MkDir strTempFileDir
    End If

    GetTempFileDir = strTempFileDir

    Exit Function

GetTempFileDirErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "GetTempFileDir"
    On Error GoTo 0
    Err.Raise vbObjectError + errProgramError, gstrSource, _
          LoadResString(errProgramError)

End Function
Public Function MakePathValid(strFileName As String) As String
    ' Checks if the passed in file path is valid

    Dim strFileDir As String
    Dim strTempDir As String
    Dim strTempFile As String
```

```
    Dim intPos As Integer
    Dim intStart As Integer

    On Error GoTo MakePathValidErr
    gstrSource = mstrModuleName & "MakePathValid"

    strTempFile = strFileName
    intPos = InstrR(strFileName, gstrFileSeparator)

    If intPos > 0 Then
        strFileDir = Left$(strTempFile, intPos - 1)
        If StringEmpty(Dir$(strFileDir, vbDirectory)) Then
            ' Loop through the entire path starting at the root
            ' since Mkdir can create only one level of sub-directory
            ' at a time
            intStart = InStr(strFileDir, gstrFileSeparator)

            Do While strTempDir <> strFileDir

                If intStart > 0 Then
                    strTempDir = Left$(strFileDir, intStart - 1)
                Else
                    strTempDir = strFileDir
                End If

                If StringEmpty(Dir$(strTempDir, vbDirectory)) Then
                    ' If the specified directory doesn't exist, try to
                    ' create it.
                    MkDir strTempDir
                Else
                    ' The directory exists - go to it's sub-directory
                End If
                intStart = InStr(intStart + 1, strFileDir, gstrFileSeparator)
            Loop

            ' Sanity check
            If StringEmpty(Dir$(strFileDir, vbDirectory)) Then
                ' We were unable to create the file directory
                ShowError errCreateDirectoryFailed, gstrSource, _
                      strFileDir, DoWriteError:=False
                MakePathValid = gstrEmptyString
            Else
                MakePathValid = strTempFile
            End If
        Else
            ' The specified directory exists - we should be able
            ' to create the output file in it
            MakePathValid = strTempFile
        End If
    Else
        ' The user has only specified a filename - VB will try
        ' to create it in the current directory
        MakePathValid = strTempFile
    End If

    Exit Function

MakePathValidErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "MakePathValid"
    ' Log the filename for debug
    Call WriteError(errInvalidFile, gstrSource, strTempFile)
    On Error GoTo 0
    Err.Raise vbObjectError + errProgramError, gstrSource, _
          LoadResString(errProgramError)

End Function
Public Function OpenFileSM(strFileName As String) As Integer
    Dim intHFile As Integer
    Dim NewFileInfo As cFileInfo

    On Error GoTo OpenFileSMErr
    gstrSource = mstrModuleName & "OpenFileSM"

    If StringEmpty(strFileName) Then
        On Error GoTo 0
        Err.Raise vbObjectError + errInvalidFile, gstrSource, _
              LoadResString(errInvalidFile)
    End If

    If mOpenFiles Is Nothing Then
        Set mOpenFiles = New cNodeCollections
    End If

    Set NewFileInfo = GetFileHandle(strFileName)

    If NewFileInfo Is Nothing Then
        ' The file has not been opened yet

        ' If the filename has not been initialized, do not
        ' attempt to open it
        strFileName = MakePathValid(strFileName)

        If strFileName <> gstrEmptyString Then
            intHFile = FreeFile
            Open strFileName For Output Shared As intHFile

            Set NewFileInfo = New cFileInfo
            NewFileInfo.FileHandle = intHFile
            NewFileInfo.FileName = strFileName
            mOpenFiles.Load NewFileInfo
        Else
            ' Either the directory was invalid or s'thing failed
            ' Display the error to the user instead of trying
            ' to log to the file
            ShowError errInvalidFile, gstrSource, strFileName, _
                  DoWriteError:=False
            intHFile = 0
        End If
    Else
        intHFile = NewFileInfo.FileHandle
    End If

    OpenFileSM = intHFile

    Exit Function

OpenFileSMErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    ' The Open command failed for some reason - write an error
    ' and let the calling function handle the error
    ShowError errInvalidFile, gstrSource, strFileName, _
          DoWriteError:=False
    OpenFileSM = 0

End Function
Public Function CreateTempFile() As String

    Dim strTempFileDir As String
    Dim strTempFileName As String

    Static lngLastFileIndex As Long

    On Error GoTo CreateTempFileErr

    strTempFileDir = GetTempFileDir()

    Do
        If lngLastFileIndex = mlngMaxFileIndex Then
            On Error GoTo 0
```

```
            Err.Raise vbObjectError + errMaxTempFiles, gstrSource, _
                LoadResString(errMaxTempFiles)
        End If

        lngLastFileIndex = lngLastFileIndex + 1
        strTempFileName = mstrTempFilePrefix & _
            Format$(lngLastFileIndex, mstrFileIndexFormat) & _
            mstrTempFileSuffix

        If Not StringEmpty(Dir$(strTempFileDir & strTempFileName)) Then
            ' Remove any files left over from a previous run,
            ' if they still exist
            Kill strTempFileDir & strTempFileName
        End If

    ' Looping in case the file delete doesn't go through for
    ' some reason
    Loop While Not StringEmpty(Dir$(strTempFileDir & strTempFileName))

    CreateTempFile = GetShortName(strTempFileDir)
    CreateTempFile = CreateTempFile & strTempFileName

    Exit Function

CreateTempFileErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = gstrSource & "CreateTempFile"
    On Error GoTo 0
    Err.Raise vbObjectError + errProgramError, gstrSource, _
        LoadResString(errProgramError)

End Function
Public Sub CloseFileSM(strFileName As String)
    Dim FileToClose As cFileInfo

    If Not mOpenFiles Is Nothing Then

        ' Get the handle to the open file, if it exists
        Set FileToClose = GetFileHandle(strFileName)

        If Not FileToClose Is Nothing Then
            Close FileToClose.FileHandle

            ' Remove the file info from the collection of open files
            mOpenFiles.Unload FileToClose.Position
        End If
    End If

End Sub
Public Sub CloseOpenFiles()
    Dim lIndex As Long

    If Not mOpenFiles Is Nothing Then
        For lIndex = mOpenFiles.Count - 1 To 0
            CloseFileSM (mOpenFiles(lIndex).FileName)
        Next lIndex
    End If

End Sub
```

PARAMETERCOMMON.BAS

```
Attribute VB_Name = "ParameterCommon"
'  FILE:      ParameterCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:   Contains functionality common across StepMaster and
'             SMRunOnly, pertaining to parameters
'             Specifically, functions to load parameter records
'             in an array.
'  Contact:   Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "ParameterCommon."

Public Sub LoadRecordsetInParameterArray(rstWorkSpaceParameters As Recordset,
_
    cParamCol As cArrParameters)

    Dim cNewParameter As cParameter

    On Error GoTo LoadRecordsetInParameterArrayErr

    If rstWorkSpaceParameters.RecordCount = 0 Then
        Exit Sub
    End If

    rstWorkSpaceParameters.MoveFirst
    While Not rstWorkSpaceParameters.EOF

        Set cNewParameter = New cParameter

        ' Initialize parameter values
        cNewParameter.ParameterId = rstWorkSpaceParameters.Fields(0)

        ' Call a procedure to raise an error if mandatory fields are
        ' null.
        cNewParameter.ParameterName = CStr( _
            ErrorOnNullField(rstWorkSpaceParameters, "parameter_name"))
        cNewParameter.ParameterValue = CheckForNullField( _
            rstWorkSpaceParameters, "parameter_value")
        cNewParameter.WorkspaceId = CStr( _
            ErrorOnNullField(rstWorkSpaceParameters, FLD_ID_WORKSPACE))
        cNewParameter.ParameterType = CStr( _
            ErrorOnNullField(rstWorkSpaceParameters, "parameter_type"))
        cNewParameter.Description = CheckForNullField( _
            rstWorkSpaceParameters, "description")

        cParamCol.Load cNewParameter

        Set cNewParameter = Nothing
        rstWorkSpaceParameters.MoveNext
    Wend

    Exit Sub

LoadRecordsetInParameterArrayErr:
    LogErrors Errors
    gstrSource = mstrModuleName & "LoadRecordsetInParameterArray"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadRsInArrayFailed, gstrSource, _
        LoadResString(errLoadRsInArrayFailed)
End Sub
```

PUBLIC.BAS

```
Attribute VB_Name = "Public"
'  FILE:      Public.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:   This module contains all the public constants for this project
'  Contact:   Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit
```

```
Public Const gsVersion01 As String = "0.1"
Public Const gsVersion10 As String = "1.0"
Public Const gsVersion21 As String = "2.1"
Public Const gsVersion23 As String = "2.3"
Public Const gsVersion24 As String = "2.4"
Public Const gsVersion241 As String = "2.4.1"
Public Const gsVersion242 As String = "2.4.2"
Public Const gsVersion243 As String = "2.4.3"
Public Const gsVersion25 As String = "2.5"
Public Const gsVersion251 As String = "2.5.1"
Public Const gsVersion253 As String = "2.5.3"
Public Const gsVersion254 As String = "2.5.4"
Public Const gsVersion255 As String = "2.5.5"
Public Const gsVersion As String = gsVersion255

' The same form is used for the creation of new nodes and
' updates to existing nodes (where each node can be a parameter,
' global step, etc.) A tag is set on each flag is used to indicate
' whether it is being called in the insert or update mode. The
' constants for these modes are defined below
Public Const gstrInsertMode = "Insert"
Public Const gstrUpdateMode = "Update"
Public Const gstrPropertiesMode = "View"

Public Const gstrEmptyString = ""
Public Const gstrSQ = "'"
Public Const gstrDQ = """"
Public Const gstrVerSeparator = "."
Public Const gstrBlank = " "

' Constants used to indicate type of node being processed
' The constants for the different objects correspond to the
' indexes in the menu control arrays (for both the main and popup
' menus) that are used to create new objects. That way we can
' use the index passed in by the click event to determine the
' type of node being processed
Public Const gintWorkspace = 1

' Decided to leave it here after some debate over whether it
' actually belongs in the cStep class definition
Public Enum gintStepType
    gintGlobalStep = 3
    gintManagerStep
    gintWorkerStep
End Enum

Public Const gintRunManager = 6
Public Const gintRunWorker = 7

Public Enum gintParameterNodeType
    gintParameter = 8
    gintNodeParamConnection
    gintNodeParamExtension
    gintNodeParamBuiltIn
End Enum

' Leave some constants free for newer types of parameters (?)
Public Const gintConnectionDtl = 15

Public Enum gintLabelNodeType
    gintGlobalsLabel = 21
    gintParameterLabel
    gintParamConnectionLabel
    gintParamExtensionLabel
    gintParamBuiltInLabel
    gintConnDtlLabel
    gintGlobalStepLabel
    gintStepLabel
End Enum

Public Enum ConnectionType
    ConnTypeStatic = 1
    ConnTypeDynamic
End Enum

Public Const giDefaultConnType As Integer = ConnTypeStatic

' The constants defined below are used to identify the different
' tabs. If any more step properties and thereby tabs are added
' to the tabbed dialog on the Step Properties form, they should
' be defined here and accessed in the code only using these
' pre-defined constants
' Note: These constants will mainly be used by the functions that
' initialize, customize and display the Step Properties form
Public Const gintDefinition = 0
Public Const gintExecution = 1
Public Const gintMgrDefinition = 2
Public Const gintPreExecutionSteps = 3
Public Const gintPostExecutionSteps = 4
Public Const gintFileLocations = 5

' These constants correspond to the index values in the imagelist
' associated with the tree view control. The imagelist contains
' the icons that will be displayed for each node.
Public Enum TreeImages
    gintImageWorkspaceClosed = 1
    gintImageWorkspaceOpen
    gintImageLabelClosed
    gintImageLabelOpen
    gintImageManagerClosedDis
    gintImageManagerClosedEn
    gintImageManagerOpenDis
    gintImageManagerOpenEn
    gintImageWorkerDis
    gintImageWorkerEn
    gintImageGlobalClosed
    gintImageGlobalOpen
    gintImageParameter
    gintImageRun
    gintImagePending
    gintImageStop
    gintImageDisabled
    gintImageAborted
    gintImageFailed
End Enum

' Public variable used to indicate the name of the function
' that raises an error
Public gstrSource As String

' Public instances of the different collections
Public gcParameters As cArrParameters
Public gcSteps As cArrSteps
Public gcConstraints As cArrConstraints
Public gcConnections As cConnections
Public gcConnDtls As cConnDtls

' Public constants for the index values of the different toolbar
' options. Will be used while dynamically enabling/disabling
' these options.
Public Const tbNew = 1
Public Const tbOpen = 2
Public Const tbSave = 3

Public Const tbCut = 5
Public Const tbCopy = 6
Public Const tbPaste = 7
Public Const tbDelete = 8

Public Const tbProperties = 10
Public Const tbRun = 11
```

```
Public Const tbStop = 12

' The initial version #
Public Const gstrMinVersion As String = "0.0"
Public Const gstrGlobalParallelism As String = "0"
Public Const gintMinParallelism As Integer = 1
Public Const gintMaxParallelism As Integer = 100

' Constant for the minimum identifier, used for all identifier, viz.
' step, workspace, etc.
Public Const glMinId As Long = 1
Public Const glInvalidId As Long = -1

' A parameter that has a special meaning to Stepmaster
' The system time will be substituted wherever it occurs
' (typically as a part of the error, log ... file names
Public Const gstrTimeStamp As String = "TIMESTAMP"
Public Const gstrEnvVarSeparator = "%"
Public Const gstrFileSeparator = "\"
Public Const gstrUnderscore = "_"

' Constants used by date and time formatting functions
Public Const gsTimeSeparator = ":"
Public Const gsDateSeparator = "-"
Public Const gsMsSeparator = "."
Public Const gsDtFormat = "00"
Public Const gsYearFormat = "0000"
Public Const gsTmFormat = "00"
Public Const gsMSecondFormat = "000"

' Default nothing value for a date variable
Public Const gdtmEmpty As Currency = 0

Public Const FMT_WSP_LOG_FILE As String = "yyyymmdd-hhnnss"

Public gsContCriteria() As String
' Note: Update the initialization of gsExecutionStatus in Initialize() if the
' InstanceStatus values are modified - also the boundary checks
Public gsExecutionStatus() As String

Public Const gsConnTypeStatic As String = "Static"
Public Const gsConnTypeDynamic As String = "Dynamic"

#If RUN_ONLY Then
Public Const gsCaptionRunWsp As String = "Run Workspace"
#End If

' Valid operations on a cNode object
Public Enum Operation
   QueryOp = 1
   InsertOp = 2
   UpdateOp = 3
   DeleteOp = 4
End Enum
```

RUNCOMMON.BAS

```
Attribute VB_Name = "RunCommon"
'  FILE:      RunCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:   Contains common functions that are used during the execution
'             of a workspace.
'  Contact:   Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = ".RunCommon."


Public Function GetInstanceItValue(cInstanceRec As cInstance) As String

   ' Returns the iterator value for the instance, if an
   ' iterator has been defined for it
   Dim cStepIt As cRunColIt
   Dim cRunIterator As cRunItNode

   On Error GoTo GetInstanceItValueErr

   ' Since we create a dummy instance for Disabled and Pending steps,
   ' doesn't make sense to look at their iterators
   If cInstanceRec.Status <> gintDisabled And cInstanceRec.Status <> gintPending
Then
      Set cStepIt = cInstanceRec.Iterators

      If Not StringEmpty(cInstanceRec.Step.IteratorName) Then
         BugAssert cStepIt.Count > 0, "Iterator Count is greater " & _
               "than zero for a step that has an iterator defined."
         Set cRunIterator = cStepIt(0)
         BugAssert cRunIterator.IteratorName = cInstanceRec.Step.IteratorName, _
               "The first iterator in the collection is the " & _
               "one that has been defined for the step."
         If cRunIterator.IteratorName = cInstanceRec.Step.IteratorName Then
            GetInstanceItValue = cRunIterator.Value
         Else
            GetInstanceItValue = gstrEmptyString
         End If
      Else
         GetInstanceItValue = gstrEmptyString
      End If
   Else
      GetInstanceItValue = gstrEmptyString
   End If

   Exit Function

GetInstanceItValueErr:
   ' Log the error code raised by Visual Basic
   Call LogErrors(Errors)
   On Error GoTo 0
   gstrSource = mstrModuleName & "GetInstanceItValue"
   Err.Raise vbObjectError + errProgramError, gstrSource, _
         LoadResString(errProgramError)

End Function
```

CRUNINST.CLS

```
VERSION 1.0 CLASS
BEGIN
  MultiUse = -1  'True
  Persistable = 0  'NotPersistable
  DataBindingBehavior = 0  'vbNone
  DataSourceBehavior  = 0  'vbNone
  MTSTransactionMode  = 0  'NotAnMTSObject
END
Attribute VB_Name = "cRunInst"
Attribute VB_GlobalNameSpace = False
Attribute VB_Creatable = True
Attribute VB_PredeclaredId = False
Attribute VB_Exposed = False
'  FILE:      cRunColIt.cls
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:   This module controls the run processing. It runs a branch
```

```
'               at a time and raises events when each step completes execution.
'  Contact:     Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "cRunInst."
Private mstrSource As String

' Local variable(s) to hold property value(s)
Private mstrRootKey As String
Public WspId As Long
Private mcParameters As cArrParameters
Private mcRunSteps As cArrSteps
Private mcRunConstraints As cArrConstraints
Public RunConnections As cConnections
Public RunConnDtls As cConnDtls
Private mcvntWspPreCons As Variant
Private mcvntWspPostCons As Variant
Private mcNavSteps As cStepTree

Private mcInstances As cInstances
Private mcFreeSteps As cVectorLng
Private mcFailures As cFailedSteps
Private mblnAsk As Boolean    ' Set to True when the a step with continuation
criteria=Ask fails
Private mblnAbort As Boolean ' Set to True when the run is aborted
Private msAbortDtls As String
Private mbarrFree() As Byte
Private WithEvents mcTermSteps As cTermSteps
Attribute mcTermSteps.VB_VarHelpID = -1
Public RunId As Long
Public CreateInputFiles As Boolean

Private Enum WspLogEvents
   mintRunStart
   mintRunComplete
   mintStepStart
   mintStepComplete
End Enum

Private mcWspLog As cFileSM

Private mstrCurBranchRoot As String
Private mcDummyRootInstance As cInstance

' Key for the dummy root instance - Should be a key that is invalid for an actual step
record
Private Const mstrDummyRootKey As String = "D"

' Public events to notify the calling function of the
' start and end time for each step
Public Event RunStart(dtmStartTime As Currency, strWspLog As String)
Public Event RunComplete(dtmEndTime As Currency)
Public Event StepStart(cStepRecord As cStep, dtmStartTime As Currency, _
      lngInstanceId As Long, lParentInstanceId As Long, sPath As String, _
      sIts As String, sItValue As String)
Public Event StepComplete(cStepRecord As cStep, dtmEndTime As Currency,
lngInstanceId As Long, lElapsed As Long)
Public Event ProcessStart(cStepRecord As cStep, strCommand As String, _
      dtmStartTime As Currency, lngInstanceId As Long, lParentInstanceId As Long, _
      sItValue As String)
Public Event ProcessComplete(cStepRecord As cStep, dtmEndTime As Currency,
lngInstanceId As Long, lElapsed As Long)

' The class that will execute each step - we trap the events
' that are raised by it when a step starts/completes
' execution
Private WithEvents cExecStep1 As cRunStep
Attribute cExecStep1.VB_VarHelpID = -1
Private WithEvents cExecStep2 As cRunStep
Attribute cExecStep2.VB_VarHelpID = -1
Private WithEvents cExecStep3 As cRunStep
Attribute cExecStep3.VB_VarHelpID = -1
Private WithEvents cExecStep4 As cRunStep
Attribute cExecStep4.VB_VarHelpID = -1
Private WithEvents cExecStep5 As cRunStep
Attribute cExecStep5.VB_VarHelpID = -1
Private WithEvents cExecStep6 As cRunStep
Attribute cExecStep6.VB_VarHelpID = -1
Private WithEvents cExecStep7 As cRunStep
Attribute cExecStep7.VB_VarHelpID = -1
Private WithEvents cExecStep8 As cRunStep
Attribute cExecStep8.VB_VarHelpID = -1
Private WithEvents cExecStep9 As cRunStep
Attribute cExecStep9.VB_VarHelpID = -1

Private WithEvents cExecStep10 As cRunStep
Attribute cExecStep10.VB_VarHelpID = -1
Private WithEvents cExecStep11 As cRunStep
Attribute cExecStep11.VB_VarHelpID = -1
Private WithEvents cExecStep12 As cRunStep
Attribute cExecStep12.VB_VarHelpID = -1
Private WithEvents cExecStep13 As cRunStep
Attribute cExecStep13.VB_VarHelpID = -1
Private WithEvents cExecStep14 As cRunStep
Attribute cExecStep14.VB_VarHelpID = -1
Private WithEvents cExecStep15 As cRunStep
Attribute cExecStep15.VB_VarHelpID = -1
Private WithEvents cExecStep16 As cRunStep
Attribute cExecStep16.VB_VarHelpID = -1
Private WithEvents cExecStep17 As cRunStep
Attribute cExecStep17.VB_VarHelpID = -1
Private WithEvents cExecStep18 As cRunStep
Attribute cExecStep18.VB_VarHelpID = -1
Private WithEvents cExecStep19 As cRunStep
Attribute cExecStep19.VB_VarHelpID = -1

Private WithEvents cExecStep20 As cRunStep
Attribute cExecStep20.VB_VarHelpID = -1
Private WithEvents cExecStep21 As cRunStep
Attribute cExecStep21.VB_VarHelpID = -1
Private WithEvents cExecStep22 As cRunStep
Attribute cExecStep22.VB_VarHelpID = -1
Private WithEvents cExecStep23 As cRunStep
Attribute cExecStep23.VB_VarHelpID = -1
Private WithEvents cExecStep24 As cRunStep
Attribute cExecStep24.VB_VarHelpID = -1
Private WithEvents cExecStep25 As cRunStep
Attribute cExecStep25.VB_VarHelpID = -1
Private WithEvents cExecStep26 As cRunStep
Attribute cExecStep26.VB_VarHelpID = -1
Private WithEvents cExecStep27 As cRunStep
Attribute cExecStep27.VB_VarHelpID = -1
Private WithEvents cExecStep28 As cRunStep
Attribute cExecStep28.VB_VarHelpID = -1
Private WithEvents cExecStep29 As cRunStep
Attribute cExecStep29.VB_VarHelpID = -1

Private WithEvents cExecStep30 As cRunStep
Attribute cExecStep30.VB_VarHelpID = -1
Private WithEvents cExecStep31 As cRunStep
Attribute cExecStep31.VB_VarHelpID = -1
Private WithEvents cExecStep32 As cRunStep
Attribute cExecStep32.VB_VarHelpID = -1
Private WithEvents cExecStep33 As cRunStep
Attribute cExecStep33.VB_VarHelpID = -1
Private WithEvents cExecStep34 As cRunStep
Attribute cExecStep34.VB_VarHelpID = -1
Private WithEvents cExecStep35 As cRunStep
Attribute cExecStep35.VB_VarHelpID = -1
```

```
Private WithEvents cExecStep36 As cRunStep
Attribute cExecStep36.VB_VarHelpID = -1
Private WithEvents cExecStep37 As cRunStep
Attribute cExecStep37.VB_VarHelpID = -1
Private WithEvents cExecStep38 As cRunStep
Attribute cExecStep38.VB_VarHelpID = -1
Private WithEvents cExecStep39 As cRunStep
Attribute cExecStep39.VB_VarHelpID = -1

Private WithEvents cExecStep40 As cRunStep
Attribute cExecStep40.VB_VarHelpID = -1
Private WithEvents cExecStep41 As cRunStep
Attribute cExecStep41.VB_VarHelpID = -1
Private WithEvents cExecStep42 As cRunStep
Attribute cExecStep42.VB_VarHelpID = -1
Private WithEvents cExecStep43 As cRunStep
Attribute cExecStep43.VB_VarHelpID = -1
Private WithEvents cExecStep44 As cRunStep
Attribute cExecStep44.VB_VarHelpID = -1
Private WithEvents cExecStep45 As cRunStep
Attribute cExecStep45.VB_VarHelpID = -1
Private WithEvents cExecStep46 As cRunStep
Attribute cExecStep46.VB_VarHelpID = -1
Private WithEvents cExecStep47 As cRunStep
Attribute cExecStep47.VB_VarHelpID = -1
Private WithEvents cExecStep48 As cRunStep
Attribute cExecStep48.VB_VarHelpID = -1
Private WithEvents cExecStep49 As cRunStep
Attribute cExecStep49.VB_VarHelpID = -1

Private WithEvents cExecStep50 As cRunStep
Attribute cExecStep50.VB_VarHelpID = -1
Private WithEvents cExecStep51 As cRunStep
Attribute cExecStep51.VB_VarHelpID = -1
Private WithEvents cExecStep52 As cRunStep
Attribute cExecStep52.VB_VarHelpID = -1
Private WithEvents cExecStep53 As cRunStep
Attribute cExecStep53.VB_VarHelpID = -1
Private WithEvents cExecStep54 As cRunStep
Attribute cExecStep54.VB_VarHelpID = -1
Private WithEvents cExecStep55 As cRunStep
Attribute cExecStep55.VB_VarHelpID = -1
Private WithEvents cExecStep56 As cRunStep
Attribute cExecStep56.VB_VarHelpID = -1
Private WithEvents cExecStep57 As cRunStep
Attribute cExecStep57.VB_VarHelpID = -1
Private WithEvents cExecStep58 As cRunStep
Attribute cExecStep58.VB_VarHelpID = -1
Private WithEvents cExecStep59 As cRunStep
Attribute cExecStep59.VB_VarHelpID = -1

Private WithEvents cExecStep60 As cRunStep
Attribute cExecStep60.VB_VarHelpID = -1
Private WithEvents cExecStep61 As cRunStep
Attribute cExecStep61.VB_VarHelpID = -1
Private WithEvents cExecStep62 As cRunStep
Attribute cExecStep62.VB_VarHelpID = -1
Private WithEvents cExecStep63 As cRunStep
Attribute cExecStep63.VB_VarHelpID = -1
Private WithEvents cExecStep64 As cRunStep
Attribute cExecStep64.VB_VarHelpID = -1
Private WithEvents cExecStep65 As cRunStep
Attribute cExecStep65.VB_VarHelpID = -1
Private WithEvents cExecStep66 As cRunStep
Attribute cExecStep66.VB_VarHelpID = -1
Private WithEvents cExecStep67 As cRunStep
Attribute cExecStep67.VB_VarHelpID = -1
Private WithEvents cExecStep68 As cRunStep
Attribute cExecStep68.VB_VarHelpID = -1
Private WithEvents cExecStep69 As cRunStep
Attribute cExecStep69.VB_VarHelpID = -1

Private WithEvents cExecStep70 As cRunStep
Attribute cExecStep70.VB_VarHelpID = -1
Private WithEvents cExecStep71 As cRunStep
Attribute cExecStep71.VB_VarHelpID = -1
Private WithEvents cExecStep72 As cRunStep
Attribute cExecStep72.VB_VarHelpID = -1
Private WithEvents cExecStep73 As cRunStep
Attribute cExecStep73.VB_VarHelpID = -1
Private WithEvents cExecStep74 As cRunStep
Attribute cExecStep74.VB_VarHelpID = -1
Private WithEvents cExecStep75 As cRunStep
Attribute cExecStep75.VB_VarHelpID = -1
Private WithEvents cExecStep76 As cRunStep
Attribute cExecStep76.VB_VarHelpID = -1
Private WithEvents cExecStep77 As cRunStep
Attribute cExecStep77.VB_VarHelpID = -1
Private WithEvents cExecStep78 As cRunStep
Attribute cExecStep78.VB_VarHelpID = -1
Private WithEvents cExecStep79 As cRunStep
Attribute cExecStep79.VB_VarHelpID = -1

Private WithEvents cExecStep80 As cRunStep
Attribute cExecStep80.VB_VarHelpID = -1
Private WithEvents cExecStep81 As cRunStep
Attribute cExecStep81.VB_VarHelpID = -1
Private WithEvents cExecStep82 As cRunStep
Attribute cExecStep82.VB_VarHelpID = -1
Private WithEvents cExecStep83 As cRunStep
Attribute cExecStep83.VB_VarHelpID = -1
Private WithEvents cExecStep84 As cRunStep
Attribute cExecStep84.VB_VarHelpID = -1
Private WithEvents cExecStep85 As cRunStep
Attribute cExecStep85.VB_VarHelpID = -1
Private WithEvents cExecStep86 As cRunStep
Attribute cExecStep86.VB_VarHelpID = -1
Private WithEvents cExecStep87 As cRunStep
Attribute cExecStep87.VB_VarHelpID = -1
Private WithEvents cExecStep88 As cRunStep
Attribute cExecStep88.VB_VarHelpID = -1
Private WithEvents cExecStep89 As cRunStep
Attribute cExecStep89.VB_VarHelpID = -1

Private WithEvents cExecStep90 As cRunStep
Attribute cExecStep90.VB_VarHelpID = -1
Private WithEvents cExecStep91 As cRunStep
Attribute cExecStep91.VB_VarHelpID = -1
Private WithEvents cExecStep92 As cRunStep
Attribute cExecStep92.VB_VarHelpID = -1
Private WithEvents cExecStep93 As cRunStep
Attribute cExecStep93.VB_VarHelpID = -1
Private WithEvents cExecStep94 As cRunStep
Attribute cExecStep94.VB_VarHelpID = -1
Private WithEvents cExecStep95 As cRunStep
Attribute cExecStep95.VB_VarHelpID = -1
Private WithEvents cExecStep96 As cRunStep
Attribute cExecStep96.VB_VarHelpID = -1
Private WithEvents cExecStep97 As cRunStep
Attribute cExecStep97.VB_VarHelpID = -1
Private WithEvents cExecStep98 As cRunStep
Attribute cExecStep98.VB_VarHelpID = -1
Private WithEvents cExecStep99 As cRunStep
Attribute cExecStep99.VB_VarHelpID = -1

Private Const msIt As String = " Iterator: "
Private Const msItValue As String = " Value: "
Public Sub Abort()

    On Error GoTo AbortErr

    ' Make sure that we don't execute any more steps
```

```
    Call StopRun

    If cExecStep1 Is Nothing And cExecStep2 Is Nothing And cExecStep3 Is Nothing
And cExecStep4 Is Nothing And cExecStep5 Is Nothing And cExecStep6 Is Nothing
And cExecStep7 Is Nothing And cExecStep8 Is Nothing And cExecStep9 Is Nothing
And _
       cExecStep10 Is Nothing And cExecStep11 Is Nothing And cExecStep12 Is
Nothing And cExecStep13 Is Nothing And cExecStep14 Is Nothing And cExecStep15
Is Nothing And cExecStep16 Is Nothing And cExecStep17 Is Nothing And
cExecStep18 Is Nothing And cExecStep19 Is Nothing And _
       cExecStep20 Is Nothing And cExecStep21 Is Nothing And cExecStep22 Is
Nothing And cExecStep23 Is Nothing And cExecStep24 Is Nothing And cExecStep25
Is Nothing And cExecStep26 Is Nothing And cExecStep27 Is Nothing And
cExecStep28 Is Nothing And cExecStep29 Is Nothing And _
       cExecStep30 Is Nothing And cExecStep31 Is Nothing And cExecStep32 Is
Nothing And cExecStep33 Is Nothing And cExecStep34 Is Nothing And cExecStep35
Is Nothing And cExecStep36 Is Nothing And cExecStep37 Is Nothing And
cExecStep38 Is Nothing And cExecStep39 Is Nothing And _
       cExecStep40 Is Nothing And cExecStep41 Is Nothing And cExecStep42 Is
Nothing And cExecStep43 Is Nothing And cExecStep44 Is Nothing And cExecStep45
Is Nothing And cExecStep46 Is Nothing And cExecStep47 Is Nothing And
cExecStep48 Is Nothing And cExecStep49 Is Nothing And _
       cExecStep50 Is Nothing And cExecStep51 Is Nothing And cExecStep52 Is
Nothing And cExecStep53 Is Nothing And cExecStep54 Is Nothing And cExecStep55
Is Nothing And cExecStep56 Is Nothing And cExecStep57 Is Nothing And
cExecStep58 Is Nothing And cExecStep59 Is Nothing And _
       cExecStep60 Is Nothing And cExecStep61 Is Nothing And cExecStep62 Is
Nothing And cExecStep63 Is Nothing And cExecStep64 Is Nothing And cExecStep65
Is Nothing And cExecStep66 Is Nothing And cExecStep67 Is Nothing And
cExecStep68 Is Nothing And cExecStep69 Is Nothing And _
       cExecStep70 Is Nothing And cExecStep71 Is Nothing And cExecStep72 Is
Nothing And cExecStep73 Is Nothing And cExecStep74 Is Nothing And cExecStep75
Is Nothing And cExecStep76 Is Nothing And cExecStep77 Is Nothing And
cExecStep78 Is Nothing And cExecStep79 Is Nothing And _
       cExecStep80 Is Nothing And cExecStep81 Is Nothing And cExecStep82 Is
Nothing And cExecStep83 Is Nothing And cExecStep84 Is Nothing And cExecStep85
Is Nothing And cExecStep86 Is Nothing And cExecStep87 Is Nothing And
cExecStep88 Is Nothing And cExecStep89 Is Nothing And _
       cExecStep90 Is Nothing And cExecStep91 Is Nothing And cExecStep92 Is
Nothing And cExecStep93 Is Nothing And cExecStep94 Is Nothing And cExecStep95
Is Nothing And cExecStep96 Is Nothing And cExecStep97 Is Nothing And
cExecStep98 Is Nothing And cExecStep99 Is Nothing Then
       ' Then...
       WriteToWspLog (mintRunComplete)
       RaiseEvent RunComplete(Determine64BitTime())
    Else
       ' Abort each of the steps that is currently executing.
       If Not cExecStep1 Is Nothing Then
          cExecStep1.Abort
       End If

       If Not cExecStep2 Is Nothing Then
          cExecStep2.Abort
       End If

       If Not cExecStep3 Is Nothing Then
          cExecStep3.Abort
       End If

       If Not cExecStep4 Is Nothing Then
          cExecStep4.Abort
       End If

       If Not cExecStep5 Is Nothing Then
          cExecStep5.Abort
       End If

       If Not cExecStep6 Is Nothing Then
          cExecStep6.Abort
       End If

       If Not cExecStep7 Is Nothing Then
          cExecStep7.Abort
       End If

       If Not cExecStep8 Is Nothing Then
          cExecStep8.Abort
       End If

       If Not cExecStep9 Is Nothing Then
          cExecStep9.Abort
       End If

       If Not cExecStep10 Is Nothing Then
          cExecStep10.Abort
       End If

       If Not cExecStep11 Is Nothing Then
          cExecStep11.Abort
       End If

       If Not cExecStep12 Is Nothing Then
          cExecStep12.Abort
       End If

       If Not cExecStep13 Is Nothing Then
          cExecStep13.Abort
       End If

       If Not cExecStep14 Is Nothing Then
          cExecStep14.Abort
       End If

       If Not cExecStep15 Is Nothing Then
          cExecStep15.Abort
       End If

       If Not cExecStep16 Is Nothing Then
          cExecStep16.Abort
       End If

       If Not cExecStep17 Is Nothing Then
          cExecStep17.Abort
       End If

       If Not cExecStep18 Is Nothing Then
          cExecStep18.Abort
       End If

       If Not cExecStep19 Is Nothing Then
          cExecStep19.Abort
       End If

       If Not cExecStep20 Is Nothing Then
          cExecStep20.Abort
       End If

       If Not cExecStep21 Is Nothing Then
          cExecStep21.Abort
       End If

       If Not cExecStep22 Is Nothing Then
          cExecStep22.Abort
       End If

       If Not cExecStep23 Is Nothing Then
          cExecStep23.Abort
       End If

       If Not cExecStep24 Is Nothing Then
          cExecStep24.Abort
       End If
```

```
If Not cExecStep25 Is Nothing Then
   cExecStep25.Abort
End If

If Not cExecStep26 Is Nothing Then
   cExecStep26.Abort
End If

If Not cExecStep27 Is Nothing Then
   cExecStep27.Abort
End If

If Not cExecStep28 Is Nothing Then
   cExecStep28.Abort
End If

If Not cExecStep29 Is Nothing Then
   cExecStep29.Abort
End If

' ============== 30 - 39 ==============
If Not cExecStep30 Is Nothing Then
   cExecStep30.Abort
End If

If Not cExecStep31 Is Nothing Then
   cExecStep31.Abort
End If

If Not cExecStep32 Is Nothing Then
   cExecStep32.Abort
End If

If Not cExecStep33 Is Nothing Then
   cExecStep33.Abort
End If

If Not cExecStep34 Is Nothing Then
   cExecStep34.Abort
End If

If Not cExecStep35 Is Nothing Then
   cExecStep35.Abort
End If

If Not cExecStep36 Is Nothing Then
   cExecStep36.Abort
End If

If Not cExecStep37 Is Nothing Then
   cExecStep37.Abort
End If

If Not cExecStep38 Is Nothing Then
   cExecStep38.Abort
End If

If Not cExecStep39 Is Nothing Then
   cExecStep39.Abort
End If

' ============== 40 - 49 ==============
If Not cExecStep40 Is Nothing Then
   cExecStep40.Abort
End If

If Not cExecStep41 Is Nothing Then
   cExecStep41.Abort
End If

If Not cExecStep42 Is Nothing Then
   cExecStep42.Abort
End If

If Not cExecStep43 Is Nothing Then
   cExecStep43.Abort
End If

If Not cExecStep44 Is Nothing Then
   cExecStep44.Abort
End If

If Not cExecStep45 Is Nothing Then
   cExecStep45.Abort
End If

If Not cExecStep46 Is Nothing Then
   cExecStep46.Abort
End If

If Not cExecStep47 Is Nothing Then
   cExecStep47.Abort
End If

If Not cExecStep48 Is Nothing Then
   cExecStep48.Abort
End If

If Not cExecStep49 Is Nothing Then
   cExecStep49.Abort
End If

' ============== 50 - 59 ==============
If Not cExecStep50 Is Nothing Then
   cExecStep50.Abort
End If

If Not cExecStep51 Is Nothing Then
   cExecStep51.Abort
End If

If Not cExecStep52 Is Nothing Then
   cExecStep52.Abort
End If

If Not cExecStep53 Is Nothing Then
   cExecStep53.Abort
End If

If Not cExecStep54 Is Nothing Then
   cExecStep54.Abort
End If

If Not cExecStep55 Is Nothing Then
   cExecStep55.Abort
End If

If Not cExecStep56 Is Nothing Then
   cExecStep56.Abort
End If

If Not cExecStep57 Is Nothing Then
   cExecStep57.Abort
End If

If Not cExecStep58 Is Nothing Then
   cExecStep58.Abort
End If

If Not cExecStep59 Is Nothing Then
   cExecStep59.Abort
```

```
End If

' ============== 60 - 69 ==============
If Not cExecStep60 Is Nothing Then
   cExecStep60.Abort
End If

If Not cExecStep61 Is Nothing Then
   cExecStep61.Abort
End If

If Not cExecStep62 Is Nothing Then
   cExecStep62.Abort
End If

If Not cExecStep63 Is Nothing Then
   cExecStep63.Abort
End If

If Not cExecStep64 Is Nothing Then
   cExecStep64.Abort
End If

If Not cExecStep65 Is Nothing Then
   cExecStep65.Abort
End If

If Not cExecStep66 Is Nothing Then
   cExecStep66.Abort
End If

If Not cExecStep67 Is Nothing Then
   cExecStep67.Abort
End If

If Not cExecStep68 Is Nothing Then
   cExecStep68.Abort
End If

If Not cExecStep69 Is Nothing Then
   cExecStep69.Abort
End If

' ============== 70 - 79 ==============
If Not cExecStep70 Is Nothing Then
   cExecStep70.Abort
End If

If Not cExecStep71 Is Nothing Then
   cExecStep71.Abort
End If

If Not cExecStep72 Is Nothing Then
   cExecStep72.Abort
End If

If Not cExecStep73 Is Nothing Then
   cExecStep73.Abort
End If

If Not cExecStep74 Is Nothing Then
   cExecStep74.Abort
End If

If Not cExecStep75 Is Nothing Then
   cExecStep75.Abort
End If

If Not cExecStep76 Is Nothing Then
   cExecStep76.Abort
End If

If Not cExecStep77 Is Nothing Then
   cExecStep77.Abort
End If

If Not cExecStep78 Is Nothing Then
   cExecStep78.Abort
End If

If Not cExecStep79 Is Nothing Then
   cExecStep79.Abort
End If

' ============== 80 - 89 ==============
If Not cExecStep80 Is Nothing Then
   cExecStep80.Abort
End If

If Not cExecStep81 Is Nothing Then
   cExecStep81.Abort
End If

If Not cExecStep82 Is Nothing Then
   cExecStep82.Abort
End If

If Not cExecStep83 Is Nothing Then
   cExecStep83.Abort
End If

If Not cExecStep84 Is Nothing Then
   cExecStep84.Abort
End If

If Not cExecStep85 Is Nothing Then
   cExecStep85.Abort
End If

If Not cExecStep86 Is Nothing Then
   cExecStep86.Abort
End If

If Not cExecStep87 Is Nothing Then
   cExecStep87.Abort
End If

If Not cExecStep88 Is Nothing Then
   cExecStep88.Abort
End If

If Not cExecStep89 Is Nothing Then
   cExecStep89.Abort
End If

' ============== 90 - 99 ==============
If Not cExecStep90 Is Nothing Then
   cExecStep90.Abort
End If

If Not cExecStep91 Is Nothing Then
   cExecStep91.Abort
End If

If Not cExecStep92 Is Nothing Then
   cExecStep92.Abort
End If

If Not cExecStep93 Is Nothing Then
   cExecStep93.Abort
End If
```

```
        If Not cExecStep94 Is Nothing Then
            cExecStep94.Abort
        End If

        If Not cExecStep95 Is Nothing Then
            cExecStep95.Abort
        End If

        If Not cExecStep96 Is Nothing Then
            cExecStep96.Abort
        End If

        If Not cExecStep97 Is Nothing Then
            cExecStep97.Abort
        End If

        If Not cExecStep98 Is Nothing Then
            cExecStep98.Abort
        End If

        If Not cExecStep99 Is Nothing Then
            cExecStep99.Abort
        End If

    End If

    Exit Sub

AbortErr:
    Call LogErrors(Errors)
    On Error GoTo 0
    ShowError errAbortFailed
    ' Try to abort the remaining steps, if any
    Resume Next

End Sub
Public Sub AbortSiblings(cTermInstance As cInstance)

    On Error GoTo AbortSiblingsErr

    ' Abort each of the steps that is currently executing.
    If Not cExecStep1 Is Nothing Then
        If cExecStep1.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep1.Abort
        End If
    End If

    If Not cExecStep2 Is Nothing Then
        If cExecStep2.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep2.Abort
        End If
    End If

    If Not cExecStep3 Is Nothing Then
        If cExecStep3.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep3.Abort
        End If
    End If

    If Not cExecStep4 Is Nothing Then
        If cExecStep4.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep4.Abort
        End If
    End If

    If Not cExecStep5 Is Nothing Then
        If cExecStep5.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep5.Abort
        End If
    End If

    If Not cExecStep6 Is Nothing Then
        If cExecStep6.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep6.Abort
        End If
    End If

    If Not cExecStep7 Is Nothing Then
        If cExecStep7.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep7.Abort
        End If
    End If

    If Not cExecStep8 Is Nothing Then
        If cExecStep8.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep8.Abort
        End If
    End If

    If Not cExecStep9 Is Nothing Then
        If cExecStep9.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep9.Abort
        End If
    End If

    If Not cExecStep10 Is Nothing Then
        If cExecStep10.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep10.Abort
        End If
    End If

    If Not cExecStep11 Is Nothing Then
        If cExecStep11.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep11.Abort
        End If
    End If

    If Not cExecStep12 Is Nothing Then
        If cExecStep12.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep12.Abort
        End If
    End If

    If Not cExecStep13 Is Nothing Then
        If cExecStep13.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep13.Abort
        End If
    End If

    If Not cExecStep14 Is Nothing Then
        If cExecStep14.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
            cExecStep14.Abort
        End If
    End If

    If Not cExecStep15 Is Nothing Then
```

```
    If cExecStep15.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep15.Abort
      End If
   End If

   If Not cExecStep16 Is Nothing Then
      If cExecStep16.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep16.Abort
      End If
   End If

   If Not cExecStep17 Is Nothing Then
      If cExecStep17.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep17.Abort
      End If
   End If

   If Not cExecStep18 Is Nothing Then
      If cExecStep18.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep18.Abort
      End If
   End If

   If Not cExecStep19 Is Nothing Then
      If cExecStep19.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep19.Abort
      End If
   End If

   If Not cExecStep20 Is Nothing Then
      If cExecStep20.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep20.Abort
      End If
   End If

   If Not cExecStep21 Is Nothing Then
      If cExecStep21.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep21.Abort
      End If
   End If

   If Not cExecStep22 Is Nothing Then
      If cExecStep22.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep22.Abort
      End If
   End If

   If Not cExecStep23 Is Nothing Then
      If cExecStep23.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep23.Abort
      End If
   End If

   If Not cExecStep24 Is Nothing Then
      If cExecStep24.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep24.Abort
      End If
   End If

   If Not cExecStep25 Is Nothing Then
      If cExecStep25.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep25.Abort
      End If
   End If

   If Not cExecStep26 Is Nothing Then
      If cExecStep26.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep26.Abort
      End If
   End If

   If Not cExecStep27 Is Nothing Then
      If cExecStep27.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep27.Abort
      End If
   End If

   If Not cExecStep28 Is Nothing Then
      If cExecStep28.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep28.Abort
      End If
   End If

   If Not cExecStep29 Is Nothing Then
      If cExecStep29.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep29.Abort
      End If
   End If

   ' ============ 30 =================
   If Not cExecStep30 Is Nothing Then
      If cExecStep30.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep30.Abort
      End If
   End If

   If Not cExecStep31 Is Nothing Then
      If cExecStep31.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep31.Abort
      End If
   End If

   If Not cExecStep32 Is Nothing Then
      If cExecStep32.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep32.Abort
      End If
   End If

   If Not cExecStep33 Is Nothing Then
      If cExecStep33.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep33.Abort
      End If
   End If

   If Not cExecStep34 Is Nothing Then
      If cExecStep34.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
        cExecStep34.Abort
      End If
   End If

   If Not cExecStep35 Is Nothing Then
```

```
      If cExecStep35.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep35.Abort
      End If
   End If

   If Not cExecStep36 Is Nothing Then
      If cExecStep36.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep36.Abort
      End If
   End If

   If Not cExecStep37 Is Nothing Then
      If cExecStep37.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep37.Abort
      End If
   End If

   If Not cExecStep38 Is Nothing Then
      If cExecStep38.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep38.Abort
      End If
   End If

   If Not cExecStep39 Is Nothing Then
      If cExecStep39.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep39.Abort
      End If
   End If

   ' ============ 40 =================
   If Not cExecStep40 Is Nothing Then
      If cExecStep40.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep40.Abort
      End If
   End If

   If Not cExecStep41 Is Nothing Then
      If cExecStep41.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep41.Abort
      End If
   End If

   If Not cExecStep42 Is Nothing Then
      If cExecStep42.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep42.Abort
      End If
   End If

   If Not cExecStep43 Is Nothing Then
      If cExecStep43.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep43.Abort
      End If
   End If

   If Not cExecStep44 Is Nothing Then
      If cExecStep44.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep44.Abort
      End If
   End If

   If Not cExecStep45 Is Nothing Then
      If cExecStep45.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep45.Abort
      End If
   End If

   If Not cExecStep46 Is Nothing Then
      If cExecStep46.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep46.Abort
      End If
   End If

   If Not cExecStep47 Is Nothing Then
      If cExecStep47.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep47.Abort
      End If
   End If

   If Not cExecStep48 Is Nothing Then
      If cExecStep48.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep48.Abort
      End If
   End If

   If Not cExecStep49 Is Nothing Then
      If cExecStep49.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep49.Abort
      End If
   End If

   ' ============ 50 =================
   If Not cExecStep50 Is Nothing Then
      If cExecStep50.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep50.Abort
      End If
   End If

   If Not cExecStep51 Is Nothing Then
      If cExecStep51.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep51.Abort
      End If
   End If

   If Not cExecStep52 Is Nothing Then
      If cExecStep52.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep52.Abort
      End If
   End If

   If Not cExecStep53 Is Nothing Then
      If cExecStep53.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep53.Abort
      End If
   End If

   If Not cExecStep54 Is Nothing Then
      If cExecStep54.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep54.Abort
      End If
   End If

   If Not cExecStep55 Is Nothing Then
```

```
      If cExecStep55.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep55.Abort
      End If
   End If

   If Not cExecStep56 Is Nothing Then
      If cExecStep56.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep56.Abort
      End If
   End If

   If Not cExecStep57 Is Nothing Then
      If cExecStep57.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep57.Abort
      End If
   End If

   If Not cExecStep58 Is Nothing Then
      If cExecStep58.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep58.Abort
      End If
   End If

   If Not cExecStep59 Is Nothing Then
      If cExecStep59.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep59.Abort
      End If
   End If

   ' ============ 60 =================
   If Not cExecStep60 Is Nothing Then
      If cExecStep60.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep60.Abort
      End If
   End If

   If Not cExecStep61 Is Nothing Then
      If cExecStep61.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep61.Abort
      End If
   End If

   If Not cExecStep62 Is Nothing Then
      If cExecStep62.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep62.Abort
      End If
   End If

   If Not cExecStep63 Is Nothing Then
      If cExecStep63.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep63.Abort
      End If
   End If

   If Not cExecStep64 Is Nothing Then
      If cExecStep64.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep64.Abort
      End If
   End If

   If Not cExecStep65 Is Nothing Then
      If cExecStep65.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep65.Abort
      End If
   End If

   If Not cExecStep66 Is Nothing Then
      If cExecStep66.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep66.Abort
      End If
   End If

   If Not cExecStep67 Is Nothing Then
      If cExecStep67.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep67.Abort
      End If
   End If

   If Not cExecStep68 Is Nothing Then
      If cExecStep68.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep68.Abort
      End If
   End If

   If Not cExecStep69 Is Nothing Then
      If cExecStep69.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep69.Abort
      End If
   End If

   ' ============ 70 =================
   If Not cExecStep70 Is Nothing Then
      If cExecStep70.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep70.Abort
      End If
   End If

   If Not cExecStep71 Is Nothing Then
      If cExecStep71.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep71.Abort
      End If
   End If

   If Not cExecStep72 Is Nothing Then
      If cExecStep72.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep72.Abort
      End If
   End If

   If Not cExecStep73 Is Nothing Then
      If cExecStep73.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep73.Abort
      End If
   End If

   If Not cExecStep74 Is Nothing Then
      If cExecStep74.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep74.Abort
      End If
   End If

   If Not cExecStep75 Is Nothing Then
```

```
      If cExecStep75.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep75.Abort
      End If
   End If

   If Not cExecStep76 Is Nothing Then
      If cExecStep76.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep76.Abort
      End If
   End If

   If Not cExecStep77 Is Nothing Then
      If cExecStep77.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep77.Abort
      End If
   End If

   If Not cExecStep78 Is Nothing Then
      If cExecStep78.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep78.Abort
      End If
   End If

   If Not cExecStep79 Is Nothing Then
      If cExecStep79.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep79.Abort
      End If
   End If

   ' ============ 80 =================
   If Not cExecStep80 Is Nothing Then
      If cExecStep80.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep80.Abort
      End If
   End If

   If Not cExecStep81 Is Nothing Then
      If cExecStep81.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep81.Abort
      End If
   End If

   If Not cExecStep82 Is Nothing Then
      If cExecStep82.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep82.Abort
      End If
   End If

   If Not cExecStep83 Is Nothing Then
      If cExecStep83.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep83.Abort
      End If
   End If

   If Not cExecStep84 Is Nothing Then
      If cExecStep84.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep84.Abort
      End If
   End If

   If Not cExecStep85 Is Nothing Then
      If cExecStep85.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep85.Abort
      End If
   End If

   If Not cExecStep86 Is Nothing Then
      If cExecStep86.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep86.Abort
      End If
   End If

   If Not cExecStep87 Is Nothing Then
      If cExecStep87.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep87.Abort
      End If
   End If

   If Not cExecStep88 Is Nothing Then
      If cExecStep88.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep88.Abort
      End If
   End If

   If Not cExecStep89 Is Nothing Then
      If cExecStep89.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep89.Abort
      End If
   End If

   ' ============ 90 =================
   If Not cExecStep90 Is Nothing Then
      If cExecStep90.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep90.Abort
      End If
   End If

   If Not cExecStep91 Is Nothing Then
      If cExecStep91.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep91.Abort
      End If
   End If

   If Not cExecStep92 Is Nothing Then
      If cExecStep92.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep92.Abort
      End If
   End If

   If Not cExecStep93 Is Nothing Then
      If cExecStep93.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep93.Abort
      End If
   End If

   If Not cExecStep94 Is Nothing Then
      If cExecStep94.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep94.Abort
      End If
   End If

   If Not cExecStep95 Is Nothing Then
```

```
      If cExecStep95.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep95.Abort
      End If
   End If

   If Not cExecStep96 Is Nothing Then
      If cExecStep96.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep96.Abort
      End If
   End If

   If Not cExecStep97 Is Nothing Then
      If cExecStep97.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep97.Abort
      End If
   End If

   If Not cExecStep98 Is Nothing Then
      If cExecStep98.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep98.Abort
      End If
   End If

   If Not cExecStep99 Is Nothing Then
      If cExecStep99.ExecuteStep.ParentStepId = cTermInstance.Step.ParentStepId
Then
         cExecStep99.Abort
      End If
   End If

   Exit Sub

AbortSiblingsErr:
   Call LogErrors(Errors)
   On Error GoTo 0
   ShowError errAbortFailed
   ' Try to abort the remaining steps, if any
   Resume Next

End Sub
Private Sub ExecutionFailed(cTermStep As cRunStep)
   ' Called when execution of a step fails for any reason - ensure that execution
   ' continues

   On Error GoTo ExecutionFailedErr

   Call AddFreeProcess(cTermStep.Index)

   Call RunBranch(mstrCurBranchRoot)

   Exit Sub

ExecutionFailedErr:
   ' Log the error code raised by Visual Basic - do not raise an error here!
   Call LogErrors(Errors)

End Sub
Private Sub FreeExecStep(lngIndex As Long)
   ' Frees an instance of a cExecuteSM object depending on the index
   On Error GoTo FreeExecStepErr

   Select Case lngIndex + 1
      Case 1
         Set cExecStep1 = Nothing
      Case 2
         Set cExecStep2 = Nothing
      Case 3
         Set cExecStep3 = Nothing
      Case 4
         Set cExecStep4 = Nothing
      Case 5
         Set cExecStep5 = Nothing
      Case 6
         Set cExecStep6 = Nothing
      Case 7
         Set cExecStep7 = Nothing
      Case 8
         Set cExecStep8 = Nothing
      Case 9
         Set cExecStep9 = Nothing
      Case 10
         Set cExecStep10 = Nothing
      Case 11
         Set cExecStep11 = Nothing
      Case 12
         Set cExecStep12 = Nothing
      Case 13
         Set cExecStep13 = Nothing
      Case 14
         Set cExecStep14 = Nothing
      Case 15
         Set cExecStep15 = Nothing
      Case 16
         Set cExecStep16 = Nothing
      Case 17
         Set cExecStep17 = Nothing
      Case 18
         Set cExecStep18 = Nothing
      Case 19
         Set cExecStep19 = Nothing
      Case 20
         Set cExecStep20 = Nothing
      Case 21
         Set cExecStep21 = Nothing
      Case 22
         Set cExecStep22 = Nothing
      Case 23
         Set cExecStep23 = Nothing
      Case 24
         Set cExecStep24 = Nothing
      Case 25
         Set cExecStep25 = Nothing
      Case 26
         Set cExecStep26 = Nothing
      Case 27
         Set cExecStep27 = Nothing
      Case 28
         Set cExecStep28 = Nothing
      Case 29
         Set cExecStep29 = Nothing
      Case 30
         Set cExecStep30 = Nothing
      Case 31
         Set cExecStep31 = Nothing
      Case 32
         Set cExecStep32 = Nothing
      Case 33
         Set cExecStep33 = Nothing
      Case 34
         Set cExecStep34 = Nothing
      Case 35
         Set cExecStep35 = Nothing
      Case 36
         Set cExecStep36 = Nothing
      Case 37
         Set cExecStep37 = Nothing
      Case 38
         Set cExecStep38 = Nothing
```

```
        Case 39
            Set cExecStep39 = Nothing
        Case 40
            Set cExecStep40 = Nothing
        Case 41
            Set cExecStep41 = Nothing
        Case 42
            Set cExecStep42 = Nothing
        Case 43
            Set cExecStep43 = Nothing
        Case 44
            Set cExecStep44 = Nothing
        Case 45
            Set cExecStep45 = Nothing
        Case 46
            Set cExecStep46 = Nothing
        Case 47
            Set cExecStep47 = Nothing
        Case 48
            Set cExecStep48 = Nothing
        Case 49
            Set cExecStep49 = Nothing
        Case 50
            Set cExecStep50 = Nothing
        Case 51
            Set cExecStep51 = Nothing
        Case 52
            Set cExecStep52 = Nothing
        Case 53
            Set cExecStep53 = Nothing
        Case 54
            Set cExecStep54 = Nothing
        Case 55
            Set cExecStep55 = Nothing
        Case 56
            Set cExecStep56 = Nothing
        Case 57
            Set cExecStep57 = Nothing
        Case 58
            Set cExecStep58 = Nothing
        Case 59
            Set cExecStep59 = Nothing
        Case 60
            Set cExecStep60 = Nothing
        Case 61
            Set cExecStep61 = Nothing
        Case 62
            Set cExecStep62 = Nothing
        Case 63
            Set cExecStep63 = Nothing
        Case 64
            Set cExecStep64 = Nothing
        Case 65
            Set cExecStep65 = Nothing
        Case 66
            Set cExecStep66 = Nothing
        Case 67
            Set cExecStep67 = Nothing
        Case 68
            Set cExecStep68 = Nothing
        Case 69
            Set cExecStep69 = Nothing
        Case 70
            Set cExecStep70 = Nothing
        Case 71
            Set cExecStep71 = Nothing
        Case 72
            Set cExecStep72 = Nothing
        Case 73
            Set cExecStep73 = Nothing
        Case 74
            Set cExecStep74 = Nothing
        Case 75
            Set cExecStep75 = Nothing
        Case 76
            Set cExecStep76 = Nothing
        Case 77
            Set cExecStep77 = Nothing
        Case 78
            Set cExecStep78 = Nothing
        Case 79
            Set cExecStep79 = Nothing
        Case 80
            Set cExecStep80 = Nothing
        Case 81
            Set cExecStep81 = Nothing
        Case 82
            Set cExecStep82 = Nothing
        Case 83
            Set cExecStep83 = Nothing
        Case 84
            Set cExecStep84 = Nothing
        Case 85
            Set cExecStep85 = Nothing
        Case 86
            Set cExecStep86 = Nothing
        Case 87
            Set cExecStep87 = Nothing
        Case 88
            Set cExecStep88 = Nothing
        Case 89
            Set cExecStep89 = Nothing
        Case 90
            Set cExecStep90 = Nothing
        Case 91
            Set cExecStep91 = Nothing
        Case 92
            Set cExecStep92 = Nothing
        Case 93
            Set cExecStep93 = Nothing
        Case 94
            Set cExecStep94 = Nothing
        Case 95
            Set cExecStep95 = Nothing
        Case 96
            Set cExecStep96 = Nothing
        Case 97
            Set cExecStep97 = Nothing
        Case 98
            Set cExecStep98 = Nothing
        Case 99
            Set cExecStep99 = Nothing
        Case Else
            BugAssert False, "FreeExecStep: Invalid index value!"
    End Select

    Exit Sub

FreeExecStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)

End Sub
Private Sub ProcessAskFailures()
    ' This procedure is called when a step with a continuation criteria = Ask has failed.
    ' Wait for all running processes to complete before displaying an Abort/Retry/Fail
    ' message to the user. We process every Ask step that has failed and use a simple
    ' algorithm to determine what to do next.
    ' 1. An abort response to any failure results in an immediate abort of the run
    ' 2. A continue means the run continues - this failure is popped off the failure list.
    ' 3. A retry means that the execution details for the instance are cleared and the
    '    step is re-executed.
```

```
    Dim lIndex As Long
    Dim cStepRec As cStep
    Dim cNextInst As cInstance
    Dim cFailureRec As cFailedStep

    On Error GoTo ProcessAskFailuresErr

    ' Display a popup message for all steps that have failed with a continuation
    ' criteria of Ask
    For lIndex = mcFailures.Count - 1 To 0 Step -1

        Set cFailureRec = mcFailures(lIndex)

        If cFailureRec.ContCriteria = gintOnFailureAsk Then
            Set cStepRec = mcRunSteps.QueryStep(cFailureRec.StepId)
            ' Ask the user whether to abort/retry/continue
            #If RUN_ONLY Then
                cFailureRec.AskResponse = ShowMessageBox(0, _
                    "Step '" & GetStepNodeText(cStepRec) & "' failed. " & _
                    "Select Abort to abort run and Ignore to continue. " & _
                    "Select Retry to re-execute the failed step.", _
                    "Step Failure", _
                    MB_ABORTRETRYIGNORE + MB_APPLMODAL +
MB_ICONEXCLAMATION)
            #Else
                cFailureRec.AskResponse = ShowMessageBox(frmRunning.hWnd, _
                    "Step '" & GetStepNodeText(cStepRec) & "' failed. " & _
                    "Select Abort to abort run and Ignore to continue. " & _
                    "Select Retry to re-execute the failed step.", _
                    "Step Failure", _
                    MB_ABORTRETRYIGNORE + MB_APPLMODAL +
MB_ICONEXCLAMATION)
            #End If

            ' Process an abort response immediately
            If cFailureRec.AskResponse = IDABORT Then
                mblnAbort = True
                Set cNextInst = mcInstances.QueryInstance(cFailureRec.InstanceId)
                Call RunPendingSiblings(cNextInst, cFailureRec.EndTime)
                Exit For
            End If
        End If

    Next lIndex

    ' Process all failed steps for which we have Ignore and Retry responses.
    If Not mblnAbort Then
        ' Navigate in reverse order since we'll be deleting items from the collection
        For lIndex = mcFailures.Count - 1 To 0 Step -1
            If mcFailures(lIndex).ContCriteria = gintOnFailureAsk Then
                mblnAsk = False
                Set cFailureRec = mcFailures.Delete(lIndex)

                Select Case cFailureRec.AskResponse
                    Case IDABORT
                        BugAssert True

                    Case IDRETRY
                        ' Delete all instances for the failed step and re-try
                        ' Returns a parent instance reference
                        Set cNextInst = ProcessRetryStep(cFailureRec)
                        Call RunPendingStepInBranch(mstrCurBranchRoot, cNextInst)

                    Case IDIGNORE
                        Set cNextInst = mcInstances.QueryInstance(cFailureRec.InstanceId)
                        Call RunPendingSiblings(cNextInst, cFailureRec.EndTime)

                End Select
            End If
        Next lIndex
    End If

    Exit Sub

ProcessAskFailuresErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errExecuteBranchFailed, mstrModuleName, _
        LoadResString(errExecuteBranchFailed)

End Sub
Private Function ProcessRetryStep(cFailureRec As cFailedStep) As cInstance
    ' This procedure is called when a step with a continuation criteria = Ask has failed
    ' and the user wants to re-execute the step.
    ' We delete all existing instances for the step and reset the iterator, if
    ' any on the parent instance - this way we ensure that the step will be executed
    ' in the next pass.
    Dim lIndex As Long
    Dim cParentInstance As cInstance
    Dim cSubStepRec As cSubStep
    Dim cStepRec As cStep

    On Error GoTo ProcessRetryStepErr

    ' Navigate in reverse order since we'll be deleting items from the collection
    For lIndex = mcInstances.Count - 1 To 0 Step -1

        If mcInstances(lIndex).Step.StepId = cFailureRec.StepId Then
            Set cParentInstance =
mcInstances.QueryInstance(mcInstances(lIndex).ParentInstanceId)
            Set cSubStepRec = cParentInstance.QuerySubStep(cFailureRec.StepId)
            Set cStepRec = mcRunSteps.QueryStep(cFailureRec.StepId)

            ' Decrement the child count on the parent instance and reset the
            ' step iterators on the sub-step record, if any -
            ' all the iterations of the step will be re-executed.
            cParentInstance.ChildDeleted cFailureRec.StepId
            cParentInstance.AllComplete = False
            cParentInstance.AllStarted = False

            cSubStepRec.InitializeIt cStepRec, mcParameters

            ' Now delete the current instance
            Set ProcessRetryStep = mcInstances.Delete(lIndex)
        End If
    Next lIndex

    Exit Function

ProcessRetryStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Err.Raise vbObjectError + errExecuteBranchFailed, mstrModuleName, _
        LoadResString(errExecuteBranchFailed)

End Function


Private Sub RunNextStep(ByVal dtmCompleteTime As Currency, ByVal lngIndex As
Long, _
    ByVal InstanceId As Long, ByVal ExecutionStatus As InstanceStatus)
    ' Checks if there are any steps remaining to be
    ' executed in the current branch. If so, it executes
    ' the step.
    Dim cTermInstance As cInstance
    Dim cFailure As cFailedStep

    On Error GoTo RunNextStepErr

    BugMessage "RunNextStep: cExecStep" & CStr(lngIndex + 1) & " has completed."

