Hewlett Packard Company

HP ProLiant DL760 X900
Using IBM DB2 UDB 7.2

TPC Benchmark™H
Full Disclosure Report

Second Edition
March 2003

Hewlett Packard Company

Second Edition – March 2003

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All performance data contained in this report was obtained in a rigorously controlled environment. Results obtained in other operating environments may vary significantly. No warranty of system performance or price/performance is expressed or implied in this report.

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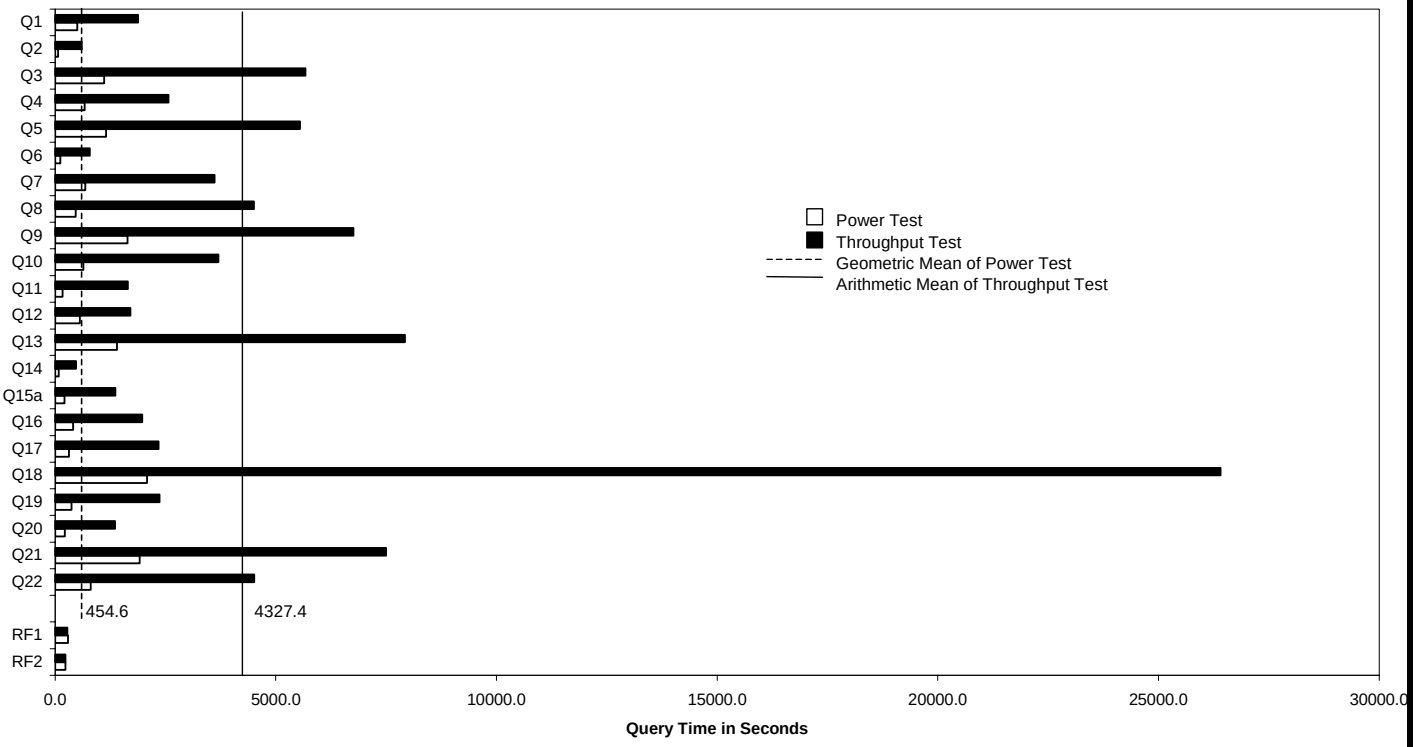
Hewlett Packard Company	HP ProLiant DL760 X900-128P	TPC-H Rev. 2.0 Report Date: **February 6, 2002**

Total System Cost	Composite Query per Hour Metric	Price / Performance
$5,955,754	**21,053.5** QphH@3000GB	**$283** $ / QphH@3000GB

Database Size	Database Manager	Operating System	Other Software	Availability Date
3000GB	**IBM DB2 UDB 7.2**	**Microsoft Windows 2000 Advanced Server**	**Microsoft Visual C++ 6.0**	**June 20, 2002**



Database Load Time = 5:58:40	Load Included Backup: N	Total Data Storage / Database Size = 10.29
RAID (Base tables only): Y	RAID (Base tables and auxiliary data structures): Y	RAID (All): Y

System Configuration: 32 nodes

Processors (per node) :	4 x 900MHz Intel Pentium III Xeon Processors w/ 2MB cache
Memory (per node) :	4 GB memory
Disks (per node) :	2 x 9GB 15K RPM drives 56 x 18GB 15K RPM drives
Servers interconnect :	32 ports Gigabit Ethernet Switch
Total Disk Storage:	30862.1 GB

Hewlett Packard Company	ProLiant DL760 X900			TPC-H Rev. 2.0		
				Report Date:		6-Feb-02
Description	**Part Number**	**Third Party Brand**	**Pricing**	**Unit Price**	**Qty**	**Extended Price**	**3 yr. Maint. Price**
Server Hardware							
Proliant DL760 X900-2M 4P 2G - 4 Pentium III Xeon/900MHz 2MB Cache - 2 GB SD RAM Memory - CD-ROM 24X - 10/100 Ethernet Controller	212692-001		1	44,400	32	1,420,800	
1G-Memory Kit SDRAM (2 x 512MB)	328808-B21		1	1,436	64	91,904	
NC6136 Gigabit Server Adapter, 64-bit/66MHz, PCI, 1000 SX	203539-B21		1	621	32	19,872	
S5500 15" Monitor	261602-169		1	169	32	5,408	
Scroll Mouse Carbon	231947-B21		1	5	32	160	
PS/2 Easy Access Internet Keyborad	265977-001		1	44	32	1,408	
Rack Model 9142 (42U - Opal) - Flat Pallet	120663-B21		1	1,321	16	21,136	
Rack Coupling Kit	120669-B21		1	83	15	1,245	
Rack Sidewall Kit	120670-B21		1	207	1	207	
UPS Model T2000	242688-005		1	897	32	28,704	
CarePaq 3YR 24X7 4HR 700 SERIES SVR (FM-HE724-36)	401784-002		1	3,390	32		108,480
					Subtotal	**1,590,844**	**108,480**
Storage							
HP SMART Array Controller 5304 - 4SCSI channels	158939-B21		1	2,052	128	262,656	
StorageWorks Enclosure Model 4314R - Rack-mountable	190209-001		1	2,955	128	378,240	
18.2GB Pluggable Ultra3 SCSI 10K 1" Universal HDD	142673-B22		1	311	64	19,904	
18.2-GB Pluggable 1" Universal WideUltra3 15K HDD	188122-B22		1	390	1792	698,880	
18.2-GB Pluggable 1" Universal WideUltra3 15K HDD (10%	188122-B22		1	390	180	70,200	
CarePaq 3YR 24X7/4HR EMPTY DISK ENCL. (FM-4E724-36)	FM-4D724-60		1	157	128		20,096
					Subtotal	**1,429,880**	**20,096**
Hardware and Maintence Discount							
Large Purchase and Net 30 discount	16.0%		1			($483,316)	($20,572)
					Hardware Subtotal	**2,537,408**	**108,004**
Software							
DB2 EE Edi. Lic. with 1Y support per processor	D5B5RLL	IBM	3	22,153	128	2,835,584	included
DB2 EE Edi. Support per processor per year (Y2 and Y3)	E1B5ULL	IBM	3	1,081	256		276,736
Microsoft Windows 2000 Advanced Server	C10-00475	Microsoft	2	2,399	32	76,768	included
Microsoft Visual Studio Professional 6.0 Win32	659-00390	Microsoft	2	1,079	1	1,079	included
					Subtotal	**2,913,431**	**276,736**
Connectivity							
Cisco Catylst 6500 Gigabit ethernet switch, 2x16 port modules		Cisco	4	88,975	1	88,975	31,200
					Connectivity Subtotal	**88,975**	**31,200**
					Total	**$5,539,814**	**$415,940**

Three-Year Cost of Ownership:	**$5,955,754**
QphH Rating:	**21053.5**
$ / QphH:	**$283**

Pricing: 1=HP; 2= Microsoft; 3=IBM; 4=Cisco

Note:The benchmark results and test methodology were audited by Francois Raab of InfoSizing (www.sizing.com); Rev. 1.3 submission on 2/6/2002; Rev 2.0 upgrade on 3/12/2003.

Audited by: Francois Raab of Infosizing (www.sizing.com)

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 assumptions 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 benchmark specifications. If you find that the stated prices are not available according to these terms, please inform at pricing@tpc.org. Thank you.

Hewlett Packard Company	HP ProLiant DL760 X900-128P	TPC-H Rev. 2.0 Report Date: **February 6, 2002**

Numerical Quantities

Measurement Results:

Database Scale Factor	= 3000
Total Data Storage / Database Size	= 10.29
Start of Database Load	= 1/30/2002 18:04:48
End of Database Load	= 1/31/2002 00:03:28
Database Load Time	= 5:58:40
Query Streams for Throughput Test	= 8
TPC-H Power	= 23756.8
TPC-H Throughput	= 18657.8
TPC-H Composite Query-per-Hour Metric (QphH@3000GB)	= 21053.5
Total System Price Over 5 Years	= $5,955,754
TPC-H Price/ Performance Metric ($/QphH@3000GB)	= $283

Measurement Intervals:

Measurement Interval in Throughput Test (Ts)	= 101877 seconds

Duration of Stream Execution:

Stream ID	Seed	Start Date	Start time	Stop Date	Stop Time	Duration
Stream00	131000328	1/31/2002	1:19:40	1/31/2002	5:44:11	4:24:32
Stream01	131000329	1/31/2002	5:48:09	2/1/2002	8:32:49	26:44:40
Stream02	131000330	1/31/2002	5:48:09	2/1/2002	8:58:15	27:10:05
Stream03	131000331	1/31/2002	5:48:09	2/1/2002	8:25:08	26:36:59
Stream04	131000332	1/31/2002	5:48:10	2/1/2002	7:19:51	25:31:41
Stream05	131000333	1/31/2002	5:48:10	2/1/2002	8:33:33	26:45:23
Stream06	131000334	1/31/2002	5:48:10	2/1/2002	7:21:02	25:32:52
Stream07	131000335	1/31/2002	5:48:11	2/1/2002	8:39:31	26:51:20
Stream08	131000336	1/31/2002	5:48:11	2/1/2002	8:08:54	26:20:43

Hewlett Packard Company	HP ProLiant DL760 X900-128P	TPC-H Rev. 2.0 Report Date: **February 6, 2002**

TPC-H Timing Intervals (in seconds)

Query	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Stream 00	498.7	67.3	1106.8	665.3	1156.7	117.7	681.0	465.9
Stream 01	1444.0	476.7	6886.3	1914.3	5017.1	599.8	3158.0	2730.8
Stream 02	2200.5	714.2	5169.2	3323.4	5587.7	840.9	3681.4	6965.2
Stream 03	3076.3	499.5	4854.2	2605.3	6576.2	840.1	4620.8	5621.9
Stream 04	1600.6	563.6	6369.1	4309.0	6387.9	712.0	3348.9	3928.6
Stream 05	1475.5	672.4	5192.2	2002.1	5006.4	924.3	3941.4	2432.5
Stream 06	1022.9	671.4	5854.3	1481.2	4681.2	939.6	3142.9	7759.4
Stream 07	1531.0	537.4	6230.5	2595.2	5200.1	825.2	3410.5	2789.1
Stream 08	2704.0	688.2	4819.9	2310.5	5929.6	576.5	3586.2	3833.7
Min Qi	1022.9	476.7	4819.9	1481.2	4681.2	576.5	3142.9	2432.5
Max Qi	3076.3	714.2	6886.3	4309.0	6576.2	939.6	4620.8	7759.4
Avg Qi	1881.9	602.9	5672.0	2567.6	5548.3	782.3	3611.3	4507.7
Query	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**
Stream 00	1638.9	634.6	169.9	557.9	1400.0	85.0	210.5	408.9
Stream 01	6769.2	3076.1	2735.9	1957.5	8420.3	623.1	1115.6	2154.8
Stream 02	7097.6	4320.5	1112.9	2106.8	6443.0	331.7	1182.1	2201.6
Stream 03	6244.5	3415.9	866.9	1671.4	8578.4	364.8	1281.8	1723.7
Stream 04	6016.2	3109.5	830.0	1253.7	7739.7	857.4	1823.3	2212.0
Stream 05	4788.8	4071.9	3103.1	2912.0	8579.3	187.5	1590.8	1930.2
Stream 06	6607.0	5597.2	949.4	956.0	8562.4	522.9	1392.0	2459.5
Stream 07	9048.8	3783.9	2668.8	1519.1	8210.5	421.5	972.9	1724.9
Stream 08	7504.4	2214.2	918.7	1278.5	6852.8	492.1	1583.4	1367.6
Min Qi	4788.8	2214.2	830.0	956.0	6443.0	187.5	972.9	1367.6
Max Qi	9048.8	5597.2	3103.1	2912.0	8579.3	857.4	1823.3	2459.5
Avg Qi	6759.6	3698.7	1648.2	1706.9	7923.3	475.1	1367.7	1971.8
Query	**Q17**	**Q18**	**Q19**	**Q20**	**Q21**	**Q22**	**RF1**	**RF2**
Stream 00	316.2	2081.7	373.6	217.2	1915.4	806.6	295.7	230.8
Stream 01	1794.6	26568.7	1491.9	1191.9	11864.3	4289.1	280.0	228.1
Stream 02	4208.4	27763.0	3290.9	1456.3	3077.0	4731.2	270.9	231.6
Stream 03	2273.6	27225.6	1663.2	1315.0	6408.9	4090.9	270.2	227.4
Stream 04	1484.8	21378.9	2031.5	1272.8	8639.0	6032.4	275.0	235.5
Stream 05	1488.4	26157.6	3100.5	1594.1	11987.8	3184.0	271.4	231.4
Stream 06	2668.4	22385.0	1598.1	1356.8	7127.2	4237.1	290.3	223.0
Stream 07	1703.0	31030.8	1489.0	1494.7	5120.9	4372.4	283.5	231.6
Stream 08	3136.0	28712.3	4262.5	1158.6	5745.2	5168.4	291.4	229.2
Min Qi	1484.8	21378.9	1489.0	1158.6	3077.0	3184.0	270.2	223.0
Max Qi	4208.4	31030.8	4262.5	1594.1	11987.8	6032.4	291.4	235.5
Avg Qi	2344.7	26402.7	2366.0	1355.0	7496.3	4513.2	279.1	229.7

Abstract

Overview

This report documents the methodology and results of the TPC Benchmark™ H test conducted on the HP ProLiant DL760 X900 using IBM DB2 UDB 7.2, in conformance with the requirements of the TPC Benchmark™ H Standard Specification, Revision 2.0. The operating system used for the benchmark was Microsoft Windows 2000 Advanced Server with Service Pack 2. The application was written in Microsoft Visual C++ v6.0.

The benchmark results are summarized in the following table.

Hardware	Software	Total System Cost	QppH @ 3TB	QthH @ 3TB	QphH @ 3TB	$ / QphH @ 3TB
HP ProLiant DL760 X900	**IBM DB2 UDB 7.2 Microsoft Windows 2000 Advanced Server**	**$5,955,754**	**23756.8**	**18657.8**	**21053.5**	**$ 283**

The TPC Benchmark™ H was developed by the Transaction Processing Performance Council (TPC). The TPC was founded to define transaction processing benchmarks and to disseminate objective, verifiable performance data to the industry.

Standard and Executive Summary Statements

Pages ii-iv contains the Executive Summary and Numerical Quantities Summary of the benchmark results for the HP ProLiant DL760 X900.

Auditor

The benchmark configuration, environment and methodology used to produce and validate the test results, and the pricing model used to calculate the cost per QppH and QthH were audited by Francios Raab of Infosizing, Inc. to verify compliance with the relevant TPC specifications. The auditor's letter of attestation is attached in Section 9.1 "Auditors' Report."

Table Of Contents

1.0 General Items

1.1 Test Sponsor

A statement identifying the benchmark sponsor(s) and other participating companies must be provided.
HP is the sponsor of this TPC-H Benchmark.

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 by not limited to:

- *Database 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*

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

Appendix A, "Tunable Parameters," contains a list of all DB2 parameters, operating system parameters and compiler options. Session initialization parameters can be set during or immediately after establishing the connection to the database within the tpchbatch program documented in Appendix D, "Implementation- Specific Layer and Driver Source Code." This result uses the default session initialization parameters established during preprocessing/binding of the tpchbatch program. The procedure for preprocessing, binding, compiling and linking the tpchbatch program is documented in Appendix A.7, "Compiler Option for TPCDBATCH Driver."

1.3 Configuration Items

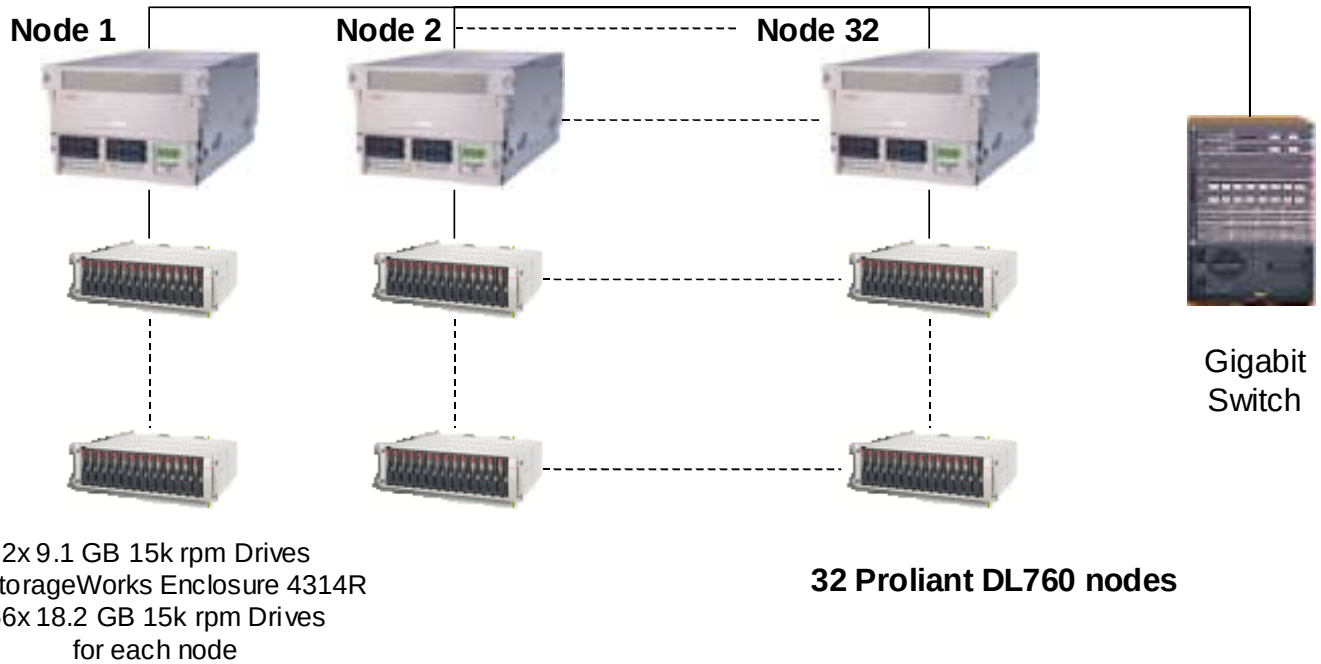
Diagrams of both measured and priced configurations must be provided, accompanied by a description of the differences. This includes, but is not limited to:

- *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, workstations, terminals, etc., that were physically used in the test or are incorporated into the pricing structure.*
- *Type and the run-time execution location of software components (e.g., DBMS, query processing tools/languages, middle-ware components, software drivers, etc.).*

The server System Under Test (SUT), a 32 nodes cluster HP ProLiant DL760 X900, depicted in Figure 1.1, consisted of (for each node):

Four 900 MHz Pentium III Xeon® Processors with 2M L2 cache
4096 MB of memory
4 x 5300 Array Controllers
4 x StorageWorks Enclosure 4314R
2 x 9.1GB Pluggable SCSI-3 15K rpm 1" height drives
56 x 18.2GB Pluggable SCSI-3 15K rpm 1" height drives
One Netelligent NC6134 Gigabit PCI Network Card

Figure 1.1 Benchmarked and priced configuration



As the 9.1 GB 10K rpm disk drives used in the benchmarked configuration are no longer available they are substituted with 18.2 GB 10K rpm disk drives in the priced configuration.

2.0 Clause 1: Logical Database Design

Appendix B, "Database Build Scripts," contains the programs and input files used to load the test and qualification databases. The test and qualification databases are built in exactly the same way in all respects except for the scale factor; they use the same table definitions, indexes and partitioning methods. Thus, the buildtpcd script documented in Appendix B was used for both the qualification and test databases except that different input files were used.

There are two phases for the loading of the database: the generation of the flat data files and the building of the database from them. The buildtpcd script executes DDL and other command scripts to create the database, load the data into the tables, create indexes, gather statistics, and set the configuration. These DDL and other command scripts are documented in Appendix B.

2.1 Table Definitions

Listings must be provided for all table definition statements and all other statements used to set up the test and qualification databases. (8.1.2.1)

Appendix B, "Database Build Scripts," contains the table definitions and the program used to load the database.

2.2 Physical Organization of Database

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.

Appendix B, "Database Build Scripts," contains the DDL for the index definitions.

2.3 Horizontal Partitioning

Horizontal partitioning of tables and rows in the test and qualification databases (see Clause 1.5.4) must be disclosed.

Horizontal partitioning was used for all tables except for the nation and region tables, see Appendix B "Database Build Scripts".

2.4 Replication

Any replication of physical objects must be disclosed and must conform to the requirements of Clause 1.5.6.

No replication was used.

3.0 Clause 2: Queries and Refresh Functions Related Items

3.1 Query Language

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

SQL was the query language used.

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.

The supplied QGEN version 1.3.0 was used.. DBGEN 1.3.0 was modified to allow the scale factor of 3000. See Appendix B "Database Build Scripts" for details.

3.3 Substitution Parameters Generation

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 to generate the substitution parameters.

3.4 Query Text and Output Data from 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.1, "Qualification Queries and Output," contains the output for each of the queries. The functional query definitions and variants used in this disclosure use the following minor query modification:

- Table names are fully qualified. For example, the "NATION" table is referred to as "TPCD.NATION."
- The standard IBM SQL date syntax is used for the date arithmetic. For example, DATE('1996-01-01') + 3 MONTHS.
- The semicolon (;) is used as a command delimiter.
- Count_big was used instead of count where aggregates exceed the range of values supported by an integer.

3.5 Query Substitution Parameters and Seeds Used

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 C.3, "Query Substitution Parameters," contains the query substitution parameters used in the performance tests.

3.6 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 isolation level used to run the queries was "repeatable read."

3.7 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 functions are part of the implementation specific layer/driver code included in Appendix D, "Implementation Specific Layer and Driver Source Code."

4.0 Clause 3: Database System Properties

4.1 Atomicity Requirements

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.

All ACID tests were conducted according to specification. The Atomicity, Isolation, Consistency and Durability tests were performed on the HP ProLiant DL760 X900. Appendix E, "ACID Transaction Source Code," contains the source code for the ACID transaction and query.

4.1.1 Atomicity of the Completed Transactions

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.

The following steps were performed to verify the Atomicity of the completed transactions:

1. The total price from the ORDER table and the extended price from the LINEITEM table were retrieved for a random Orderkey. The number of records in the HISTORY table was also retrieved.
2. The ACID transaction T1 was executed for the Orderkey used in step 1.
3. The total price and the extended price were retrieved for the same Orderkey used in steps 1 and 2. It was verified that: T1.EXTENDEDPRICE = OLD.EXTENDEDPRICE + ((T1.DELTA) * (OLD.EXTENDEDPRICE / OLD.QUANTITY)), T1.TOTALPRICE = OLD.TOTALPRICE + ((T1.EXTENDEDPRICE-OLD.EXTENDEDPRICE)*(1-DISCOUNT)*(1+TAX)), and that the number of records in the history table had increased by 1.

4.1.2 Atomicity of Aborted Transactions

Perform the ACID transaction for a randomly selected set of input data, submitting 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.

The following steps were performed to verify the Atomicity of the aborted ACID transaction:

1. The ACID application is passed a parameter to execute a rollback of the transaction instead of performing the commit.
2. The total price from the ORDER table and the extended price from the LINEITEM table were retrieved for a random Orderkey. The number of records in the HISTORY table was also retrieved.
3. The ACID transaction was executed for the Orderkey used in step 2. The transaction was rolled back.
4. The total price and the extended price were retrieved for the same Orderkey used in steps 2 and 3. It was verified that the extended price and the total price were the same as in step 2.

4.2 Consistency Requirements

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

A consistent state for the TPC-H database is defined to exist when:

*O_TOTALPRICE = SUM(L_EXTENDEDPRICE – L_DISCOUNT) * (1 + L_TAX)*
For each ORDER and LINEITEM defined by (O_ORDERKEY = L_ORDERKEY)

The following queries were executed before and after a measurement to show that the database was always in a consistent state both initially and after a measurement.

SELECT DECIMAL (SUM (DECIMAL (INTEGER (INTEGER (DECIMAL (INTEGER (100 * DECIMAL (L_EXTENDEDPRICE, 20, 3)), 20, 3) * (1 – L_DISCOUNT)) * (1 + L_TAX)), 20, 3) / 100.0) 20, 3) FROM TPCD.LINEITEM WHERE L_ORDERKEY = okey

SELECT DECIMAL(SUM(O_TOTALPRICE, 20, 3)) from TPCH.ORDERS WHERE O_ORDERKEY = okey

4.2.1 Consistency Tests

Verify that ORDER and LINEITEM tables are initially consistent as defined in Clause 3.3.2.1, based upon a random sample of at least 10 distinct values of O_ORDERKEY.

The queries defined in section 3.3 "Consistency Condition" of TPC-H specification were run after the initial database build and prior to executing the ACID transaction. The queries showed that the database was in a consistent state.

After executing 7 streams of 100 ACID transactions, the queries defined in 3.3 "Consistency Condition" section were run again. The queries showed that the database was still in a consistent state.

4.3 Isolation Requirements

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 Isolation Test 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.

The following steps were performed to satisfy the test of isolation for a read-only and a read-write committed transaction:

1. First session: Start an ACID transaction with a randomly selected O_KEY, L_KEY and DELTA. The transaction is delayed for 60 seconds just prior to the Commit.
2. Second session: Start an ACID query for the same O_KEY as in the ACID transaction.
3. Second session: The ACID query attempts to read the file but is locked out by the ACID transaction waiting to complete.
4. First session: The ACID transaction is released and the Commit is executed releasing the record. With the LINEITEM record now released, the ACID query can now complete.
5. Second session: Verify that the ACID query delays for approximately 60 seconds and that the results displayed for the ACID query match the input for the ACID transaction.

4.3.2 Isolation Test 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.

The following steps were performed to satisfy the test of isolation for a read-only and a rolled back read-write transaction:

1. First session: Perform the ACID transaction for a random O_KEY, L_KEY and DELTA. The transaction is delayed for 60 seconds just prior to the Rollback.
2. Second session: Start an ACID query for the same O_KEY as in the ACID transaction. The ACID query attempts to read the LINEITEM table but is locked by the ACID transaction.
3. First session: The ACID transaction is released and the Rollback is executed, releasing the record.
4. Second session: With the LINEITEM record now released, the ACID query completes.

4.3.3 Isolation Test 3 - Write-Write Conflict with Commit

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

The following steps were performed to verify isolation of two update transactions:

1. First session: Start an ACID transaction T1 for a randomly selected O_KEY, L_KEY and DELTA. The transaction is delayed for 60 seconds just prior to the Commit.
2. Second session: Start a second ACID transaction T2 for the same O_KEY, L_KEY and for a randomly selected DELTA2. This transaction is forced to wait while the First Session holds a lock on the LINEITEM record requested by the Second Session.
3. First session: The ACID transaction T1 is released and the Commit is executed, releasing the record. With the LINEITEM record now released, the ACID transaction T2 can now complete.
4. Verify that: T2.L_EXTENDEDPRICE = T1.EXTENDEDPRICE + (DELTA * (T1.L_EXTENDEDPRICE) / T1.L_QUANTITY)

4.3.4 Isolation Test 4 - Write-Write Conflict with Rollback

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

The following steps were performed to verify isolation of two update transactions after the first one is rolled back:

1. First session: Start an ACID transaction T1 for a randomly selected O_KEY, L_KEY and DELTA. The transaction is delayed for 60 seconds just prior to the Rollback.
2. Second session: Start a second ACID transaction T2 for the same O_KEY, L_KEY used by the First Session. This transaction is forced to wait while the First Session holds a lock on the LINEITEM record requested by the Second Session.
3. First session: Roll back the ACID transaction T1. With the LINEITEM record now released, the ACID transaction T2 completes.
4. Verify that: T2.L_EXTENDEDPRICE = T1.EXTENDEDPRICE

4.3.5 Isolation Test 5 – Concurrent Read and Write Transactions on Different Tables

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

The following steps were performed to successfully conduct this test:

1. First session: Start an ACID transaction T1 for a randomly selected O_KEY, L_KEY and DELTA. The ACID transaction was suspended prior to Commit.
2. Second session: Start a second ACID transaction T2, which selects random values of PS_PARTKEY and PS_SUPPKEY and returns all columns of the PARTSUPP table for which PS_PARTKEY and PS_SUPPKEY are equal to the selected values.
3. T2 completes.
4. T1 is allowed to complete.
5. Verify that the appropriate rows in the ORDERS, LINEITEM and HISTORY tables are changed.

4.3.6 Isolation Test 6 – Update Transactions During Continuous Read-Only Query Stream

Demonstrate 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.

Isolation Test 6 specifies that Q1 (from TPC-H specification Clause 2.4) must be used as T1. However, this query's execution time is too short to be able to complete after Step 2 has completed. A longer-running modification of Q1, called Q1x, was used instead.

Q1x

```
SELECT
  L_RETURNFLAG, L_LINESTATUS,
  CAST SUM(L_QUANTITY) AS NUMERIC(31,3)) AS SUM_QTY,
  CAST SUM(L_EXTENDEDPRICE) AS NUMERIC(31,3)) AS SUM_BASE_PRICE,
  CAST SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT)) AS NUMERIC(31,3)) AS SUM_DISC_PRICE,
  CAST SUM(L_EXTENDEDPRICE*(1-L_DISCOUNT)*(1+L_TAX)) AS NUMERIC(31,3)) AS
SUM_CHARGE,
```

```
  CAST AVG(L_QUANTITY) AS NUMERIC(31,3)) AS AVG_QTY,
  CAST AVG(L_EXTENDEDPRICE) AS NUMERIC(31,3)) AS AVG_PRICE,
  CAST AVG(L_DISCOUNT) AS NUMERIC(31,3)) AS AVG_DISC,
  COUNT(*) AS COUNT_ORDER
FROM TPCD.LINEITEM
WHERE L_SHIPDATE <= DATE('1998-12-01') - 0 DAYS
  AND L_QUANTITY != (SELECT COUNT(*) FROM TPCD.LINEITEM AS L2 WHERE L2.L_DISCOUNT =
L_DISCOUNT
  AND L_EXTENDEDPRICE != (SELECT COUNT(*) FROM TPCD.LINEITEM AS L2 WHERE
L2.L_QUANTITY = L_QUANTITY)
GROUP BY L_RETURNFLAG, L_LINESTATUS
ORDER BY L_RETURNFLAG, L_LINESTATUS;
```

The following steps were performed to successfully conduct this test:

1. First session: A transaction T1, which executes Q1x with DELTA = 0 is started.
2. Second session: Before T1 completes, an ACID transaction T2 with randomly selected values of O_KEY, L_KEY and DELTA, is started.
3. Third session: Before T1 completes, a transaction T3, which executes Q1 with a randomly selected value of DELTA (not equal to 0), is started.
4. T1 completes.
5. T2 completes.
6. T3 completes.
7. Verify that the appropriate rows in the ORDERS, LINEITEM and HISTORY tables are changed.

4.4 Durability Requirements

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 Permanent Unrecoverable Failure of Any Durable Medium and Loss of System Power

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 tests were conducted on the qualification database. The steps performed are shown below.

1. The consistency test was verified.
2. The current count of the total number of records in the HISTORY table was determined giving hist1.
3. A test to run 200 ACID transactions on each execution was started.
4. One of the disks containing the DB2 TPCH database transaction log data was removed after at least 25 ACID transactions had completed.
5. The database consistency was not affected because of log mirroring, and ACID transactions continued to execute successfully.
6. One of the disks containing the DB2 TPCH database data tables was removed after at least 25 additional transactions had executed.
7. The database consistency was not affected because of data mirroring, and ACID transactions continued to execute successfully.
8. The system was shut down by Powering OFF the system after at least 25 additional transactions had completed.
9. The system was powered back on and rebooted.
10. The mirrored disks removed in Steps 4 and 6 were reinserted and reestablished.
11. Step 2 was performed, giving hist2. It was verified that hist2 – hist1 was equal to or greater than the number of records in the success file.
12. Consistency test was verified.

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.

See section 4.4.1.

4.4.3 Memory Failure

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

See section 4.4.1

5.0 Clause 4: Scaling and Database Population

5.1 Initial 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 5.1 lists the TPC Benchmark H defined tables and the row count for each table as they existed upon completion of the build.

Table 5. 1: Initial Number of Rows

Table Name	Row Count
Region	5
Nation	25
Supplier	30,000,000
Customer	450,000,000
Part	600,000,000
Partsupp	2,400,000,000
Orders	4,500,000,000
Lineitem	18,000,046,306

5.2 Distribution of Tables and Logs Across Media

The distribution of tables and logs across all media must be explicitly described for the tested and priced systems.

DB2 was configured on 32 HP Proliant DL760 X900 nodes on the test system.
Each node had:

- 4 x Smart Array 5300 disk controllers
- 4 x StorageWorks Enclosure 4314R
- 56 x 18.2GB 15k rpm external disk drives
- 2 x 9.1GB 15k rpm internal disk drives

For each node, all 56 disks were used for the table data tablespaces (LINEITEM_TABLE, OTHER_STUFF), the index tablespaces (LINITEM_INDEXES, OTHER_INDEXES) and the temporary tablespace (TEMP_TABLE1).
The database log was distributed on 14 disks.
The benchmark execution programs resided on a shared home directory NFS (Z:) mounted from the coordinator node. The tablespace for NATION and REGION tables resided also on that drive.
All tablespaces above were mirrored. For each mirror, the primary and secondary copies were on separate disks.
The operating system resided on 2 internal disks on each node and was fully mirrored.
A detailed description of distribution of tablespaces and log can be found in Table 5.2.1 and Table 5.2.2

Table 5.2.1: SMART Array Controller Disk Array to Logical Drive Mapping

SMART Array Controller Number	SMART Logical Drive Array Letter	Number of Physical Drives in SMART LDA	SMART Logical Drive Number	SMART Fault Tolerance	NT Drive Letter	Disk Format	Size (MB)	Contents
0	A	14	1	RAID0+1	D:	RAW	24000	Lineitem table
			2	RAID0+1	E:	RAW	5000	Lineitem indexes
			3	RAID0+1	F:	RAW	60000	Temp tables
			4	RAID0+1	G:	RAW	20000	Other Tables
			5	RAID0+1	H:	RAW	5000	Other Indexes
			6	RAID0+1	I:	RAW	7500	Log
1	A	14	1	RAID0+1	J:	RAW	24000	Lineitem table
			2	RAID0+1	K:	RAW	5000	Lineitem indexes
			3	RAID0+1	L:	RAW	60000	Temp tables
			4	RAID0+1	M:	RAW	20000	Other Tables
			5	RAID0+1	N:	RAW	5000	Other Indexes
2	A	14	1	RAID0+1	O:	RAW	24000	Lineitem table
			2	RAID0+1	P:	RAW	5000	Lineitem indexes
			3	RAID0+1	Q:	RAW	60000	Temp tables
			4	RAID0+1	R:	RAW	20000	Other Tables
			5	RAID0+1	S:	RAW	5000	Other Indexes
3	A	14	1	RAID0+1	U:	RAW	24000	Lineitem table
			2	RAID0+1	V:	RAW	5000	Lineitem indexes
			3	RAID0+1	W:	RAW	60000	Temp tables
			4	RAID0+1	X:	RAW	20000	Other Tables
			5	RAID0+1	Y:	RAW	5000	Other Indexes

Table 5.2.2: Distribution of TPC-H Database Tables Across Media

Ctrl	LINEITEM TABLE	LINEITEM INDEXES	TEMP TABLE	OTHER TABLES	OTHER INDEXES
0	D: 24,000 MB 25%	E: 5,000 MB 25%	F: 60,000 MB 25%	G: 20,000 MB 25%	H: 5,000 MB 25%
1	J: 24,000 MB 25%	K: 5,000 MB 25%	L: 60,000 MB 25%	M: 20,000 MB 25%	N: 5,000 MB 25%
2	O: 24,000 MB 25%	P: 5,000 MB 25%	Q: 60,000 MB 25%	R: 20,000 MB 25%	S: 5,000 MB 25%
3	U: 24,000 MB 25%	V: 5,000 MB 25%	W: 60,000 MB 25%	X: 20,000 MB 25%	Y: 5,000 MB 25%
Total	96,000 MB 100%	20,000 MB 100%	240,000 MB 100%	80,000 MB 100%	20,000 MB 100%

Note: An additional 28 disks/node (28 x 18.2 GB) were used to store the flat data files and were not priced. These drives were physically removed from the system after the initial loading of the 3000 GB database. These disk drives remained physically detached from the system during the execution of the power, throughput, qualification and ACID tests.

5.3 Mapping of Database Partitions/Replications

The mapping of database partitions/replications must be explicitly described.

The database was not replicated. The database was physically partitioned into 32 logical nodes, each residing on one physical node.

5.4 Implementation of RAID

Implementations may use some form of RAID to ensure high availability. If used for data, auxiliary storage (e.g. indexes) or temporary space, the level of RAID used must be disclosed for each device.

RAID 0+1 was used for the entire database and database recovery logs.

5.5 DBGEN Modifications

The version number, release number, modification number, and patch level of DBGEN must be disclosed. Any modifications to the DBGEN (see Clause 4.2.1) 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.

We used a modified version of the standard distribution of DBGEN 1.3.0 so that data could be generated in parallel for each of the nodes, and to allow for a scale factor of 3000. Also DBGEN was modified to facilitate the generation of data for a specific node in a clustered environment. See Appendix B for details.

5.6 Database Load time

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

The database load time was 5 hours 58 minutes 40 seconds.

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 as defined in 4.1.3.1. The ratio must be reported to the nearest 1/100th, rounded up.

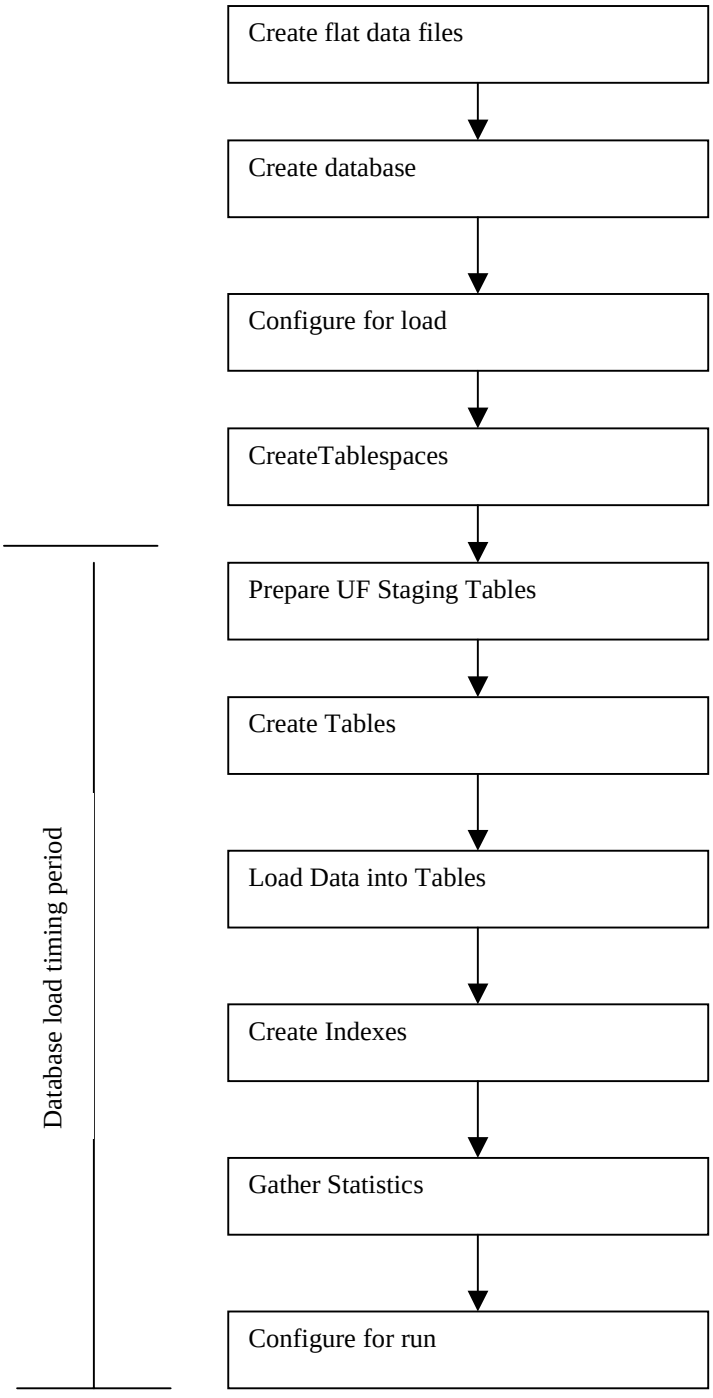
Disk Type	Number of Disks	Space per Disk	Total Disk Space	Data Storage Ratio
9.1 GB 15k rpm Ultra3 SCSI	2 /node	8.46 GB	541.44	
18.2 GB 15k rpm Ultra3 SCSI	56 /node	16.92 GB	30320.64	10.29

5.8 Database Load Mechanism Details and Illustration

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.

Flat files for each of the tables were created using DBGEN.
The NATION and REGION tables were created on node 1 and then loaded from dbgen output. The other tables were loaded on all of the nodes.
The tables were loaded as depicted in Figure 5.8.

Figure 5.8: Block Diagram of Database Load Process



6.0 Clause 5: Performance Metrics and Execution Rules Related Items

6.1 Steps in the Power Test

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 used to implement the power test:

1 The system was rebooted
2. RF1 Refresh Transaction
3. Stream 00 Execution
4. RF2 Refresh Transaction.

6.2 Timing Intervals for Each Query and Refresh Function

The timing intervals (see Clause 5.3.6) for each query of the measured set and for both refresh functions must be reported for the power test.

The timing intervals for each query and both refresh functions are given in the Numerical Quantities Summary earlier in the executive summary.

6.3 Number of Streams for The Throughput Test

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

8 streams were used for the Throughput Test.

6.4 Start and End Date/Times for Each Query Stream

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

The Numerical Quantities Summary contains the start and stop times for the query execution streams run on the system reported.

6.5 Total Elapsed Time for the Measurement Interval

The total elapsed time of the measurement interval(see Clause 5.3.5) must be reported for the throughput test.

The Numerical Quantities Summary contains the timing intervals for the throughput test run on the system reported.

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

Start and finish time for each update function in the update stream must be reported for the throughput test.

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

The timing intervals (see Clause 5.3.6) for each query of each stream and for each update function must be reported for the throughput test.

The timing intervals for each query and each update function are given in the Numerical Quantities Summary earlier in the executive summary.

Stream ID	RF	Start Date	Start time	Stop Date	Stop Time
Stream00	RF1	1/31/2002	1:19:39	1/31/2002	1:24:35
Stream00	RF2	1/31/2002	5:44:11	1/31/2002	5:48:02
Stream01	RF1	2/1/2002	8:58:15	2/1/2002	9:02:55
Stream01	RF2	2/1/2002	9:02:55	2/1/2002	9:06:43
Stream02	RF1	2/1/2002	9:06:43	2/1/2002	9:11:14
Stream02	RF2	2/1/2002	9:11:14	2/1/2002	9:15:05
Stream03	RF1	2/1/2002	9:15:05	2/1/2002	9:19:35
Stream03	RF2	2/1/2002	9:19:35	2/1/2002	9:23:23
Stream04	RF1	2/1/2002	9:23:23	2/1/2002	9:27:58
Stream04	RF2	2/1/2002	9:27:58	2/1/2002	9:31:53
Stream05	RF1	2/1/2002	9:31:53	2/1/2002	9:36:25
Stream05	RF2	2/1/2002	9:36:25	2/1/2002	9:40:16
Stream06	RF1	2/1/2002	9:40:16	2/1/2002	9:45:06
Stream06	RF2	2/1/2002	9:45:06	2/1/2002	9:48:50
Stream07	RF1	2/1/2002	9:48:50	2/1/2002	9:53:33
Stream07	RF2	2/1/2002	9:53:33	2/1/2002	9:57:25
Stream08	RF1	2/1/2002	9:57:25	2/1/2002	10:02:16
Stream08	RF2	2/1/2002	10:02:16	2/1/2002	10:06:05

6.8 Performance Metrics

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

The Numerical Quantities Summary contains the performance metrics, related numerical quantities, and the price/performance metric for the system reported.

6.9 The Performance Metric and Numerical Quantities from Both Runs

A description of the method used to determine the reproducibility of the measurement results must be reported. This must include the performance metrics (QppH and QthH) from the reproducibility runs.

Performance results from the first two executions of the TPC-H benchmark indicated the following difference for the metric points:

Run	QppH @ 3TB	QthH @ 3TB	QphH @ 3TB
Run 1	23756.8	18657.8	21053.5
Run 2	23994.9	18737.4	21203.9

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 disclosed.

The system was restarted between runs.
7.0 Clause 6: SUT and Driver Implementation Related Items

7.1 Driver

A detailed description of how the driver performs its functions must be supplied, including any related source code or scripts. This description should allow an independent reconstruction of the driver.

Appendix D "Implementation specific layer and Driver Source Code" contains the source code used for the driver and all scripts used in connection with it.

The power test is invoked by calling tpcdbatch with the stream number 0 specified, an indication that the refresh functions must be run, and the SQL file that contains the power stream queries.
The Throughput test is invoked by initiating a call to tpcdbatch for every query stream that will be run. tpcdbatch gets the stream number for each of the streams, and the SQL file specific to that stream number as the queries to execute. The refresh function is initiated as a separate call to tpcdbatch with the SQL script for the refresh functions and the total number of query streams specified.

7.2 Implementation Specific Layer (ISL)

If an implementation-specific layer is used, then a detailed description of how it performs its functions must be supplied, including any related source code or scripts. This description should allow an independent reconstruction of the implementation-specific layer.

The implementation specific layer is a single executable SQL application that uses embedded dynamic SQL to process the EQT generated by QGEN. The application is called tpcdbatch to indicate that it processes a batch of TPC-H queries, although it is completely capable of processing any arbitrary SQL statement (both DML and DDL).
A separate instance of tpcdbatch is invoked for each stream. Each instance establishes a distinct connection to the database server through which the EQT is transmitted to the database and the results are returned through the implementation specific layer to the driver. When an instance of tpcdbatch is invoked, it is provided with a context of whether it is running a power test, query stream or refresh stream, as well as an input file containing the 22 queries and/or refresh functions. tpcdbatch then connects to the database, performs any session initialization as well as preparing output files required by the auditor. Then it proceeds to read from the input file and processes each query or refresh function in turn.

For queries, each query is prepared, described, and a cursor is opened and used to fetch the required number of rows. After the last row has been retrieved a commit is issued. For the refresh functions, during the database build all data is first split for each node. For RF1, the data for each node is further split into n equal por-tions for both the lineitem and orders tables taking care that the records for the same orderkey remain in the same set. For RF2, the data for each node is further split into m equal portions. During the run, when tpcdbatch encounters a call to execute RF1, it first calls a shell script which loads these n sets of data into the temporary tables (one each for lineitem and orders), containing a column to hold the chunk number. Then tpcdbatch forks off n children to do an insert with subselect into the original lineitem and orders tables. When tpcdbatch encounters a call to execute RF2, it calls a shell script that loads these data into a single staging table. Then tpcdbatch forks off p children (where p * x = m) to do x sets of deletes from the orders and lineitem tables with a subselect from the staging table.

7.3 Profile-Directed Optimization

If profile-directed optimization as described in Clause 5.2.9 is used, such used must be disclosed.

Profile-directed optimization was not used.

8.0 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 vendor part number, description, and release/revision level, and either 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.

A detailed list of all hardware and software, including the 5-year price, is provided in the Executive Summary at the front of this report. The price quotations are included in Appendix F, at the end of this document.

8.2 Total 3 Year Price

The total 3-year price of the entire configuration must be reported including: hardware, software, and maintenance charges. Separate component pricing is recommended. The basis of all discounts used must be disclosed.

A detailed list of all hardware and software, including the 3-year price, is provided in the Executive Summary at the front of this report. The price quotations are included in Appendix F, at the end of this document. For a large purchase and cash discount, this purchase qualifies for a 16% discount from Hewlett Packard Company.

8.3 Availability Date

The committed delivery date for general availability of products used in the price calculations must be reported. When the priced system includes products with different availability dates, the availability date reported on 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.

The HP ProLiant DL760 X900, system memory, additional processors, disk controllers and hard drives are available at the time of publication. All other hardware is generally available at the time of publication.

The system software, Microsoft Windows 2000 Advanced Server, used in this test is generally available at the time of publication. Service Pack 2 for Microsoft Windows 2000 Advanced Server is generally available at the time of publication. The database software, IBM DB2 UDB 7.2.0 for Windows 2000 is generally available at the time of publication. Fix Pack 4 for DB2 is generally available at the time of publication.
Any modifications made to DB2 that were not in FP-4 will be available by June 20, 2002

8.4 Country-Specific Pricing

Additional Clause 7 related items may be included in the Full Disclosure Report for each country-specific priced configuration. Country-specific pricing is subject to Clause 7.1.7.

The configuration is priced for the United States of America
.

9.0 Clause 9: Related Items

9.1 Auditors' Report

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.

This implementation of the TPC Benchmark H was audited by Francois Raab of InfoSizing (www.sizing.com). Further information regarding the audit process may be obtained from:

InfoSizing
1373 North Franklin Street
Colorado Springs, CO 80903-2527
Telephone: (719) 473-7555
Fax: (719) 473-7554

Requests for this TPC Benchmark H Full Disclosure Report should be sent to:

Transaction Processing Performance Council
c/o Shanley Public Relations
777 North First Street, Suite 6000
San Jose, CA 95112-6311 USA
Telephone: (408) 295-8894
Fax: (408) 295-9768

INFO SIZING

TPC TRANSACTION PROCESSING PERFORMANCE COUNCIL CERTIFIED AUDITOR

Benchmark Sponsor: Daniel Pol
Compaq Computer Corporation
20555 SH-249, MS150402
Houston, TX 77070

February 5, 2002

I verified the TPC Benchmark™ H performance of the following configuration:

Platform: **COMPAQ ProLiant DL760 X900, 32-node Cluster**

Database Manager: **IBM DB2 UDB 7.2**

Operating System: **Microsoft Windows 2000 Advanced Server**

The results were:

CPU (Speed)	Memory	Disks	**QphH@3000GB**
COMPAQ ProLiant DL760 X900 (32 nodes, each with)			
4 x Intel Pentium III Xeon (900 MHz)	2MB Cache/cpu 4 GB Main	56 x 18 GB 2 x 9 GB	**21,053.5**

In my opinion, this performance result was produced in compliance with the TPC's requirements for the benchmark. The following verification items were given special attention:

- The database records were defined with the proper layout and size
- The database population was generated using DBGEN
- The database was properly scaled to 3000GB and populated accordingly
- The compliance of the database auxiliary data structures was verified
- The database load time was correctly measured and reported
- The required ACID properties were verified and met

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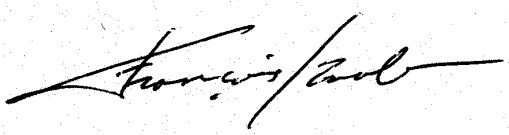
- The query input variables were generated by QGEN
- The query text was produced using minor modifications and an approved query variant
- The execution of the queries against the SF1 database produced compliant answers
- A compliant implementation specific layer was used to drive the tests
- The throughput tests involved 8 query streams
- The ratio between the longest and the shortest query was such that no query timing was adjusted
- The execution times for queries and refresh functions were correctly measured and reported
- The repeatability of the measured results was verified
- The required amount of database log was configured
- The system pricing was verified for major components and maintenance
- The major pages from the FDR were verified for accuracy

Additional Audit Notes:

None.