    Call mcTermSteps.Delete
```

```
    Call FreeExecStep(lngIndex)

    ' Call a procedure to add the freed up object to the list
    Call AddFreeProcess(lngIndex)

    Set cTermInstance = mcInstances.QueryInstance(InstanceId)
    cTermInstance.Status = ExecutionStatus

    If ExecutionStatus = gintFailed Then
       If cTermInstance.Step.ContinuationCriteria = gintOnFailureAbortSiblings Then
          Call AbortSiblings(cTermInstance)
       End If

       If Not mcFailures.StepFailed(cTermInstance.Step.StepId) Then
          Set cFailure = New cFailedStep
          cFailure.InstanceId = cTermInstance.InstanceId
          cFailure.StepId = cTermInstance.Step.StepId
          cFailure.ParentStepId = cTermInstance.Step.ParentStepId
          cFailure.ContCriteria = cTermInstance.Step.ContinuationCriteria
          cFailure.EndTime = dtmCompleteTime
          mcFailures.Add cFailure
          Set cFailure = Nothing
       End If
    End If

    If ExecutionStatus = gintFailed And cTermInstance.Step.ContinuationCriteria =
gintOnFailureAbort Then
       If StringEmpty(msAbortDtls) Then
          ' Initialize the abort message
          msAbortDtls = "Step '" & GetStepNodeText(cTermInstance.Step) & "' failed. " &
_
                "Aborting execution. Please check the error file for details."
       End If
       Call Abort
    ElseIf ExecutionStatus = gintFailed And cTermInstance.Step.ContinuationCriteria =
gintOnFailureAsk Then
       mblnAsk = True

       ' If the step failed due to a Cancel operation (Abort), abort the run
       If mblnAbort Then
          Call RunPendingSiblings(cTermInstance, dtmCompleteTime)
       End If
    Else
       Call RunPendingSiblings(cTermInstance, dtmCompleteTime)
    End If

    If mblnAbort Then
       If Not AnyStepRunning(mcFreeSteps, mbarrFree) And Not
StringEmpty(msAbortDtls) Then
          ' Display an error only if the abort is due to a failure
          ' We had to abort since a step failed - since no other steps are currently
          ' running, we can display a message to the user saying that we had to abort
          #If RUN_ONLY Then
             Call ShowMessageBox(0, msAbortDtls, "Run Aborted", _
                   MB_APPLMODAL + MB_OK + MB_ICONEXCLAMATION)
          #Else
             Call ShowMessageBox(frmRunning.hWnd, msAbortDtls, "Run Aborted", _
                   MB_APPLMODAL + MB_OK + MB_ICONEXCLAMATION)
          #End If
'         MsgBox msAbortDtls, vbOKOnly, "Run Aborted"
       End If
    ElseIf mblnAsk Then
       If Not AnyStepRunning(mcFreeSteps, mbarrFree) Then
          ' Ask the user whether to abort/retry/ignore failed steps
          Call ProcessAskFailures
       End If
    End If

    Exit Sub

RunNextStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errExecuteBranchFailed, mstrSource
    Call ResetForm(lngIndex)

End Sub
Public Sub StopRun()

    ' Setting the Abort flag to True will ensure that we
    ' don't execute any more steps
    mblnAbort = True

End Sub

Private Sub CreateDummyInstance(strRootKey As String)

    Dim cNewInstance As cInstance
    Dim cSubStepDtls  As cStep
    Dim lngSubStepId As Long

    On Error GoTo CreateDummyInstanceErr

    ' Create a new instance of the step
    ' initialize substeps for the step
    Set cNewInstance = New cInstance

    ' There can be multiple iterations of the top level nodes
    ' running at the same time, but only one branch at any
    ' time - so enforce a degree of parallelism of 1 on this
    ' node!
    Set cNewInstance.Step = New cStep
    cNewInstance.DegreeParallelism = 1
    cNewInstance.Key = mstrDummyRootKey

    cNewInstance.InstanceId = NewInstanceId
    cNewInstance.ParentInstanceId = 0

    lngSubStepId = MakeIdentifierValid(strRootKey)

    Set cSubStepDtls = mcRunSteps.QueryStep(lngSubStepId)
    If cSubStepDtls.EnabledFlag Then
       ' Create a child node for the step corresponding to
       ' the root node of the branch being currently executed,
       ' only if it has been enabled
       Call cNewInstance.CreateSubStep(cSubStepDtls, mcParameters)
    End If

    mcInstances.Add cNewInstance
    Set cNewInstance.Iterators = DetermineIterators(cNewInstance)

    ' Set a reference to the newly created dummy instance
    Set mcDummyRootInstance = cNewInstance

    Set cNewInstance = Nothing

    Exit Sub

CreateDummyInstanceErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "CreateDummyInstance"
    Err.Raise vbObjectError + errCreateInstanceFailed, _
          mstrSource, LoadResString(errCreateInstanceFailed)

End Sub
Private Function CreateInstance(cExecStep As cStep, _
       cParentInstance As cInstance) As cInstance
    ' Creates a new instance of the passed in step. Returns
    ' a reference to the newly created instance object.
```

```
    Dim cNewInstance As cInstance
    Dim nodChild As cStep
    Dim lngSubStepId As Long

    On Error GoTo CreateInstanceErr

    ' Create a new instance of the step
    ' initialize substeps for the step
    Set cNewInstance = New cInstance
    Set cNewInstance.Step = cExecStep
    cNewInstance.Key = MakeKeyValid(cExecStep.StepId, cExecStep.StepType)
    cNewInstance.ParentInstanceId = cParentInstance.InstanceId
    cNewInstance.InstanceId = NewInstanceId
    ' Validate the degree of parallelism field before assigning it to the instance -
    ' (the parameter value might have been set to an invalid value at runtime)
    Call ValidateParallelism(cExecStep.DegreeParallelism, _
          cExecStep.WorkspaceId, ParamsInWsp:=mcParameters)
    cNewInstance.DegreeParallelism =
SubstituteParameters(cExecStep.DegreeParallelism, _
          cExecStep.WorkspaceId, WspParameters:=mcParameters)

    If mcNavSteps.HasChild(StepKey:=cNewInstance.Key) Then
       Set nodChild = mcNavSteps.ChildStep(StepKey:=cNewInstance.Key)
       Do
          If nodChild.EnabledFlag Then
             ' Create nodes for all it's substeps only
             ' if the substeps have been enabled
             Call cNewInstance.CreateSubStep(nodChild, mcParameters)
          End If

          Set nodChild = mcNavSteps.NextStep(StepId:=nodChild.StepId)
       Loop While (Not nodChild Is Nothing)
    End If

    mcInstances.Add cNewInstance
    Set cNewInstance.Iterators = DetermineIterators(cNewInstance)

    ' Increment the number of executing steps on the parent
    cParentInstance.ChildExecuted (cExecStep.StepId)

    Set CreateInstance = cNewInstance

    Exit Function

CreateInstanceErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "CreateInstance"
    Err.Raise vbObjectError + errCreateInstanceFailed, _
          mstrSource, LoadResString(errCreateInstanceFailed)

End Function
Private Function DetermineIterators(cInstanceRec As cInstance) As cRunColIt
    ' Returns a collection of all the iterator values for this
    ' instance - since an iterator that is defined at a
    ' particular level can be used in all it's substeps, we
    ' need to navigate the step tree all the way to the root

    Dim cRunIts As cRunColIt
    Dim cRunIt As cRunItNode
    Dim cStepIt As cIterator
    Dim cParentInst As cInstance
    Dim cSubStepRec As cSubStep
    Dim cSubStepDtls As cStep
    Dim lngSubStepId As Long
    Dim lngIndex As Long

    On Error GoTo DetermineIteratorsErr

    Set cRunIts = New cRunColIt

    If cInstanceRec.ParentInstanceId > 0 Then
       ' The last iterator for an instance of a step is stored
       ' on it's parent! So navigate up before beginning the
       ' search for iterator values.
       Set cParentInst = mcInstances.QueryInstance(cInstanceRec.ParentInstanceId)

       ' Get the sub-step record for the current step
       ' on it's parent's instance!
       lngSubStepId = cInstanceRec.Step.StepId
       Set cSubStepRec = cParentInst.QuerySubStep(lngSubStepId)
       Set cSubStepDtls = mcRunSteps.QueryStep(lngSubStepId)

       ' And determine the next iteration value for the
       ' substep in this instance
       Set cStepIt = cSubStepRec.NewIteration(cSubStepDtls)

       If Not cStepIt Is Nothing Then
          ' Add the iterator details to the collection since
          ' an iterator has been defined for the step
          Set cRunIt = New cRunItNode
          cRunIt.IteratorName = cSubStepDtls.IteratorName
          cRunIt.Value = SubstituteParameters(cStepIt.Value,
cSubStepDtls.WorkspaceId, WspParameters:=mcParameters)
          cRunIt.StepId = cSubStepRec.StepId
          cRunIts.Push cRunIt
       End If

       ' Since the parent instance has all the iterators upto
       ' that level, read them and push them on to the stack for
       ' this instance
       For lngIndex = 0 To cParentInst.Iterators.Count - 1
          Set cRunIt = cParentInst.Iterators(lngIndex)
          cRunIts.Push cRunIt
       Next lngIndex
    End If

    Set DetermineIterators = cRunIts

    Exit Function

DetermineIteratorsErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "DetermineIterators"
    Err.Raise vbObjectError + errExecInstanceFailed, _
          mstrSource, LoadResString(errExecInstanceFailed)

End Function
Private Function DetermineConstraints(cInstanceRec As cInstance, _
       intConsType As ConstraintType) As Variant
    ' Returns a collection of all the constraints for this
    ' instance of the passed in type - all the constraints defined
    ' for the manager are executed first, followed by those defined
    ' for the step. If a step has an iterator defined for it, each
    ' constraint is executed only once.

    Dim cParentInst As cInstance
    Dim cTempInst As cInstance
    Dim vntConstraints As Variant
    Dim vntTempCons As Variant
    Dim cColConstraints() As Variant
    Dim lngConsCount As Long

    On Error GoTo DetermineConstraintsErr

    Set cTempInst = cInstanceRec
    lngConsCount = 0

    ' Go all the way to the root
```

```
    Do
        If cTempInst.ParentInstanceId > 0 Then
            Set cParentInst = mcInstances.QueryInstance(cTempInst.ParentInstanceId)
        Else
            Set cParentInst = Nothing
        End If

        ' Check if the step has an iterator defined for it
        If cTempInst.ValidForIteration(cParentInst, intConsType) Then
            vntTempCons = mcRunConstraints.ConstraintsForStep( _
                cTempInst.Step.StepId, cTempInst.Step.VersionNo, _
                intConsType, blnSort:=True, _
                blnGlobal:=False, blnGlobalConstraintsOnly:=False)

            If Not IsEmpty(vntTempCons) Then
                ReDim Preserve cColConstraints(lngConsCount)
                cColConstraints(lngConsCount) = vntTempCons
                lngConsCount = lngConsCount + 1
            End If
        End If

        Set cTempInst = cParentInst

    Loop While Not cTempInst Is Nothing

    If lngConsCount > 0 Then
        vntTempCons = OrderConstraints(cColConstraints, intConsType)
    End If

    DetermineConstraints = vntTempCons

    Exit Function

DetermineConstraintsErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "DetermineConstraints"
    Err.Raise vbObjectError + errExecInstanceFailed, _
        mstrSource, LoadResString(errExecInstanceFailed)

End Function
Private Function GetInstanceToExecute(cParentNode As cInstance, _
    cSubStepRec As cSubStep, _
    cSubStepDtls As cStep) As cInstance

    Dim cSubStepInst As cInstance

    On Error GoTo GetInstanceToExecuteErr

    BugAssert Not (cParentNode Is Nothing Or _
        cSubStepRec Is Nothing Or _
        cSubStepDtls Is Nothing), _
        "GetInstanceToExecute: Input invalid"

    ' Check if it has iterators
    If cSubStepDtls.IteratorCount = 0 Then
        ' Check if the step has been executed
        If cSubStepRec.TasksRunning = 0 And cSubStepRec.TasksComplete = 0 And _
            Not mcInstances.CompletedInstanceExists(cParentNode.InstanceId,
cSubStepDtls) Then
            ' The sub-step hasn't been executed yet.
            ' Create an instance for it and exit
            Set cSubStepInst = CreateInstance(cSubStepDtls, cParentNode)
        Else
            Set cSubStepInst = Nothing
        End If
    Else
        ' Check if there are pending iterations for the sub-step
        If Not cSubStepRec.NextIteration(cSubStepDtls) Is Nothing Then
            ' Pending iterations exist - create an instance for the sub-step and exit
            Set cSubStepInst = CreateInstance(cSubStepDtls, cParentNode)
        Else
            ' No more iterations - continue with the next substep
            Set cSubStepInst = Nothing
        End If
    End If

    Set GetInstanceToExecute = cSubStepInst
    Exit Function

GetInstanceToExecuteErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "GetInstanceToExecute"
    Err.Raise vbObjectError + errNavInstancesFailed, _
        mstrSource, LoadResString(errNavInstancesFailed)

End Function

Public Function InstancesForStep(lngStepId As Long, ByRef StepStatus As
InstanceStatus) As cInstances
    ' Returns an array of all the instances for a step
    Dim lngIndex As Long
    Dim cTempInst As cInstance
    Dim cStepInstances As cInstances
    Dim cStepRec As cStep

    On Error GoTo InstancesForStepErr

    Set cStepInstances = New cInstances

    For lngIndex = 0 To mcInstances.Count - 1
        Set cTempInst = mcInstances(lngIndex)

        If cTempInst.Step.StepId = lngStepId Then
            cStepInstances.Add cTempInst
        End If
    Next lngIndex

    If cStepInstances.Count = 0 Then
        Set cStepRec = mcRunSteps.QueryStep(lngStepId)
        If Not mcFailures.ExecuteSubStep(cStepRec.ParentStepId) Then
            StepStatus = gintAborted
        End If
        Set cStepRec = Nothing
    End If

    ' Set the return value of the function to the array of
    ' constraints that has been built above
    Set InstancesForStep = cStepInstances

    Set cStepInstances = Nothing
    Exit Function

InstancesForStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "InstancesForStep"
    Err.Raise vbObjectError + errNavInstancesFailed, mstrSource, _
        LoadResString(errNavInstancesFailed)

End Function
Private Sub RemoveFreeProcess(lngRunningProcess As Long)
    ' Removes the passed in element from the collection of
    ' free objects

    ' Confirm that the last element in the array is the one
    ' we need to delete
    If mcFreeSteps(mcFreeSteps.Count - 1) = lngRunningProcess Then
```

```
        mcFreeSteps.Delete Position:=mcFreeSteps.Count - 1
    Else
        ' Ask the class to find the element and delete it
        mcFreeSteps.Delete Item:=lngRunningProcess
    End If

End Sub
Private Sub AddFreeProcess(lngTerminatedProcess As Long)
    ' Adds the passed in element to the collection of
    ' free objects

    mcFreeSteps.Add lngTerminatedProcess

End Sub

Private Sub ResetForm(Optional ByVal lngIndex As Long)

    Dim lngTemp As Long

    On Error GoTo ResetFormErr

    ' Check if there are any running instances to wait for
    If mcFreeSteps.Count <> glngNumConcurrentProcesses Then

        For lngTemp = 0 To mcFreeSteps.Count - 1
            If mcFreeSteps(lngTemp) = lngIndex Then
                Exit For
            End If
        Next lngTemp

        If lngTemp <= mcFreeSteps.Count - 1 Then
            ' This process that just completed did not exist in the list of
            ' free processes
            Call AddFreeProcess(lngIndex)
        End If

        If Not AnyStepRunning(mcFreeSteps, mbarrFree) Then
            WriteToWspLog (mintRunComplete)
            ' All steps are complete
            RaiseEvent RunComplete(Determine64BitTime())
        End If
    Else
        WriteToWspLog (mintRunComplete)
        RaiseEvent RunComplete(Determine64BitTime())
    End If

    Exit Sub

ResetFormErr:

End Sub
Private Function NewInstanceId() As Long
    ' Will return new instance id's - uses a static counter
    ' that it increments each time
    Static lngInstance As Long

    lngInstance = lngInstance + 1
    NewInstanceId = lngInstance

End Function

Private Function RunPendingStepInBranch(strCurBranchRoot As String, _
        Optional cExecInstance As cInstance = Nothing) As cInstance
    ' Runs a worker step in the branch being executed, if
    ' there are any pending execution
    ' This function is also called when a step has just completed
    ' execution - in which case the terminated instance is
    ' passed in as the optional parameter. When that happens,
    ' we first try to execute the siblings of the terminated
    ' step if any are pending execution.
    ' If the terminated instance has not been passed in, we
    ' start with the dummy root instance and navigate down,
    ' trying to find a pending worker step.

    Dim cExecSubStep As cStep
    Dim cParentInstance As cInstance
    Dim cNextInst As cInstance

    On Error GoTo RunPendingStepInBranchErr

    If Not cExecInstance Is Nothing Then
        ' Called when an instance has terminated
        ' When a worker step terminates, then we need to
        ' decremement the number of running steps on it's
        ' manager
        Set cParentInstance = _
            mcInstances.QueryInstance(cExecInstance.ParentInstanceId)

    Else
        If StringEmpty(strCurBranchRoot) Or mcDummyRootInstance Is Nothing Then
            ' Run complete - event raised by Run method
            Set RunPendingStepInBranch = Nothing
            Exit Function
        End If

        ' If there are no pending steps on the root instance,
        ' then there are no steps within the branch that need
        ' to be executed
        If mcDummyRootInstance.AllComplete Or mcDummyRootInstance.AllStarted
Then
            Set RunPendingStepInBranch = Nothing
            Exit Function
        End If

        Set cParentInstance = mcDummyRootInstance
    End If

    Do
        Set cNextInst = GetSubStepToExecute(cParentInstance)
        If cNextInst Is Nothing Then
            ' There are no steps within the branch that can
            ' be executed - If we are at the dummy instance,
            ' this branch has completed executing
            If cParentInstance.Key = mstrDummyRootKey Then
                Set cNextInst = Nothing
                Exit Do
            Else
                ' Go to the parent instance and try to find
                ' some other sibling is pending execution
                Set cNextInst =
mcInstances.QueryInstance(cParentInstance.ParentInstanceId)

                If cParentInstance.SubSteps.Count = 0 Then
                    cNextInst.ChildTerminated cParentInstance.Step.StepId
                End If
            End If
        End If

        BugAssert Not cNextInst Is Nothing
        Set cParentInstance = cNextInst

    Loop While cNextInst.Step.StepType <> gintWorkerStep

    If Not cNextInst Is Nothing Then
        Call ExecuteStep(cNextInst)
    End If

    Set RunPendingStepInBranch = cNextInst

    Exit Function

RunPendingStepInBranchErr:
```

```
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errNavInstancesFailed, _
        mstrModuleName & "RunPendingStepInBranch",
LoadResString(errNavInstancesFailed)

End Function
Private Function RunPendingSibling(cTermInstance As cInstance, _
    dtmCompleteTime As Currency) As cInstance
    ' This process is called when a step terminates. Tries to
    ' run a sibling of the terminated step, if one is pending
    ' execution.

    Dim cParentInstance As cInstance
    Dim cNextInst As cInstance

    On Error GoTo RunPendingSiblingErr

    If StringEmpty(mstrCurBranchRoot) Or mcDummyRootInstance Is Nothing Then
        ' Run complete - event raised by Run method
        Set RunPendingSibling = Nothing
        Exit Function
    End If

    BugAssert cTermInstance.ParentInstanceId > 0, "Orphaned instance in array!"

    ' When a worker step terminates, then we need to
    ' decremement the number of running steps on it's
    ' manager
    Set cParentInstance =
mcInstances.QueryInstance(cTermInstance.ParentInstanceId)

    ' Decrement the number of running processes on the
    ' parent by 1
    Call cParentInstance.ChildTerminated(cTermInstance.Step.StepId)

    ' The first step that terminates has to be a worker
    ' If it is complete, update the completed steps on the
    ' parent by 1.
    Call cParentInstance.ChildCompleted(cTermInstance.Step.StepId)
    cParentInstance.AllStarted = False

    Do
        Set cNextInst = GetSubStepToExecute(cParentInstance, dtmCompleteTime)
        If cNextInst Is Nothing Then
            If cParentInstance.Key = mstrDummyRootKey Then
                Set cNextInst = Nothing
                Exit Do
            Else
                ' Go to the parent instance and try to find
                ' some other sibling is pending execution
                Set cNextInst =
mcInstances.QueryInstance(cParentInstance.ParentInstanceId)
                If cParentInstance.IsRunning Then
                    cNextInst.AllStarted = True
                Else
                    ' No more sub-steps to execute
                    Call cNextInst.ChildCompleted(cParentInstance.Step.StepId)
                    Call cNextInst.ChildTerminated(cParentInstance.Step.StepId)
                    cNextInst.AllStarted = False
                End If
            End If
        End If

        BugAssert Not cNextInst Is Nothing
        Set cParentInstance = cNextInst

    Loop While cNextInst.Step.StepType <> gintWorkerStep

    If Not cNextInst Is Nothing Then
        Call ExecuteStep(cNextInst)
    End If

    Set RunPendingSibling = cNextInst

    Exit Function

RunPendingSiblingErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "RunPendingSibling"
    Err.Raise vbObjectError + errNavInstancesFailed, mstrSource, _
        LoadResString(errNavInstancesFailed)

End Function
Private Sub RunPendingSiblings(cTermInstance As cInstance, _
    dtmCompleteTime As Currency)
    ' This process is called when a step terminates. Tries to
    ' run siblings of the terminated step, if they are pending
    ' execution.

    Dim cExecInst As cInstance

    On Error GoTo RunPendingSiblingsErr
    BugMessage "In RunPendingSiblings"

    ' Call a procedure to run the sibling of the terminated
    ' step, if any. This procedure will also update the
    ' number of complete/running tasks on the manager steps.
    Set cExecInst = RunPendingSibling(cTermInstance, dtmCompleteTime)

    If Not cExecInst Is Nothing Then
        Do
            ' Execute any other pending steps in the branch.
            ' The step that has just terminated might be
            ' the last one that was executing in a sub-branch.
            ' That would mean that we can execute another
            ' sub-branch that might involve more than 1 step.
            ' Pass the just executed step as a parameter.
            Set cExecInst = RunPendingStepInBranch(mstrCurBranchRoot, cExecInst)
        Loop While Not cExecInst Is Nothing
    Else
        If Not mcDummyRootInstance.IsRunning Then
            ' All steps have been executed in the branch - run
            ' a new branch
            Call RunNewBranch
        Else
            ' There are no more steps to execute in the current
            ' branch but we have running processes.
        End If
    End If

    Exit Sub

RunPendingSiblingsErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "RunPendingSiblings"
    Err.Raise vbObjectError + errNavInstancesFailed, _
        mstrSource, LoadResString(errNavInstancesFailed)

End Sub

Private Sub NoSubStepsToExecute(cMgrInstance As cInstance, Optional
dtmCompleteTime As Currency = gdtmEmpty)
    ' Called when we cannot find any more substeps to run for
    ' manager step - set the allcomplete or allstarted
    ' properties to true
```

```
    If cMgrInstance.IsRunning() Then
        cMgrInstance.AllStarted = True
    Else
        cMgrInstance.AllComplete = True
        If dtmCompleteTime <> gdtmEmpty Then
            ' Update the end time on the manager step
            Call TimeCompleteUpdateForStep(cMgrInstance, dtmCompleteTime)
        End If
    End If

End Sub

Private Function GetSubStepToExecute(cParentNode As cInstance, _
        Optional dtmCompleteTime As Currency = 0) As cInstance
    ' Returns the child of the passed in node that is to be
    ' executed next. Checks if we are in the middle of an instance
    ' being executed in which case it returns the pending
    ' instance. Creates a new instance if there are pending
    ' instances for a sub-step.

    Dim lngIndex As Long
    Dim cSubStepRec As cSubStep
    Dim cSubStepDtls As cStep
    Dim cSubStepInst As cInstance

    On Error GoTo GetSubStepToExecuteErr

    ' There are a number of cases that need to be accounted
    ' for here.
    ' 1. While traversing through all enabled nodes for the
    ' first time - instance records may not exist for the
    ' substeps.
    ' 2. Instance records exist, and there are processes
    ' that need to be executed for a sub-step
    ' 3. There are no more processes that need to be currently
    ' executed (till a process completes)
    ' 4. There are no more processes that need to be executed
    ' (All substeps have completed execution)

    ' This is the only point where we check the Abort flag -
    ' since this is the heart of the navigation routine that
    ' selects processes to execute. Also, when a step terminates
    ' selection of the next process goes through here.
    If mblnAbort Then
        Set GetSubStepToExecute = Nothing
        cParentNode.Status = gintAborted
        Exit Function
    End If

    If mblnAsk Then
        Set GetSubStepToExecute = Nothing
        Exit Function
    End If

    If Not mcFailures.ExecuteSubStep(cParentNode.Step.StepId) Then
        Set GetSubStepToExecute = Nothing
        cParentNode.Status = gintAborted
        Exit Function
    End If

    ' First check if there are pending steps for the parent!
    If cParentNode.IsPending Then
        ' Loop through all the sub-steps for the parent node
        For lngIndex = 0 To cParentNode.SubSteps.Count - 1
            Set cSubStepRec = cParentNode.SubSteps(lngIndex)
            Set cSubStepDtls = mcRunSteps.QueryStep(cSubStepRec.StepId)
            If Not mcInstances.InstanceAborted(cSubStepRec) Then
                ' Check if the sub-step is a worker
                If cSubStepDtls.StepType = gintWorkerStep Then
                    ' Find/create an instance to execute
                    Set cSubStepInst = GetInstanceToExecute( _
                        cParentNode, cSubStepRec, cSubStepDtls)
                    If Not cSubStepInst Is Nothing Then
                        Exit For
                    Else
                        ' Continue w/ the next sub-step
                    End If
                Else
                    ' The sub-step is a manager step
                    ' Check if there are any pending instances for
                    ' the manager
                    Set cSubStepInst = mcInstances.QueryPendingInstance( _
                        cParentNode.InstanceId, cSubStepRec.StepId)
                    If cSubStepInst Is Nothing Then
                        ' Find/create an instance to execute
                        Set cSubStepInst = GetInstanceToExecute( _
                            cParentNode, cSubStepRec, cSubStepDtls)
                        If Not cSubStepInst Is Nothing Then
                            Exit For
                        Else
                            ' Continue w/ the next sub-step
                        End If
                    Else
                        ' We have found a pending instance for the
                        ' sub-step (manager) - exit the loop
                        Exit For
                    End If
                End If
            End If
        Next lngIndex

        If lngIndex > cParentNode.SubSteps.Count - 1 Or cParentNode.SubSteps.Count
= 0 Then
            ' If we could not find any sub-steps to execute,
            ' mark the parent node as complete/all started
            Call NoSubStepsToExecute(cParentNode, dtmCompleteTime)
            Set cSubStepInst = Nothing
        End If
    End If

    Set GetSubStepToExecute = cSubStepInst
    Exit Function

GetSubStepToExecuteErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "GetSubStepToExecute"
    Err.Raise vbObjectError + errNavInstancesFailed, mstrSource, _
        LoadResString(errNavInstancesFailed)

End Function

Private Sub TimeCompleteUpdateForStep(cMgrInstance As cInstance, ByVal
EndTime As Currency)

    ' Called when there are no more sub-steps to execute for
    ' the manager step. It updates the end time and status on
    ' the manager.
    Dim lElapsed As Long

    On Error GoTo TimeCompleteUpdateForStepErr

    If cMgrInstance.Key <> mstrDummyRootKey Then
        cMgrInstance.EndTime = EndTime
        cMgrInstance.Status = gintComplete
        lElapsed = (EndTime - cMgrInstance.StartTime) * 10000
        cMgrInstance.ElapsedTime = lElapsed
        RaiseEvent StepComplete(cMgrInstance.Step, EndTime,
cMgrInstance.InstanceId, lElapsed)
    End If
```

```
    Exit Sub

TimeCompleteUpdateForStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errUpdateDisplayFailed, mstrModuleName &
"TimeCompleteUpdateForStep"

End Sub

Private Function GetFreeObject() As Long

    ' Check the array of free objects and retrieve the first one
    If mcFreeSteps.Count > 0 Then
        GetFreeObject = mcFreeSteps(mcFreeSteps.Count - 1)
    Else
        mstrSource = mstrModuleName & "GetFreeObject"
        ShowError errMaxProcessesExceeded
        On Error GoTo 0
        Err.Raise vbObjectError + errMaxProcessesExceeded, _
            mstrSource, _
            LoadResString(errMaxProcessesExceeded)
    End If

End Function
Private Function StepTerminated(cCompleteStep As cStep, ByVal dtmCompleteTime
As Currency, _
    ByVal lngIndex As Long, ByVal InstanceId As Long, ByVal ExecutionStatus As
InstanceStatus) As cStep
    ' This procedure is called whenever a step terminates.
    Dim cTermRec As cTermStep
    Dim cInstRec As cInstance
    Dim cStartInst As cInstance
    Dim lElapsed As Long
    Dim sLogLabel As String
    Dim LogLabels As New cVectorStr
    Dim iItIndex As Long

    On Error GoTo StepTerminatedErr

    Set cInstRec = mcInstances.QueryInstance(InstanceId)
    If dtmCompleteTime <> 0 And cInstRec.StartTime <> 0 Then
        ' Convert to milliseconds since that is the default precision
        lElapsed = (dtmCompleteTime - cInstRec.StartTime) * 10000
    Else
        lElapsed = 0
    End If

    Set cStartInst = cInstRec
    iItIndex = 0
    Do While cInstRec.Key <> mstrDummyRootKey
        sLogLabel = gstrSQ & cInstRec.Step.StepLabel & gstrSQ

        If iItIndex < cInstRec.Iterators.Count Then
            If cStartInst.Iterators(iItIndex).StepId = cInstRec.Step.StepId Then
                sLogLabel = sLogLabel & msIt & gstrSQ &
cStartInst.Iterators(iItIndex).IteratorName & gstrSQ & _
                    msItValue & gstrSQ & cStartInst.Iterators(iItIndex).Value & gstrSQ
                iItIndex = iItIndex + 1
            End If
        End If

        If cInstRec.Key = cStartInst.Key Then
            ' Append the execution status
            sLogLabel = sLogLabel & " Status: " & gstrSQ &
gsExecutionStatus(ExecutionStatus) & gstrSQ
            If ExecutionStatus = gintFailed Then
                ' Append the continuation criteria for the step since it failed
                sLogLabel = sLogLabel & " Continuation Criteria: " & gstrSQ &
gsContCriteria(cInstRec.Step.ContinuationCriteria) & gstrSQ
            End If
        End If
        LogLabels.Add sLogLabel

        Set cInstRec = mcInstances.QueryInstance(cInstRec.ParentInstanceId)
    Loop

    Call WriteToWspLog(mintStepComplete, LogLabels, dtmCompleteTime)
    Set LogLabels = Nothing

    ' Adds the terminated step details to a queue.
    Set cTermRec = New cTermStep
    cTermRec.ExecutionStatus = ExecutionStatus
    cTermRec.Index = lngIndex
    cTermRec.InstanceId = InstanceId
    cTermRec.TimeComplete = dtmCompleteTime
    Call mcTermSteps.Add(cTermRec)
    Set cTermRec = Nothing

    RaiseEvent StepComplete(cCompleteStep, dtmCompleteTime, InstanceId,
lElapsed)

    Exit Function

StepTerminatedErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errExecuteBranchFailed, mstrSource
    Call ResetForm(lngIndex)

End Function
Public Property Let RootKey(ByVal vdata As String)

    mstrRootKey = vdata

End Property

Public Property Get RootKey() As String
    RootKey = mstrRootKey
End Property

Private Function InitExecStep() As cRunStep
    ' Since arrays of objects cannot be declared as WithEvents,
    ' we use a limited number of objects and set a maximum
    ' on the number of steps that can run in parallel
    ' This is a wrapper that will create an instance of
    ' a cExecuteSM object depending on the index
    Dim lngIndex As Long

    On Error GoTo InitExecStepErr

    lngIndex = GetFreeObject

    Select Case lngIndex + 1
        Case 1
            Set cExecStep1 = New cRunStep
            Set InitExecStep = cExecStep1
        Case 2
            Set cExecStep2 = New cRunStep
            Set InitExecStep = cExecStep2
        Case 3
            Set cExecStep3 = New cRunStep
            Set InitExecStep = cExecStep3
        Case 4
            Set cExecStep4 = New cRunStep
            Set InitExecStep = cExecStep4
        Case 5
            Set cExecStep5 = New cRunStep
            Set InitExecStep = cExecStep5
        Case 6
            Set cExecStep6 = New cRunStep
            Set InitExecStep = cExecStep6
```

```
Case 7
   Set cExecStep7 = New cRunStep
   Set InitExecStep = cExecStep7
Case 8
   Set cExecStep8 = New cRunStep
   Set InitExecStep = cExecStep8
Case 9
   Set cExecStep9 = New cRunStep
   Set InitExecStep = cExecStep9
Case 10
   Set cExecStep10 = New cRunStep
   Set InitExecStep = cExecStep10
Case 11
   Set cExecStep11 = New cRunStep
   Set InitExecStep = cExecStep11
Case 12
   Set cExecStep12 = New cRunStep
   Set InitExecStep = cExecStep12
Case 13
   Set cExecStep13 = New cRunStep
   Set InitExecStep = cExecStep13
Case 14
   Set cExecStep14 = New cRunStep
   Set InitExecStep = cExecStep14
Case 15
   Set cExecStep15 = New cRunStep
   Set InitExecStep = cExecStep15
Case 16
   Set cExecStep16 = New cRunStep
   Set InitExecStep = cExecStep16
Case 17
   Set cExecStep17 = New cRunStep
   Set InitExecStep = cExecStep17
Case 18
   Set cExecStep18 = New cRunStep
   Set InitExecStep = cExecStep18
Case 19
   Set cExecStep19 = New cRunStep
   Set InitExecStep = cExecStep19
Case 20
   Set cExecStep20 = New cRunStep
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Case 22
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Case 25
   Set cExecStep25 = New cRunStep
   Set InitExecStep = cExecStep25
Case 26
   Set cExecStep26 = New cRunStep
   Set InitExecStep = cExecStep26
Case 27
   Set cExecStep27 = New cRunStep
   Set InitExecStep = cExecStep27
Case 28
   Set cExecStep28 = New cRunStep
   Set InitExecStep = cExecStep28
Case 29
   Set cExecStep29 = New cRunStep
   Set InitExecStep = cExecStep29
Case 30
   Set cExecStep30 = New cRunStep
   Set InitExecStep = cExecStep30
Case 31
   Set cExecStep31 = New cRunStep
   Set InitExecStep = cExecStep31
Case 32
   Set cExecStep32 = New cRunStep
   Set InitExecStep = cExecStep32
Case 33
   Set cExecStep33 = New cRunStep
   Set InitExecStep = cExecStep33
Case 34
   Set cExecStep34 = New cRunStep
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Case 35
   Set cExecStep35 = New cRunStep
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Case 36
   Set cExecStep36 = New cRunStep
   Set InitExecStep = cExecStep36
Case 37
   Set cExecStep37 = New cRunStep
   Set InitExecStep = cExecStep37
Case 38
   Set cExecStep38 = New cRunStep
   Set InitExecStep = cExecStep38
Case 39
   Set cExecStep39 = New cRunStep
   Set InitExecStep = cExecStep39
Case 40
   Set cExecStep40 = New cRunStep
   Set InitExecStep = cExecStep40
Case 41
   Set cExecStep41 = New cRunStep
   Set InitExecStep = cExecStep41
Case 42
   Set cExecStep42 = New cRunStep
   Set InitExecStep = cExecStep42
Case 43
   Set cExecStep43 = New cRunStep
   Set InitExecStep = cExecStep43
Case 44
   Set cExecStep44 = New cRunStep
   Set InitExecStep = cExecStep44
Case 45
   Set cExecStep45 = New cRunStep
   Set InitExecStep = cExecStep45
Case 46
   Set cExecStep46 = New cRunStep
   Set InitExecStep = cExecStep46
Case 47
   Set cExecStep47 = New cRunStep
   Set InitExecStep = cExecStep47
Case 48
   Set cExecStep48 = New cRunStep
   Set InitExecStep = cExecStep48
Case 49
   Set cExecStep49 = New cRunStep
   Set InitExecStep = cExecStep49
Case 50
   Set cExecStep50 = New cRunStep
   Set InitExecStep = cExecStep50
Case 51
   Set cExecStep51 = New cRunStep
   Set InitExecStep = cExecStep51
Case 52
   Set cExecStep52 = New cRunStep
   Set InitExecStep = cExecStep52
Case 53
   Set cExecStep53 = New cRunStep
   Set InitExecStep = cExecStep53
Case 54
```

```
    Set cExecStep54 = New cRunStep
    Set InitExecStep = cExecStep54
  Case 55
    Set cExecStep55 = New cRunStep
    Set InitExecStep = cExecStep55
  Case 56
    Set cExecStep56 = New cRunStep
    Set InitExecStep = cExecStep56
  Case 57
    Set cExecStep57 = New cRunStep
    Set InitExecStep = cExecStep57
  Case 58
    Set cExecStep58 = New cRunStep
    Set InitExecStep = cExecStep58
  Case 59
    Set cExecStep59 = New cRunStep
    Set InitExecStep = cExecStep59
  Case 60
    Set cExecStep60 = New cRunStep
    Set InitExecStep = cExecStep60
  Case 61
    Set cExecStep61 = New cRunStep
    Set InitExecStep = cExecStep61
  Case 62
    Set cExecStep62 = New cRunStep
    Set InitExecStep = cExecStep62
  Case 63
    Set cExecStep63 = New cRunStep
    Set InitExecStep = cExecStep63
  Case 64
    Set cExecStep64 = New cRunStep
    Set InitExecStep = cExecStep64
  Case 65
    Set cExecStep65 = New cRunStep
    Set InitExecStep = cExecStep65
  Case 66
    Set cExecStep66 = New cRunStep
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  Case 67
    Set cExecStep67 = New cRunStep
    Set InitExecStep = cExecStep67
  Case 68
    Set cExecStep68 = New cRunStep
    Set InitExecStep = cExecStep68
  Case 69
    Set cExecStep69 = New cRunStep
    Set InitExecStep = cExecStep69
  Case 70
    Set cExecStep70 = New cRunStep
    Set InitExecStep = cExecStep70
  Case 71
    Set cExecStep71 = New cRunStep
    Set InitExecStep = cExecStep71
  Case 72
    Set cExecStep72 = New cRunStep
    Set InitExecStep = cExecStep72
  Case 73
    Set cExecStep73 = New cRunStep
    Set InitExecStep = cExecStep73
  Case 74
    Set cExecStep74 = New cRunStep
    Set InitExecStep = cExecStep74
  Case 75
    Set cExecStep75 = New cRunStep
    Set InitExecStep = cExecStep75
  Case 76
    Set cExecStep76 = New cRunStep
    Set InitExecStep = cExecStep76
  Case 77
    Set cExecStep77 = New cRunStep
    Set InitExecStep = cExecStep77
  Case 78
    Set cExecStep78 = New cRunStep
    Set InitExecStep = cExecStep78
  Case 79
    Set cExecStep79 = New cRunStep
    Set InitExecStep = cExecStep79
  Case 80
    Set cExecStep80 = New cRunStep
    Set InitExecStep = cExecStep80
  Case 81
    Set cExecStep81 = New cRunStep
    Set InitExecStep = cExecStep81
  Case 82
    Set cExecStep82 = New cRunStep
    Set InitExecStep = cExecStep82
  Case 83
    Set cExecStep83 = New cRunStep
    Set InitExecStep = cExecStep83
  Case 84
    Set cExecStep84 = New cRunStep
    Set InitExecStep = cExecStep84
  Case 85
    Set cExecStep85 = New cRunStep
    Set InitExecStep = cExecStep85
  Case 86
    Set cExecStep86 = New cRunStep
    Set InitExecStep = cExecStep86
  Case 87
    Set cExecStep87 = New cRunStep
    Set InitExecStep = cExecStep87
  Case 88
    Set cExecStep88 = New cRunStep
    Set InitExecStep = cExecStep88
  Case 89
    Set cExecStep89 = New cRunStep
    Set InitExecStep = cExecStep89
  Case 90
    Set cExecStep90 = New cRunStep
    Set InitExecStep = cExecStep90
  Case 91
    Set cExecStep91 = New cRunStep
    Set InitExecStep = cExecStep91
  Case 92
    Set cExecStep92 = New cRunStep
    Set InitExecStep = cExecStep92
  Case 93
    Set cExecStep93 = New cRunStep
    Set InitExecStep = cExecStep93
  Case 94
    Set cExecStep94 = New cRunStep
    Set InitExecStep = cExecStep94
  Case 95
    Set cExecStep95 = New cRunStep
    Set InitExecStep = cExecStep95
  Case 96
    Set cExecStep96 = New cRunStep
    Set InitExecStep = cExecStep96
  Case 97
    Set cExecStep97 = New cRunStep
    Set InitExecStep = cExecStep97
  Case 98
    Set cExecStep98 = New cRunStep
    Set InitExecStep = cExecStep98
  Case 99
    Set cExecStep99 = New cRunStep
    Set InitExecStep = cExecStep99
  Case Else
    Set InitExecStep = Nothing
End Select

BugMessage "Sending cExecStep" & (lngIndex + 1) & "!"
```

```
    If Not InitExecStep Is Nothing Then
        InitExecStep.Index = lngIndex

        ' Remove this element from the collection of free objects
        Call RemoveFreeProcess(lngIndex)
    End If

    Exit Function

InitExecStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Set InitExecStep = Nothing

End Function
Public Sub Run()
    ' Calls procedures to build a list of all the steps that
    ' need to be executed and to execute them
    ' Determines whether the run has started/terminated and
    ' raises the Run Start and Complete events.
    Dim cTempStep As cStep

    On Error GoTo RunErr

    If StringEmpty(mstrRootKey) Then
        Call ShowError(errExecuteBranchFailed)
        On Error GoTo 0
        Err.Raise vbObjectError + errExecuteBranchFailed, mstrModuleName & "Run", _
            LoadResString(errExecuteBranchFailed)
    Else
        ' Execute the first branch
        WriteToWspLog (mintRunStart)
        RaiseEvent RunStart(Determine64BitTime(), mcWspLog.FileName)

        If mcNavSteps.HasChild(StepKey:=mstrRootKey) Then
            Set cTempStep = mcNavSteps.ChildStep(StepKey:=mstrRootKey)
            mstrCurBranchRoot = MakeKeyValid(cTempStep.StepId,
cTempStep.StepType)

            Call CreateDummyInstance(mstrCurBranchRoot)

            ' Run all pending steps in the branch
            If Not RunBranch(mstrCurBranchRoot) Then
                ' Execute a new branch if there aren't any
                ' steps to run
                Call RunNewBranch
            End If
        Else
            WriteToWspLog (mintRunComplete)
            ' No children to execute - the run is complete
            RaiseEvent RunComplete(Determine64BitTime())
        End If
    End If

    Exit Sub

RunErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Call ShowError(errExecuteBranchFailed, OptArgs:=mstrCurBranchRoot)
    Call ResetForm

End Sub
Private Sub RunNewBranch()
    ' We will build a tree of all instances that occur and
    ' the count of the sub-steps that are running will be
    ' stored at each node in the tree (maintained internally
    ' as an array). Since there can be multiple iterations
    ' of the top level nodes running at the same time, we
    ' create a dummy node at the root that keeps a record of
    ' the instances of the top level node.

    ' Determines whether the run has started/terminated and
    ' raises the Run Start and Complete events.
    Dim cNextStep As cStep
    Dim bRunComplete As Boolean

    On Error GoTo RunNewBranchErr

    bRunComplete = False

    Do
        If StringEmpty(mstrCurBranchRoot) Then
            Exit Do
'           On Error GoTo 0
'           Err.Raise vbObjectError + errExecuteBranchFailed, mstrSource, _
'               LoadResString(errExecuteBranchFailed)
        Else
            Set cNextStep = mcNavSteps.NextStep(StepKey:=mstrCurBranchRoot)
            If cNextStep Is Nothing Then
                mstrCurBranchRoot = gstrEmptyString
                bRunComplete = True
                Exit Do
            Else
                ' Starting execution of a new branch - initialize the
                ' module-level variable
                mstrCurBranchRoot = MakeKeyValid(cNextStep.StepId,
cNextStep.StepType)
                Call CreateDummyInstance(mstrCurBranchRoot)
            End If
        End If
        Debug.Print "Running new branch: " & mstrCurBranchRoot

    ' Loop until we find a branch that has steps to execute
    Loop While Not RunBranch(mstrCurBranchRoot)

    If bRunComplete Then
        WriteToWspLog (mintRunComplete)
        ' Run is complete
        RaiseEvent RunComplete(Determine64BitTime())
    End If

    Exit Sub

RunNewBranchErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Call ShowError(errExecuteBranchFailed, OptArgs:=mstrCurBranchRoot)
    On Error GoTo 0
    mstrSource = mstrModuleName & "RunNewBranch"
    Err.Raise vbObjectError + errExecuteBranchFailed, mstrSource, _
        LoadResString(errExecuteBranchFailed)

End Sub
Private Function RunBranch(strRootNode As String) As Boolean
    ' This procedure is called to run all the necessary steps
    ' in a branch. It can also be called when a step terminates,
    ' in which case the terminated step is passed in as the
    ' optional parameter. When a step terminates, we need to
    ' either wait for some other steps to terminate before
    ' we execute more steps or run as many steps as necessary
    ' Returns True if there are steps currently executing
    ' in the branch, else returns False
    Dim cRunning As cInstance

    On Error GoTo RunBranchErr

    If Not StringEmpty(strRootNode) Then
        ' Call a procedure to execute all the enabled steps
        ' in the branch - will return the step node that is
        ' being executed - nothing means 'No more steps to
```

```
        ' execute in the branch'.
        Do
            Set cRunning = RunPendingStepInBranch(strRootNode, cRunning)

        Loop While Not cRunning Is Nothing

        RunBranch = mcDummyRootInstance.IsRunning
    End If

    Exit Function

RunBranchErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    mstrSource = mstrModuleName & "RunBranch"
    Err.Raise vbObjectError + errExecuteBranchFailed, _
        mstrSource, LoadResString(errExecuteBranchFailed)

End Function
Private Sub TimeUpdateForProcess(StepRecord As cStep, _
        ByVal InstanceId As Long, _
        Optional ByVal StartTime As Currency = 0, _
        Optional ByVal EndTime As Currency = 0, _
        Optional ByVal ElapsedTime As Long = 0, _
        Optional Command As String)
    ' We do not maintain start and end timestamps for the constraint
    ' of a step. Hence we check if the process that just started/
    ' terminated is the worker step that is being executed. If so,
    ' we update the start/end time and status on the instance record.

    Dim cInstanceRec As cInstance
    Dim sItVal As String

    On Error GoTo TimeUpdateForProcessErr

    Set cInstanceRec = mcInstances.QueryInstance(InstanceId)

    If StartTime = 0 Then
        RaiseEvent ProcessComplete(StepRecord, EndTime, InstanceId, ElapsedTime)
    Else
        sItVal = GetInstanceItValue(cInstanceRec)
        RaiseEvent ProcessStart(StepRecord, Command, StartTime, InstanceId, _
            cInstanceRec.ParentInstanceId, sItVal)
    End If

    Call cInstanceRec.UpdateStartTime(StepRecord.StepId, StartTime, EndTime,
ElapsedTime)

    Exit Sub

TimeUpdateForProcessErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errUpdateDisplayFailed, mstrModuleName & "TimeUpdateForProcess"

End Sub
Private Sub TimeStartUpdateForStep(StepRecord As cStep, _
        ByVal InstanceId As Long, _
        ByVal StartTime As Currency)

    ' Called when a step starts execution. Checks if this is the
    ' first enabled child of the manager step. If so, updates
    ' the start time and status on the manager.
    ' Also raises the Step Start event for the completed step.