Respectfully Yours,



François Raab
President

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Appendix A: Tunable Parameters

- *Note: These are the settings used during the power test. The settings altered for the load are documented in Appendix B.*

A.1 DB2 Database TPCH Configuration

Database Configuration for Database TPCD

```
 Database configuration release level            = 0x0900
 Database release level                          = 0x0900
 Database territory                              = US
 Database code page                              = 1252
 Database code set                               = IBM-1252
 Database country code                           = 1
 Dynamic SQL Query management          (DYN_QUERY_MGMT) =
DISABLE
 Directory object name                 (DIR_OBJ_NAME) =
 Discovery support for this database       (DISCOVER_DB) = ENABLE
 Default query optimization class        (DFT_QUERYOPT) = 7
 Degree of parallelism                   (DFT_DEGREE) = 4
 Continue upon arithmetic exceptions   (DFT_SQLMATHWARN) = NO
 Default refresh age                 (DFT_REFRESH_AGE) = 0
 Number of frequent values retained     (NUM_FREQVALUES) = 0
 Number of quantiles retained          (NUM_QUANTILES) = 600
 Backup pending                                  = NO
 Database is consistent                          = YES
 Rollforward pending                             = NO
 Restore pending                                 = NO
 Multi-page file allocation enabled              = NO
 Log retain for recovery status                  = NO
 User exit for logging status                    = NO
 Data Links Token Expiry Interval (sec)      (DL_EXPINT) = 60
 Data Links Number of Copies           (DL_NUM_COPIES) = 1
 Data Links Time after Drop (days)       (DL_TIME_DROP) = 1
 Data Links Token in Uppercase             (DL_UPPER) = NO
 Data Links Token Algorithm               (DL_TOKEN) = MAC0
 Database heap (4KB)                     (DBHEAP) = 20000
 Catalog cache size (4KB)           (CATALOGCACHE_SZ) = 386
 Log buffer size (4KB)                   (LOGBUFSZ) = 512
 Utilities heap size (4KB)              (UTIL_HEAP_SZ) = 5000
 Buffer pool size (pages)                (BUFFPAGE) = 80000
 Extended storage segments size (4KB)    (ESTORE_SEG_SZ) = 16000
 Number of extended storage segments    (NUM_ESTORE_SEGS) = 0
 Max storage for lock list (4KB)           (LOCKLIST) = 16384
 Max appl. control heap size (4KB)     (APP_CTL_HEAP_SZ) = 2048
 Sort list heap (4KB)                    (SORTHEAP) = 20000
 SQL statement heap (4KB)                (STMTHEAP) = 10000
 Default application heap (4KB)          (APPLHEAPSZ) = 16000
 Package cache size (4KB)               (PCKCACHESZ) = 640
 Statistics heap size (4KB)            (STAT_HEAP_SZ) = 10000
 Interval for checking deadlock (ms)       (DLCHKTIME) = 5000
 Percent. of lock lists per application       (MAXLOCKS) = 15
 Lock timeout (sec)                    (LOCKTIMEOUT) = -1
 Changed pages threshold              (CHNGPGS_THRESH) = 80
 Number of asynchronous page cleaners   (NUM_IOCLEANERS) = 16
 Number of I/O servers                 (NUM_IOSERVERS) = 16
 Index sort flag                         (INDEXSORT) = YES
 Sequential detect flag                  (SEQDETECT) = YES
 Default prefetch size (pages)        (DFT_PREFETCH_SZ) = 16
 Track modified pages                     (TRACKMOD) = OFF
 Default number of containers                    = 1
 Default tablespace extentsize (pages)   (DFT_EXTENT_SZ) = 32
 Max number of active applications          (MAXAPPLS) = 40
 Average number of active applications       (AVG_APPLS) = 1
 Max DB files open per application          (MAXFILOP) = 1024
 Log file size (4KB)                     (LOGFILSIZ) = 8192
 Number of primary log files              (LOGPRIMARY) = 100
 Number of secondary log files            (LOGSECOND) = 25
 Changed path to log files               (NEWLOGPATH) =
 Path to log files                               = \\.\i:
 First active log file                           =
 Group commit count                       (MINCOMMIT) = 1
 Percent log file reclaimed before soft chckpt (SOFTMAX) = 800
 Log retain for recovery enabled           (LOGRETAIN) = OFF
 User exit for logging enabled             (USEREXIT) = OFF
 Auto restart enabled                    (AUTORESTART) = ON
 Index re-creation time                    (INDEXREC) = SYSTEM (ACCESS)
 Default number of loadrec sessions    (DFT_LOADREC_SES) = 1
 Number of database backups to retain   (NUM_DB_BACKUPS) = 12
 Recovery history retention (days)     (REC_HIS_RETENTN) = 366
 TSM management class                   (TSM_MGMTCLASS) =
 TSM node name                          (TSM_NODENAME) =
 TSM owner                              (TSM_OWNER) =
 TSM password                           (TSM_PASSWORD) =
```

A.2 DB2 Database Manager Configuration

Database Manager Configuration

Node type = Partitioned Database Server with local and remote clients

```
 Database manager configuration release level            = 0x0900
 Maximum total of files open             (MAXTOTFILOP) = 16000
 CPU speed (millisec/instruction)          (CPUSPEED) = 6.297923e-007
 Communications bandwidth (MB/sec)      (COMM_BANDWIDTH) =
3.500000e+000
 Max number of concurrently active databases     (NUMDB) = 1
 Data Links support                      (DATALINKS) = NO
 Federated Database System Support         (FEDERATED) = NO
 Transaction processor monitor name       (TP_MON_NAME) =
 Default charge-back account          (DFT_ACCOUNT_STR) =
 Java Development Kit 1.1 installation path (JDK11_PATH) =
 Diagnostic error capture level            (DIAGLEVEL) = 3
 Notify Level                          (NOTIFYLEVEL) = 2
 Diagnostic data directory path            (DIAGPATH) = z:\bigblue\blue
 Default database monitor switches
 Buffer pool                        (DFT_MON_BUFPOOL) = OFF
 Lock                               (DFT_MON_LOCK) = OFF
 Sort                               (DFT_MON_SORT) = OFF
 Statement                          (DFT_MON_STMT) = OFF
 Table                              (DFT_MON_TABLE) = OFF
Unit of work                        (DFT_MON_UOW) = OFF
SYSADM group name                      (SYSADM_GROUP) =
SYSCTRL group name                     (SYSCTRL_GROUP) =
SYSMAINT group name                    (SYSMAINT_GROUP) =
Database manager authentication       (AUTHENTICATION) = SERVER
Cataloging allowed without authority   (CATALOG_NOAUTH) = NO
Trust all clients                   (TRUST_ALLCLNTS) = YES
Trusted client authentication         (TRUST_CLNTAUTH) = CLIENT
Default database path                  (DFTDBPATH) = C:
```

```
 Database monitor heap size (4KB)          (MON_HEAP_SZ) = 12
 UDF shared memory set size (4KB)          (UDF_MEM_SZ) = 256
 Java Virtual Machine heap size (4KB)      (JAVA_HEAP_SZ) = 512
 Audit buffer size (4KB)                   (AUDIT_BUF_SZ) = 0
 Backup buffer default size (4KB)          (BACKBUFSZ) = 1024
 Restore buffer default size (4KB)         (RESTBUFSZ) = 1024
 Agent stack size                          (AGENT_STACK_SZ) = 16
 Minimum committed private memory (4KB)    (MIN_PRIV_MEM) = 32
 Private memory threshold (4KB)            (PRIV_MEM_THRESH) = 1296
 Sort heap threshold (4KB)                 (SHEAPTHRES) = 430000
 Directory cache support                   (DIR_CACHE) = YES
 Application support layer heap size (4KB) (ASLHEAPSZ) = 15
 Max requester I/O block size (bytes)      (RQRIOBLK) = 32767
 DOS requester I/O block size (bytes)      (DOS_RQRIOBLK) = 4096
 Query heap size (4KB)                     (QUERY_HEAP_SZ) = 1000
 DRDA services heap size (4KB)             (DRDA_HEAP_SZ) = 128
 Priority of agents                        (AGENTPRI) = SYSTEM
 Max number of existing agents             (MAXAGENTS) = 1500
 Agent pool size                           (NUM_POOLAGENTS) = 64
 Initial number of agents in pool          (NUM_INITAGENTS) = 4
 Max number of coordinating agents         (MAX_COORDAGENTS) =
(MAXAGENTS - NUM_INITAGENTS)
 Max no. of concurrent coordinating agents (MAXCAGENTS) =
MAX_COORDAGENTS
 Max number of logical agents              (MAX_LOGICAGENTS) =
MAX_COORDAGENTS
 Keep DARI process                         (KEEPDARI) = YES
 Max number of DARI processes              (MAXDARI) =
MAX_COORDAGENTS
 Initialize DARI process with JVM          (INITDARI_JVM) = NO
 Initial number of fenced DARI process     (NUM_INITDARIS) = 0
 Index re-creation time                    (INDEXREC) = ACCESS
 Transaction manager database name         (TM_DATABASE) =
1ST_CONN
 Transaction resync interval (sec)         (RESYNC_INTERVAL) = 180
 SPM name                                  (SPM_NAME) =
 SPM log size                              (SPM_LOG_FILE_SZ) = 256
 SPM resync agent limit                    (SPM_MAX_RESYNC) = 20
 SPM log path                              (SPM_LOG_PATH) =
 NetBIOS Workstation name                  (NNAME) =
 TCP/IP Service name                       (SVCENAME) = DB2cBLUE
 APPC Transaction program name             (TPNAME) =
 IPX/SPX File server name                  (FILESERVER) =
 IPX/SPX DB2 server object name            (OBJECTNAME) =
 IPX/SPX Socket number                     (IPX_SOCKET) = 879E
 Discovery mode                            (DISCOVER) = SEARCH
 Discovery communication protocols         (DISCOVER_COMM) =
 Discover server instance                  (DISCOVER_INST) = ENABLE
 Directory services type                   (DIR_TYPE) = NONE
 Directory path name                       (DIR_PATH_NAME) =
/.:/subsys/database/
 Directory object name                     (DIR_OBJ_NAME) =
 Routing information object name           (ROUTE_OBJ_NAME) =
 Default client comm. protocols            (DFT_CLIENT_COMM) =
 Default client adapter number             (DFT_CLIENT_ADPT) = 0
 Maximum query degree of parallelism       (MAX_QUERYDEGREE) = ANY
 Enable intra-partition parallelism        (INTRA_PARALLEL) = YES
 No. of int. communication buffers(4KB)(FCM_NUM_BUFFERS) = 10000
 Number of FCM request blocks              (FCM_NUM_RQB) = 10000
 Number of FCM connection entries          (FCM_NUM_CONNECT) =
(FCM_NUM_RQB * 0.75)
 Number of FCM message anchors             (FCM_NUM_ANCHORS) =
(FCM_NUM_RQB * 0.75)
 Node connection elapse time (sec)         (CONN_ELAPSE) = 10
 Max number of node connection retries (MAX_CONNRETRIES) = 5
 Max time difference between nodes (min) (MAX_TIME_DIFF) = 60
 db2start/db2stop timeout (min)            (START_STOP_TIME) = 10
```

A.3 DB2 Environment Variables

```
DB2_ANTIJOIN=Y
DB2_STRIPED_CONTAINERS=ON
DB2_LIKE_VARCHAR=y,y
DB2BPVARS=z:\tpch\cpq_ddl\cpq_scattered-read
DB2_HASH_JOIN=Y
DB2_BINSORT=N
DB2ACCOUNTNAME=db2\tpch
DB2INSTOWNER=G1
DB2PORTRANGE=50101:50132
DB2MEMMAXFREE=137438953472,20
DB2_RR_TO_RS=ON
DB2OPTIONS=-t -v +c
DB2NTPRICLASS=H
DB2NTNOCACHE=ON
DB2INSTPROF=z:\bigblue
DB2_PARALLEL_IO=*
```

A.4 Windows 2000 Environment Variables

```
ALLUSERSPROFILE=C:\Documents and Settings\All Users
APPDATA=C:\Documents and Settings\tpch\Application Data
CLASSPATH=.;C:\Program Files\SQLLIB\java\db2java.zip;C:\Program
Files\SQLLIB\java\runtime.zip;C:\Program
Files\SQLLIB\java\sqlj.zip;C:\Program Files\SQLLIB\bin
CommonProgramFiles=C:\Program Files\Common Files
COMPUTERNAME=G1
ComSpec=C:\WINNT\system32\cmd.exe
DB2CLP=417218
DB2INSTANCE=BLUE
DB2PATH=C:\Program Files\SQLLIB
DB2TEMPDIR=C:\Program Files\sqllib
DSS_NODE=0
DSS_NUMNODES=32
HOME=C:/Documents and Settings/Administrator
HOMEDRIVE=C:
HOMEPATH=\Documents and Settings\tpch
ICM_FOLDER=Information Catalog Manager
IMNINST=help
IMNINSTSRV=C:\PROGRA~1\IBM\IMNNQ
INCLUDE=c:\devstudio\atl\include;c:\devstudio\mfc\include;c:\devstudio\in
clude;C:\Program Files\Sqllib\include;
LIB=c:\devstudio\mfc\lib;c:\devstudio\lib;C:\Program Files\sqllib\lib
LOGONSERVER=\\G1
MSDevDir=C:\Program Files\Microsoft Visual Studio\Common\MSDev98
NUMBER_OF_PROCESSORS=4
OS=Windows_NT
Os2LibPath=C:\WINNT\system32\os2\dll;
Path=Z:\perl\bin;z:\tools;z:\tpch\tools;C:\WINNT\system32;C:\WINNT;C:\
WINNT\System32\Wbem;C:\PROGRA~1\MICROS~3\80\Tools\BINN;C:\P
ROGRA~1\IBM\IMNNQ;C:\Program Files\SQLLIB\BIN;C:\Program
Files\SQLLIB\FUNCTION;C:\Program
Files\SQLLIB\SAMPLES\REPL;C:\Program
Files\SQLLIB\HELP;C:\Program Files\Microsoft Visual
Studio\Common\Tools\WinNT;C:\Program Files\Microsoft Visual
Studio\Common\MSDev98\Bin;C:\Program Files\Microsoft Visual
Studio\Common\Tools;c:\devstudio\bin
PATHEXT=.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH
PROCESSOR_ARCHITECTURE=x86
PROCESSOR_IDENTIFIER=x86 Family 6 Model 10 Stepping 4,
GenuineIntel
PROCESSOR_LEVEL=6
PROCESSOR_REVISION=0a04
ProgramFiles=C:\Program Files
PROMPT=$P$G
RAHOSTFILE=z:\bigblue\blue\db2nodes.cfg
RAHSLEEPTIME=9999999999
```

```
ROOTDIR=C:/
SESSIONNAME=Console
SHELL=/bin/bash
SystemDrive=C:
SystemRoot=C:\WINNT
TEMP=C:\DOCUME~1\tpch\LOCALS~1\Temp
TMP=C:\DOCUME~1\tpch\LOCALS~1\Temp
TMPDIR=C:/WINNT/TEMP
TPCD_DBNAME=tpcd
USERDNSDOMAIN=DB2.compaq.com
USERDOMAIN=DB2
USERNAME=tpch
USERPROFILE=C:\Documents and Settings\tpch
VWSPATH=C:\Program Files\SQLLIB
VWS_FOLDER=IBM DB2
VWS_LOGGING=C:\Program Files\SQLLIB\LOGGING
VWS_TEMPLATES=C:\Program Files\SQLLIB\TEMPLATES
windir=C:\WINNT
```

A.5 Windows 2000 Configuration

All services were running in their default state.

From the Control Panel the Network, Services, Server, Propertities, Optimization was changed from the default of “Maximize Throughput for File Sharing” to “Maximize Throughput for Network Applications”. This setting remained in effect for the duration of the benchmark.

From the Control Panel the System, Performance, Optimize performance for was set to “Applications”. This setting remained in effect for the duration of the benchmark.

A.6 HPSMART Array Controller Cache Settings and registry entries

The HPSMART Array Controller cache settings for all the database data drives was reconfigured for the default ratio of 50% read / 50% write . The HPSMART Array Controller cache for the database log drives was disabled.

```
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\cpqcissb]
"Type"=dword:00000001
"Start"=dword:00000000
"ErrorControl"=dword:00000001
"Tag"=dword:00000102
"ImagePath"=hex(2):53,00,79,00,73,00,74,00,65,00,6d,00,33,00,32,00,5c,00,44,00,\

52,00,49,00,56,00,45,00,52,00,53,00,5c,00,63,00,70,00,71,00,63,00,69,00,73,\
  00,73,00,62,00,2e,00,73,00,79,00,73,00,00,00
"DisplayName"="Compaq CISS Controllers Device Driver"
"Group"="port"

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\cpqcissb\Parameters]
"CompletionMode"=dword:00000001

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\cpqcissb\Security]
"Security"=hex:01,00,14,80,a0,00,00,00,ac,00,00,00,14,00,00,00,30,00,00,00,02,\

00,1c,00,01,00,00,00,02,80,14,00,ff,01,0f,00,01,01,00,00,00,00,00,01,00,00,\

00,00,02,00,70,00,04,00,00,00,00,00,18,00,fd,01,02,00,01,01,00,00,00,00,00,\

05,12,00,00,00,74,00,69,00,00,00,1c,00,ff,01,0f,00,01,02,00,00,00,00,00,05,\

20,00,00,00,20,02,00,00,76,00,65,00,00,00,18,00,8d,01,02,00,01,01,00,00,00,\

00,00,05,0b,00,00,00,20,02,00,00,00,00,1c,00,fd,01,02,00,01,02,00,00,00,00,\

00,05,20,00,00,00,23,02,00,00,76,00,65,00,01,01,00,00,00,00,00,05,12,00,00,\
  00,01,01,00,00,00,00,00,05,12,00,00,00

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\cpqcissb\Enum]
"0"="PCI\\VEN_0E11&DEV_B060&SUBSYS_40700E11&REV_02\\3&267a616a&0&10"
"Count"=dword:00000004
"NextInstance"=dword:00000004
"1"="PCI\\VEN_0E11&DEV_B060&SUBSYS_40700E11&REV_02\\3&13c0b0c5&0&28"
"2"="PCI\\VEN_0E11&DEV_B060&SUBSYS_40700E11&REV_02\\3&1070020&0&08"
"3"="PCI\\VEN_0E11&DEV_B060&SUBSYS_40700E11&REV_02\\3&1070020&0&10"
```

A.7 Compiler Options for TPCD Batch Driver

```
erase tpcdUF.c
erase tpcdUF.obj
erase tpcdbatch.c
erase tpcdbatch.obj
erase tpcdbatch.map

set db2options=+c -t +p -v
db2start
db2 connect to %1
db2 prep tpcdbatch.sqc bindfile package isolation rr blocking all datetime iso
db2 prep tpcdUF.sqc    bindfile package isolation rs blocking all optlevel 1
degree 1 datetime iso
db2 connect reset
db2 terminate
REM make sure LIBPATH is set to include the compiler libraries and db2
libraries
cl -c -Z7 -G6 -DWIN32 -DSQLWINT -D_X86_=1 -W3 -J tpcdbatch.C
cl -c -Z7 -G6 -DWIN32 -DSQLWINT -D_X86_=1 -W3 -J tpcdUF.C
link -debug -out:tpcdbatch.exe tpcdbatch.obj tpcdUF.obj -align:0x1000
user32.lib kernel32.lib db2api.lib -subsystem:console
```

A.8 Compiler Options for ACID Driver

```
db2start
db2 connect to %1
db2 prep acid.sqc bindfile package isolation rr
db2 connect reset
db2 terminate

cl -c -Zi -DTPCD_V2 -DWIN32 -DSQLWINT -D_X86_=1 -W3 -J
mainacid.c acid.c

REM !!!! The compilation of the mainacid program absolutely requires
REM !!!! including the COMMODE.OBJ file.
```

```
REM !!!! This is used to avoid NT file buffering    -gav
REM Attempting to link with COMMODE.OBJ ...
link -debug -out:mainacid.exe commode.obj mainacid.obj acid.obj -
align:0x1000 "user32.lib" "kernel32.lib"  db2api.lib -subsystem:console
```

A.9 Cpq_scattered-read

```
NUMPREFETCHQUEUES=4
PREFETCHQUEUESIZE=200

# turn on scatter read for these types
NT_SCATTER_SMS=1
NT_SCATTER_DMSFILE=1
NT_SCATTER_DMSDEVICE=1

#diaglevels at which it writes configuration
LOG_CFG=4
LOG_PERF_HINTS=5
```

Appendix B: Database Build Scripts

B.1 buildtpcd

```
#!/usr/bin/perl
# usage   buildtpcd [QUAL]

# ASSUMPTIONS: all ddl files have commits in them!
($myName = $0) =~ s@.*/@@; $usage="
Usage: buildtpcd [QUAL]
   where QUAL is the optional parameter saying to build the qualification
         database (sf = .1 = 100MB)\n";

$qual="";
if (@ARGV == 1)
{
   $qual = $ARGV[0];
}

# get TPC-D specific environment variables
require 'getvars';

# Use the macros in here so that they can handle the platform differences.
# macro.pl should be sourced from cmvc, other people wrote and maintain it.
require "macro.pl";
require "tpcdmacro.pl";

# Make output unbuffered.
select(STDOUT);
$| = 1 ;

# verify that necessary environment variables for building the database
# are present.  Default those that aren't necessary
require "version";

if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
$platform=$ENV{"TPCD_PLATFORM"};
if ( $platform eq "nt" )
{
   $sep="&";
}
else
{
   $sep=";";
}
if ((length($ENV{"TPCD_BUILD_STAGE"}) <= 0) ||
($ENV{"TPCD_BUILD_STAGE"}) eq "NULL" )
{
   $ENV{"TPCD_BUILD_STAGE"} = "ALL";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
   die "Must set TPCD_PRODUCT env't var.\n";
}
if ( length($ENV{"TPCD_DBNAME"}) <= 0 )
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_MODE"}) <= 0)
{
  die "TPCD_MODE environment variable not set - uni/smp/mln \n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_DBPATH"}) <= 1)
{
   # if no db pathname specified, build the db in the home directory
   if ( $platform eq "aix" || $platform eq "sun" || $platform eq "ptx" ||
$platform eq "hp" || $platform eq "linux")
   {
      $ENV{"TPCD_DBPATH"} = $ENV{"HOME"};
   }
   elsif ( $platform eq "nt" )
   {
      $ENV{"TPCD_DBPATH"} = $ENV{"HOMEDRIVE"};
   }
   else
   {
      die "platform $platform not supported yet\n";
   }
}
if (length($ENV{"TPCD_DDLPATH"}) <= 0)
{
   # if no db pathname specified, use default
  $ENV{"TPCD_DDLPATH"} =
"/afs/tor/groups/dbp/perf/benchmark/tpcd/ddl/vanilla";
}
if (length($ENV{"TPCD_GENERATE_SEED_FILE"}) <= 0)
{
   # if no db pathname specified, use default
  $ENV{"TPCD_GENERATE_SEED_FILE"} = "no";
}
if (length($ENV{"TPCD_DDL"}) <= 0)
{
   $ENV{"TPCD_DDL"} = "dss.ddl";
}
if (length($ENV{"TPCD_STAGING_TABLE_DDL"}) <= 0)
{
   $ENV{"TPCD_STAGING_TABLE_DDL"} = "NULL";
}
if (length($ENV{"TPCD_PRELOAD_STAGING_TABLE_SCRIPT"}) <=
0)
{
   $ENV{"TPCD_PRELOAD_STAGING_TABLE_DDL"} = "NULL";
}
if (length($ENV{"TPCD_DELETE_STAGING_TABLE_SQL"}) <= 0)
{
   $ENV{"TPCD_DELETE_STAGING_TABLE_DDL"} = "NULL";
}
if (length($ENV{"TPCD_TBSP_DDL"}) <= 0)
{
   $ENV{"TPCD_TBSP_DDL"} = "dss.tbsp.ddl";
}
if (length($ENV{"TPCD_INDEXDDL"}) <= 0)
{
   $ENV{"TPCD_INDEXDDL"} = "dss.index";
}
if (length($ENV{"TPCD_RUNSTATS"}) <= 0)
{
   $ENV{"TPCD_RUNSTATS"} = "dss.runstats";
}
if (length($ENV{"TPCD_RUNSTATSHORT"}) <= 0)
{
   $ENV{"TPCD_RUNSTATSHORT"} = "NULL";
}
if (length($ENV{"TPCD_ADD_RI"}) <= 0)
{
```

```
   $ENV{"TPCD_ADD_RI"} = "NULL";
}
if (length($ENV{"TPCD_AST"}) <= 0)
{
   $ENV{"TPCD_AST"} = "NULL";
}
if ( ($ENV{"TPCD_INPUT"}) eq "NULL" )
{
   if (length($ENV{"TPCD_DBGEN"}) <= 0)
   {
      die "Must set TPCD_DBGEN if pregenerated flatfiles are not provided
(TPCD_INPUT=NULL)\n";
   }
}
if ( $qual eq "QUAL" )
{
   if ( ($ENV{"TPCD_QUAL_INPUT"}) eq "NULL" )
   {
      if (length($ENV{"TPCD_DBGEN"}) <= 0)
      {
         die "Must set TPCD_DBGEN if pregenerated flatfiles are not
provided (TPCD_QUAL_INPUT=NULL)\n";
      }
}
}
if (length($ENV{"TPCD_TEMP"}) <= 1)
{
   $ENV{"TPCD_TEMP"} = "/u/$instance/sqllib/tmp";
}
if (length($ENV{"TPCD_SORTBUF"}) <= 0)
{
   $ENV{"TPCD_SORTBUF"} = 4096;
}
if (length($ENV{"TPCD_LOAD_PARALLELISM"}) <= 0)
{
   $ENV{"TPCD_LOAD_PARALLELISM"} = 0;
}
if (length($ENV{"TPCD_LOADSTATS"}) <= 0)
{
   $ENV{"TPCD_LOADSTATS"} = "no";
}
if (length($ENV{"TPCD_COPY_DIR"}) <= 0)
{
   $ENV{"TPCD_COPY_DIR"} = "${delim}dev${delim}null";
}
if (length($ENV{"TPCD_FASTPARSE"}) <= 0)
{
   $ENV{"TPCD_FASTPARSE"} = "no";
}
if (length($ENV{"TPCD_BACKUP_DIR"}) <= 0)
{
   $ENV{"TPCD_BACKUP_DIR"} = "${delim}dev${delim}null";
}
if (length($ENV{"TPCD_LOG"}) <= 0)
{
   $ENV{"TPCD_LOG"} = "no";
}
if (length($ENV{"TPCD_LOGPRIMARY"}) <= 0)
{
   $ENV{"TPCD_LOGPRIMARY"} = "NULL";
}
if (length($ENV{"TPCD_LOGSECOND"}) <= 0)
{
   $ENV{"TPCD_LOGSECOND"} = "NULL";
}
if (length($ENV{"TPCD_LOGFILSIZ"}) <= 0)
{
   $ENV{"TPCD_LOGFILSIZ"} = "NULL";
}
if (length($ENV{"TPCD_LOG_DIR"}) <= 0)
{
   $ENV{"TPCD_LOG_DIR"} = "NULL";
}
if (length($ENV{"TPCD_LOG_DIR_SETUP_SCRIPT"}) <= 0)
{
   $ENV{"TPCD_LOG_DIR_SETUP_SCRIPT"} = "NULL";
}
if (length($ENV{"TPCD_CONFIGFILE"}) <= 0)
{
   $ENV{"TPCD_CONFIGFILE"} = "dss.dbconfig";
}
if (length($ENV{"TPCD_DBM_CONFIG"}) <= 0)
{
   $ENV{"TPCD_DBM_CONFIG"} = "NULL";
}
if (length($ENV{"TPCD_MACHINE"}) <= 0)
{
   $ENV{"TPCD_MACHINE"} = "medium";
}
if (length($ENV{"TPCD_SMPDEGREE"}) <= 0 ||
$ENV{"TPCD_SMPDEGREE"} eq "NULL")
{
   $ENV{"TPCD_SMPDEGREE"} = 1;
}
if (length($ENV{"TPCD_AGENTPRI"}) <= 0)
{
   $ENV{"TPCD_AGENTPRI"} = NULL;
}
if (length($ENV{"TPCD_ACTIVATE"}) <= 0)
{
   $ENV{"TPCD_ACTIVATE"} = "no";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
   die "Must set TPCD_AUDIT env't var.  Real audit timing sequence run if
yes\n";
}
if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
{
   die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_LOAD_DB2SET_SCRIPT"}) <= 0)
{
   $ENV{"TPCD_LOAD_DB2SET_SCRIPT"}="NULL"
}
if (length($ENV{"TPCD_DB2SET_SCRIPT"}) <= 0)
{
   $ENV{"TPCD_DB2SET_SCRIPT"}="NULL"
}
if (length($ENV{"TPCD_BUFFERPOOL_DEF"}) <= 0)
{
   $ENV{"TPCD_BUFFERPOOL_DEF"}="NULL"
}
if (length($ENV{"TPCD_EXPLAIN_DDL"}) <= 0)
{
   $ENV{"TPCD_EXPLAIN_DDL"}="NULL"
}
if (length($ENV{"TPCD_NODEGROUP_DEF"}) <= 0)
{
   $ENV{"TPCD_NODEGROUP_DEF"}="NULL"
}
if (length($ENV{"TPCD_PHYS_NODE"}) <= 0)
{
   $ENV{"TPCD_NODEGROUP_DEF"}="NULL"
}
if (length($ENV{"TPCD_APPEND_ON"}) <= 0)
{
   $ENV{"TPCD_APPEND_ON"}="yes"
}
#set up local variables
```

```
$tpcdVersion=$ENV{"TPCD_VERSION"};
$buildStage=$ENV{"TPCD_BUILD_STAGE"};
$product=$ENV{"TPCD_PRODUCT"};
$dbname=$ENV{"TPCD_DBNAME"};
$mode=$ENV{"TPCD_MODE"};
$sf=$ENV{"TPCD_SF"};
$sfReal=$sf;          # need a "saved" one for qualification stuff
$dbpath=$ENV{"TPCD_DBPATH"};
$ddlpath=$ENV{"TPCD_DDLPATH"};
$ddl=$ENV{"TPCD_DDL"};
$stagingTbl=$ENV{"TPCD_STAGING_TABLE_DDL"};
$preloadSampleUF=$ENV{"TPCD_PRELOAD_STAGING_TABLE_SCRI
PT"};
$deleteSampleUF=$ENV{"TPCD_DELETE_STAGING_TABLE_SQL"};
$buffpooldef=$ENV{"TPCD_BUFFERPOOL_DEF"};
$nodegroupdef=$ENV{"TPCD_NODEGROUP_DEF"};
$tbspddl=$ENV{"TPCD_TBSP_DDL"};
$indexddl=$ENV{"TPCD_INDEXDDL"};
$extraindex=$ENV{"TPCD_EXTRAINDEX"};
$runstats=$ENV{"TPCD_RUNSTATS"};
$runstatShort=$ENV{"TPCD_RUNSTATSHORT"};
$dbgen=$ENV{"TPCD_DBGEN"};
$input=$ENV{"TPCD_INPUT"};
$earlyindex=$ENV{"TPCD_EARLYINDEX"};
$ldtemp=$ENV{"TPCD_TEMP"};
$sortbuf=$ENV{"TPCD_SORTBUF"};
$load_parallelism=$ENV{"TPCD_LOAD_PARALLELISM"};
$loadstats=$ENV{"TPCD_LOADSTATS"};
$copydir=$ENV{"TPCD_COPY_DIR"};
$fparse=$ENV{"TPCD_FASTPARSE"};
$addRI=$ENV{"TPCD_ADD_RI"};
$astFile=$ENV{"TPCD_AST"};
$genSeed=$ENV{"TPCD_GENERATE_SEED_FILE"};
$appendOn=$ENV{"TPCD_APPEND_ON"};

if ( $fparse eq "yes" )
{
   $fastparse="FASTPARSE";
}
else
{
   $fastparse=" ";
}
$backupdir=$ENV{"TPCD_BACKUP_DIR"};
$logprimary=$ENV{"TPCD_LOGPRIMARY"};
$logsecond=$ENV{"TPCD_LOGSECOND"};
$logfilsiz=$ENV{"TPCD_LOGFILSIZ"};
$log=$ENV{"TPCD_LOG"};
$logDir=$ENV{"TPCD_LOG_DIR"};
$logDirScript=$ENV{"TPCD_LOG_DIR_SETUP_SCRIPT"};
$machine=$ENV{"TPCD_MACHINE"};
$configfile=$ENV{"TPCD_CONFIGFILE"};
$dbmconfig=$ENV{"TPCD_DBM_CONFIG"};
$loadconfigfile=$ENV{"TPCD_LOAD_CONFIGFILE"};
$loadDBMconfig=$ENV{"TPCD_LOAD_DBM_CONFIGFILE"};
$smpdegree=$ENV{"TPCD_SMPDEGREE"};
$agentpri=$ENV{"TPCD_AGENTPRI"};
$activate=$ENV{"TPCD_ACTIVATE"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$loadscript=$ENV{"TPCD_LOAD_SCRIPT"};
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$loadsetScript=$ENV{"TPCD_LOAD_DB2SET_SCRIPT"};
$setScript=$ENV{"TPCD_DB2SET_SCRIPT"};
$explainDDL=$ENV{"TPCD_EXPLAIN_DDL"};
$user=$ENV{"USER"};

# set up override of some parameters to override for qualification database
if ( $qual eq "QUAL" )
{
   $loadscript=$ENV{"TPCD_LOAD_SCRIPT_QUAL"};
   if ( length($ENV{"TPCD_QUAL_DBNAME"}) <= 0 )
   {
      die "TPCD_QUAL_DBNAME environment variable not set\n";
   }
   $dbname=$ENV{"TPCD_QUAL_DBNAME"};

   print "DBNAME= $dbname\n\n";

   $sf=$ENV{"TPCD_QUAL_SF"};
   if ( length($ENV{"TPCD_QUAL_DDL"}) <= 0 )
   {
      die "TPCD_QUAL_DDL environment variable not set\n";
   }
   $ddl=$ENV{"TPCD_QUAL_DDL"};
   if ( length($ENV{"TPCD_QUAL_TBSP_DDL"}) <= 0 )
   {
      die "TPCD_QUAL_TBSP_DDL environment variable not set\n";
   }
   $tbspddl=$ENV{"TPCD_QUAL_TBSP_DDL"};
   $input=$ENV{"TPCD_QUAL_INPUT"};
   if ( length($ENV{"TPCD_QUALCONFIGFILE"}) <= 0 )
   {
      die "TPCD_QUALCONFIGFILE environment variable not set\n";
   }
   $configfile=$ENV{"TPCD_QUALCONFIGFILE"};
   if ( length($ENV{"TPCD_DBM_QUALCONFIG"}) <= 0 )
   {
      die "TPCD_DBM_QUALCONFIG environment variable not set\n";
   }
   $dbmconfig=$ENV{"TPCD_DBM_QUALCONFIG"};
   if ( length($ENV{"TPCD_LOAD_QUALCONFIGFILE"}) <= 0 )
   {
      die "TPCD_LOAD_QUALCONFIGFILE environment variable not
set\n";
   }
   $loadconfigfile=$ENV{"TPCD_LOAD_QUALCONFIGFILE"};
   if ( length($ENV{"TPCD_LOAD_DBM_QUALCONFIGFILE"}) <= 0 )
   {
      die "TPCD_LOAD_DBM_QUALCONFIGFILE environment variable
not set\n";
   }
   $loadDBMconfig=$ENV{"TPCD_LOAD_DBM_QUALCONFIGFILE"};
   if (length($ENV{"TPCD_LOG_DIR"}) <= 0)
   {
      $ENV{"TPCD_LOG_DIR"} = "NULL";
   }
   $logDir=$ENV{"TPCD_LOG_QUAL_DIR"};
}

if (( $mode eq "uni" ) || ( $mode eq "smp" ))
{
  $all_ln="once";
  $all_pn="once";
  $once="once";
}
else
{
  $all_ln="all_ln";
  $all_pn="all_pn";
  $once="once";
}

##################### set up the config parms for the load, indexes and
stats ############################
if ($loadconfigfile eq "NULL")
{
  if ( ($machine eq "NULL") )
  {
   die "Neither a LOAD config file name not a machine size has been
specified!\n";
```

```
 }
 $ioclnrs=1;
 $chngpgs=60;

 if ( $machine eq "small" )
 {
    $buffpage = 5000;
    $sortheap = 3000;
    $sheapthres = 8000;
    $util_heap_sz = 5000;
    $ioservers = 6;
 }
 elsif ( $machine eq "medium" )
 {
    $buffpage = 10000;
    $sortheap =  8000;
    $sheapthres = 20000;
    $util_heap_sz = 10000;
    $ioservers = 10;
 }
 elsif ( $machine eq "big" )
 {
    $buffpage = 30000;
    $sortheap = 20000;
    $sheapthres = 50000;
    $util_heap_sz = 30000;
    $ioservers = 20;
 }
 elsif ( $machine eq "sunsmp" )
 {
    $buffpage = 60000;
    $sortheap = 20000;
    $sheapthres = 80000;
    $util_heap_sz = 30000;
    $ioservers = 80;
 }
 elsif ( $machine eq "eastwood" )
 {
    $buffpage = 80000;
    $sortheap = 50000;
    $sheapthres = 81000;
    $ioclnrs = 4;
    $chngpgs = 30;
    $ioservers = 21;
    $util_heap_sz = 50000;
 }
}
###################### echo parameter settings to acknowledge what is
being built ##########################
if ( $buildStage ne "ALL" ){
   print " ***** STARTING the build process at the $buildStage Stage
*****\n";
}
print "Building a TPC-D Version $tpcdVersion $sf GB database on $dbpath
with: \n";
print "   Mode = $mode \n";
print "   Tablespace ddl in $ddlpath${delim}$tbspddl \n";
if ( $nodegroupdef ne "NULL" )
{
  print "   Nodegroup ddl in $ddlpath${delim}$nodegroupdef \n";
}
if ( $buffpooldef ne "NULL" )
{
  print "   Bufferpool ddl in $ddlpath${delim}$buffpooldef \n";
}
print "   Table ddl in $ddlpath${delim}$ddl \n";
print "   Index ddl in              $ddlpath${delim}$indexddl\n";
if ( $extraindex ne "no" )
{
 print " Indices to create after the load $ddlpath${delim}$extraindex\n";
}
if ( $loadscript eq "NULL")
{
   if ( $input eq "NULL" )
   {
      print "   Data generated by DBGEN in $dbgen\n";
   }
   else
   {
      print "   Data loaded from flat files in $input\n";
   }
}
if ( $earlyindex eq "yes" )
{
 print "   Indexes created before loading\n";
}
else
{
 print "   Indexes created after loading\n";
}
if ( $addRI ne "NULL" )
{
   print "   RI being used from $ddlpath${delim}$addRI\n";
}
if ( $astFile ne "NULL" )
{
   print "   AST being used from $ddlpath${delim}$astFile\n";
}
if ( $loadstats eq "yes" )
{
 if ( $earlyindex eq "yes" )
 {
  print "   Statistics for tables and indexes gathered during load\n";
 }
 else
 {
  if ( $runstatShort eq "NULL" )
  {
   print "   Statistics for tables and indexes gathered after load using
$ddlpath${delim}$runstats \n";
   }
   else
   {
      print "   Statistics for tables and indexes gathered after load using
$ddlpath${delim}$runstats and $ddlpath${delim}$runstatShort\n";
   }
  }
}
else
{
 if ( $runstatShort eq "NULL" )
 {
   print "   Statistics for tables and indexes gathered after load using
$ddlpath${delim}$runstats \n";
 }
 else
 {
   print "   Statistics for tables and indexes gathered after load using
$ddlpath${delim}$runstats and $ddlpath${delim}$runstatShort\n";
 }
}
if ( $loadconfigfile ne "NULL" )
{
 print "   Database Configuration parameters for LOAD taken from
$ddlpath${delim}$loadconfigfile\n";
}
if ( $loadDBMconfig ne "NULL" )
{
 print "   Database manager Configuration parameters for LOAD taken from
$ddlpath${delim}$loadDBMconfig\n";
```

```
}
if ( $configfile ne "NULL" )
{
  print "   Database Configuration parameters taken from
$ddlpath${delim}$configfile\n";
}
else
{
  print "   Database Configuration paramters taken from
$ddlpath${delim}dss.dbconfig${sfReal}GB\n";
  $configfile="dss.dbconfig${sfReal}GB";
}
if ( $dbmconfig ne "NULL" )
{
  print "   Database Manager Configuration parameters taken from
$ddlpath${delim}$dbmconfig\n";
}
else
{
  print "   Database Manager Configuration paramters taken from
$ddlpath${delim}dss.dbmconfig${sfReal}GB\n";
  $configfile="dss.dbmconfig${sfReal}GB";
}
#print "   Copy image for load command created in $copydir\n";
if ( $log eq "yes" )
{
  print "   Backup files placed in $backupdir\n";
}
else
{
  print "   No backup will be taken.\n";
}
print "   Log retain set to $log\n";
if ( $logDir eq "NULL" )
{
    print "   Log files remain in database path\n";
}
else
{
    print "   Log file path set to $logDir\n";
}
if ( $logprimary eq "NULL" )
{
    print "   Log Primary left at default\n";
}
else
{
    print "   Log Primary set to $logprimary\n";
}
if ( $logsecond eq "NULL" )
{
    print "   Log Second left at default\n";
}
else
{
    print "   Log second set to $logsecond\n";
}
if ( $logfilsiz eq "NULL" )
{
    print "   Logfilsiz left at default\n";
}
else
{
    print "   Logfilsiz set to $logfilsiz\n";
}

if ($loadconfigfile eq "NULL")
{
  print "   Machine size set to $machine so the following configuration\n";
  print "   parameters are used for load, create index and runstats: \n";
  print "      BUFFPAGE = $buffpage \n";
  print "      SORTHEAP = $sortheap \n";
  print "      SHEAPTHRES = $sheapthres\n";
  print "      NUM_IOSERVERS = $ioservers\n";
  print "      NUM_IOCLEANERS = $ioclnrs\n";
  print "      CHNGPGS_THRESH = $chngpgs\n";
  print "      UTIL_HEAP_SZ = $util_heap_sz\n";
  print "      Degree of parallelism (dft_degree and max_querydegree) set to
$smpdegree\n";
  print "      Parameters for load are: temp file      = $ldtemp\n";
  print "                               sort buf       = $sortbuf\n";
  print "                               ld parallelism = $load_parallelism\n";
  if ( $fparse eq "yes" )
  {
    print "                                FASTPARSE used on load\n";
  }
}
if ( $loadscript ne "NULL")
{
  print "   Load commands  in $ddlpath${delim}$loadscript\n";
}



print "   Degree of parallelism (dft_degree and max_querydegree) set to
$smpdegree\n";
if ( $agentpri ne "NULL" )
{
    print "   AGENTPRI set to $agentpri\n";
}
if ( $activate eq "yes" )
{
    print "   Database will be activated when build is complete\n";
}
if ( $explainDDL ne "NULL" )
{
    print "   EXPLAIN DDL being used from
$ddlpath${delim}$explainDDL\n";
}
else
{
    print "   EXPLAIN DDL being used from default sqllib directory\n";
}

print "Sleeping for 15 seconds to give you a chance to reconsider...\n";
sleep 15;
########################################## end echo parameters
############################################
# don't need separate calls for mln/mpp vs uni since the $all_ln will be
# defined appropriately
if ( $platform eq "nt" )
{
    if (($mode eq "uni") || ($mode eq "smp"))
    {
      #spaces required for NT
      $rc=&dodb_noconn("db2set DB2OPTIONS=\"   -t -v +c\"",$all_ln);
    }
    else
    {
      $rc=&dodb_noconn("db2set DB2OPTIONS=\\\"   -t -v +c\\\"",$all_ln);
    }
}
else
{
    if (($mode eq "uni") || ($mode eq "smp"))
    {
      $rc=&dodb_noconn("db2set DB2OPTIONS=\"-t -v +c\"",$all_ln);
    }
    else
    {
```

```
      $rc=&dodb_noconn("db2set DB2OPTIONS=\\\"-t -v +c\\\"",$all_ln);
   }
}

if ( $rc != 0 )
{
  die "failure setting db2 environment variable : DB2OPTIONS  rc=$rc\n";
}

if ( $platform eq "nt" )
{
   $rc=&dodb_noconn("db2set DB2NTNOCACHE=ON",$all_ln);
}

if ( $rc != 0 )
{
  die "failure setting db2 environment variable : DB2NTNOCACHE\n";
}
# @de980723wlc

# set the db2 env vars for loading, from the
TPCD_LOAD_DB2SET_SCRIPT script
if ( $loadsetScript ne "NULL" )
{
   if ( $platform eq "nt" )
   {
      #### Mike , th, the- for some reason rah on NT doesn't like running
      #### a fully qualified file name.  Switch to dir, then run
      ## check CHANGE THIS to have single node and multinode execution
      if (( $mode eq "uni" ) || ( $mode eq "smp" ))
      {
         $ret=system("${ddlpath}${delim}$loadsetScript");
         #$ret=system("cd ${ddlpath} $sep $loadsetScript");
      }
      else
      {
         $ret=system(" rah \" call ${ddlpath}${delim}$loadsetScript\" ");
      }
   }
   else
   {
      $ret=system("${ddlpath}${delim}$loadsetScript");
   }
   if ( $ret != 0 )
   {
      die "failure setting load time db2set parms from $loadsetScript \n";
   }
}
# stopping and starting db2 before we continue
print "Stopping DB2 ...\n";
$rc=system("db2stop");
if ( $rc < 0 )
{
   die "failure during db2stop rc = $rc \n";
}
print "Starting DB2 ...\n";
$rc=system("db2start");
if ( $rc != 0 )
{
   die "failure during db2start rc = $rc \n";
}

############################################ create database
################################################
if ( $buildStage eq "ALL" )
{
   # build from the beginning
   &outtime("*** Starting to create the database");

   $rc = &dodb_noconn("db2 \"create database $dbname on $dbpath collate
using identity with 'TPC-D $sf GB'\"",$once);
   # remove the update.pair.num file so when setupDir runs, it doesn't
   # hang waiting for an answer on nt

   if($rc != 0){
      die "Failure during create database. rc = $rc\n";
   }


   &rm("$auditDir${delim}$dbname.$user.update.pair.num");

   # reset the db and dbm configuration before we start
   &dodb_noconn("db2 reset database configuration for $dbname",$all_ln);
   &dodb_conn($dbname,"db2 alter bufferpool ibmdefaultbp size -1 $sep   \
           db2 grant connect on database to public $sep            \
           db2 grant dbadm on database to $dbname $sep             \
           db2 commit",$once);
   &dodb_noconn("db2 reset database manager configuration",$once);

   # update the log information first
   # set up the log directory before we do any index creation
   if ($logDirScript ne "NULL")
   {
      system ("perl $ddlpath${delim}$logDirScript");
   }
   elsif ( $logDir ne "NULL" )
   {
      &dodb_noconn("db2 update database configuration for $dbname using
newlogpath $logDir",$all_ln);
   }
   $setLogs=0;
   $setLogString="";
   if ( $logprimary ne "NULL" )
   {
      $setLogString.="db2 update db cfg for $dbname using logprimary
$logprimary";
      $setLogs=1;
   }
   if ( $logsecond ne "NULL" )
   {
      if ( $setLogs != 0 )
      {
         $setLogString.=" $sep ";
      }
      $setLogString.="db2 update db cfg for $dbname using logsecond
$logsecond";
      $setLogs=1;
   }
   if ( $logfilsiz ne "NULL" )
   {
      if ( $setLogs != 0 )
      {
         $setLogString.=" $sep ";
      }
      $setLogString.="db2 update db cfg for $dbname using logfilsiz
$logfilsiz";
      $setLogs=1;
   }
   if ( $setLogs != 0 )
   {
      $setLogString.=" $sep ";
   }
   $setLogString.="db2 update db cfg for $dbname using logbufsz 128";
   &dodb_noconn("$setLogString",$all_ln);


   # setup the load configuration
   &loadConfig;
}  # end of "CREATE DATABASE" phase
```

```
if (( $buildStage eq "ALL" ) || ( $buildStage eq "CRTTBSP" ) ||
   ( $buildStage eq "LOAD" ) ||
   (( $buildStage eq "INDEX" ) && ( $earlyindex eq "yes" )) )
{
   # create the nodegroups is there is a file specified
   if ( $nodegroupdef ne "NULL" )
   {
      #run the create bufferpool ddl
      &outtime("*** Creating the nodegroups");
      &dodb2file($dbname,"$ddlpath${delim}$nodegroupdef",$once);

   }
   # create the explain tables - these should go into userspace1 since no
   # other tablespaces exist
   if ( $explainDDL ne "NULL" )
   {
      $explnPathFile="$ddlpath${delim}$explainDDL";
   }
   else
   {
      if ( $platform eq "ptx" )
      {
         $home=$ENV{"HOME"};
         $sqlpath="$home${delim}sqllib";
      }
      if ( $platform ne "nt" )
      {
         $sqlpath="~${delim}sqllib";
      }
      else
      {
         $sqlpath=$ENV{"DB2PATH"};
         $sqlpath="\"$sqlpath\"";
      }
      $explnPathFile="${sqlpath}${delim}misc${delim}EXPLAIN.DDL";
   }
   &dodb_conn($dbname,
            "db2 -tvf $explnPathFile $sep \
             db2 alter table explain_instance locksize table append on $sep \
             db2 alter table explain_statement locksize table append on $sep \
             db2 alter table explain_argument locksize table append on $sep \
             db2 alter table explain_object locksize table append on $sep \
             db2 alter table explain_operator locksize table append on $sep \
             db2 alter table explain_predicate locksize table append on $sep \
             db2 alter table explain_stream locksize table append on",
            $once);

   if ( $buffpooldef ne "NULL" )
   {
      #run the create bufferpool ddl
      &outtime("*** Creating the bufferpools");
      &dodb2file($dbname,"$ddlpath${delim}$buffpooldef",$once);

   }
   # create the tablespaces
   &outtime("*** Ready to start creating the tablespaces");
   &dodb2file($dbname,"$ddlpath${delim}$tbspddl",$once);
   # if we are in audit mode, then we must create the the tablespaces and
   # tables for the update functions and we must generate the data for the
   # update functions before we start timing the load.  (All activity
   # on the database after the table creation is started and before the
performance
   # tests are run must be included in load time
   # NOTE: we do not have to do this if we are building the qualification
database
   &outtime("*** Start of audited Load Time - starting to create tables");

   # create/populate the staging tables
   if ( $stagingTbl ne "NULL" )
   {
      # staging tables must be created for both test and qualification database
      # but they do not need to be populated for the qualification database
      &dodb2file($dbname,"$ddlpath${delim}$stagingTbl",$once);
      if ( $qual ne "QUAL" )
      {
         if ( $preloadSampleUF ne "NULL" )
         {
            # preload the sample UF data for statistics gathering
            $rc = system ("perl $ddlpath${delim}$preloadSampleUF");
         }
         if ( $deleteSampleUF ne "NULL" )
         {
            # delete the sample rows now that stats have been gathered

&dodb2file($dbname,"$ddlpath${delim}$deleteSampleUF",$once);
         }
      }
   }
   &dodb2file($dbname,"$ddlpath${delim}$ddl",$once);

   # update the locksize on the non-updated tables to be table level locking
   # update the tables for appendmode

   if ($appendOn eq "yes"){
     &dodb_conn($dbname,
            "db2 alter table tpcd.nation locksize table $sep \
             db2 alter table tpcd.region locksize table $sep \
             db2 alter table tpcd.customer locksize table $sep \
             db2 alter table tpcd.supplier locksize table $sep \
             db2 alter table tpcd.part locksize table $sep \
             db2 alter table tpcd.partsupp locksize table $sep \
             db2 alter table tpcd.lineitem append on $sep \
             db2 alter table tpcd.orders append on",
            $once);
   }
   else{
     &dodb_conn($dbname,
            "db2 alter table tpcd.nation locksize table $sep \
             db2 alter table tpcd.region locksize table $sep \
             db2 alter table tpcd.customer locksize table $sep \
             db2 alter table tpcd.supplier locksize table $sep \
             db2 alter table tpcd.part locksize table $sep \
             db2 alter table tpcd.partsupp locksize table $sep \
             db2 alter table tpcd.lineitem pctfree 4 $sep \
             db2 alter table tpcd.orders pctfree 4",
            $once);
   }

   if ( $mode eq "mpp" )
   {
      #need parallel specific
      print "need to figure parallel specific creation of tmp\n";
   }
   mkdir("${delim}tmp${delim}$instance",0777);
}  # end of "CREATE TABLESPACE and TABLES" phase
if (( $buildStage eq "ALL" ) || ( $buildStage eq "CRTTBSP" ) ||
   ( $buildStage eq "LOAD" ) ||
   (( $buildStage eq "INDEX" ) && ( $earlyindex eq "yes" )) )
{
   # do the load stage of the build, or if early index is on do
   # the index creation also
   # setup the load configuration
   if ( $buildStage ne "ALL"){ # we're restarting a build so reapply the load
config
      &loadConfig;
   }

   # if earlyindex requested, create indexes
   if ( $earlyindex eq "yes" )
   {
```

```
      &outtime("*** Starting to create indexes");
      &dodb2file($dbname,"$ddlpath${delim}$indexddl",$once);

      &outtime("*** Create index completed");
   }


   # start the dbgen and load.....call the specific mode for loading
(uni,smp,mln)
   if (( $mode eq "uni" ) || ( $mode eq "smp" ))
   {
      &outtime("*** Starting the load");
      # call the appropriate dbgen/load for uni/smp
      if (( $loadscript eq "NULL") || ( $loadscript eq "" ))
      {
         $rc = system("perl genloaduni $qual");
         if ( $rc != 0 )
         {
            die "genloaduni failed rc = $rc\n";
         }
      }
      else
      {
         &dodb2file_noconn("$ddlpath${delim}$loadscript",$once);
      }
   }
   elsif (( $mode eq "mln" ) || ( $mode eq "mpp" ))
   {
      &outtime("*** Starting the load");
      # call the appropriate dbgen/split/(sort)/load for mln/mpp

      if (( $loadscript eq "NULL") || ( $loadscript eq "" ))
      {
         $rc = system("perl genloadmpp $qual");
        if ( $rc != 0 )
        {
           die "genloadmpp failed rc = $rc\n";
        }
      }
      else
      {
#          $rc = &dodb2file_noconn("$ddlpath${delim}$loadscript $sf");
         $rc = system("call $ddlpath${delim}$loadscript");
      }

      if ( $rc != 0 )
      {
         die "doload for $dbname failed rc = $rc. Script is
$ddlpath${delim}$loadscript\n";
      }
   }

   else
   {
      die "TPCD_MODE not set to one of uni, smp, mln or mpp\n";
   }

   &outtime("*** Load complete");


   # verify that the audit directory exists
   $filename="$auditDir";
   if (-e $filename)
   {
    # set up the $auditDir/$dbname.$user.update.pair.num file
    # to start at update pair 1
    $filename="$auditDir${delim}$dbname.$user.update.pair.num";
   }
   else
   {
     mkdir ("$auditDir", 0775) || die "cannot mkdir $auditDir";
   }
   print "setting update pair num to 1\n";
   system("echo 1 > $filename");

}  # end all and load stage (and create index if early index was specified

if (( $buildStage eq "ALL" ) || ( $buildStage eq "CRTTBSP" ) ||
   ( $buildStage eq "LOAD" ) ||
   ( $buildStage eq "INDEX" ))
{
   if ( $buildStage eq "INDEX")
   { # we're restarting a build so reapply the load config
      &loadConfig;
   }
   # if indexes haven't been created, do so now
   if ( $earlyindex ne "yes" )
   {
      &outtime("*** Create index started");
      &dodb2file($dbname,"$ddlpath${delim}$indexddl",$once);

      &outtime("*** Create index completed");
   }
   if ( $extraindex ne "no" )
   {
      # use this additional file for indexes
      &outtime("*** Create index (part 2) started");
      &dodb2file($dbname,"$ddlpath${delim}$extraindex",$once);
      &outtime("*** Create index (part 2) completed");
   }

} # end create/load/index phase of the build

if (( $buildStage eq "ALL" ) ||  ( $buildStage eq "CRTTBSP" ) ||
   ( $buildStage eq "LOAD" ) ||
   ( $buildStage eq "INDEX" ) || ( $buildStage eq "RUNSTATS" ))
{
   if ( $buildStage eq "RUNSTATS")
   { # we're restarting a build so reapply the load config
      &loadConfig;
   }
   # if statistics not gathered on the load, run runstats  (we have to run the
   # stats at the same time as the index creation whether it be both during
load,
   # or after load)
   # We need to run the runstats as well if we have specifed an extra index
file
   # for "after load" indexes
   if (( $loadstats eq "no" ) || ( $earlyindex eq "no" ) || ( $extraindex ne "no" ))
   {
      # if loadstats not gathered, then index stats not gathered either.
      &outtime("*** Runstats started");

      if ( $runstatShort ne "NULL" )
      {
         # we've specified a second runstats file...This runstats file should do
         # runstats for all table except lineitem. The lineitem runstats
command
         # should be left in the main runstats file.
         if ( $platform eq "aix" || $platform eq "sun" || $platform eq "ptx" )
         {
            print "runstats from $ddlpath${delim}$runstatShort running
now\n";
            $rc = system("db2 -tvf \"$ddlpath${delim}$runstatShort\" >
\"$auditDir${delim}tools${delim}runstatShort.out\"  & ");
            print "rc from runstatshort=$rc\n";
         }
         elsif ( $platform eq "nt" )
         {
            system("start db2 -tvf $ddlpath${delim}$runstatShort");
```

```
         }
         else
         {
            print "Don't know how to start in background on $platform
platform\n";
            print "therefore running runstats serially\n";
            &dodb2file($dbname,"$ddlpath${delim}$runstatShort",$once);
         }
      }
      # run the full runstats, or the remainder of what wasn't put into the short
      # runstats file. You should be sure that this runstats will take longer
      # than the short runstats that is running in the background, otherwise
      # setting the config will happen before this is done.
      &dodb2file($dbname,"$ddlpath${delim}$runstats",$once);
      &outtime("*** Runstats completed");
   }
} # end build phaose all/load/index/runstats

# add the RI
if ( $addRI ne "NULL" )
{
   &outtime("*** Adding RI contraints started");
   &dodb2file($dbname,"$ddlpath${delim}$addRI",$once);
   &outtime("*** Adding RI contraints completed");
}

#add the AST if it has been requested
if ( $astFile ne "NULL" )
{
   &outtime("*** Adding AST started");
   &dodb2file($dbname,"$ddlpath${delim}$astFile",$once);
   &outtime("*** Adding AST completed");
}

# check tbsp info
&dodb_conn($dbname,"db2 list tablespaces show detail",$once);

# set the configuration
&outtime("*** Set Configuration started");
&outtime("*** Setting degree of parallelism");
&dodb_noconn("db2 update database configuration for $dbname using
dft_degree $smpdegree",$all_ln);
&dodb_noconn("db2 update database manager configuration using
max_querydegree $smpdegree",$once);

&dodb2file_noconn("${ddlpath}${delim}$configfile",$all_ln);
&dodb2file_noconn("${ddlpath}${delim}$dbmconfig",$once);

if ( $agentpri ne "NULL" )
{
   &dodb_noconn("db2 update dbm cfg using AGENTPRI
$agentpri",$once);
}

# set the db2 environment variables for running the benchmark
if ( $setScript ne "NULL" )
{
   if ( $platform eq "aix" || $platform eq "sun" || $platform eq "ptx")
   {
      $ret=system("${ddlpath}${delim}$setScript");
   }
   elsif ( $platform eq "nt" )
   {
      if (($mode eq "uni" ) || ($mode eq "smp" ))
      {
         $ret = system("perl ${ddlpath}${delim}$setScript");
      }
      else
      {
         $ret = system(" rah \"call ${ddlpath}${delim}$setScript\" ");
      }
   }
   if ( $ret != 0 )
   {
      die "failure setting runtime db2set parms from $setScript \n";
   }
}
# if logging is enabled, we must take a backup of the database
if ( $log eq "yes" )
{
   &dodb_noconn("db2 update database configuration for $dbname using
LOGRETAIN yes",$all_ln);
   print "\n NOTE:  DO NOT RESET THE DATABASE
CONFIGURATION or you will lose logretain\n";
   # force a connection to the database on all nodes to ensure LOGRETAIN
is
   # set in effect.
   # An error message will print to screen if the logretain is set properly
   # i.e. SQL116N A connection to or activation of database <database
name>
   # cannot  be made.
   # This is expected and the lack of this error message should be seen as an
   # error in the database build.
   &dodb_conn($dbname,"db2 \"select count(*) from tpcd.region\"",$all_ln);

   if ( $qual eq "QUAL" )
   {
      &outtime("*** Starting the backup");

      if (( $mode eq "mln" ) || ( $mode eq "mpp"))
      {
         # must back up catalog node first...assume node 00
         $rc=system("db2_all \'}]<<+000< db2 \"backup database $dbname to
$backupdir without prompting\" \' ");
         if ( $rc != 0 )
         {
            die "backup of catalog node failed rc = $rc\n";
         }
         # back up remaining nodes
         $rc=system("db2_all \'||}]<<-000< db2 backup database $dbname to
$backupdir without prompting\' ");
         if ( $rc != 0 )
         {
            die "backup of remaining nodes failed rc = $rc\n";
         }
      }
      else
      {
         &dodb_noconn("db2 backup database $dbname to
$backupdir",$once);
      }
      &outtime("*** Finished the backup");
   }
   else
   {
      # This is the test database. Clause 3.1.4 states that "the test sponsor is
      # not required to make or have backup copies of the test database;
however
      # all other mechanisms that guarantee durability of the qualification
      # database must be enabled in the same way for the test database".
      # According to this clause we do need to keep the backup of the
database.
      &dodb_noconn("db2dart $dbname /CHST /WHAT DBBP
OFF",$all_ln);
   }
}

# stop and restart the database to get config parms recognized
$rc=system("db2stop");
if ( $rc != 0 )
```

```
{
   die "failure during db2stop rc = $rc \n";
}
$rc=system("db2start");
if ( $rc != 0 )
{
   die "failure during db2start rc = $rc \n";
}

&outtime("*** Set Configuration completed");
&outtime("*** End of audited Load Time");

#create generated seeds
if ( $genSeed ne "no" )
{
  $rc = system("perl createmseedme.pl 1000");
  if ( $rc != 0 )
  {
    warn "createmseedme failed\n";
  }
}

$rc = system("perl buildtpcdbatch $qual");
if ( $rc != 0 )
{
  die "buildtpcdbatch failed rc=$rc\n";
}

if ( $RealAudit eq "yes" )
{
   # if we are in real audit mode then we have to do a number of things
   # set up the audit directory structure and the run directory structure
   # so that once we have completed the buildtpcd, we are ready to run.
   # first remove any old "update pair number" file so we won't get prompted
   # doing setupDir
   &rm("$auditDir${delim}tools${delim}tpcd.runsetup");
   system("perl setupRun");
   # before we stop the database for the final time
   # if we are in the real audit mode then run dbtables and dbcheck before
   # we print out the final notice that we are ready to run the performance
tests
   # if we are building the qualification database then we will bind to both
   # the dbname database and the qualification database
   if ( $qual eq "QUAL" )
   {
      $verifyType="q";
   }
   else
   {
      $verifyType="t";
   }
   system("perl tablesdb $verifyType");

&dodb2file($dbname,"$auditDir${delim}tools${delim}first10rows.sql",$on
ce);
}
# stop, restart and activate the database, if necessary

#Create Catalog info
$rc = system("perl catinfo.pl b");

if ( $rc != 0 )
{
  warn "catinfo failed!!!  rc = $rc\n";
}

$rc=system("db2stop");
if ( $rc != 0 )
{
   die "failure during db2stop rc = $rc \n";
}

&outtime("*** Ready to run the performance tests once the dbm has
restarted");

if ( $RealAudit ne "yes" )
{
   # if we are not in a real audit, then we can restart the database manager
   # if we are in a real audit, then we don't want to do this until the
   # power test starts
   $rc=system("db2start");
   if ( $rc != 0 )
   {
      die "failure during db2start rc = $rc \n";
   }
   if ( $activate eq "yes" )
   {
      &dodb_noconn("activate database $dbname",$once);
   }
}

# finished creating the database
&outtime("*** Finished creating the database");

############################## subroutine for setting the load
configuration ##############################
sub loadConfig{

   &outtime("*** Setting LOAD configuration.");
   if ($loadconfigfile eq "NULL" || $loadDBMconfig eq "NULL")
   {
     &dodb_noconn("db2 update db cfg for $dbname using buffpage
$buffpage $sep \
          db2 update db cfg for $dbname using sortheap $sortheap $sep \
          db2 update db cfg for $dbname using num_iocleaners $ioclnrs $sep \
          db2 update db cfg for $dbname using num_ioservers $ioservers $sep
\
          db2 update db cfg for $dbname using util_heap_sz $util_heap_sz
$sep \
          db2 update db cfg for $dbname using chngpgs_thresh $chngpgs",
          $all_ln);
     &dodb_noconn("db2 update dbm cfg using sheapthres
$sheapthres",$once);
   }
   else
   {
      &dodb2file_noconn("$ddlpath${delim}$loadconfigfile",$all_ln);
      &dodb2file_noconn("$ddlpath${delim}$loadDBMconfig",$once);
   }
   &dodb_noconn("db2 terminate",$once);
   $rc=system("db2stop");
   if ( $rc != 0 )
   {
      die "failure during db2stop after resetting for load config rc = $rc \n";
   }
   $rc=system("db2start");
   if ( $rc != 0 )
   {
      die "failure during db2start rc = $rc \n";
   }
}



1;
```