    Dim cStartInst As cInstance
    Dim cInstanceRec As cInstance
    Dim LogLabels As New cVectorStr
    Dim iItIndex As Long
    Dim sLogLabel As String
    Dim sPath As String
    Dim sIt As String
    Dim sItVal As String

    On Error GoTo TimeStartUpdateForStepErr

    Set cStartInst = mcInstances.QueryInstance(InstanceId)

    ' Determine the step path and iterator values for the step and raise a step start event
    Set cInstanceRec = cStartInst
    Do While cInstanceRec.Key <> mstrDummyRootKey
        If Not StringEmpty(sPath) Then
            sPath = sPath & gstrFileSeparator
        End If
        sPath = sPath & gstrSQ & cInstanceRec.Step.StepLabel & gstrSQ
        Set cInstanceRec = mcInstances.QueryInstance(cInstanceRec.ParentInstanceId)
    Loop

    For iItIndex = cStartInst.Iterators.Count - 1 To 0 Step -1
        If Not StringEmpty(sIt) Then
            sIt = sIt & gstrFileSeparator
        End If
        sIt = sIt & gstrSQ & cStartInst.Iterators(iItIndex).Value & gstrSQ
    Next iItIndex

    sItVal = GetInstanceItValue(cStartInst)
    RaiseEvent StepStart(StepRecord, StartTime, InstanceId,
cStartInst.ParentInstanceId, _
            sPath, sIt, sItVal)

    iItIndex = 0
    Set cInstanceRec = cStartInst
    ' Raise a StepStart event for the manager step, if this is it's first sub-step being
executed
    Do While cInstanceRec.Key <> mstrDummyRootKey

        sLogLabel = gstrSQ & cInstanceRec.Step.StepLabel & gstrSQ
        If iItIndex < cStartInst.Iterators.Count Then
            If cStartInst.Iterators(iItIndex).StepId = cInstanceRec.Step.StepId Then
                sLogLabel = sLogLabel & msIt & gstrSQ &
cStartInst.Iterators(iItIndex).IteratorName & gstrSQ & _
                    msItValue & gstrSQ & cStartInst.Iterators(iItIndex).Value & gstrSQ
                iItIndex = iItIndex + 1
            End If
        End If
        LogLabels.Add sLogLabel

        If cInstanceRec.Key <> cStartInst.Key And cInstanceRec.StartTime = 0 Then
            cInstanceRec.StartTime = StartTime
            cInstanceRec.Status = gintRunning
            sItVal = GetInstanceItValue(cInstanceRec)
            ' The step path and iterator values are not needed for manager steps, since
            ' they are primarily used by the run status form
            RaiseEvent StepStart(cInstanceRec.Step, StartTime, cInstanceRec.InstanceId,
_
                cInstanceRec.ParentInstanceId, gstrEmptyString, gstrEmptyString, _
                sItVal)
        End If

        Set cInstanceRec = mcInstances.QueryInstance(cInstanceRec.ParentInstanceId)
    Loop

    Call WriteToWspLog(mintStepStart, LogLabels, StartTime)
    Set LogLabels = Nothing

    Exit Sub

TimeStartUpdateForStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    WriteError errUpdateDisplayFailed, mstrModuleName & "TimeStartUpdateForStep"
```

```
End Sub
Private Sub WriteToWspLog(iLogEvent As WspLogEvents, Optional StepDtls As
cVectorStr, _
      Optional dtStamp As Currency = gdtmEmpty)

   ' Writes to the workspace log that is generated for the run. The last three
   ' parameters are valid only for Step Start and Step Complete events.
   Static bError As Boolean
   Dim sLabel As String
   Dim lIndex As Long
   Dim bHdr As Boolean
   Dim cTempConn As cConnection

   On Error GoTo WriteToWspLogErr

   Select Case iLogEvent
      Case mintRunStart
         Set mcWspLog = New cFileSM
         mcWspLog.FileName = GetDefaultDir(WspId, mcParameters) &
gstrFileSeparator & _
               Trim(Str(RunId)) & gstrFileSeparator & "SMLog-" & Format(Now,
FMT_WSP_LOG_FILE) & gstrLogFileSuffix
         mcWspLog.WriteLine (JulianDateToString(Determine64BitTime()) & " Start
Run: " & vbTab & gstrSQ & GetWorkspaceDetails(WorkspaceId:=WspId)) & gstrSQ

         ' Write all current parameter values to the log
         bHdr = False
         For lIndex = 0 To mcParameters.ParameterCount - 1
            If mcParameters(lIndex).ParameterType <> gintParameterApplication Then
               If Not bHdr Then
                  mcWspLog.WriteField JulianDateToString(Determine64BitTime()) & "
Parameters: "
                  bHdr = True
               Else
                  mcWspLog.WriteField vbTab & vbTab & vbTab
               End If
               mcWspLog.WriteLine vbTab & gstrSQ &
mcParameters(lIndex).ParameterName & gstrSQ & vbTab & vbTab & gstrSQ &
mcParameters(lIndex).ParameterValue & gstrSQ
            End If
         Next lIndex

         ' Write all connection properties to the log
         For lIndex = 0 To RunConnections.Count - 1
            Set cTempConn = RunConnections(lIndex)
            If lIndex = 0 Then
               mcWspLog.WriteField JulianDateToString(Determine64BitTime()) & "
Connections: "
            Else
               mcWspLog.WriteField vbTab & vbTab & vbTab
            End If
            mcWspLog.WriteLine vbTab & gstrSQ & cTempConn.ConnectionName &
gstrSQ & _
                  vbTab & vbTab & gstrSQ & cTempConn.ConnectionValue & gstrSQ &
_
                  vbTab & "No Count: " & gstrSQ & cTempConn.NoCountDisplay &
gstrSQ & gstrBlank & _
                  "No Execute: " & gstrSQ & cTempConn.NoExecute & gstrSQ &
gstrBlank & _
                  "Parse Query Only: " & gstrSQ & cTempConn.ParseQueryOnly &
gstrSQ & gstrBlank & _
                  "Quoted Identifiers: " & gstrSQ & cTempConn.QuotedIdentifiers &
gstrSQ & gstrBlank & _
                  "ANSI Nulls: " & gstrSQ & cTempConn.AnsiNulls & gstrSQ & gstrBlank
& _
                  "Show Query Plan: " & gstrSQ & cTempConn.ShowQueryPlan &
gstrSQ & gstrBlank & _
                  "Show Stats Time: " & gstrSQ & cTempConn.ShowStatsTime & gstrSQ
& gstrBlank & _
                  "Show Stats IO: " & gstrSQ & cTempConn.ShowStatsIO & gstrSQ &
gstrBlank & _
                  "Row Count" & gstrSQ & cTempConn.RowCount & gstrSQ & gstrBlank
& _
                  "Query Timeout" & gstrSQ & cTempConn.QueryTimeOut & gstrSQ
         Next lIndex

      Case mintRunComplete
         BugAssert Not mcWspLog Is Nothing
         mcWspLog.WriteLine (JulianDateToString(Determine64BitTime()) & " Comp.
Run: " & vbTab & gstrSQ & GetWorkspaceDetails(WorkspaceId:=WspId)) & gstrSQ
         Set mcWspLog = Nothing

      Case mintStepStart
         For lIndex = StepDtls.Count - 1 To 0 Step -1
            sLabel = StepDtls(lIndex)
            If lIndex = StepDtls.Count - 1 Then
               mcWspLog.WriteLine JulianDateToString(dtStamp) & " Start Step: " &
vbTab & sLabel
            Else
               mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & sLabel
            End If
         Next lIndex

      Case mintStepComplete
         For lIndex = StepDtls.Count - 1 To 0 Step -1
            sLabel = StepDtls(lIndex)
            If lIndex = StepDtls.Count - 1 Then
               mcWspLog.WriteLine JulianDateToString(dtStamp) & " Comp. Step: " &
vbTab & sLabel
            Else
               mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & sLabel
            End If
         Next lIndex

   End Select

   Exit Sub

WriteToWspLogErr:
   If Not bError Then
      bError = True
   End If

End Sub
'Private Sub WriteToWspLog(iLogEvent As WspLogEvents, Optional StepDtls As
cVectorStr, _
'      Optional dtStamp As Date = gdtmEmpty)
'
'   This function uses the LogWriter dll - memory corruption problems since the vb exe
'   and the vc Execute Dll both use the same dll to write.
'    ' Writes to the workspace log that is generated for the run. The last three
'    ' parameters are valid only for StepStart and StepComplete events.
'    Static bError As Boolean
'    Static sFile As String
'    Dim sLabel As String
'    Dim lIndex As Long
'    Dim bHdr As Boolean
'
'    On Error GoTo WriteToWspLogErr
'
'    Select Case iLogEvent
'       Case mintRunStart
'          Set mcWspLog = New LOGWRITERLib.SMLog
'          sFile = App.Path & "\" & "SMLog-" & Format(Now, FMT_WSP_LOG_FILE) &
gstrLogFileSuffix
'          mcWspLog.FileName = sFile
'          mcWspLog.Init
'          mcWspLog.WriteLine (Format(Now, FMT_WSP_LOG_DATE) & " Start Run: "
& vbTab & gstrSQ & GetWorkspaceDetails(WorkspaceId:=WspId)) & gstrSQ
'
```

```
'           ' Write all current parameter values to the log
'           bHdr = False
'           For lIndex = 0 To mcParameters.ParameterCount - 1
'              If mcParameters(lIndex).ParameterType <> gintParameterApplication Then
'                 If Not bHdr Then
'                    'mcWspLog.WriteLine Format(Now, FMT_WSP_LOG_DATE) & "
Parameters: " & vbTab & gstrSQ & mcParameters(lIndex).ParameterName & gstrSQ &
vbTab & vbTab & gstrSQ & mcParameters(lIndex).ParameterValue & gstrSQ
'                    bHdr = True
'                 Else
'                    'mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & gstrSQ &
mcParameters(lIndex).ParameterName & gstrSQ & vbTab & vbTab & gstrSQ &
mcParameters(lIndex).ParameterValue & gstrSQ
'                 End If
'              End If
'           Next lIndex
'
'       Case mintRunComplete
'           BugAssert Not mcWspLog Is Nothing
'           mcWspLog.WriteLine (Format(Now, FMT_WSP_LOG_DATE) & " Comp. Run:
" & vbTab & gstrSQ & GetWorkspaceDetails(WorkspaceId:=WspId)) & gstrSQ
'           Set mcWspLog = Nothing
'
'       Case mintStepStart
'           For lIndex = StepDtls.Count - 1 To 0 Step -1
'              sLabel = StepDtls(lIndex)
'              If lIndex = StepDtls.Count - 1 Then
'                 mcWspLog.WriteLine Format(dtStamp, FMT_WSP_LOG_DATE) & " Start
Step: " & vbTab & sLabel
'              Else
'                 mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & sLabel
'              End If
'           Next lIndex
'
'       Case mintStepComplete
'           For lIndex = StepDtls.Count - 1 To 0 Step -1
'              sLabel = StepDtls(lIndex)
'              If lIndex = StepDtls.Count - 1 Then
'                 mcWspLog.WriteLine Format(dtStamp, FMT_WSP_LOG_DATE) & "
Comp. Step: " & vbTab & sLabel
'              Else
'                 mcWspLog.WriteLine vbTab & vbTab & vbTab & vbTab & sLabel
'              End If
'           Next lIndex
'
'    End Select
'
'    Exit Sub
'
'WriteToWspLogErr:
'    If Not bError Then
'       bError = True
'    End If
'
'End Sub
'
Public Property Get WspPreExecution() As Variant
    WspPreExecution = mcvntWspPreCons
End Property
Public Property Let WspPreExecution(ByVal vdata As Variant)
    mcvntWspPreCons = vdata
End Property

Public Property Get WspPostExecution() As Variant
    WspPostExecution = mcvntWspPostCons
End Property
Public Property Let WspPostExecution(ByVal vdata As Variant)
    mcvntWspPostCons = vdata
End Property

Private Sub ExecuteStep(cCurStep As cInstance)
    ' Initializes a cRunStep object with all the properties
    ' corresponding to the step to be executed and calls it's
    ' execute method to execute the step

    Dim cExecStep As cRunStep

    On Error GoTo ExecuteStepErr
    mstrSource = mstrModuleName & "ExecuteStep"

    ' Confirm that the step is a worker
    If cCurStep.Step.StepType <> gintWorkerStep Then
       On Error GoTo 0
       Err.Raise vbObjectError + errExecInstanceFailed, mstrSource, _
             LoadResString(errExecInstanceFailed)
    End If

    Set cExecStep = InitExecStep()
    ' Exceeded the number of processes that we can run simultaneously
    If cExecStep Is Nothing Then
       ' Raise an error
       On Error GoTo 0
       Err.Raise vbObjectError + errProgramError, mstrSource, _
          LoadResString(errProgramError)
    End If
    ' Initialize the instance id - not needed for step execution
    ' but necessary to identify later which instance completed
    cExecStep.InstanceId = cCurStep.InstanceId

    Set cExecStep.ExecuteStep = cCurStep.Step
    Set cExecStep.Iterators = cCurStep.Iterators
    Set cExecStep.Globals = mcRunSteps
    Set cExecStep.WspParameters = mcParameters
    Set cExecStep.WspConnections = RunConnections
    Set cExecStep.WspConnDtls = RunConnDtls

    ' Initialize all the pre and post-execution constraints that
    ' have been defined globally for the workspace
    cExecStep.WspPreCons = mcvntWspPreCons
    cExecStep.WspPostCons = mcvntWspPostCons

    ' Initialize all the pre and post-execution constraints for
    ' the step being executed
    cExecStep.PreCons = DetermineConstraints(cCurStep, gintPreStep)
    cExecStep.PostCons = DetermineConstraints(cCurStep, gintPostStep)

    cExecStep.RunId = RunId
    cExecStep.CreateInputFiles = CreateInputFiles

    ' Call the execute method to execute the step
    cExecStep.Execute

    Set cExecStep = Nothing

    Exit Sub

ExecuteStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Call ExecutionFailed(cExecStep)

End Sub

Public Property Set Steps(cRunSteps As cArrSteps)

    Set mcRunSteps = cRunSteps
    Set mcNavSteps.StepRecords = cRunSteps

End Property
Public Property Set Parameters(cParameters As cArrParameters)
    ' A reference to the parameter array - we use it to
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    ' substitute parameter values in the step text

    Set mcParameters = cParameters

End Property
Public Property Get Steps() As cArrSteps

    Set Steps = mcRunSteps

End Property
Public Property Get Constraints() As cArrConstraints

    Set Constraints = mcRunConstraints

End Property
Public Property Set Constraints(vdata As cArrConstraints)

    Set mcRunConstraints = vdata

End Property


Private Sub cExecStep1_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep1_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep1_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep1.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep1_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep9_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep9_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep9_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep9.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep9_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep10_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep10_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep10_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep10.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep10_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep11_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep11_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep11_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)
```

```
    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep11.Index, lnstanceId,
Status)

End Sub

Private Sub cExecStep11_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep12_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep12_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep12_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep12.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep12_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep13_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep13_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep13_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep13.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep13_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep14_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep14_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep14_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep14.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep14_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep15_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep15_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep15_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep15.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep15_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep16_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)
```

```
    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep16_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep16_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep16.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep16_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub
Private Sub cExecStep17_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep17_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep17_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep17.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep17_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep18_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep18_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep18_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep18.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep18_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep19_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub


Private Sub cExecStep19_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep19_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep19.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep19_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep20_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep20_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)
```

```
End Sub

Private Sub cExecStep20_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep20.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep20_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep21_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep21_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep21_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep21.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep21_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep22_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep22_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep22_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep22.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep22_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep23_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep23_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep23_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep23.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep23_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep24_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep24_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep24_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep24.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep24_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep25_ProcessComplete(cStepRecord As cStep, _
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    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep25_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep25_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep25.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep25_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep26_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep26_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep26_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep26.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep26_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep27_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep27_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep27_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep27.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep27_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep28_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep28_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep28_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep28.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep28_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep29_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep29_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep29_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)
```

```
    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep29.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep29_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep30_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep30_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep30_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep30.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep30_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep31_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep31_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep31_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep31.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep31_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep32_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep32_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep32_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep32.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep32_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep33_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep33_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep33_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep33.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep33_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep34_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)
```

```
End Sub

Private Sub cExecStep34_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep34_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep34.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep34_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep35_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep35_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep35_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep35.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep35_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep36_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep36_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep36_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep36.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep36_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep37_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep37_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep37_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep37.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep37_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep38_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep38_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep38_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep38.Index, InstanceId,
Status)

End Sub
```

```
Private Sub cExecStep38_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep39_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep39_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep39_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep39.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep39_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep40_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep40_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep40_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep40.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep40_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep41_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep41_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep41_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep41.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep41_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep42_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep42_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep42_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep42.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep42_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep43_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep43_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)
```

```
    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep43_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep43.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep43_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep44_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep44_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep44_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep44.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep44_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep45_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep45_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep45_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep45.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep45_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep46_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep46_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep46_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep46.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep46_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep47_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep47_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep47_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep47.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep47_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)
```

```
End Sub

Private Sub cExecStep48_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep48_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep48_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep48.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep48_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep49_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep49_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep49_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep49.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep49_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep50_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep50_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep50_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep50.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep50_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep51_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep51_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep51_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep51.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep51_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep52_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep52_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub
```

```
Private Sub cExecStep52_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep52.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep52_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep53_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep53_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep53_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep53.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep53_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep54_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep54_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep54_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep54.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep54_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep55_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep55_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep55_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep55.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep55_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep56_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep56_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep56_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep56.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep56_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep57_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)
```

```
    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep57_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep57_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep57.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep57_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep58_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep58_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep58_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep58.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep58_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep59_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep59_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep59_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep59.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep59_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep60_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep60_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep60_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep60.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep60_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep61_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep61_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep61_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)
```

```
    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep61.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep61_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep62_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep62_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep62_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep62.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep62_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep63_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep63_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep63_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep63.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep63_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep64_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep64_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep64_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep64.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep64_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep65_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep65_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep65_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep65.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep65_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep66_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)
```

```
End Sub

Private Sub cExecStep66_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep66_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep66.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep66_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep67_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep67_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep67_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep67.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep67_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep68_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep68_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep68_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep68.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep68_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep69_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep69_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep69_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep69.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep69_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep70_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep70_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep70_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep70.Index, InstanceId,
Status)

End Sub
```

```
Private Sub cExecStep70_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep71_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep71_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep71_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep71.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep71_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep72_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep72_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep72_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep72.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep72_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep73_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep73_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep73_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep73.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep73_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep74_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep74_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep74_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep74.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep74_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep75_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep75_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)
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```
    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep75_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep75.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep75_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep76_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep76_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep76_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep76.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep76_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep77_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep77_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep77_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep77.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep77_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep78_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep78_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep78_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep78.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep78_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep79_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep79_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep79_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep79.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep79_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)
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```
End Sub

Private Sub cExecStep80_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep80_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep80_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep80.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep80_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep81_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep81_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep81_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep81.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep81_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep82_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep82_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep82_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep82.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep82_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep83_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep83_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep83_StepComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

  Call StepTerminated(cStepRecord, dtmEndTime, cExecStep83.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep83_StepStart(cStepRecord As cStep, _
    dtmStartTime As Currency, InstanceId As Long)

  Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep84_ProcessComplete(cStepRecord As cStep, _
    dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep84_ProcessStart(cStepRecord As cStep, _
    strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

  Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub
```

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Private Sub cExecStep84_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep84.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep84_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep85_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep85_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep85_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep85.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep85_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep86_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep86_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep86_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep86.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep86_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep87_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep87_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep87_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep87.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep87_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep88_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep88_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep88_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep88.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep88_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep89_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)
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```
    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep89_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep89_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep89.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep89_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep90_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep90_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep90_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep90.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep90_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep91_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep91_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep91_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep91.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep91_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep92_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep92_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep92_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep92.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep92_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep93_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep93_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep93_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)
```

```
    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep93.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep93_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep94_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep94_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep94_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep94.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep94_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep95_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep95_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep95_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep95.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep95_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep96_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep96_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep96_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep96.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep96_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep97_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep97_ProcessStart(cStepRecord As cStep, _
        strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep97_StepComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

    Call StepTerminated(cStepRecord, dtmEndTime, cExecStep97.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep97_StepStart(cStepRecord As cStep, _
        dtmStartTime As Currency, InstanceId As Long)

    Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep98_ProcessComplete(cStepRecord As cStep, _
        dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

    Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)
```

```
End Sub

Private Sub cExecStep98_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep98_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep98.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep98_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep99_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep99_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep99_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep99.Index, InstanceId,
Status)

End Sub

Private Sub cExecStep99_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep2_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep2_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep2_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep2.Index, _
         InstanceId, Status)

End Sub

Private Sub cExecStep2_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub


Private Sub cExecStep3_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep3_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub


Private Sub cExecStep3_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep3.Index, _
         InstanceId, Status)

End Sub

Private Sub cExecStep3_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub


Private Sub cExecStep4_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep4_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep4_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep4.Index, _
```

```
        InstanceId, Status)

End Sub


Private Sub cExecStep4_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep5_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep5_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep5_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep5.Index, _
         InstanceId, Status)

End Sub

Private Sub cExecStep5_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep6_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep6_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep6_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep6.Index, _
         InstanceId, Status)

End Sub

Private Sub cExecStep6_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep7_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep7_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep7_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep7.Index, _
         InstanceId, Status)

End Sub

Private Sub cExecStep7_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub cExecStep8_ProcessComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, lngInstanceId As Long, lElapsed As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, EndTime:=dtmEndTime,
ElapsedTime:=lElapsed)

End Sub

Private Sub cExecStep8_ProcessStart(cStepRecord As cStep, _
      strCommand As String, dtmStartTime As Currency, lngInstanceId As Long)

   Call TimeUpdateForProcess(cStepRecord, lngInstanceId, StartTime:=dtmStartTime,
Command:=strCommand)

End Sub

Private Sub cExecStep8_StepComplete(cStepRecord As cStep, _
      dtmEndTime As Currency, InstanceId As Long, Status As InstanceStatus)

   Call StepTerminated(cStepRecord, dtmEndTime, cExecStep8.Index, _
         InstanceId, Status)

End Sub

Private Sub cExecStep8_StepStart(cStepRecord As cStep, _
      dtmStartTime As Currency, InstanceId As Long)

   Call TimeStartUpdateForStep(cStepRecord, InstanceId, dtmStartTime)

End Sub

Private Sub Class_Initialize()

   Dim lngCount As Long
   Dim lngTemp As Long

   On Error GoTo InitializeErr
```

```
    Set mcFreeSteps = New cVectorLng
    ' Initialize the array of free objects with all elements
    ' for now
    For lngCount = 0 To glngNumConcurrentProcesses - 1 Step 1
        mcFreeSteps.Add lngCount
    Next lngCount

    ' Initialize a byte array with the number of free processes. It will
    ' be used later to determine if any step is running
    ' Each element in the array can represent 8 steps, 1 for each bit
    ReDim mbarrFree(glngNumConcurrentProcesses \ gintBitsPerByte)

    ' Initialize each element in the byte array w/ all 1's
    ' (upto glngNumConcurrentProcesses)
    For lngCount = LBound(mbarrFree) To UBound(mbarrFree) Step 1
        lngTemp = IIf( _
            glngNumConcurrentProcesses - (gintBitsPerByte * lngCount) >
gintBitsPerByte, _
            gintBitsPerByte, _
            glngNumConcurrentProcesses - (gintBitsPerByte * lngCount))

        mbarrFree(lngCount) = (2 ^ lngTemp) - 1
    Next lngCount

    Set mcInstances = New cInstances
    Set mcFailures = New cFailedSteps
    Set mcNavSteps = New cStepTree
    Set mcTermSteps = New cTermSteps

    ' Initialize the Abort flag to False
    mblnAbort = False
    mblnAsk = False

    Exit Sub

InitializeErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errInitializeFailed, mstrModuleName & "Initialize", _
        LoadResString(errInitializeFailed)

End Sub
Private Sub Class_Terminate()

    On Error GoTo Class_TerminateErr

    mcFreeSteps.Clear
    Set mcFreeSteps = Nothing
    ReDim mbarrFree(0)

    mcInstances.Clear
    Set mcInstances = Nothing

    Set mcFailures = Nothing
    Set mcNavSteps = Nothing
    Set mcTermSteps = Nothing

    Exit Sub

Class_TerminateErr:
    Call LogErrors(Errors)

End Sub

Private Sub mcTermSteps_TermStepExists(cStepDetails As cTermStep)

    Call RunNextStep(cStepDetails.TimeComplete, cStepDetails.Index, _
        cStepDetails.InstanceId, cStepDetails.ExecutionStatus)

End Sub
```

RUNINSTHELPER.BAS

```
Attribute VB_Name = "RunInstHelper"
'  FILE:      RunInstHelper.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    This module contains helper procedures that are called by
'              cRunInst.cls
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this class
Private Const mstrModuleName As String = "RunInstHelper."

' Should be equal to the number of steps defined in cRunInst.cls
Public Const glngNumConcurrentProcesses As Long = 99
Public Const gintBitsPerByte = 8
Public Function AnyStepRunning(cFreeSteps As cVectorLng, arrFree() As Byte) As
Boolean

    Dim lngIndex As Long
    Dim intPosInByte As Integer
    Dim lngTemp As Long

    ' Check if there are any running instances to wait for
    If cFreeSteps.Count <> glngNumConcurrentProcesses Then

        ' For every free step, reset the corresponding element
        ' in the byte array to 0
        For lngIndex = 0 To cFreeSteps.Count - 1

            lngTemp = cFreeSteps(lngIndex) \ gintBitsPerByte
            intPosInByte = cFreeSteps(lngIndex) Mod gintBitsPerByte

            arrFree(lngTemp) = arrFree(lngTemp) Xor 2 ^ intPosInByte
        Next lngIndex

        AnyStepRunning = False

        ' Check if we have a non-zero bit in the byte array
        For lngIndex = LBound(arrFree) To UBound(arrFree) Step 1
            If arrFree(lngIndex) <> 0 Then
                ' We are waiting for a step to complete
                AnyStepRunning = True
                Exit For
            End If
        Next lngIndex

    Else
        AnyStepRunning = False
    End If

End Function


Public Function OrderConstraints(vntTempCons() As Variant, _
        intConsType As ConstraintType) As Variant
    ' Returns a variant containing all the constraint records in the order
    ' in which they should be executed

    Dim vntTemp As Variant
    Dim lngOuter As Long
    Dim lngInner As Long
    Dim cTempConstraint As cConstraint
    Dim cConstraints() As cConstraint
```

```
    Dim lngConsCount As Long
    Dim lngLbound As Long
    Dim lngUbound As Long
    Dim lngStep As Long

    On Error GoTo OrderConstraintsErr

    If intConsType = gintPreStep Then
        ' Since we are travelling up and we need to execute the constraints
        ' for the top-level steps first, reverse the order that they
        ' have been stored in the array
        lngLbound = UBound(vntTempCons)
        lngUbound = LBound(vntTempCons)
        lngStep = -1
    Else
        lngLbound = LBound(vntTempCons)
        lngUbound = UBound(vntTempCons)
        lngStep = 1
    End If

    lngConsCount = 0

    For lngOuter = lngLbound To lngUbound Step lngStep
        vntTemp = vntTempCons(lngOuter)

        If Not IsEmpty(vntTemp) Then
            ' Each of the elements is an array
            For lngInner = LBound(vntTemp) To UBound(vntTemp) Step 1
                If Not IsEmpty(vntTemp(lngInner)) Then
                    Set cTempConstraint = vntTemp(lngInner)

                    If Not cTempConstraint Is Nothing Then
                        ReDim Preserve cConstraints(lngConsCount)
                        Set cConstraints(lngConsCount) = cTempConstraint
                        lngConsCount = lngConsCount + 1
                    End If
                End If
            Next lngInner
        End If
    Next lngOuter

    ' Set the return value of the function to the array of
    ' constraints that has been built above
    If lngConsCount = 0 Then
        OrderConstraints = Empty
    Else
        OrderConstraints = cConstraints()
    End If

    Exit Function

OrderConstraintsErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errExecInstanceFailed, _
        mstrModuleName, LoadResString(errExecInstanceFailed)

End Function
```

SHELLSM.BAS

```
Attribute VB_Name = "ShellSM"
' FILE:      ShellSM.bas
'            Microsoft TPC-H Kit Ver. 1.00
'            Copyright Microsoft, 1999
'            All Rights Reserved
'
'
' PURPOSE:   This module contains a function that creates a process and
'            waits for it to complete.
' Contact:   Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Public Function SyncShell(CommandLine As String, Optional Timeout As Long, _
    Optional WaitForInputIdle As Boolean) As Boolean

    Dim proc As PROCESS_INFORMATION
    Dim Start As STARTUPINFO
    Dim ret As Long
    Dim nMilliseconds As Long

    BugMessage "Executing: " & CommandLine
    If Timeout > 0 Then
        nMilliseconds = Timeout
    Else
        nMilliseconds = INFINITE
    End If

    'Initialize the STARTUPINFO structure:
    Start.cb = Len(Start)
    Start.dwFlags = STARTF_USESHOWWINDOW
    Start.wShowWindow = SW_SHOWMINNOACTIVE

    'Start the shelled application:
    CreateProcessA 0&, CommandLine, 0&, 0&, 1&, _
        NORMAL_PRIORITY_CLASS, 0&, 0&, Start, proc

    If WaitForInputIdle Then
        'Wait for the shelled application to finish setting up its UI:
        ret = InputIdle(proc.hProcess, nMilliseconds)
    Else
        'Wait for the shelled application to terminate:
        ret = WaitForSingleObject(proc.hProcess, nMilliseconds)
    End If

    CloseHandle proc.hProcess

    'Return True if the application finished. Otherwise it timed out or erred.
    SyncShell = (ret = WAIT_OBJECT_0)
End Function
```

SMERR.BAS

```
Attribute VB_Name = "SMErr"
' FILE:      SMErr.bas
'            Microsoft TPC-H Kit Ver. 1.00
'            Copyright Microsoft, 1999
'            All Rights Reserved
'
'
' PURPOSE:   This module contains error code for all the errors that are
'            raised by StepMaster.
' Contact:   Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' A public enum containing the codes for all the error
' messages that will be displayed by the project - each
' of the codes has the prefix, err
Public Enum errErrorConstants
    errParameterIdInvalid = 1000
    errParameterNameMandatory
    errParameterInsertFailed
    errStepLabelOrTextOrFileRequired
    errMandatoryNodeTextMissing
    errParameterUpdateFailed
    errDupConnDtlName
    errDummy14
    errContCriteriaMandatory
    errContCriteriaNullForGlobal
    errContCriteriaInvalid = 1010
    errParamSeparatorMissing
```

errStepTextOrTextFileMandatory
errStepTextOrFile
errEnabledFlagFalseForGlobal
errEnabledFlagLetFailed
errDegParallelismNullForGlobal
errInvalidDegParallelism
errExecutionMechanismInvalid
errExecutionMechanismLetFailed
errStepLevelNull = 1020
errStepLevelZeroForGlobal
errStepLevelLetFailed
errRowCountNumeric
errConnNameInvalid
errTimeoutNumeric
errResetConnPropertiesFailed
errFailureThresholdNumeric
errConnectionUpdateFailed
errGlobalRunMethodMandatory
errGlobalRunMethodNull = 1030
errGlobalRunMethodInvalid
errGlobalRunMethodLetFailed
errNoTrueOption
errGetOptionFailed
errSetEnabled
errStepLabelTextAndFileNull
errInvalidNodeType
errSetOptionFailed
errQueryParameterFailed
errParamNotFound = 1040
errQueryStepFailed
errStepNotFound
errReadFromScreenFailed
errCopyPropertiesToFormFailed
errMandatoryFieldNull
errUnableToCheckNull
errUpgradeFailed
errFindStepSequenceFailed
errFindParentStepIdFailed
errCircularReference = 1050
errAddStepFailed
errModifyStepFailed
errDeleteColumnFailed
errFindPositionFailed
errDeleteStepFailed
errRunExistsForStepFailed
errCreateNewParentFailed
errInsertNewStepVersionFailed
errCreateNewStepFailed
errDuplicateParameterName = 1060
errCheckDupParameterNameFailed
errConstraintTypeInvalid
errConstraintTypeLetFailed
errAddConstraintFailed
errWorkspaceIdMandatory
errInvalidWorkspaceData
errGetWorkspaceDetailsFailed
errNoWorkspaceLoaded
errWorkspaceAlreadyOpen
errDuplicateWorkspaceName = 1070
errWorkspaceNameMandatory
errWorkspaceNameSetFailed
errWorkspaceIdInvalid
errWorkspaceIdSetFailed
errWorkspaceInsertFailed
errWorkspaceDeleteFailed
errWorkspaceUpdateFailed
errInvalidFile
errCheckWorkspaceOpenFailed
errWriteFailed = 1080
errDeleteParameterRecordFailed
errUnableToLogOutput
errDeleteDBRecordFailed
errRunExistsForWorkspaceFailed
errClearHistoryFailed
errCreateDBFailed
errImportWspFailed
errStepModifyFailed
errStepDeleteFailed
errDummy3 = 1090
errUnableToGetWorkspace
errInvalidNode
errUnableToRemoveSubtree
errSetFileNameFailed
errStepTypeInvalid
errObjectMandatory
errBuiltInUpdateOnly
errInvalidStep
errTypeOfStepFailed
errGetParentKeyFailed = 1100
errLabelTextAndFileCheckFailed
errStepTextAndFileNull
errTextOrFileCheckFailed
errParentStepManager
errDeleteSubStepsFailed
errWorkspaceNameDuplicateFailed
errNewConstraintVersionFailed
errDeleteStepConstraintsFailed
errOldVersionMandatory
errLoadConstraintsInListFailed = 1110
errLoadGlobalStepsFailed
errDeleteConstraintFailed
errUpdateConstraintFailed
errConstraintIdInvalid
errConstraintIdSetFailed
errGlobalStepIdInvalid
errGlobalStepIdSetFailed
errUpdateVersionFailed
errQueryAdjacentConsFailed
errConstraintNotFound = 1120
errQueryConstraintFailed
errSetDBBeforeLoad
errLoadDataFailed
errLoadRsInArrayFailed
errConstraintsForStepFailed
errPreConstraintsForStepFailed
errPostConstraintsForStepFailed
errExecuteConstraintMethodFailed
errIdOrKeyMandatory
errInListFailed = 1130
errUnableToWriteChanges
errQuickSortFailed
errCheckParentValidFailed
errLogErrorFailed
errCopyListFailed
errConnected
errVersionMismatch
errStepNodeFailed
errWorkspaceSelectedFailed
errIdentifierSelectedFailed = 1140
errCheckForNullFieldFailed
errInstanceInUse
errSetVisiblePropertyFailed
errExportWspFailed
errMakeKeyValidFailed
errDummy16
errRunApplicationFailed
errStepLabelUnique
errDeleteSingleFile
errMakeIdentifierValidFailed = 1150
errTypeOfNodeFailed
errConstraintCommandFailed
errOpenDbFailed

errInsertNewConstraintsFailed
errLoadPostExecutionStepsFailed
errLoadPreExecutionStepsFailed
errCreateNewNodeFailed
errDeleteNodeFailed
errDisplayPopupFailed
errDisplayPropertiesFailed = 1160
errUnableToCreateNewObject
errDiffFailed
errLoadWorkspaceFailed
errTerminateProcessFailed
errCompareFailed
errCreateConnectionFailed
errShowFormFailed
errAbortFailed
errDeleteParameterFailed
errUpdateViewFailed = 1170
errParameterNewFailed
errCopyNodeFailed
errCutNodeFailed
errCheckObjectValidFailed
errDeleteViewNodeFailed
errMainFailed
errNewStepFailed
errProcessStepModifyFailed
errCustomizeStepFormFailed
errInitializeStepFormFailed = 1180
errInsertStepFailed
errIncVersionYFailed
errIncVersionXFailed
errShowCreateStepFormFailed
errShowStepFormFailed
errStepNewFailed
errUnableToApplyChanges
errUnableToCommitChanges
errGetStepNodeTextFailed
errSelectGlobalRunMethodFailed = 1190
errConnectionNameMandatory
errUpdateStepFailed
errBrowseFailed
errDummy4
errDummy1
errDummy2
errDummy
errUnableToPreviewFile
errCopyWorkspaceFailed
errCopyParameterFailed = 1200
errGetStepTypeAndPositionFailed
errCopyStepFailed
errMandatoryParameterMissing
errDeleteWorkspaceRecordsFailed
errCreateDirectoryFailed
errConfirmDeleteOrMoveFailed
errCreateWorkspaceFailed
errTypeOfObjectFailed
errCreateNodeFailed
errCreateParameterFailed = 1210
errInsertParameterFailed
errCreateStepFailed
errNoConstraintsCreated
errCopyFailed
errCloneFailed
errCloneGlobalFailed
errCloneWorkerFailed
errCloneManagerFailed
errLetStepTypeFailed
errUnableToCloseWorkspace = 1220
errUnableToModifyWorkspace
errUnableToCreateWorkspace
errAddArrayElementFailed
errUpdateSequenceFailed
errCannotCopySubSteps
errSubStepsFailed
errModifyInArrayFailed
errUpdateParentVersionFailed
errGetNodeTextFailed
errAddToArrayFailed = 1230
errDeleteFromArrayFailed
errQueryIndexFailed
errCreateNewConstraintVersionFailed
errGetRootNodeFailed
errPopulateWspDetailsFailed
errLoadRsInTreeFailed
errAddNodeToTreeFailed
errMaxTempFiles
errMoveFailed
errRootNodeKeyInvalid = 1240
errNextNodeFailed
errBranchWillMove
errMoveBranchInvalid
errCreateIdRecordsetFailed
errIdentifierColumnFailed
errGetIdentifierFailed
errGetStepTypeFailed
errUpdateConstraintSeqFailed
errDelParamsInWspFailed
errDuplicateConnectionName = 1250
errOpenWorkspaceFailed
errShowWorkspaceNewFailed
errShowWorkspaceModifyFailed
errPopulateListFailed
errExploreNodeFailed
errInitializeListNodeFailed
errMakeListColumnsFailed
errRefreshViewFailed
errExploreFailed
errCollapseNodeFailed = 1260
errUnableToProcessListViewClick
errSetEnabledForStepFailed
errDisplayStepFormFailed
errSetEnabledPropertyFailed
errInvalidDB
errDeleteConnectionFailed
errInvalidOperation
errLetOperationFailed
errIdGetFailed
errCommitFailed = 1270
errSaveParametersInWspFailed
errDeleteArrayElementFailed
errSaveWorkspaceFailed
errInitializeFailed
errLoadInArrayFailed
errSaveStepsInWspFailed
errCommitStepFailed
errStepIdGetFailed
errUnloadFromArrayFailed
errValidateFailed = 1280
errTextEnteredFailed
errStepLabelMandatory
errTextAndFileNullForManager
errFailureDetailsNullForMgr
errSetTabOrderFailed
errSaveWspConstraintsFailed
errCommitConstraintFailed
errUnloadStepConstraintsFailed
errUnableToModifyMenu
errConfirmFailed = 1290
errInitSubItemsFailed
errUpdateListNodeFailed
errAddNodeFailed
errLoadListNodeFailed
errAddListNodeFailed

```
    errExecutionFailed
    errSetListViewStyleFailed
    errSetCheckedFailed
    errGetCheckedFailed
    errUnableToProcessListViewDblClick = 1300
    errDefaultPosition
    errShellFailed
    errOpenFileFailed
    errSetTBar97Failed
    errConnectFailed
    errApiFailed
    errRegEntryInvalid
    errParseStringFailed
    errConstraintsForWspFailed
    errPostConstraintsForWspFailed = 1310
    errPreConstraintsForWspFailed
    errLoadWspPostExecStepsFailed
    errLoadWspPreExecStepsFailed
    errLoadConstraintsOnFormFailed
    errQueryFailed
    errPasteNodeFailed
    errShowAllWorkspacesFailed
    errMakeFieldValidFailed
    errInitializeTree
    errRootNodeFailed = 1320
    errDirectionInvalid
    errUnableToDetListProperty
    errUnableToGetListData
    errItemNotFound
    errItemDoesNotExist
    errParamNameInvalid
    errGetParamValueFailed
    errSubValuesFailed
    errStringOpFailed
    errReadWorkspaceDataFailed = 1330
    errUpdateRunDataFailed
    errProgramError
    errUnableToOpenFile
    errLoadRunDataFailed
    errExecuteODBCCommandFailed
    errRunWorkspaceFailed
    errExecuteStepFailed
    errUnableToWriteError
    errRunStepFailed
    errSaveChanges = 1340
    errDragDropFailed
    errInvalidParameter
    errAssignParametersFailed
    errLoadLabelsInTreeFailed
    errInstrRFailed
    errInsertIteratorFailed
    errDeleteIteratorFailed
    errTypeInvalid
    errLoadFailed
    errDeleteFailed = 1350
    errModifyFailed
    errIteratorsFailed
    errInsertFailed
    errUpdateFailed
    errDuplicateIterator
    errSaveFailed
    errReadDataFailed
    errUnloadFailed
    errAddFailed
    errExecuteBranchFailed = 1360
    errRangeNumeric
    errRangeInvalid
    errNextStepFailed
    errUpdateDisplayFailed
    errDateToStringFailed
    errGetElapsedTimeFailed
    errMaxProcessesExceeded
    errInvalidProperty
    errInvalidChild
    errCreateInstanceFailed = 1370
    errInvalidForWorker
    errInstanceOpFailed
    errNavInstancesFailed
    errIterateFailed
    errExecInstanceFailed
    errDupIterator
End Enum
```

SORTSM.BAS

```
Attribute VB_Name = "SortSM"
'  FILE:      SortSM.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    This module contains an implementation of QuickSort.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Comment out for case-sensitive sorts
Option Compare Text

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "SortSM."

Private Function Compare(ByVal vntToCompare1 As Variant, _
        ByVal vntToCompare2 As Variant) As Integer

    On Error GoTo CompareErr

    Compare = 0

    If vntToCompare1.SequenceNo < vntToCompare2.SequenceNo Then
        Compare = -1
    ElseIf vntToCompare1.SequenceNo > vntToCompare2.SequenceNo Then
        Compare = 1
    End If

    Exit Function

CompareErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errCompareFailed, _
          gstrSource, _
          LoadResString(errCompareFailed)

End Function

Private Sub Swap(ByRef vntToSwap1 As Variant, _
        ByRef vntToSwap2 As Variant)

    Dim vntTemp As Variant

    On Error GoTo SwapErr

    If IsObject(vntToSwap1) And IsObject(vntToSwap2) Then
        Set vntTemp = vntToSwap1
        Set vntToSwap1 = vntToSwap2
        Set vntToSwap2 = vntTemp
    Else
        vntTemp = vntToSwap1
        vntToSwap1 = vntToSwap2
```

```
        vntToSwap2 = vntTemp
    End If

    Exit Sub

SwapErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errQuickSortFailed, mstrModuleName & "Swap", _
        LoadResString(errQuickSortFailed)

End Sub

Public Sub QuickSort(vntArray As Variant, _
        Optional ByVal intLBound As Integer, _
        Optional ByVal intUBound As Integer)
    ' Sorts a variant array using Quicksort

    Dim i As Integer
    Dim j As Integer
    Dim vntMid As Variant

    On Error GoTo QuickSortErr

    If IsEmpty(vntArray) Or _
          Not IsArray(vntArray) Then
        Exit Sub
    End If

    ' Set default boundary values for first time through
    If intLBound = 0 And intUBound = 0 Then
        intLBound = LBound(vntArray)
        intUBound = UBound(vntArray)
    End If

    ' BugMessage "Sorting elements " & Str(intLBound) & " and " & Str(intUBound)

    If intLBound > intUBound Then
        Exit Sub
    End If

    ' Only two elements in this subdivision; exchange if they
    ' are out of order and end recursive calls
    If (intUBound - intLBound) = 1 Then
        If Compare(vntArray(intLBound), vntArray(intUBound)) > 0 Then
            Call Swap(vntArray(intLBound), vntArray(intUBound))
        End If
        Exit Sub
    End If

    ' Set the pivot point
    Set vntMid = vntArray(intUBound)
    i = intLBound
    j = intUBound

    Do
        ' Move in from both sides towards pivot element
        Do While (i < j) And Compare(vntArray(i), vntMid) <= 0
            i = i + 1
        Loop

        Do While (j > i) And Compare(vntArray(j), vntMid) >= 0
            j = j - 1
        Loop

        If i < j Then
            Call Swap(vntArray(i), vntArray(j))
        End If
    Loop While i < j

    ' Since i has been adjusted, swap element i with element,
    ' intUBound
    Call Swap(vntArray(i), vntArray(intUBound))

    ' Recursively call sort array - pass smaller subdivision
    ' first to conserve stack space
    If (i - intLBound) < (intUBound - 1) Then
        ' Recursively sort with adjusted values for upper and
        ' lower bounds
        Call QuickSort(vntArray, intLBound, i - 1)
        Call QuickSort(vntArray, i + 1, intUBound)
    Else
        Call QuickSort(vntArray, i + 1, intUBound)
        Call QuickSort(vntArray, intLBound, i - 1)
    End If
    Exit Sub

QuickSortErr:
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errQuickSortFailed, mstrModuleName & "QuickSort", _
        LoadResString(errQuickSortFailed)

End Sub
```

STARTUP.BAS

```
Attribute VB_Name = "Startup"
'  FILE:      Startup.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    This module contains startup and cleanup functions for the project.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Public Const LISTVIEW_BUTTON = 14

Public gstrProjectPath As String

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "Startup."

Private Sub Initialize()

    On Error GoTo InitializeErr

    ReDim gsContCriteria(gintOnFailureAbort To gintOnFailureAsk) As String
    gsContCriteria(gintOnFailureAbort) = "Abort"
    gsContCriteria(gintOnFailureContinue) = "Continue"
    gsContCriteria(gintOnFailureCompleteSiblings) = "Execute sibling steps and stop"
    gsContCriteria(gintOnFailureAbortSiblings) = "Abort sibling steps and execute next
parent"
    gsContCriteria(gintOnFailureSkipSiblings) = "Skip sibling steps and execute next
parent"
    gsContCriteria(gintOnFailureAsk) = "Ask"

    ReDim gsExecutionStatus(gintDisabled To gintAborted) As String
    gsExecutionStatus(gintDisabled) = "Disabled"
    gsExecutionStatus(gintPending) = "Pending"
    gsExecutionStatus(gintRunning) = "Running"
    gsExecutionStatus(gintComplete) = "Complete"
    gsExecutionStatus(gintFailed) = "Failed"
    gsExecutionStatus(gintAborted) = "Stopped"

#If Not RUN_ONLY Then
    ' Call a procedure to change the style of the toolbar
    ' on the Step Properties form
```

```
    Call SetTBar97(frmSteps.tblConstraintCommands)

#End If

    Call InitRunEngine

    Exit Sub

InitializeErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "Initialize"
    Call ShowError(errInitializeFailed)

End Sub
Sub Main()

    On Error GoTo MainErr

    ' Mousepointer should indicate busy
    Call ShowBusy

    ' Display the Splash screen while we carry out some initialization
    frmSplash.Show
    frmSplash.Refresh

    gstrProjectPath = App.Path

    ' Open the database
    If OpenDBFile() = False Then
        Unload frmSplash
        Exit Sub
    End If

#If Not RUN_ONLY Then
    Load frmMain

    ' Enable the Stop Run menu options only when a workspace is
    ' actually running
    Call EnableStop(False)

    ' Clear all application extension menu items
    Call ClearToolsMenu
#End If

    Call Initialize

    ' Mousepointer - ready to accept user input
    Call ShowFree

    ' Unload the Splash screen and display the main form
    Unload frmSplash

#If RUN_ONLY Then
    frmWorkspaceOpen.Caption = gsCaptionRunWsp

    Call ShowWorkspacesInDb(dbsAttTool)
#Else
    frmMain.Show
#End If

    Exit Sub

MainErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Call ShowFree
    Call ShowError(errMainFailed)

End Sub
Private Function OpenDBFile() As Boolean

    Dim sDb As String

    On Error GoTo OpenDBFileErr

#If RUN_ONLY Then
    ' Always use the registry setting for the run_only mode
    sDb = DefaultDBFile()
#Else
    ' Check if the user has specified the workspace defn. file to open on the command
line
    ' Else, use the registry setting
    sDb = IIf(StringEmpty(Command), DefaultDBFile(), Command)

    If Len(sDb) > 0 Then
        ' Trim off the enclosing double-quotes if any
        If Mid(sDb, 1, 1) = gstrDQ Then
            If Len(sDb) > 1 Then
                sDb = Mid(sDb, 2)
            Else
                sDb = gstrEmptyString
            End If
        End If
    End If

    If Len(sDb) > 0 Then
        If Mid(sDb, Len(sDb), 1) = gstrDQ Then
            If Len(sDb) > 1 Then
                sDb = Mid(sDb, 1, Len(sDb) - 1)
            Else
                sDb = gstrEmptyString
            End If
        End If
    End If
#End If

    ' Open the database
    OpenDBFile = SMOpenDatabase(sDb)

    Exit Function

OpenDBFileErr:
    Call LogErrors(Errors)
    OpenDBFile = False

End Function
Public Sub Cleanup()

    On Error GoTo CleanupErr

    ' Set the mousepointer to indicate Busy
    Call ShowBusy

#If Not RUN_ONLY Then
    ' Close all open workspaces - will also prompt for unsaved
    ' changes
    Call CloseOpenWorkspaces
#End If

    ' Close all open files
    Call CloseOpenFiles

    ' Reset the mousepointer
    Call ShowFree

    Exit Sub

CleanupErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    Resume Next
```

```
End Sub
```

STEPCOMMON.BAS

```
Attribute VB_Name = "StepCommon"
'  FILE:      StepCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    Contains functionality common across StepMaster and
'             SMRunOnly, pertaining to steps
'             Specifically, functions to load iterators records
'             in an array, determine the type of step, etc.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "StepCommon."

' Step property constants
Private Const mintMinFailureThreshold As Integer = 1
Public Const gintMinSequenceNo As Integer = 1
Public Const gintMinLevel As Integer = 0
Public Function ValidateParallelism(sParallelism As String, lWorkspace As Long, _
       Optional ParamsInWsp As cArrParameters = Nothing) As String
   ' Returns the degree of parallelism for the step if the user input is valid
   Dim sTemp As String

   On Error GoTo ValidateParallelismErr
   gstrSource = mstrModuleName & "ValidateParallelism"

   sTemp = SubstituteParameters(Trim$(sParallelism), lWorkspace,
WspParameters:=ParamsInWsp)

   If Not IsNumeric(sTemp) Then
      ShowError errInvalidDegParallelism
      On Error GoTo 0
      Err.Raise vbObjectError + errInvalidDegParallelism, gstrSource, _
            LoadResString(errInvalidDegParallelism)
   Else
      If (CInt(sTemp) < gintMinParallelism) Or (CInt(sTemp) > gintMaxParallelism)
Then
         ShowError errInvalidDegParallelism
         On Error GoTo 0
         Err.Raise vbObjectError + errInvalidDegParallelism, gstrSource, _
               LoadResString(errInvalidDegParallelism)
      Else
         ValidateParallelism = Trim$(sParallelism)
      End If
   End If

   Exit Function

ValidateParallelismErr:
   ' Log the error code raised by Visual Basic
   gstrSource = mstrModuleName & "ValidateParallelism"
   If Err.Number = vbObjectError + errSubValuesFailed Then
      ShowError errInvalidDegParallelism
   End If

   Call LogErrors(Errors)
   On Error GoTo 0
   Err.Raise vbObjectError + errInvalidDegParallelism, gstrSource, _
      LoadResString(errInvalidDegParallelism)

End Function

Public Function IsGlobal( _
      Optional ByVal StepClass As cStep = Nothing, _
      Optional ByVal StepRecord As Recordset = Nothing, _
      Optional ByVal StepKey As String = gstrEmptyString, _
      Optional ByVal StepId As Long = 0, _
      Optional StepForm As Form = Nothing) As Boolean

   ' This function contains all the possible checks for whether
   ' a step is global - The check that will be made depends on
   ' the parameter passed in

   Dim cStepRecord As cStep

   If Not StepClass Is Nothing Then
      IsGlobal = StepClass.GlobalFlag
      Exit Function
   End If

   If Not StepRecord Is Nothing Then
      IsGlobal = StepRecord![global_flag]
      Exit Function
   End If

   If Not StringEmpty(StepKey) Then
      IsGlobal = InStr(StepKey, gstrGlobalStepPrefix) > 0
      Exit Function
   End If

   If StepId <> 0 Then
      Set cStepRecord = gcSteps.QueryStep(StepId)
      IsGlobal = cStepRecord.GlobalFlag
      Set cStepRecord = Nothing
      Exit Function
   End If

   If Not StepForm Is Nothing Then
      IsGlobal = (StepForm.lblStepType.Caption = Str(gintGlobalStep))
      Exit Function
   End If

   ' Not a single object was passed in! - raise an error
   On Error GoTo 0
   Err.Raise vbObjectError + errObjectMandatory, _
         mstrModuleName & "IsGlobal", _
         LoadResString(errObjectMandatory)

End Function
Public Function TypeOfStep(Optional ByVal StepClass As cStep = Nothing, _
      Optional ByVal StepRecord As Recordset = Nothing, _
      Optional ByVal StepKey As String = gstrEmptyString, _
      Optional ByVal StepId As Long = 0, _
      Optional StepForm As Form = Nothing) As Integer
   ' Calls functions to determine the type of step
   ' The check that will be made depends on the parameter passed in

   On Error GoTo TypeOfStepErr

   ' Make the check whether a step is global first - both
   ' worker and global steps have the step text or file name
   ' not null - but only the global step will have the global
   ' flag set
   If IsGlobal(StepClass, StepRecord, StepKey, StepId, StepForm) Then
      TypeOfStep = gintGlobalStep
   ElseIf IsManager(StepClass, StepRecord, StepKey, StepId, StepForm) Then
      TypeOfStep = gintManagerStep
   ElseIf IsWorker(StepClass, StepRecord, StepKey, StepId, StepForm) Then
      TypeOfStep = gintWorkerStep
   Else
      On Error GoTo 0
      Err.Raise vbObjectError + errInvalidStep, _
            mstrModuleName & "TypeOfStep", _
            LoadResString(errInvalidStep)
```

```
    End If

    Exit Function

TypeOfStepErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errTypeOfStepFailed, _
          mstrModuleName & "TypeOfStep", _
          LoadResString(errTypeOfStepFailed)

End Function

Public Function IsStep(intNodeType As Integer) As Boolean
    ' Returns true if the node type corresponds to a global, manager
    ' or worker step
    IsStep = (intNodeType = gintGlobalStep) Or (intNodeType = gintManagerStep) Or _
       (intNodeType = gintWorkerStep)

End Function

Public Function IsManager(Optional ByVal StepClass As cStep = Nothing, _
       Optional ByVal StepRecord As Recordset = Nothing, _
       Optional ByVal StepKey As String = gstrEmptyString, _
       Optional ByVal StepId As Long = 0, _
       Optional StepForm As Form = Nothing) As Boolean

    ' This function contains all the possible checks for whether
    ' a step is a manager step - The check that will be made depends
    ' on the parameter passed in

    Dim cStepRecord As cStep

    If Not StepClass Is Nothing Then
       IsManager = (StepClass.StepType = gintManagerStep)
       Exit Function
    End If

    If Not StepRecord Is Nothing Then
       IsManager = (IsNull(StepRecord![step_text]) And
IsNull(StepRecord![step_file_name]))
       Exit Function
    End If

    If Not StringEmpty(StepKey) Then
       IsManager = (InStr(StepKey, gstrManagerStepPrefix) > 0)
       Exit Function
    End If

    If StepId <> 0 Then
       Set cStepRecord = gcSteps.QueryStep(StepId)
       IsManager = (cStepRecord.StepType = gintManagerStep)
       Set cStepRecord = Nothing
       Exit Function
    End If

    If Not StepForm Is Nothing Then
       IsManager = (StepForm.lblStepType.Caption = Str(gintManagerStep))
       Exit Function
    End If

    ' Not a single object was passed in! - raise an error
    On Error GoTo 0
    Err.Raise vbObjectError + errObjectMandatory, _
          "Step.IsManager", _
          LoadResString(errObjectMandatory)

End Function
Public Function IsWorker( _
       Optional ByVal StepClass As cStep = Nothing, _
       Optional ByVal StepRecord As Recordset = Nothing, _
       Optional ByVal StepKey As String = gstrEmptyString, _
       Optional ByVal StepId As Long = 0, _
       Optional StepForm As Form = Nothing) As Boolean

    ' This function contains all the possible checks for whether
    ' a step is a Worker step - The check that will be made depends
    ' on the parameter passed in

    Dim cStepRecord As cStep

    If Not StepClass Is Nothing Then
       IsWorker = (StepClass.StepType = gintWorkerStep)
       Exit Function
    End If

    If Not StepRecord Is Nothing Then
       IsWorker = (Not StepRecord![global_flag] And _
             (Not IsNull(StepRecord![step_text]) Or Not
IsNull(StepRecord![step_file_name])))
       Exit Function
    End If

    If Not StringEmpty(StepKey) Then
       IsWorker = InStr(StepKey, gstrWorkerStepPrefix) > 0
       Exit Function
    End If

    If StepId <> 0 Then
       Set cStepRecord = gcSteps.QueryStep(StepId)
       IsWorker = (cStepRecord.StepType = gintWorkerStep)
       Set cStepRecord = Nothing
       Exit Function
    End If

    If Not StepForm Is Nothing Then
       IsWorker = (StepForm.lblStepType.Caption = Str(gintWorkerStep))
       Exit Function
    End If

    ' Not a single object was passed in! - raise an error
    On Error GoTo 0
    Err.Raise vbObjectError + errObjectMandatory, _
          "Step.IsWorker", _
          LoadResString(errObjectMandatory)

End Function
Public Function GetStepNodeText(ByVal cStepNode As cStep) As String

    On Error GoTo GetStepNodeTextErr

    ' Returns the string that will be displayed as the text
    ' in the tree view node to the user
    If StringEmpty(cStepNode.StepLabel) Then

       If StringEmpty(cStepNode.StepTextFile) Then

          If StringEmpty(cStepNode.StepText) Then
             ' This should never happen
             On Error GoTo 0
             Err.Raise vbObjectError + errStepLabelTextAndFileNull, _
                gstrSource, _
                LoadResString(errStepLabelTextAndFileNull)
          Else
             GetStepNodeText = cStepNode.StepText
          End If
       Else
          GetStepNodeText = cStepNode.StepTextFile
       End If
    Else
       GetStepNodeText = cStepNode.StepLabel
```

```
    End If

    Exit Function

GetStepNodeTextErr:
    ' Log the error code raised by Visual Basic
    Call LogErrors(Errors)
    On Error GoTo 0
    Err.Raise vbObjectError + errGetStepNodeTextFailed, _
        gstrSource, _
        LoadResString(errGetStepNodeTextFailed)

End Function

Public Function LoadRecordsetInStepsArray(rstSteps As Recordset, _
    cStepCol As cArrSteps) As Boolean

    Dim cNewStep As cStep
    Dim cNewGlobal As cGlobalStep
    Dim cNewManager As cManager
    Dim cNewWorker As cWorker

    On Error GoTo LoadRecordsetInStepsArrayErr

    If rstSteps.RecordCount = 0 Then
        Exit Function
    End If

    rstSteps.MoveFirst
    While Not rstSteps.EOF
        ' For fields that should not be null, a procedure is first
        ' called to raise an error if the field is null

        Set cNewStep = New cStep

        cNewStep.StepType = TypeOfStep(StepRecord:=rstSteps)

        If cNewStep.StepType = gintGlobalStep Then
            Set cNewGlobal = New cGlobalStep
            Set cNewStep = cNewGlobal
        ElseIf cNewStep.StepType = gintManagerStep Then
            Set cNewManager = New cManager
            Set cNewStep = cNewManager
        Else
            Set cNewWorker = New cWorker
            Set cNewStep = cNewWorker
        End If

        ' Initialize the global flag first, since subsequent
        ' validations might depend on whether the step is global
        cNewStep.GlobalFlag = CBool(ErrorOnNullField(rstSteps, "global_flag"))

        ' Initialize step values
        cNewStep.StepId = CLng(ErrorOnNullField(rstSteps, "step_id"))
        cNewStep.VersionNo = CStr(ErrorOnNullField(rstSteps, "version_no"))

        cNewStep.StepLabel = CheckForNullField(rstSteps, "step_label")
        cNewStep.StepTextFile = CheckForNullField(rstSteps, "step_file_name")
        cNewStep.StepText = CheckForNullField(rstSteps, "step_text")
        cNewStep.StartDir = CheckForNullField(rstSteps, "start_directory")

        cNewStep.WorkspaceId = CLng(ErrorOnNullField(rstSteps,
FLD_ID_WORKSPACE))
        cNewStep.ParentStepId = CLng(ErrorOnNullField(rstSteps, "parent_step_id"))
        cNewStep.ParentVersionNo = CStr(ErrorOnNullField(rstSteps,
"parent_version_no"))

        cNewStep.SequenceNo = CInt(ErrorOnNullField(rstSteps, "sequence_no"))
        cNewStep.StepLevel = CInt(ErrorOnNullField(rstSteps, "step_level"))
        cNewStep.EnabledFlag = CBool(ErrorOnNullField(rstSteps, "enabled_flag"))

        ' Initialize the execution details for the step
        cNewStep.DegreeParallelism = CheckForNullField(rstSteps,
"degree_parallelism")
        cNewStep.ExecutionMechanism = CInt(ErrorOnNullField(rstSteps,
"execution_mechanism"))
        cNewStep.FailureDetails = CheckForNullField(rstSteps, "failure_details")
        cNewStep.ContinuationCriteria = CInt(ErrorOnNullField(rstSteps,
"continuation_criteria"))

        ' Initialize the output file locations for the step
        cNewStep.OutputFile = CheckForNullField(rstSteps, "output_file_name")
        ' cNewStep.LogFile = CheckForNullField(rstSteps, "log_file_name")
        cNewStep.ErrorFile = CheckForNullField(rstSteps, "error_file_name")

        ' Initialize the iterator name for the step, if any
        cNewStep.IteratorName = CheckForNullField(rstSteps, "iterator_name")

        ' Add this record to the array of steps
        cStepCol.Load cNewStep

        Set cNewStep = Nothing
        rstSteps.MoveNext
    Wend

    Exit Function

LoadRecordsetInStepsArrayErr:

    LogErrors Errors
    gstrSource = mstrModuleName & "LoadRecordsetInStepsArray"
    On Error GoTo 0
    Err.Raise vbObjectError + errLoadRsInArrayFailed, gstrSource, _
        LoadResString(errLoadRsInArrayFailed)

End Function
```

TIMERSM.BAS

```
Attribute VB_Name = "TimerSM"
'  FILE:      TimerSM.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    This module contains wrapper functions for Timer APIs.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'

Option Explicit

Private Declare Function SetTimer Lib "user32" (ByVal hWnd As Long, _
    ByVal nIDEvent As Long, ByVal uElapse As Long, ByVal lpTimerFunc As Long) _
    As Long
Private Declare Function KillTimer Lib "user32" (ByVal hWnd As Long, _
    ByVal nIDEvent As Long) As Long
Private Declare Sub CopyMemory Lib "kernel32" Alias "RtlMoveMemory" ( _
    pDest As Any, pSource As Any, ByVal ByteLen As Long)

Public gcTimerObjects As Collection

Private Sub TimerProc(ByVal lHwnd As Long, ByVal lMsg As Long, _
    ByVal lTimerID As Long, ByVal lTime As Long)

    Dim nPtr As Long
    Dim oTimerObject As cTimerSM

    'Create a Timer object from the pointer
    nPtr = gcTimerObjects.Item(Str$(lTimerID))
    CopyMemory oTimerObject, nPtr, 4
    'Call a method which will fire the Timer event
    oTimerObject.Tick
```

```
    'Get rid of the Timer object so that VB will not try to release it
    CopyMemory oTimerObject, 0&, 4
End Sub

Public Function StartTimer(lInterval As Long) As Long
    StartTimer = SetTimer(0, 0, lInterval, AddressOf TimerProc)
End Function

Public Sub StopTimer(lTimerID As Long)
    KillTimer 0, lTimerID
End Sub

Public Sub SetInterval(lInterval As Long, lTimerID As Long)
    SetTimer 0, lTimerID, lInterval, AddressOf TimerProc
End Sub
```