B.2 tpcd.setup

```
# NOTE: ALL variable defitions must have a comment at the end - haven't
got
```

```
#       the getvars script recognizing the uncommented line yet
TPCD_PLATFORM=nt                # aix, nt, sun ....
TPCD_VERSION=2                  # 1 or 2 (Version of tpcd). Default 1
TPCD_DBNAME=TPCD                # name to create database under
TPCD_WORKLOAD=H                 # TPC version (R for TPCR, H for
TPCH)
TPCD_AUDIT_DIR=Z:\tpch          # top level directory of tar file for
                        # all the tpcd scripts
TPCD_PRODUCT=v5                 # v5 or pe
                        # Use pe if you really are using pe v1.2!
                        # but I won't guarantee that it will work!
TPCD_MODE=mpp                   # uni/smp/mln/mpp
TPCD_PHYS_NODE=32               # number of physical nodes
TPCD_LN_PER_PN=1                # number of logical nodes per physical
node
TPCD_SF=3000                    # size of the database (1=1GB,...) to
                        # get test size databases use:
                        #     0.012 = 12MB
                        #     0.1   = 100MB
TPCD_BUILD_STAGE=ALL            # where to start the build -
currently the
                        # following is possible:
                        #  ALL - do everything (create,load,
                        #       index,stats,config) (Default)
                        #  CRTTBSP - start after create db and
                        #     config setting.  Start righ at
                        #     create tbsp
                        #  LOAD - start from the load of the tables
                        #  INDEX - start from the index creation
                        #      (NOTE if earlyindex is specified,
                        #       then this will do the create index
                        #       followed by the load...)
                        #  RUNSTATS - start from the runstats
                        #      (NOTE Do not use this option if
                        #       distribution stats are gathered
                        #       as part of the load, this will
                        #       start after the load and indices
                        #       have been created.
                        #  CONFIG - start from the setting up of
                        #       the benchmark runs config setup
                        #
TPCD_DBPATH=C:                  # Path for database (defaults to home)
TPCD_DDLPATH=Z:\tpch\cpq_ddl    # Path for all ddl files and
customized
                        # scripts (load script), config files,etc
TPCD_BUFFERPOOL_DEF=cpq_buffer_pools   # Name of file with
bufferpool definitions
                        # and  sizes
TPCD_NODEGROUP_DEF=NULL         # Name of file in ddlpath with
nodegroup
                        # definitions
TPCD_EXPLAIN_DDL=EXPLAIN.DDL    # File with DDL for
explains statments
                        # if this is NULL then uses the default
                        # and puts it in USERSPACE1 across all
                        # nodes...nt 1TB found it was faster if
                        # just in a single node nodegroup
TPCD_TBSP_DDL=cpq_create_tablespaces   # ddl file for tablespaces
TPCD_DDL=cpq_create_tables      # ddl file for tables
TPCD_QUAL_TBSP_DDL=dss.ddl12MB.tbsp.nt.qual # ddl file for
tablespaces for qual
TPCD_QUAL_DDL=dss.ddl12MB.nt.qual   # ddl file for qualification
database
                        # tablespaces and tables should be identical
                        # to regular ddl except container names
TPCD_INDEXDDL=cpq_tpch_indexes  # ddl file for indexes
TPCD_EXTRAINDEX=no              # no = no extra indexes
                        # filename = If you want to create some
                        # indices before
                        # the load, and some indices after, then
                        # use this additional file to specify the
TPCD_ADD_RI=NULL                # file name that contains any RI
                        # constraints to add after index creation
                        # set to NULL (default) if unused
                        # indices to create after the load.
TPCD_AST=NULL                   # file name that contains complete AST
TPCD_RUNSTATS=cpq_runstats      # ddl file for runstats.  If you have
                        # created indices before the load (ie
                        # TPCD_EARLYINDEX=yes), have specified to
                        # gather stats on the load command (either
                        # through your own load script or by using
                        # TPCD_LOADSTATS=yes, AND you have
                        # specified a file for TPCD_EXTRAINDEX
                        # then this runstats file should include
                        # the runstats commands specifically for
                        # the extra indices.
TPCD_RUNSTATSHORT=NULL          # ddl file for short runstats that
are
                        # run in the background while the
                        # TPCD_RUNSTATS are run in the foreground
                        # of the build.  If this is used, then
                        # TPCD_RUNSTATS should have the runstats
                        # command for lineitem and
                        # TPCD_RUNSTATSHORT should have runstats
                        # commands for all other tables.
TPCD_DBGEN=Z:\tpch\appendix.v2\dbgen   # path name to data generation
code

                        # Parameters used to specify source of
                        # data for load scripts
TPCD_INPUT=flatfiles            # NULL - use dbgen generated data  OR
                        # path name -  to the pre-generated
                        #          flat files
                        # /gwl/dss/12MB  - path for pregen'd 12MB
                        # /gwl/dss/100MB - path for pregen'd 100MB
                        #
TPCD_QUAL_INPUT=NULL            # NULL - use dbgen generated
data  OR
                        # path name -  to the pre-generated
                        #          flat files

TPCD_TAILOR_DIR=C:\tailor       # path name for the directory used
to
                        # generate split specific config files
                        # only used for partitioned environment

TPCD_EARLYINDEX=no              # create indexes before the load

                        # LOAD specific parameters follow:
TPCD_LOAD_DB2SET_SCRIPT=cpq_db2set_build.bat  # Script that
contains the db2set commands
                        # for the load process Use NULL if not
                        # specified
TPCD_LOAD_CONFIGFILE=cpq.dbcfg.load    # config file with specific
database config
                        # parms for the load/index/runstats part
                        # of the build.
                        # set to NULL if use defaults
TPCD_LOAD_DBM_CONFIGFILE=cpq.dbmcfg.load # config file with
specific
                        # database manager config parts for the
                        # load/index/runstats part of the build.
                        # set to NULL if use defaults
TPCD_LOAD_QUALCONFIGFILE=loadcfg.sql   # config file with specific
database config
                        # parms for the load/index/runstats part
                        # of the build for qualification db.
                        # set to NULL if use defaults
TPCD_LOAD_DBM_QUALCONFIGFILE=loaddbmcfg.sql   # config file
with specific
```

```
                        # database manager config parts for the
                        # load/index/runstats part of the build.
                        # set to NULL if use defaults

TPCD_LOADSTATS=no                   # gather statistics during load
                        # ignored if EARLYINDEX is not set
                        # due to runstats limitation
TPCD_TEMP=C:\temp                   # path for LOAD temp files
                        # defaults to /u/<instance>/sqllib/tmp
                        # used in load script only
TPCD_SORTBUF=4096                   # sortbuf size for LOAD
                        # used in load script only
TPCD_LOAD_PARALLELISM=0             # degree of parallelism to use
on load
                        # 0 = use the "intelligent default" that
                        # the load will chose at run time
                        # used in load script only
TPCD_COPY_DIR=NULL                  # directory where copy image is
created
                        # on load command CURRENTLY UNUSED
                        # used in load script only
TPCD_FASTPARSE=yes                  # use fastparse on load
                        # used in load script only

                # Backup and logfile specific parameters follow:
TPCD_BACKUP_DIR=z:\db2_tpch\backupdir  # directory where backup
files are placed
TPCD_LOGPRIMARY=NULL                # NULL/value = how many
primary log files
                        # to configure.  If NULL is specified then
                        # the default is not changed.
TPCD_LOGFILSIZ=1000                 # NULL/value = how 4KB pages to
use for
                        # logfilsiz db cfg parameter.  If NULL is
                        # specified then the default is not changed
TPCD_LOGSECOND=NULL                 # NULL/value = how many
secondary log files
                        # to configure.  If NULL is specified then
                        # the default is not changed.
TPCD_LOG_DIR=NULL                   # directory where log files stored..
                        # NULL leaves them in the dbpath
TPCD_LOG_QUAL_DIR=NULL              # directory where qual log files
stored
                        # NULL leaves them in the dbpath
TPCD_LOG=no                         # yes/no - whether to turn LOG_RETAIN
on
                        # i.e. are backups needed to be taken



                        # CONFIG specific parameters
TPCD_DB2SET_SCRIPT=cpq_db2set_run.bat  # Script that contains the
db2set commands
                        # for the benchmark run.  Use NULL if not
                        # specified
TPCD_CONFIGFILE=cpq.dbcfg.run       # name of configuration file in
ddl path
                        # that will be used for the benchmark run
TPCD_DBM_CONFIG=cpq.dbmcfg.run      # name of config file for
database manager
                        # cfg parms
TPCD_QUALCONFIGFILE=NULL            # name of database cfg file in
ddl path
                        # for qualification database
TPCD_DBM_QUALCONFIG=NULL            # name of config file for
database
                        # manager cfg parms

TPCD_MACHINE=small                  # set to NULL if using load config
file
                        # big/medium/small  size of machine used to
                        # determine buffpage, sortheap,sheapthres
                        # and ioservers parms for load, create
                        # index and runstats
                        # NOTE that this parameter is ignored if
                        # a TPCD_LOAD_CONFIGFILE

TPCD_SMPDEGREE=1                    # 1...# of degrees of parallelism to
run
                        # with
TPCD_AGENTPRI=NULL                  # set agentpri to this value (default
                        # is SYSTEM)

TPCD_ACTIVATE=yes                   # activate the database upon build
                        # completion



                        # run specific parameters
TPCD_AUDIT=yes                      # no/yes
                        # no - don't set up qualification db stuff
                        # yes - set up qualification db queries
                        #     - build the update function tables
                        #       and data before we get into the
                        #       timing of the creation of the
                        #       tables and the load.
TPCD_TMP_DIR=C:\temp                # place to put temp working files


TPCD_SHARED_TEMP_FULL_PATHNAME=NULL    # just added
TPCD_QUERY_TEMPLATE_DIR=standard.V2    # subdirectory in
AUDIT_DIR/queries
                        # to use as the source of the query
                        # templates.  Currently there are
                        # v2 ones and pe ones.  You can make
                        # your own directory following the same
                        # form as in the v2 directory using
                        # any variant you wish
TPCD_QUAL_DBNAME=TPCD               # name of qualification
database
TPCD_NUMSTREAM=8                    # number of streams for the
throughput test
TPCD_FLATFILES=c:\uf_flatfiles      # where to generate flat files
# TPCD_FLATFILES=t:\uf_flatfiles.2      # where to generate flat files
                        # for update functions
TPCD_STAGING_TABLE_DDL=createUFtbls    # script that contains the
ddl for creating
                        # the staging tables if they are used for
                        # the update functions
TPCD_PRELOAD_STAGING_TABLE_SCRIPT=loadSampleUFData # file
that contains the sql for preloading
                        # and gathering stats on sample UF data
                        # Note that the data used is sample data
                        # and is not data from any of the applied
                        # update pairs
TPCD_DELETE_STAGING_TABLE_SQL=delSampleUFData.sql # file
that contains the sql for deleting
                        # the preloaded data from the staging
                        # tables
TPCD_UPDATE_IMPORT=false            # true = use import for the
staging tables
                        #   for UNI/SMP mode only (code change in
                        #   tpcdbatch) (if not uni mode then must
                        #   change load_update)
                        # false = use load for staging tables
                        # The default is false if not set.
                        # NOTE that this parm is only for UNI/SMP
                        # it is not for multi node invocation

TPCD_SPLIT_UPDATES=256              # number of chunks to split the
update
                        # function into.
```

```
TPCD_CONCURRENT_INSERTS=32          # number of insert chunks that are run
                    # concurrently.  TPCD_SPLIT_UPDATES
                    # should be evenly divisible by this number
TPCD_CONCURRENT_INSERTS_LOAD=32     # number of insert chunks that are loaded
                    # concurrently.  TPCD_SPLIT_UPDATES should
                    # be evenly divisible by this number.
                    # this controls the load portion of the
                    # insert routine for partitioned databases
TPCD_SPLIT_DELETES=256              # number of portions to split the delete
                    # function into.
                    # this variable is only valid in UNI/SMP
                    # mode.
TPCD_CONCURRENT_DELETES=32          # number of delete chunks that are run
                    # concurrently.  This number should be
                    # evenly divisible by TPCD_SPLIT_DELETES
TPCD_GEN_UPDATEPAIRS=30             # number of pairs of update function data
                    # to generate
                    # if 0 the update data generation and
                    # setup will not be done.  use this if
                    # you don't want to run the update
                    # functions   (Update functions not
                    # fully tested in new env't yet)
TPCD_GENERATE_SEED_FILE=yes         # yes/no  These are the seed files for
                    # generating the query substitution values
                    # yes - generate a seed file base on
                    #      year/month/day (for audited runs)
                    # no  - use qgen's default seeds
TPCD_RUN_ON_MULTIPLE_NODES=NULL     # pe V1.2 only - will we be running each
                    # query stream of throughput starting at
                    # different nodes or from same node
TPCD_STATS_INTERVAL=3               # timing interval for vmstats/iostats
TPCD_STATS_THRU_INT=60              # timing interval for vmstats/iostats for
                    # throughput run
TPCD_GATHER_STATS=off               # on/off   - only implement for AIX yet
                    # on = gather statistics around power
                    #      test run  (vmstat,iostat,netstat)
                    # off = no stats gathered during power run

TPCD_UFTEMP=UFTEMP                  # base name of tablespace(s) where the
                    # staging tables for the update functions
                    # are created
                    # this name will be used as the
                    # basename for the tablespaces...eg
                    # UFTEMP1 UFTEMP2 ....
TPCD_HAVECOMPILER=yes               # rebuild tpcdbatch executable
                    # yes/no
TPCD_SLEEP=5                        # ?
TPCD_INLISTMAX=default              # max num of keys to delete at a time
                    # for UF2, use "default" for default.
TPCD_LOAD_SCRIPT=LOAD.bat           # script to run for loading tables
                    # in TPCD_DDLPATH directory under mln/mpp
                    # leave as NULL if using default genloaduni
TPCD_LOAD_SCRIPT_QUAL=NULL          # script to run for loading tables in
                    # TPCD_DDLPATH directory under mln/mpp
                    # for QUAL db
TPCD_ROOTPRIV=no                    # do you have root privileges to be able
                    # get values of things like schedtune
                    # and vmtune (currently on AIX only)
                    #  acid test specific information
TPCD_DB2LOG=z:\BIGBLUE\BLUE         # directory where the db2diag.log can
                    # be found for the durability tests
TPCD_APPEND_ON=no                   # set to no if the cluster indexes are used
```

B.3 cpq.dbmcfg.load

```
update database manager configuration using
svcename DB2cBLUE
cpuspeed  6.297923e-007
comm_bandwidth 3.5
sheapthres 320000
agent_stack_sz 16
aslheapsz 15
rqrioblk 32767
intra_parallel yes
max_querydegree -1
maxagents 1500
fcm_num_rqb 7700
num_poolagents 64
num_initagents 4
diaglevel 3;

get database manager configuration;

--connect reset;
```

B.4 cpq.dbcfg.load

```
update database configuration for tpcd using
NUM_FREQVALUES 0

NUM_QUANTILES 600
buffpage  20000
catalogcache_sz 386
chngpgs_thresh 40
dbheap 6654
locklist 16384
logbufsz 512
logfilsiz 4094
logprimary 100
logsecond 25
newlogpath '\\.\i:'
maxappls 40
maxlocks 75
mincommit 1
num_iocleaners 16
num_ioservers 16
pckcachesz 320
softmax 100
sortheap 32000
stat_heap_sz 4384
stmtheap 4096
util_heap_sz  80000
applheapsz 768
app_ctl_heap_sz 1024
dft_degree 10;

get database configuration for tpcd;

--connect reset;
```

B.5 cpq_db2set_build.bat

```
db2set DB2_STRIPED_CONTAINERS=ON
db2set DB2_PARALLEL_IO=*
db2set DB2BPVARS=z:\tpch\cpq_ddl\cpq_scattered-read
db2set DB2_LIKE_VARCHAR=y,y
db2set DB2_HASH_JOIN=Y
db2set DB2_RR_TO_RS=ON
db2set DB2_ANTIJOIN=Y
db2set DB2OPTIONS="-t -v +c"
db2set DB2NTNOCACHE=ON
db2set DB2MEMMAXFREE=137438953472,20
```

B.6 cpq_create_tablespaces

```
create regular tablespace LINEITEM_TABLE
  pagesize 16K
  managed by database
  using (device '\\.\d:'    1450000,
        device '\\.\j:'    1450000,
        device '\\.\o:'    1450000,
        device '\\.\u:'    1450000)
  bufferpool   BP16K
  extentsize    32
  prefetchsize  1536
  overhead       7
  transferrate  0.5;

create regular tablespace LINEITEM_INDEXES
  pagesize 16K
  managed by database
  using (device '\\.\e:'    300000,
        device '\\.\k:'    300000,
        device '\\.\p:'    300000,
        device '\\.\v:'    300000)
  bufferpool   BP16K
  extentsize    32
  prefetchsize  1536
  overhead       7
  transferrate  0.5;

create temporary tablespace TEMP_TABLE1
  pagesize 16K
  managed by database
  using (device '\\.\f:'    3650000,
        device '\\.\l:'    3650000,
        device '\\.\q:'    3650000,
        device '\\.\w:'    3650000)
  bufferpool   BP16K
  extentsize    32
  prefetchsize  1536
  overhead       7
  transferrate  0.5;


create regular tablespace OTHER_STUFF
  pagesize 16K
  managed by database
  using (device '\\.\g:'   1215000,
        device '\\.\m:'   1215000,
        device '\\.\r:'   1215000,
        device '\\.\x:'   1215000)
  bufferpool   BP16K
  extentsize    32
  prefetchsize  1536
  overhead       7
  transferrate  0.5;

create regular tablespace OTHER_INDEXES
  pagesize 16K
  managed by database
  using (device '\\.\h:'   300000,
        device '\\.\n:'   300000,
        device '\\.\s:'   300000,
        device '\\.\y:'   300000)
  bufferpool   BP16K
  extentsize    32
  prefetchsize  1536
  overhead       7
  transferrate  0.5;

create nodegroup SMALLTABLE on node(0);
create regular tablespace SMALLTABLE in nodegroup SMALLTABLE
  managed by system
  USING ( 'z:\small_tables') on node (0);

--drop tablespace USERSPACE1;

--drop tablespace TEMPSPACE1;

commit work;
```