TOOLSCOMMON.BAS

```
Attribute VB_Name = "ToolsCommon"
'  FILE:      ToolsCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    Contains functions to remove run history and initialize
'             table creation scripts
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

Public sCreateTables() As String

Public Const gsExtSeparator As String = "."

Public Sub DeleteRunHistory(dbFile As DAO.Database)
    ' Delete all run history records from the database, viz. the records in
    ' run_header, run_step_details and run_parameters

    Dim sDelete As String

    On Error GoTo DeleteRunHistoryErr

    sDelete = "delete from run_header "
    dbFile.Execute sDelete, dbFailOnError

    sDelete = "delete from run_step_details "
    dbFile.Execute sDelete, dbFailOnError

    sDelete = "delete from run_parameters "
    dbFile.Execute sDelete, dbFailOnError

    sDelete = "update att_identifiers " & _
        " set run_id = " & CStr(glMinId)
    dbFile.Execute sDelete, dbFailOnError

    Exit Sub

DeleteRunHistoryErr:
    LogErrors Errors
    Err.Raise vbObjectError + errDeleteDBRecordFailed, "DeleteRunHistory", _
          LoadResString(errDeleteDBRecordFailed)

End Sub

Public Function CreateConnectionsTableScript() As String
    ' Returns the table creation script for the workspace_connections table

    Call InitCreateSQLArray
    CreateConnectionsTableScript = sCreateTables(10)
    ReDim sCreateTables(0)

End Function
Public Function CreateConnectionDtlsTableScript() As String
    ' Returns the table creation script for the connection_dtls table

    Call InitCreateSQLArray
    CreateConnectionDtlsTableScript = sCreateTables(11)
    ReDim sCreateTables(0)

End Function

Public Sub InitCreateSQLArray()

ReDim sCreateTables(0 To 11)

sCreateTables(0) = "Create table att_identifiers (" & _
        "workspace_id            Long, " & _
        "parameter_id            Long, " & _
        "step_id                 Long, " & _
        "constraint_id           Long, " & _
        "run_id                  Long, " & _
        "connection_id           Long " & _
");"

sCreateTables(1) = "Create table att_steps (step_id   Long, " & _
        "version_no              Text(255), " & _
        "step_label              Text(255), " & _
        "step_file_name          Text(255), " & _
        "step_text               Memo, " & _
        "start_directory         Text(255), " & _
        "workspace_id            Long, " & _
        "parent_step_id          Long, " & _
        "parent_version_no       Text(255), " & _
        "step_level              Long, " & _
        "sequence_no             Integer, " & _
        "enabled_flag            Bit, " & _
        "degree_parallelism      Text(255), " & _
        "execution_mechanism     Text(50), " & _
        "failure_details         Text(255), " & _
        "continuation_criteria   Text(50), " & _
        "global_flag             Long, " & _
        "archived_flag           Bit, " & _
        "output_file_name        Text(255), " & _
        "error_file_name         Text(255), " & _
        "iterator_name           Text(255), " & _
        "CONSTRAINT pk_steps PRIMARY KEY (step_id, version_no) " & _
");"

'       "log_file_name           Text(255), " & _

sCreateTables(2) = "Create table att_workspaces (" & _
        "workspace_id            Long, " & _
        "workspace_name          Text(255), " & _
        "archived_flag           Bit, " & _
        "CONSTRAINT pk_workspaces PRIMARY KEY (workspace_id) " & _
");"

sCreateTables(3) = "Create table iterator_values (" & _
        "step_id                 Long, " & _
        "version_no              Text(255), " & _
        "type                    Integer, " & _
        "iterator_value          Text(255), " & _
        "sequence_no             Integer " & _
");"

sCreateTables(4) = "Create table run_header (" & _
        "run_id                  Long, " & _
        "workspace_id            Long, " & _
        "start_time              Currency, " & _
        "end_time                Currency, " & _
        "CONSTRAINT pk_run_header PRIMARY KEY (run_id) " & _
");"
```

```
sCreateTables(5) = "Create table run_parameters (" & _
        "run_id                 Long, " & _
        "parameter_name          Text(255), " & _
        "parameter_value         Text(255) " & _
");"

sCreateTables(6) = "Create table run_step_details (" & _
        "run_id                 Long, " & _
        "step_id                Long, " & _
        "version_no             Text(255), " & _
        "instance_id            Long, " & _
        "parent_instance_id     Long, " & _
        "command                Memo, " & _
        "iterator_value         Text(255), " & _
        "start_time             Currency, " & _
        "end_time               Currency, " & _
        "elapsed_time           Long " & _
");"

sCreateTables(7) = "Create table step_constraints (" & _
        "constraint_id          Long, " & _
        "step_id                Long, " & _
        "version_no             Text(255), " & _
        "constraint_type        Integer, " & _
        "global_step_id         Long, " & _
        "global_version_no      Text(255), " & _
        "sequence_no            Integer " & _
");"

sCreateTables(8) = "Create table workspace_parameters (" & _
        "workspace_id           Long, " & _
        "parameter_id           Long, " & _
        "parameter_name          Text(255), " & _
        "parameter_value         Text(255), " & _
        "description            Text(255), " & _
        "parameter_type          Integer, " & _
        "CONSTRAINT pk_parameters PRIMARY KEY (parameter_id) " & _
");"

sCreateTables(9) = "Create table db_details (" & _
        "db_version             Text(50) " & _
");"

sCreateTables(10) = "Create table " & TBL_CONNECTION_STRINGS & " (" & _
        "workspace_id           Long, " & _
        "connection_id          Long, " & _
        "connection_name         Text(255), " & _
        "connection_value        Text(255), " & _
        "description            Text(255), " & _
        "no_count_display        Bit, " & _
        "no_execute             Bit, " & _
        "parse_query_only        Bit, " & _
        "ANSI_quoted_identifiers  Bit, " & _
        "ANSI_nulls             Bit, " & _
        "show_query_plan         Bit, " & _
        "show_stats_time         Bit, " & _
        "show_stats_io          Bit, " & _
        "parse_odbc_msg_prefixes  Bit, " & _
        "row_count              long, " & _
        "tsql_batch_separator    Text(255), " & _
        "query_time_out         long, " & _
        "server_language         Text(255), " & _
        "character_translation    Bit, " & _
        "regional_settings       Bit, " & _
        "CONSTRAINT pk_connections PRIMARY KEY (connection_id) " & _
");"

' This table has been added in order to satisfy the TPC-H requirement that
' all the queries in a stream need to be executed on a single connection.
' Specify a connection for each odbc step. If the connection is of type,
' static, it should be kept open till the step execution is complete.
sCreateTables(11) = "Create table " & TBL_CONNECTION_DTLS & " (" & _
        FLD_ID_WORKSPACE & gstrBlank & DATA_TYPE_LONG & ", " & _
        FLD_ID_CONN_NAME & gstrBlank & DATA_TYPE_LONG & ", " & _
        FLD_CONN_DTL_CONNECTION_NAME & gstrBlank & DATA_TYPE_TEXT255
& ", " & _
        FLD_CONN_DTL_CONNECTION_STRING & gstrBlank &
DATA_TYPE_TEXT255 & ", " & _
        FLD_CONN_DTL_CONNECTION_TYPE & gstrBlank & DATA_TYPE_INTEGER
& ", " & _
        "CONSTRAINT pk_connection_name PRIMARY KEY (" &
FLD_ID_CONN_NAME & ") " & _
");"

End Sub
```

WINDOWSAPICOMMON.BAS

```
Attribute VB_Name = "WindowsApiCommon"
'  FILE:      WindowsApiCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    This module contains functions that are wrappers around the
'              Windows API and are used by both StepMaster and SMRunOnly.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "WindowsApiCommon."

Public Type PROCESS_INFORMATION
   hProcess    As Long
   hThread     As Long
   dwProcessID As Long
   dwThreadID  As Long
End Type

' Used by GetShortName to return the short file name for a given file
Private Declare Function GetShortPathName Lib "kernel32" _
     Alias "GetShortPathNameA" (ByVal lpszLongPath As String, _
     ByVal lpszShortPath As String, ByVal cchBuffer As Long) As Long

Public Declare Function GetExitCodeProcess Lib "kernel32" ( _
   ByVal hProcess As Long, lpExitCode As Long) As Long
Public Declare Function TerminateProcess Lib "kernel32" ( _
      hProcess As Long, uExitCode As Long) As Long
Public Declare Function CloseHandle Lib "kernel32" ( _
   ByVal hObject As Long) As Long

Public Const NORMAL_PRIORITY_CLASS      As Long = &H20&
Public Const INFINITE                   As Long = -1&

Public Const STATUS_WAIT_0              As Long = &H0
Public Const STATUS_ABANDONED_WAIT_0    As Long = &H80
Public Const STATUS_USER_APC            As Long = &HC0
Public Const STATUS_TIMEOUT             As Long = &H102
Public Const STATUS_PENDING             As Long = &H103

Public Const WAIT_FAILED                As Long = &HFFFFFFFF
Public Const WAIT_OBJECT_0              As Long = STATUS_WAIT_0
Public Const WAIT_TIMEOUT               As Long = STATUS_TIMEOUT

Public Const WAIT_ABANDONED             As Long =
STATUS_ABANDONED_WAIT_0
Public Const WAIT_ABANDONED_0           As Long =
STATUS_ABANDONED_WAIT_0
```

```
Public Const WAIT_IO_COMPLETION        As Long = STATUS_USER_APC
Public Const STILL_ACTIVE              As Long = STATUS_PENDING

Public Const PROCESS_QUERY_INFORMATION  As Long = &H400
Public Const STANDARD_RIGHTS_REQUIRED   As Long = &HF0000

'--------------------------------------------------------------------------------
'Declarations for shelling:

Public Type STARTUPINFO
   cb              As Long
   lpReserved      As String
   lpDesktop       As String
   lpTitle         As String
   dwX             As Long
   dwY             As Long
   dwXSize         As Long
   dwYSize         As Long
   dwXCountChars   As Long
   dwYCountChars   As Long
   dwFillAttribute As Long
   dwFlags         As Long
   wShowWindow     As Integer
   cbReserved2     As Integer
   lpReserved2     As Long
   hStdInput       As Long
   hStdOutput      As Long
   hStdError       As Long
End Type

Public Declare Function WaitForSingleObject Lib "kernel32" ( _
   ByVal hProcess As Long, ByVal dwMilliseconds As Long) As Long

Public Declare Function InputIdle Lib "user32" Alias "WaitForInputIdle" ( _
   ByVal hProcess As Long, ByVal dwMilliseconds As Long) As Long

Public Declare Function CreateProcessA Lib "kernel32" ( _
   ByVal lpApplicationName As Long, ByVal lpCommandLine As String, _
   ByVal lpProcessAttributes As Long, ByVal lpThreadAttributes As Long, _
   ByVal bInheritHandles As Long, ByVal dwCreationFlags As Long, _
   ByVal lpEnvironment As Long, ByVal lpCurrentDirectory As Long, _
   lpStartupInfo As STARTUPINFO, lpProcessInformation As _
   PROCESS_INFORMATION) As Long

Public Declare Function GetLastError Lib "kernel32" () As Long

Private Type OPENFILENAME
   lStructSize As Long
   hwndOwner As Long
   hInstance As Long
   lpstrFilter As String
   lpstrCustomFilter As String
   nMaxCustFilter As Long
   nFilterIndex As Long
   lpstrFile As String
   nMaxFile As Long
   lpstrFileTitle As String
   nMaxFileTitle As Long
   lpstrInitialDir As String
   lpstrTitle As String
   Flags As Long
   nFileOffset As Integer
   nFileExtension As Integer
   lpstrDefExt As String
   lCustData As Long
   lpfnHook As Long
   lpTemplateName As Long
End Type

Private Declare Function GetOpenFileName Lib "COMDLG32" _
      Alias "GetOpenFileNameA" (file As OPENFILENAME) As Long

Private Declare Function lstrlen Lib "kernel32" (lpsz As String) As Long

Public Const MAX_PATH = 255

' Used when creating a process
Public Const SW_SHOWMINNOACTIVE = 7
Public Const STARTF_USESHOWWINDOW = &H1

Public Const MB_YESNOCANCEL = &H3&
Public Const MB_ABORTRETRYIGNORE = &H2&
Public Const MB_OK = &H0&

Public Const MB_APPLMODAL = &H0&

Public Const MB_ICONQUESTION = &H20&
Public Const MB_ICONEXCLAMATION = &H30&

Public Const IDABORT = 3
Public Const IDRETRY = 4
Public Const IDIGNORE = 5
Public Const IDYES = 6
Public Const IDNO = 7
Public Const IDCANCEL = 2

Private Declare Function MessageBox Lib "user32" Alias "MessageBoxA" ( _
      ByVal hWnd As Long, ByVal lpText As String, _
      ByVal lpCaption As String, ByVal wType As Long) As Long

Private Type SYSTEMTIME
      wYear As Integer
      wMonth As Integer
      wDayOfWeek As Integer
      wDay As Integer
      wHour As Integer
      wMinute As Integer
      wSecond As Integer
      wMilliseconds As Integer
End Type

Private Declare Function Get64BitTime Lib "smtime.dll" ( _
      ByVal lpInitTime As Any) As Currency

Public Function ShowMessageBox(hWnd As Long, strText As String, _
      strTitle As String, wType As Integer) As Long
   ' Using the Windows MessageBox Api since the VB Msgbox function suppresses
   ' all events
   ShowMessageBox = MessageBox(hWnd, ByVal strText, ByVal strTitle, wType)

   If ShowMessageBox = 0 Then
      LogSystemError
      Err.Raise vbObjectError + errConfirmFailed, App.EXEName, _
            LoadResString(errConfirmFailed)
   End If

End Function
Public Function ShowFileOpenDialog(ByVal strFilter As String, _
      ByVal strDialogTitle As String, ByVal lngFlags As Long, _
      Optional ByVal strOldFile As String = gstrEmptyString) As String
   ' Returns the file name selected by the user
   Dim strInitDir As String
   Dim intPos As Integer
   Dim opfile As OPENFILENAME
   Dim sFile As String

   On Error GoTo ShowFileOpenDialogErr

   If Not StringEmpty(strOldFile) Then
      intPos = InstrR(strOldFile, gstrFileSeparator)
      If intPos > 0 Then
         strInitDir = Left$(strOldFile, intPos - 1)
```

```
        End If
    End If

    With opfile
        .lStructSize = Len(opfile)
        .Flags = lngFlags
        .lpstrInitialDir = strInitDir
        .lpstrTitle = strDialogTitle
        .lpstrFilter = MakeWindowsFilter(strFilter)
        sFile = strOldFile & String$(MAX_PATH - Len(strOldFile), 0)
        .lpstrFile = sFile
        .nMaxFile = MAX_PATH
    End With

    If GetOpenFileName(opfile) Then
        ShowFileOpenDialog = Left$(opfile.lpstrFile, InStr(opfile.lpstrFile, vbNullChar) - 1)
    Else
        ShowFileOpenDialog = strOldFile
    End If

    Exit Function

ShowFileOpenDialogErr:
    Call LogErrors(Errors)
    ' Reset the selection to the passed in file, if any
    ShowFileOpenDialog = strOldFile

End Function

Private Function MakeWindowsFilter(sFilter As String) As String

    Dim s As String, ch As String, iTemp As Integer

    On Error GoTo MakeWindowsFilterErr

    ' To make Windows-style filter, replace | and : with nulls
    For iTemp = 1 To Len(sFilter)
        ch = Mid$(sFilter, iTemp, 1)
        If ch = "|" Then
            s = s & vbNullChar
        Else
            s = s & ch
        End If
    Next iTemp

    ' Put double null at end
    s = s & vbNullChar & vbNullChar
    MakeWindowsFilter = s

    Exit Function

MakeWindowsFilterErr:
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "MakeWindowsFilter"
    On Error GoTo 0
    Err.Raise vbObjectError + errApiFailed, gstrSource, _
          LoadResString(errApiFailed)

End Function


Public Function GetShortName(ByVal sLongFileName As String) As String
    ' Returns the short name for the passed in file - will only work
    ' if the passed in path/file exists

    Dim lRetVal As Long, sShortPathName As String, iLen As Integer
    Dim sLongFile As String
    Dim sDir As String
    Dim sFile As String
    Dim intPos As Integer

    On Error GoTo GetShortNameErr

    sFile = gstrEmptyString
    sLongFile = MakePathValid(sLongFileName)
    If StringEmpty(Dir$(sLongFile, vbNormal + vbDirectory)) Then
        ' The passed in path is a file that does not exist - since
        ' the GetShortPathName api does not work on non-existent files
        ' on Win2K, use the directory as an argument to the api and
        ' then append the file
        intPos = InstrR(sLongFile, gstrFileSeparator)
        sDir = Mid$(sLongFile, 1, intPos - 1)
        sFile = Right(sLongFile, Len(sLongFile) - intPos + 1)
        sLongFile = sDir
    End If

    'Set up buffer area for API function call return
    sShortPathName = Space(MAX_PATH)
    iLen = Len(sShortPathName)

    'Call the function
    lRetVal = GetShortPathName(sLongFile, sShortPathName, iLen)
    If lRetVal = 0 Then
        Call LogSystemError
    End If

    GetShortName = IIf(lRetVal = 0, sLongFile, Left(sShortPathName, lRetVal))
    If Not StringEmpty(sFile) Then
        GetShortName = GetShortName & sFile
    End If

    Exit Function

GetShortNameErr:
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "GetShortName"
    On Error GoTo 0
    Err.Raise vbObjectError + errApiFailed, gstrSource, _
          LoadResString(errApiFailed)

End Function
Public Function Determine64BitTime() As Currency

    Determine64BitTime = Get64BitTime(ByVal 0&)

End Function
```

WORKSPACECOMMON.BAS

```
Attribute VB_Name = "WorkspaceCommon"
'  FILE:      WorkspaceCommon.bas
'             Microsoft TPC-H Kit Ver. 1.00
'             Copyright Microsoft, 1999
'             All Rights Reserved
'
'
'  PURPOSE:    Contains functionality common across StepMaster and
'              SMRunOnly, pertaining to workspaces
'              Specifically, functions to read workspace records from
'              the database and so on.
'  Contact:    Reshma Tharamal (reshmat@microsoft.com)
'
Option Explicit

' Used to indicate the source module name when errors
' are raised by this module
Private Const mstrModuleName As String = "WorkspaceCommon."


Public Function GetWorkspaceDetails( _
    Optional ByVal WorkspaceId As Long, _
    Optional WorkspaceName As String = gstrEmptyString _
    ) As Variant
```

```
    ' Depending on the passed in parameter, it returns
    ' either the workspace name or the workspace identifier
    ' in a variant. The calling function must convert the
    ' return value to the appropriate type

    Dim rstWorkspace As Recordset
    Dim qyWsp As DAO.QueryDef
    Dim strSql As String
    Dim cTempStr As cStringSM

    On Error GoTo GetWorkspaceDetailsErr
    gstrSource = mstrModuleName & "GetWorkspaceDetails"

    If WorkspaceId = 0 And _
          WorkspaceName = gstrEmptyString Then
       On Error GoTo 0
       Err.Raise vbObjectError + errMandatoryParameterMissing, _
             gstrSource, _
             LoadResString(errMandatoryParameterMissing)
    End If

    Set cTempStr = New cStringSM

    If WorkspaceId = 0 Then
       strSql = " Select workspace_id from att_workspaces " & _
             " where workspace_name = [w_name] "
       Set qyWsp = dbsAttTool.CreateQueryDef(gstrEmptyString, strSql)
       qyWsp.Parameters("w_name").Value = WorkspaceName
    Else
       strSql = " Select workspace_name from att_workspaces " & _
             " where workspace_id = [w_id] "
       Set qyWsp = dbsAttTool.CreateQueryDef(gstrEmptyString, strSql)
       qyWsp.Parameters("w_id").Value = WorkspaceId
    End If

    Set cTempStr = Nothing

    Set rstWorkspace = qyWsp.OpenRecordset(dbOpenForwardOnly)

    If rstWorkspace.RecordCount <> 0 Then
       GetWorkspaceDetails = rstWorkspace.Fields(0)
    Else
       rstWorkspace.Close
       qyWsp.Close
       On Error GoTo 0
       Err.Raise vbObjectError + errInvalidWorkspaceData, _
             gstrSource, _
             LoadResString(errInvalidWorkspaceData)
    End If

    rstWorkspace.Close
    qyWsp.Close
    Exit Function

GetWorkspaceDetailsErr:
    Call LogErrors(Errors)
    gstrSource = mstrModuleName & "GetWorkspaceDetails"
    On Error GoTo 0
    Err.Raise vbObjectError + errGetWorkspaceDetailsFailed, _
          gstrSource, _
          LoadResString(errGetWorkspaceDetailsFailed)

End Function

Public Sub ReadStepsInWorkspace(rstStepsInWorkSpace As Recordset, _
       qySteps As DAO.QueryDef, _
       Optional lngWorkspaceId As Long = glInvalidId, _
       Optional dbLoad As DAO.Database = Nothing, _
       Optional ByVal bSelectArchivedRecords As Boolean = False)

    ' This function will populate the passed in recordset with
    ' all the steps for a given workspace (if one is passed in, else all workspaces)

    Dim strSql As String

    On Error GoTo ReadStepsInWorkspaceErr

    ' Create a recordset object to retrieve all steps for
    ' the given workspace
    strSql = "Select step_id, step_label, step_file_name, step_text, " & _
       " start_directory, version_no, workspace_id, " & _
       " parent_step_id, parent_version_no, " & _
       " sequence_no, step_level, " & _
       " enabled_flag, degree_parallelism, " & _
       " execution_mechanism, " & _
       " failure_details, continuation_criteria, " & _
       " global_flag, archived_flag, " & _
       " output_file_name, " & _
       " error_file_name, iterator_name " & _
       " from att_steps a " & _
       " where "

       ' log_file_name,

    If lngWorkspaceId <> glInvalidId Then
       strSql = strSql & " workspace_id = [w_id] AND "
    End If

    If Not bSelectArchivedRecords Then
       strSql = strSql & " archived_flag = [archived] AND "
    End If

    ' Find the highest X-component of the version number
    strSql = strSql & " cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) = " & _
       " ( select max( cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) ) " & _
       " from att_steps AS d " & _
       " WHERE a.step_id = d.step_id ) "

    ' Find the highest Y-component of the version number for the highest X-component
    strSql = strSql & " AND cint( mid( version_no, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) + 1 ) ) = " & _
       " ( select max( cint( mid( version_no, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) + 1 ) ) ) " & _
       " from att_steps AS b " & _
       " Where a.step_id = b.step_id " & _
       " AND cint( mid( version_no, 1, instr( version_no, " & gstrDQ & gstrVerSeparator
& gstrDQ & " ) - 1 ) ) = " & _
       " ( select max( cint( mid( version_no, 1, instr( version_no, " & gstrDQ &
gstrVerSeparator & gstrDQ & " ) - 1 ) ) ) " & _
       " from att_steps AS c " & _
       " WHERE a.step_id = c.step_id ) ) "

    ' Append the order clause as follows
    ' First, separate all global/non-global steps
    ' Order the worker and manager steps by step_level to
    ' ensure that the parent steps are populated before
    ' any sub-steps within it
    ' Further ordering by parent_step_id and sequence_no
    ' ensures that all the children within a parent are
    ' selected in the necessary order
    strSql = strSql & " order by global_flag, step_level, " & _
       " parent_step_id, sequence_no "

    If dbLoad Is Nothing Then Set dbLoad = dbsAttTool

    ' Create a temporary Querydef object
    Set qySteps = dbLoad.CreateQueryDef(gstrEmptyString, strSql)

    ' Initialize the parameter values
    If lngWorkspaceId <> glInvalidId Then
```

```
    qySteps.Parameters("w_id").Value = lngWorkspaceId
  End If

  If Not bSelectArchivedRecords Then
    qySteps.Parameters("archived").Value = False
  End If

  Set rstStepsInWorkSpace = qySteps.OpenRecordset(dbOpenSnapshot)

  Exit Sub

ReadStepsInWorkspaceErr:

  LogErrors Errors
  gstrSource = mstrModuleName & "ReadStepsInWorkspace"
  On Error GoTo 0
  Err.Raise vbObjectError + errReadWorkspaceDataFailed, _
      gstrSource, _
      LoadResString(errReadWorkspaceDataFailed)

End Sub
Public Sub ReadWorkspaces(dbLoad As Database, rstWsp As Recordset, _
    qyWsp As DAO.QueryDef, _
    Optional ByVal bSelectArchivedRecords As Boolean = False)

  ' This function will populate the passed in recordset with all workspace records

  Dim strSql As String

  On Error GoTo ReadWorkspacesErr

  ' Create a recordset object containing all the workspaces
  ' (that haven't been archived) in the database
  strSql = " Select workspace_id, workspace_name, archived_flag " & _
      " from att_workspaces "

  If Not bSelectArchivedRecords Then
    strSql = strSql & " where archived_flag = [archived]"
  End If
  strSql = strSql & " order by workspace_name"

  Set qyWsp = dbLoad.CreateQueryDef(gstrEmptyString, strSql)
  If Not bSelectArchivedRecords Then
    qyWsp.Parameters("archived").Value = False
  End If

  Set rstWsp = qyWsp.OpenRecordset(dbOpenForwardOnly)

  Exit Sub

ReadWorkspacesErr:

  LogErrors Errors
  gstrSource = mstrModuleName & "ReadWorkspaces"
  On Error GoTo 0
  Err.Raise vbObjectError + errReadWorkspaceDataFailed, _
      gstrSource, _
      LoadResString(errReadWorkspaceDataFailed)

End Sub
Public Sub ShowWorkspacesInDb(dbLoad As Database)

  Dim recWorkspaces As Recordset
  Dim qryAllWsp As QueryDef

  On Error GoTo ShowWorkspacesInDbErr

  ' Set the mousepointer to indicate Busy
  Call ShowBusy

  Load frmWorkspaceOpen

  Call ReadWorkspaces(dbLoad, recWorkspaces, qryAllWsp)

  frmWorkspaceOpen.lstWorkspaces.Clear

  ' Load all the workspaces into the listbox
  If recWorkspaces.RecordCount <> 0 Then
    Do
      ' Add the workspace name to the list and store
      ' the corresponding workspace id as the ItemData
      ' property of the item.
      ' The workspace id will be used for all further
      ' processing of the workspace
      frmWorkspaceOpen.lstWorkspaces.AddItem
recWorkspaces![workspace_name]

frmWorkspaceOpen.lstWorkspaces.ItemData(frmWorkspaceOpen.lstWorkspaces.New
Index) = _
          recWorkspaces![workspace_id]
      recWorkspaces.MoveNext

    Loop Until recWorkspaces.EOF
  End If
  recWorkspaces.Close
  qryAllWsp.Close

  ' Reset the mousepointer
  ShowFree

  #If RUN_ONLY Then
    frmWorkspaceOpen.Show vbModal
  #Else
    frmWorkspaceOpen.Show vbModal, frmMain
  #End If

  Exit Sub

ShowWorkspacesInDbErr:
  LogErrors Errors
  Call ShowFree
  Err.Raise vbObjectError + errProgramError, mstrModuleName &
"ShowWorkspacesInDb", _
      LoadResString(errProgramError)

End Sub
Private Sub ReadWorkspaceParameters(lngWorkspaceId As Long, _
  rstWorkSpaceParameters As Recordset, _
  qyWspParams As DAO.QueryDef)

  ' Will populate the recordset with all the parameters for
  ' a given workspace

  Dim strSql As String

  On Error GoTo ReadWorkspaceParametersErr

  strSql = "Select parameter_id, parameter_name, " & _
      " parameter_value, workspace_id, parameter_type, description " & _
      " from workspace_parameters " & _
      " where workspace_id = [w_id] " & _
      " order by parameter_name, parameter_value "

  ' Create a temporary Querydef object and initialize
  ' it's parameter values
  Set qyWspParams = dbsAttTool.CreateQueryDef(gstrEmptyString, strSql)
  qyWspParams.Parameters("w_id").Value = lngWorkspaceId

  Set rstWorkSpaceParameters = qyWspParams.OpenRecordset(dbOpenSnapshot)

  Exit Sub
```

```
ReadWorkspaceParametersErr:

    LogErrors Errors
    gstrSource = mstrModuleName & "ReadWorkspaceParameters"
    On Error GoTo 0
    Err.Raise vbObjectError + errReadWorkspaceDataFailed, _
          gstrSource, _
          LoadResString(errReadWorkspaceDataFailed)

End Sub
Private Sub ReadConnections(lngWorkspaceId As Long, rstConns As Recordset, _
    qyConns As DAO.QueryDef)

    ' Will populate the recordset with all the parameters for
    ' a given workspace

    Dim strSql As String

    On Error GoTo ReadWorkspaceParametersErr

    strSql = "Select connection_id, " & _
          " connection_name, connection_value, workspace_id, description, " & _
          " no_count_display, no_execute, parse_query_only, ANSI_quoted_identifiers, "
& _
          " ANSI_nulls, show_query_plan, show_stats_time, show_stats_io, " & _
          " parse_odbc_msg_prefixes, row_count, tsql_batch_separator,
query_time_out, " & _
          " server_language, character_translation, regional_settings " & _
          " from workspace_connections " & _
          " where workspace_id = [w_id] " & _
          " order by connection_name, connection_value "

    ' Create a temporary Querydef object and initialize
    ' it's parameter values
    Set qyConns = dbsAttTool.CreateQueryDef(gstrEmptyString, strSql)
    qyConns.Parameters("w_id").Value = lngWorkspaceId

    Set rstConns = qyConns.OpenRecordset(dbOpenSnapshot)

    Exit Sub

ReadWorkspaceParametersErr:

    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errReadWorkspaceDataFailed, _
          mstrModuleName & "ReadConnections",
LoadResString(errReadWorkspaceDataFailed)

End Sub
Private Sub ReadConnectionDtls(lngWorkspaceId As Long, rstConns As Recordset, _
    qyConns As DAO.QueryDef)

    ' Will populate the recordset with all the connection_dtls records for
    ' a given workspace

    Dim strSql As String

    On Error GoTo ReadWorkspaceParametersErr

    strSql = "Select " & FLD_ID_CONN_NAME & ", " & _
          FLD_CONN_DTL_CONNECTION_NAME & ", " & _
          FLD_CONN_DTL_CONNECTION_STRING & ", " & _
          FLD_ID_WORKSPACE & ", " & _
          FLD_CONN_DTL_CONNECTION_TYPE & _
          " from " & TBL_CONNECTION_DTLS & _
          " where " & FLD_ID_WORKSPACE & " = [w_id] " & _
          " order by " & FLD_CONN_DTL_CONNECTION_NAME

    ' Create a temporary Querydef object and initialize
    ' it's parameter values
    Set qyConns = dbsAttTool.CreateQueryDef(gstrEmptyString, strSql)
    qyConns.Parameters("w_id").Value = lngWorkspaceId

    Set rstConns = qyConns.OpenRecordset(dbOpenSnapshot)

    Exit Sub

ReadWorkspaceParametersErr:

    LogErrors Errors
    On Error GoTo 0
    Err.Raise vbObjectError + errReadWorkspaceDataFailed, _
          mstrModuleName & "ReadConnectionDtls",
LoadResString(errReadWorkspaceDataFailed)

End Sub

Public Sub ReadWorkspaceData(lngWorkspaceId As Long, _
      cStepsCol As cArrSteps, _
      cParamsCol As cArrParameters, _
      cConsCol As cArrConstraints, _
      cConns As cConnections, _
      cConnDetails As cConnDtls, _
      rstStepsInWsp As Recordset, _
      qyStepsInWsp As DAO.QueryDef, _
      rstParamsInWsp As Recordset, _
      qyParamsInWsp As DAO.QueryDef, _
      rstConns As Recordset, _
      qyConns As DAO.QueryDef, _
      rstConnDtls As Recordset, _
      qyConnDtls As DAO.QueryDef)
    ' Loads the passed in structures with all the data for
    ' the workspace. It also initializes the recordsets
    ' with the step and parameter records for the workspace.

    On Error GoTo ReadWorkspaceDataErr

    ShowBusy

    Call ReadStepsInWorkspace(rstStepsInWsp, qyStepsInWsp, lngWorkspaceId)

    ' Load all the steps in the array
    LoadRecordsetInStepsArray rstStepsInWsp, cStepsCol

    ' Initialize the steps with all the iterator
    ' records for each step
    Call LoadIteratorsForWsp(cStepsCol, lngWorkspaceId, rstStepsInWsp)

    ReadWorkspaceParameters lngWorkspaceId, rstParamsInWsp, qyParamsInWsp

    ' Load all the workspace parameters in the array
    LoadRecordsetInParameterArray rstParamsInWsp, cParamsCol

    ' Read and load connection strings
    ReadConnections lngWorkspaceId, rstConns, qyConns

    LoadRecordsetInConnectionArray rstConns, cConns

    ' Read and load connection information
    ReadConnectionDtls lngWorkspaceId, rstConnDtls, qyConnDtls

    LoadRSInConnDtlArray rstConnDtls, cConnDetails

    ' Finally, load the step constraints collection class with
    ' all the constraints for the steps in the workspace
    cConsCol.LoadConstraints lngWorkspaceId, rstStepsInWsp

    ShowFree
    Exit Sub

ReadWorkspaceDataErr:
```

```
    ' Log the error code raised by Visual Basic
    ShowFree
    Call LogErrors(Errors)
    On Error GoTo 0
    gstrSource = mstrModuleName & "ReadWorkspaceData"
    Err.Raise vbObjectError + errReadWorkspaceDataFailed, _
          gstrSource, _
          LoadResString(errReadWorkspaceDataFailed)

End Sub
```

The listings in this section implement the SMTime module.

SMTIME.CPP

```
// SMTime.cpp : Implementation of DLL Exports.
//
//           Microsoft TPC-H Kit Ver. 1.00
//           Copyright Microsoft, 1999
//           All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//

// Note: Proxy/Stub Information
//      To build a separate proxy/stub DLL,
//      run nmake -f SMTimeps.mk in the project directory.

#include "stdafx.h"
#include "resource.h"
#include <initguid.h>
#include "SMTime.h"

#include "SMTime_i.c"
#include "SMTimer.h"


CComModule _Module;

BEGIN_OBJECT_MAP(ObjectMap)
OBJECT_ENTRY(CLSID_SMTimer, CSMTimer)
END_OBJECT_MAP()

/////////////////////////////////////////////////////////////////////////////
// DLL Entry Point

extern "C"
BOOL WINAPI DllMain(HINSTANCE hInstance, DWORD dwReason, LPVOID /*lpReserved*/)
{
    if (dwReason == DLL_PROCESS_ATTACH)
    {
        _Module.Init(ObjectMap, hInstance, &LIBID_SMTIMELib);
        DisableThreadLibraryCalls(hInstance);
    }
    else if (dwReason == DLL_PROCESS_DETACH)
        _Module.Term();
    return TRUE;    // ok
}

/////////////////////////////////////////////////////////////////////////////
// Used to determine whether the DLL can be unloaded by OLE

STDAPI DllCanUnloadNow(void)
{
    return (_Module.GetLockCount()==0) ? S_OK : S_FALSE;
}

/////////////////////////////////////////////////////////////////////////////
// Returns a class factory to create an object of the requested type

STDAPI DllGetClassObject(REFCLSID rclsid, REFIID riid, LPVOID* ppv)
{
    return _Module.GetClassObject(rclsid, riid, ppv);
}

/////////////////////////////////////////////////////////////////////////////
// DllRegisterServer - Adds entries to the system registry

STDAPI DllRegisterServer(void)
{
    // registers object, typelib and all interfaces in typelib
    return _Module.RegisterServer(TRUE);
```

```
}

////////////////////////////////////////////////////////////////////////
// DllUnregisterServer - Removes entries from the system registry

STDAPI DllUnregisterServer(void)
{
   return _Module.UnregisterServer(TRUE);
}
```

SMTIME.DEF

```
; SMTime.def : Declares the module parameters.

LIBRARY      "SMTime.DLL"

EXPORTS
                DllCanUnloadNow     @1 PRIVATE
                DllGetClassObject   @2 PRIVATE
                DllRegisterServer   @3 PRIVATE
                DllUnregisterServer       @4 PRIVATE
                Get64BitTime              @5
                SMTime_JulianToTime  @6
```

SMTIME.IDL

```
// SMTime.idl : IDL source for SMTime.dll
//
//           Microsoft TPC-H Kit Ver. 1.00
//           Copyright Microsoft, 1999
//           All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//

// This file will be processed by the MIDL tool to
// produce the type library (SMTime.tlb) and marshalling code.

import "oaidl.idl";
import "ocidl.idl";
                [
                        object,
                        uuid(1A6D0AE4-8528-453B-B8E3-8DAD1F0561B7),
                        dual,
                        helpstring("ISMTimer Interface"),
                        pointer_default(unique)
                ]
                interface ISMTimer : IDispatch
                {
                        [id(1), helpstring("method Start")] HRESULT Start();
                        [id(2), helpstring("method Stop")] HRESULT Stop(CURRENCY *pElapsedTime);
                        [propget, id(3), helpstring("property Running")] HRESULT Running([out, retval] BOOL *pVal);
                };

[
                uuid(1B31AB30-D7C1-41DB-B654-C9FA1A7D267F),
                version(1.0),
                helpstring("SMTime 1.0 Type Library")
]
library SMTIMELib
{
                importlib("stdole32.tlb");
                importlib("stdole2.tlb");

                // Now define the module that will "declare" your C functions.
                [
                helpstring("Functions exported by SMTime.dll"),
                version(1.0),
                dllname("SMTime.dll")
                ]
                module StepMasterTimeFunctions
                {
```

```
                [
                        // Add a description for your function that the developer can
                        // read in the VB Object Browser.
                        helpstring("Returns the time in 64 bits."),
                        // Specify the actual DLL entry point for the function. Notice
                        // the entry field is like the Alias keyword in a VB Declare
                        // statement -- it allows you to specify a more friendly name
                        // for your exported functions.
                        entry("SMTime_Get64BitTime")
                ]
                // The [in], [out], and [in, out] keywords tell the Automation
                // client which direction parameters need to be passed. Some
                // calls can be optimized if a function only needs a parameter
                // to be passed one-way.
                CURRENCY __stdcall Get64BitTime([in] LPSYSTEMTIME lpInitTime);
                [
                        helpstring("Converts the Julian time into it's components."),
                        entry("SMTime_JulianToTime")
                ]
                void __stdcall JulianToTime([in] CURRENCY julianTS, [in, out] int *yr, [in, out] int* mm, [in, out] int* dd, [in, out] int *hh, [in, out] int *mi, [in, out] int *ss, [in, out] int
*ms);

        } // End of Module

        [
                uuid(27BAB71B-89E1-4A78-8854-FDFFBDC8037E),
                helpstring("SMTimer Class")
        ]
        coclass SMTimer
        {
                [default] interface ISMTimer;
        };
};
```

SMTIMER.CPP

```
// SMTimer.cpp : Implementation of CSMTimer
//
//      Microsoft TPC-H Kit Ver. 1.00
//      Copyright Microsoft, 1999
//      All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//
#include "stdafx.h"
#include "SMTime.h"
#include "SMTimer.h"

/////////////////////////////////////////////////////////////////////////////
// CSMTimer

/////////////////////////////////////////////////////////////////////////////
// Construction/Destruction
/////////////////////////////////////////////////////////////////////////////

CSMTimer::~CSMTimer()
{

}

STDMETHODIMP CSMTimer::Start()
{
        // Starts the timer
        assert(!m_bInProcess);
        m_bInProcess = TRUE;

        m_lStartTime = MyTickCount();

        return S_OK;
}
```

```
STDMETHODIMP CSMTimer::Stop(CURRENCY *pElapsedTime)
{
	TC_TIME			lEndTime = MyTickCount();

	// Stops the timer and returns the elapsed time
	assert(m_bInProcess);
	m_bInProcess = FALSE;

	pElapsedTime->int64 = lEndTime - m_lStartTime;

	return S_OK;
}

TC_TIME CSMTimer::MyTickCount(void)
{
	TC_TIME	currentTC;
	LARGE_INTEGER	l;
	__int64 count;

	//The purpose of this function is to prevent the 49 day wrapping effect of the
	//system API GetTickCount(). This function essentially provides a monotonically
	//increasing timer value which is milliseconds from class instantiation.

	if ( m_bCountUnavailable )
	{
		count = (__int64)GetTickCount();
		currentTC = (TC_TIME)(count-m_baseTC);
	}
	else
	{
		QueryPerformanceCounter(&l);
		count = (__int64)l.HighPart << 32 | (__int64)l.LowPart;
		currentTC = (TC_TIME)(((count-m_baseTC) * 1000) / m_Timerfreq);
	}

	return currentTC;
}

STDMETHODIMP CSMTimer::get_Running(BOOL *pVal)
{
	*pVal = m_bInProcess;

	return S_OK;
}

CURRENCY __stdcall Get64BitTime(LPSYSTEMTIME lpInitTime)
{
	__int64	ms_day, ms_hour, ms_minute, ms_seconds, ms_milliseconds, ms_total;
	int			day;
	SYSTEMTIME		tim;
	CURRENCY		tmReturn;

	if ( lpInitTime )
		memcpy(&tim, lpInitTime, sizeof(SYSTEMTIME));
	else
		GetLocalTime(&tim);
	day = JulianDay((int)tim.wYear, (int)tim.wMonth, (int)tim.wDay);

	ms_day			= (__int64)day * (__int64)(24 * 1000 * 60 * 60);
	ms_hour			= (__int64)tim.wHour	* (__int64)(1000 * 3600);
	ms_minute		= (__int64)tim.wMinute * (1000 * 60);
	ms_seconds		= (__int64)(tim.wSecond * 1000);
	ms_milliseconds	= (__int64)tim.wMilliseconds;

	ms_total = ms_day + ms_hour + ms_minute + ms_seconds + ms_milliseconds;
	tmReturn.int64 = ms_total;

	return tmReturn;
}

// JulianDay computes the number of days since Jan 1, 1900.
```

```
// This function is valid for dates from 1-Jan-1900 to 1-Jan-2100.
// 1-Jan-1900 = 0
int JulianDay( int yr, int mm, int dd )
{
	// MonthArray contains cumulative days for months in a non leap-year
	int MonthArray[12] = { 0, 31, 59, 90, 120, 151, 181, 212, 243, 273, 304, 334};
	int j1, j2;

	// compute day of year (j1)
	j1 = MonthArray[mm-1] + dd - 1;
	// adjust day of year if this is a leap year and it is after February
	if ((yr % 4)==0 && (yr != 1900) && (mm > 2))
		j1++;
	// compute number of days from 1/1/1900 to beginning of present year
	j2 = (yr-1900)*365 + (yr-1901)/4;
	return j1+j2;

}

// Breaks up the Julian Time into it's sub-components
void __stdcall SMTime_JulianToTime( CURRENCY CurJulian, int* yr, int* mm, int* dd, int *hh, int *mi, int *ss, int *ms )
{
	int julianDay, msLeft;
	JULIAN_TIME			julianTS = CurJulian.int64;

	*ms = julianTS % 1000;

	julianTS /= 1000;

	julianDay = (int)(julianTS / ( 60 * 60 * 24 ));

	JulianToCalendar(julianDay, yr, mm, dd );

	msLeft = (int)(julianTS - (julianDay * (__int64)( 60 * 60 * 24 )));

	*hh = msLeft / (60 * 60);
	msLeft = msLeft - *hh * 3600;
	*mi = msLeft / (60);
	*ss = msLeft % 60;
}

// JulianToCalendar converts a day index (from the JulianDay function) to
// its corresponding calendar value (mm/dd/yr).  The valid range for days
// is { 0 .. 73049 } for dates from 1-Jan-1900 to 1-Jan-2100.
void JulianToCalendar( int day, int* yr, int* mm, int* dd )
{
	int y, m, d;
	// month array contains days of months for months in a non leap-year
	int month[12] = { 31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31 };

	// compute year from days
	if (day < 365)
		y = 1900;
	else
		y = 1901 + ((day-365)/1461)*4 + (4*((day-365)%1461)+3)/1461;

	// adjust February if this year is a leap year
	if ((y % 4)==0 && (y != 1900))
		month[1] = 29;
	else
		month[1] = 28;

	d = day - JulianDay( y, 1, 1 ) + 1;
	m = 1;

	while (d > month[m-1])
	{
		d = d - month[m-1];
		m++;
	}
```

```
		*yr = y;
		*mm = m;
		*dd = d;
}
```

SMTIMER.H

```
// SMTimer.h : Declaration of the CSMTimer
//
//		Microsoft TPC-H Kit Ver. 1.00
//		Copyright Microsoft, 1999
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//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//

#ifndef __SMTIMER_H_
#define __SMTIMER_H_

#include "resource.h"       // main symbols

#include "assert.h"

#define	MAX_JULIAN_TIME			0x7FFFFFFFFFFFFFFF
#define JULIAN_TIME	__int64
#define	TC_TIME			DWORD

#ifdef SMTIMER
#define DLL_LINK	__declspec( dllexport )
#else
#define DLL_LINK	__declspec( dllimport )
#endif

#ifdef __cplusplus
extern "C"
{
#endif
//DLL_LINK CURRENCY		__stdcall SMTime_Get64BitTime(LPSYSTEMTIME lpInitTime);
int				JulianDay( int yr, int mm, int dd );
void			JulianToCalendar( int day, int* yr, int* mm, int* dd );
#ifdef __cplusplus
}
#endif


/////////////////////////////////////////////////////////////////////////////
// CSMTimer
class ATL_NO_VTABLE CSMTimer :
	public CComObjectRootEx<CComSingleThreadModel>,
	public CComCoClass<CSMTimer, &CLSID_SMTimer>,
	public IDispatchImpl<ISMTimer, &IID_ISMTimer, &LIBID_SMTIMELib>
{
public:
	CSMTimer()
	{
		LARGE_INTEGER	l;

		if ( !QueryPerformanceFrequency(&l) )
		{
			m_baseTC = (__int64)GetTickCount();
			m_bCountUnavailable = TRUE;
		}
		else
		{
			m_bCountUnavailable = FALSE;

			m_Timerfreq = (__int64)l.HighPart << 32 | (__int64)l.LowPart;
			QueryPerformanceCounter(&l);
			m_baseTC = (__int64)l.HighPart << 32 | (__int64)l.LowPart;
		}
		m_bInProcess = FALSE;
	}
```

```
DECLARE_REGISTRY_RESOURCEID(IDR_SMTIMER)

DECLARE_PROTECT_FINAL_CONSTRUCT()

BEGIN_COM_MAP(CSMTimer)
	COM_INTERFACE_ENTRY(ISMTimer)
	COM_INTERFACE_ENTRY(IDispatch)
//	COM_INTERFACE_ENTRY2(IDispatch, ISMTimer)
END_COM_MAP()

// ISMTimer
public:
	STDMETHOD(get_Running)(/*[out, retval]*/ BOOL *pVal);
	STDMETHOD(Stop)(CURRENCY *pElapsedTime);
	STDMETHOD(Start)();
	virtual ~CSMTimer();

private:
	__int64			m_baseTC;
	__int64			m_Timerfreq;
	BOOL			m_bCountUnavailable;
	TC_TIME			m_lStartTime;
	BOOL			m_bInProcess;

	TC_TIME			MyTickCount(void);
};

#endif //__SMTIMER_H_
```

The listings in this section implement the executedll.dll module.

EXECUTE.CPP

```
// Execute.cpp : Implementation of CExecute
//
//		Microsoft TPC-H Kit Ver. 1.00
//		Copyright Microsoft, 1999
//		All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//
#include "stdafx.h"

#include "ExecuteDll.h"
#include "SMExecute.h"
#include "Execute.h"

extern SQLHENV henv;

extern SM_Connection_Info		*p_Connections;				// Pointer to open connections
extern int				iConnectionCount;			// Number of open connections
extern CRITICAL_SECTION			hConnections;				// Critical section to serialize access to available connections

#ifdef _TPCH_AUDIT
		extern FILE *pfLogFile;					// Log file containing timestamps
		extern CRITICAL_SECTION hLogFileWrite;			// Handle to critical section
#endif

////////////////////////////////////////////////////////////////////////
// CExecute

char * CExecute::m_szOdbcOps[] = {
				"SQLAllocHandle",
				"SQLDriverConnect",
				"SQLExecDirect",
				"SQLSetStmtAttr",
				"SQLCancel",
				"SQLNumResultCols",
				"SQLDescribeCol",
				"SQLColAttribute",
				"SQLFetch",
				"SQLGetData",
				"SQLRowCount",
				"SQLMoreResults"
		};

STDMETHODIMP CExecute::InterfaceSupportsErrorInfo(REFIID riid)
{
		static const IID* arr[] =
		{
				&IID_IExecute
		};
		for (int i=0; i < sizeof(arr) / sizeof(arr[0]); i++)
		{
				if (InlineIsEqualGUID(*arr[i],riid))
						return S_OK;
		}
		return S_FALSE;
}

STDMETHODIMP CExecute::put_OutputFile(BSTR newVal)
{
		assert(m_pOutputFile);
		m_OutputFile = newVal;

		HRESULT	hr = m_pOutputFile->put_FileName(newVal);
		if FAILED(hr)
		{
				m_pOutputFile->Release();
				m_pOutputFile = NULL;
		}
```

```
		return hr;
}

//DEL STDMETHODIMP CExecute::put_LogFile(BSTR newVal)
//DEL {
//DEL 	assert(m_pLogFile);
//DEL
//DEL 	m_pLogFile->put_FileName(newVal);
//DEL 	return S_OK;
//DEL }

STDMETHODIMP CExecute::put_ErrorFile(BSTR newVal)
{
		assert(m_pErrorFile);
		m_ErrorFile = newVal;

		HRESULT	hr = m_pErrorFile->put_FileName(newVal);
		if FAILED(hr)
		{
			m_pErrorFile->Release();
			m_pErrorFile = NULL;
		}
		return hr;
}

STDMETHODIMP CExecute::DoExecute(BSTR szCommand, BSTR szExecutionDtls, ExecutionType ExecMethod, \
                                 BOOL bNoCount, BOOL bNoExecute, BOOL bParseOnly, BOOL bQuotedIds, \
                                 BOOL bAnsiNulls, BOOL bShowQP, BOOL bStatsTime, BOOL bStatsIO, \
                                 long lRowCount, long lQueryTmout, BSTR szConnection)
{
   HANDLE		hThrd;
   DWORD		tid;

  _CrtSetReportFile(_CRT_WARN, _CRTDBG_FILE_STDOUT);

		m_szCommand = szCommand;
		m_szExecDtls = szExecutionDtls;

		m_ExecMthd = ExecMethod;
		if (m_ExecMthd == execODBC)
   {
      m_bNoCount = bNoCount;
			m_bNoExecute = bNoExecute;
			m_bParseOnly = bParseOnly;
			m_bQuotedIds = bQuotedIds;
			m_bAnsiNulls = bAnsiNulls;
			m_bShowQP = bShowQP;
			m_bStatsTime = bStatsTime;
			m_bStatsIO = bStatsIO;
			m_lRowCount = lRowCount;
			m_lQueryTmout = lQueryTmout;
			m_szConnection = szConnection;
   }

		if((hThrd = CreateThread( 0, 0, (LPTHREAD_START_ROUTINE)ExecutionThread,
				this, 0, &tid)) == NULL)
			return(RaiseSystemError());

		CloseHandle(hThrd);

		return S_OK;
}

STDMETHODIMP CExecute::Abort()
{
		if (m_ExecMthd == execShell)
			return(AbortShell());
		else
			return(AbortODBC());
}
```

```
void ExecutionThread(LPVOID lpParameter)
{

	CExecute	*MyExecute = (CExecute*)lpParameter;

	MyExecute->m_tElapsedTime = 0;

	GetLocalTime(&MyExecute->m_tStartTime);
	MyExecute->PostMessage(WM_TASK_START, 0, 0);

#ifdef _TPCH_AUDIT
	char			szBuffer[MAXLOGCMDBUF];
	char			szFmt[MAXBUFLEN];

	sprintf(szFmt, "Start Step: '%%.%ds' at '%d/%d/%d %d:%d:%d:%d'\n",
			MAXLOGCMDLEN,
			MyExecute->m_tStartTime.wMonth, MyExecute->m_tStartTime.wDay,
			MyExecute->m_tStartTime.wYear, MyExecute->m_tStartTime.wHour,
			MyExecute->m_tStartTime.wMinute, MyExecute->m_tStartTime.wSecond,
			MyExecute->m_tStartTime.wMilliseconds);
	if (MyExecute->m_ExecMthd == execShell)
			WriteFileToTpchLog((LPSTR)MyExecute->m_szCommand, szFmt);
	else
	{
			sprintf(szBuffer, szFmt, (LPSTR)MyExecute->m_szCommand);
			WriteToTpchLog(szBuffer);
	}
#endif

	// Initialize the run status for the step to running. The completion status for
	// the step will be initialized by the Shell and ODBC execution functions.
   MyExecute->m_StepStatus = gintRunning;

	if (MyExecute->m_ExecMthd == execShell)
			MyExecute->m_tElapsedTime = MyExecute->ExecuteShell(MyExecute);
	else
			MyExecute->m_tElapsedTime = MyExecute->ExecuteODBC(MyExecute);

	// Close the output, log and error files
	if (MyExecute->m_pOutputFile)
			MyExecute->m_pOutputFile->Release();
	MyExecute->m_pOutputFile = NULL;

	MyExecute->m_ExecTime = NULL;

	GetLocalTime(&MyExecute->m_tEndTime);

#ifdef _TPCH_AUDIT
	sprintf(szFmt, "Complete Step: '%%.%ds' at '%d/%d/%d %d:%d:%d:%d'\n",
			MAXLOGCMDLEN,
			MyExecute->m_tEndTime.wMonth, MyExecute->m_tEndTime.wDay,
			MyExecute->m_tEndTime.wYear, MyExecute->m_tEndTime.wHour,
			MyExecute->m_tEndTime.wMinute, MyExecute->m_tEndTime.wSecond,
			MyExecute->m_tEndTime.wMilliseconds);
	if (MyExecute->m_ExecMthd == execShell)
			WriteFileToTpchLog((LPSTR)MyExecute->m_szCommand, szFmt);
	else
	{
			sprintf(szBuffer, szFmt, (LPSTR)MyExecute->m_szCommand);
			WriteToTpchLog(szBuffer);
	}
#endif

	MyExecute->PostMessage(WM_TASK_FINISH, 0, 0);

	return;
}

#ifdef _TPCH_AUDIT

void WriteFileToTpchLog(LPSTR szFile, LPSTR szFmt)
```

```
{
	// Reads a maximum of MAXLOGCMDBUF characters from the command file and writes it to the log
	FILE	*fpCmd;
	int		iRead;
	char	szBuf[MAXLOGCMDBUF];
	char	szCmd[MAXLOGCMDLEN];

	if ( pfLogFile != NULL )
	{
		if ( (fpCmd = fopen(szFile, FILE_ACCESS_READ)) != NULL)
		{
			iRead = fread(szCmd, sizeof(char), sizeof(szCmd) / sizeof(char), fpCmd);
			if (iRead < MAXLOGCMDLEN)
				szCmd[iRead] = '\0';
			else
				szCmd[MAXLOGCMDLEN - 1] = '\0';
			sprintf(szBuf, szFmt, szCmd);
			WriteToTpchLog(szBuf);
			fclose(fpCmd);
		}
	}
}

void WriteToTpchLog(char *szMsg)
{
	if (pfLogFile != NULL)
	{
		EnterCriticalSection(&hLogFileWrite);
		fprintf(pfLogFile, szMsg);
		LeaveCriticalSection(&hLogFileWrite);
	}

	return;
}
#endif

TC_TIME CExecute::ExecuteShell(CExecute *p)
{
	STARTUPINFOA			Start;
	PROCESS_INFORMATION		proc;
	DWORD					exitCode;
	TC_TIME					tElapsed = 0;
	_bstr_t					szCommand("cmd /c ");
	LPSTR					szStartDir;
	CURRENCY				Elapsed;

	szCommand += p->m_szCommand;

	// Redirect output and error information
	szCommand += " > " + m_OutputFile + " 2> " + m_ErrorFile;

	// Initialize the STARTUPINFO structure:
	memset(&Start, 0, sizeof(STARTUPINFOA)) ;
	Start.cb		= sizeof(Start);
	Start.dwFlags	= STARTF_USESHOWWINDOW;
	Start.wShowWindow	= SW_SHOWMINNOACTIVE;

	memset(&proc, 0, sizeof(PROCESS_INFORMATION)) ;

	szStartDir = strcmp((LPCTSTR)m_szExecDtls, "") == 0 ? NULL : (LPSTR)m_szExecDtls;

	p->m_ExecTime->Start();

	// Start the shelled application:
	if (!CreateProcessA( NULL, (LPSTR)szCommand, NULL, NULL, FALSE,
		NORMAL_PRIORITY_CLASS, NULL, szStartDir, &Start, &proc ))
	{
		m_StepStatus = gintFailed;
		LogSystemError(p->m_pErrorFile);

		p->m_ExecTime->Stop(&Elapsed);
```

```
                return((TC_TIME)Elapsed.int64);
        }

        m_hHandle = proc.hProcess;
        // Give the process time to execute and finish
        WaitForSingleObject(m_hHandle, INFINITE);
        p->m_ExecTime->Stop(&Elapsed);

        if (!GetExitCodeProcess(m_hHandle, &exitCode))
        {
                m_StepStatus = gintFailed;
                LogSystemError(p->m_pErrorFile);
        }
        else
                m_StepStatus = gintComplete;

        // Close all open handles to the shelled process
        CloseHandle(m_hHandle);

        return((TC_TIME)Elapsed.int64);
}

STDMETHODIMP CExecute::AbortShell()
{
        if (m_hHandle != SQL_NULL_HSTMT)
                if (!TerminateProcess(m_hHandle, 0))
                        return(RaiseSystemError());

        return(S_OK);
}

TC_TIME CExecute::ExecuteODBC(CExecute *p)
{
        TC_TIME                                 tElapsed = 0;
        HDBC                                    m_hdbc;
        SQLRETURN                               rc;
        LPSTR                                   szCmd;
        CURRENCY                                Elapsed;
        BOOL                                    bDoConnect = FALSE;

        // ODBC specific initialization
        m_hdbc = SQL_NULL_HDBC;

        // Allocate a new connection if we are creating a dynamic connection or if
        // the named connection doesn't exist
        if (!InitializeConnection(&m_hdbc, &bDoConnect))
                return(tElapsed);

        if (bDoConnect)
        {
                // Allocate connection handle, open a connection and set connection attributes.
#ifdef _DEBUG
                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLDriverConnect.\n");
#endif

                if (m_bAbort)
                        return(tElapsed);

                // Connect to the server using the passed in connection string
                rc = SQLDriverConnect(m_hdbc, NULL,
                        (unsigned char *)(LPSTR)p->m_szExecDtls, SQL_NTS,
                        NULL, 0, NULL, SQL_DRIVER_NOPROMPT);
                if (rc != SQL_SUCCESS)
                {
                        if (!HandleODBCError(rc, SQL_HANDLE_DBC, m_hdbc, &m_hdbc, SMSQLDriverConnect))
                                return(tElapsed);
                }
        }

#ifdef _DEBUG
        _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLAllocHandle for hdbc.\n");
```

```
#endif

	if (!m_bAbort && (rc = SQLAllocHandle(SQL_HANDLE_STMT, m_hdbc, &m_hHandle)) != SQL_SUCCESS)
	{
		if (!HandleODBCError(rc, SQL_HANDLE_DBC, m_hdbc, &m_hdbc, SMSQLAllocHandle))
			return(tElapsed);
	}

	// Set connection attributes if any have been modified from the default values
	if (m_lRowCount > 0)
	{
		char 					szConnOptions[512];

		sprintf(szConnOptions, "SET ROWCOUNT %d ", m_lRowCount);
		if (!SetConnectionOption(szConnOptions, &m_hdbc))
			return(tElapsed);
	}

	if (m_bQuotedIds)
	{
		if (!SetConnectionOption("SET QUOTED_IDENTIFIER ON ", &m_hdbc))
			return(tElapsed);
	}

	if (!m_bAnsiNulls)
	{
		if (!SetConnectionOption("SET ANSI_NULL_DFLT_OFF ON ", &m_hdbc))
			return(tElapsed);
	}
	if (!m_bAbort && m_lQueryTmout > 0)
	{
#ifdef _DEBUG
		_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLSetStmtAttr.\n");
#endif

		// Set the query timeout on the statement handle
		rc = SQLSetStmtAttr(m_hHandle, SQL_ATTR_QUERY_TIMEOUT, &m_lQueryTmout,
			SQL_IS_UINTEGER);

		if (!HandleODBCError(rc, SQL_HANDLE_STMT, m_hHandle, &m_hdbc, SMSQLSetStmtAttr))
			return(tElapsed);
	}

	if (m_bNoExecute)
	{
		if (!SetConnectionOption("SET NOEXEC ON ", &m_hdbc))
			return(tElapsed);
	}
	else if (m_bParseOnly)
	{
		if (!SetConnectionOption("SET PARSEONLY ON ", &m_hdbc))
			return(tElapsed);
	}
	else if (m_bShowQP)
	{
		// Important to ensure that this is the last connection attributes being set -
		// otherwise showplans are generated for all remaining SET statements
		if (!SetConnectionOption("SET SHOWPLAN_TEXT ON ", &m_hdbc))
			return(tElapsed);
	}
	else
	{
		if (m_bNoCount)
		{
			if (!SetConnectionOption("SET NOCOUNT ON ", &m_hdbc))
				return(tElapsed);
		}

		if (m_bStatsIO)
		{
			if (!SetConnectionOption("SET STATISTICS IO ON ", &m_hdbc))
```

```
                                        return(tElapsed);
                }

                // Important to ensure that this is the last connection attributes being set -
                // otherwise timing statistics are generated for all remaining SET statements
                if (m_bStatsTime)
                {
                        if (!SetConnectionOption("SET STATISTICS TIME ON ", &m_hdbc))
                                return(tElapsed);
                }
        }

        m_szCmd = (LPSTR)p->m_szCommand;
        p->m_ExecTime->Start();

        while ((szCmd = NextCmdInBatch((LPSTR)p->m_szCommand)) != NULL && !m_bAbort)
        {
#ifdef _DEBUG
                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLExecDirect.\n");
#endif

                // Execute the ODBC command
                rc = SQLExecDirect(m_hHandle, (unsigned char *)szCmd, SQL_NTS);
                if (!HandleODBCError(rc, SQL_HANDLE_STMT, m_hHandle, &m_hdbc, SMSQLExecDirect))
                        return(tElapsed);

                free(szCmd);

                // Call a procedure to log the results to the output file
                ProcessResultsets();
        }
        p->m_ExecTime->Stop(&Elapsed);

        ResetConnectionProperties(&m_hdbc);

        ODBCCleanup(&m_hdbc, &m_hHandle);

        if (m_StepStatus != gintFailed)
                m_StepStatus = gintComplete;

        return((DWORD)Elapsed.int64);
}

BOOL CExecute::InitializeConnection(HDBC *phdbc, BOOL *pbDoConnect)
{
        SQLRETURN                                       rc;

        *pbDoConnect = TRUE;

        if (IsDynamicConnection())
        {
#ifdef _DEBUG
                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLAllocHandle for m_hdbc.\n");
#endif

                if (!m_bAbort && (rc = SQLAllocHandle(SQL_HANDLE_DBC, henv, phdbc)) != SQL_SUCCESS)
                {
                        if (!HandleODBCError(rc, SQL_HANDLE_ENV, henv, phdbc, SMSQLAllocHandle))
                                return FALSE;
                }
                return TRUE;
        }

        EnterCriticalSection(&hConnections);
        // Returns the connection handle if the connection, m_szConnection, exists
        for (m_iConnectionIndex = iConnectionCount - 1; m_iConnectionIndex >= 0; m_iConnectionIndex--)
        {
                if (!strcmp( (p_Connections + m_iConnectionIndex)->szConnectionName, (LPSTR)m_szConnection))
                {
                        if (!(p_Connections + m_iConnectionIndex)->bInUse)
                        {
```

```
                                        *phdbc = (p_Connections + m_iConnectionIndex)->hdbc;
                                        (p_Connections + m_iConnectionIndex)->bInUse = TRUE;

                                        *pbDoConnect = FALSE;
                                        break;
                                }
                                else
                                {
                                        LeaveCriticalSection(&hConnections);

                                        m_StepStatus = gintFailed;
                                        _bstr_t temp(SM_ERR_CONN_IN_USE);
                                        if (m_pErrorFile)
                                                m_pErrorFile->WriteLine((BSTR)temp);

                                        return FALSE;
                                }
                        }
                }

                if (m_iConnectionIndex < 0)
                {
                        // Connection was not found. Allocate connection handle and add it to list of
                        // available connections.
#ifdef _DEBUG
                        _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLAllocHandle for m_hdbc.\n");
#endif

                        if (!m_bAbort && (rc = SQLAllocHandle(SQL_HANDLE_DBC, henv, phdbc)) != SQL_SUCCESS)
                        {
                                if (!HandleODBCError(rc, SQL_HANDLE_ENV, henv, phdbc, SMSQLAllocHandle))
                                        return FALSE;
                        }

                        m_iConnectionIndex = iConnectionCount++;

                        p_Connections = (SM_Connection_Info *)realloc(p_Connections, iConnectionCount * sizeof(SM_Connection_Info));

                        strcpy((p_Connections + m_iConnectionIndex)->szConnectionName, (LPSTR)m_szConnection);
                        (p_Connections + m_iConnectionIndex)->hdbc = *phdbc;
                        (p_Connections + m_iConnectionIndex)->bInUse = TRUE;
                }

                LeaveCriticalSection(&hConnections);

                return TRUE;
}

void CExecute::ResetConnectionUsage()
{
                if(m_iConnectionIndex >= 0 && m_iConnectionIndex < iConnectionCount)
                {
                        EnterCriticalSection(&hConnections);
                        (p_Connections + m_iConnectionIndex)->bInUse = FALSE;
                        LeaveCriticalSection(&hConnections);
                }

                return;
}

BOOL CExecute::ResetConnectionProperties(HDBC *p_hdbc)
{
                SQLRETURN                                       rc;

                // Reset connection attributes if any have been modified from the default values

                if (m_bNoExecute)
                {
                        if (!SetConnectionOption("SET NOEXEC OFF ", p_hdbc))
                                return FALSE;
                }
```

```
	else if (m_bParseOnly)
	{
		if (!SetConnectionOption("SET PARSEONLY OFF ", p_hdbc))
			return FALSE;
	}
	else if (m_bShowQP)
	{
		// Reset connection attributes in reverse order
		if (!SetConnectionOption("SET SHOWPLAN_TEXT OFF ", p_hdbc))
			return FALSE;
	}
	else
	{
		// Reset connection attributes in reverse order
		if (m_bStatsTime)
		{
			if (!SetConnectionOption("SET STATISTICS TIME OFF ", p_hdbc))
				return FALSE;
		}

		if (m_bNoCount)
		{
			if (!SetConnectionOption("SET NOCOUNT OFF ", p_hdbc))
				return FALSE;
		}

		if (m_bStatsIO)
		{
			if (!SetConnectionOption("SET STATISTICS IO OFF ", p_hdbc))
				return FALSE;
		}
	}

	if (m_lRowCount > 0)
	{
		char				szConnOptions[512];

		sprintf(szConnOptions, "SET ROWCOUNT 0 ");
		if (!SetConnectionOption(szConnOptions, p_hdbc))
			return FALSE;
	}

	if (m_bQuotedIds)
	{
		if (!SetConnectionOption("SET QUOTED_IDENTIFIER OFF ", p_hdbc))
			return FALSE;
	}

	if (!m_bAnsiNulls)
	{
		if (!SetConnectionOption("SET ANSI_NULL_DFLT_OFF OFF ", p_hdbc))
			return FALSE;
	}

	if (m_lQueryTmout > 0)
	{
		SQLUINTEGER			lQueryTmout = 0;

#ifdef _DEBUG
		_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLSetStmtAttr.\n");
#endif

		// Set the query timeout on the statement handle
		rc = SQLSetStmtAttr(m_hHandle, SQL_ATTR_QUERY_TIMEOUT, &lQueryTmout,
			SQL_IS_UINTEGER);

		if (!HandleODBCError(rc, SQL_HANDLE_STMT, m_hHandle, p_hdbc, SMSQLSetStmtAttr))
			return FALSE;
	}

	return TRUE;
```

```
}

LPSTR CExecute::NextCmdInBatch(LPSTR szBatch)
{
	LPSTR	szCmd, szSeparator, szStart;
	char	szNext;

	szStart = m_szCmd;

	while ( (szSeparator = strstr(szStart, CMD_SEPARATOR)) != NULL)
	{
		szNext = *(szSeparator + strlen(CMD_SEPARATOR));
		if ( szNext == '\n' || szNext == '\r' || szNext == '\0')
			break;
		else
			szStart = szSeparator + strlen(CMD_SEPARATOR);
	}

	if (!szSeparator)
	{
		// No more GO's
		if (strlen(m_szCmd) > 0)
		{
			szCmd = (LPSTR)malloc(strlen(m_szCmd) + 1);
			strcpy(szCmd, m_szCmd);
			m_szCmd += strlen(m_szCmd);
		}
		else
			szCmd = NULL;
	}
	else if (szSeparator - m_szCmd > 0)
	{
		// Strip the succeeding newline
		szCmd = (LPSTR)malloc(szSeparator - m_szCmd);
		strncpy(szCmd, m_szCmd, szSeparator - m_szCmd - 1);
		*(szCmd + (szSeparator - m_szCmd - 1)) = '\0';
		m_szCmd += szSeparator - m_szCmd + strlen(CMD_SEPARATOR);
		if ( szNext == '\n' || szNext == '\r')
			m_szCmd += 1;
	}
	else
		szCmd = NULL;

	return(szCmd);
}

BOOL CExecute::SetConnectionOption(LPSTR szConn, HDBC *pHdbc)
{
	// Executes the passed in connection options 'set' statement. Returns True if it succeeded
	char				szConnOptions[512];
	SQLRETURN			rc;

	sprintf(szConnOptions, szConn);

#ifdef _DEBUG
	_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLExecDirect for connection option.\n");
#endif

	if (m_bAbort)
		return FALSE;

	rc = SQLExecDirect(m_hHandle, (unsigned char *)szConnOptions, SQL_NTS);
	if (rc != SQL_SUCCESS)
		LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLExecDirect);

	if (!SQL_SUCCEEDED(rc))
	{
		ODBCCleanup(pHdbc, &m_hHandle);
		return FALSE;
	}
```

```
		return TRUE;
}

BOOL CExecute::HandleODBCError(SQLRETURN rc, SWORD fHandleType, SQLHANDLE handle, HDBC *pHdbc, OdbcOperations OdbcOp)
{
		if (rc != SQL_SUCCESS)
   {
				LogODBCErrors(rc, fHandleType, handle, OdbcOp);
				if (!SQL_SUCCEEDED(rc))
				{
						ODBCCleanup(pHdbc, &m_hHandle);
						return FALSE;
				}
   }
		return TRUE;
}

STDMETHODIMP CExecute::AbortODBC()
{
		m_bAbort = TRUE;

		if (m_hHandle != SQL_NULL_HSTMT)
		{
#ifdef _DEBUG
				_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLCancel.\n");
#endif

				SQLRETURN rc = SQLCancel(m_hHandle);
				if (rc != SQL_SUCCESS)
						LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLCancel);
		}

		return(S_OK);
}

void CExecute::ProcessResultsets()
{
   SQLSMALLINT *CTypeArray, *CScaleArray;
   SQLINTEGER  *ColLenArray, *DispLenArray;
		SQLSMALLINT iColNameLen, SQLType, iColNull, i, NumCols = 0;
		SQLINTEGER		iDispLen, iRowCount, LenOrInd;
   SQLRETURN		rc;
		char			szColName[MAX_DATA_LEN + 1];
   void			*DataPtr;


		if (!m_pOutputFile || m_bAbort)
				return;

		do
		{
#ifdef _DEBUG
				_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLNumResultCols.\n");
#endif

				// Determine the number of result set columns.
				rc = SQLNumResultCols(m_hHandle, &NumCols);
				if (rc != SQL_SUCCESS)
				{
						LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLNumResultCols);
						if (!SQL_SUCCEEDED(rc))
								break;
				}

				if (NumCols > 0)
				{

						// Allocate arrays to hold the C type, scale, column and display length of the data
						CTypeArray = (SQLSMALLINT *) malloc(NumCols * sizeof(SQLSMALLINT));
						CScaleArray = (SQLSMALLINT *) malloc(NumCols * sizeof(SQLSMALLINT));
						ColLenArray = (SQLINTEGER *) malloc(NumCols * sizeof(SQLINTEGER));
```

```
                DispLenArray = (SQLINTEGER *) malloc(NumCols * sizeof(SQLINTEGER));

                for (i = 0; i < NumCols && !m_bAbort; i++)
                {
#ifdef _DEBUG
                        _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLDescribeCol.\n");
#endif

                        // Get the column description, include the SQL type
                        rc = SQLDescribeCol(m_hHandle, ((SQLUSMALLINT) i)+1,
                                (unsigned char *)szColName, sizeof(szColName), &iColNameLen,
                                &SQLType, (unsigned long *)&ColLenArray[i], &CScaleArray[i], &iColNull);
                        if (rc != SQL_SUCCESS)
                        {
                                LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLDescribeCol);
                                if (!SQL_SUCCEEDED(rc))
                                        return;
                        }

#ifdef _DEBUG
                        _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLColAttribute.\n");
#endif

                        if (m_bAbort)
                                return;

                        rc = SQLColAttribute(m_hHandle, ((SQLUSMALLINT) i)+1, SQL_DESC_DISPLAY_SIZE, NULL, 0, NULL, &iDispLen);
                        if (rc != SQL_SUCCESS)
                        {
                                LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLColAttribute);
                                if (!SQL_SUCCEEDED(rc))
                                        return;
                        }

                        // GetDefaultCType contains a switch statement that returns the default C type
                        // for each SQL type.
                        CTypeArray[i] = GetDefaultCType(SQLType);
                        if ( (CTypeArray[i] == SQL_C_CHAR || CTypeArray[i] == SQL_C_BINARY) && ColLenArray[i] > MAX_DATA_LEN)
                        {
                                ColLenArray[i] = MAX_DATA_LEN;
                                iDispLen = MAX_DATA_LEN;
                        }

                        DispLenArray[i] = max(iColNameLen, iDispLen);
                        DispLenArray[i] = max(DispLenArray[i], sizeof(S_NULL));

                        // Print the column names in the header
                        PrintData(szColName, SQL_C_CHAR, DispLenArray[i], 0, m_pOutputFile);

                        // Add a byte for the null-termination character
                        ColLenArray[i] += 1;
                        ColLenArray[i] = ALIGNBUF(ColLenArray[i]);
                }
                m_pOutputFile->WriteLine(NULL);

                // Underline each column name
                for (i = 0; i < NumCols; i++)
                {
                        memset(szColName, '-', DispLenArray[i]);
                        *(szColName + DispLenArray[i]) = '\0';
                        PrintData(szColName, SQL_C_CHAR, DispLenArray[i], 0, m_pOutputFile);
                }
                m_pOutputFile->WriteLine(NULL);

                // Retrieve and print each row. PrintData accepts a pointer to the data, its C type,
                // and its byte length/indicator.
#ifdef _DEBUG
                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLFetch.\n");
#endif

                while (!m_bAbort && (rc = SQLFetch(m_hHandle)) != SQL_NO_DATA)
```

```
                {
                        if (!SQL_SUCCEEDED(rc))
                        {
                                LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLFetch);
                                break;
                        }

                        for (i = 0; i < NumCols; i++)
                        {
                                // Allocate the data buffer.
                                DataPtr = malloc(ColLenArray[i]);

#ifdef _DEBUG
                                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLGetData.\n");
#endif
                                while (!m_bAbort && (rc=SQLGetData(m_hHandle, i + 1, CTypeArray[i],
                                        DataPtr, ColLenArray[i], &LenOrInd)) != SQL_NO_DATA)
                                {
                                        if (!SQL_SUCCEEDED(rc))
                                        {
                                                LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLGetData);
                                                if (!SQL_SUCCEEDED(rc))
                                                        return;
                                        }

                                        if (LenOrInd == SQL_NULL_DATA)
                                                PrintData(S_NULL, SQL_C_CHAR, DispLenArray[i], 0, m_pOutputFile);
                                        else
                                        {
                                                PrintData((SQLCHAR *)DataPtr, CTypeArray[i], DispLenArray[i],
                                                        CScaleArray[i], m_pOutputFile);
                                                // Currently  printing a maximum of MAX_DATA_LEN chars.
                                                break;
                                        }
                                }

                                free(DataPtr);
                        }
                        m_pOutputFile->WriteLine(NULL);
                }
                m_pOutputFile->WriteLine(NULL);

                free(CTypeArray);
                free(CScaleArray);
                free(ColLenArray);
                free(DispLenArray);
        }

        // Write io statistics, if applicable
        LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLFetch);

#ifdef _DEBUG
        _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLRowCount.\n");
#endif

        if (m_bAbort)
                break;

        // action (insert, update, delete) query
        rc = SQLRowCount(m_hHandle, &iRowCount);
        if (rc != SQL_SUCCESS)
        {
                LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLRowCount);
                if (!SQL_SUCCEEDED(rc))
                        break;
        }

        if (!m_bNoCount && iRowCount != -1)
        {
                sprintf(szColName, "(%d row(s) affected)", iRowCount);
                _bstr_t temp(szColName);
```

```
                        m_pOutputFile->WriteLine((BSTR)temp);
                        m_pOutputFile->WriteLine(NULL);
                }

#ifdef _DEBUG
                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLFreeStmt.\n");
#endif

                if (m_bAbort)
                        break;

                SQLFreeStmt(m_hHandle, SQL_UNBIND);

#ifdef _DEBUG
                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLMoreResults.\n");
#endif

                if (m_bAbort)
                        break;

                // Process the next resultset. This function returns 'success with info' even
                // if there is no other resultset and there are statistics messages to be printed.
                // Hence the check for -1 rows before printing.
                rc=SQLMoreResults(m_hHandle);
                if (rc != SQL_SUCCESS)
                {
                        LogODBCErrors(rc, SQL_HANDLE_STMT, m_hHandle, SMSQLMoreResults);

                        if (!SQL_SUCCEEDED(rc))
                                break;
                }

   } while (rc != SQL_NO_DATA);

        return;
}

void CExecute::PrintData(void *vData, SQLSMALLINT CType, SQLINTEGER IndPtr, SQLSMALLINT iScale, ISMLog *pOutput)
{
        // PrintData accepts a pointer to the data, its C type,
        // and its byte length/indicator. It contains a switch statement that casts and prints
        // the data according to its type.

        char            *s;
        char            fmt[MAXBUFLEN];
        int                     j = 0;
        SQLINTEGER      iColLen = IndPtr + 1;

        assert(iColLen);
        s = (LPSTR)malloc(iColLen + 1);

        if (s)
        {
                if (vData)
                {
                        switch(CType)
                        {
                        case SQL_C_CHAR:
                        case SQL_C_WCHAR:
                        case SQL_C_TYPE_DATE:
                        case SQL_C_TYPE_TIME:
                        case SQL_C_TYPE_TIMESTAMP:
                        case SQL_C_INTERVAL_YEAR:
                        case SQL_C_INTERVAL_MONTH:
                        case SQL_C_INTERVAL_YEAR_TO_MONTH:
                        case SQL_C_INTERVAL_DAY:
                        case SQL_C_INTERVAL_HOUR:
                        case SQL_C_INTERVAL_MINUTE:
                        case SQL_C_INTERVAL_SECOND:
                        case SQL_C_INTERVAL_DAY_TO_HOUR:
                        case SQL_C_INTERVAL_DAY_TO_MINUTE:
```

```
                                        case SQL_C_INTERVAL_DAY_TO_SECOND:
                                        case SQL_C_INTERVAL_HOUR_TO_MINUTE:
                                        case SQL_C_INTERVAL_HOUR_TO_SECOND:
                                        case SQL_C_INTERVAL_MINUTE_TO_SECOND:
                                        case SQL_C_BINARY:
                                                sprintf(fmt, "%%.%ds", iColLen);
                                                j = sprintf(s, fmt, (char *)vData);
                                                break;

                                        case SQL_C_SHORT:
                                                j = sprintf(s, "%d", *(short *)vData);
                                                break;

                                        case SQL_C_LONG:
                                                j = sprintf(s, "%ld", *(long *)vData);
                                                break;

                                        case SQL_C_UBIGINT:
                                                j = sprintf(s, "%I64d", *(__int64 *)vData);
                                                break;

                                        case SQL_C_FLOAT:
                                                sprintf(fmt, "%%.0%df", iScale);
                                                j = sprintf(s, fmt, *(float *)vData);
                                                break;

                                        case SQL_C_DOUBLE:
                                        case SQL_C_NUMERIC:
                                                sprintf(fmt, "%%.0%df", iScale);
                                                j = sprintf(s, fmt, *(double *)vData);
                                                break;

                                        default:
                                                j = sprintf(s, "%s", vData);
                                                break;
                                        }
                                }

                                // Strip off terminating null character and pad the string with blanks
                                if (iColLen - j > 0)
                                        memset(s + j, ' ', iColLen - j);

                                *(s + iColLen) = '\0';

                                // Write the field to the output file
                                _bstr_t temp(s);
                                pOutput->WriteField((BSTR)temp);
                                free(s);
                        }

                        return;
}

SQLSMALLINT CExecute::GetDefaultCType(SQLINTEGER SQLType)
{
                // GetDefaultCType returns the C type for the passed in SQL datatype.

   switch(SQLType)
   {
   case SQL_CHAR:
                case SQL_VARCHAR:
                case SQL_LONGVARCHAR:
                case SQL_WCHAR:
                case SQL_WVARCHAR:
                case SQL_WLONGVARCHAR:
        return(SQL_C_CHAR);

   case SQL_TINYINT:
                                        return(SQL_C_CHAR);

   case SQL_SMALLINT:
```

```
                                        return(SQL_C_SHORT);

    case SQL_INTEGER:
                                        return(SQL_C_LONG);

    case SQL_BIGINT:
                                        return(SQL_C_UBIGINT);

    case SQL_REAL:
                                        return(SQL_C_FLOAT);

    case SQL_FLOAT:
    case SQL_DOUBLE:
//              case SQL_DECIMAL:
                                        return(SQL_C_DOUBLE);

                case SQL_DECIMAL:
                                        return(SQL_C_CHAR);

                case SQL_BIT:
                                        return(SQL_C_CHAR);

    case SQL_BINARY:
                case SQL_VARBINARY:
                case SQL_LONGVARBINARY:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_BINARY);

    case SQL_TYPE_DATE:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_TYPE_DATE);

    case SQL_TYPE_TIME:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_TYPE_TIME);

    case SQL_TYPE_TIMESTAMP:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_TYPE_TIMESTAMP);

                case SQL_NUMERIC:
          return(SQL_C_FLOAT);

    case SQL_INTERVAL_YEAR:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_YEAR);

    case SQL_INTERVAL_MONTH:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_MONTH);

    case SQL_INTERVAL_YEAR_TO_MONTH:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_YEAR_TO_MONTH);

    case SQL_INTERVAL_DAY:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_DAY);

    case SQL_INTERVAL_HOUR:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_HOUR);

    case SQL_INTERVAL_MINUTE:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_MINUTE);

    case SQL_INTERVAL_SECOND:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_SECOND);
```

```
   case SQL_INTERVAL_DAY_TO_HOUR:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_DAY_TO_HOUR);

   case SQL_INTERVAL_DAY_TO_MINUTE:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_DAY_TO_MINUTE);

   case SQL_INTERVAL_DAY_TO_SECOND:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_DAY_TO_SECOND);

   case SQL_INTERVAL_HOUR_TO_MINUTE:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_HOUR_TO_MINUTE);

   case SQL_INTERVAL_HOUR_TO_SECOND:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_HOUR_TO_SECOND);

   case SQL_INTERVAL_MINUTE_TO_SECOND:
                                        return(SQL_C_CHAR);
//                                      return(SQL_C_INTERVAL_MINUTE_TO_SECOND);

                default:
                                assert(TRUE);
                                return(SQL_C_CHAR);
                                break;
   }
}

/*
   FUNCTION: LogODBCErrors(SQLRETURN rc, SWORD fHandleType, SQLHANDLE handle)
   COMMENTS: Formats ODBC errors or warnings and logs them. Also initializes the
                                         completion status for the step to failure, if an ODBC error has occurred.
*/

void CExecute::LogODBCErrors(SQLRETURN nResult, SWORD fHandleType, SQLHANDLE handle, OdbcOperations FailedOp)
{
                // Messages returned by the server (e.g. Print statements) will be logged to the output file
                // ODBC warnings will be logged to the log file
                // All other ODBC errors will be logged to the error file.

                UCHAR                   szErrState[SQL_SQLSTATE_SIZE+1];                        // SQL Error State string
                UCHAR                   szErrText[SQL_MAX_MESSAGE_LENGTH+1];    // SQL Error Text string
                char                    szBuffer[SQL_SQLSTATE_SIZE+SQL_MAX_MESSAGE_LENGTH+MAXBUFLEN+1] = "";
                                                                                                                                                                // formatted
Error text Buffer
                SWORD                   wErrMsgLen;                                                                                     // Error message length
                SQLINTEGER              dwErrCode;                                                                              // Native Error code
                SQLRETURN               nErrResult;                                                                             // Return Code from SQLGetDiagRec
                SWORD                   sMsgNum = 1;                                                                            // Error sequence number
                _bstr_t                 temp;

                if (IsErrorReturn(nResult))
                {
                                sprintf(szBuffer, "ODBC Operation: '%s' returned error code: %d",
                                                m_szOdbcOps[FailedOp], nResult);
                                temp = szBuffer;
                                m_pErrorFile->WriteLine((BSTR) temp);
                                m_StepStatus = gintFailed;
                }

                if (handle == SQL_NULL_HSTMT)
                                return;

#ifdef _DEBUG
                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLGetDiagRec.\n");
#endif

                // call SQLGetDiagRec function with proper ODBC handles, repeatedly until
```

```
		// function returns SQL_NO_DATA.
		while (!m_bAbort && (nErrResult = SQLGetDiagRec(fHandleType, handle, sMsgNum++,
				szErrState, &dwErrCode, szErrText, SQL_MAX_MESSAGE_LENGTH-1, &wErrMsgLen))
				!= SQL_NO_DATA)
		{
				if (!SQL_SUCCEEDED(nErrResult))
						break;

				if (m_pOutputFile && IsServerMessage(dwErrCode, szErrText))
				{
						wsprintf(szBuffer, SM_SQLMSG_FORMAT, (LPSTR)szErrText);
						temp = szBuffer;
						m_pOutputFile->WriteLine((BSTR) temp);
				}
				else if (IsODBCWarning(szErrState) && dwErrCode != 5701 && dwErrCode != 5703)
				{
						// Suppress warnings - 'Changed database context to...' and 'Changed language setting to...'
						wsprintf(szBuffer, SM_SQLMSG_FORMAT, ParseOdbcMsgPrefixes((LPCSTR)szErrText));
						temp = szBuffer;
						m_pOutputFile->WriteLine((BSTR) temp);
				}
				else if (m_pErrorFile && !IsODBCWarning(szErrState))
				{
						wsprintf(szBuffer, SM_SQLERR_FORMAT, (LPSTR)szErrState, dwErrCode, (LPSTR)szErrText);
						temp = szBuffer;
						m_pErrorFile->WriteLine((BSTR) temp);
				}
		}
}

/*
   FUNCTION: ODBCCleanup(HDBC *hdbc, HSTMT *hstmt)
   COMMENTS: Cleanup of all ODBC structures
*/

void CExecute::ODBCCleanup(HDBC *hdbc, HSTMT *hstmt)
{
		SQLRETURN		lReturn;

#ifdef _DEBUG
		_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing ODBCCleanup.\n");
#endif

		if (*hstmt != SQL_NULL_HSTMT)
		{
#ifdef _DEBUG
				_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLCloseCursor.\n");
#endif
				SQLCloseCursor(hstmt);
#ifdef _DEBUG
				_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLFreeHandle for hstmt.\n");
#endif
				SQLFreeHandle(SQL_HANDLE_STMT, hstmt);
				*hstmt = SQL_NULL_HSTMT;
		}

		// Cleanup connection if it is a dynamic connection
		if (IsDynamicConnection())
		{
				if (*hdbc != SQL_NULL_HDBC)
				{
#ifdef _DEBUG
						_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLDisconnect.\n");
#endif
						lReturn = SQLDisconnect(*hdbc);
#ifdef _DEBUG
						_CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLFreeHandle for hdbc.\n");
#endif
						SQLFreeHandle(SQL_HANDLE_DBC, hdbc);
						*hdbc = SQL_NULL_HDBC;
				}
```

```
	}
	else
		ResetConnectionUsage();

	return;
}

// Wrapper function that raises an error if a Windows Api fails
STDMETHODIMP CExecute::RaiseSystemError(void)
{
	char s[MAXBUFLEN];

	GetSystemError(s);
	return Error(s, 0, NULL, GUID_NULL);
}

// Wrapper function that logs the error raised by an Api function to the passed in file
void CExecute::LogSystemError(ISMLog *pFile)
{
	if (pFile)
	{
		char s[MAXBUFLEN];
		GetSystemError(s);

		_bstr_t temp(s);
		pFile->WriteLine((BSTR)temp);
	}
}

// Populates the passed in string with the last Windows Api error that occurred
void CExecute::GetSystemError(LPSTR s)
{
	long c;
	DWORD e;

	e = GetLastError();

	c = sprintf(s, "Error code: %ld. ", e);
	c = FormatMessage(FORMAT_MESSAGE_FROM_SYSTEM | FORMAT_MESSAGE_IGNORE_INSERTS,
		NULL, e, 0, s + c, MAXBUFLEN - c, NULL);

	return;
}

STDMETHODIMP CExecute::get_StepStatus(InstanceStatus *pVal)
{
	*pVal = m_StepStatus;
	return S_OK;
}

STDMETHODIMP CExecute::WriteError(BSTR szMsg)
{
	if (m_pErrorFile)
		return(m_pErrorFile->WriteLine(szMsg));

	return S_OK;
}
```

EXECUTE.H

```
// Execute.h : Declaration of the CExecute
//
//		Microsoft TPC-H Kit Ver. 1.00
//		Copyright Microsoft, 1999
//		All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//

#ifndef __EXECUTE_H_
#define __EXECUTE_H_
```

```
#include <atlwin.h>
#include <comdef.h>
#include <stdio.h>
#include "resource.h"       // main symbols
#include "ExecuteDllCP.h"
#include "..\LogWriter\LogWriter.h"
#include "..\LogWriter\SMLog.h"
#include "..\common\SMTime\SMTime.h"
#include "..\common\SMTime\SMTimer.h"

// ODBC-specific includes
#define DBNTWIN32
#include <sqltypes.h>
#include <sql.h>
#include <sqlext.h>

/////////////////////////////////////////////////////////////////////////////
// CExecute

#define WM_TASK_START  (WM_USER + 101)
#define WM_TASK_FINISH  (WM_USER + 102)

#define SM_SQLERR_FORMAT                "SQL Error State:%s, Native Error Code: %ld\r\nODBC Error: %s"
                                                                                                        // format for ODBC error
messages
#define SM_SQLWARN_FORMAT               SM_SQLERR_FORMAT// format for ODBC warnings
#define SM_SQLMSG_FORMAT                "%s"                                    // format for messages from the server

#define SM_SQL_STATE_WARNING            "01000"
#define SM_MSG_SERVER                           "[Microsoft][ODBC SQL Server Driver][SQL Server]"

#define SM_ERR_CONN_IN_USE              "StepMaster Error: Connection is already in use."

#define CMD_SEPARATOR                           "\nGO"

#define INV_ARRAY_INDEX    -1                   // invalid index into an array

#define MAXBUFLEN          256      // display buffer size
#define MAXLOGCMDLEN       256      // maximum characters in command that will be
                                                                                        // printed to log
#define MAXLOGCMDBUF       512      // maximum characters in command that will be
                                                                                        // printed to log
#define MAX_DATA_LEN       4000     // maximum buffer size for variable-length data types
                                                                                        // viz. character and binary fields
#define FILE_ACCESS_READ   "r"                  // Open file for read access

#define ALIGNSIZE 4
#define S_NULL          "NULL"
#define ALIGNBUF(Length) Length % ALIGNSIZE ? \
   Length + ALIGNSIZE - (Length % ALIGNSIZE) : Length

class ATL_NO_VTABLE CExecute :
        public CWindowImpl<CExecute>,
        public CComObjectRootEx<CComSingleThreadModel>,
        public CComCoClass<CExecute, &CLSID_Execute>,
        public IConnectionPointContainerImpl<CExecute>,
        public ISupportErrorInfo,
        public IDispatchImpl<IExecute, &IID_IExecute, &LIBID_EXECUTEDLLLib>,
        public CProxy_IExecuteEvents< CExecute >
{
public:
        CExecute()
        {
                m_pErrorFile = NULL;
                //m_pLogFile = NULL;
                m_pOutputFile = NULL;

                // Initialize the elapsed time for the step
                m_tElapsedTime = 0;

                // Initialize the run status for the step
```

```
		m_StepStatus = gintPending;

		m_hHandle = SQL_NULL_HSTMT;
		m_bAbort = FALSE;

		m_iConnectionIndex = INV_ARRAY_INDEX;
	}

	~CExecute()
	{
	}

public:
	DECLARE_WND_CLASS("Execute")

		BEGIN_MSG_MAP(CExecute)
		MESSAGE_HANDLER(WM_TASK_FINISH, OnTaskFinished)
		MESSAGE_HANDLER(WM_TASK_START, OnTaskStarted)
		END_MSG_MAP()
public:

	LRESULT OnTaskStarted(UINT uMsg, WPARAM wParam,
		LPARAM lParam, BOOL& bHandled)
	{
		CURRENCY		CStartTime = Get64BitTime(&m_tStartTime);

		Fire_Start(CStartTime);
		return 0;
	}

	LRESULT OnTaskFinished(UINT uMsg, WPARAM wParam,
		LPARAM lParam, BOOL& bHandled)
	{
		CURRENCY		CEndTime = Get64BitTime(&m_tEndTime);

		Fire_Complete(CEndTime, (long)m_tElapsedTime);
		return 0;
	}

	HRESULT FinalConstruct()
	{
		HRESULT		hr;
		RECT		rect;

		rect.left=0;
		rect.right=100;
		rect.top=0;
		rect.bottom=100;

		HWND hwnd = Create( NULL, rect, "ExecuteWindow", WS_POPUP);

		if (!hwnd)
			return HRESULT_FROM_WIN32(GetLastError());

		hr = CoCreateInstance(CLSID_SMLog, NULL, CLSCTX_INPROC,
			IID_ISMLog, (void **)&m_pErrorFile);
		if FAILED(hr)
			return(hr);
		m_pErrorFile->put_Append(TRUE);

		//hr = CoCreateInstance(CLSID_SMLog, NULL, CLSCTX_INPROC,
		//		IID_ISMLog, (void **)&m_pLogFile);
		//if FAILED(hr)
		//		return(hr);

		hr = CoCreateInstance(CLSID_SMLog, NULL, CLSCTX_INPROC,
			IID_ISMLog, (void **)&m_pOutputFile);
		if FAILED(hr)
			return(hr);
		m_pOutputFile->put_Append(TRUE);
```

```
		hr = CoCreateInstance(CLSID_SMTimer, NULL, CLSCTX_INPROC,
			IID_ISMTimer, (void **)&m_ExecTime);
		if FAILED(hr)
			return(hr);

		return S_OK;
	}

	void FinalRelease()
	{
		if (m_hWnd != NULL)
			DestroyWindow();

		// Close the log and error files
		if (m_pErrorFile)
			m_pErrorFile->Release();
		m_pErrorFile = NULL;

		//if (m_pLogFile)
		//	m_pLogFile->Release();
		//m_pLogFile = NULL;

		if (m_ExecTime)
			m_ExecTime->Release();
		m_ExecTime = NULL;
	}

DECLARE_REGISTRY_RESOURCEID(IDR_EXECUTE)

DECLARE_PROTECT_FINAL_CONSTRUCT()

BEGIN_COM_MAP(CExecute)
	COM_INTERFACE_ENTRY(IExecute)
	COM_INTERFACE_ENTRY(ISupportErrorInfo)
	COM_INTERFACE_ENTRY(IDispatch)
	COM_INTERFACE_ENTRY(IConnectionPointContainer)
	COM_INTERFACE_ENTRY_IMPL(IConnectionPointContainer)
END_COM_MAP()
BEGIN_CONNECTION_POINT_MAP(CExecute)
CONNECTION_POINT_ENTRY(DIID__IExecuteEvents)
END_CONNECTION_POINT_MAP()

// ISupportsErrorInfo
STDMETHOD(InterfaceSupportsErrorInfo)(REFIID riid);

// IExecute
public:
	STDMETHOD(put_ErrorFile)(/*[in]*/ BSTR newVal);
	STDMETHOD(put_OutputFile)(/*[in]*/ BSTR newVal);
	STDMETHOD(WriteError)(BSTR szMsg);
	STDMETHOD(Abort)();
	STDMETHOD(get_StepStatus)(/*[out, retval]*/ InstanceStatus *pVal);
	STDMETHOD(DoExecute)(/*[in]*/ BSTR szCommand, /*[in]*/ BSTR szExecutionDtls, /*[in]*/ ExecutionType ExecMethod,
		/*[in]*/ BOOL bNoCount, /*[in]*/ BOOL bNoExecute, /*[in]*/ BOOL bParseOnly,
		/*[in]*/ BOOL bQuotedIds, /*[in]*/ BOOL bAnsiNulls, /*[in]*/ BOOL bShowQP,
		/*[in]*/ BOOL bStatsTime, /*[in]*/ BOOL bStatsIO, /*[in]*/ long lRowCount,
		/*[in]*/ long lQueryTmout, /*[in]*/ BSTR szConnection);

	TC_TIME			ExecuteShell(CExecute *p);
	TC_TIME			ExecuteODBC(CExecute *p);
	STDMETHODIMP	AbortShell();
	STDMETHODIMP	AbortODBC();

	_bstr_t			m_szCommand;
	_bstr_t			m_szExecDtls;
	_bstr_t			m_szConnection;
	DWORD			m_lMode;
	//DATE			m_CurTime;
	SYSTEMTIME		m_tStartTime;
	SYSTEMTIME		m_tEndTime;
	TC_TIME			m_tElapsedTime;
```

```
	ISMLog			*m_pErrorFile;
	//ILog			*m_pLogFile;
	ISMLog			*m_pOutputFile;
	ISMTimer		*m_ExecTime;
	ExecutionType		m_ExecMthd;
	InstanceStatus		m_StepStatus;
	HANDLE			m_hHandle;		// Process handle for shell commands and
								// Statement handle for ODBC commands
	LPSTR			m_szCmd;

private:
	typedef enum OdbcOperations
	{
		SMSQLAllocHandle,
		SMSQLDriverConnect,
		SMSQLExecDirect,
		SMSQLSetStmtAttr,
		SMSQLCancel,
		SMSQLNumResultCols,
		SMSQLDescribeCol,
		SMSQLColAttribute,
		SMSQLFetch,
		SMSQLGetData,
		SMSQLRowCount,
		SMSQLMoreResults
	};

	LPSTR			NextCmdInBatch(LPSTR szBatch);
	void			ProcessResultsets();
	SQLSMALLINT		GetDefaultCType(SQLINTEGER SQLType);
	void			PrintData(void *vData, SQLSMALLINT CType, SQLINTEGER IndPtr, SQLSMALLINT iScale, ISMLog *pOutput);
	void			LogODBCErrors(SQLRETURN nResult, SWORD fHandleType, SQLHANDLE handle, OdbcOperations FailedOp);
	void			ODBCCleanup(HDBC *hdbc, HSTMT *hstmt);
	STDMETHODIMP		RaiseSystemError(void);
	void			LogSystemError(ISMLog *pFile);
	void			GetSystemError(LPSTR s);
	BOOL			SetConnectionOption(LPSTR szConn, HDBC *pHdbc);
	BOOL			ResetConnectionProperties(HDBC *p_hdbc);
	BOOL			HandleODBCError(SQLRETURN rc, SWORD fHandleType, SQLHANDLE handle, HDBC *pHdbc, OdbcOperations OdbcOp);

	BOOL			InitializeConnection(HDBC *phdbc, BOOL *pbDoConnect);
	void			ResetConnectionUsage();

	int				m_iConnectionIndex;

	static char		*m_szOdbcOps[];

	BOOL			m_bNoCount, m_bNoExecute, m_bParseOnly, m_bQuotedIds, m_bAnsiNulls, \
				m_bShowQP, m_bStatsTime, m_bStatsIO;
	long			m_lRowCount;
	SQLUINTEGER		m_lQueryTmout;
	_bstr_t			m_ErrorFile, m_OutputFile;
	BOOL			m_bAbort;

private:
inline BOOL IsServerMessage(SQLINTEGER lNativeError, UCHAR *szErr){
	return( (strstr((LPCTSTR)szErr, SM_MSG_SERVER) != NULL) ? (lNativeError == 0) : FALSE); }
inline BOOL IsODBCWarning(UCHAR *szSqlState){	return(strcmp((LPCSTR)szSqlState, SM_SQL_STATE_WARNING) == 0);}
inline BOOL IsErrorReturn(SQLRETURN iRetCode){
	return( (iRetCode != SQL_SUCCESS) && (iRetCode != SQL_SUCCESS_WITH_INFO) && (iRetCode != SQL_NO_DATA) );}
inline LPCSTR ParseOdbcMsgPrefixes(LPCSTR szMsg){ char *pDest;
	return( (pDest = strstr(szMsg, SM_MSG_SERVER)) == NULL ? szMsg : pDest + strlen(SM_MSG_SERVER));}
inline BOOL IsDynamicConnection(){ return(!strcmp((LPSTR)m_szConnection, ""));}
};

void			ExecutionThread(LPVOID lpParameter);

#ifdef _TPCH_AUDIT
	void			WriteFileToTpchLog(LPSTR szFile, LPSTR szFmt);
	void			WriteToTpchLog(char *szMsg);
#endif
```

```
#endif //__EXECUTE_H_
```

EXECUTEDLL.CPP

```
// ExecuteDll.cpp : Implementation of DLL Exports.
//
//           Microsoft TPC-H Kit Ver. 1.00
//           Copyright Microsoft, 1999
//           All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//

// Note: Proxy/Stub Information
//      To build a separate proxy/stub DLL,
//      run nmake -f ExecuteDllps.mk in the project directory.

#include "stdafx.h"
#include "resource.h"
#include <initguid.h>

#include "..\LogWriter\LogWriter.h"
#include "..\LogWriter\LogWriter_i.c"

#include "..\common\SMTime\SMTime.h"
#include "..\common\SMTime\SMTime_i.c"

#include "ExecuteDll.h"
#include "SMExecute.h"

#include "ExecuteDll_i.c"
#include "Execute.h"

CComModule _Module;

BEGIN_OBJECT_MAP(ObjectMap)
OBJECT_ENTRY(CLSID_Execute, CExecute)
END_OBJECT_MAP()

SQLHENV henv = NULL;                                                                    // ODBC environment handle

static char szCaption[] = "StepMaster";                                 // Message box caption

CRITICAL_SECTION hConnections;                                                  // Critical section to serialize access to available connections
SM_Connection_Info      *p_Connections = NULL;                  // Pointer to open connections
int                                                     iConnectionCount = 0;                                   // Number of open connections

#ifdef _TPCH_AUDIT
        FILE *pfLogFile = NULL;                                                         // Log file containing timestamps
        CRITICAL_SECTION hLogFileWrite;                                 // Critical section to serialize writes to log

        static char szFileOpenModeAppend[] = "a+";                      // Log file open mode

        static char szEnvVarLogFile[] = "TPCH_LOG_FILE";        // Environment variable - initialized to
                                                                                                                                                // log file
name if timing information
                                                                                                                                                // is to be
logged
#endif

void ShowODBCErrors(SWORD fHandleType, SQLHANDLE handle);
void CloseOpenConnections();

////////////////////////////////////////////////////////////////////////
// DLL Entry Point

extern "C"
BOOL WINAPI DllMain(HINSTANCE hInstance, DWORD dwReason, LPVOID /*lpReserved*/)
{

   if (dwReason == DLL_PROCESS_ATTACH)
```

```
    {
        _Module.Init(ObjectMap, hInstance, &LIBID_EXECUTEDLLLib);
        DisableThreadLibraryCalls(hInstance);

#ifdef _TPCH_AUDIT
                        char szMsg[MAXBUFLEN];
                        LPSTR szLogFileName = getenv(szEnvVarLogFile);

                        if (szLogFileName == NULL)
                        {
                                sprintf(szMsg, "The environment variable '%s' does not exist. "
                                        "Step timing information will not be written to a log.", szEnvVarLogFile);
                                MessageBox(NULL, szMsg, szCaption, MB_OK);
                        }
                        else
                        {
                                if ( (pfLogFile = fopen(szLogFileName, szFileOpenModeAppend)) == NULL )
                                {
                                        sprintf(szMsg, "The file '%s' does not exist. "
                                                "Step timing information will not be written to log.", szLogFileName);
                                        MessageBox(NULL, szMsg, szCaption, MB_OK);
                                }
                                else
                                        InitializeCriticalSection(&hLogFileWrite);
                        }
#endif

                        InitializeCriticalSection(&hConnections);

                        p_Connections = NULL;
                        iConnectionCount = 0;

                        if (!SQL_SUCCEEDED(SQLSetEnvAttr(NULL, SQL_ATTR_CONNECTION_POOLING, (SQLPOINTER)SQL_CP_ONE_PER_HENV , 0)))
                                ShowODBCErrors(SQL_HANDLE_ENV, henv);

                        if (!SQL_SUCCEEDED(SQLAllocHandle(SQL_HANDLE_ENV, SQL_NULL_HANDLE, &henv)))
                                return FALSE;
                        /*
                        SQLUINTEGER CpMatch;
                        if (!SQL_SUCCEEDED(SQLGetEnvAttr(henv, SQL_ATTR_CP_MATCH, &CpMatch, 0, NULL)))
                                ShowODBCErrors(SQL_HANDLE_ENV, henv);

                        if (!SQL_SUCCEEDED(SQLSetEnvAttr(henv, SQL_ATTR_CP_MATCH, (SQLPOINTER)SQL_CP_STRICT_MATCH, SQL_IS_INTEGER)))
                                ShowODBCErrors(SQL_HANDLE_ENV, henv);
                                */

                        if (!SQL_SUCCEEDED(SQLSetEnvAttr(henv, SQL_ATTR_ODBC_VERSION, (LPVOID)SQL_OV_ODBC3, 0)))
                                ShowODBCErrors(SQL_HANDLE_ENV, henv);

    }
    else if (dwReason == DLL_PROCESS_DETACH)
                {

#ifdef _TPCH_AUDIT
                        if (pfLogFile != NULL)
                        {
                                fclose(pfLogFile);

                                DeleteCriticalSection(&hLogFileWrite);
                        }
#endif

                        CloseOpenConnections();

                        if (henv != NULL)
                                SQLFreeEnv(henv);

                        DeleteCriticalSection(&hConnections);

        _Module.Term();
                }
```

```
    return TRUE;    // ok
}

void ShowODBCErrors(SWORD fHandleType, SQLHANDLE handle)
{
        UCHAR           szErrState[SQL_SQLSTATE_SIZE+1];                        // SQL Error State string
        UCHAR           szErrText[SQL_MAX_MESSAGE_LENGTH+1];    // SQL Error Text string
        char            szBuffer[SQL_SQLSTATE_SIZE+SQL_MAX_MESSAGE_LENGTH+MAXBUFLEN+1] = "";
                                                                                                                                                                // formatted
Error text Buffer
        SWORD           wErrMsgLen;                                                                                                     // Error message length
        SQLINTEGER      dwErrCode;                                                                                      // Native Error code
        SQLRETURN       nErrResult;                                                                                     // Return Code from SQLGetDiagRec
        SWORD           sMsgNum = 1;                                                                                    // Error sequence number

        // call SQLGetDiagRec function with proper ODBC handles, repeatedly until
        // function returns SQL_NO_DATA.
        while ((nErrResult = SQLGetDiagRec(fHandleType, handle, sMsgNum++,
                szErrState, &dwErrCode, szErrText, SQL_MAX_MESSAGE_LENGTH-1, &wErrMsgLen))
                != SQL_NO_DATA)
        {
                if (!SQL_SUCCEEDED(nErrResult))
                        break;

                wsprintf(szBuffer, SM_SQLERR_FORMAT, (LPSTR)szErrState, dwErrCode, (LPSTR)szErrText);

                MessageBox(NULL, szBuffer, szCaption, MB_OK);
        }
}

void CloseOpenConnections()
{
        // Closes all open connections

        if (p_Connections)
        {
                for (int iConnIndex = iConnectionCount - 1; iConnIndex >= 0; iConnIndex--)
                {
                        if ((p_Connections + iConnIndex)->hdbc != SQL_NULL_HDBC)
                        {
#ifdef _DEBUG
                                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLDisconnect.\n");
#endif
                                SQLDisconnect((p_Connections + iConnIndex)->hdbc);
#ifdef _DEBUG
                                _CrtDbgReport(_CRT_WARN, NULL, 0, NULL, "Executing SQLFreeHandle for hdbc.\n");
#endif
                                SQLFreeHandle(SQL_HANDLE_DBC, (p_Connections + iConnIndex)->hdbc );
                                (p_Connections + iConnIndex)->hdbc = SQL_NULL_HDBC;
                        }

                }

                free(p_Connections);
        }
        p_Connections = NULL;

        return;
}

////////////////////////////////////////////////////////////////////////
// Used to determine whether the DLL can be unloaded by OLE

STDAPI DllCanUnloadNow(void)
{
    return (_Module.GetLockCount()==0) ? S_OK : S_FALSE;
}

////////////////////////////////////////////////////////////////////////
// Returns a class factory to create an object of the requested type
```

```
STDAPI DllGetClassObject(REFCLSID rclsid, REFIID riid, LPVOID* ppv)
{
   return _Module.GetClassObject(rclsid, riid, ppv);
}

////////////////////////////////////////////////////////////////////////////
// DllRegisterServer - Adds entries to the system registry

STDAPI DllRegisterServer(void)
{
   // registers object, typelib and all interfaces in typelib
   return _Module.RegisterServer(TRUE);
}

////////////////////////////////////////////////////////////////////////////
// DllUnregisterServer - Removes entries from the system registry

STDAPI DllUnregisterServer(void)
{
   return _Module.UnregisterServer(TRUE);
}
```

EXECUTEDLL.DEF

```
; ExecuteDll.def : Declares the module parameters.

LIBRARY      "ExecuteDll.DLL"

EXPORTS
                DllCanUnloadNow     @1 PRIVATE
                DllGetClassObject   @2 PRIVATE
                DllRegisterServer   @3 PRIVATE
                DllUnregisterServer       @4 PRIVATE
```

EXECUTEDLL.IDL

```
// ExecuteDll.idl : IDL source for ExecuteDll.dll
//
//           Microsoft TPC-H Kit Ver. 1.00
//           Copyright Microsoft, 1999
//           All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//

// This file will be processed by the MIDL tool to
// produce the type library (ExecuteDll.tlb) and marshalling code.

import "oaidl.idl";
import "ocidl.idl";
                typedef
                [
                                uuid(0AC32070-B0DB-11d2-BC0D-00A0C90D2CA5),
                                helpstring("Execution Types"),
                ]

                enum ExecutionType
                {
                                [helpstring("Shell")]       execODBC  = 0x0001,
                                [helpstring("ODBC")]      execShell    = 0x0002
                } ExecutionType;

                typedef
                [
                                uuid(D4A4B9B0-BAE3-11d2-BC0F-00A0C90D2CA5),
                                helpstring("Run Status Values"),
                ]

                enum InstanceStatus
                {
                                [helpstring("Disabled")]  gintDisabled                = 0x0001,
                                [helpstring("Pending")]                gintPending                = 0x0002,
                                [helpstring("Running")]                gintRunning                = 0x0003,
```

```
                [helpstring("Complete")] gintComplete       = 0x0004,
                [helpstring("Failed")]   gintFailed         = 0x0005,
                [helpstring("Aborted")]  gintAborted        = 0x0006
        } InstanceStatus;


[
        uuid(551AC525-AB1C-11D2-BC0C-00A0C90D2CA5),
        version(1.0),
        helpstring("ExecuteDll 1.0 Type Library")
]
library EXECUTEDLLLib
{
        importlib("stdole32.tlb");
        importlib("stdole2.tlb");

        [
                uuid(551AC532-AB1C-11D2-BC0C-00A0C90D2CA5),
                helpstring("_IExecuteEvents Interface")
        ]
        dispinterface _IExecuteEvents
        {
                properties:
                methods:
                [id(1), helpstring("method Start")] void Start([in] CURRENCY StartTime);
                [id(2), helpstring("method Complete")] void Complete([in] CURRENCY EndTime, [in] long Elapsed);
        };
        [
                object,
                uuid(551AC531-AB1C-11D2-BC0C-00A0C90D2CA5),
                dual,
                helpstring("IExecute Interface"),
                pointer_default(unique)
        ]
        interface IExecute : IDispatch
        {
                [id(1), helpstring("method DoExecute")] HRESULT DoExecute([in] BSTR szCommand, [in] BSTR szExecutionDtls, [in] ExecutionType ExecMethod, [in] BOOL
bNoCount, [in] BOOL bNoExecute, [in] BOOL bParseOnly, [in] BOOL bQuotedIds, [in] BOOL bAnsiNulls, [in] BOOL bShowQP, [in] BOOL bStatsTime, [in] BOOL bStatsIO, [in] long
lRowCount, [in] long lQueryTmout, [in] BSTR szConnection);
                [propget, id(2), helpstring("property StepStatus")] HRESULT StepStatus([out, retval] InstanceStatus *pVal);
                [id(3), helpstring("method Abort")] HRESULT Abort();
                [id(4), helpstring("method WriteError")] HRESULT WriteError(BSTR szMsg);
                [propput, id(5), helpstring("property OutputFile")] HRESULT OutputFile([in] BSTR newVal);
                [propput, id(6), helpstring("property ErrorFile")] HRESULT ErrorFile([in] BSTR newVal);
        };
        [
                uuid(2EFC198E-AA8D-11D2-BC0C-00A0C90D2CA5),
                helpstring("Execute Class")
        ]
        coclass Execute
        {
                [default] interface IExecute;
                [default, source] dispinterface _IExecuteEvents;
        };
};
```

EXECUTEDLLCP.H

```
//
//          Microsoft TPC-H Kit Ver. 1.00
//          Copyright Microsoft, 1999
//          All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//
#ifndef _EXECUTEDLLCP_H_
#define _EXECUTEDLLCP_H_

template <class T>
class CProxy_IExecuteEvents : public IConnectionPointImpl<T, &DIID__IExecuteEvents, CComDynamicUnkArray>
{
        //Warning this class may be recreated by the wizard.
```

```
public:
	VOID Fire_Start(CY StartTime)
	{
		T* pT = static_cast<T*>(this);
		int nConnectionIndex;
		CComVariant* pvars = new CComVariant[1];
		int nConnections = m_vec.GetSize();

		for (nConnectionIndex = 0; nConnectionIndex < nConnections; nConnectionIndex++)
		{
			pT->Lock();
			CComPtr<IUnknown> sp = m_vec.GetAt(nConnectionIndex);
			pT->Unlock();
			IDispatch* pDispatch = reinterpret_cast<IDispatch*>(sp.p);
			if (pDispatch != NULL)
			{
				pvars[0] = StartTime;
				DISPPARAMS disp = { pvars, NULL, 1, 0 };
				pDispatch->Invoke(0x1, IID_NULL, LOCALE_USER_DEFAULT, DISPATCH_METHOD, &disp, NULL, NULL, NULL);
			}
		}
		delete[] pvars;

	}
	VOID Fire_Complete(CY EndTime, LONG Elapsed)
	{
		T* pT = static_cast<T*>(this);
		int nConnectionIndex;
		CComVariant* pvars = new CComVariant[2];
		int nConnections = m_vec.GetSize();

		for (nConnectionIndex = 0; nConnectionIndex < nConnections; nConnectionIndex++)
		{
			pT->Lock();
			CComPtr<IUnknown> sp = m_vec.GetAt(nConnectionIndex);
			pT->Unlock();
			IDispatch* pDispatch = reinterpret_cast<IDispatch*>(sp.p);
			if (pDispatch != NULL)
			{
				pvars[1] = EndTime;
				pvars[0] = Elapsed;
				DISPPARAMS disp = { pvars, NULL, 2, 0 };
				pDispatch->Invoke(0x2, IID_NULL, LOCALE_USER_DEFAULT, DISPATCH_METHOD, &disp, NULL, NULL, NULL);
			}
		}
		delete[] pvars;

	}
};
#endif
```

SMEXECUTE.H

```
//
//	Microsoft TPC-H Kit Ver. 1.00
//	Copyright Microsoft, 1999
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//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//
#pragma once

// ODBC-specific includes
#define DBNTWIN32
#include <sqltypes.h>
#include <sql.h>
#include <sqlext.h>

#define CONNECTION_NAME_LEN 256		// connection name length

typedef struct _SM_Connection_Info
{
```

```
        char        szConnectionName[CONNECTION_NAME_LEN];
        HDBC        hdbc;
        BOOL        bInUse;
} SM_Connection_Info;
```

The listings in this section implement the Log Writer module.