B.7 cpq_create_tables

```
CREATE TABLE TPCD.NATION  ( N_NATIONKEY  INTEGER NOT
NULL,
                    N_NAME       CHAR(25) NOT NULL,
                    N_REGIONKEY  INTEGER NOT NULL,
                    N_COMMENT    VARCHAR(152))
      IN SMALLTABLE;

CREATE TABLE TPCD.REGION  ( R_REGIONKEY  INTEGER NOT
NULL,
                    R_NAME       CHAR(25) NOT NULL,
                    R_COMMENT    VARCHAR(152))
      IN SMALLTABLE;

CREATE TABLE TPCD.PART  ( P_PARTKEY     INTEGER 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        INTEGER NOT NULL,
                  P_CONTAINER   CHAR(10) NOT NULL,
                  P_RETAILPRICE FLOAT NOT NULL,
                  P_COMMENT     VARCHAR(23) NOT NULL )
      IN OTHER_STUFF
      INDEX IN OTHER_INDEXES;

CREATE TABLE TPCD.SUPPLIER ( S_SUPPKEY     INTEGER NOT
NULL,
                    S_NAME       CHAR(25) NOT NULL,
                    S_ADDRESS    VARCHAR(40) NOT NULL,
                    S_NATIONKEY  INTEGER NOT NULL,
                    S_PHONE      CHAR(15) NOT NULL,
                    S_ACCTBAL    FLOAT NOT NULL,
                    S_COMMENT    VARCHAR(101) NOT NULL)
       IN OTHER_STUFF
      INDEX IN OTHER_INDEXES;

CREATE TABLE TPCD.PARTSUPP ( PS_PARTKEY     INTEGER NOT
NULL,
                    PS_SUPPKEY     INTEGER NOT NULL,
                    PS_AVAILQTY    INTEGER NOT NULL,
                    PS_SUPPLYCOST  FLOAT   NOT NULL,
                    PS_COMMENT     VARCHAR(199) NOT NULL )
      IN OTHER_STUFF
```

```
    INDEX IN OTHER_INDEXES;

CREATE TABLE TPCD.CUSTOMER ( C_CUSTKEY     INTEGER NOT
NULL,
                C_NAME       CHAR(25) NOT NULL,
                C_ADDRESS    VARCHAR(40) NOT NULL,
                C_NATIONKEY  INTEGER 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)
    IN OTHER_STUFF
    INDEX IN OTHER_INDEXES;

CREATE TABLE TPCD.ORDERS ( O_ORDERKEY       BIGINT NOT
NULL,
              O_CUSTKEY       INTEGER NOT NULL,
              O_ORDERSTATUS   CHAR(1) NOT NULL,
              O_TOTALPRICE    FLOAT NOT NULL,
              O_ORDERDATE     DATE NOT NULL,
              O_ORDERPRIORITY  CHAR(15) NOT NULL,
              O_CLERK         CHAR(15) NOT NULL,
              O_SHIPPRIORITY  INTEGER NOT NULL,
              O_COMMENT       VARCHAR(79) NOT NULL)
    IN OTHER_STUFF
    INDEX IN OTHER_INDEXES;

CREATE TABLE TPCD.LINEITEM ( L_ORDERKEY    BIGINT NOT
NULL,
                L_PARTKEY    INTEGER NOT NULL,
                L_SUPPKEY    INTEGER NOT NULL,
                L_LINENUMBER  INTEGER 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   DATE NOT NULL,
                L_COMMITDATE  DATE NOT NULL,
                L_RECEIPTDATE DATE NOT NULL,
                L_SHIPINSTRUCT CHAR(25) NOT NULL,
                L_SHIPMODE    CHAR(10) NOT NULL,
                L_COMMENT     VARCHAR(44) NOT NULL)
    IN LINEITEM_TABLE
    INDEX IN LINEITEM_INDEXES;

COMMIT WORK;
```

B.8 Load

```
CONNECT TO TPCD;

LOAD FROM t:\flatfiles\supplier.tbl.1.pmap,
       t:\flatfiles\supplier.tbl.2.pmap,
       t:\flatfiles\supplier.tbl.3.pmap,
       t:\flatfiles\supplier.tbl.4.pmap,
       t:\flatfiles\supplier.tbl.5.pmap,
       t:\flatfiles\supplier.tbl.6.pmap,
       t:\flatfiles\supplier.tbl.7.pmap,
       t:\flatfiles\supplier.tbl.8.pmap,
       t:\flatfiles\supplier.tbl.9.pmap,
       t:\flatfiles\supplier.tbl.10.pmap OF DEL
  MODIFIED BY COLDEL| FASTPARSE
  SAVECOUNT 100000
  MESSAGES t:\temp\msgs\supplier.msg
  REPLACE INTO TPCD.SUPPLIER
  STATISTICS NO
  NONRECOVERABLE
  CPU_PARALLELISM 16;

LOAD FROM t:\flatfiles\part.tbl.1.pmap,
       t:\flatfiles\part.tbl.2.pmap,
       t:\flatfiles\part.tbl.3.pmap,
       t:\flatfiles\part.tbl.4.pmap,
       t:\flatfiles\part.tbl.5.pmap,
       t:\flatfiles\part.tbl.6.pmap,
       t:\flatfiles\part.tbl.7.pmap,
       t:\flatfiles\part.tbl.8.pmap,
       t:\flatfiles\part.tbl.9.pmap,
       t:\flatfiles\part.tbl.10.pmap OF DEL
  MODIFIED BY COLDEL| FASTPARSE
  SAVECOUNT 100000
  MESSAGES t:\temp\msgs\part.msg
  REPLACE INTO TPCD.PART
  STATISTICS NO
  NONRECOVERABLE
  CPU_PARALLELISM 16;

LOAD FROM t:\flatfiles\customer.tbl.1.pmap,
       t:\flatfiles\customer.tbl.2.pmap,
       t:\flatfiles\customer.tbl.3.pmap,
       t:\flatfiles\customer.tbl.4.pmap,
       t:\flatfiles\customer.tbl.5.pmap,
       t:\flatfiles\customer.tbl.6.pmap,
       t:\flatfiles\customer.tbl.7.pmap,
       t:\flatfiles\customer.tbl.8.pmap,
       t:\flatfiles\customer.tbl.9.pmap,
       t:\flatfiles\customer.tbl.10.pmap OF DEL
  MODIFIED BY COLDEL| FASTPARSE
  SAVECOUNT 100000
  MESSAGES t:\temp\msgs\customer.msg
  REPLACE INTO TPCD.CUSTOMER
  STATISTICS NO
  NONRECOVERABLE
  CPU_PARALLELISM 16;

LOAD FROM t:\flatfiles\partsupp.tbl.1.pmap,
       t:\flatfiles\partsupp.tbl.2.pmap,
       t:\flatfiles\partsupp.tbl.3.pmap,
       t:\flatfiles\partsupp.tbl.4.pmap,
       t:\flatfiles\partsupp.tbl.5.pmap,
       t:\flatfiles\partsupp.tbl.6.pmap,
       t:\flatfiles\partsupp.tbl.7.pmap,
       t:\flatfiles\partsupp.tbl.8.pmap,
       t:\flatfiles\partsupp.tbl.9.pmap,
       t:\flatfiles\partsupp.tbl.10.pmap,
       t:\flatfiles\partsupp.tbl.11.pmap,
       t:\flatfiles\partsupp.tbl.12.pmap,
       t:\flatfiles\partsupp.tbl.13.pmap,
       t:\flatfiles\partsupp.tbl.14.pmap,
       t:\flatfiles\partsupp.tbl.15.pmap,
       t:\flatfiles\partsupp.tbl.16.pmap,
       t:\flatfiles\partsupp.tbl.17.pmap,
       t:\flatfiles\partsupp.tbl.18.pmap,
       t:\flatfiles\partsupp.tbl.19.pmap,
       t:\flatfiles\partsupp.tbl.20.pmap OF DEL
  MODIFIED BY COLDEL| FASTPARSE
  SAVECOUNT 100000
  MESSAGES t:\temp\msgs\partsupp.msg
  REPLACE INTO TPCD.PARTSUPP
  STATISTICS NO
  NONRECOVERABLE
  CPU_PARALLELISM 16;


LOAD FROM t:\flatfiles\orders.tbl.1.pmap,
       t:\flatfiles\orders.tbl.2.pmap,
```

```
        t:\flatfiles\orders.tbl.3.pmap,
        t:\flatfiles\orders.tbl.4.pmap,
        t:\flatfiles\orders.tbl.5.pmap,
        t:\flatfiles\orders.tbl.6.pmap,
        t:\flatfiles\orders.tbl.7.pmap,
        t:\flatfiles\orders.tbl.8.pmap,
        t:\flatfiles\orders.tbl.9.pmap,
        t:\flatfiles\orders.tbl.10.pmap,
        t:\flatfiles\orders.tbl.11.pmap,
        t:\flatfiles\orders.tbl.12.pmap,
        t:\flatfiles\orders.tbl.13.pmap,
        t:\flatfiles\orders.tbl.14.pmap,
        t:\flatfiles\orders.tbl.15.pmap,
        t:\flatfiles\orders.tbl.16.pmap,
        t:\flatfiles\orders.tbl.17.pmap,
        t:\flatfiles\orders.tbl.18.pmap,
        t:\flatfiles\orders.tbl.19.pmap,
        t:\flatfiles\orders.tbl.20.pmap OF DEL
  MODIFIED BY COLDEL| FASTPARSE
  SAVECOUNT 100000
  MESSAGES t:\temp\msgs\orders.msg
  REPLACE INTO TPCD.ORDERS
  STATISTICS NO
  NONRECOVERABLE
  CPU_PARALLELISM 16;

LOAD FROM t:\flatfiles\lineitem.tbl.1.pmap,
        t:\flatfiles\lineitem.tbl.2.pmap,
        t:\flatfiles\lineitem.tbl.3.pmap,
        t:\flatfiles\lineitem.tbl.4.pmap,
        t:\flatfiles\lineitem.tbl.5.pmap,
        t:\flatfiles\lineitem.tbl.6.pmap,
        t:\flatfiles\lineitem.tbl.7.pmap,
        t:\flatfiles\lineitem.tbl.8.pmap,
        t:\flatfiles\lineitem.tbl.9.pmap,
        t:\flatfiles\lineitem.tbl.10.pmap,
        t:\flatfiles\lineitem.tbl.11.pmap,
        t:\flatfiles\lineitem.tbl.12.pmap,
        t:\flatfiles\lineitem.tbl.13.pmap,
        t:\flatfiles\lineitem.tbl.14.pmap,
        t:\flatfiles\lineitem.tbl.15.pmap,
        t:\flatfiles\lineitem.tbl.16.pmap,
        t:\flatfiles\lineitem.tbl.17.pmap,
        t:\flatfiles\lineitem.tbl.18.pmap,
        t:\flatfiles\lineitem.tbl.19.pmap,
        t:\flatfiles\lineitem.tbl.20.pmap,
        t:\flatfiles\lineitem.tbl.21.pmap,
        t:\flatfiles\lineitem.tbl.22.pmap,
        t:\flatfiles\lineitem.tbl.23.pmap,
        t:\flatfiles\lineitem.tbl.24.pmap,
        t:\flatfiles\lineitem.tbl.25.pmap,
        t:\flatfiles\lineitem.tbl.26.pmap,
        t:\flatfiles\lineitem.tbl.27.pmap,
        t:\flatfiles\lineitem.tbl.28.pmap,
        t:\flatfiles\lineitem.tbl.29.pmap,
        t:\flatfiles\lineitem.tbl.30.pmap,
        t:\flatfiles\lineitem.tbl.31.pmap,
        t:\flatfiles\lineitem.tbl.32.pmap,
        t:\flatfiles\lineitem.tbl.33.pmap,
        t:\flatfiles\lineitem.tbl.34.pmap,
        t:\flatfiles\lineitem.tbl.35.pmap,
        t:\flatfiles\lineitem.tbl.36.pmap,
        t:\flatfiles\lineitem.tbl.37.pmap,
        t:\flatfiles\lineitem.tbl.38.pmap,
        t:\flatfiles\lineitem.tbl.39.pmap,
        t:\flatfiles\lineitem.tbl.40.pmap,
        t:\flatfiles\lineitem.tbl.41.pmap,
        t:\flatfiles\lineitem.tbl.42.pmap,
        t:\flatfiles\lineitem.tbl.43.pmap,
        t:\flatfiles\lineitem.tbl.44.pmap,
        t:\flatfiles\lineitem.tbl.45.pmap,
        t:\flatfiles\lineitem.tbl.46.pmap,
        t:\flatfiles\lineitem.tbl.47.pmap,
        t:\flatfiles\lineitem.tbl.48.pmap,
        t:\flatfiles\lineitem.tbl.49.pmap,
        t:\flatfiles\lineitem.tbl.50.pmap,
        t:\flatfiles\lineitem.tbl.51.pmap,
        t:\flatfiles\lineitem.tbl.52.pmap,
        t:\flatfiles\lineitem.tbl.53.pmap,
        t:\flatfiles\lineitem.tbl.54.pmap,
        t:\flatfiles\lineitem.tbl.55.pmap,
        t:\flatfiles\lineitem.tbl.56.pmap,
        t:\flatfiles\lineitem.tbl.57.pmap,
        t:\flatfiles\lineitem.tbl.58.pmap,
        t:\flatfiles\lineitem.tbl.59.pmap,
        t:\flatfiles\lineitem.tbl.60.pmap,
        t:\flatfiles\lineitem.tbl.61.pmap,
        t:\flatfiles\lineitem.tbl.62.pmap,
        t:\flatfiles\lineitem.tbl.63.pmap,
        t:\flatfiles\lineitem.tbl.64.pmap,
        t:\flatfiles\lineitem.tbl.65.pmap,
        t:\flatfiles\lineitem.tbl.66.pmap,
        t:\flatfiles\lineitem.tbl.67.pmap,
        t:\flatfiles\lineitem.tbl.68.pmap,
        t:\flatfiles\lineitem.tbl.69.pmap,
        t:\flatfiles\lineitem.tbl.70.pmap,
        t:\flatfiles\lineitem.tbl.71.pmap,
        t:\flatfiles\lineitem.tbl.72.pmap,
        t:\flatfiles\lineitem.tbl.73.pmap,
        t:\flatfiles\lineitem.tbl.74.pmap,
        t:\flatfiles\lineitem.tbl.75.pmap,
        t:\flatfiles\lineitem.tbl.76.pmap,
        t:\flatfiles\lineitem.tbl.77.pmap,
        t:\flatfiles\lineitem.tbl.78.pmap,
        t:\flatfiles\lineitem.tbl.79.pmap,
        t:\flatfiles\lineitem.tbl.80.pmap OF DEL
  MODIFIED BY COLDEL| FASTPARSE
  SAVECOUNT 100000
  MESSAGES t:\temp\msgs\lineitem.msg
  REPLACE INTO TPCD.LINEITEM
  STATISTICS NO
  NONRECOVERABLE
  CPU_PARALLELISM 16;

COMMIT WORK;
CONNECT RESET;
TERMINATE;
```

B.9 cpq_tpch_indexes

```
values(current timestamp);
CREATE      INDEX "TPCD  "."R_RK" ON "TPCD    "."REGION"
            ("R_REGIONKEY" ASC)
            PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE      INDEX "TPCD  "."N_NK" ON "TPCD    "."NATION"
            ("N_NATIONKEY" ASC)
            PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE      INDEX "TPCD  "."N_RK" ON "TPCD    "."NATION"
            ("N_REGIONKEY" ASC)
            PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE UNIQUE INDEX "TPCD  "."S_SK" ON "TPCD    "."SUPPLIER"
```

```
        ("S_SUPPKEY" ASC)
        PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE      INDEX "TPCD  "."S_NK" ON "TPCD    "."SUPPLIER"
        ("S_NATIONKEY" ASC)
        PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE      INDEX "TPCD  "."PS_PK" ON "TPCD    "."PARTSUPP"
        ("PS_PARTKEY" ASC)
        PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE UNIQUE INDEX "TPCD  "."PS_PKSK" ON "TPCD
"."PARTSUPP"
        ("PS_PARTKEY" ASC,
         "PS_SUPPKEY" ASC)
        PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE UNIQUE INDEX "TPCD  "."C_CK" ON "TPCD
"."CUSTOMER"
        ("C_CUSTKEY" ASC)
        PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE UNIQUE INDEX "TPCD  "."O_OK" ON "TPCD    "."ORDERS"
        ("O_ORDERKEY" ASC)
        PCTFREE 5 ;
commit work;

values(current timestamp);
CREATE      INDEX "TPCD  "."O_CK" ON "TPCD    "."ORDERS"
        ("O_CUSTKEY" ASC)
        PCTFREE 5 ;
commit work;

values(current timestamp);
CREATE      INDEX "TPCD  "."O_OD" ON "TPCD    "."ORDERS"
        ("O_ORDERDATE" ASC)
        CLUSTER
        PCTFREE 5 ;
commit work;

values(current timestamp);
CREATE      INDEX "TPCD  "."L_OK" ON "TPCD    "."LINEITEM"
        ("L_ORDERKEY" ASC)
        PCTFREE 5 ;
commit work;

values(current timestamp);
CREATE      INDEX "TPCD  "."L_SD" ON "TPCD    "."LINEITEM"
        ("L_SHIPDATE" ASC)
        CLUSTER
        PCTFREE 5 ;
commit work;
values(current timestamp);
```

B.10 cpq_runstats

```
values(current timestamp);
RUNSTATS ON TABLE TPCD.NATION    WITH DISTRIBUTION AND
DETAILED INDEXES ALL;
commit;
values(current timestamp);
RUNSTATS ON TABLE TPCD.REGION    WITH DISTRIBUTION AND
DETAILED INDEXES ALL;
commit;
values(current timestamp);
RUNSTATS ON TABLE TPCD.SUPPLIER  WITH DISTRIBUTION AND
DETAILED INDEXES ALL;
commit;
values(current timestamp);
RUNSTATS ON TABLE TPCD.PART      WITH DISTRIBUTION AND
DETAILED INDEXES ALL;
commit;
values(current timestamp);
RUNSTATS ON TABLE TPCD.PARTSUPP  WITH DISTRIBUTION
AND DETAILED INDEXES ALL;
commit;
values(current timestamp);
RUNSTATS ON TABLE TPCD.CUSTOMER  WITH DISTRIBUTION
AND DETAILED INDEXES ALL;
commit;
values(current timestamp);
RUNSTATS ON TABLE TPCD.ORDERS    WITH DISTRIBUTION AND
DETAILED INDEXES ALL;
commit;
values(current timestamp);
RUNSTATS ON TABLE TPCD.LINEITEM  WITH DISTRIBUTION AND
DETAILED INDEXES ALL;
COMMIT WORK;
values(current timestamp);
```

B.11 cpq.dbmcfg.run

```
update database manager configuration using
numdb 1
svcename DB2cBLUE
cpuspeed -1
comm_bandwidth 3.5
sheapthres  430000
agent_stack_sz 16
aslheapsz 15
rqrioblk 32767
intra_parallel yes
max_querydegree -1
maxagents 1500
num_poolagents 64
num_initagents 4
fcm_num_rqb 10000
fcm_num_buffers 10000
diagpath z:\bigblue\blue
diaglevel 3;

get database manager configuration;
```

B.12 cpq.dbcfg.run

```
update database configuration for tpcd using
NUM_QUANTILES 600
buffpage 80000
catalogcache_sz 386
dbheap 20000
locklist 16384
logbufsz 512
logfilsiz 8192
logprimary 100
logsecond 25
newlogpath \\.\i:
maxappls  40
avg_appls 1
maxfilop  1024
```

```
maxlocks  15
mincommit 1
num_iocleaners 16
num_ioservers  16
DLCHKTIME 5000
pckcachesz 640
softmax  800
sortheap 20000
stat_heap_sz 10000
stmtheap 10000
util_heap_sz 5000
applheapsz 16000
app_ctl_heap_sz 2048
dft_degree   4
dft_queryopt  7
chngpgs_thresh 80;

get database configuration for tpcd;

--connect reset;
```

B.13 cpq_db2set_run.bat

```
db2set DB2_STRIPED_CONTAINERS=ON
db2set DB2_PARALLEL_IO=*
db2set DB2BPVARS=z:\tpch\cpq_ddl\cpq_scattered-read
db2set DB2_LIKE_VARCHAR=y,y
db2set DB2_HASH_JOIN=Y
db2set DB2_RR_TO_RS=ON
db2set DB2_ANTIJOIN=Y
db2set DB2OPTIONS="-t -v +c"
db2set DB2NTNOCACHE=ON
db2set DB2_BINSORT=N
db2set DB2MEMMAXFREE=137438953472,20
```

B.14 cpq_buffer_pools

```
--connect to tpcd;
alter bufferpool ibmdefaultbp size 1000;
create bufferpool BP16K size -1 pagesize 16k;
-- create bufferpool BP32K size 40000 pagesize 32k;
commit;
--connect reset;
```

B.15 createuftbls

```
connect to tpcd;

drop table TPCDTEMP.ORDERS_NEW;
drop table TPCDTEMP.ORDERS_DEL;
drop table TPCDTEMP.LINEITEM_NEW;

commit;

CREATE TABLE TPCDTEMP.ORDERS_NEW ( APP_ID INTEGER NOT
NULL,
                O_ORDERKEY       BIGINT NOT NULL,
                O_CUSTKEY        INTEGER NOT NULL,
                O_ORDERSTATUS    CHAR(1) NOT NULL,
                O_TOTALPRICE     FLOAT NOT NULL,
                O_ORDERDATE      DATE NOT NULL,
                O_ORDERPRIORITY  CHAR(15) NOT NULL,
                O_CLERK          CHAR(15) NOT NULL,
                O_SHIPPRIORITY   INTEGER NOT NULL,
                O_COMMENT        VARCHAR(79) NOT NULL WITH
DEFAULT)
      IN OTHER_STUFF
      PARTITIONING KEY(O_ORDERKEY) USING HASHING;

create unique index tpcdtemp.i_orders_new
  on tpcdtemp.orders_new
  (o_orderkey) include (app_id);

CREATE TABLE TPCDTEMP.ORDERS_DEL ( APP_ID INTEGER NOT
NULL,
                O_ORDERKEY       BIGINT NOT NULL)
      IN OTHER_STUFF
      PARTITIONING KEY(O_ORDERKEY) USING HASHING;

CREATE TABLE TPCDTEMP.LINEITEM_NEW ( APP_ID INTEGER
NOT NULL,
                L_ORDERKEY    BIGINT NOT NULL,
                L_PARTKEY     INTEGER NOT NULL,
                L_SUPPKEY     INTEGER NOT NULL,
                L_LINENUMBER  INTEGER 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    DATE NOT NULL,
                L_COMMITDATE  DATE NOT NULL,
                L_RECEIPTDATE DATE NOT NULL,
                L_SHIPINSTRUCT CHAR(25) NOT NULL,
                L_SHIPMODE     CHAR(10) NOT NULL,
                L_COMMENT      VARCHAR(44) NOT NULL WITH
DEFAULT)
      IN LINEITEM_TABLE
      INDEX IN LINEITEM_INDEXES
      PARTITIONING KEY(L_ORDERKEY) USING HASHING;

COMMIT WORK;

alter table tpcdtemp.orders_new locksize table;
alter table tpcdtemp.orders_del locksize table;
alter table tpcdtemp.lineitem_new locksize table;

COMMIT WORK;

connect reset;
```

B.16 Prepdrvr.bat

```
db2 connect to TPCD;
db2 prep driver.sqc BINDFILE OPTLEVEL 1 ISOLATION RS
MESSAGES prep.msg NOLINEMACRO;
db2 bind driver.bnd GRANT PUBLIC MESSAGES bnd.msg;
db2 connect reset;
db2 terminate;
```