LOGWRITER.CPP

```
// LogWriter.cpp : Implementation of DLL Exports.
//
//           Microsoft TPC-H Kit Ver. 1.00
//           Copyright Microsoft, 1999
//           All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//

// Note: Proxy/Stub Information
//      To build a separate proxy/stub DLL,
//      run nmake -f LogWriterps.mk in the project directory.

#include "stdafx.h"
#include "resource.h"
#include <initguid.h>
#include "LogWriter.h"

#include "LogWriter_i.c"
#include "SMLog.h"


CComModule _Module;

BEGIN_OBJECT_MAP(ObjectMap)
OBJECT_ENTRY(CLSID_SMLog, CSMLog)
END_OBJECT_MAP()

////////////////////////////////////////////////////////////////////////////
// DLL Entry Point

extern "C"
BOOL WINAPI DllMain(HINSTANCE hInstance, DWORD dwReason, LPVOID /*lpReserved*/)
{
    if (dwReason == DLL_PROCESS_ATTACH)
    {
        _Module.Init(ObjectMap, hInstance, &LIBID_LOGWRITERLib);
        DisableThreadLibraryCalls(hInstance);
    }
    else if (dwReason == DLL_PROCESS_DETACH)
        _Module.Term();
    return TRUE;    // ok
}

////////////////////////////////////////////////////////////////////////////
// Used to determine whether the DLL can be unloaded by OLE

STDAPI DllCanUnloadNow(void)
{
    return (_Module.GetLockCount()==0) ? S_OK : S_FALSE;
}

////////////////////////////////////////////////////////////////////////////
// Returns a class factory to create an object of the requested type

STDAPI DllGetClassObject(REFCLSID rclsid, REFIID riid, LPVOID* ppv)
{
    return _Module.GetClassObject(rclsid, riid, ppv);
}

////////////////////////////////////////////////////////////////////////////
// DllRegisterServer - Adds entries to the system registry

STDAPI DllRegisterServer(void)
{
    // registers object, typelib and all interfaces in typelib
    return _Module.RegisterServer(TRUE);
}
```

```
////////////////////////////////////////////////////////////////////////
// DllUnregisterServer - Removes entries from the system registry

STDAPI DllUnregisterServer(void)
{
   return _Module.UnregisterServer(TRUE);
}
```

LOGWRITER.DEF

```
; LogWriter.def : Declares the module parameters.

LIBRARY      "LogWriter.DLL"

EXPORTS
                DllCanUnloadNow     @1 PRIVATE
                DllGetClassObject   @2 PRIVATE
                DllRegisterServer   @3 PRIVATE
                DllUnregisterServer       @4 PRIVATE
```

LOGWRITER.IDL

```
// LogWriter.idl : IDL source for LogWriter.dll
//
//           Microsoft TPC-H Kit Ver. 1.00
//           Copyright Microsoft, 1999
//           All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//

// This file will be processed by the MIDL tool to
// produce the type library (LogWriter.tlb) and marshalling code.

import "oaidl.idl";
import "ocidl.idl";
                [
                        object,
                        uuid(5AC75DAD-1936-11D3-BC2D-00A0C90D2CA5),
                        dual,
                        helpstring("ISMLog Interface"),
                        pointer_default(unique)
                ]
                interface ISMLog : IDispatch
                {
                        [propput, id(1), helpstring("property FileHeader")] HRESULT FileHeader([in] BSTR newVal);
                        [id(2), helpstring("method WriteLine")] HRESULT WriteLine(BSTR szMsg);
                        [id(3), helpstring("method WriteField")] HRESULT WriteField(/*[in]*/ BSTR szMsg);
                        [propput, id(4), helpstring("property FileName")] HRESULT FileName([in] BSTR newVal);
                        [propput, id(5), helpstring("property Append")] HRESULT Append([in] BOOL newVal);
                };

[
                uuid(5AC75DA1-1936-11D3-BC2D-00A0C90D2CA5),
                version(1.0),
                helpstring("LogWriter 1.0 Type Library")
]
library LOGWRITERLib
{
                importlib("stdole32.tlb");
                importlib("stdole2.tlb");

                [
                        uuid(5AC75DB1-1936-11D3-BC2D-00A0C90D2CA5),
                        helpstring("_ISMLogEvents Interface")
                ]
                dispinterface _ISMLogEvents
                {
                        properties:
                        methods:
                };
```

```
	[
		uuid(5AC75DB0-1936-11D3-BC2D-00A0C90D2CA5),
		helpstring("SMLog Class")
	]
	coclass SMLog
	{
		[default] interface ISMLog;
		[default, source] dispinterface _ISMLogEvents;
	};
};
```

LogWriteCP.h

```
//
//		Microsoft TPC-H Kit Ver. 1.00
//		Copyright Microsoft, 1999
//		All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//
#ifndef _LOGWRITERCP_H_
#define _LOGWRITERCP_H_

template <class T>
class CProxy_ISMLogEvents : public IConnectionPointImpl<T, &DIID__ISMLogEvents, CComDynamicUnkArray>
{
		//Warning this class may be recreated by the wizard.
public:
};
#endif
```

SMLog.cpp

```
// SMLog.cpp : Implementation of CSMLog
//
//		Microsoft TPC-H Kit Ver. 1.00
//		Copyright Microsoft, 1999
//		All Rights Reserved
//
//  Contact:   Reshma Tharamal (reshmat@microsoft.com)
//
#include "stdafx.h"
#include <stdio.h>
#include "LogWriter.h"
#include "SMLog.h"

/////////////////////////////////////////////////////////////////////////////
// CSMLog

STDMETHODIMP CSMLog::InterfaceSupportsErrorInfo(REFIID riid)
{
	static const IID* arr[] =
	{
		&IID_ISMLog
	};
	for (int i=0; i < sizeof(arr) / sizeof(arr[0]); i++)
	{
		if (InlineIsEqualGUID(*arr[i],riid))
			return S_OK;
	}
	return S_FALSE;
}

STDMETHODIMP CSMLog::WriteToFile(BSTR szMsg)
{
   // Writes the passed in string to the file
	_bstr_t szTempMsg(szMsg);

	return(Write((PBYTE)(LPSTR)szTempMsg, SysStringLen(szMsg)));
}

HRESULT CSMLog::Init()
{
```

```
		char		szDrive[256];
		char		szDir[256];
		char		szLogDir[256];
		HANDLE	hLogThread;
		DWORD	dwThreadID;
		_bstr_t szFile(m_szFile);
		DWORD	lDisposition;

		//create transaction log directory
		_splitpath((LPCTSTR)szFile, szDrive, szDir, NULL, NULL);
		_makepath(szLogDir, szDrive, szDir, NULL, NULL);
		CreateDirectory(szLogDir, NULL);

   iBufferSize = WRITE_BUFFER_SIZE;
		iBytesFreeInBuffer	= iBufferSize;

		// use VirtualAlloc to get page aligned buffers //
		for (int i=0;i<MAX_NUM_BUFFERS;i++)
		{
			// use VirtualAlloc to get page aligned buffers //
			pBuffer[i] = (BYTE *)VirtualAlloc(NULL, iBufferSize, MEM_COMMIT, PAGE_READWRITE );
			if (pBuffer[i] == NULL)
				return RaiseSystemError();
		}

		iActiveBuffer = 0;
		pCurrent = pBuffer[iActiveBuffer];

		lDisposition = m_bAppend ? OPEN_ALWAYS : CREATE_ALWAYS;
		m_hTxnFile = CreateFile((LPCTSTR)szFile, GENERIC_WRITE, FILE_SHARE_READ,
			NULL, lDisposition, FILE_ATTRIBUTE_NORMAL, NULL);
		if ( m_hTxnFile == INVALID_HANDLE_VALUE )
			return (RaiseSystemError());

		if (m_bAppend)
			if ( SetFilePointer(m_hTxnFile, 0, NULL, FILE_END) == ERR_SET_FILE_POINTER )
				return (RaiseSystemError());

		hIoComplete  = CreateEvent(NULL, TRUE, TRUE, NULL);
		if ( hIoComplete == NULL)
			return RaiseSystemError();

		hLogFileIo = CreateEvent(NULL, FALSE, FALSE, NULL);
		if ( hLogFileIo == NULL)
			return RaiseSystemError();

		hLogThread = CreateThread( NULL, 0, (LPTHREAD_START_ROUTINE)LogFileIO, this, 0, &dwThreadID );
		if (hLogThread == NULL)
			return RaiseSystemError();

		if (m_szHeader != NULL)
			WriteLine(m_szHeader);

		return S_OK;
}

void CSMLog::LogFileIO(void *ptr)
{
		unsigned long		BytesWritten;
		CSMLog *p=(CSMLog *)ptr;

		while( TRUE )
		{
			WaitForSingleObject(p->hLogFileIo, INFINITE);
			if ( p->m_hTxnFile == INVALID_HANDLE_VALUE )
				break;

			// do synchronous (blocking) write to log file
			if ( !WriteFile(p->m_hTxnFile, p->pBuffer[p->iIoBuffer], p->iWriteSize, &BytesWritten, NULL) )
			{
				// set error code in this thread, but don't throw an exception
```

```
                                        // because no one will catch it.
                                        p->dwError = GetLastError();

                                }
                                SetEvent(p->hIoComplete);
                        }

                        SetEvent(p->hIoComplete);
}

HRESULT CSMLog::Write(BYTE *ptr, DWORD iSize)
{
                        int                     StartPos, Remainder;
                        int                     dwErrorLocal = 0;

                        if (!m_bInitialized)
                        {
                                HRESULT hr = Init();
                                m_bInitialized = TRUE;

                                if (FAILED(hr))
                                        return hr;
                        }

                        if ( m_hTxnFile == INVALID_HANDLE_VALUE )
                                return S_OK;

                        if ( iBytesFreeInBuffer >= iSize )
                        {
                                memcpy(pCurrent, ptr, iSize);
                                pCurrent += iSize;
                                iBytesFreeInBuffer -= iSize;
                        }
                        else
                        {
                                // We don't expect to ever have to wait here, but just in case...
                                WaitForSingleObject(hIoComplete, INFINITE);

                                // check for an error from the log writer thread
                                if (dwError != 0)
                                {
                                        SetLastError(dwError);
                                        return RaiseSystemError();
                                }

                                assert( iSize <= iBufferSize );
                                memcpy(pCurrent, ptr, iBytesFreeInBuffer);
                                StartPos = iBytesFreeInBuffer;
                                Remainder = iSize - iBytesFreeInBuffer;

                                // trigger an IO on the current buffer and roll to the next buffer
                                iIoBuffer = iActiveBuffer;
                                iWriteSize = iBufferSize;
                                ResetEvent(hIoComplete);
                                SetEvent( hLogFileIo );                 // wake up IO writer

                                iActiveBuffer = (iActiveBuffer+1) % MAX_NUM_BUFFERS;
                                pCurrent = pBuffer[iActiveBuffer];

                                memcpy(pCurrent, ((BYTE *)ptr+StartPos), Remainder);
                                pCurrent += Remainder;
                                iBytesFreeInBuffer = iBufferSize - Remainder;
                        }

                        return S_OK;
}

void CSMLog::CloseLogFile(void)
{

                        if ( m_hTxnFile != INVALID_HANDLE_VALUE )
```

```
	{
		if ( iBytesFreeInBuffer < iBufferSize )
		{
			WaitForSingleObject(hIoComplete, INFINITE);
			ResetEvent(hIoComplete);

			// check for an error from the log writer thread
			if (dwError != 0)
			{
				SetLastError( dwError );
				goto exit_SpinLock;
			}

			//zero fill remainder of buffer
			ZeroMemory(pCurrent, iBytesFreeInBuffer);

			iIoBuffer = iActiveBuffer;
			iWriteSize = iBufferSize - iBytesFreeInBuffer;
			SetEvent(hLogFileIo);			// wake up IO writer
		}

		WaitForSingleObject(hIoComplete, INFINITE);
		// check for an error from the log writer thread
		if (dwError != 0)
			goto exit_SpinLock;

		pCurrent = pBuffer[iActiveBuffer];
		ZeroMemory(pCurrent, iBufferSize);
		iIoBuffer = iActiveBuffer;

		CloseHandle(m_hTxnFile);
		m_hTxnFile = INVALID_HANDLE_VALUE;			//handle to open transaction log file

		// wake up IO writer one more time for it to terminate
		ResetEvent(hIoComplete);
		SetEvent(hLogFileIo);			// wake up IO writer
		WaitForSingleObject(hIoComplete, INFINITE);
	}

exit_SpinLock:

	if (dwError != 0)
	{
		if (m_hTxnFile != INVALID_HANDLE_VALUE)
		{
			CloseHandle(m_hTxnFile);
			m_hTxnFile = INVALID_HANDLE_VALUE;
		}

		SetLastError( dwError );
		// TODO: Don't know yet what to do with an error on the file close,
		// since this function is called by the desctructor (which does not return a value)
		//throw new CSystemErr( CSystemErr::eWriteFile, "CTxnLog::CloseTransactionLogFile" );
	}

}

// Wrapper function that raises an error if a Windows Api fails
STDMETHODIMP CSMLog::RaiseSystemError(void)
{
	char s[ERR_BUFFER_SIZE];
	long c;
	DWORD e;

	e = GetLastError();

	c = sprintf(s, "Error code: %ld. ", e);
	c = FormatMessage(FORMAT_MESSAGE_FROM_SYSTEM | FORMAT_MESSAGE_IGNORE_INSERTS,
		NULL, e, 0, s + c, sizeof(s) - c, NULL);

	return Error(s, 0, NULL, GUID_NULL);
```

```
}

//DEL STDMETHODIMP CSMLog::get_FileName(BSTR *pVal)
//DEL {
//DEL	*pVal = m_szFile;
//DEL	return S_OK;
//DEL }

STDMETHODIMP CSMLog::put_FileName(BSTR newVal)
{
	m_szFile = SysAllocString(newVal);

	return S_OK;
}

//DEL STDMETHODIMP CSMLog::get_FileHeader(BSTR *pVal)
//DEL {
//DEL	*pVal = m_szHeader;
//DEL	return S_OK;
//DEL }

STDMETHODIMP CSMLog::put_FileHeader(BSTR newVal)
{
	m_szHeader = SysAllocString(newVal);
	return S_OK;
}

STDMETHODIMP CSMLog::WriteLine(BSTR szMsg)
{
	_bstr_t szTmp(szMsg);

	szTmp += "\r";
	szTmp += "\n";
	return(WriteToFile(szTmp));
}

STDMETHODIMP CSMLog::WriteField(BSTR szMsg)
{
	return(WriteToFile(szMsg));
}

//DEL STDMETHODIMP CSMLog::get_Append(BOOL *pVal)
//DEL {
//DEL	*pVal = m_bAppend;
//DEL	return S_OK;
//DEL }

STDMETHODIMP CSMLog::put_Append(BOOL newVal)
{
	m_bAppend = newVal;
	return S_OK;
}
```

WAIT4SQL.CPP

```
//
//          Microsoft TPC-H Kit Ver. 1.00
//          Copyright Microsoft, 1999
//          All Rights Reserved
//
////////////////////////////////////////////////////////////////////
// wait4sql
//
// created 5/15/96 by Jack Richins
//
// waits for sqlserverRecComplete (recovery complete event) for command line
// specified time(in milliseconds). Returns 0 if signaled (meaning server is
// already up and running), 1 if time out or other error.
//
////////////////////////////////////////////////////////////////////
#include <windows.h>
#include <stdlib.h>
#include <iostream.h>
#include <stdio.h>

int main (int argc, char *argv[])
{
        char                    eventString[MAX_PATH];
        char                    *instanceName = "";
        const char   *szName = "sqlserverRecComplete";

        // Check valid time argument
        if(argv[1] == NULL || *(argv[1]) == '-' || *(argv[1]) == '/')
        {
                cout << "Correct usage:  wait4sql <time-in-ms> [-s<instanceName>]" << endl;

                return EXIT_FAILURE;
        }

        // Set Time
        DWORD time = atol (argv[1]);

        // Setting the time argument equal to zero causes an infinite wait
        //
        if(time == 0)
                time = INFINITE;

        // Check whether the optional instance name argument was specified
        if(argv[2])
        {
                if(*(argv[2]) == '-' || *(argv[2]) == '/')
                {
                        if(*(argv[2]+1) == 's')
                        {
                                instanceName = _strupr(argv[2]+2);
                        }
                }
        }

        // Create the event name. For a named instance, the instancename is appended
        // to the end.
        //
        if(strcmp(instanceName, "") && stricmp(instanceName, "MSSQLServer"))
        {
                sprintf(eventString, "%s$%s", szName, instanceName);
        }
        else
        {
                strcpy(eventString, szName);
        }

        // Try and open the SQL server event
        //
        HANDLE hRecovered = CreateEvent (NULL, TRUE, FALSE, eventString);
```

```
	// Do we have a valid handle?
	//
	if (NULL == hRecovered)
		{
		cout << "wait4sql: Error - cannot open event '" << eventString << "'" << endl;
		return EXIT_FAILURE;
		}

	// Wait for recovery or timeout. If result equals object signaled, success, else failure.
	//
	BOOL fSrvUp = (WaitForSingleObject (hRecovered, time) == WAIT_OBJECT_0);

	// Close the event handle
	CloseHandle (hRecovered);

	if (fSrvUp)
		return EXIT_SUCCESS;
	else
		return EXIT_FAILURE;
}
```

SEMAPHORE.CPP

```
#define _WIN32_WINNT		0x0400

#include <windows.h>
#include <string.h>
#include <iostream.h>
#include <stdlib.h>
#include <stdio.h>
#include <assert.h>

void main(int argc, char **argv)
{

	typedef enum { eUnknown, eWait, eSignal, eRelease, eWaitList, eWaitGroup } OPERATION;

	OPERATION		eOP = eUnknown;

	int			iCount;
	int			i;

	HANDLE			hSemaphore;
	HANDLE			*pHandles;
	SYSTEMTIME		Time;

	if (argc < 3)
		goto usage;

	if (_stricmp(argv[1], "-wait") == 0)
		eOP = eWait;
	else if (_stricmp(argv[1], "-signal") == 0)
		eOP = eSignal;
	else if (_stricmp(argv[1], "-release") == 0)
		eOP = eRelease;
	else if (_stricmp(argv[1], "-waitlist") == 0)
		eOP = eWaitList;
	else if (_stricmp(argv[1], "-waitgroup") == 0)
		eOP = eWaitGroup;
	else goto usage;


	if ((eOP == eWait) || (eOP == eRelease))
	{
		// argv[2] is the semaphore name
		// if -count option specified, then there must be exactly 5 args
		if ((argc == 5) && (_stricmp(argv[3], "-count") == 0))
		{
			iCount = atoi(argv[4]);
			if (iCount < 1)
				goto usage;
		}
			// check that
		else if (argc != 3)
			goto usage;
		else
			iCount = 1;
	}
	else if (eOP == eWaitGroup)
	{
		if ((argc != 5) || (_stricmp(argv[3], "-count") != 0))
			goto usage;
		iCount = atoi(argv[4]);
		if (iCount < 1)
			goto usage;
	}
	else
		// eWaitList or eSignal
		iCount = argc - 2;

	if (eOP == eWait)
	{
```

```
		printf( "semaphore name  = %s\n", argv[2] );
		printf( "semaphore count = %d\n", iCount );
		hSemaphore = CreateSemaphore( NULL, 0, 2000000000, argv[2] );
		if (hSemaphore == NULL)
		{
			DWORD dwError = GetLastError();
			cout << "*ERROR*  CreateSemaphore returned " << dwError << endl;
			exit(EXIT_FAILURE);
		}
		for (i=0; i<iCount; i++)
		{
			WaitForSingleObject( hSemaphore, INFINITE );
			GetLocalTime( &Time );
			printf( "%4.4d-%2.2d-%2.2d %2.2d:%2.2d:%2.2d - released \n",
				Time.wYear, Time.wMonth, Time.wDay, Time.wHour, Time.wMinute, Time.wSecond );
		}
		CloseHandle( hSemaphore );
	}
	else if ((eOP == eWaitGroup) || (eOP == eWaitList))
	{
		char **szEventNames;
		szEventNames = new char*[iCount];
		char szTmp[128];

		printf( "event-list =" );
		for (i=0; i<iCount; i++)
		{
			if (eOP == eWaitGroup)
			{
				wsprintf( szTmp, "%s.%d", argv[2], i+1 );
				szEventNames[i] = new char[strlen(szTmp)+1];
				strcpy( szEventNames[i], szTmp );
			}
			else
			{
				szEventNames[i] = new char[strlen(argv[i+2])+1];
				strcpy( szEventNames[i], argv[i+2] );
			}

			printf( " %s", szEventNames[i] );
		}
		printf( "\n" );

		pHandles = new HANDLE[iCount-1];
		for (i=0; i<iCount; i++)
		{
			pHandles[i] = CreateEvent( NULL, TRUE /* manual reset */, FALSE /* initially non-signaled */, szEventNames[i] );
			if (pHandles[i] == NULL)
			{
				DWORD dwError = GetLastError();
				cout << "*ERROR*  CreateEvent returned " << dwError << endl;
				exit(EXIT_FAILURE);
			}
		}
		for (i=iCount; i>0;i--)
		{
			int idx = WaitForMultipleObjects( i, pHandles, FALSE /* wait for all */, INFINITE ) - WAIT_OBJECT_0;
			GetLocalTime( &Time );
			printf( "%4.4d-%2.2d-%2.2d %2.2d:%2.2d:%2.2d - signaled: %s \n",
				Time.wYear, Time.wMonth, Time.wDay, Time.wHour, Time.wMinute, Time.wSecond, szEventNames[idx]  );

			HANDLE hTmp = pHandles[idx];
			pHandles[idx] = pHandles[i-1];
			pHandles[i-1] = hTmp;

			char* szTmp = szEventNames[idx];
			szEventNames[idx] = szEventNames[i-1];
			szEventNames[i-1] = szTmp;
		}
		for (i=0; i<iCount; i++)
			CloseHandle( pHandles[i] );
```

```
	}
	else if (eOP == eRelease)
	{
		hSemaphore = OpenSemaphore( SEMAPHORE_MODIFY_STATE, FALSE, argv[2] );
		if (hSemaphore == NULL)
		{
			DWORD dwError = GetLastError();
			cout << "*ERROR*  OpenSemaphore returned " << dwError << endl;
			exit(EXIT_FAILURE);
		}
		if (!ReleaseSemaphore( hSemaphore, iCount, NULL ))
		{
			DWORD dwError = GetLastError();
			cout << "*ERROR*  ReleaseSemaphore returned " << dwError << endl;
			exit(EXIT_FAILURE);
		}
		CloseHandle( hSemaphore );
	}
	else if (eOP == eSignal)
	{
		for (i=0; i<iCount; i++)
		{
			HANDLE hHandle = OpenEvent( EVENT_MODIFY_STATE, FALSE, argv[i+2] );
			if (hHandle == NULL)
			{
				DWORD dwError = GetLastError();
				cout << "*ERROR*  OpenEvent returned " << dwError << endl;
				exit(EXIT_FAILURE);
			}
			SetEvent( hHandle );
			CloseHandle( hHandle );
		}
	}

	exit(EXIT_SUCCESS);

   // syntax was bad; show usage and quit
usage:
	printf(
		"Semaphore Utility - Ver. 1.2 - 26-Jul-99 \n"
		"Copyright (C) Microsoft Corp 1999.  All rights reserved.\n\n"
		"usage: \n"
		"  semaphore { -wait | -release } <semaphore-name> [ -count <count> ] \n"
		"  semaphore { -waitlist | -signal } <event-list> \n"
		"  semaphore -waitgroup <event-prefix> -count <count>\n"
		"\n"
		"   <semaphore-name> == alpha-numeric identifier \n"
		"   <count> == integer > 0; default value = 1 \n"
		"   <event-list> == { <event-name> ... } \n"
		"   <event-name> == alpha-numeric identifier \n"
		"   <event-prefix> == alpha-numeric identifier \n"
		"\n"
		"There are two modes to choose from: a semaphore or a list of events. \n"
		"\n"
		"Semaphore mode: \n"
		"A semaphore is a single identifier with an associated count.  Each time \n"
		"the semaphore is released, the count is decremented by one (or the amount \n"
		"specified).  When the count reaches zero, the waiter completes. If there \n"
		"are multiple waiters on the same semaphore, each release releases only \n"
		"the number of waiters specified in count.\n"
		"\n"
		"List of Events: \n"
		"A list of events (alpha-numeric tags) is specified for the waiter.  The \n"
		"waiter doesn't complete until all of the events have been signaled.  A \n"
		"given event may be signaled more than once.  There are two ways to define \n"
		"the list of events, either explicitly (-waitlist) by naming all of them or \n"
		"implicitly (-waitgroup) with a prefix and a count.  Using the -waitgroup \n"
		"option, you provide an alpha-numeric tag which is used as the prefix for a \n"
		"group of events.  The event names are generated by concatenating the prefix \n"
		"with \".<n>\", where <n> is 1 to the specified count. \n"
		);
```

```
        exit(EXIT_FAILURE);
}
```

The text that follows is the contents of the Access database used to drive Stepmaster:

Att_workspaces

workspace_id	workspace_name	archived_flag
12	Data Load - TPC-H Kit V1.01d (Spec Revision 2.3.0)	0

Workspace_parameters

workspace_id =	12	parameter_id	160	parameter_type =	0
parameter_name	TEMPLATE_DIR				
parameter_valu	%RUN_DIR%\templates				
workspace_id =	12	parameter_id	145	parameter_type =	0
parameter_name	TRACEFLAGS				
parameter_valu	-c -x -E -T834 -T2301				
workspace_id =	12	parameter_id	191	parameter_type =	0
parameter_name	FLATFILE_DIR_5				
parameter_valu	f:\5				
workspace_id =	12	parameter_id	190	parameter_type =	0
parameter_name	TOTAL_LOAD_FILES_PER_TABLE				
parameter_valu	64				
workspace_id =	12	parameter_id	189	parameter_type =	0
parameter_name	FILES_PER_UPDATE_SET				
parameter_valu	64				
workspace_id =	12	parameter_id	185	parameter_type =	0
parameter_name	SERVER				
parameter_valu	LE374P0				
workspace_id =	12	parameter_id	168	parameter_type =	0
parameter_name	FLATFILE_DIR_1				
parameter_valu	f:\1				
workspace_id =	12	parameter_id	167	parameter_type =	0
parameter_name	FLATFILE_DIR_2				
parameter_valu	f:\2				

workspace_id = 12 ***parameter_id*** 166 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_3
parameter_valu f:\3

workspace_id = 12 ***parameter_id*** 165 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_4
parameter_valu f:\4

workspace_id = 12 ***parameter_id*** 164 ***parameter_type =*** 3
parameter_name RUN_ID
parameter_valu 113

workspace_id = 12 ***parameter_id*** 163 ***parameter_type =*** 0
parameter_name KIT_DIR
parameter_valu C:\mstpch.101d.for3TB

workspace_id = 12 ***parameter_id*** 193 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_7
parameter_valu f:\7

workspace_id = 12 ***parameter_id*** 161 ***parameter_type =*** 0
parameter_name QUERY_DIR
parameter_valu %RUN_DIR%\Queries-8

workspace_id = 12 ***parameter_id*** 194 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_8
parameter_valu f:\8

workspace_id = 12 ***parameter_id*** 159 ***parameter_type =*** 0
parameter_name MAX_STREAMS
parameter_valu 8

workspace_id = 12 ***parameter_id*** 158 ***parameter_type =*** 0
parameter_name TOOLS_DIR
parameter_valu %KIT_DIR%\tools

workspace_id = 12 ***parameter_id*** 157 ***parameter_type =*** 3
parameter_name DEFAULT_DIR
parameter_valu c:\OUTPUT\2005-Nov-Audit

workspace_id = 12 ***parameter_id*** 156 ***parameter_type =*** 0
parameter_name RF_FLATFILE_DIR
parameter_valu I:\RF_FlatFile_DIR

workspace_id = 12 ***parameter_id*** 155 ***parameter_type =*** 0
parameter_name TABLE_LOAD_PARALLELISM
parameter_valu 64

workspace_id = 12 ***parameter_id*** 153 ***parameter_type =*** 0
parameter_name VALIDATION_DIR
parameter_valu %SETUP_DIR%\Validation

workspace_id = 12 ***parameter_id*** 150 ***parameter_type =*** 0
parameter_name UPDATE_SETS
parameter_valu 24

workspace_id = 12 ***parameter_id*** 149 ***parameter_type =*** 0
parameter_name SCALEFACTOR
parameter_valu 3000

workspace_id = 12 ***parameter_id*** 148 ***parameter_type =*** 3
parameter_name OUTPUT_DIR
parameter_valu c:\OUTPUT\2005-N~2\113

workspace_id = 12 ***parameter_id*** 147 ***parameter_type =*** 0
parameter_name SETUP_DIR
parameter_valu %KIT_DIR%\Setup

workspace_id = 12 ***parameter_id*** 146 ***parameter_type =*** 0
parameter_name DBNAME
parameter_valu tpch3000g

workspace_id = 12 ***parameter_id*** 162 ***parameter_type =*** 0
parameter_name RUN_DIR
parameter_valu %KIT_DIR%\run

workspace_id = 12 ***parameter_id*** 209 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_18
parameter_valu g:\18

workspace_id = 12 ***parameter_id*** 222 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_31
parameter_valu j:\31

workspace_id = 12 ***parameter_id*** 221 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_30
parameter_valu j:\30

workspace_id = 12 ***parameter_id*** 220 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_29
parameter_valu j:\29

workspace_id = 12 ***parameter_id*** 219 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_28
parameter_valu j:\28

workspace_id = 12 ***parameter_id*** 218 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_27
parameter_valu h:\27

workspace_id = 12 ***parameter_id*** 217 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_26
parameter_valu h:\26

workspace_id = 12 ***parameter_id*** 216 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_25
parameter_valu h:\25

workspace_id = 12 ***parameter_id*** 215 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_24
parameter_valu h:\24

workspace_id = 12 ***parameter_id*** 214 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_23
parameter_valu h:\23

workspace_id = 12 ***parameter_id*** 213 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_22
parameter_valu h:\22

workspace_id = 12 ***parameter_id*** 212 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_21
parameter_valu h:\21

workspace_id = 12 ***parameter_id*** 192 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_6
parameter_valu f:\6

workspace_id = 12 ***parameter_id*** 210 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_19
parameter_valu h:\19

workspace_id = 12 ***parameter_id*** 223 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_32
parameter_valu j:\32

workspace_id = 12 ***parameter_id*** 208 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_17
parameter_valu g:\17

workspace_id = 12 ***parameter_id*** 204 ***parameter_type =*** 0
parameter_name BCP_ROWS
parameter_valu 10000

workspace_id = 12 ***parameter_id*** 203 ***parameter_type =*** 0
parameter_name FLAT_FILE_PARALLELISM
parameter_valu 2

workspace_id = 12 ***parameter_id*** 202 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_16
parameter_valu g:\16

workspace_id = 12 ***parameter_id*** 201 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_15
parameter_valu g:\15

workspace_id = 12 ***parameter_id*** 200 ***parameter_type =*** 0
parameter_name FLATFILE_DIR_14
parameter_valu g:\14

workspace_id =	12	***parameter_id***	199	***parameter_type =***	0
parameter_name	FLATFILE_DIR_13				
parameter_valu	g:\13				
workspace_id =	12	***parameter_id***	198	***parameter_type =***	0
parameter_name	FLATFILE_DIR_12				
parameter_valu	g:\12				
workspace_id =	12	***parameter_id***	197	***parameter_type =***	0
parameter_name	FLATFILE_DIR_11				
parameter_valu	g:\11				
workspace_id =	12	***parameter_id***	196	***parameter_type =***	0
parameter_name	FLATFILE_DIR_10				
parameter_valu	g:\10				
workspace_id =	12	***parameter_id***	195	***parameter_type =***	0
parameter_name	FLATFILE_DIR_9				
parameter_valu	f:\9				
workspace_id =	12	***parameter_id***	211	***parameter_type =***	0
parameter_name	FLATFILE_DIR_20				
parameter_valu	h:\20				

Connection_dtls

workspace_id	*connection_name_id*	*connection_name*	*connection_string_name*	*connection_type*
12	91	Dynamic_connection_to_MASTER_Node4	MASTERDBCONNECTION_NODE4	2
12	90	Dynamic_connection_to_MASTER_Node3	MASTERDBCONNECTION_NODE3	2
12	89	Dynamic_connection_to_MASTER_Node2	MASTERDBCONNECTION_NODE2	2
12	88	Dynamic_connection_to_MASTER_Node1	MASTERDBCONNECTION_NODE1	2
12	70	Static_Connection_to_Master	MASTERDBCONNECTION	1
12	69	Static_Connection_to_DB	DBCONNECTION	1
12	68	Dynamic_Connection_to_Master	MASTERDBCONNECTION	2
12	67	Dynamic_Connection_to_DB	DBCONNECTION	2

Workspace_connections

workspace_i	12
connection_i	19
connection_name	MASTERDBCONNECTION
connection_valu	DRIVER=SQL Server;SERVER=%SERVER%;UID=sa;PWD=;
descriptio	
no_count_display	0
no_execute	0
parse_query_onl	0
ANSI_quoted_identifiers	0
ANSI_nulls	-1
show_query_pla	0
show_stats_tim	0
show_stats_i	0
parse_odbc_msg_prefix	-1
row_count	0
tsql_batch_separat	GO
query_time_out	0
server_languag	(Default)
character_translation	-1
regional_settings	0

workspace_i	12
connection_i	18
connection_name	DBCONNECTION
connection_valu	DRIVER=SQL Server;SERVER=%SERVER%;UID=sa;PWD=;DATABASE=%DBNAME%;
descriptio	
no_count_display	0
no_execute	0
parse_query_onl	0
ANSI_quoted_identifiers	0
ANSI_nulls	-1
show_query_pla	0
show_stats_tim	0
show_stats_i	0
parse_odbc_msg_prefix	-1
row_count	0
tsql_batch_separat	GO
query_time_out	0
server_languag	(Default)

character_translation -1
regional_settings 0

Att_steps

workspace_id = 12

step_label = SqlServer Startup ***step_id =*** 1087 ***global_flag =*** -1
sequence_no = 1 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 0
execution_mechanism = 2 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 3.0
start_directory = ***parent_version_no =*** 0.0
step_text = start "SqlServer" sqlservr %TRACEFLAGS%
%TOOLS_DIR%\Utility\wait4sql 40000

step_label = SqlServer Shutdown ***step_id =*** 1088 ***global_flag =*** -1
sequence_no = 2 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 0
execution_mechanism = 2 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.0
start_directory = ***parent_version_no =*** 0.0
step_text = osql -Usa -P -t10 -Q"shutdown"
%TOOLS_DIR%\Utility\wait4sql 200000

step_label = Wait For SQL Server ***step_id =*** 1089 ***global_flag =*** -1
sequence_no = 3 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 0
execution_mechanism = 2 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 0.0
step_text = %TOOLS_DIR%\Utility\wait4sql.exe 60000

step_label = Generate FlatFiles ***step_id =*** 1090 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 26.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Start SqlServer ***step_id =*** 1091 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 13.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Create database ***step_id =*** 1092 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 89.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Configure SqlServer ***step_id =*** 1093 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 65.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Create and Load Tables ***step_id =*** 1094 ***global_flag =*** 0
sequence_no = 5 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 93.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Create Indexes and Statistics ***step_id =*** 1095 ***global_flag =*** 0
sequence_no = 6 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 42.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Prep Database, End of Load ***step_id =*** 1096 ***global_flag =*** 0
sequence_no = 7 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 73.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Backup TPC-H Database (If not used for ACID) ***step_id =*** 1097 ***global_flag =*** 0
sequence_no = 8 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 17.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Capture Database and Table Space Used (Do Not Use on ***step_id =*** 1098 ***global_flag =*** 0
sequence_no = 9 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Generate Queries via QGen ***step_id =*** 1099 ***global_flag =*** 0
sequence_no = 10 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 9.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Validation (for SCALEFACTOR=1 Only) ***step_id =*** 1100 ***global_flag =*** 0
sequence_no = 11 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Generate Query Plans ***step_id =*** 1101 ***global_flag =*** 0
sequence_no = 12 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 8.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Generate FlatFiles in Parallel ***step_id =*** 1102 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1090 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 64
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 11.0
start_directory = ***parent_version_no =*** 26.0
step_text =

step_label = Generate Update Files ***step_id =*** 1103 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1090 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = ***version_no =*** 7.0
start_directory = %RF_FLATFILE_DIR% ***parent_version_no =*** 26.0
step_text = %TOOLS_DIR%\DBGEN\dbgen -q -b %TOOLS_DIR%\dists.dss -U %UPDATE_SETS% -s %SCALEFACTOR% -f -C %UPDATE_SETS% -i %FILES_PER_UPDATE_SET% -d %FILES_PER_UPDATE_SET%

step_label = Start SqlServer ***step_id =*** 1104 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1091 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = ***parent_version_no =*** 13.0
step_text = start sqlservr %TRACEFLAGS%

step_label = Create TPC-H Database ***step_id =*** 1105 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1092 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\%DBNAME%\CreateDatabase.sql ***version_no =*** 16.0
start_directory = Static_Connection_to_Master ***parent_version_no =*** 89.0
step_text =

step_label = Move TempDB ***step_id =*** 1108 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1093 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\%DBNAME%\tempdb\MoveTempDB.sql ***version_no =*** 22.0
start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 65.0
step_text =

step_label = ReSize TempDB ***step_id =*** 1109 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1093 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\%DBNAME%\tempdb\ReSizeTempDB.sql ***version_no =*** 22.0
start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 65.0
step_text =

step_label = (Drop/)Create Tables ***step_id =*** 1111 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1094 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 17.0
start_directory = ***parent_version_no =*** 93.0
step_text =

step_label = Parallel Partitioned Table Load ***step_id =*** 1112 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 1 ***parent_step_id =*** 1094 ***enabled_flag =*** -1
iterator_name = TABLE ***degree_parallelism*** %TABLE_LOAD_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 40.1
start_directory = ***parent_version_no =*** 93.0
step_text =

step_label = Parallel Load Simple Tables ***step_id =*** 1113 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 1 ***parent_step_id =*** 1094 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %TABLE_LOAD_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 15.0
start_directory = ***parent_version_no =*** 93.0
step_text =

step_label = Reset DB_Option ***step_id =*** 1119 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1096 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = ***version_no =*** 6.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 73.0
step_text = sp_dboption %DBNAME%, 'trunc. log on chkpt.',false
GO

step_label = Install Refresh Function Stored Procedures ***step_id =*** 1120 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 1 ***parent_step_id =*** 1096 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %MAX_STREAMS%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.0
start_directory = ***parent_version_no =*** 73.0
step_text =

step_label = Backup TPC-H Database (Only if using backup to satisfy ***step_id =*** 1121 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 1 ***parent_step_id =*** 1096 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 2.0
start_directory = ***parent_version_no =*** 73.0
step_text =

step_label = End of Load ***step_id =*** 1122 ***global_flag =*** 0
sequence_no = 5 ***step_level =*** 1 ***parent_step_id =*** 1096 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = ***version_no =*** 5.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 73.0
step_text =

```
UPDATE TPCH_AUX_TABLE SET LoadFinish = getdate()
GO

SELECT      LoadStart    AS 'Load Start TimeStamp',
     LoadFinish  AS 'Load Finish TimeStamp',
     QgenSeed  AS 'Generated QGen Seed'
FROM    TPCH_AUX_TABLE
GO
```

step_label = Verify TPC-H Load ***step_id =*** 1123 ***global_flag =*** 0
sequence_no = 6 ***step_level =*** 1 ***parent_step_id =*** 1096 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\Utility\VerifyTpchLoad.sql ***version_no =*** 2.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 73.0
step_text =

step_label = Generate QGEN Seed ***step_id =*** 1124 ***global_flag =*** 0

sequence_no = 7 ***step_level =*** 1 ***parent_step_id =*** 1096 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 4.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 73.0

step_text =

```
DECLARE @Finish datetime
DECLARE @seed0 integer

--
-- Get ending time of database load
--
SELECT @Finish=LoadFinish FROM TPCH_AUX_TABLE

--
-- Calculate seed per clause 2.1.3.3
--
SET @seed0 =
CONVERT(integer,100000000*DATEPART(MM,@Finish)+1000000*DATEPART(DD,@Finish)+10000*DAT
EPART(HH,@Finish)+100*DATEPART(MI,@Finish)+DATEPART(SS,@Finish))

--
-- Update the benchmark auxillary table
--
UPDATE TPCH_AUX_TABLE SET QgenSeed=@seed0

SELECT * from TPCH_AUX_TABLE
```

step_label = Create Backup Device(s) ***step_id =*** 1125 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1097 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = %SETUP_DIR%\%DBNAME%\CreateBackupDevices.sql ***version_no =*** 3.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 17.0

step_text =

step_label = Execute the backup ***step_id =*** 1126 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1097 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = %SETUP_DIR%\%DBNAME%\BackupDatabase.sql ***version_no =*** 3.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 17.0

step_text =

step_label = Execute DBCC UPDATEUSAGE ***step_id =*** 1127 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1098 ***enabled_flag =*** 0

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 4.0

step_text =

```
--
-- Correct any potential inaccuracies in the system tables before running sp_spaceused
--

dbcc updateusage (%DBNAME%)
GO

dbcc updateusage (tempdb)
GO
```

step_label = Execute SpaceUsed Procedure ***step_id =*** 1128 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1098 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 4.0

step_text =

```
sp_spaceused
GO
sp_spaceused 'REGION'
GO
sp_spaceused 'NATION'
GO
sp_spaceused 'PART'
GO
sp_spaceused 'SUPPLIER'
GO
sp_spaceused 'PARTSUPP'
GO
sp_spaceused 'CUSTOMER'
GO
sp_spaceused 'ORDERS'
GO
sp_spaceused 'LINEITEM'
GO
```

step_label = Execute Table Row Counts ***step_id =*** 1129 ***global_flag =*** 0

sequence_no = 3 ***step_level =*** 1 ***parent_step_id =*** 1098 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 1.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 4.0

step_text =

```
print 'Count of REGION Table'
GO
select count(*) from REGION
GO
print 'Count of NATION Table'
GO
select count(*) from NATION
GO
print 'Count of PART Table'
GO
select count(*) from PART
GO
print 'Count of SUPPLIER Table'
GO
select count(*) from SUPPLIER
GO
print 'Count of PARTSUPP Table'
GO
select count_big(*) from PARTSUPP
GO
print 'Count of CUSTOMER Table'
GO
select count(*) from CUSTOMER
GO
print 'Count of ORDERS Table'
GO
select count_big(*) from ORDERS
GO
print 'Count of LINEITEM Table'
GO
select count_big(*) from LINEITEM
GO
```

step_label = Execute Log File Spaceused ***step_id =*** 1130 ***global_flag =*** 0

sequence_no = 4 ***step_level =*** 1 ***parent_step_id =*** 1098 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 4.0

step_text = dbcc sqlperf(logspace)

step_label = Execute TempDB spaceused ***step_id =*** 1131 ***global_flag =*** 0
sequence_no = 5 ***step_level =*** 1 ***parent_step_id =*** 1098 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.0
step_text =

```
use tempdb
GO

sp_spaceused
GO

use %DBNAME%
GO
```

step_label = Generate Power Queries ***step_id =*** 1132 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1099 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 2.0
start_directory = ***parent_version_no =*** 9.0
step_text =

step_label = Generate Stream Queries ***step_id =*** 1133 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 1 ***parent_step_id =*** 1099 ***enabled_flag =*** -1
iterator_name = STREAM_NUM ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 2.0
start_directory = ***parent_version_no =*** 9.0
step_text =

step_label = Generate Validation Queries via QGEN ***step_id =*** 1134 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1100 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %MAX_STREAMS%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 1.0
step_text =

step_label = Execute Validation Queries ***step_id =*** 1135 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1100 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 1.0
step_text =

step_label = Relocate Validation Query Output Files ***step_id =*** 1136 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 1 ***parent_step_id =*** 1100 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = %VALIDATION_DIR% ***parent_version_no =*** 1.0
step_text =

```
::
:: Copy the StepMaster Query output file to the Validation\Run_Output directory
::
copy %OUTPUT_DIR%\Validation_Query_%QUERY%.out
%VALIDATION_DIR%\RUN_OUTPUT\Validation_Query_%QUERY%.out
```

step_label = Execute SHOWPLAN ALL for Each Query ***step_id =*** 1137 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1101 ***enabled_flag =*** -1

iterator_name = QUERY ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = %SETUP_DIR% ***parent_version_no =*** 8.0

step_text =

```
::
::  First Build the query with the appropriate SQL ShowPlan commands
::
copy %SETUP_DIR%\showplan_sql\set_showplan_all_on.sql
%SETUP_DIR%\showplan_queries\SP_ALL_%QUERY%.SQL
type  %QUERY_DIR%\Power\%QUERY%.SQL                    >>
%SETUP_DIR%\showplan_queries\SP_ALL_%QUERY%.SQL
type  %SETUP_DIR%\showplan_sql\set_showplan_all_off.sql    >>
%SETUP_DIR%\showplan_queries\SP_ALL_%QUERY%.SQL

::
::  Now execute the query, placing the output in %SETUP_DIR%\Showplan_Out
::
osql -l -t600 -Usa -P -w1000 -d %DBNAME% -e -i
%SETUP_DIR%\showplan_queries\SP_ALL_%QUERY%.sql -w 4096 -o
%SETUP_DIR%\showplan_Out\SP_ALL_%QUERY%.out
```

step_label = Execute SHOWPLAN TEXT for Each Query ***step_id =*** 1138 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1101 ***enabled_flag =*** -1

iterator_name = QUERY ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = %SETUP_DIR% ***parent_version_no =*** 8.0

step_text =

```
::
::  First Build the query with the appropriate SQL ShowPlan commands
::
copy %SETUP_DIR%\showplan_sql\set_showplan_text_on.sql
%SETUP_DIR%\showplan_queries\SP_TEXT_%QUERY%.SQL
type  %QUERY_DIR%\Power\%QUERY%.SQL                    >>
%SETUP_DIR%\showplan_queries\SP_TEXT_%QUERY%.SQL
type  %SETUP_DIR%\showplan_sql\set_showplan_text_off.sql    >>
%SETUP_DIR%\showplan_queries\SP_TEXT_%QUERY%.SQL

::
::  Now execute the query, placing the output in %SETUP_DIR%\Showplan_Out
::
osql -l -t600 -Usa -P -w1000 -d %DBNAME% -e -i
%SETUP_DIR%\showplan_queries\SP_TEXT_%QUERY%.sql -w 4096 -o
%SETUP_DIR%\showplan_Out\SP_TEXT_%QUERY%.out
```

step_label = Generate Flat Files to FlatFile_Dir_1 ***step_id =*** 1140 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 13.0

start_directory = %FLATFILE_DIR_1% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for REGION and NATION Tables
%TOOLS_DIR%\DBGen\dbgen -T l -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_2 ***step_id =*** 1141 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_2% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_3 ***step_id =*** 1142 ***global_flag =*** 0

sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 12.0

start_directory = %FLATFILE_DIR_3% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_4 ***step_id =*** 1143 ***global_flag =*** 0

sequence_no = 4 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 10.0

start_directory = %FLATFILE_DIR_4% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Create Auxilliary Table ***step_id =*** 1145 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1111 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = %SETUP_DIR%\Utility\CreateBuildTimer.sql ***version_no =*** 9.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 17.0

step_text =

step_label = Create Base Tables ***step_id =*** 1146 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1111 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = %SETUP_DIR%\%DBNAME%\CreateTables.sql ***version_no =*** 7.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 17.0

step_text =

step_label = Load Nation Table ***step_id =*** 1155 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1113 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 1.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 15.0

step_text =

```
bulk insert %DBNAME%..NATION
from '%FLATFILE_DIR_1%\nation.tbl'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock)
```

step_label = Load Region Table ***step_id =*** 1156 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1113 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 1.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 15.0

step_text =

```
bulk insert %DBNAME%..REGION
from '%FLATFILE_DIR_1%\region.tbl'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock)
```

step_label = Create Backup Device(s) (For ACID) ***step_id =*** 1164 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1121 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = %SETUP_DIR%\%DBNAME%\CreateBackupDevices.sql ***version_no =*** 0.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 2.0

step_text =

step_label = Execute the backup (For ACID) ***step_id =*** 1165 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1121 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\%DBNAME%\BackupDatabase.sql ***version_no =*** 0.0
start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 2.0
step_text =

step_label = Install RF1 Stored Procedure(s) ***step_id =*** 1166 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1120 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\CreateRF1Proc.sql ***version_no =*** 7.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 4.0
step_text =

step_label = Install RF2 Stored Procedure(s) ***step_id =*** 1167 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1120 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\CreateRF2Proc.sql ***version_no =*** 6.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 4.0
step_text =

step_label = Generate Power Query Directory ***step_id =*** 1168 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1132 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = %RUN_DIR% ***parent_version_no =*** 2.0
step_text = if not exist %QUERY_DIR%\Power mkdir %QUERY_DIR%\Power

step_label = Generate QGen Command File ***step_id =*** 1169 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1132 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = %TEMPLATE_DIR% ***parent_version_no =*** 2.0

step_text =

```
::
:: First use OSQL to grab the QgenSeed value from TPCH_AUX_TABLE
::
osql -Usa -P -n -d%DBNAME% -w 255 -i%SETUP_DIR%\Generate\GenQGENcmd.sql >
%SETUP_DIR%\Generate\QgenCmd.cmd
```

step_label = Parallel Power Query Generation ***step_id =*** 1170 ***global_flag =*** 0

sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1132 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** %MAX_STREAMS%

execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = ***parent_version_no =*** 2.0

step_text =

step_label = Set Seed Value for Stream ***step_id =*** 1171 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1133 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 2.0

step_text =

```
--
--    Increment QGen Seed in TPCH_AUX_TABLE
--
UPDATE   TPCH_AUX_TABLE
SET      QgenSeed = QgenSeed + %STREAM_NUM%
```

step_label = Create Query Stream Directories ***step_id =*** 1172 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1133 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = %QUERY_DIR% ***parent_version_no =*** 2.0

step_text = if not exist %QUERY_DIR%\STREAM%STREAM_NUM% mkdir %QUERY_DIR%\STREAM%STREAM_NUM%

step_label = Generate QGen Stream Command File ***step_id =*** 1173 ***global_flag =*** 0

sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1133 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = %TEMPLATE_DIR% ***parent_version_no =*** 2.0

step_text = ::
:: First use OSQL to grab the QgenSeed value from TPCH_AUX_TABLE
::
osql -Usa -P -n -d%DBNAME% -w 255 -i%SETUP_DIR%\Generate\GenQgenStreamCmd.sql > %SETUP_DIR%\Generate\QgenStreamCmd.cmd

step_label = Parallel Stream Query Generation ***step_id =*** 1174 ***global_flag =*** 0

sequence_no = 4 ***step_level =*** 2 ***parent_step_id =*** 1133 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** %MAX_STREAMS%

execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = ***parent_version_no =*** 2.0

step_text =

step_label = Re-set QGen Seed Value ***step_id =*** 1175 ***global_flag =*** 0

sequence_no = 5 ***step_level =*** 2 ***parent_step_id =*** 1133 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 2.0

step_text =

```
--
--  Resets the QGen seed kept in the temporary table
--
UPDATE   TPCH_AUX_TABLE
SET      QgenSeed  =  QgenSeed - %STREAM_NUM%
```

step_label = Generate Validation Queries ***step_id =*** 1176 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1134 ***enabled_flag =*** -1

iterator_name = QUERY ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = %TEMPLATE_DIR% ***parent_version_no =*** 0.0

step_text =

```
%TOOLS_DIR%\QGen\qgen -d -b %TOOLS_DIR%\dists.dss  %QUERY% >
%VALIDATION_DIR%\Queries\v%QUERY%.sql
```

step_label = Validation Query 1 ***step_id =*** 1177 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = %VALIDATION_DIR%\Queries\v1.sql ***version_no =*** 0.0

start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0

step_text =

step_label = Validation Query 2 ***step_id =*** 1178 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v2.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 3 ***step_id =*** 1179 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v3.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 4 ***step_id =*** 1180 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v4.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 5 ***step_id =*** 1181 ***global_flag =*** 0
sequence_no = 5 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v5.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 6 ***step_id =*** 1182 ***global_flag =*** 0
sequence_no = 6 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v6.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 7 ***step_id =*** 1183 ***global_flag =*** 0
sequence_no = 7 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v7.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 8 ***step_id =*** 1184 ***global_flag =*** 0
sequence_no = 8 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v8.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 9 ***step_id =*** 1185 ***global_flag =*** 0
sequence_no = 9 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v9.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 10 ***step_id =*** 1186 ***global_flag =*** 0
sequence_no = 10 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v10.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 11 ***step_id =*** 1187 ***global_flag =*** 0
sequence_no = 11 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v11.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 12 ***step_id =*** 1188 ***global_flag =*** 0
sequence_no = 12 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v12.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 13 ***step_id =*** 1189 ***global_flag =*** 0
sequence_no = 13 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v13.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 14 ***step_id =*** 1190 ***global_flag =*** 0
sequence_no = 14 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v14.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 15 ***step_id =*** 1191 ***global_flag =*** 0
sequence_no = 15 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v15.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 16 ***step_id =*** 1192 ***global_flag =*** 0
sequence_no = 16 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v16.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 17 ***step_id =*** 1193 ***global_flag =*** 0
sequence_no = 17 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v17.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 18 ***step_id =*** 1194 ***global_flag =*** 0
sequence_no = 18 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v18.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 19 ***step_id =*** 1195 ***global_flag =*** 0
sequence_no = 19 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v19.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 20 ***step_id =*** 1196 ***global_flag =*** 0
sequence_no = 20 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v20.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 21 ***step_id =*** 1197 ***global_flag =*** 0
sequence_no = 21 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v21.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Validation Query 22 ***step_id =*** 1198 ***global_flag =*** 0
sequence_no = 22 ***step_level =*** 2 ***parent_step_id =*** 1135 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %VALIDATION_DIR%\Queries\v22.sql ***version_no =*** 0.0
start_directory = Static_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Power - Execute Generated QGen Command File ***step_id =*** 1199 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1170 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\Generate\QgenCmd.cmd ***version_no =*** 0.0
start_directory = %TEMPLATE_DIR% ***parent_version_no =*** 0.0
step_text =

step_label = Throughput - Execute Generated QGen Command File ***step_id =*** 1200 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1174 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\Generate\QgenStreamCmd.cmd ***version_no =*** 0.0
start_directory = %TEMPLATE_DIR% ***parent_version_no =*** 0.0
step_text =

step_label = Set SEED to the Unisys 6/2005 publication ***step_id =*** 1277 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1099 ***enabled_flag =*** 0

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 1.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 9.0

step_text =

```
-- Update the benchmark auxillary table
-- Use the Compaq seed for the 1253.3 QphH result (load end at (1999) 11-01 18:01:42
--
UPDATE TPCH_AUX_TABLE SET QgenSeed=619193122

SELECT * from TPCH_AUX_TABLE
```

step_label = Set Correlation ***step_id =*** 1343 ***global_flag =*** 0

sequence_no = 5 ***step_level =*** 1 ***parent_step_id =*** 1095 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 2.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 42.0

step_text = alter database %DBNAME% set date_correlation_optimization ON

step_label = Create Statistics ***step_id =*** 1358 ***global_flag =*** 0

sequence_no = 4 ***step_level =*** 1 ***parent_step_id =*** 1095 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 2.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 42.0

step_text = sp_createstats

step_label = Generate Flat Files to FlatFile_Dir_5 ***step_id =*** 1359 ***global_flag =*** 0

sequence_no = 5 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_5% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_6 ***step_id =*** 1360 ***global_flag =*** 0

sequence_no = 6 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_6% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_7 ***step_id =*** 1361 ***global_flag =*** 0

sequence_no = 7 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_7% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_8 ***step_id =*** 1362 ***global_flag =*** 0

sequence_no = 8 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_8% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Load Partitioned Tables from FlatFile_Dir_1 ***step_id =*** 1363 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1388 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 22.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 2.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_1%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_2 ***step_id =*** 1364 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1389 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 22.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 3.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_2%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_3 ***step_id =*** 1365 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1390 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_3%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_4 ***step_id =*** 1366 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1391 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_4%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_5 ***step_id =*** 1367 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1392 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_5%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_6 ***step_id =*** 1368 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1393 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_6%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_7 ***step_id =*** 1369 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1394 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_7%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_8 ***step_id =*** 1370 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1395 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_8%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_9 ***step_id =*** 1371 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1396 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_9%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_10 ***step_id =*** 1372 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1397 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_10%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_11 ***step_id =*** 1373 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1398 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_11%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_12 ***step_id =*** 1374 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1399 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_12%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_13 ***step_id =*** 1375 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1400 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_13%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_14 ***step_id =*** 1376 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1401 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 21.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_14%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_15 ***step_id =*** 1377 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1402 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_15%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_16 ***step_id =*** 1378 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1403 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 4.1

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_16%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Generate Flat Files to FlatFile_Dir_9 ***step_id =*** 1379 ***global_flag =*** 0

sequence_no = 9 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_9% ***parent_version_no =*** 11.0

step_text =
```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_10 ***step_id =*** 1380 ***global_flag =*** 0

sequence_no = 10 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_10% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_11 ***step_id =*** 1381 ***global_flag =*** 0

sequence_no = 11 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_11% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_12 ***step_id =*** 1382 ***global_flag =*** 0

sequence_no = 12 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_12% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_13 ***step_id =*** 1383 ***global_flag =*** 0

sequence_no = 13 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_13% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_14 ***step_id =*** 1384 ***global_flag =*** 0

sequence_no = 14 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_14% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_15 ***step_id =*** 1385 ***global_flag =*** 0

sequence_no = 15 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_15% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_16 ***step_id =*** 1386 ***global_flag =*** 0

sequence_no = 16 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_16% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Files 1 ***step_id =*** 1388 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%

execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***

step_file_name = ***version_no =*** 2.1

start_directory = ***parent_version_no =*** 40.1

step_text =

step_label = Files 2 ***step_id =*** 1389 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%

execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***

step_file_name = ***version_no =*** 3.1

start_directory = ***parent_version_no =*** 40.1

step_text =

step_label = Files 3 ***step_id =*** 1390 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 4 ***step_id =*** 1391 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 5 ***step_id =*** 1392 ***global_flag =*** 0
sequence_no = 5 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 6 ***step_id =*** 1393 ***global_flag =*** 0
sequence_no = 6 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 7 ***step_id =*** 1394 ***global_flag =*** 0
sequence_no = 7 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 8 ***step_id =*** 1395 ***global_flag =*** 0
sequence_no = 8 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 9 ***step_id =*** 1396 ***global_flag =*** 0
sequence_no = 9 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 10 ***step_id =*** 1397 ***global_flag =*** 0
sequence_no = 10 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 11 ***step_id =*** 1398 ***global_flag =*** 0
sequence_no = 11 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 12 ***step_id =*** 1399 ***global_flag =*** 0
sequence_no = 12 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 13 ***step_id =*** 1400 ***global_flag =*** 0
sequence_no = 13 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 14 ***step_id =*** 1401 ***global_flag =*** 0
sequence_no = 14 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 15 ***step_id =*** 1402 ***global_flag =*** 0
sequence_no = 15 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 16 ***step_id =*** 1403 ***global_flag =*** 0
sequence_no = 16 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 4.1
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Create FK Constraints ***step_id =*** 1441 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1095 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\%DBNAME%\createFK.sql ***version_no =*** 2.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 42.0
step_text =

step_label = Set Database Options ***step_id =*** 1447 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1094 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 12.0

start_directory = Static_Connection_to_Master ***parent_version_no =*** 93.0

step_text =

```
sp_dboption %DBNAME%, 'trunc. log on chkpt.',true
GO
sp_dboption '%DBNAME%','auto create statistics','OFF'
GO
sp_dboption '%DBNAME%','auto update statistics','OFF'
GO
alter database %DBNAME% set PAGE_VERIFY NONE
GO
```

step_label = Load Start Timestamp ***step_id =*** 1448 ***global_flag =*** 0

sequence_no = 3 ***step_level =*** 1 ***parent_step_id =*** 1093 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 15.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 65.0

step_text =

```
--    Create temporary table for timing in the Master Database
--
--            This is just temporary until we build the TPCH_AUX_TABLE later
--

--
-- Delete any existing tpch_temp_timer table
--
if exists ( select name from sysobjects where name = 'tpch_temp_timer' )
      drop table tpch_temp_timer

--
-- Create the temporary table
--
create table tpch_temp_timer
(
      load_start_time                              datetime
)

--
-- Store the starting time in the temporary table
--
insert            into tpch_temp_timer values (getdate())
```

step_label = Set sp_configure Options ***step_id =*** 1449 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 1 ***parent_step_id =*** 1093 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\Utility\conf_tpch.sql ***version_no =*** 20.0
start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 65.0
step_text =

step_label = Create Indexes 1 ***step_id =*** 1450 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1095 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\%DBNAME%\CreateIndexes_1.sql ***version_no =*** 8.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 42.0
step_text =

step_label = Create Indexes 2 ***step_id =*** 1451 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 1 ***parent_step_id =*** 1095 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\%DBNAME%\CreateIndexes_2.sql ***version_no =*** 5.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 42.0
step_text =

step_label = Drop Load Filegroup ***step_id =*** 1453 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1096 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\%DBNAME%\DropLoadFG.sql ***version_no =*** 0.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 73.0
step_text =

step_label = Generate Flat Files to FlatFile_Dir_17 ***step_id =*** 1454 ***global_flag =*** 0

sequence_no = 17 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_17% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_18 ***step_id =*** 1455 ***global_flag =*** 0

sequence_no = 18 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_18% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_19 ***step_id =*** 1456 ***global_flag =*** 0

sequence_no = 19 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 13.0

start_directory = %FLATFILE_DIR_19% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for REGION and NATION Tables
%TOOLS_DIR%\DBGen\dbgen -T l -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_20 ***step_id =*** 1457 ***global_flag =*** 0

sequence_no = 20 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 13.0

start_directory = %FLATFILE_DIR_20% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for REGION and NATION Tables
%TOOLS_DIR%\DBGen\dbgen -T l -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_21 ***step_id =*** 1458 ***global_flag =*** 0

sequence_no = 21 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 13.0

start_directory = %FLATFILE_DIR_21% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for REGION and NATION Tables
%TOOLS_DIR%\DBGen\dbgen -T l -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_22 ***step_id =*** 1459 ***global_flag =*** 0

sequence_no = 22 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_22% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_23 ***step_id =*** 1460 ***global_flag =*** 0

sequence_no = 23 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_23% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_24 ***step_id =*** 1461 ***global_flag =*** 0

sequence_no = 24 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_24% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_25 ***step_id =*** 1462 ***global_flag =*** 0

sequence_no = 25 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_25% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_26 ***step_id =*** 1463 ***global_flag =*** 0

sequence_no = 26 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_26% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_27 ***step_id =*** 1464 ***global_flag =*** 0

sequence_no = 27 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_27% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_28 ***step_id =*** 1465 ***global_flag =*** 0

sequence_no = 28 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_28% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_29 ***step_id =*** 1466 ***global_flag =*** 0

sequence_no = 29 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 11.0

start_directory = %FLATFILE_DIR_29% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_30 ***step_id =*** 1467 ***global_flag =*** 0

sequence_no = 30 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 12.0

start_directory = %FLATFILE_DIR_30% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_31 ***step_id =*** 1468 ***global_flag =*** 0

sequence_no = 31 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 12.0

start_directory = %FLATFILE_DIR_31% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Generate Flat Files to FlatFile_Dir_32 ***step_id =*** 1469 ***global_flag =*** 0

sequence_no = 32 ***step_level =*** 2 ***parent_step_id =*** 1102 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 1

execution_mechanism = 2 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 13.0

start_directory = %FLATFILE_DIR_32% ***parent_version_no =*** 11.0

step_text =

```
:: Generate Data for CUSTOMER Table
%TOOLS_DIR%\DBGen\dbgen -T c -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for ORDERS and LINEITEM Tables
%TOOLS_DIR%\DBGen\dbgen -T o -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for PARTS/PARTSUPP Table
%TOOLS_DIR%\DBGen\dbgen -T p -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%

:: Generate Data for SUPPLIER Table
%TOOLS_DIR%\DBGen\dbgen -T s -fF -q -b %TOOLS_DIR%\dists.dss -s%SCALEFACTOR% -
C%TOTAL_LOAD_FILES_PER_TABLE% -S%PARALLEL_PROCESS%
```

step_label = Files 17 ***step_id =*** 1470 ***global_flag =*** 0

sequence_no = 17 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%

execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = ***parent_version_no =*** 40.1

step_text =

step_label = Files 18 ***step_id =*** 1471 ***global_flag =*** 0

sequence_no = 18 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%

execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = ***parent_version_no =*** 40.1

step_text =

step_label = Files 19 ***step_id =*** 1472 ***global_flag =*** 0
sequence_no = 19 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 20 ***step_id =*** 1473 ***global_flag =*** 0
sequence_no = 20 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 21 ***step_id =*** 1474 ***global_flag =*** 0
sequence_no = 21 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 22 ***step_id =*** 1475 ***global_flag =*** 0
sequence_no = 22 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 23 ***step_id =*** 1476 ***global_flag =*** 0
sequence_no = 23 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 24 ***step_id =*** 1477 ***global_flag =*** 0
sequence_no = 24 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 25 ***step_id =*** 1478 ***global_flag =*** 0
sequence_no = 25 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 26 ***step_id =*** 1479 ***global_flag =*** 0
sequence_no = 26 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 27 ***step_id =*** 1480 ***global_flag =*** 0
sequence_no = 27 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 28 ***step_id =*** 1481 ***global_flag =*** 0
sequence_no = 28 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 29 ***step_id =*** 1482 ***global_flag =*** 0
sequence_no = 29 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 30 ***step_id =*** 1483 ***global_flag =*** 0
sequence_no = 30 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 31 ***step_id =*** 1484 ***global_flag =*** 0
sequence_no = 31 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Files 32 ***step_id =*** 1485 ***global_flag =*** 0
sequence_no = 32 ***step_level =*** 2 ***parent_step_id =*** 1112 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FLAT_FILE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 40.1
step_text =

step_label = Load Partitioned Tables from FlatFile_Dir_17 ***step_id =*** 1486 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1470 ***enabled_flag =*** -1
iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = ***version_no =*** 22.0
start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0
step_text =

```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_17%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_161 ***step_id =*** 1487 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1471 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_18%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_162 ***step_id =*** 1488 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1472 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_19%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_163 ***step_id =*** 1489 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1473 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_20%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_164 ***step_id =*** 1490 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1474 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_21%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_165 ***step_id =*** 1491 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1475 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_22%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_166 ***step_id =*** 1492 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1476 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_23%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_167 ***step_id =*** 1493 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1477 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_24%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_168 ***step_id =*** 1494 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1478 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_25%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_169 ***step_id =*** 1495 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1479 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_26%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_1610 ***step_id =*** 1496 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1480 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_27%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_1611 ***step_id =*** 1497 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1481 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_28%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_1612 ***step_id =*** 1498 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1482 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text =
```
bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_29%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)
```

step_label = Load Partitioned Tables from FlatFile_Dir_1613 ***step_id =*** 1499 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1483 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text = bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_30%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)

step_label = Load Partitioned Tables from FlatFile_Dir_1614 ***step_id =*** 1500 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1484 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text = bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_31%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)

step_label = Load Partitioned Tables from FlatFile_Dir_1615 ***step_id =*** 1501 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1485 ***enabled_flag =*** -1

iterator_name = PARALLEL_PROCESS ***degree_parallelism*** 2

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = ***version_no =*** 20.0

start_directory = Dynamic_Connection_to_Master ***parent_version_no =*** 0.0

step_text = bulk insert %DBNAME%..%TABLE%
from '%FLATFILE_DIR_32%\%TABLE%.tbl.%PARALLEL_PROCESS%'
with (FieldTerminator = '|', RowTerminator ='|\n',tablock,ROWS_PER_BATCH=%BCP_ROWS%)

Step_constraints

workspace_id	***constraint_id***	***step_id***	***version_no***	***constraint_type***	***global_step_id***	***global_version_no***	***sequence_no***

12	33	1108	22.0	2	1087	3.0	1
12	35	1108	22.0	2	1088	4.0	0
12	38	1108	22.0	2	1089	1.0	2
12	37	1104	1.0	2	1089	1.0	0
12	37	1104	1.0	2	1089	0.0	0

Iterator_values

workspace_id	*step_id*	*version_no*	*type*	*iterator_value*	*sequence_no*
12	1361	11.0	1	13	0
12	1112	40.1	4	SUPPLIER	5
12	1365	20.0	3	1	0
12	1365	20.0	1	5	0
12	1364	22.0	2	4	0
12	1364	22.0	1	3	0
12	1364	22.0	3	1	0
12	1363	22.0	3	1	0
12	1363	22.0	2	2	0
12	1363	22.0	1	1	0
12	1362	11.0	1	15	0
12	1362	11.0	2	16	0
12	1366	20.0	1	7	0
12	1361	11.0	3	1	0
12	1366	20.0	3	1	0
12	1361	11.0	2	14	0
12	1360	11.0	2	12	0
12	1360	11.0	3	1	0
12	1360	11.0	1	11	0
12	1359	11.0	1	9	0
12	1359	11.0	2	10	0
12	1359	11.0	3	1	0

12	1200	0.0	1 1	0
12	1200	0.0	2 22	0
12	1200	0.0	3 1	0
12	1199	0.0	2 22	0
12	1362	11.0	3 1	0
12	1370	20.0	2 16	0
12	1374	20.0	2 24	0
12	1374	20.0	3 1	0
12	1374	20.0	1 23	0
12	1373	20.0	1 21	0
12	1373	20.0	2 22	0
12	1373	20.0	3 1	0
12	1372	20.0	2 20	0
12	1372	20.0	3 1	0
12	1372	20.0	1 19	0
12	1371	20.0	3 1	0
12	1371	20.0	2 18	0
12	1365	20.0	2 6	0
12	1370	20.0	3 1	0
12	1176	0.0	1 1	0
12	1370	20.0	1 15	0
12	1369	20.0	2 14	0
12	1369	20.0	1 13	0
12	1369	20.0	3 1	0
12	1368	20.0	2 12	0
12	1368	20.0	3 1	0
12	1368	20.0	1 11	0
12	1367	20.0	1 9	0
12	1367	20.0	3 1	0
12	1367	20.0	2 10	0
12	1366	20.0	2 8	0

12	1371	20.0	1	17	0
12	1455	11.0	2	36	0
12	1459	11.0	3	1	0
12	1459	11.0	1	43	0
12	1458	13.0	1	41	0
12	1458	13.0	2	42	0
12	1458	13.0	3	1	0
12	1457	13.0	1	39	0
12	1457	13.0	2	40	0
12	1457	13.0	3	1	0
12	1456	13.0	3	1	0
12	1456	13.0	2	38	0
12	1456	13.0	1	37	0
12	1199	0.0	3	1	0
12	1455	11.0	3	1	0
12	1460	11.0	3	1	0
12	1454	11.0	1	33	0
12	1454	11.0	3	1	0
12	1454	11.0	2	34	0
12	1133	2.0	1	1	0
12	1133	2.0	2	%MAX_STREAMS%	0
12	1133	2.0	3	1	0
12	1112	40.1	4	PARTSUPP	3
12	1112	40.1	4	CUSTOMER	4
12	1112	40.1	4	ORDERS	2
12	1112	40.1	4	PART	1
12	1112	40.1	4	LINEITEM	0
12	1455	11.0	1	35	0
12	1140	13.0	2	2	0
12	1375	20.0	1	25	0
12	1176	0.0	2	22	0

12	1176	0.0	3 1	0
12	1143	10.0	2 8	0
12	1143	10.0	1 7	0
12	1143	10.0	3 1	0
12	1142	12.0	2 6	0
12	1142	12.0	3 1	0
12	1142	12.0	1 5	0
12	1141	11.0	3 1	0
12	1141	11.0	1 3	0
12	1459	11.0	2 44	0
12	1140	13.0	1 1	0
12	1460	11.0	1 45	0
12	1140	13.0	3 1	0
12	1138	0.0	3 1	0
12	1138	0.0	1 1	0
12	1138	0.0	2 22	0
12	1137	0.0	3 1	0
12	1137	0.0	2 22	0
12	1137	0.0	1 1	0
12	1136	0.0	1 1	0
12	1136	0.0	2 22	0
12	1136	0.0	3 1	0
12	1460	11.0	2 46	0
12	1199	0.0	1 1	0
12	1141	11.0	2 4	0
12	1487	20.0	3 1	0
12	1492	20.0	3 1	0
12	1491	20.0	2 44	0
12	1491	20.0	1 43	0
12	1491	20.0	3 1	0
12	1490	20.0	3 1	0

12	1490	20.0	2 42	0
12	1490	20.0	1 41	0
12	1489	20.0	3 1	0
12	1489	20.0	2 40	0
12	1489	20.0	1 39	0
12	1488	20.0	1 37	0
12	1467	12.0	1 59	0
12	1488	20.0	3 1	0
12	1493	20.0	1 47	0
12	1487	20.0	1 35	0
12	1487	20.0	2 36	0
12	1486	22.0	3 1	0
12	1486	22.0	2 34	0
12	1486	22.0	1 33	0
12	1469	13.0	2 64	0
12	1469	13.0	1 63	0
12	1469	13.0	3 1	0
12	1468	12.0	3 1	0
12	1468	12.0	2 62	0
12	1375	20.0	2 26	0
12	1488	20.0	2 38	0
12	1497	20.0	1 55	0
12	1501	20.0	2 64	0
12	1501	20.0	1 63	0
12	1500	20.0	3 1	0
12	1500	20.0	2 62	0
12	1500	20.0	1 61	0
12	1499	20.0	2 60	0
12	1499	20.0	1 59	0
12	1499	20.0	3 1	0
12	1498	20.0	2 58	0

12	1498	20.0	1 57	0
12	1498	20.0	3 1	0
12	1492	20.0	1 45	0
12	1497	20.0	2 56	0
12	1492	20.0	2 46	0
12	1496	20.0	3 1	0
12	1496	20.0	2 54	0
12	1496	20.0	1 53	0
12	1495	20.0	3 1	0
12	1495	20.0	2 52	0
12	1495	20.0	1 51	0
12	1494	20.0	3 1	0
12	1494	20.0	2 50	0
12	1494	20.0	1 49	0
12	1493	20.0	3 1	0
12	1493	20.0	2 48	0
12	1467	12.0	2 60	0
12	1497	20.0	3 1	0
12	1379	11.0	1 17	0
12	1383	11.0	1 25	0
12	1383	11.0	3 1	0
12	1383	11.0	2 26	0
12	1382	11.0	1 23	0
12	1382	11.0	2 24	0
12	1382	11.0	3 1	0
12	1381	11.0	1 21	0
12	1381	11.0	3 1	0
12	1381	11.0	2 22	0
12	1380	11.0	1 19	0
12	1380	11.0	2 20	0
12	1468	12.0	1 61	0

12	1379	11.0	2 18	0
12	1384	11.0	2 28	0
12	1379	11.0	3 1	0
12	1378	20.0	3 1	0
12	1378	20.0	2 32	0
12	1378	20.0	1 31	0
12	1377	20.0	2 30	0
12	1377	20.0	3 1	0
12	1377	20.0	1 29	0
12	1376	21.0	2 28	0
12	1376	21.0	3 1	0
12	1376	21.0	1 27	0
12	1501	20.0	3 1	0
12	1380	11.0	3 1	0
12	1462	11.0	2 50	0
12	1467	12.0	3 1	0
12	1466	11.0	1 57	0
12	1466	11.0	3 1	0
12	1466	11.0	2 58	0
12	1465	11.0	1 55	0
12	1465	11.0	2 56	0
12	1465	11.0	3 1	0
12	1464	11.0	1 53	0
12	1464	11.0	2 54	0
12	1464	11.0	3 1	0
12	1463	11.0	1 51	0
12	1384	11.0	1 27	0
12	1463	11.0	3 1	0
12	1384	11.0	3 1	0
12	1462	11.0	3 1	0
12	1462	11.0	1 49	0

12	1461	11.0	1	47	0
12	1461	11.0	3	1	0
12	1461	11.0	2	48	0
12	1386	11.0	2	32	0
12	1386	11.0	3	1	0
12	1386	11.0	1	31	0
12	1385	11.0	3	1	0
12	1385	11.0	2	30	0
12	1385	11.0	1	29	0
12	1375	20.0	3	1	0
12	1463	11.0	2	52	0

Att_workspaces

workspace_id	*workspace_name*	*archived_flag*
13	Power/Throughput Runs - TPC-H Kit V1.01d (Spec Revision 2.3.0)	0

Workspace_parameters

workspace_id = 13 ***parameter_id*** 178 ***parameter_type =*** 3
parameter_name DEFAULT_DIR
parameter_valu C:\OUTPUT\2005-Nov-Audit

workspace_id = 13 ***parameter_id*** 170 ***parameter_type =*** 3
parameter_name OUTPUT_DIR
parameter_valu C:\OUTPUT\2005-N~1\115

workspace_id = 13 ***parameter_id*** 171 ***parameter_type =*** 0
parameter_name QUERY_DIR
parameter_valu %RUN_DIR%\Queries-8

workspace_id = 13 ***parameter_id*** 172 ***parameter_type =*** 0
parameter_name DBNAME
parameter_valu tpch3000g

workspace_id = 13 ***parameter_id*** 173 ***parameter_type =*** 0
parameter_name DELETE_PARALLELISM
parameter_valu 96

workspace_id = 13 ***parameter_id*** 174 ***parameter_type =*** 0
parameter_name INSERT_PARALLELISM
parameter_valu 64

workspace_id =	13	***parameter_id***	175	***parameter_type =***	0
parameter_name	DELETE_EXECUTIONS				
parameter_valu	288				

workspace_id =	13	***parameter_id***	169	***parameter_type =***	0
parameter_name	RUN_DIR				
parameter_valu	%KIT_DIR%\Run				

workspace_id = 13 ***parameter_id*** 177 ***parameter_type =*** 0
parameter_name MAX_STREAMS
parameter_valu 8

workspace_id = 13 ***parameter_id*** 207 ***parameter_type =*** 0
parameter_name FILES_PER_UPDATE_SET
parameter_valu 64

workspace_id = 13 ***parameter_id*** 180 ***parameter_type =*** 0
parameter_name TOOLS_DIR
parameter_valu %KIT_DIR%\Tools

workspace_id = 13 ***parameter_id*** 181 ***parameter_type =*** 0
parameter_name BATCH_SIZE
parameter_valu 30

workspace_id = 13 ***parameter_id*** 182 ***parameter_type =*** 0
parameter_name KIT_DIR
parameter_valu C:\mstpch.101d.for3TB

workspace_id = 13 ***parameter_id*** 183 ***parameter_type =*** 3
parameter_name RUN_ID
parameter_valu 115

workspace_id = 13 ***parameter_id*** 184 ***parameter_type =*** 0
parameter_name TRACEFLAGS
parameter_valu -c -x -E -T834 -T2301

workspace_id = 13 ***parameter_id*** 186 ***parameter_type =*** 0
parameter_name SETUP_DIR
parameter_valu %KIT_DIR%\Setup

workspace_id = 13 ***parameter_id*** 206 ***parameter_type =*** 0
parameter_name RF_FLATFILE_DIR
parameter_valu I:\RF_FlatFile_DIR

workspace_id = 13 ***parameter_id*** 176 ***parameter_type =*** 0
parameter_name INSERT_EXECUTIONS
parameter_valu 192

Connection_dtls

workspace_id	connection_name_id	connection_name	connection_string_name	connection_type
13	87	Dynamic_Connection_to_Master	MASTERCONNECTION	2
13	84	Power_Dynamic_DB_Connection	DBCONNECTION	2
13	83	Throughput_Static_Stream_10_Connection	DBCONNECTION	1
13	82	Throughput_Static_Stream_9_Connection	DBCONNECTION	1
13	81	Throughput_Static_Stream_8_Connection	DBCONNECTION	1
13	80	Throughput_Static_Stream_7_Connection	DBCONNECTION	1
13	79	Throughput_Static_Stream_6_Connection	DBCONNECTION	1
13	78	Throughput_Static_Stream_5_Connection	DBCONNECTION	1
13	77	Throughput_Static_Stream_4_Connection	DBCONNECTION	1
13	76	Throughput_Static_Stream_3_Connection	DBCONNECTION	1
13	75	Throughput_Static_Stream_2_Connection	DBCONNECTION	1
13	74	Throughput_Static_Stream_1_Connection	DBCONNECTION	1
13	73	Throughput_RF_Connection	DBCONNECTION	2
13	72	Dynamic_Connection_to_DB	DBCONNECTION	2
13	71	Power_Static_DB_Connection	DBCONNECTION	1

Workspace_connections

workspace_i	13
connection_i	21
connection_name	MASTERCONNECTION
connection_valu	DRIVER=SQL Server;SERVER=192.61.207.34;UID=sa;PWD=;
descriptio	
no_count_display	0
no_execute	0
parse_query_onl	0
ANSI_quoted_identifiers	0
ANSI_nulls	-1
show_query_pla	0
show_stats_tim	0
show_stats_i	0
parse_odbc_msg_prefix	-1
row_count	0
tsql_batch_separat	GO
query_time_out	0
server_languag	(Default)
character_translation	-1
regional_settings	0

workspace_i	13
connection_i	20
connection_name	DBCONNECTION
connection_valu	DRIVER=SQL Server;SERVER=192.61.207.34;UID=sa;PWD=;DATABASE=%DBNAME%;
descriptio	
no_count_display	0
no_execute	0
parse_query_onl	0
ANSI_quoted_identifiers	0
ANSI_nulls	-1
show_query_pla	0
show_stats_tim	0
show_stats_i	0
parse_odbc_msg_prefix	-1
row_count	0
tsql_batch_separat	GO
query_time_out	0
server_languag	(Default)

character_translation -1
regional_settings 0

Att_steps

workspace_id = 13

step_label = Clear any Outstanding Semaphores ***step_id =*** 1201 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 67.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 0.0
step_text =

```
::
:: This step must always be run to insure that a semaphore.exe was not left open by a
:: previous run
::
:: If there are no open semaphore.exe's then the 'KILL' will do nothing.
::
%TOOLS_DIR%\Utility\KILL.EXE SEMAPHORE.EXE
```

step_label = Execute Power Run ***step_id =*** 1202 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 123.7
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Execute Throughput Run ***step_id =*** 1203 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 2
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 43.0
start_directory = ***parent_version_no =*** 0.0
step_text =

step_label = Power - Sequential Query Execution ***step_id =*** 1205 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1202 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 24.1
start_directory = ***parent_version_no =*** 123.7
step_text =

step_label = Power - Increment Update Set ***step_id =*** 1207 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 1 ***parent_step_id =*** 1202 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 47.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 123.7
step_text = UPDATE TPCH_AUX_TABLE SET updateset=updateset+1

step_label = Sequential Refresh Stream Execution ***step_id =*** 1208 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1203 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.5
start_directory = ***parent_version_no =*** 43.0
step_text =

step_label = Parallel Stream Execution ***step_id =*** 1209 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 1 ***parent_step_id =*** 1203 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %MAX_STREAMS%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 3.0
start_directory = ***parent_version_no =*** 43.0
step_text =

step_label = Power - Execute Query 14 ***step_id =*** 1211 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\14.sql ***version_no =*** 14.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 02 ***step_id =*** 1212 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\2.sql ***version_no =*** 15.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 09 ***step_id =*** 1213 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\9.sql ***version_no =*** 13.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 20 ***step_id =*** 1214 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\20.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 06 ***step_id =*** 1215 ***global_flag =*** 0
sequence_no = 5 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\6.sql ***version_no =*** 11.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 17 ***step_id =*** 1216 ***global_flag =*** 0
sequence_no = 6 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\17.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 18 ***step_id =*** 1217 ***global_flag =*** 0
sequence_no = 7 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\18.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 08 ***step_id =*** 1218 ***global_flag =*** 0
sequence_no = 8 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\8.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 21 ***step_id =*** 1219 ***global_flag =*** 0
sequence_no = 9 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\21.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 13 ***step_id =*** 1220 ***global_flag =*** 0
sequence_no = 10 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\13.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 03 ***step_id =*** 1221 ***global_flag =*** 0
sequence_no = 11 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\3.sql ***version_no =*** 13.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 22 ***step_id =*** 1222 ***global_flag =*** 0
sequence_no = 12 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\22.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 16 ***step_id =*** 1223 ***global_flag =*** 0
sequence_no = 13 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\16.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 04 ***step_id =*** 1224 ***global_flag =*** 0
sequence_no = 14 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\4.sql ***version_no =*** 13.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 11 ***step_id =*** 1225 ***global_flag =*** 0
sequence_no = 15 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\11.sql ***version_no =*** 13.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 15 ***step_id =*** 1226 ***global_flag =*** 0
sequence_no = 16 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\15.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 01 ***step_id =*** 1227 ***global_flag =*** 0
sequence_no = 17 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\1.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 10 ***step_id =*** 1228 ***global_flag =*** 0
sequence_no = 18 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\10.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 19 ***step_id =*** 1229 ***global_flag =*** 0
sequence_no = 19 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\19.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 05 ***step_id =*** 1230 ***global_flag =*** 0
sequence_no = 20 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\5.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 07 ***step_id =*** 1231 ***global_flag =*** 0
sequence_no = 21 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\7.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Power - Execute Query 12 ***step_id =*** 1232 ***global_flag =*** 0
sequence_no = 22 ***step_level =*** 2 ***parent_step_id =*** 1205 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\Power\12.sql ***version_no =*** 12.0
start_directory = Power_Static_DB_Connection ***parent_version_no =*** 24.1
step_text =

step_label = Throughput - Semaphore Loop for RF Delay ***step_id =*** 1234 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1208 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 2.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 1.5
step_text = %TOOLS_DIR%\Utility\semaphore -waitgroup S -count %MAX_STREAMS%

step_label = Throughput - Refresh Streams ***step_id =*** 1235 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1208 ***enabled_flag =*** -1
iterator_name = STREAM_NUM ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.4
start_directory = ***parent_version_no =*** 1.5
step_text =

step_label = Stream 1 Manager ***step_id =*** 1236 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.3
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 2 Manager ***step_id =*** 1237 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.2
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 3 Manager ***step_id =*** 1238 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.2
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 4 Manager ***step_id =*** 1239 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.2
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 5 Manager ***step_id =*** 1240 ***global_flag =*** 0
sequence_no = 5 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.2
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 6 Manager ***step_id =*** 1241 ***global_flag =*** 0
sequence_no = 6 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 2.1
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 7 Manager ***step_id =*** 1242 ***global_flag =*** 0
sequence_no = 7 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.1
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 8 Manager ***step_id =*** 1243 ***global_flag =*** 0
sequence_no = 8 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.1
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 9 Manager ***step_id =*** 1244 ***global_flag =*** 0
sequence_no = 9 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Stream 10 Manager ***step_id =*** 1245 ***global_flag =*** 0
sequence_no = 10 ***step_level =*** 2 ***parent_step_id =*** 1209 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = ***parent_version_no =*** 3.0
step_text =

step_label = Throughput - RF1 - Stream%STREAM_NUM% ***step_id =*** 1246 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1235 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %INSERT_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.1
start_directory = ***parent_version_no =*** 0.4
step_text =

step_label = Throughput - RF2 - Stream%STREAM_NUM% ***step_id =*** 1247 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 3 ***parent_step_id =*** 1235 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %DELETE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = ***parent_version_no =*** 0.4
step_text =

step_label = Throughput - Stream - Increment Update Set ***step_id =*** 1248 ***global_flag =*** 0
sequence_no = 5 ***step_level =*** 3 ***parent_step_id =*** 1235 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = Throughput_RF_Connection ***parent_version_no =*** 0.4
step_text = UPDATE TPCH_AUX_TABLE SET updateset=updateset+1

step_label = Throughput - Query Stream 1 ***step_id =*** 1249 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1236 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM1\Stream1Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_1_Connection ***parent_version_no =*** 0.3
step_text =

step_label = Throughput - Post to Semaphore (S1) ***step_id =*** 1250 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1236 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 2.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 0.3
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.1

step_label = Throughput - Query Stream 2 ***step_id =*** 1251 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1237 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM2\Stream2Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_2_Connection ***parent_version_no =*** 0.2
step_text =

step_label = Throughput - Post to Semaphore (S2) ***step_id =*** 1252 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1237 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 0.2
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.2

step_label = Throughput - Query Stream 3 ***step_id =*** 1253 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1238 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM3\Stream3Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_3_Connection ***parent_version_no =*** 0.2
step_text =

step_label = Throughput - Post to Semaphore (S3) ***step_id =*** 1254 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1238 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 0.2
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.3

step_label = Throughput - Query Stream 4 ***step_id =*** 1255 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1239 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM4\Stream4Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_4_Connection ***parent_version_no =*** 0.2
step_text =

step_label = Throughput - Post to Semaphore (S4) ***step_id =*** 1256 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1239 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 0.2
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.4

step_label = Throughput - Query Stream 5 ***step_id =*** 1257 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1240 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM5\Stream5Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_5_Connection ***parent_version_no =*** 0.2
step_text =

step_label = Throughput - Post to Semaphore (S5) ***step_id =*** 1258 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1240 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 0.2
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.5

step_label = Throughput - Query Stream 6 ***step_id =*** 1259 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1241 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM6\Stream6Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_6_Connection ***parent_version_no =*** 2.1
step_text =

step_label = Throughput - Post to Semaphore (S6) ***step_id =*** 1260 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1241 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 2.1
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.6

step_label = Throughput - Query Stream 7 ***step_id =*** 1261 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1242 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM7\Stream7Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_7_Connection ***parent_version_no =*** 1.1
step_text =

step_label = Throughput - Post to Semaphore (S7) ***step_id =*** 1262 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1242 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 1.1
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.7

step_label = Throughput - Query Stream 8 ***step_id =*** 1263 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1243 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM8\Stream8Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_8_Connection ***parent_version_no =*** 1.1
step_text =

step_label = Throughput - Post to Semaphore (S8) ***step_id =*** 1264 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1243 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 1.1
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.8

step_label = Throughput - Query Stream 9 ***step_id =*** 1265 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1244 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM9\Stream9Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_9_Connection ***parent_version_no =*** 1.0
step_text =

step_label = Throughput - Post to Semaphore (S9) ***step_id =*** 1266 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1244 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 1.0
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.9

step_label = Throughput - Query Stream 10 ***step_id =*** 1267 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1245 ***enabled_flag =*** -1
iterator_name = QUERY ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %QUERY_DIR%\STREAM10\Stream10Q%QUERY%.sql ***version_no =*** 0.0
start_directory = Throughput_Static_Stream_10_Connection ***parent_version_no =*** 1.0
step_text =

step_label = Throughput - Post to Semaphore (S10) ***step_id =*** 1268 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 3 ***parent_step_id =*** 1245 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 2 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 1.0
step_text = %TOOLS_DIR%\Utility\semaphore -signal S.10

step_label = Throughput - Execute Stream%STREAM_NUM% RF1 ***step_id =*** 1269 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 4 ***parent_step_id =*** 1246 ***enabled_flag =*** -1

iterator_name = INSERT_SEGMENT ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 5.0

start_directory = Throughput_RF_Connection ***parent_version_no =*** 1.1

step_text =

```
--
-- Execute the Refresh RF1 Stored Procedure
--
EXEC  RF1 %INSERT_SEGMENT%, %BATCH_SIZE%, %INSERT_PARALLELISM%,
%INSERT_EXECUTIONS%
```

step_label = Throughput - Execute Stream%STREAM_NUM% RF2 ***step_id =*** 1270 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 4 ***parent_step_id =*** 1247 ***enabled_flag =*** -1

iterator_name = DELETE_SEGMENT ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 4.0

start_directory = Throughput_RF_Connection ***parent_version_no =*** 1.0

step_text =

```
--
-- Execute the Refresh RF2 Stored Procedure
--
EXEC RF2 %DELETE_SEGMENT%, %BATCH_SIZE%, %DELETE_PARALLELISM%,
%DELETE_EXECUTIONS%
```

step_label = SqlServer Startup ***step_id =*** 1294 ***global_flag =*** -1

sequence_no = 1 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0

iterator_name = ***degree_parallelism*** 0

execution_mechanism = 2 ***continuation_criteria =*** 0 ***failure_details =***

step_file_name = ***version_no =*** 0.0

start_directory = ***parent_version_no =*** 0.0

step_text =

```
start "SqlServer" sqlservr -c %TRACEFLAGS%
%TOOLS_DIR%\Utility\wait4sql 40000
```

step_label = SqlServer Shutdown ***step_id =*** 1295 ***global_flag =*** -1
sequence_no = 2 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 0
execution_mechanism = 2 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 0.0
step_text = isql -Usa -P -t10 -Q"shutdown"
%TOOLS_DIR%\Utility\wait4sql 10000

step_label = Wait For SQL Server ***step_id =*** 1296 ***global_flag =*** -1
sequence_no = 3 ***step_level =*** 0 ***parent_step_id =*** 0 ***enabled_flag =*** 0
iterator_name = ***degree_parallelism*** 0
execution_mechanism = 2 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = %TOOLS_DIR% ***parent_version_no =*** 0.0
step_text = %TOOLS_DIR%\Utility\wait4sql.exe 60000

step_label = Power - Execute RF1 ***step_id =*** 1405 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 1 ***parent_step_id =*** 1202 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 14.0
start_directory = ***parent_version_no =*** 123.7
step_text =

step_label = Parallel RF1 Execution ***step_id =*** 1406 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 2 ***parent_step_id =*** 1405 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %INSERT_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 3.0
start_directory = ***parent_version_no =*** 14.0
step_text =

step_label = Execute RF1 ***step_id =*** 1407 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1406 ***enabled_flag =*** -1

iterator_name = INSERT_SEGMENT ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***

step_file_name = ***version_no =*** 9.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 3.0

step_text =

```
--
-- Execute the Refresh RF1 Stored Procedure
--


EXEC  RF1 %INSERT_SEGMENT%, %BATCH_SIZE%, %INSERT_PARALLELISM%,
%INSERT_EXECUTIONS%
```

step_label = Create RF1 Tables ***step_id =*** 1411 ***global_flag =*** 0

sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1405 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** 1

execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***

step_file_name = %SETUP_DIR%\RF_Procs\RF1_init.sql ***version_no =*** 9.0

start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 14.0

step_text =

step_label = Parallel Load RF1 Input ***step_id =*** 1414 ***global_flag =*** 0

sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1405 ***enabled_flag =*** -1

iterator_name = ***degree_parallelism*** %FILES_PER_UPDATE_SET%

execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***

step_file_name = ***version_no =*** 2.0

start_directory = ***parent_version_no =*** 14.0

step_text =

step_label = Throughput - Load RF1 Input ***step_id =*** 1415 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 5 ***parent_step_id =*** 1431 ***enabled_flag =*** -1
iterator_name = SEGMENT ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF1_load.sql ***version_no =*** 3.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 0.0
step_text =

step_label = Create RF1 Indices ***step_id =*** 1417 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1405 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF1_index.sql ***version_no =*** 3.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 14.0
step_text =

step_label = Power - Execute RF2 ***step_id =*** 1419 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 1 ***parent_step_id =*** 1202 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 11.0
start_directory = ***parent_version_no =*** 123.7
step_text =

step_label = Create RF2 Tables ***step_id =*** 1420 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 2 ***parent_step_id =*** 1419 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF2_init.sql ***version_no =*** 5.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 11.0
step_text =

step_label = Parallel Load RF2 Input ***step_id =*** 1421 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 2 ***parent_step_id =*** 1419 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FILES_PER_UPDATE_SET%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.2
start_directory = ***parent_version_no =*** 11.0
step_text =

step_label = Load RF2 Input ***step_id =*** 1422 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1421 ***enabled_flag =*** -1
iterator_name = SEGMENT ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF2_load.sql.new ***version_no =*** 4.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 1.2
step_text =

step_label = Create RF2 Indices ***step_id =*** 1424 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 2 ***parent_step_id =*** 1419 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF2_index.sql ***version_no =*** 5.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 11.0
step_text =

step_label = Parallel RF2 Execution ***step_id =*** 1425 ***global_flag =*** 0
sequence_no = 4 ***step_level =*** 2 ***parent_step_id =*** 1419 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %DELETE_PARALLELISM%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 5.0
start_directory = ***parent_version_no =*** 11.0
step_text =

step_label = Execute RF2 ***step_id =*** 1426 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1425 ***enabled_flag =*** -1
iterator_name = DELETE_SEGMENT ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = ***version_no =*** 9.0
start_directory = Power_Dynamic_DB_Connection ***parent_version_no =*** 5.0
step_text =

```
--
-- Execute the Refresh RF2 Stored Procedure
--

EXEC RF2 %DELETE_SEGMENT%, %BATCH_SIZE%, %DELETE_PARALLELISM%,
%DELETE_EXECUTIONS%
```

step_label = Throughput - Init RF1 Input ***step_id =*** 1428 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1235 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 1.0
start_directory = ***parent_version_no =*** 0.4
step_text =

step_label = Throughput - Init RF2 Input ***step_id =*** 1429 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 3 ***parent_step_id =*** 1235 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.1
start_directory = ***parent_version_no =*** 0.4
step_text =

step_label = Throughput - Create RF1 Tables ***step_id =*** 1430 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 4 ***parent_step_id =*** 1428 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 1 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF1_init.sql ***version_no =*** 7.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 1.0
step_text =

step_label = Throughput - Parallel Load RF1 Input ***step_id =*** 1431 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 4 ***parent_step_id =*** 1428 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FILES_PER_UPDATE_SET%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.0
start_directory = ***parent_version_no =*** 1.0
step_text =

step_label = Load RF1 Input ***step_id =*** 1432 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 3 ***parent_step_id =*** 1414 ***enabled_flag =*** -1
iterator_name = SEGMENT ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF1_load.sql ***version_no =*** 3.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 2.0
step_text =

step_label = Throughput - Create RF1 Indices ***step_id =*** 1434 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 4 ***parent_step_id =*** 1428 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF1_index.sql ***version_no =*** 1.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 1.0
step_text =

step_label = Throughput - Create RF2 Tables ***step_id =*** 1435 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 4 ***parent_step_id =*** 1429 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF2_init.sql ***version_no =*** 4.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 0.1
step_text =

step_label = Throughput - Parallel Load RF2 Input ***step_id =*** 1436 ***global_flag =*** 0
sequence_no = 2 ***step_level =*** 4 ***parent_step_id =*** 1429 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** %FILES_PER_UPDATE_SET%
execution_mechanism = 0 ***continuation_criteria =*** 0 ***failure_details =***
step_file_name = ***version_no =*** 0.1
start_directory = ***parent_version_no =*** 0.1
step_text =

step_label = Throughput - Load RF2 Input ***step_id =*** 1437 ***global_flag =*** 0
sequence_no = 1 ***step_level =*** 5 ***parent_step_id =*** 1436 ***enabled_flag =*** -1
iterator_name = SEGMENT ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF2_load.sql.new ***version_no =*** 3.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 0.1
step_text =

step_label = Throughput - Create RF2 Indices ***step_id =*** 1438 ***global_flag =*** 0
sequence_no = 3 ***step_level =*** 4 ***parent_step_id =*** 1429 ***enabled_flag =*** -1
iterator_name = ***degree_parallelism*** 1
execution_mechanism = 1 ***continuation_criteria =*** 2 ***failure_details =***
step_file_name = %SETUP_DIR%\RF_Procs\RF2_index.sql ***version_no =*** 3.0
start_directory = Dynamic_Connection_to_DB ***parent_version_no =*** 0.1
step_text =

Iterator_values

workspace_id	*step_id*	*version_no*	*type*	*iterator_value*	*sequence_no*
13	1235	0.4	2	%MAX_STREAMS%	0
13	1255	0.0	3	1	0
13	1255	0.0	1	1	0
13	1255	0.0	2	22	0
13	1253	0.0	1	1	0
13	1253	0.0	2	22	0
13	1253	0.0	3	1	0
13	1251	0.0	2	22	0
13	1251	0.0	3	1	0
13	1251	0.0	1	1	0
13	1249	0.0	3	1	0
13	1249	0.0	1	1	0
13	1422	4.0	3	1	0
13	1235	0.4	3	1	0
13	1257	0.0	2	22	0
13	1235	0.4	1	1	0
13	1437	3.0	2	%FILES_PER_UPDATE_SET%	0
13	1437	3.0	3	1	0
13	1437	3.0	1	1	0
13	1432	3.0	2	%FILES_PER_UPDATE_SET%	0
13	1432	3.0	1	1	0
13	1432	3.0	3	1	0
13	1426	9.0	2	%DELETE_EXECUTIONS%	0

13	1426	9.0	3	1		0
13	1426	9.0	1	1		0
13	1422	4.0	1	1		0
13	1422	4.0	2	%FILES_PER_UPDATE_SET%		0
13	1249	0.0	2	22		0
13	1265	0.0	1	1		0
13	1415	3.0	2	%FILES_PER_UPDATE_SET%		0
13	1415	3.0	1	1		0
13	1407	9.0	1	1		0
13	1407	9.0	3	1		0
13	1407	9.0	2	%INSERT_EXECUTIONS%		0
13	1270	4.0	3	1		0
13	1270	4.0	2	%DELETE_EXECUTIONS%		0
13	1270	4.0	1	1		0
13	1269	5.0	1	1		0
13	1269	5.0	2	%INSERT_EXECUTIONS%		0
13	1269	5.0	3	1		0
13	1267	0.0	1	1		0
13	1257	0.0	3	1		0
13	1267	0.0	3	1		0
13	1257	0.0	1	1		0
13	1265	0.0	3	1		0
13	1265	0.0	2	22		0
13	1263	0.0	2	22		0
13	1263	0.0	1	1		0
13	1263	0.0	3	1		0
13	1261	0.0	3	1		0
13	1261	0.0	2	22		0
13	1261	0.0	1	1		0
13	1259	0.0	2	22		0
13	1259	0.0	3	1		0

13	1259	0.0	1	1	0
13	1415	3.0	3	1	0
13	1267	0.0	2	22	0

Appendix F: Disk Configuration

Disk #	Type	Data_FG	Tempdb	Load_FG	Other
0	Bas.				C: 32GB - Boot
1	B				D: 32GB - Second disk
2	Dyn	15GB	7.5GB	8.6GB	M: MountPts - 100MB
3	D	15GB	7.5GB	8.6GB	M: MountPts - 100MB
4	D	15GB	7.5GB	8.6GB	
5	D	15GB	7.5GB	8.6GB	
6	D	15GB	7.5GB	8.6GB	
7	D	15GB	7.5GB	8.6GB	
8	D	15GB	7.5GB	8.6GB	
9	D				68GB - BkupFiles- Raid5
10	D				68GB - BkupFiles- Raid5
11	D				68GB - BkupFiles- Raid5
12	D				68GB - BkupFiles- Raid5
13	D				68GB - BkupFiles- Raid5
14	D				68GB - BkupFiles- Raid5
15	D				68GB - BkupFiles- Raid5
16	D	15GB	7.5GB	8.6GB	
17	D	15GB	7.5GB	8.6GB	
18	D	15GB	7.5GB	8.6GB	
19	D	15GB	7.5GB	8.6GB	
20	D	15GB	7.5GB	8.6GB	
21	D	15GB	7.5GB	8.6GB	
22	D	15GB	7.5GB	8.6GB	
23	D				68GB - BkupFiles- Raid5
24	D				68GB - BkupFiles- Raid5
25	D				68GB - BkupFiles- Raid5
26	D				68GB - BkupFiles- Raid5
27	D				68GB - BkupFiles- Raid5
28	D				68GB - BkupFiles- Raid5
29	D				68GB - BkupFiles- Raid5
30	D	15GB	7.5GB	8.6GB	
31	D	15GB	7.5GB	8.6GB	
32	D	15GB	7.5GB	8.6GB	
33	D	15GB	7.5GB	8.6GB	
34	D	15GB	7.5GB	8.6GB	
35	D	15GB	7.5GB	8.6GB	

36	D	15GB	7.5GB	8.6GB	
37	D				68GB - BkupFiles- Raid5
38	D				68GB - BkupFiles- Raid5
39	D				68GB - BkupFiles- Raid5
40	D				68GB - BkupFiles- Raid5
41	D				68GB - BkupFiles- Raid5
42	D				68GB - BkupFiles- Raid5
43	D				68GB - BkupFiles- Raid5
44	D	15GB	7.5GB	8.6GB	
45	D	15GB	7.5GB	8.6GB	
46	D	15GB	7.5GB	8.6GB	
47	D	15GB	7.5GB	8.6GB	
48	D	15GB	7.5GB	8.6GB	
49	D	15GB	7.5GB	8.6GB	
50	D	15GB	7.5GB	8.6GB	
51	D				68GB - BkupFiles- Raid5
52	D				68GB - BkupFiles- Raid5
53	D				68GB - BkupFiles- Raid5
54	D				68GB - BkupFiles- Raid5
55	D				68GB - BkupFiles- Raid5
56	D				68GB - BkupFiles- Raid5
57	D				68GB - BkupFiles- Raid5
58	D	15GB	7.5GB	8.6GB	
59	D	15GB	7.5GB	8.6GB	
60	D	15GB	7.5GB	8.6GB	
61	D	15GB	7.5GB	8.6GB	
62	D	15GB	7.5GB	8.6GB	
63	D	15GB	7.5GB	8.6GB	
64	D	15GB	7.5GB	8.6GB	
65	D				68GB - BkupFiles- Raid5
66	D				68GB - BkupFiles- Raid5
67	D				68GB - BkupFiles- Raid5
68	D				68GB - BkupFiles- Raid5
69	D				68GB - BkupFiles- Raid5
70	D				68GB - BkupFiles- Raid5
71	D				68GB - BkupFiles- Raid5
72	D	15GB	7.5GB	8.6GB	
73	D	15GB	7.5GB	8.6GB	
74	D	15GB	7.5GB	8.6GB	
75	D	15GB	7.5GB	8.6GB	
76	D	15GB	7.5GB	8.6GB	
77	D	15GB	7.5GB	8.6GB	
78	D	15GB	7.5GB	8.6GB	
79	D				68GB - BkupFiles- Raid5
80	D				68GB - BkupFiles- Raid5
81	D				68GB - BkupFiles- Raid5
82	D				68GB - BkupFiles- Raid5
83	D				68GB - BkupFiles- Raid5

84	D				68GB - BkupFiles- Raid5
85	D				68GB - BkupFiles- Raid5
86	D	15GB	7.5GB	8.6GB	
87	D	15GB	7.5GB	8.6GB	
88	D	15GB	7.5GB	8.6GB	
89	D	15GB	7.5GB	8.6GB	
90	D	15GB	7.5GB	8.6GB	
91	D	15GB	7.5GB	8.6GB	
92	D	15GB	7.5GB	8.6GB	
93	D				68GB - BkupFiles- Raid5
94	D				68GB - BkupFiles- Raid5
95	D				68GB - BkupFiles- Raid5
96	D				68GB - BkupFiles- Raid5
97	D				68GB - BkupFiles- Raid5
98	D				68GB - BkupFiles- Raid5
99	D				68GB - BkupFiles- Raid5
100	D	15GB	7.5GB	8.6GB	
101	D	15GB	7.5GB	8.6GB	
102	D	15GB	7.5GB	8.6GB	
103	D	15GB	7.5GB	8.6GB	
104	D	15GB	7.5GB	8.6GB	
105	D	15GB	7.5GB	8.6GB	
106	D	15GB	7.5GB	8.6GB	
107	D				68GB - BkupFiles- Raid5
108	D				68GB - BkupFiles- Raid5
109	D				68GB - BkupFiles- Raid5
110	D				68GB - BkupFiles- Raid5
111	D				68GB - BkupFiles- Raid5
112	D				68GB - BkupFiles- Raid5
113	D				68GB - BkupFiles- Raid5
114	D	15GB	7.5GB	8.6GB	
115	D	15GB	7.5GB	8.6GB	
116	D	15GB	7.5GB	8.6GB	
117	D	15GB	7.5GB	8.6GB	
118	D	15GB	7.5GB	8.6GB	
119	D	15GB	7.5GB	8.6GB	
120	D	15GB	7.5GB	8.6GB	
121	D				68GB - BkupFiles- Raid5
122	D				68GB - BkupFiles- Raid5
123	D				68GB - BkupFiles- Raid5
124	D				68GB - BkupFiles- Raid5
125	D				68GB - BkupFiles- Raid5
126	D				68GB - BkupFiles- Raid5
127	D				68GB - BkupFiles- Raid5
128	D	15GB	7.5GB	8.6GB	
129	D	15GB	7.5GB	8.6GB	
130	D	15GB	7.5GB	8.6GB	
131	D	15GB	7.5GB	8.6GB	

132	D	15GB	7.5GB	8.6GB	
133	D	15GB	7.5GB	8.6GB	
134	D	15GB	7.5GB	8.6GB	
135	D				68GB - BkupFiles- Raid5
136	D				68GB - BkupFiles- Raid5
137	D				68GB - BkupFiles- Raid5
138	D				68GB - BkupFiles- Raid5
139	D				68GB - BkupFiles- Raid5
140	D				68GB - BkupFiles- Raid5
141	D				68GB - BkupFiles- Raid5
142	D	15GB	7.5GB	8.6GB	
143	D	15GB	7.5GB	8.6GB	
144	D	15GB	7.5GB	8.6GB	
145	D	15GB	7.5GB	8.6GB	
146	D	15GB	7.5GB	8.6GB	
147	D	15GB	7.5GB	8.6GB	
148	D	15GB	7.5GB	8.6GB	
149	D				68GB - BkupFiles- Raid5
150	D				68GB - BkupFiles- Raid5
151	D				68GB - BkupFiles- Raid5
152	D				68GB - BkupFiles- Raid5
153	D				68GB - BkupFiles- Raid5
154	D				68GB - BkupFiles- Raid5
155	D				68GB - BkupFiles- Raid5
156	D	15GB	7.5GB	8.6GB	
157	D	15GB	7.5GB	8.6GB	
158	D	15GB	7.5GB	8.6GB	
159	D	15GB	7.5GB	8.6GB	
160	D	15GB	7.5GB	8.6GB	
161	D	15GB	7.5GB	8.6GB	
162	D	15GB	7.5GB	8.6GB	
163	D				68GB - BkupFiles- Raid5
164	D				68GB - BkupFiles- Raid5
165	D				68GB - BkupFiles- Raid5
166	D				68GB - BkupFiles- Raid5
167	D				68GB - BkupFiles- Raid5
168	D				68GB - BkupFiles- Raid5
169	D				68GB - BkupFiles- Raid5
170	D	15GB	7.5GB	8.6GB	
171	D	15GB	7.5GB	8.6GB	
172	D	15GB	7.5GB	8.6GB	
173	D	15GB	7.5GB	8.6GB	
174	D	15GB	7.5GB	8.6GB	
175	D	15GB	7.5GB	8.6GB	
176	D	15GB	7.5GB	8.6GB	
177	D				68GB - BkupFiles- Raid5
178	D				68GB - BkupFiles- Raid5
179	D				68GB - BkupFiles- Raid5

180	D				68GB - BkupFiles- Raid5
181	D				68GB - BkupFiles- Raid5
182	D				68GB - BkupFiles- Raid5
183	D				68GB - BkupFiles- Raid5
184	D	15GB	7.5GB	8.6GB	
185	D	15GB	7.5GB	8.6GB	
186	D	15GB	7.5GB	8.6GB	
187	D	15GB	7.5GB	8.6GB	
188	D	15GB	7.5GB	8.6GB	
189	D	15GB	7.5GB	8.6GB	
190	D	15GB	7.5GB	8.6GB	
191	D				68GB - BkupFiles- Raid5
192	D				68GB - BkupFiles- Raid5
193	D				68GB - BkupFiles- Raid5
194	D				68GB - BkupFiles- Raid5
195	D				68GB - BkupFiles- Raid5
196	D				68GB - BkupFiles- Raid5
197	D				Adic Files
198	D	15GB	7.5GB	8.6GB	
199	D	15GB	7.5GB	8.6GB	
200	D	15GB	7.5GB	8.6GB	
201	D	15GB	7.5GB	8.6GB	
202	D	15GB	7.5GB	8.6GB	
203	D	15GB	7.5GB	8.6GB	
204	D	15GB	7.5GB	8.6GB	
205	D				68GB - BkupFiles- Raid5
206	D				68GB - BkupFiles- Raid5
207	D				68GB - BkupFiles- Raid5
208	D				68GB - BkupFiles- Raid5
209	D				68GB - BkupFiles- Raid5
210	D				68GB - BkupFiles- Raid5
211	D				Adic Files
212	D	15GB	7.5GB	8.6GB	
213	D	15GB	7.5GB	8.6GB	
214	D	15GB	7.5GB	8.6GB	
215	D	15GB	7.5GB	8.6GB	
216	D	15GB	7.5GB	8.6GB	
217	D	15GB	7.5GB	8.6GB	
218	D	15GB	7.5GB	8.6GB	
219	D				34GBGB - Flat Files
220	D				34GBGB - Flat Files
221	D				34GBGB - Flat Files
222	D				34GBGB - Flat Files
223	D				34GBGB - Flat Files
224	D				34GBGB - Flat Files
225	D				34GBGB - Flat Files
226	D	15GB	7.5GB	8.6GB	
227	D	15GB	7.5GB	8.6GB	

228	D	15GB	7.5GB	8.6GB	
229	D	15GB	7.5GB	8.6GB	
230	D	15GB	7.5GB	8.6GB	
231	D	15GB	7.5GB	8.6GB	
232	D	15GB	7.5GB	8.6GB	
233	D				34GBGB - Flat Files
234	D				34GBGB - Flat Files
235	D				34GBGB - Flat Files
236	D				34GBGB - Flat Files
237	D				34GBGB - Flat Files
238	D				34GBGB - Flat Files
239	D				34GBGB - Flat Files
240	D	15GB	7.5GB	8.6GB	
241	D	15GB	7.5GB	8.6GB	
242	D	15GB	7.5GB	8.6GB	
243	D	15GB	7.5GB	8.6GB	
244	D	15GB	7.5GB	8.6GB	
245	D	15GB	7.5GB	8.6GB	
246	D	15GB	7.5GB	8.6GB	
247	D				34GBGB - Flat Files
248	D				34GBGB - Flat Files
249	D				34GBGB - Flat Files
250	D				34GBGB - Flat Files
251	D				34GBGB - Flat Files
252	D				34GBGB - Flat Files
253	D				34GBGB - Flat Files
254	D	15GB	7.5GB	8.6GB	
255	D	15GB	7.5GB	8.6GB	
256	D	15GB	7.5GB	8.6GB	
257	D	15GB	7.5GB	8.6GB	
258	D	15GB	7.5GB	8.6GB	
259	D	15GB	7.5GB	8.6GB	
260	D	15GB	7.5GB	8.6GB	
261	D				34GBGB - Flat Files
262	D				34GBGB - Flat Files
263	D				34GBGB - Flat Files
264	D				34GBGB - Flat Files
265	D				34GBGB - Flat Files
266	D				34GBGB - Flat Files
267	D				34GBGB - Flat Files
268	D	15GB	7.5GB	8.6GB	
269	D	15GB	7.5GB	8.6GB	
270	D	15GB	7.5GB	8.6GB	
271	D	15GB	7.5GB	8.6GB	
272	D	15GB	7.5GB	8.6GB	
273	D	15GB	7.5GB	8.6GB	
274	D	15GB	7.5GB	8.6GB	
275	D				34GBGB - Flat Files

276	D				34GBGB - Flat Files
277	D				34GBGB - Flat Files
278	D				34GBGB - Flat Files
279	D				34GBGB - Flat Files
280	D				34GBGB - Flat Files
281	D				34GBGB - Flat Files
282	D	15GB	7.5GB	8.6GB	
283	D	15GB	7.5GB	8.6GB	
284	D	15GB	7.5GB	8.6GB	
285	D	15GB	7.5GB	8.6GB	
286	D	15GB	7.5GB	8.6GB	
287	D	15GB	7.5GB	8.6GB	
288	D	15GB	7.5GB	8.6GB	
289	D				34GBGB - Flat Files
290	D				34GBGB - Flat Files
291	D				34GBGB - Flat Files
292	D				34GBGB - Flat Files
293	D				34GBGB - Flat Files
294	D				34GBGB - Flat Files
295	D				34GBGB - Flat Files
296	B	15GB	7.5GB	8.6GB	
297	B	15GB	7.5GB	8.6GB	
298	B	15GB	7.5GB	8.6GB	
299	B	15GB	7.5GB	8.6GB	
300	B	15GB	7.5GB	8.6GB	
301	B	15GB	7.5GB	8.6GB	
302	B	15GB	7.5GB	8.6GB	
303	D				34GBGB - Flat Files
304	D				34GBGB - Flat Files
305	D				34GBGB - Flat Files
306	D				34GBGB - Flat Files
307	D				34GBGB - Flat Files
308	D				34GBGB - Flat Files
309	D				34GBGB - Flat Files
310	B	15GB	7.5GB	8.6GB	
311	B	15GB	7.5GB	8.6GB	
312	B	15GB	7.5GB	8.6GB	
313	B	15GB	7.5GB	8.6GB	
314	B	15GB	7.5GB	8.6GB	
315	B	15GB	7.5GB	8.6GB	
316	B	15GB	7.5GB	8.6GB	
317	D				34GBGB - Flat Files
318	D				34GBGB - Flat Files
319	D				34GBGB - Flat Files
320	D				34GBGB - Flat Files
321	D				34GBGB - Flat Files
322	D				34GBGB - Flat Files
323	D				34GBGB - Flat Files

324	B	15GB	7.5GB	8.6GB	
325	B	15GB	7.5GB	8.6GB	
326	B	15GB	7.5GB	8.6GB	
327	B	15GB	7.5GB	8.6GB	
328	B	15GB	7.5GB	8.6GB	
329	B	15GB	7.5GB	8.6GB	
330	B	15GB	7.5GB	8.6GB	
331	D				34GBGB - Flat Files
332	D				34GBGB - Flat Files
333	D				34GBGB - Flat Files
334	D				34GBGB - Flat Files
335	D				34GBGB - Flat Files
336	D				34GBGB - Flat Files
337	D				34GBGB - Flat Files
338	B	15GB	7.5GB	8.6GB	
339	B	15GB	7.5GB	8.6GB	
340	B	15GB	7.5GB	8.6GB	
341	B	15GB	7.5GB	8.6GB	
342	B	15GB	7.5GB	8.6GB	
343	B	15GB	7.5GB	8.6GB	
344	B	15GB	7.5GB	8.6GB	
345	D				34GBGB - Flat Files
346	D				34GBGB - Flat Files
347	D				34GBGB - Flat Files
348	D				34GBGB - Flat Files
349	D				34GBGB - Flat Files
350	D				34GBGB - Flat Files
351	D				34GBGB - Flat Files
352	B	15GB	7.5GB	8.6GB	
353	B	15GB	7.5GB	8.6GB	
354	B	15GB	7.5GB	8.6GB	
355	B	15GB	7.5GB	8.6GB	
356	B	15GB	7.5GB	8.6GB	
357	B	15GB	7.5GB	8.6GB	
358	B	15GB	7.5GB	8.6GB	
359	D				34GBGB - Flat Files
360	D				34GBGB - Flat Files
361	D				34GBGB - Flat Files
362	D				34GBGB - Flat Files
363	D				34GBGB - Flat Files
364	D				34GBGB - Flat Files
365	D				34GBGB - Flat Files
366	B	15GB	7.5GB	8.6GB	
367	B	15GB	7.5GB	8.6GB	
368	B	15GB	7.5GB	8.6GB	
369	B	15GB	7.5GB	8.6GB	
370	B	15GB	7.5GB	8.6GB	
371	B	15GB	7.5GB	8.6GB	

372	B	15GB	7.5GB	8.6GB	
373	D				34GBGB - Flat Files
374	D				34GBGB - Flat Files
375	D				34GBGB - Flat Files
376	D				34GBGB - Flat Files
377	D				34GBGB - Flat Files
378	D				34GBGB - Flat Files
379	D				34GBGB - Flat Files
380	B	15GB	7.5GB	8.6GB	
381	B	15GB	7.5GB	8.6GB	
382	B	15GB	7.5GB	8.6GB	
383	B	15GB	7.5GB	8.6GB	
384	B	15GB	7.5GB	8.6GB	
385	B	15GB	7.5GB	8.6GB	
386	B	15GB	7.5GB	8.6GB	
387	B	15GB	7.5GB	8.6GB	
388	B	15GB	7.5GB	8.6GB	
389	B	15GB	7.5GB	8.6GB	
390	B	15GB	7.5GB	8.6GB	
391	B	15GB	7.5GB	8.6GB	
392	B	15GB	7.5GB	8.6GB	
393	B	15GB	7.5GB	8.6GB	
394	B	15GB	7.5GB	8.6GB	
395	B	15GB	7.5GB	8.6GB	
396	B	15GB	7.5GB	8.6GB	
397	B	15GB	7.5GB	8.6GB	
398	B	15GB	7.5GB	8.6GB	
399	B	15GB	7.5GB	8.6GB	
400	B	15GB	7.5GB	8.6GB	
401	B	15GB	7.5GB	8.6GB	
402	B	15GB	7.5GB	8.6GB	
403	B	15GB	7.5GB	8.6GB	
404	B	15GB	7.5GB	8.6GB	
405	B	15GB	7.5GB	8.6GB	
406	B	15GB	7.5GB	8.6GB	
407	B	15GB	7.5GB	8.6GB	
408	B	15GB	7.5GB	8.6GB	
409	B	15GB	7.5GB	8.6GB	
410	B	15GB	7.5GB	8.6GB	
411	B	15GB	7.5GB	8.6GB	
412	B	15GB	7.5GB	8.6GB	
413	B	15GB	7.5GB	8.6GB	
414	B	15GB	7.5GB	8.6GB	
415	B	15GB	7.5GB	8.6GB	
416	B	15GB	7.5GB	8.6GB	
417	B	15GB	7.5GB	8.6GB	
418	B	15GB	7.5GB	8.6GB	
419	B	15GB	7.5GB	8.6GB	

420	B	15GB	7.5GB	8.6GB	
421	B	15GB	7.5GB	8.6GB	
422	B	15GB	7.5GB	8.6GB	
423	B	15GB	7.5GB	8.6GB	
424	B	15GB	7.5GB	8.6GB	
425	B	15GB	7.5GB	8.6GB	
426	B	15GB	7.5GB	8.6GB	
427	B	15GB	7.5GB	8.6GB	
428	B	15GB	7.5GB	8.6GB	
429	B	15GB	7.5GB	8.6GB	
430	B	15GB	7.5GB	8.6GB	
431	B	15GB	7.5GB	8.6GB	
432	B	15GB	7.5GB	8.6GB	
433	B	15GB	7.5GB	8.6GB	
434	B	15GB	7.5GB	8.6GB	
435	B	15GB	7.5GB	8.6GB	
436	B	15GB	7.5GB	8.6GB	
437	B	15GB	7.5GB	8.6GB	
438	B	15GB	7.5GB	8.6GB	
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620	B	15GB	7.5GB	8.6GB	
621	B	15GB	7.5GB	8.6GB	
622	B	15GB	7.5GB	8.6GB	
623	B	15GB	7.5GB	8.6GB	
624	B	15GB	7.5GB	8.6GB	
625	B	15GB	7.5GB	8.6GB	
626	B	15GB	7.5GB	8.6GB	
627	B	15GB	7.5GB	8.6GB	
628	B	15GB	7.5GB	8.6GB	
629	B	15GB	7.5GB	8.6GB	
630	B	15GB	7.5GB	8.6GB	
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632	B	15GB	7.5GB	8.6GB	
633	B	K: TempLog - 333GB			
634	B	N: 3TB db Log - 266GB Raid-10			
635	B	L: 3TB db Log - 483GB Raid-10 + Acid Log			