B.17 build.c

```
/* @(#)build.c  2.1.8.1 */
/* Sccsid:     @(#)build.c      9.1.1.17     11/15/95  12:52:28 */
/* stuff related to the customer table */
#include <stdio.h>
#include <string.h>
#ifndef VMS
```

```
#include <sys/types.h>
#endif
#if defined(SUN)
#include <unistd.h>
#endif
#include <math.h>

#include "dss.h"
#include "dsstypes.h"
#include "bcd2.h"
#ifdef ADHOC
#include "adhoc.h"

extern adhoc_t adhocs[];
// extern int Numnodes;
#endif /* ADHOC */

/*************************************************************
**********************/

#define MAX_KEY_LEN   32                    // guojian@0725
// #define NumNodes      04                  // guojian@0726
#define LARGE_TABLE   1                     // DJD
#define SMALL_TABLE   0                     // DJD
/*************************************************************
**********************/

#define LEAP_ADJ(yr, mnth)     \
((LEAP(yr) && (mnth) >= 2) ? 1 : 0)
#define JDAY_BASE       8035    /* start from 1/1/70 a la unix */
#define JMNTH_BASE      (-70 * 12) /* start from 1/1/70 a la unix */
#define JDAY(date) ((date) - STARTDATE + JDAY_BASE + 1)
#define PART_SUPP_BRIDGE(tgt, p, s) \
   { \
   long tot_scnt = tdefs[SUPP].base * scale; \
   tgt = (p + s *  (tot_scnt / SUPP_PER_PART +  \
      (long) ((p - 1) / tot_scnt))) % tot_scnt + 1; \
   }
#define RPRICE_BRIDGE(tgt, p) tgt = rpb_routine(p)
#define V_STR(avg, sd, tgt)  a_rnd((int)(avg * V_STR_LOW), \
(int)(avg * V_STR_HGH), sd, tgt)
#define TEXT(avg, sd, tgt)  \
dbg_text(tgt, (int)(avg * V_STR_LOW),(int)(avg * V_STR_HGH), sd)
static void gen_phone PROTO((long ind, char *target, long seed));


/*************************************************************
**********************/

int isItme (unsigned _int64, struct sqlupi*, int);                  // guojian@0723

/*guojian@0725 stuffs for calling sqlugrpn   */
unsigned short     countrycode = 1;     // country code
unsigned short     codepage    = 1252;  // code page
unsigned short     chklvl      = 3;     // check level
short              sDataFormat = 0x0;   // data format
/* guojian@0725 end */

/*************************************************************
**********************/

long
rpb_routine(long p)
      {
      long price;

      price = 90000;
      price += (p/10) % 20001;       /* limit contribution to $200 */
      price += (p % 1000) * 100;
      return(price);
      }

static void
gen_phone(long ind, char *target, long seed)
      {
   long       acode,
              exchg,
              number;

   RANDOM(acode, 100, 999, seed);
   RANDOM(exchg, 100, 999, seed);
      RANDOM(number, 1000, 9999, seed);

      sprintf(target, "%02d", 10 + (ind % NATIONS_MAX));
   sprintf(target + 3, "%03d", acode);
   sprintf(target + 7, "%03d", exchg);
   sprintf(target + 11, "%04d", number);
   target[2] = target[6] = target[10] = '-';

   return;
      }



long
mk_cust(_int64 n_cust, customer_t *c)
      {
      long rc = 0;
      long i;

      c->custkey = n_cust;
      sprintf(c->name, C_NAME_FMT, C_NAME_TAG, n_cust);
      c->alen = V_STR(C_ADDR_LEN, C_ADDR_SD, c->address);
      RANDOM(i, 0, (nations.count - 1), C_NTRG_SD);
      c->nation_code = i;
      gen_phone(i, c->phone, (long)C_PHNE_SD);
      RANDOM(c->acctbal, C_ABAL_MIN, C_ABAL_MAX,
C_ABAL_SD);
      pick_str(&c_mseg_set, C_MSEG_SD, c->mktsegment);
      c->clen = TEXT(C_CMNT_LEN, C_CMNT_SD, c->comment);

      /* guojian@010908 if the record belongs to this node, return 0,
otherwise, return 1 */
      if (!isItMe ((unsigned _int64)c->custkey, part_info_for_customer,
SMALL_TABLE)) {
        rc = 1;
      }
      /* guojian@010908 */

      return(rc);       //Guojian.
     }


/*
 * generate the numbered order and its associated lineitems
 */
//mk_sparse (long i, DSS_HUGE *ok, long seq)
void
mk_sparse (DSS_HUGE i, DSS_HUGE *ok, long seq)
      {
#ifndef SUPPORT_64BITS
      if (scale < MAX_32B_SCALE)
#endif
            ez_sparse(i, ok, seq);
#ifndef SUPPORT_64BITS
      else
            hd_sparse(i, ok, seq);
#endif
      return;
```

```
	}

	/*
	* the "simple" version of mk_sparse, used on systems with 64b support
	* and on all systems at SF <= 300G where 32b support is sufficient
*/
//ez_sparse(long i, DSS_HUGE *ok, long seq)
void
ez_sparse(DSS_HUGE i, DSS_HUGE *ok, long seq)
	{
	long low_bits;

	LONG2HUGE(i, ok);
	//low_bits = (long)(i & ((1 << SPARSE_KEEP) - 1));
	low_bits = (DSS_HUGE)(i & ((1 << SPARSE_KEEP) - 1));
	*ok = *ok >> SPARSE_KEEP;
	*ok = *ok << SPARSE_BITS;
	*ok += seq;
	*ok = *ok << SPARSE_KEEP;
	*ok += low_bits;

	return;
	}

#ifndef SUPPORT_64BITS
void
hd_sparse(DSS_HUGE i, DSS_HUGE *ok, long seq)
	{
	long low_mask, seq_mask;
	static int init = 0;
	static DSS_HUGE *base, *res;

	if (init == 0)
		{
		INIT_HUGE(base);
		INIT_HUGE(res);
		init = 1;
		}

	low_mask = (1 << SPARSE_KEEP) - 1;
	seq_mask = (1 << SPARSE_BITS) - 1;
	bin_bcd2(i, base, base + 1);
	HUGE_SET (base, res);
	HUGE_DIV (res, 1 << SPARSE_KEEP);
	HUGE_MUL (res, 1 << SPARSE_BITS);
	HUGE_ADD (res, seq, res);
	HUGE_MUL (res, 1 << SPARSE_KEEP);
	HUGE_ADD (res, *base & low_mask, res);
	bcd2_bin (&low_mask, *res);
	bcd2_bin (&seq_mask, *(res + 1));
	*ok = low_mask;
	*(ok + 1) = seq_mask;
	return;
	}
#endif

long
mk_order(DSS_HUGE index, order_t *o, long upd_num)
	{
	long	rc = 0;	// guojian
	long	lcnt;
	long	rprice;
	long	ocnt;
	long	tmp_date;
	long	s_date;
	long	r_date;
	long	c_date;
	long	clk_num;
	long	supp_num;
	static char **asc_date = NULL;
	char tmp_str[2];
	char **mk_ascdate PROTO((void));
	int delta = 1;

	if (asc_date == NULL)
	asc_date = mk_ascdate();
	mk_sparse (index, o->okey,
		(upd_num == 0) ? 0 : 1 + upd_num / (10000 / refresh));

	RANDOM(o->custkey, O_CKEY_MIN, O_CKEY_MAX,
O_CKEY_SD);
	while (o->custkey % CUST_MORTALITY == 0)
		{
		o->custkey += delta;
		o->custkey = MIN(o->custkey, O_CKEY_MAX);
		delta *= -1;
		}


	RANDOM(tmp_date, O_ODATE_MIN, O_ODATE_MAX,
O_ODATE_SD);
	strcpy(o->odate, asc_date[tmp_date - STARTDATE]);

	pick_str(&o_priority_set, O_PRIO_SD, o->opriority);
	  RANDOM(clk_num, 1, MAX((scale * O_CLRK_SCL),
O_CLRK_SCL), O_CLRK_SD);
	sprintf(o->clerk, O_CLRK_FMT,
	  O_CLRK_TAG,
	  clk_num);
	o->clen = TEXT(O_CMNT_LEN, O_CMNT_SD, o->comment);
#ifdef DEBUG
	if (o->clen > O_CMNT_MAX) fprintf(stderr, "comment error:
O%d\n", partsupp.tblindex);
#endif /* DEBUG */
	o->spriority = 0;

	o->totalprice = 0;
	o->orderstatus = 'O';
	ocnt = 0;

	  RANDOM(o->lines, O_LCNT_MIN, O_LCNT_MAX,
O_LCNT_SD);
	for (lcnt = 0; lcnt < o->lines; lcnt++)
		{
	  HUGE_SET(o->okey, o->l[lcnt].okey);
	  o->l[lcnt].lcnt = lcnt + 1;
	  RANDOM(o->l[lcnt].quantity, L_QTY_MIN, L_QTY_MAX,
L_QTY_SD);
	  RANDOM(o->l[lcnt].discount, L_DCNT_MIN, L_DCNT_MAX,
L_DCNT_SD);
	  RANDOM(o->l[lcnt].tax, L_TAX_MIN, L_TAX_MAX,
L_TAX_SD);
	  pick_str(&l_instruct_set, L_SHIP_SD, o->l[lcnt].shipinstruct);
	  pick_str(&l_smode_set, L_SMODE_SD, o->l[lcnt].shipmode);
	  o->l[lcnt].clen = TEXT(L_CMNT_LEN, L_CMNT_SD, o-
>l[lcnt].comment);
	  RANDOM(o->l[lcnt].partkey, L_PKEY_MIN, L_PKEY_MAX,
L_PKEY_SD);
	  RPRICE_BRIDGE( rprice, o->l[lcnt].partkey);
	  RANDOM(supp_num, 0, 3, L_SKEY_SD);
	  PART_SUPP_BRIDGE( o->l[lcnt].suppkey, o->l[lcnt].partkey,
supp_num);
	  o->l[lcnt].eprice = rprice * o->l[lcnt].quantity;

	  o->totalprice +=
	    ((o->l[lcnt].eprice *
	    ((long)100 - o->l[lcnt].discount)) / (long)PENNIES ) *
	    ((long)100 + o->l[lcnt].tax)
	    / (long)PENNIES;
```

```
                RANDOM(s_date, L_SDTE_MIN, L_SDTE_MAX,
L_SDTE_SD);
        s_date += tmp_date;
                RANDOM(c_date, L_CDTE_MIN, L_CDTE_MAX,
L_CDTE_SD);
        c_date += tmp_date;
                RANDOM(r_date, L_RDTE_MIN, L_RDTE_MAX,
L_RDTE_SD);
        r_date += s_date;


        strcpy(o->l[lcnt].sdate, asc_date[s_date - STARTDATE]);
        strcpy(o->l[lcnt].cdate, asc_date[c_date - STARTDATE]);
        strcpy(o->l[lcnt].rdate, asc_date[r_date - STARTDATE]);


        if (julian(r_date) <= CURRENTDATE)
                {
           pick_str(&l_rflag_set, L_RFLG_SD, tmp_str);
           o->l[lcnt].rflag[0] = *tmp_str;
                }
        else
           o->l[lcnt].rflag[0] = 'N';

        if (julian(s_date) <= CURRENTDATE)
                {
           ocnt++;
           o->l[lcnt].lstatus[0] = 'F';
                }
        else
           o->l[lcnt].lstatus[0] = 'O';
              }

      if (ocnt > 0)
         o->orderstatus = 'P';
      if (ocnt == o->lines)
         o->orderstatus = 'F';

    /* guojian@010908 */
    if (!isItMe ((unsigned _int64)o->okey, part_info_for_orders,
LARGE_TABLE))
      rc = 1;

    return (rc);  //Guojian
}

long
mk_part(_int64 index, part_t *p)
    {
    long    rc = 0;
    long    temp;
    long    snum;
    long    brnd;

    p->partkey = index;
      agg_str(&colors, (long)P_NAME_SCL, (long)P_NAME_SD, p-
>name);
      RANDOM(temp, P_MFG_MIN, P_MFG_MAX, P_MFG_SD);
      sprintf(p->mfgr, P_MFG_FMT, P_MFG_TAG, temp);
      RANDOM(brnd, P_BRND_MIN, P_BRND_MAX, P_BRND_SD);
      sprintf(p->brand, P_BRND_FMT,
            P_BRND_TAG,
            (temp * 10 + brnd));
      p->tlen = pick_str(&p_types_set, P_TYPE_SD, p->type);
      p->tlen = strlen(p_types_set.list[p->tlen].text);
      RANDOM(p->size, P_SIZE_MIN, P_SIZE_MAX, P_SIZE_SD);
      pick_str(&p_cntr_set, P_CNTR_SD, p->container);
      RPRICE_BRIDGE( p->retailprice, index);
      p->clen = TEXT(P_CMNT_LEN, P_CMNT_SD, p->comment);

      for (snum = 0; snum < SUPP_PER_PART; snum++)
            {
            p->s[snum].partkey = p->partkey;
            PART_SUPP_BRIDGE( p->s[snum].suppkey, index, snum);
            RANDOM(p->s[snum].qty, PS_QTY_MIN, PS_QTY_MAX,
PS_QTY_SD);
            RANDOM(p->s[snum].scost, PS_SCST_MIN, PS_SCST_MAX,
PS_SCST_SD);
            p->s[snum].clen = TEXT(PS_CMNT_LEN, PS_CMNT_SD, p-
>s[snum].comment);
            }

    /* guojian@010908  */
    if (!isItMe ((unsigned _int64)p->partkey, part_info_for_part,
SMALL_TABLE))
      rc = 1;

    return (rc);
  }

long
mk_supp(_int64 index, supplier_t *s)
    {
    long    rc = 0;
    long    i,
          bad_press,
          noise,
          offset,
          type;

    s->suppkey = index;

      sprintf(s->name, S_NAME_FMT, S_NAME_TAG, index);
      s->alen = V_STR(S_ADDR_LEN, S_ADDR_SD, s->address);
      RANDOM(i, 0, nations.count - 1, S_NTRG_SD);
      s->nation_code= i;
      gen_phone(i, s->phone, S_PHNE_SD);
      RANDOM(s->acctbal, S_ABAL_MIN, S_ABAL_MAX,
S_ABAL_SD);

      s->clen = TEXT(S_CMNT_LEN, S_CMNT_SD, s->comment);
      /* these calls should really move inside the if stmt below,
      * but this will simplify seedless parallel load
      */
      RANDOM(bad_press, 1, 10000, BBB_CMNT_SD);
      RANDOM(type, 0, 100, BBB_TYPE_SD);
      RANDOM(noise, 0, (s->clen - BBB_CMNT_LEN), BBB_JNK_SD);
      RANDOM(offset, 0, (s->clen - (BBB_CMNT_LEN + noise)),
          BBB_OFFSET_SD);
      if (bad_press <= S_CMNT_BBB)
          {
          type = (type < BBB_DEADBEATS) ?0:1;
      memcpy(s->comment + offset, BBB_BASE, BBB_BASE_LEN);
      if (type == 0)
                memcpy(s->comment + BBB_BASE_LEN + offset + noise,
                BBB_COMPLAIN, BBB_TYPE_LEN);
      else
                memcpy(s->comment + BBB_BASE_LEN + offset + noise,
                BBB_COMMEND, BBB_TYPE_LEN);
          }

    /* guojian@010908 */
    if(!isItMe((unsigned _int64)s->suppkey, part_info_for_supplier,
SMALL_TABLE))
      rc = 1;

    return (rc);    // guojian
    }

struct
```

```
{
char    *mdes;
long     days;
long     dcnt;
}       months[] =

{
        {NULL, 0, 0},
        {"JAN", 31, 31},
        {"FEB", 28, 59},
        {"MAR", 31, 90},
        {"APR", 30, 120},
        {"MAY", 31, 151},
        {"JUN", 30, 181},
        {"JUL", 31, 212},
        {"AUG", 31, 243},
        {"SEP", 30, 273},
        {"OCT", 31, 304},
        {"NOV", 30, 334},
        {"DEC", 31, 365}
        };

long
        mk_time(long index, dss_time_t *t)
        {
        long     m = 0;
        long     y;
        long     d;

        t->timekey = index + JDAY_BASE;
        y = julian(index + STARTDATE - 1) / 1000;
        d = julian(index + STARTDATE - 1) % 1000;
        while (d > months[m].dcnt + LEAP_ADJ(y, m))
                m++;
        PR_DATE(t->alpha, y, m,
                d - months[m - 1].dcnt - ((LEAP(y) && m > 2) ? 1 : 0));
        t->year = 1900 + y;
        t->month = m + 12 * y + JMNTH_BASE;
        t->week = (d + T_START_DAY - 1) / 7 + 1;
        t->day = d - months[m - 1].dcnt - LEAP_ADJ(y, m-1);

        return (0);
        }

int
        mk_nation(_int64 index, code_t *c)
        {
        c->code = (long) index - 1;
        c->text = nations.list[index - 1].text;
        c->join = nations.list[index - 1].weight;
        c->clen = TEXT(N_CMNT_LEN, N_CMNT_SD, c->comment);
        return(0);
        }

int
        mk_region(_int64 index, code_t *c)
        {

        c->code = (long) index - 1;
        c->text = regions.list[index - 1].text;
        c->join = 0;        /* for completeness */
        c->clen = TEXT(R_CMNT_LEN, R_CMNT_SD, c->comment);
        return(0);
        }

/*************************************************************
************************/
/* This function helps judging if the record should be populated to the
current node */
/*************************************************************
************************/
int isItMe(unsigned _int64 key, struct sqlupi *part_info, int tablesize)
// guojian@723
{
  int i;
  int rc;
  unsigned short     num_ptrs    = 1;     // number of pointers
  unsigned char      *ptr_arr[1];         // an array of pointers to char string
  unsigned short     ptr_len[1];          // an array of character string lengths
  short              part_num;            // partition number
  SQL_PDB_NODE_TYPE  node_number;         // node number
  struct sqlca       sqlca_tpch;          // SQLCA

  /* allocate memory
   * 19 bytes is the larges
   */
  ptr_arr[0] = (unsigned char*)malloc(MAX_KEY_LEN);
  memset(ptr_arr[0], 0, sizeof(unsigned char) * MAX_KEY_LEN);


  // get the value for ptr_arr[0]
  if(tablesize == LARGE_TABLE)
    sprintf (ptr_arr[0],HUGE_FORMAT,*(DSS_HUGE *)key);
  else
    sprintf (ptr_arr[0], "%I64u\0", key);


  /* get the length of ptr_arr[0] */
  ptr_len[0] = strlen(ptr_arr[0]);
  part_num=0;
  node_number=0;

  // printf("Key = %s, Key length = %d\n", ptr_arr[0], ptr_len[0]);

  sqlugrpn (num_ptrs,
            ptr_arr,
            ptr_len,
            countrycode,
            codepage,
            part_info,
            &part_num,
            &node_number,
            chklvl,
            &sqlca_tpch,
            sDataFormat,
            (void*)0,
            (void*)0);

  // free up memory   des@0725 (memfree)  guojian@0725 (free)
  free (ptr_arr[0]);
  // printf("(%ld - ", key);
  // printf("%d)\n", part_num);
  if(sqlca_tpch.sqlcode != 0) {
    printf("SQLUGRPN Failed - sqlcode = %d\n", sqlca_tpch.sqlcode);
    exit(1);
  }
  //printf("Node number = %d, me = (%d / %d) = %d\n", node_number,
part_num, Numnodes, (part_num / Numnodes));
  // see if it is me
  if ((part_num % Numnodes) != me)
    rc = 0;
  else
    rc = 1;

  return rc;
}
```

B.18 driver.sqc

```
/* @(#)driver.c 2.1.8.4 */
/* 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 */

/*********************************************************************
*****************************/

#define NUM_TABLES  6                   // guojian@0725

/*********************************************************************
*****************************/

#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"
#include "bcd2.h"

EXEC SQL BEGIN DECLARE SECTION;             /* Declare Host
Variables  */
char   dbname[8];
EXEC SQL END DECLARE SECTION;

/*
* 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, long start, long count, long upd_num);
void    gen_tbl (int tnum, DSS_HUGE start, DSS_HUGE count, long
upd_num);
int             pr_drange (int tbl, long min, long cnt, long num);
int             set_files (int t, int pload);
int             partial (int, int);

/*********************************************************************
************/

void getPart_info (void);                       // guojian@0725


extern char *tablename[] = {"tpcd.supplier",
                        "tpcd.customer",
                        "tpcd.part",
                        "tpcd.partsupp",
                        "tpcd.orders",
                        "tpcd.lineitem"};          // guojian@0725

struct sqlupi part_info[NUM_TABLES];              // guojian@0725
struct sqlca sqlca_tpch[NUM_TABLES];              // guojian@0725

/*********************************************************************
***************/

extern int optind, opterr;
extern char *optarg;
//long rowcnt = 0, minrow = 0, upd_num = 0;
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, long skip_count);
long sd_line (int child, long skip_count);
long sd_order (int child, long skip_count);
long sd_part (int child, long skip_count);
long sd_psupp (int child, long skip_count);
long sd_supp (int child, long skip_count);
long sd_order_line (int child, long skip_count);
long sd_part_psupp (int child, long 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
*/
//gen_tbl (int tnum, long start, long count, long upd_num)
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;
    static int init = 0;
    DSS_HUGE i;

    int rows_per_segment=0;
    int rows_this_segment=-1;
    int residual_rows=0;

    if (insert_segments)
        {
        rows_per_segment = count / insert_segments;
        residual_rows = count - (rows_per_segment * insert_segments);
        }

    if (init == 0)
    {
        INIT_HUGE(o.okey);
        for (i=0; i < O_LCNT_MAX; i++)
            INIT_HUGE(o.l[i].okey);
        init = 1;
    }

    for (i = start; count; count--, i++)
    {
        LIFENOISE (1000, i);
        row_start(tnum);
        switch (tnum)
        {
        case LINE:
        case ORDER:
        case ORDER_LINE:
          if (!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:
                if (!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:
                if (!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:
                if (!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;
    long 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 connect_to_TM() {
  SQL_STRUCTURE sqlca  sqlca;
  char              *dbname_ptr;
  void              *ctx;

  if ((dbname_ptr=getenv("TPCD_DBNAME")) != NULL)
       strcpy(dbname, dbname_ptr);
  else {
    printf(" Database name not defined.\n");
    exit(1);
  }

  EXEC SQL CONNECT TO :dbname IN SHARE MODE;

  if (SQLCODE != 0) {
     fprintf(stderr, "%s: CONNECT TO %s: SQLCODE = %d\n",
__FILE__, dbname, SQLCODE);
     exit(-1);
  }
} /* connect_to_TM */
void disconnect_from_TM() {
  SQL_STRUCTURE sqlca  sqlca;
  void              *ctx;

  EXEC SQL CONNECT RESET;

  if (SQLCODE != 0)
    fprintf(stderr, "%s: CONNECT RESET: SQLCODE = %d\n",
__FILE__, SQLCODE);

} /* disconnect_from_TM */



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;

                                scale = 1;
                                for (i = PART; i < REGION; i++)
                                {
                                        tdefs[i].base *= flt_scale;
                                        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)
{
    int i;
    char   *numnodesptr;

/********************** Get partition info for each table
***************/
    char *p;
    if((p=getenv("DSS_NODE")) == NULL) {
      printf("Node Number not defined.\n");
      exit(1);
    }
    else {
      me = atoi(p);
      printf("Generating Data for Node %d.\n", me);
    }
    getPart_info();                 // guojian@0725
/*************************************************************
************/

    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);
        }

    //DJD
    if ((numnodesptr=getenv("DSS_NUMNODES")) != NULL) {
        Numnodes = atoi(numnodesptr);
        printf( "Using %d Nodes\n", Numnodes);
    }
    else {
      printf(" Database name not defined.\n");
      exit(1);
    }

    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
         */
        double fix1;
        set_state (ORDER, scale, 1, 2, (long *)&i);
        fix1 = (double)tdefs[ORDER_LINE].base / (double)10000;
        rowcnt = (int)(fix1 * 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 (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 (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 (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 (i, minrow, rowcnt, upd_num);    /*
start@guojian/00708 */
                    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);
}

/*************************************************************
******************/
/* get partition info for each table    guojian@0725                */
/*************************************************************
******************/
void getPart_info (void)
{
  int i;
  struct sqlupi *dummyptr;

  connect_to_TM();
```

```
  for (i = 0; i < NUM_TABLES; i++ ) {
    sqlugtpi( tablename[i], &part_info[i], &sqlca_tpch[i]);
  } /* endfor */

  part_info_for_supplier = &part_info[0];
  dummyptr               = part_info_for_supplier;
  part_info_for_customer = &part_info[1];
  part_info_for_part     = &part_info[2];
  part_info_for_partsupp = &part_info[3];
  part_info_for_orders   = &part_info[4];
  part_info_for_lineitem = &part_info[5];

  disconnect_from_TM();

  return;
}
```