Appendix G: DBGen Modifications

Four files from dbgen 2.1.1b were modified. The source code for each file is listed below.

qgen.c

```
/*
* $Id: qgen.c,v 1.1.1.1 2003/04/03 18:54:21 jms Exp $
*
* Revision History
* ===================
* $Log: qgen.c,v $
* Revision 1.1.1.1  2003/04/03 18:54:21  jms
* recreation after CVS crash
*
* Revision 1.1.1.1  2003/04/03 18:54:21  jms
* initial checkin
*
*
*/
/*
 * qgen.c -- routines to convert query templates to executable query
 *           text for TPC-H and TPC-R
 */
#define DECLARER

#include <stdio.h>
#include <string.h>
#if (defined(_POSIX_)||!defined(WIN32))
#include <unistd.h>
#else
#include "process.h"
#endif /* WIN32 */
#include <ctype.h>
#include <time.h>
#include "config.h"
#include "dss.h"
#include "tpcd.h"
#include "permute.h"


#define LINE_SIZE 512

/*
 * Function Protoypes
 */
void varsub PROTO((int qnum, int vnum, int flags));
int strip_comments PROTO((char *line));
void usage PROTO((void));
int process_options PROTO((int cnt, char **args));
```

```
int setup PROTO((void));
void qsub PROTO((char *qtag, int flags));



extern char *optarg;
extern int optind;
char **mk_ascdate(void);
extern seed_t Seed[];

char **asc_date;
int snum = -1;
char *prog;
tdef tdefs = { NULL };
long rndm;
double flt_scale;
distribution q13a, q13b;
int qnum;


/*
 * FUNCTION strip_comments(line)
 *
 * remove all comments from 'line'; recognizes both {} and -- comments
 */
int
strip_comments(char *line)
{
    static int in_comment = 0;
    char *cp1, *cp2;

    cp1 = line;

    while (1)   /* traverse the entire string */
        {
        if (in_comment)
            {
            if ((cp2 = strchr(cp1, '}')) != NULL) /* comment ends */
                {
                strcpy(cp1, cp2 + 1);
                in_comment = 0;
                continue;
                }
            else
                {
                *cp1 = '\0';
                break;
                }
            }
        else    /* not in_comment */
            {
            if ((cp2 = strchr(cp1, '-')) != NULL)
                {
                if (*(cp2 + 1) == '-')  /* found a '--' comment */
                    {
```

```
                    *cp2 = '\0';
                    break;
                    }
                }
            if ((cp2 = strchr(cp1, '{')) != NULL) /* comment starts */
                {
                in_comment = 1;
                *cp2 = ' ';
                continue;
                }
            else break;
            }
        }
    return(0);
}

/*
 * FUNCTION qsub(char *qtag, int flags)
 *
 * based on the settings of flags, and the template file $QDIR/qtag.sql
 * make the following substitutions to turn a query template into EQT
 *
 *  String      Converted to            Based on
 *  ======      ============            ===========
 *  first line  database <db_name>;      -n from command line
 *  second line set explain on;         -x from command line
 *   :<number>  parameter <number>
 *  :k          set number
 *  :o          output to outpath/qnum.snum
 *                                      -o from command line,
SET_OUTPUT
 *  :s          stream number
 *  :b          BEGIN WORK;             -a from command line,
START_TRAN
 *  :e          COMMIT WORK;            -a from command line, END_TRAN
 *  :q          query number
 *  :n<number>                          sets rowcount to be returned
 */
void
qsub(char *qtag, int flags)
{
static char *line = NULL,
    *qpath = NULL;
FILE *qfp;
char *cptr,
    *mark,
    *qroot = NULL;

    qnum = atoi(qtag);
    if (line == NULL)
        {
        line = malloc(BUFSIZ);
        qpath = malloc(BUFSIZ);
        MALLOC_CHECK(line);
        MALLOC_CHECK(qpath);
```

```
    }

qroot = env_config(QDIR_TAG, QDIR_DFLT);
sprintf(qpath, "%s%c%s.sql",
        qroot, PATH_SEP, qtag);
qfp = fopen(qpath, "r");
OPEN_CHECK(qfp, qpath);

rowcnt = rowcnt_dflt[qnum];
varsub(qnum, 0, flags); /* set the variables */
if (flags & DFLT_NUM)
    fprintf(ofp, SET_ROWCOUNT, rowcnt);
while (fgets(line, BUFSIZ, qfp) != NULL)
    {
    if (!(flags & COMMENT))
        strip_comments(line);
    mark = line;
    while ((cptr = strchr(mark, VTAG)) != NULL)
        {
        *cptr = '\0';
         cptr++;
        fprintf(ofp,"%s", mark);
        switch(*cptr)
            {
            case 'b':
            case 'B':
                if (!(flags & ANSI))
                    fprintf(ofp,"%s\n", START_TRAN);
                cptr++;
                break;
            case 'c':
            case 'C':
                if (flags & DBASE)
                    fprintf(ofp, SET_DBASE, db_name);
                cptr++;
                break;
            case 'e':
            case 'E':
                if (!(flags & ANSI))
                    fprintf(ofp,"%s\n", END_TRAN);
                cptr++;
                break;
            case 'n':
            case 'N':
                if (!(flags & DFLT_NUM))
                    {
                    rowcnt=atoi(++cptr);
                    while (isdigit(*cptr) || *cptr == ' ') cptr++;
                    fprintf(ofp, SET_ROWCOUNT, rowcnt);
                    }
                continue;
            case 'o':
            case 'O':
                if (flags & OUTPUT)
                    fprintf(ofp,"%s '%s/%s.%d'", SET_OUTPUT, osuff,
```

```
                        qtag, (snum < 0)?0:snum);
                    cptr++;
                    break;
                case 'q':
                case 'Q':
                    fprintf(ofp,"%s", qtag);
                    cptr++;
                    break;
                case 's':
                case 'S':
                    fprintf(ofp,"%d", (snum < 0)?0:snum);
                    cptr++;
                    break;
                case 'X':
                case 'x':
                    if (flags & EXPLAIN)
                        fprintf(ofp, "%s\n", GEN_QUERY_PLAN);
                    cptr++;
                    break;
            case '1':
            case '2':
            case '3':
            case '4':
            case '5':
            case '6':
            case '7':
            case '8':
            case '9':
                    varsub(qnum, atoi(cptr), flags & DFLT);
                    while (isdigit(*++cptr));
                    break;
                default:
                fprintf(stderr, "-- unknown flag '%c%c' ignored\n",
                        VTAG, *cptr);
                cptr++;
                break;
                }
            mark=cptr;
            }
        fprintf(ofp,"%s", mark);
        }
    fclose(qfp);
    fflush(stdout);
    return;
}

void
usage(void)
{
printf("%s Parameter Substitution (v. %d.%d.%d%s)\n",
          NAME, VERSION,RELEASE,
            MODIFICATION,PATCH);
printf("Copyright %s %s\n", TPC, C_DATES);
printf("USAGE: %s <options> [ queries ]\n", prog);
printf("Options:\n");
```

```
printf("\t-a\t\t-- use ANSI semantics.\n");
printf("\t-b <str>\t-- load distributions from <str>\n");
printf("\t-c\t\t-- retain comments found in template.\n");
printf("\t-d\t\t-- use default substitution values.\n");
printf("\t-h\t\t-- print this usage summary.\n");
printf("\t-i <str>\t-- use the contents of file <str> to begin a
query.\n");
printf("\t-l <str>\t-- log parameters to <str>.\n");
printf("\t-n <str>\t-- connect to database <str>.\n");
printf("\t-N\t\t-- use default rowcounts and ignore :n directive.\n");
printf("\t-o <str>\t-- set the output file base path to <str>.\n");
printf("\t-p <n>\t\t-- use the query permutation for stream <n>\n");
printf("\t-r <n>\t\t-- seed the random number generator with <n>\n");
printf("\t-s <n>\t\t-- base substitutions on an SF of <n>\n");
printf("\t-v\t\t-- verbose.\n");
printf("\t-t <str>\t-- use the contents of file <str> to complete a
query\n");
printf("\t-x\t\t-- enable SET EXPLAIN in each query.\n");
}

int
process_options(int cnt, char **args)
{
    int flag;

    while((flag = getopt(cnt, args, "ab:cdhi:n:Nl:o:p:r:s:t:vx")) != -
1)
        switch(flag)
            {
            case 'a':   /* use ANSI semantics */
                flags |= ANSI;
                break;
                  case 'b':               /* load distributions from
named file */
                       d_path = (char *)malloc(strlen(optarg) + 1);
                       MALLOC_CHECK(d_path);
                       strcpy(d_path, optarg);
                       break;
                  case 'c':   /* retain comments in EQT */
                flags |= COMMENT;
                break;
            case 'd':   /* use default substitution values */
                flags |= DFLT;
                break;
            case 'h':   /* just generate the usage summary */
                usage();
                exit(0);
                break;
            case 'i':   /* set stream initialization file name */
                ifile = malloc(strlen(optarg) + 1);
                MALLOC_CHECK(ifile);
                strcpy(ifile, optarg);
                flags |= INIT;
                break;
            case 'l':   /* log parameter usages */
```

```
                lfile = malloc(strlen(optarg) + 1);
                MALLOC_CHECK(lfile);
                strcpy(lfile, optarg);
                flags |= LOG;
                break;
            case 'N':   /* use default rowcounts */
                flags |= DFLT_NUM;
                break;
            case 'n':   /* set database name */
                db_name = malloc(strlen(optarg) + 1);
                MALLOC_CHECK(db_name);
                strcpy(db_name, optarg);
                flags |= DBASE;
                break;
            case 'o':   /* set the output path */
                osuff = malloc(strlen(optarg) + 1);
                MALLOC_CHECK(osuff);
                strcpy(osuff, optarg);
                flags |=OUTPUT;
                break;
            case 'p':   /* permutation for a given stream */
                snum = atoi(optarg);
                break;
            case 'r':   /* set random number seed for parameter gen */
                flags |= SEED;
                rndm = atol(optarg);
                break;
            case 's':   /* scale of data set to run against */
                flt_scale = atof(optarg);
                        /*
                        if (scale > MAX_SCALE)
                              fprintf(stderr, "%s %5.0f %s\n%s\n",
                                    "WARNING: Support for scale factors
>",
                                    MAX_SCALE,
                                    "GB is still in development.",
                                    "Data set integrity is not
guaranteed.\n");
                        */
                break;
            case 't':   /* set termination file name */
                tfile = malloc(strlen(optarg) + 1);
                MALLOC_CHECK(tfile);
                strcpy(tfile, optarg);
                flags |= TERMINATE;
                break;
            case 'v':   /* verbose */
                flags |= VERBOSE;
                break;
            case 'x':   /* set explain in the queries */
                flags |= EXPLAIN;
                break;
            default:
                printf("unknown option '%s' ignored\n", args[optind]);
                usage();
```

```
                exit(1);
                break;
            }
    return(0);
}

int
setup(void)
{
    asc_date = mk_ascdate();
    read_dist(env_config(DIST_TAG, DIST_DFLT), "p_cntr", &p_cntr_set);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "colors", &colors);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "p_types",
&p_types_set);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "nations", &nations);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "nations2", &nations2);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "regions", &regions);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "o_oprio",
        &o_priority_set);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "instruct",
        &l_instruct_set);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "smode", &l_smode_set);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "category",
        &l_category_set);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "rflag", &l_rflag_set);
    read_dist(env_config(DIST_TAG, DIST_DFLT), "msegmnt", &c_mseg_set);
      read_dist(env_config(DIST_TAG, DIST_DFLT), "Q13a", &q13a);
      read_dist(env_config(DIST_TAG, DIST_DFLT), "Q13b", &q13b);

    return(0);
}


main(int ac, char **av)
{
    int i;
    FILE *ifp;
    char line[LINE_SIZE];

    prog = av[0];
    flt_scale = (double)1.0;
    flags = 0;
      d_path = NULL;
    process_options(ac, av);
    if (flags & VERBOSE)
        fprintf(ofp,
          "-- TPC %s Parameter Substitution (Version %d.%d.%d%s)\n",
            NAME, VERSION, RELEASE, MODIFICATION, PATCH);

    setup();

    if (!(flags & DFLT))        /* perturb the RNG */
          {
          if (!(flags & SEED))
                rndm = (long)((unsigned)time(NULL) * DSS_PROC);
```

```
        if (rndm < 0)
              rndm += 2147483647;
        Seed[0].value = rndm;
        for (i=1; i <= QUERIES_PER_SET; i++)
              {
              Seed[0].value = NextRand(Seed[0].value);
              Seed[i].value = Seed[0].value;
              }
        printf("-- using %ld as a seed to the RNG\n", rndm);
        }
else
    printf("-- using default substitutions\n");

if (flags & INIT)           /* init stream with ifile */
    {
    ifp = fopen(ifile, "r");
  OPEN_CHECK(ifp, ifile);
    while (fgets(line, LINE_SIZE, ifp) != NULL)
        fprintf(stdout, "%s", line);
    }

if (snum >= 0)
    if (optind < ac)
        for (i=optind; i < ac; i++)
            {
            char qname[10];
            sprintf(qname, "%d", SEQUENCE(snum, atoi(av[i])));
            qsub(qname, flags);
            }
    else
        for (i=1; i <= QUERIES_PER_SET; i++)
            {
            char qname[10];
            sprintf(qname, "%d", SEQUENCE(snum, i));
            qsub(qname, flags);
            }
else
    if (optind < ac)
        for (i=optind; i < ac; i++)
            qsub(av[i], flags);
    else
        for (i=1; i <= QUERIES_PER_SET; i++)
            {
            char qname[10];
            sprintf(qname, "%d", i);
            qsub(qname, flags);
            }

if (flags & TERMINATE)      /* terminate stream with tfile */
    {
    ifp = fopen(tfile, "r");
    if (ifp == NULL)
  OPEN_CHECK(ifp, tfile);
    while (fgets(line, LINE_SIZE, ifp) != NULL)
        fprintf(stdout, "%s", line);
```

```
        }

    return(0);
}
```

driver.c

```
/*
* $Id: driver.c,v 1.5 2004/04/07 20:17:29 jms Exp $
*
* Revision History
* ===================
* $Log: driver.c,v $
* Revision 1.5  2004/04/07 20:17:29  jms
* bug #58 (join fails between order/lineitem)
*
* Revision 1.4  2004/02/18 16:26:49  jms
* 32/64 bit changes for overflow handling needed additional changes
when ported back to windows
*
* Revision 1.3  2004/01/22 05:49:29  jms
* AIX porting (AIX 5.1)
*
* Revision 1.2  2004/01/22 03:54:12  jms
* 64 bit support changes for customer address
*
* Revision 1.1.1.1  2003/08/08 21:50:33  jms
* recreation after CVS crash
*
* Revision 1.3  2003/08/08 21:35:26  jms
* first integration of rng64 for o_custkey and l_partkey
*
* Revision 1.2  2003/08/07 17:58:34  jms
* Convery RNG to 64bit space as preparation for new large scale RNG
*
* Revision 1.1.1.1  2003/04/03 18:54:21  jms
* initial checkin
*
*
*/
/* main driver for dss banchmark */

#define DECLARER                    /* EXTERN references get defined
here */
#define NO_FUNC (int (*) ()) NULL   /* to clean up tdefs */
#define NO_LFUNC (long (*) ()) NULL       /* to clean up tdefs */

#include "config.h"
#include <stdlib.h>
#if (defined(_POSIX_)||!defined(WIN32))         /* Change for Windows
NT */
#include <unistd.h>
#include <sys/wait.h>
#endif /* WIN32 */
#include <stdio.h>                          /* */
```

```
#include <limits.h>
#include <math.h>
#include <ctype.h>
#include <signal.h>
#include <string.h>
#include <errno.h>
#ifdef HP
#include <strings.h>
#endif
#if (defined(WIN32)&&!defined(_POSIX_))
#include <process.h>
#pragma warning(disable:4201)
#pragma warning(disable:4214)
#pragma warning(disable:4514)
#define WIN32_LEAN_AND_MEAN
#define NOATOM
#define NOGDICAPMASKS
#define NOMETAFILE
#define NOMINMAX
#define NOMSG
#define NOOPENFILE
#define NORASTEROPS
#define NOSCROLL
#define NOSOUND
#define NOSYSMETRICS
#define NOTEXTMETRIC
#define NOWH
#define NOCOMM
#define NOKANJI
#define NOMCX
#include <windows.h>
#pragma warning(default:4201)
#pragma warning(default:4214)
#endif

#include "dss.h"
#include "dsstypes.h"

/*
* Function prototypes
*/
void  usage (void);
int         prep_direct (char *);
int         close_direct (void);
void  kill_load (void);
int         pload (int tbl);
void  gen_tbl (int tnum, DSS_HUGE start, DSS_HUGE count, long upd_num);
int         pr_drange (int tbl, DSS_HUGE min, DSS_HUGE cnt, long num);
int         set_files (int t, int pload);
int         partial (int, int);


extern int optind, opterr;
extern char *optarg;
DSS_HUGE rowcnt = 0, minrow = 0;
```

```
long upd_num = 0;
double flt_scale;
#if (defined(WIN32)&&!defined(_POSIX_))
char *spawn_args[25];
#endif


/*
* general table descriptions. See dss.h for details on structure
* NOTE: tables with no scaling info are scaled according to
* another table
*
*
* the following is based on the tdef structure defined in dss.h as:
* typedef struct
* {
* char     *name;            -- name of the table;
*                               flat file output in <name>.tbl
* long      base;            -- base scale rowcount of table;
*                               0 if derived
* int       (*header) ();    -- function to prep output
* int       (*loader[2]) (); -- functions to present output
* long      (*gen_seed) ();  -- functions to seed the RNG
* int       (*verify) ();    -- function to verfiy the data set without
building it
* int       child;           -- non-zero if there is an associated
detail table
* unsigned long vtotal;      -- "checksum" total
* }         tdef;
*
*/

/*
* flat file print functions; used with -F(lat) option
*/
int pr_cust (customer_t * c, int mode);
int pr_line (order_t * o, int mode);
int pr_order (order_t * o, int mode);
int pr_part (part_t * p, int mode);
int pr_psupp (part_t * p, int mode);
int pr_supp (supplier_t * s, int mode);
int pr_order_line (order_t * o, int mode);
int pr_part_psupp (part_t * p, int mode);
int pr_nation (code_t * c, int mode);
int pr_region (code_t * c, int mode);

/*
* inline load functions; used with -D(irect) option
*/
int ld_cust (customer_t * c, int mode);
int ld_line (order_t * o, int mode);
int ld_order (order_t * o, int mode);
int ld_part (part_t * p, int mode);
int ld_psupp (part_t * p, int mode);
int ld_supp (supplier_t * s, int mode);
```

```
int ld_order_line (order_t * o, int mode);
int ld_part_psupp (part_t * p, int mode);
int ld_nation (code_t * c, int mode);
int ld_region (code_t * c, int mode);

/*
* seed generation functions; used with '-O s' option
*/
long sd_cust (int child, DSS_HUGE skip_count);
long sd_line (int child, DSS_HUGE skip_count);
long sd_order (int child, DSS_HUGE skip_count);
long sd_part (int child, DSS_HUGE skip_count);
long sd_psupp (int child, DSS_HUGE skip_count);
long sd_supp (int child, DSS_HUGE skip_count);
long sd_order_line (int child, DSS_HUGE skip_count);
long sd_part_psupp (int child, DSS_HUGE skip_count);

/*
* header output functions); used with -h(eader) option
*/
int hd_cust (FILE * f);
int hd_line (FILE * f);
int hd_order (FILE * f);
int hd_part (FILE * f);
int hd_psupp (FILE * f);
int hd_supp (FILE * f);
int hd_order_line (FILE * f);
int hd_part_psupp (FILE * f);
int hd_nation (FILE * f);
int hd_region (FILE * f);

/*
* data verfication functions; used with -O v option
*/
int vrf_cust (customer_t * c, int mode);
int vrf_line (order_t * o, int mode);
int vrf_order (order_t * o, int mode);
int vrf_part (part_t * p, int mode);
int vrf_psupp (part_t * p, int mode);
int vrf_supp (supplier_t * s, int mode);
int vrf_order_line (order_t * o, int mode);
int vrf_part_psupp (part_t * p, int mode);
int vrf_nation (code_t * c, int mode);
int vrf_region (code_t * c, int mode);


tdef tdefs[] =
{
      {"part.tbl", "part table", 200000, hd_part,
            {pr_part, ld_part}, sd_part, vrf_part, PSUPP, 0},
      {"partsupp.tbl", "partsupplier table", 200000, hd_psupp,
            {pr_psupp, ld_psupp}, sd_psupp, vrf_psupp, NONE, 0},
      {"supplier.tbl", "suppliers table", 10000, hd_supp,
            {pr_supp, ld_supp}, sd_supp, vrf_supp, NONE, 0},
      {"customer.tbl", "customers table", 150000, hd_cust,
```

```
            {pr_cust, ld_cust}, sd_cust, vrf_cust, NONE, 0},
      {"orders.tbl", "order table", 150000, hd_order,
            {pr_order, ld_order}, sd_order, vrf_order, LINE, 0},
      {"lineitem.tbl", "lineitem table", 150000, hd_line,
            {pr_line, ld_line}, sd_line, vrf_line, NONE, 0},
      {"orders.tbl", "orders/lineitem tables", 150000, hd_order_line,
            {pr_order_line, ld_order_line}, sd_order, vrf_order_line,
LINE, 0},
      {"part.tbl", "part/partsupplier tables", 200000, hd_part_psupp,
            {pr_part_psupp, ld_part_psupp}, sd_part, vrf_part_psupp,
PSUPP, 0},
      {"nation.tbl", "nation table", NATIONS_MAX, hd_nation,
            {pr_nation, ld_nation}, NO_LFUNC, vrf_nation, NONE, 0},
      {"region.tbl", "region table", NATIONS_MAX, hd_region,
            {pr_region, ld_region}, NO_LFUNC, vrf_region, NONE, 0},
};

int *pids;


/*
* routines to handle the graceful cleanup of multi-process loads
*/

void
stop_proc (int signum)
{
      exit (0);
}

void
kill_load (void)
{
      int i;

#if !defined(U2200) && !defined(DOS)
      for (i = 0; i < children; i++)
            if (pids[i])
                  KILL (pids[i]);
#endif /* !U2200 && !DOS */
            return;
}

/*
* re-set default output file names
*/
int
set_files (int i, int pload)
{
      char line[80], *new_name;

      if (table & (1 << i))
child_table:
      {
            if (pload != -1)
```

```
                sprintf (line, "%s.%d", tdefs[i].name, pload);
            else
            {
                printf ("Enter new destination for %s data: ",
                    tdefs[i].name);
                if (fgets (line, sizeof (line), stdin) == NULL)
                    return (-1);;
                if ((new_name = strchr (line, '\n')) != NULL)
                    *new_name = '\0';
                if (strlen (line) == 0)
                    return (0);
            }
            new_name = (char *) malloc (strlen (line) + 1);
            MALLOC_CHECK (new_name);
            strcpy (new_name, line);
            tdefs[i].name = new_name;
            if (tdefs[i].child != NONE)
            {
                i = tdefs[i].child;
                tdefs[i].child = NONE;
                goto child_table;
            }
        }

        return (0);
}



/*
* read the distributions needed in the benchamrk
*/
void
load_dists (void)
{
        read_dist (env_config (DIST_TAG, DIST_DFLT), "p_cntr",
&p_cntr_set);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "colors", &colors);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "p_types",
&p_types_set);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "nations",
&nations);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "regions",
&regions);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "o_oprio",
              &o_priority_set);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "instruct",
              &l_instruct_set);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "smode",
&l_smode_set);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "category",
              &l_category_set);
        read_dist (env_config (DIST_TAG, DIST_DFLT), "rflag",
&l_rflag_set);
```

```
      read_dist (env_config (DIST_TAG, DIST_DFLT), "msegmnt",
&c_mseg_set);

      /* load the distributions that contain text generation */
      read_dist (env_config (DIST_TAG, DIST_DFLT), "nouns", &nouns);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "verbs", &verbs);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "adjectives",
&adjectives);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "adverbs",
&adverbs);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "auxillaries",
&auxillaries);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "terminators",
&terminators);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "articles",
&articles);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "prepositions",
&prepositions);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "grammar",
&grammar);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "np", &np);
      read_dist (env_config (DIST_TAG, DIST_DFLT), "vp", &vp);

}

/*
* generate a particular table
*/
void
gen_tbl (int tnum, DSS_HUGE start, DSS_HUGE count, long upd_num)
{
      static order_t o;
      supplier_t supp;
      customer_t cust;
      part_t part;
      code_t code;
      static int completed = 0;
      DSS_HUGE i;

      DSS_HUGE rows_per_segment=0;
      DSS_HUGE rows_this_segment=-1;
      DSS_HUGE residual_rows=0;

      if (insert_segments)
            {
            rows_per_segment = count / insert_segments;
            residual_rows = count - (rows_per_segment *
insert_segments);
            }

      for (i = start; count; count--, i++)
      {
            LIFENOISE (1000, i);
            row_start(tnum);
```

```
            switch (tnum)
            {
            case LINE:
            case ORDER:
            case ORDER_LINE:
                  mk_order (i, &o, upd_num % 10000);

              if (insert_segments  && (upd_num > 0))
                  if((upd_num / 10000) < residual_rows)
                        {
                        if((++rows_this_segment) > rows_per_segment)
                              {
                              rows_this_segment=0;
                              upd_num += 10000;
                              }
                        }
                  else
                        {
                        if((++rows_this_segment) >= rows_per_segment)
                              {
                              rows_this_segment=0;
                              upd_num += 10000;
                              }
                        }

                  if (set_seeds == 0)
                        if (validate)
                              tdefs[tnum].verify(&o, 0);
                        else
                              tdefs[tnum].loader[direct] (&o, upd_num);
                  break;
            case SUPP:
                  mk_supp (i, &supp);
                  if (set_seeds == 0)
                        if (validate)
                              tdefs[tnum].verify(&supp, 0);
                        else
                              tdefs[tnum].loader[direct] (&supp,
upd_num);
                  break;
            case CUST:
                  mk_cust (i, &cust);
                  if (set_seeds == 0)
                        if (validate)
                              tdefs[tnum].verify(&cust, 0);
                        else
                              tdefs[tnum].loader[direct] (&cust,
upd_num);
                  break;
            case PSUPP:
            case PART:
            case PART_PSUPP:
                  mk_part (i, &part);
                  if (set_seeds == 0)
                        if (validate)
```

```
                              tdefs[tnum].verify(&part, 0);
                        else
                              tdefs[tnum].loader[direct] (&part,
upd_num);
                  break;
            case NATION:
                  mk_nation (i, &code);
                  if (set_seeds == 0)
                        if (validate)
                              tdefs[tnum].verify(&code, 0);
                        else
                              tdefs[tnum].loader[direct] (&code, 0);
                  break;
            case REGION:
                  mk_region (i, &code);
                  if (set_seeds == 0)
                        if (validate)
                              tdefs[tnum].verify(&code, 0);
                        else
                              tdefs[tnum].loader[direct] (&code, 0);
                  break;
            }
            row_stop(tnum);
            if (set_seeds && (i % tdefs[tnum].base) < 2)
            {
                  printf("\nSeeds for %s at rowcount %ld\n",
tdefs[tnum].comment, i);
                  dump_seeds(tnum);
            }
      }
      completed |= 1 << tnum;
}



void
usage (void)
{
      fprintf (stderr, "%s\n%s\n\t%s\n%s %s\n\n",
            "USAGE:",
            "dbgen [-{vfFD}] [-O {fhmsv}][-T {pcsoPSOL}]",
            "[-s <scale>][-C <procs>][-S <step>]",
            "dbgen [-v] [-O {dfhmr}] [-s <scale>]",
            "[-U <updates>] [-r <percent>]");
      fprintf (stderr, "-b <s> -- load distributions for <s>\n");
      fprintf (stderr, "-C <n> -- use <n> processes to generate
data\n");
      fprintf (stderr, "          [Under DOS, must be used with -
S]\n");
      fprintf (stderr, "-D     -- do database load in line\n");
    fprintf (stderr, "-d <n> -- split deletes between <n> files\n");
      fprintf (stderr, "-f     -- force. Overwrite existing files\n");
      fprintf (stderr, "-F     -- generate flat files output\n");
      fprintf (stderr, "-h     -- display this message\n");
    fprintf (stderr, "-i <n> -- split inserts between <n> files\n");
```

```
      fprintf (stderr, "-n <s> -- inline load into database <s>\n");
      fprintf (stderr, "-O d   -- generate SQL syntax for deletes\n");
      fprintf (stderr, "-O f   -- over-ride default output file
names\n");
      fprintf (stderr, "-O h   -- output files with headers\n");
      fprintf (stderr, "-O m   -- produce columnar output\n");
      fprintf (stderr, "-O r   -- generate key ranges for deletes.\n");
      fprintf (stderr, "-O v   -- Verify data set without generating
it.\n");
      fprintf (stderr, "-q     -- enable QUIET mode\n");
      fprintf (stderr, "-r <n> -- updates refresh (n/100)%% of the\n");
      fprintf (stderr, "          data set\n");
      fprintf (stderr, "-s <n> -- set Scale Factor (SF) to  <n> \n");
      fprintf (stderr, "-S <n> -- build the <n>th step of the
data/update set\n");
      fprintf (stderr, "-T c   -- generate cutomers ONLY\n");
      fprintf (stderr, "-T l   -- generate nation/region ONLY\n");
      fprintf (stderr, "-T L   -- generate lineitem ONLY\n");
      fprintf (stderr, "-T n   -- generate nation ONLY\n");
      fprintf (stderr, "-T o   -- generate orders/lineitem ONLY\n");
      fprintf (stderr, "-T O   -- generate orders ONLY\n");
      fprintf (stderr, "-T p   -- generate parts/partsupp ONLY\n");
      fprintf (stderr, "-T P   -- generate parts ONLY\n");
      fprintf (stderr, "-T r   -- generate region ONLY\n");
      fprintf (stderr, "-T s   -- generate suppliers ONLY\n");
      fprintf (stderr, "-T S   -- generate partsupp ONLY\n");
      fprintf (stderr, "-U <s> -- generate <s> update sets\n");
      fprintf (stderr, "-v     -- enable VERBOSE mode\n");
      fprintf (stderr,
            "\nTo generate the SF=1 (1GB), validation database
population, use:\n");
      fprintf (stderr, "\tdbgen -vfF -s 1\n");
      fprintf (stderr, "\nTo generate updates for a SF=1 (1GB),
use:\n");
      fprintf (stderr, "\tdbgen -v -U 1 -s 1\n");
}

/*
* pload() -- handle the parallel loading of tables
*/
#ifndef DOS
/*
* int partial(int tbl, int s) -- generate the s-th part of the named
tables data
*/
int
partial (int tbl, int s)
{
      DSS_HUGE rowcnt;
      DSS_HUGE extra;

      if (verbose > 0)
      {
            fprintf (stderr, "\tStarting to load stage %d of %d for
%s...",
```

```
                s, children, tdefs[tbl].comment);
        }

        if (direct == 0)
                set_files (tbl, s);

        rowcnt = set_state(tbl, scale, children, s, &extra);

        if (s == children)
                gen_tbl (tbl, rowcnt * (s - 1) + 1, rowcnt + extra,
upd_num);
        else
                gen_tbl (tbl, rowcnt * (s - 1) + 1, rowcnt, upd_num);

        if (verbose > 0)
                fprintf (stderr, "done.\n");

        return (0);
}


int
pload (int tbl)
{
        int c = 0, i, status;

        if (verbose > 0)
        {
                fprintf (stderr, "Starting %d children to load %s",
                        children, tdefs[tbl].comment);
        }
        for (c = 0; c < children; c++)
        {
                pids[c] = SPAWN ();
                if (pids[c] == -1)
                {
                        perror ("Child loader not created");
                        kill_load ();
                        exit (-1);
                }
                else if (pids[c] == 0)  /* CHILD */
                {
                        SET_HANDLER (stop_proc);
                        verbose = 0;
                        partial (tbl, c+1);
                        exit (0);
                }
                else if (verbose > 0)               /* PARENT */
                        fprintf (stderr, ".");
        }

        if (verbose > 0)
                fprintf (stderr, "waiting...");

        c = children;
```

```
      while (c)
      {
            i = WAIT (&status, pids[c - 1]);
            if (i == -1 && children)
            {
                  if (errno == ECHILD)
                        fprintf (stderr, "\nCould not wait on pid
%d\n", pids[c - 1]);
                  else if (errno == EINTR)
                        fprintf (stderr, "\nProcess %d stopped
abnormally\n", pids[c - 1]);
                  else if (errno == EINVAL)
                        fprintf (stderr, "\nProgram bug\n");
            }
            if (! WIFEXITED(status)) {
                  (void) fprintf(stderr, "\nProcess %d: ", i);
                  if (WIFSIGNALED(status)) {
                        (void) fprintf(stderr, "rcvd signal %d\n",
                              WTERMSIG(status));
                        } else if (WIFSTOPPED(status)) {
                        (void) fprintf(stderr, "stopped, signal %d\n",
                              WSTOPSIG(status));
                              }

                  }
            c--;
      }

      if (verbose > 0)
            fprintf (stderr, "done\n");
      return (0);
}
#endif /* !DOS */

void
process_options (int count, char **vector)
{
      int option;

      while ((option = getopt (count, vector,
            "b:C:Dd:Ffi:hn:O:P:qr:s:S:T:U:v")) != -1)
      switch (option)
            {
            case 'b':                     /* load distributions from
named file */
                  d_path = (char *)malloc(strlen(optarg) + 1);
                  MALLOC_CHECK(d_path);
                  strcpy(d_path, optarg);
                  break;
            case 'q':                     /* all prompts disabled */
                  verbose = -1;
                  break;
            case 'i':
                  insert_segments = atoi (optarg);
                  break;
```

```
            case 'd':
                  delete_segments = atoi (optarg);
                  break;
            case 'S':                     /* generate a particular STEP */
                  step = atoi (optarg);
                  break;
            case 'v':                     /* life noises enabled */
                  verbose = 1;
                  break;
            case 'f':                     /* blind overwrites; Force */
                  force = 1;
                  break;
            case 'T':                     /* generate a specifc table */
                  switch (*optarg)
                  {
                  case 'c':               /* generate customer ONLY */
                        table = 1 << CUST;
                        break;
                  case 'L':               /* generate lineitems ONLY */
                        table = 1 << LINE;
                        break;
                  case 'l':               /* generate code table ONLY */
                        table = 1 << NATION;
                        table |= 1 << REGION;
                        break;
                  case 'n':               /* generate nation table ONLY */
                        table = 1 << NATION;
                        break;
                  case 'O':               /* generate orders ONLY */
                        table = 1 << ORDER;
                        break;
                  case 'o':               /* generate orders/lineitems ONLY
*/
                        table = 1 << ORDER_LINE;
                        break;
                  case 'P':               /* generate part ONLY */
                        table = 1 << PART;
                        break;
                  case 'p':               /* generate part/partsupp ONLY */
                        table = 1 << PART_PSUPP;
                        break;
                  case 'r':               /* generate region table ONLY */
                        table = 1 << REGION;
                        break;
                  case 'S':               /* generate partsupp ONLY */
                        table = 1 << PSUPP;
                        break;
                  case 's':               /* generate suppliers ONLY */
                        table = 1 << SUPP;
                        break;
                  default:
                        fprintf (stderr, "Unknown table name %s\n",
                              optarg);
                        usage ();
                        exit (1);
```

```
            }
            break;
            case 's':                   /* scale by Percentage of
base rowcount */
            case 'P':                   /* for backward compatibility
*/
                  flt_scale = atof (optarg);
                  if (flt_scale < MIN_SCALE)
                  {
                        int i;
                        int int_scale;

                        scale = 1;
                        int_scale = (int)(1000 * flt_scale);
                        for (i = PART; i < REGION; i++)
                        {
                              tdefs[i].base = (DSS_HUGE)(int_scale *
tdefs[i].base)/1000;
                              if (tdefs[i].base < 1)
                                    tdefs[i].base = 1;
                        }
                  }
                  else
                        scale = (long) flt_scale;
                  /*
                  if (scale > MAX_SCALE)
                  {
                        fprintf (stderr, "%s %5.0f %s\n\t%s\n\n",
                              "NOTE: Data generation for scale
factors >",
                              MAX_SCALE,
                              "GB is still in development,",
                              "and is not yet supported.\n");
                        fprintf (stderr,
                              "Your resulting data set MAY NOT BE
COMPLIANT!\n");
                  }
                  */
                  break;
            case 'O':                   /* optional actions */
                  switch (tolower (*optarg))
                  {
                  case 'd':             /* generate SQL for deletes
*/
                        gen_sql = 1;
                        break;
                  case 'f':             /* over-ride default file
names */
                        fnames = 1;
                        break;
                  case 'h':             /* generate headers */
                        header = 1;
                        break;
                  case 'm':             /* generate columnar output
*/
```

```
                        columnar = 1;
                        break;
                  case 'r':             /* generate key ranges for
delete */
                        gen_rng = 1;
                        break;
                  case 's':             /* calibrate the RNG usage */
                        set_seeds = 1;
                        break;
                  case 'v':             /* validate the data set */
                        validate = 1;
                        break;
                  default:
                        fprintf (stderr, "Unknown option name %s\n",
                              optarg);
                        usage ();
                        exit (1);
                  }
                  break;
                  case 'D':                   /* direct load of
generated data */
                        direct = 1;
                        break;
                  case 'F':                   /* generate flat files
for later loading */
                        direct = 0;
                        break;
                  case 'U':                   /* generate flat files
for update stream */
                        updates = atoi (optarg);
                        break;
                  case 'r':                   /* set the refresh
(update) percentage */
                        refresh = atoi (optarg);
                        break;
#ifndef DOS
                  case 'C':
                        children = atoi (optarg);
                        break;
#endif /* !DOS */
                  case 'n':                   /* set name of database
for direct load */
                        db_name = (char *) malloc (strlen (optarg) +
1);
                        MALLOC_CHECK (db_name);
                        strcpy (db_name, optarg);
                        break;
                  default:
                        printf ("ERROR: option '%c' unknown.\n",
                              *(vector[optind] + 1));
                  case 'h':                   /* something unexpected
*/
                        fprintf (stderr,
                              "%s Population Generator (Version
%d.%d.%d%s)\n",
```

```
                                NAME, VERSION, RELEASE,
                                MODIFICATION, PATCH);
                        fprintf (stderr, "Copyright %s %s\n", TPC,
C_DATES);
                        usage ();
                        exit (1);
        }

#ifndef DOS
      if (children != 1 && step == -1)
            {
            pids = malloc(children * sizeof(pid_t));
            MALLOC_CHECK(pids)
            }
#else
      if (children != 1 && step < 0)
            {
            fprintf(stderr, "ERROR: -C must be accompanied by -S on
this platform\n");
            exit(1);
            }
#endif /* DOS */

      return;
}

/*
* MAIN
*
* assumes the existance of getopt() to clean up the command
* line handling
*/
int
main (int ac, char **av)
{
      DSS_HUGE i;

      table = (1 << CUST) |
            (1 << SUPP) |
            (1 << NATION) |
            (1 << REGION) |
            (1 << PART_PSUPP) |
            (1 << ORDER_LINE);
      force = 0;
    insert_segments=0;
    delete_segments=0;
    insert_orders_segment=0;
    insert_lineitem_segment=0;
    delete_segment=0;
      verbose = 0;
      columnar = 0;
      set_seeds = 0;
      header = 0;
      direct = 0;
      scale = 1;
```

```
      flt_scale = 1.0;
      updates = 0;
      refresh = UPD_PCT;
      step = -1;
      tdefs[ORDER].base *=
            ORDERS_PER_CUST;              /* have to do this after init
*/
      tdefs[LINE].base *=
            ORDERS_PER_CUST;              /* have to do this after init
*/
      tdefs[ORDER_LINE].base *=
            ORDERS_PER_CUST;              /* have to do this after init
*/
      fnames = 0;
      db_name = NULL;
      gen_sql = 0;
      gen_rng = 0;
      children = 1;
      d_path = NULL;

#ifdef NO_SUPPORT
      signal (SIGINT, exit);
#endif /* NO_SUPPORT */
      process_options (ac, av);
#if (defined(WIN32)&&!defined(_POSIX_))
      for (i = 0; i < ac; i++)
      {
            spawn_args[i] = malloc ((strlen (av[i]) + 1) * sizeof
(char));
            MALLOC_CHECK (spawn_args[i]);
            strcpy (spawn_args[i], av[i]);
      }
      spawn_args[ac] = NULL;
#endif

      if (verbose >= 0)
            {
            fprintf (stderr,
                  "%s Population Generator (Version %d.%d.%d%s)\n",
                  NAME, VERSION, RELEASE, MODIFICATION, PATCH);
            fprintf (stderr, "Copyright %s %s\n", TPC, C_DATES);
            }

      load_dists ();
      /* have to do this after init */
      tdefs[NATION].base = nations.count;
      tdefs[REGION].base = regions.count;

      /*
      * updates are never parallelized
      */
      if (updates)
            {
            /*
             * set RNG to start generating rows beyond SF=scale
```

```
             */
            set_state (ORDER, scale, children, children + 1, &i);
            rowcnt = (int)(tdefs[ORDER_LINE].base / 10000 * scale *
refresh);
            if (step > 0)
                  {
                  /*
                   * adjust RNG for any prior update generation
                   */
                  sd_order(0, rowcnt * (step - 1));
                  sd_line(0, rowcnt * (step - 1));
                  upd_num = step - 1;
                  }
            else
                  upd_num = 0;

            while (upd_num < updates)
                  {
                  if (verbose > 0)
                        fprintf (stderr,
                        "Generating update pair #%d for %s [pid: %d]",
                        upd_num + 1, tdefs[ORDER_LINE].comment,
DSS_PROC);
                  insert_orders_segment=0;
                  insert_lineitem_segment=0;
                  delete_segment=0;
                  minrow = upd_num * rowcnt + 1;
                  gen_tbl (ORDER_LINE, minrow, rowcnt, upd_num + 1);
                  if (verbose > 0)
                        fprintf (stderr, "done.\n");
                  pr_drange (ORDER_LINE, minrow, rowcnt, upd_num + 1);
                  upd_num++;
                  }

            exit (0);
            }

      /**
      ** actual data generation section starts here
      **/
/*
 * open database connection or set all the file names, as appropriate
 */
      if (direct)
            prep_direct ((db_name) ? db_name : DBNAME);
      else if (fnames)
            for (i = PART; i <= REGION; i++)
            {
                  if (table & (1 << i))
                        if (set_files ((int)i, -1))
                        {
                              fprintf (stderr, "Load aborted!\n");
                              exit (1);
                        }
            }
```

```
/*
 * traverse the tables, invoking the appropriate data generation
routine for any to be built
 */
      for (i = PART; i <= REGION; i++)
            if (table & (1 << i))
            {
                  if (children > 1 && i < NATION)
                        if (step >= 0)
                        {
                              if (validate)
                              {
                                    INTERNAL_ERROR("Cannot validate
parallel data generation");
                              }
                              else
                                    partial ((int)i, step);
                        }
#ifdef DOS
                        else
                        {
                              fprintf (stderr,
                                    "Parallel load is not supported on
your platform.\n");
                              exit (1);
                        }
#else
                        else
                        {
                              if (validate)
                              {
                                    INTERNAL_ERROR("Cannot validate
parallel data generation");
                              }
                              else
                                    pload ((int)i);
                        }
#endif /* DOS */
                        else
                        {
                              minrow = 1;
                              if (i < NATION)
                                    rowcnt = tdefs[i].base * scale;
                              else
                                    rowcnt = tdefs[i].base;
                              if (verbose > 0)
                                    fprintf (stderr, "%s data for %s
[pid: %ld]",

      (validate)?"Validating":"Generating", tdefs[i].comment,
DSS_PROC);
                              gen_tbl ((int)i, minrow, rowcnt,
upd_num);
                              if (verbose > 0)
```

```
                                    fprintf (stderr, "done.\n");
                        }
                        if (validate)
                              printf("Validation checksum for %s at %d
GB: %0x\n",
                                    tdefs[i].name, scale,
tdefs[i].vtotal);
            }

            if (direct)
                  close_direct ();

            return (0);
}
```

speed_seed.c

```
/*
* $Id: speed_seed.c,v 1.2 2004/01/22 03:54:12 jms Exp $
*
* Revision History
* ===================
* $Log: speed_seed.c,v $
* Revision 1.2  2004/01/22 03:54:12  jms
* 64 bit support changes for customer address
*
* Revision 1.1.1.1  2003/08/08 22:37:36  jms
* recreation after CVS crash
*
* Revision 1.3  2003/08/08 22:37:36  jms
* first integration of rng64 for o_custkey and l_partkey
*
* Revision 1.2  2003/08/07 17:58:34  jms
* Convery RNG to 64bit space as preparation for new large scale RNG
*
* Revision 1.1.1.1  2003/04/03 18:54:21  jms
* initial checkin
*
*
*/
#include <stdio.h>
#include <stdlib.h>
#include "dss.h"
#include "rng64.h"
#include "dss.h"

/*  _tal long RandSeed = "Random^SeedFromTimestamp" (void); */

#define FAKE_V_STR(avg, sd, cnt) \
      ADVANCE_STREAM(sd, \
            (long)(Seed[sd].boundary*cnt))
#define ADVANCE_STREAM(stream_id, num_calls) \
        NthElement(num_calls, &Seed[stream_id].value)
#define ADVANCE_STREAM64(stream_id, num_calls) \
```

```
        Seed[stream_id].value = AdvanceRand64(Seed[stream_id].value,
num_calls)

#define MAX_COLOR 92
long name_bits[MAX_COLOR / BITS_PER_LONG];
extern seed_t Seed[];

/* WARNING!  This routine assumes the existence of 64-bit
*/
/* integers.  The notation used here- "HUGE" is *not* ANSI standard. */
/* Hopefully, you have this extension as well.  If not, use whatever
*/
/* nonstandard trick you need to in order to get 64 bit integers.
*/
/* The book says that this will work if MAXINT for the type you choose
*/
/* is at least 2**46  - 1, so 64 bits is more than you *really* need
*/

static DSS_HUGE Multiplier = 16807;      /* or whatever nonstandard */
static DSS_HUGE Modulus =  2147483647;   /* trick you use to get 64 bit
int */

/* Advances value of Seed after N applications of the random number
generator
   with multiplier Mult and given Modulus.
   NthElement(Seed[],count);

   Theory:  We are using a generator of the form
        X_n = [Mult * X_(n-1)]  mod Modulus.    It turns out that
        X_n = [(Mult ** n) X_0] mod Modulus.
   This can be computed using a divide-and-conquer technique, see
   the code below.

   In words, this means that if you want the value of the Seed after n
   applications of the generator,  you multiply the initial value of
the
   Seed by the "super multiplier" which is the basic multiplier raised
   to the nth power, and then take mod Modulus.
*/

/* Nth Element of sequence starting with StartSeed */
void NthElement (DSS_HUGE N, DSS_HUGE *StartSeed)
   {
   DSS_HUGE Z;
   DSS_HUGE Mult;
   static int ln=-1;
   int i;

   if ((verbose > 0) && ++ln % 1000 == 0)
       {
       i = ln % LN_CNT;
       fprintf(stderr, "%c\b", lnoise[i]);
       }
   Mult = Multiplier;
```

```
   Z = (DSS_HUGE) *StartSeed;
   while (N > 0 )
      {
      if (N % 2 != 0)    // testing for oddness, this seems portable
         Z = (Mult * Z) % Modulus;
      N = N / 2;         // integer division, truncates
      Mult = (Mult * Mult) % Modulus;
      }
   *StartSeed = Z;

   return;
   }

/* updates Seed[column] using the a_rnd algorithm */
void
fake_a_rnd(int min, int max, int column)
{
   DSS_HUGE len;
   DSS_HUGE itcount;

   RANDOM(len, min, max, column);
   if (len % 5L == 0)
      itcount = len/5;
   else
         itcount = len/5 + 1L;
   NthElement(itcount, &Seed[column].usage);
   return;
}


long
sd_part(int child, DSS_HUGE skip_count)
{
   int i;

   for (i=P_MFG_SD; i<= P_CNTR_SD; i++)
       ADVANCE_STREAM(i, skip_count);

   FAKE_V_STR(P_CMNT_LEN, P_CMNT_SD, skip_count);
   ADVANCE_STREAM(P_NAME_SD, skip_count * 92);

   return(0L);
}

long
sd_line(int child, DSS_HUGE skip_count)
      {
      int i,j;

      for (j=0; j < O_LCNT_MAX; j++)
      {
            for (i=L_QTY_SD; i<= L_RFLG_SD; i++)
                  if (scale >= 30000 && i == L_PKEY_SD)
                        ADVANCE_STREAM64(i, skip_count);
                  else
```

```
                        ADVANCE_STREAM(i, skip_count);
      }

      FAKE_V_STR(L_CMNT_LEN, L_CMNT_SD, skip_count);
      /* need to special case this as the link between master and
detail */
      if (child == 1)
      {
            ADVANCE_STREAM(O_ODATE_SD, skip_count);
            ADVANCE_STREAM(O_LCNT_SD, skip_count);
      }

      return(0L);
      }

long
sd_order(int child, DSS_HUGE skip_count)
{
      ADVANCE_STREAM(O_LCNT_SD, skip_count);
/*
      if (scale >= 30000)
            ADVANCE_STREAM(O_CKEY_SD, skip_count);
      else
            ADVANCE_STREAM64(O_CKEY_SD, skip_count);
            */
      if (scale >= 30000)
            ADVANCE_STREAM64(O_CKEY_SD, skip_count);
      else
            ADVANCE_STREAM(O_CKEY_SD, skip_count);
      FAKE_V_STR(O_CMNT_LEN, O_CMNT_SD, skip_count);
      ADVANCE_STREAM(O_SUPP_SD, skip_count);
      ADVANCE_STREAM(O_CLRK_SD, skip_count);
      ADVANCE_STREAM(O_PRIO_SD, skip_count);
      ADVANCE_STREAM(O_ODATE_SD, skip_count);

      return (0L);
}

long
sd_psupp(int child, DSS_HUGE skip_count)
      {
      int j;

      for (j=0; j < SUPP_PER_PART; j++)
            {
            ADVANCE_STREAM(PS_QTY_SD, skip_count);
            ADVANCE_STREAM(PS_SCST_SD, skip_count);
            }
      FAKE_V_STR(PS_CMNT_LEN, PS_CMNT_SD, skip_count);

      return(0L);
      }

long
sd_cust(int child, DSS_HUGE skip_count)
```

```
{

   FAKE_V_STR(C_ADDR_LEN, C_ADDR_SD, skip_count);
   FAKE_V_STR(C_CMNT_LEN, C_CMNT_SD, skip_count);
   ADVANCE_STREAM(C_NTRG_SD, skip_count);
   ADVANCE_STREAM(C_PHNE_SD, 3L * skip_count);
   ADVANCE_STREAM(C_ABAL_SD, skip_count);
   ADVANCE_STREAM(C_MSEG_SD, skip_count);
   return(0L);
}

long
sd_supp(int child, DSS_HUGE skip_count)
{
   ADVANCE_STREAM(S_NTRG_SD, skip_count);
   ADVANCE_STREAM(S_PHNE_SD, 3L * skip_count);
   ADVANCE_STREAM(S_ABAL_SD, skip_count);
   FAKE_V_STR(S_ADDR_LEN, S_ADDR_SD, skip_count);
   FAKE_V_STR(S_CMNT_LEN, S_CMNT_SD, skip_count);
   ADVANCE_STREAM(BBB_CMNT_SD, skip_count);
   ADVANCE_STREAM(BBB_JNK_SD, skip_count);
   ADVANCE_STREAM(BBB_OFFSET_SD, skip_count);
   ADVANCE_STREAM(BBB_TYPE_SD, skip_count);      /* avoid one trudge */

   return(0L);
}
```

rnd.c

```
/*
* $Id: rnd.c,v 1.6 2004/03/26 20:22:56 jms Exp $
*
* Revision History
* ===================
* $Log: rnd.c,v $
* Revision 1.6  2004/03/26 20:22:56  jms
* correct Solaris header
*
* Revision 1.5  2004/03/02 20:50:50  jms
* MP/RAS porting changes
*
* Revision 1.4  2004/02/18 16:37:33  jms
* add int32_t for solaris
*
* Revision 1.3  2004/02/18 16:26:49  jms
* 32/64 bit changes for overflow handling needed additional changes
when ported back to windows
*
* Revision 1.2  2004/02/18 16:17:32  jms
* add 32bit specific changes to UnifInt
*
* Revision 1.1.1.1  2003/08/08 21:50:34  jms
* recreation after CVS crash
*
* Revision 1.3  2003/08/08 21:35:26  jms
```

```
* first integration of rng64 for o_custkey and l_partkey
*
* Revision 1.2  2003/08/07 17:58:34  jms
* Convery RNG to 64bit space as preparation for new large scale RNG
*
* Revision 1.1.1.1  2003/04/03 18:54:21  jms
* initial checkin
*
*
*/
/*
 * RANDOM.C -- Implements Park & Miller's "Minimum Standard" RNG
 *
 * (Reference:  CACM, Oct 1988, pp 1192-1201)
 *
 * NextRand:  Computes next random integer
 * UnifInt:   Yields an long uniformly distributed between given bounds
 * UnifReal: ields a real uniformly distributed between given bounds
 * Exponential: Yields a real exponentially distributed with given mean
 *
 */

#include "config.h"
#include <stdio.h>
#include <math.h>
#ifdef LINUX
#include <stdint.h>
#endif
#ifdef IBM
#include <inttypes.h>
#endif
#ifdef SOLARIS
#include <inttypes.h>
#endif
#ifdef ATT
#include <sys/bitypes.h>
#endif
#ifdef WIN32
#define int32_t   __int32
#endif
#include "dss.h"
#include "rnd.h"

char *env_config PROTO((char *tag, char *dflt));
void NthElement(DSS_HUGE, DSS_HUGE *);

void
dss_random(DSS_HUGE *tgt, DSS_HUGE lower, DSS_HUGE upper, long stream)
{
      *tgt = UnifInt(lower, upper, stream);
      Seed[stream].usage += 1;

      return;
}
```

```
void
row_start(int t)  \
{
      int i;
      for (i=0; i <= MAX_STREAM; i++)
            Seed[i].usage = 0 ;

      return;
}

void
row_stop(int t)   \
      {
      int i;

      /* need to allow for handling the master and detail together */
      if (t == ORDER_LINE)
            t = ORDER;
      if (t == PART_PSUPP)
            t = PART;

      for (i=0; i <= MAX_STREAM; i++)
            if ((Seed[i].table == t) || (Seed[i].table ==
tdefs[t].child))
                  {
                  if (set_seeds && (Seed[i].usage > Seed[i].boundary))
                        {
                        fprintf(stderr, "\nSEED CHANGE: seed[%d].usage
= %d\n",
                              i, Seed[i].usage);
                        Seed[i].boundary = Seed[i].usage;
                        }
                  else
                        {
                        NthElement((Seed[i].boundary - Seed[i].usage),
&Seed[i].value);
                        }
                  }
            return;
      }

void
dump_seeds(int tbl)
{
      int i;

      for (i=0; i <= MAX_STREAM; i++)
            if (Seed[i].table == tbl)
                  printf("%d:\t%ld\n", i, Seed[i].value);
      return;
}

/*************************************************************

   NextRand:  Computes next random integer
```

```
*************************************************************/

/*
 * long NextRand( long nSeed )
 */
DSS_HUGE
NextRand(DSS_HUGE nSeed)

/*
 * nSeed is the previous random number; the returned value is the
 * next random number. The routine generates all numbers in the
 * range 1 .. nM-1.
 */

{

    /*
     * The routine returns (nSeed * nA) mod nM, where   nA (the
     * multiplier) is 16807, and nM (the modulus) is
     * 2147483647 = 2^31 - 1.
     *
     * nM is prime and nA is a primitive element of the range 1..nM-1.
     * This * means that the map nSeed = (nSeed*nA) mod nM, starting
     * from any nSeed in 1..nM-1, runs through all elements of 1..nM-1
     * before repeating.  It never hits 0 or nM.
     *
     * To compute (nSeed * nA) mod nM without overflow, use the
     * following trick.  Write nM as nQ * nA + nR, where nQ = nM / nA
     * and nR = nM % nA.   (For nM = 2147483647 and nA = 16807,
     * get nQ = 127773 and nR = 2836.) Write nSeed as nU * nQ + nV,
     * where nU = nSeed / nQ and nV = nSeed % nQ.  Then we have:
     *
     * nM  =  nA * nQ  +  nR        nQ = nM / nA        nR < nA < nQ
     *
     * nSeed = nU * nQ  +  nV       nU = nSeed / nQ     nV < nU
     *
     * Since nA < nQ, we have nA*nQ < nM < nA*nQ + nA < nA*nQ + nQ,
     * i.e., nM/nQ = nA.  This gives bounds on nU and nV as well:
     * nM > nSeed  =>  nM/nQ * >= nSeed/nQ  =>  nA >= nU ( > nV ).
     *
     * Using ~ to mean "congruent mod nM" this gives:
     *
     * nA * nSeed  ~  nA * (nU*nQ + nV)
     *
     * ~  nA*nU*nQ + nA*nV
     *
     * ~  nU * (-nR)  +  nA*nV      (as nA*nQ ~ -nR)
     *
     * Both products in the last sum can be computed without overflow
     * (i.e., both have absolute value < nM) since nU*nR < nA*nQ < nM,
     * and  nA*nV < nA*nQ < nM.  Since the two products have opposite
     * sign, their sum lies between -(nM-1) and +(nM-1).  If
     * non-negative, it is the answer (i.e., it's congruent to
     * nA*nSeed and lies between 0 and nM-1). Otherwise adding nM
```

```
     * yields a number still congruent to nA*nSeed, but now between
     * 0 and nM-1, so that's the answer.
     */

      nSeed = ((unsigned long long)nSeed * 16807) % 2147483647;

      if ((nSeed <= 0) || (nSeed >= 2147483647))
      {
            printf("Error!!\n");
            exit(-1);
      }
      return (nSeed);
}

/*************************************************************

   UnifInt:  Yields an long uniformly distributed between given bounds

*************************************************************/

/*
 * long UnifInt( long nLow, long nHigh, long nStream )
 */
DSS_HUGE
UnifInt(DSS_HUGE nLow, DSS_HUGE nHigh, long nStream)

/*
 * Returns an integer uniformly distributed between nLow and nHigh,
 * including * the endpoints.  nStream is the random number stream.
 * Stream 0 is used if nStream is not in the range 0..MAX_STREAM.
 */

{
    double          dRange;
    DSS_HUGE            nTemp;
    int32_t nLow32 = (int32_t)nLow,
            nHigh32 = (int32_t)nHigh;

    if (nStream < 0 || nStream > MAX_STREAM)
        nStream = 0;

    if (nLow > nHigh)
    {
        nTemp = nLow;
        nLow = nHigh;
        nHigh = nTemp;
    }

      if ((nHigh == MAX_LONG) && (nLow == 0))
dRange = DOUBLE_CAST (nHigh32 - nLow32 + 1);
else
dRange = DOUBLE_CAST (nHigh - nLow + 1);
    Seed[nStream].value = NextRand(Seed[nStream].value);
    nTemp = (long) (((double) Seed[nStream].value / dM) * (dRange));
    return (nLow + nTemp);
```

```
    /*
    Seed[nStream].value = NextRand(Seed[nStream].value);
      nTemp = nHigh - nLow + 1;
      return((Seed[nStream].value % nTemp) + nLow);
      */
}
```