B.19 dss.h

```
/*
 * Sccsid:     @(#)dss.h        2.1.8.5
 *
 * general definitions and control information for the DSS code
 * generator; if it controls the data set, it's here
 */
#ifndef DSS_H
#define  DSS_H
#ifdef TPCH
#define NAME                    "TPC-H"
#define VERSION          1
#define RELEASE          3
#define MODIFICATION     0
#define PATCH            ""
#endif
#ifdef TPCR
#define NAME                    "TPC-R"
#define VERSION          1
#define RELEASE          3
#define MODIFICATION     0
#define PATCH            ""
#endif
#ifndef NAME
#error Benchmark version must be defined in config.h
#endif
#define TPC             "Transaction Processing Performance Council"
#define C_DATES         "1994 - 2000"

#include "config.h"
#include "shared.h"

/*************************************************************
************/

#include <sqludf.h>                     // guojian@0725
#include <sqlutil.h>                    // guojian@0725

/*************************************************************
************/

#include <stdio.h>
#include <stdlib.h>

#define  NONE          -1
#define  PART           0
#define  PSUPP          1
#define  SUPP           2
#define  CUST           3
#define  ORDER          4
#define  LINE           5
#define  ORDER_LINE 6
#define  PART_PSUPP 7
#define  NATION         8
#define  REGION         9
#define  UPDATE         10
#define  MAX_TABLE      11
#define  ONE_STREAM     1
#define  ADD_AT_END     2

#ifdef MAX
#undef MAX
#endif
#ifdef MIN
#undef MIN
#endif
#define MAX(a,b) ((a > b )?a:b)
#define MIN(A,B)  ( (A) < (B) ? (A) : (B))

#define INTERNAL_ERROR(p)  {fprintf(stderr,"%s", p);abort();}
#define LN_CNT  4
static char lnoise[4] = {'|', '/', '-', '\\' };
#define LIFENOISE(n, var)       \
        if (verbose > 0) fprintf(stderr, "%c\b", lnoise[(var%LN_CNT)])

#define MALLOC_CHECK(var) \
    if ((var) == NULL) \
        { \
        fprintf(stderr, "Malloc failed at %s:%d\n",  \
            __FILE__, __LINE__); \
        exit(1);\
        }
#define OPEN_CHECK(var, path) \
    if ((var) == NULL) \
        { \
        fprintf(stderr, "Open failed for %s at %s:%d\n",  \
            path, __FILE__, __LINE__); \
        exit(1);\
        }
#ifndef MAX_CHILDREN
#define MAX_CHILDREN    1000
#endif

/*
 * macros that control sparse keys
 *
 * refer to Porting.Notes for a complete explanation
 */
#ifndef BITS_PER_LONG
#define BITS_PER_LONG   32
#define MAX_LONG        0x7FFFFFFF
#endif /* BITS_PER_LONG */
#define SPARSE_BITS      2
#define SPARSE_KEEP      3
#define  MK_SPARSE(key, seq) \
        (((((key>>3)<<2)|(seq & 0x0003))<<3)|(key & 0x0007))

#define RANDOM(tgt, lower, upper, stream)       dss_random(&tgt, lower,
upper, stream)



typedef struct
{
   long      weight;
   char     *text;
}        set_member;
```

```
typedef struct
{
  int     count;
  int     max;
  set_member *list;
  long *permute;
}       distribution;
/*
 * some handy access functions
 */
#define DIST_SIZE(d)          d->count
#define DIST_MEMBER(d, i)     ((set_member *)((d)->list + i))->text

typedef struct
{
  char    *name;
  char    *comment;
  long     base;
  int     (*header) ();
  int     (*loader[2]) ();
  long    (*gen_seed)();
  int     (*verify) ();
  int     child;
  unsigned long vtotal;
}       tdef;

typedef struct SEED_T {
      long table;
      long value;
      long usage;
      long boundary;
      } seed_t;


#if defined(__STDC__)
#define PROTO(s) s
#else
#define PROTO(s) ()
#endif

/* bm_utils.c */
char   *env_config PROTO((char *var, char *dflt));
long   yes_no PROTO((char *prompt));
int    a_rnd PROTO((int min, int max, int column, char *dest));
int    tx_rnd PROTO((long min, long max, long column, char *tgt));
long   julian PROTO((long date));
long   unjulian PROTO((long date));
FILE   *tbl_open PROTO((int tbl, char *mode));
long   dssncasecmp PROTO((char *s1, char *s2, int n));
long   dsscasecmp PROTO((char *s1, char *s2));
int          pick_str PROTO((distribution * s, int c, char *target));
void   agg_str PROTO((distribution *set, long count, long col, char
*dest));
void   read_dist PROTO((char *path, char *name, distribution * target));
void   embed_str PROTO((distribution *d, int min, int max, int stream,
char *dest));
#ifndef STDLIB_HAS_GETOPT
int          getopt PROTO((int arg_cnt, char **arg_vect, char *oprions));
#endif /* STDLIB_HAS_GETOPT */
long   set_state PROTO((int t, long scale, long procs, long step, long *e));

/* rnd.c */
long   NextRand PROTO((long nSeed));
long   UnifInt PROTO((long nLow, long nHigh, long nStream));
double UnifReal PROTO((double dLow, double dHigh, long nStream));
double Exponential PROTO((double dMean, long nStream));
void   dss_random(long *tgt, long min, long max, long seed);
void   row_start(int t);
void   row_stop(int t);
void   dump_seeds(int t);

/* text.c */
#define MAX_GRAMMAR_LEN 12     /* max length of grammar
component */
#define MAX_SENT_LEN    256 /* max length of populated sentence */
#define RNG_PER_SENT    27     /* max number of RNG calls per
sentence */

int          dbg_text PROTO((char * t, int min, int max, int s));

#ifdef DECLARER
#define EXTERN
#else
#define EXTERN extern
#endif          /* DECLARER */


EXTERN distribution nations;
EXTERN distribution nations2;
EXTERN distribution regions;
EXTERN distribution o_priority_set;
EXTERN distribution l_instruct_set;
EXTERN distribution l_smode_set;
EXTERN distribution l_category_set;
EXTERN distribution l_rflag_set;
EXTERN distribution c_mseg_set;
EXTERN distribution colors;
EXTERN distribution p_types_set;
EXTERN distribution p_cntr_set;

/* distributions that control text generation */
EXTERN distribution articles;
EXTERN distribution nouns;
EXTERN distribution adjectives;
EXTERN distribution adverbs;
EXTERN distribution prepositions;
EXTERN distribution verbs;
EXTERN distribution terminators;
EXTERN distribution auxillaries;
EXTERN distribution np;
EXTERN distribution vp;
EXTERN distribution grammar;


EXTERN long scale;
EXTERN int refresh;
EXTERN int resume;
EXTERN long verbose;
EXTERN long force;
EXTERN long header;
EXTERN long columnar;
EXTERN long direct;
EXTERN long updates;
EXTERN long table;
EXTERN long children;
EXTERN long fnames;
EXTERN int  gen_sql;
EXTERN int  gen_rng;
EXTERN char *db_name;
EXTERN int  step;
EXTERN int     set_seeds;
EXTERN int  validate;
EXTERN char *d_path;

/* added for segmented updates */
EXTERN int insert_segments;
EXTERN int delete_segments;
EXTERN int insert_orders_segment;
EXTERN int insert_lineitem_segment;
```

```
EXTERN int delete_segment;

/*************************************************************
*********/
/* guojian@0725 part_info for each table                     */

EXTERN struct sqlupi *part_info_for_part;
EXTERN struct sqlupi *part_info_for_supplier;
EXTERN struct sqlupi *part_info_for_partsupp;
EXTERN struct sqlupi *part_info_for_customer;
EXTERN struct sqlupi *part_info_for_orders;
EXTERN struct sqlupi *part_info_for_lineitem;
EXTERN int me;
EXTERN int Numnodes;
/*************************************************************
*********/

#ifndef DECLARER
extern tdef tdefs[];

#endif          /* DECLARER */


/*************************************************************
*****
 ** table level defines use the following naming convention: t_ccc_xxx
 ** with: t, a table identifier
 **       ccc, a column identifier
 **       xxx, a limit type

*************************************************************
****
 */

/*
 * defines which control the parts table
 */
#define  P_SIZE      126
#define  P_NAME_SCL   5
#define  P_MFG_TAG    "Manufacturer#"
#define  P_MFG_FMT    "%s%01d"
#define  P_MFG_MIN    1
#define  P_MFG_MAX    5
#define  P_BRND_TAG   "Brand#"
#define  P_BRND_FMT   "%s%02d"
#define  P_BRND_MIN    1
#define  P_BRND_MAX    5
#define  P_SIZE_MIN    1
#define  P_SIZE_MAX    50
#define  P_MCST_MIN    100
#define  P_MCST_MAX    99900
#define  P_MCST_SCL    100.0
#define  P_RCST_MIN    90000
#define  P_RCST_MAX    200000
#define  P_RCST_SCL    100.0
/*
 * defines which control the suppliers table
 */
#define  S_SIZE     145
#define  S_NAME_TAG "Supplier#"
#define  S_NAME_FMT "%s%09ld"
#define  S_ABAL_MIN   -99999
#define  S_ABAL_MAX    999999
#define  S_CMNT_MAX    101
#define  S_CMNT_BBB    10      /* number of BBB comments/SF */
#define  BBB_DEADBEATS 50      /* % that are complaints */
#define  BBB_BASE  "Customer "
#define  BBB_COMPLAIN  "Complaints"
#define  BBB_COMMEND   "Recommends"
#define  BBB_CMNT_LEN  19
#define  BBB_BASE_LEN  9
#define  BBB_TYPE_LEN  10

/*
 * defines which control the partsupp table
 */
#define  PS_SIZE     145
#define  PS_SKEY_MIN  0
#define  PS_SKEY_MAX  ((tdefs[SUPP].base - 1) * scale)
#define  PS_SCST_MIN  100
#define  PS_SCST_MAX  100000
#define  PS_QTY_MIN   1
#define  PS_QTY_MAX   9999
/*
 * defines which control the customers table
 */
#define  C_SIZE      165
#define  C_NAME_TAG   "Customer#"
#define  C_NAME_FMT   "%s%09d"
#define  C_MSEG_MAX    5
#define  C_ABAL_MIN   -99999
#define  C_ABAL_MAX    999999
/*
 * defines which control the order table
 */
#define  O_SIZE         109
#define  O_CKEY_MIN      1
#define  O_CKEY_MAX      (long)(tdefs[CUST].base * scale)
#define  O_ODATE_MIN     STARTDATE
#define  O_ODATE_MAX     (STARTDATE + TOTDATE - \
                (L_SDTE_MAX + L_RDTE_MAX) - 1)
#define  O_CLRK_TAG      "Clerk#"
#define  O_CLRK_FMT      "%s%09d"
#define  O_CLRK_SCL      1000
#define  O_LCNT_MIN      1
#define  O_LCNT_MAX      7

/*
 * defines which control the lineitem table
 */
#define  L_SIZE      144L
#define  L_QTY_MIN    1
#define  L_QTY_MAX    50
#define  L_TAX_MIN    0
#define  L_TAX_MAX    8
#define  L_DCNT_MIN   0
#define  L_DCNT_MAX   10
#define  L_PKEY_MIN   1
#define  L_PKEY_MAX   (tdefs[PART].base * scale)
#define  L_SDTE_MIN   1
#define  L_SDTE_MAX   121
#define  L_CDTE_MIN   30
#define  L_CDTE_MAX   90
#define  L_RDTE_MIN   1
#define  L_RDTE_MAX   30
/*
 * defines which control the time table
 */
#define  T_SIZE      30
#define  T_START_DAY  3     /* wednesday ? */
#define  LEAP(y)  ((!(y % 4) && (y % 100))?1:0)

/*************************************************************
*******

*************************************************************
*******
 ***
 *** general or inter table defines
 ***
```

```
**************************************************************
*******

**************************************************************
*******/
#define  SUPP_PER_PART 4
#define  ORDERS_PER_CUST 10 /* sync this with CUST_MORTALITY
*/
#define  CUST_MORTALITY 3  /* portion with have no orders */
#define  NATIONS_MAX  90 /* limited by country codes in phone
numbers */
#define  PHONE_FMT    "%02d-%03d-%03d-%04d"
#define  STARTDATE    92001
#define  CURRENTDATE  95168
#define  ENDDATE      98365
#define  TOTDATE      2557
#define  UPD_PCT      10
#define  MAX_STREAM   47
#define  V_STR_LOW    0.4
#define  PENNIES    100 /* for scaled int money arithmetic */
#define  Q11_FRACTION (double)0.0001
/*
 * max and min SF in GB; Larger SF will require changes to the build
routines
 */
#define  MIN_SCALE      1.0
#define  MAX_SCALE   1000.0
/*
 * beyond this point we need to allow for BCD calculations
 */
#define  MAX_32B_SCALE   1000.0
#define INIT_HUGE(v)    { \
                v = (DSS_HUGE *)malloc(sizeof(DSS_HUGE) *
HUGE_COUNT); \
                MALLOC_CHECK(v); \
                }
#define FREE_HUGE(v)    free(v)
#ifdef SUPPORT_64BITS
#define LONG2HUGE(src, dst)           *dst = (DSS_HUGE)src
#define HUGE2LONG(src, dst)           *dst = (long)src
#define HUGE_SET(src, dst)           *dst = *src
#define HUGE_MUL(op1, op2)            *op1 *= op2
#define HUGE_DIV(op1, op2)            *op1 /= op2
#define HUGE_ADD(op1, op2, dst) *dst = *op1 + op2
#define HUGE_SUB(op1, op2, dst) *dst = *op1 - op2
#define HUGE_MOD(op1, op2)            *op1 % op2
#define HUGE_CMP(op1, op2)            (*op1 == *op2)?0:(*op1 < *op2)-
1:1
#else
#define LONG2HUGE(src, dst)           {*dst = src; *(dst + 1) = 0;}
#define HUGE2LONG(src, dst)           { dst=0 ; \
                        bcd2_bin(dst, (src + 1)); \
                        bcd2_bin(dst, src); }
#define HUGE_SET(src, dst)           { *dst = *src ; *(dst + 1) = *(src + 1);
}
#define HUGE_MUL(op1,op2)             bcd2_mul(op1, (op1 + 1), op2)
#define HUGE_DIV(op1,op2)            bcd2_div(op1, (op1 + 1), op2)
#define HUGE_ADD(op1,op2,d)           { \
                        HUGE_SET(op1, d); \
                        bcd2_add(d, (d + 1), op2); \
                        }
#define HUGE_SUB(op1,op2,d)           { \
                        HUGE_SET(op1, d); \
                        bcd2_sub(d, (d + 1), op2); \
                        }
#define HUGE_MOD(op1, op2)            bcd2_mod(op1, (op1 + 1), op2)
#define HUGE_CMP(op1, op2)            (bcd2_cmp(op1, (op1 + 1), op2)
== 0)?0:\
                        ((bcd2_cmp(op1, (op1 + 1), op2) < 0)?-1:1)
#endif /* SUPPORT_64BITS */

/******** environmental variables and defaults ***************/
#define  DIST_TAG  "DSS_DIST"          /* environment var to override ...
*/
#define  DIST_DFLT "dists.dss"         /* default file to hold distributions */
#define  PATH_TAG  "DSS_PATH"          /* environment var to override
... */
#define  PATH_DFLT "."                 /* default directory to hold tables
*/
#define  CONFIG_TAG  "DSS_CONFIG"      /* environment var to
override ... */
#define  CONFIG_DFLT "."               /* default directory to config
files */
#define  ADHOC_TAG  "DSS_ADHOC"        /* environment var to
override ... */
#define  ADHOC_DFLT "adhoc.dss"        /* default file name for adhoc
vars */

/******* output macros ********/
#ifndef SEPARATOR
#define SEPARATOR '|' /* field spearator for generated flat files */
#endif
/* Data type flags for a single print routine */
#define DT_STR         0
#ifndef MVS
#define DT_VSTR        DT_STR
#else
#define DT_VSTR        1
#endif /* MVS */
#define DT_INT         2
#define DT_HUGE        3
#define DT_KEY         4
#define DT_MONEY       5
#define DT_CHR         6

int dbg_print(int dt, FILE *tgt, void *data, int len, int eol);
#define PR_STR(f, str, len)           dbg_print(DT_STR, f, (void *)str, len,
1)
#define PR_VSTR(f, str, len)    dbg_print(DT_VSTR, f, (void *)str, len, 1)
#define PR_VSTR_LAST(f, str, len)       dbg_print(DT_VSTR, f, (void
*)str, len, 0)
#define PR_INT(f, str)                dbg_print(DT_INT, f, (void *)str, 0, 1)
#define PR_HUGE(f, str)               dbg_print(DT_HUGE, f, (void *)str, 0,
1)
#define PR_KEY(f, str)                dbg_print(DT_KEY, f, (void *)str, 0, -1)
#define PR_MONEY(f, str)              dbg_print(DT_MONEY, f, (void
*)str, 0, 1)
#define PR_CHR(f, str)                dbg_print(DT_CHR, f, (void *)str, 0, 1)
#define  PR_STRT(fp)   /* any line prep for a record goes here */
#define  PR_END(fp)    fprintf(fp, "\n")   /* finish the record here */
#ifdef MDY_DATE
#define  PR_DATE(tgt, yr, mn, dy)      \
  sprintf(tgt, "%02d-%02d-19%02d", mn, dy, yr)
#else
#define  PR_DATE(tgt, yr, mn, dy)      \
sprintf(tgt, "19%02d-%02d-%02d", yr, mn, dy)
#endif /* DATE_FORMAT */

/*
 * verification macros
 */
#define  VRF_STR(t, d) {char *xx = d; while (*xx) tdefs[t].vtotal +=
*xx++;}
#define  VRF_INT(t,d)  tdefs[t].vtotal += d
#ifdef SUPPORT_64BITS
#define  VRF_HUGE(t,d)  tdefs[t].vtotal = *((long *)&d) + *((long *)(&d
+ 1))
#else
#define VRF_HUGE(t,d)   tdefs[t].vtotal += d[0] + d[1]
```

```
#endif /* SUPPORT_64BITS */
/* assume float is a 64 bit quantity */
#define  VRF_MONEY(t,d) tdefs[t].vtotal = *((long *)&d) + *((long *)(&d
+ 1))
#define  VRF_CHR(t,d)   tdefs[t].vtotal += d
#define  VRF_STRT(t)
#define  VRF_END(t)

/********** distribuitons currently defined *************/
#define  UNIFORM   0

/*
 * seed indexes; used to separate the generation of individual columns
 */
#define  P_MFG_SD  0
#define  P_BRND_SD 1
#define  P_TYPE_SD 2
#define  P_SIZE_SD 3
#define  P_CNTR_SD 4
#define  P_RCST_SD 5
#define  PS_QTY_SD 7
#define  PS_SCST_SD   8
#define  O_SUPP_SD 10
#define  O_CLRK_SD 11
#define  O_ODATE_SD   13
#define  L_QTY_SD  14
#define  L_DCNT_SD 15
#define  L_TAX_SD  16
#define  L_SHIP_SD 17
#define  L_SMODE_SD   18
#define  L_PKEY_SD 19
#define  L_SKEY_SD 20
#define  L_SDTE_SD 21
#define  L_CDTE_SD 22
#define  L_RDTE_SD 23
#define  L_RFLG_SD 24
#define  C_NTRG_SD 27
#define  C_PHNE_SD 28
#define  C_ABAL_SD 29
#define  C_MSEG_SD 30
#define  S_NTRG_SD 33
#define  S_PHNE_SD 34
#define  S_ABAL_SD 35
#define  P_NAME_SD 37
#define  O_PRIO_SD 38
#define  HVAR_SD   39
#define  O_CKEY_SD 40
#define  N_CMNT_SD 41
#define  R_CMNT_SD 42
#define  O_LCNT_SD 43
#define  BBB_JNK_SD    44
#define  BBB_TYPE_SD   45
#define  BBB_CMNT_SD   46
#define  BBB_OFFSET_SD 47
#endif          /* DSS_H */
```

B.20 dsstypes.h

```
/*
 * Sccsid:     @(#)dsstypes.h   2.1.8.1
 *
 * general definitions and control information for the DSS data types
 * and function prototypes
 */

/* guojian@0725 structure for wraping those parameters passed into
sqlugrpn */
/*
struct prepared_values
{
  unsigned short  country code;          // Country code
  unsigned short  codepage;              // Code page
  struct sqlupi   *part_info;            // partition Infomation
  unsigned short  chklvl;                // check level
  short           sDataFormat            // data format
}
*/

/*
 * typedefs
 */
typedef struct
{
    //long          custkey;  //DJD
    DSS_HUGE      custkey;  //DJD
    char          name[C_NAME_LEN + 1];
    char          address[C_ADDR_MAX + 1];
    int           alen;
    long          nation_code;
    char          phone[PHONE_LEN + 1];
    long          acctbal;
    char          mktsegment[MAXAGG_LEN + 1];
    char          comment[C_CMNT_MAX + 1];
    int           clen;
}           customer_t;
/* customers.c */
long mk_cust   PROTO((long n_cust, customer_t * c));
int pr_cust    PROTO((customer_t * c, int mode));
int ld_cust    PROTO((customer_t * c, int mode));

typedef struct
{
    DSS_HUGE      *okey;
    long          partkey;
    long          suppkey;
    long          lcnt;
    long          quantity;
    long          eprice;
    long          discount;
    long          tax;
    char          rflag[1];
    char          lstatus[1];
    char          cdate[DATE_LEN];
    char          sdate[DATE_LEN];
    char          rdate[DATE_LEN];
    char          shipinstruct[MAXAGG_LEN + 1];
    char          shipmode[MAXAGG_LEN + 1];
    char          comment[L_CMNT_MAX + 1];
    int           clen;
}           line_t;

typedef struct
{
    DSS_HUGE      *okey;
    long          custkey;
    char          orderstatus;
    long          totalprice;
    char          odate[DATE_LEN];
    char          opriority[MAXAGG_LEN + 1];
    char          clerk[O_CLRK_LEN + 1];
    long          spriority;
    long          lines;
    char          comment[O_CMNT_MAX + 1];
    int           clen;
    line_t        l[O_LCNT_MAX];
}           order_t;

/* order.c */
```

```
//long    mk_order        PROTO((long index, order_t * o, long upd_num));
//djd
long    mk_order        PROTO((_int64 index, order_t * o, long upd_num));
//djd
int             pr_order        PROTO((order_t * o, int mode));
int             ld_order        PROTO((order_t * o, int mode));
void    ez_sparse       PROTO((long index, DSS_HUGE *ok, long seq));
#ifndef SUPPORT_64BITS
void    hd_sparse       PROTO((long index, DSS_HUGE *ok, long seq));
#endif


typedef struct
{
   //long          partkey;          //DJD
   //long          suppkey;          //DJD
   DSS_HUGE        partkey;          //DJD
   DSS_HUGE        suppkey;          //DJD
   long            qty;
   long            scost;
   char            comment[PS_CMNT_MAX + 1];
   int             clen;
}               partsupp_t;

typedef struct
{
   //long          partkey;   //DJD
   DSS_HUGE        partkey;   //DJD
   char            name[P_NAME_LEN + 1];
   int             nlen;
   char            mfgr[P_MFG_LEN + 1];
   char            brand[P_BRND_LEN + 1];
   char            type[P_TYPE_LEN + 1];
   int             tlen;
   long            size;
   char            container[P_CNTR_LEN + 1];
   long            retailprice;
   char            comment[P_CMNT_MAX + 1];
   int             clen;
   partsupp_t      s[SUPP_PER_PART];
}               part_t;

/* parts.c */
long mk_part    PROTO((long index, part_t * p));
int pr_part     PROTO((part_t * part, int mode));
int ld_part     PROTO((part_t * part, int mode));

typedef struct
{
   //long          suppkey; //DJD
   DSS_HUGE        suppkey; //DJD

   char            name[S_NAME_LEN + 1];
   char            address[S_ADDR_MAX + 1];
   int             alen;
   long            nation_code;
   char            phone[PHONE_LEN + 1];
   long            acctbal;
   char            comment[S_CMNT_MAX + 1];
   int             clen;
}               supplier_t;
/* supplier.c */
//long mk_supp    PROTO((long index, supplier_t * s));  //DJD
long mk_supp    PROTO(( _int64 index, supplier_t * s));  //DJD
int pr_supp     PROTO((supplier_t * supp, int mode));
int ld_supp     PROTO((supplier_t * supp, int mode));

typedef struct
{
   long            timekey;
   char            alpha[DATE_LEN];
   long            year;
   long            month;
   long            week;
   long            day;
} dss_time_t;

/* time.c */
long mk_time    PROTO((long index, dss_time_t * t));

/*
 * this assumes that N_CMNT_LEN >= R_CMNT_LEN
 */
typedef struct
{
   long            code;
   char            *text;
   long            join;
   char            comment[N_CMNT_MAX + 1];
   int             clen;
}               code_t;

/* code table */
int mk_nation    PROTO((long i, code_t * c));
int pr_nation    PROTO((code_t * c, int mode));
int ld_nation    PROTO((code_t * c, int mode));
int mk_region    PROTO((long i, code_t * c));
int pr_region    PROTO((code_t * c, int mode));
int ld_region    PROTO((code_t * c, int mode));
```

Appendix C: Query Text and Output

C.1 Qualification Queries and Output

Qualification Query 1

```
-----------------------------------------------
-- Query 01 - Var_0 Rev_01 - Pricing Summary Report Query

Tag: Q1     Stream: -1   Sequence number: 17

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(*) as count_order
from
tpcd.lineitem
where
l_shipdate <= date ('1998-12-01') - 90 day
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                37734107.000       56586554400.730
53758257134.870       55909065222.828              25.522             38273.130
0.050      1478493
N            F                  991417.000        1487504710.380
1413082168.054        1469649223.194              25.516             38284.468
0.050        38854
N            O                74476040.000      111701729697.740
106118230307.606      110367043872.497              25.502
38249.118               0.050      2920374
R            F                37719753.000       56568041380.900
53741292684.604       55889619119.832              25.506             38250.855
0.050      1478870


Number of rows retrieved is:      4
-----------------------------------------------
```

Qualification Query 2

```
-----------------------------------------------

-- Query 02 - Var_0 Rev_02 - Minimum Cost Supplier Query

Tag: Q2     Stream: -1   Sequence number: 2

select
s_acctbal,
s_name,
n_name,
p_partkey,
p_mfgr,
s_address,
s_phone,
s_comment
from
tpcd.part,
tpcd.supplier,
tpcd.partsupp,
tpcd.nation,
tpcd.region
where
p_partkey = ps_partkey
and s_suppkey = ps_suppkey
and p_size = 15
and p_type like '%BRASS'
and s_nationkey = n_nationkey
and n_regionkey = r_regionkey
and r_name = 'EUROPE'
and ps_supplycost = (
select
min(ps_supplycost)
from
tpcd.partsupp,
tpcd.supplier,
tpcd.nation,
tpcd.region
where
p_partkey = ps_partkey
and s_suppkey = ps_suppkey
and s_nationkey = n_nationkey
and n_regionkey = r_regionkey
and r_name = 'EUROPE'
)
order by
s_acctbal desc,
n_name,
s_name,
p_partkey
fetch first 100 rows only

S_ACCTBAL           S_NAME                N_NAME
P_PARTKEY    P_MFGR                S_ADDRESS
S_PHONE         S_COMMENT
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
         9938.530  Supplier#000005359        UNITED KINGDOM
185358  Manufacturer#4           QKuHYh,vZGiwu2FWEJoLDx04
33-429-790-6131  blithely silent pinto beans are furiously. slyly final
deposits acros
         9937.840  Supplier#000005969        ROMANIA
108438  Manufacturer#1
ANDENSOSmk,miq23Xfb5RWt6dvUcvt6Qa         29-520-692-3537
carefully slow deposits use furiously. slyly ironic platelets above the ironic
         9936.220  Supplier#000005250        UNITED KINGDOM
249  Manufacturer#4           B3rqp0xbSEim4Mpy2RH J                33-
320-228-2957  blithely special packages are. stealthily express deposits
across the closely final instructi
         9923.770  Supplier#000002324        GERMANY
29821  Manufacturer#4           y3OD9UywSTOk                17-779-
299-1839  quickly express packages breach quiet pinto beans. requ
```

```
        9871.220  Supplier#000006373        GERMANY
43868  Manufacturer#5          J8fcXWsTqM                17-813-
485-8637  never silent deposits integrate furiously blit

…. Additional rows deleted …..

159180  Manufacturer#5
2wQRVovHrm3,v03IKzfTd,1PYsFXQFFOG        17-266-947-7315  final
requests integrate slyly above the silent, even
        7912.910  Supplier#000004211        GERMANY
184210  Manufacturer#4
2wQRVovHrm3,v03IKzfTd,1PYsFXQFFOG        17-266-947-7315  final
requests integrate slyly above the silent, even
        7894.560  Supplier#000007981        GERMANY
85472  Manufacturer#4          NSJ96vMROAbeXP                17-
963-404-3760  regular, even theodolites integrate carefully. bold, special
theodolites are slyly fluffily iron
        7887.080  Supplier#000009792        GERMANY
164759  Manufacturer#3          Y28ITVeYriT3kIGdV2K8fSZ
V2UqT5H1Otz       17-988-938-4296  pending, ironic packages sleep among
the carefully ironic accounts. quickly final accounts
        7871.500  Supplier#000007206        RUSSIA                104695
Manufacturer#1          3w fNCnrVmvJjE95sgWZzvW                32-432-
452-7731  furiously dogged pinto beans cajole. bold, express notornis until
the slyly pending
        7852.450  Supplier#000005864        RUSSIA                8363
Manufacturer#4          WCNfBPZeSXh3h,c                32-454-883-
3821  blithely regular deposits
        7850.660  Supplier#000001518        UNITED KINGDOM
86501  Manufacturer#1          ONda3YJiHKJOC                33-730-
383-3892  furiously final accounts wake carefully idle requests. even
dolphins wake acc
        7843.520  Supplier#000006683        FRANCE
11680  Manufacturer#4          2Z0JGkiv01Y00oCFwUGfviIbhzCdy
16-464-517-8943  carefully bold accounts doub


Number of rows retrieved is:    100
------------------------------------------------
```

Qualification Query 3

```
------------------------------------------------

-- Query 03 - Var_0 Rev_01 - Shipping Priority Query

Tag: Q3     Stream: -1   Sequence number: 11

select
l_orderkey,
sum(l_extendedprice * (1 - l_discount)) as revenue,
o_orderdate,
o_shippriority
from
tpcd.customer,
tpcd.orders,
tpcd.lineitem
where
c_mktsegment = 'BUILDING'
and c_custkey = o_custkey
and l_orderkey = o_orderkey
and o_orderdate < date ('1995-03-15')
and l_shipdate > date ('1995-03-15')
group by
l_orderkey,
o_orderdate,
o_shippriority
order by
revenue desc,
o_orderdate
fetch first 10 rows only

L_ORDERKEY          REVENUE             O_ORDERDATE
O_SHIPPRIORITY
-------------------------------------------------------------------------
          2456423          406181.011  1995-03-05                0
          3459808          405838.699  1995-03-04                0
           492164          390324.061  1995-02-19                0
          1188320          384537.936  1995-03-09                0
          2435712          378673.056  1995-02-26                0
          4878020          378376.795  1995-03-12                0
          5521732          375153.922  1995-03-13                0
          2628192          373133.309  1995-02-22                0
           993600          371407.460  1995-03-05                0
          2300070          367371.145  1995-03-13                0


Number of rows retrieved is:     10
------------------------------------------------
```

Qualification Query 4

```
------------------------------------------------

-- Query 04 - Var_0 Rev_01 - Order Priority Checking Query

Tag: Q4     Stream: -1   Sequence number: 14

select
o_orderpriority,
count(*) as order_count
from
tpcd.orders
where
o_orderdate >= date ('1993-07-01')
and o_orderdate < date ('1993-07-01') + 3 month
and exists (
select
*
from
tpcd.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              10594
2-HIGH                10476
3-MEDIUM              10410
4-NOT SPECIFIED       10556
5-LOW                 10487


Number of rows retrieved is:      5
------------------------------------------------
```

Qualification Query 5

```
------------------------------------------------

-- Query 05 - Var_0 Rev_02 Local Supplier Volume Query

Tag: Q5     Stream: -1   Sequence number: 20
```

```
select
n_name,
sum(l_extendedprice * (1 - l_discount)) as revenue
from
tpcd.customer,
tpcd.orders,
tpcd.lineitem,
tpcd.supplier,
tpcd.nation,
tpcd.region
where
c_custkey = o_custkey
and o_orderkey = l_orderkey
and l_suppkey = s_suppkey
and c_nationkey = s_nationkey
and s_nationkey = n_nationkey
and n_regionkey = r_regionkey
and r_name = 'ASIA'
and o_orderdate >= date ('1994-01-01')
and o_orderdate < date ('1994-01-01') + 1 year
group by
n_name
order by
revenue desc
```

```
N_NAME                REVENUE
--------------------------------------------------
INDONESIA                  55502041.170
VIETNAM                    55295086.997
CHINA                      53724494.257
INDIA                      52035512.000
JAPAN                      45410175.695


Number of rows retrieved is:      5
--------------------------------------------------
```

Qualification Query 6

```
--------------------------------------------------

-- Query 06 - Var_0 Rev_01 - Forecasting Revenue Change Query

Tag: Q6     Stream: -1    Sequence number: 5

select
sum(l_extendedprice * l_discount) as revenue
from
tpcd.lineitem
where
l_shipdate >= date ('1994-01-01')
and l_shipdate < date ('1994-01-01') + 1 year
and l_discount between .06 - 0.01 and .06 + 0.01
and l_quantity < 24

REVENUE
----------------------
      123141078.228


Number of rows retrieved is:      1
--------------------------------------------------
```

Qualification Query 7

```
--------------------------------------------------

-- Query 07 - Var_0 Rev_01 - Volume Shipping Query

Tag: Q7     Stream: -1    Sequence number: 21

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,
year (l_shipdate) as l_year,
l_extendedprice * (1 - l_discount) as volume
from
tpcd.supplier,
tpcd.lineitem,
tpcd.orders,
tpcd.customer,
tpcd.nation n1,
tpcd.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 = 'GERMANY')
or (n1.n_name = 'GERMANY' and n2.n_name = 'FRANCE')
)
and l_shipdate between date('1995-01-01') and date('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                GERMANY               1995
54639732.734
FRANCE                GERMANY               1996
54633083.308
GERMANY               FRANCE                1995
52531746.670
GERMANY               FRANCE                1996
52520549.022


Number of rows retrieved is:      4
--------------------------------------------------
```

Qualification Query 8

```
--------------------------------------------------

-- Query 08 - Var_0 Rev_01 - National Market Share Query

Tag: Q8     Stream: -1    Sequence number: 8

select
o_year,
sum(case
when nation = 'BRAZIL' then volume
else 0
```

```
end) / sum(volume) as mkt_share
from
(
select
year(o_orderdate) as o_year,
l_extendedprice * (1 - l_discount) as volume,
n2.n_name as nation
from
tpcd.part,
tpcd.supplier,
tpcd.lineitem,
tpcd.orders,
tpcd.customer,
tpcd.nation n1,
tpcd.nation n2,
tpcd.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 date('1995-01-01') and date ('1996-12-31')
and p_type = 'ECONOMY ANODIZED STEEL'
) as all_nations
group by
o_year
order by
o_year
```

```
O_YEAR      MKT_SHARE
------------------------------------
     1995            0.034
     1996            0.041


Number of rows retrieved is:     2
-----------------------------------------------
```

Qualification Query 9

```
-----------------------------------------------

-- Query 09 - Var_0 Rev_01 - Product Type Profit Measure Query

Tag: Q9     Stream: -1    Sequence number: 3

select
nation,
o_year,
sum(amount) as sum_profit
from
(
select
n_name as nation,
year(o_orderdate) as o_year,
l_extendedprice * (1 - l_discount) - ps_supplycost * l_quantity as amount
from
tpcd.part,
tpcd.supplier,
tpcd.lineitem,
tpcd.partsupp,
tpcd.orders,
tpcd.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 '%green%'
) as profit
group by
nation,
o_year
order by
nation,
o_year desc

NATION                O_YEAR      SUM_PROFIT
-------------------------------------------------------------------
ALGERIA                 1998       31342867.235
ALGERIA                 1997       57138193.023
ALGERIA                 1996       56140140.133
ALGERIA                 1995       53051469.653
ALGERIA                 1994       53867582.129
ALGERIA                 1993       54942718.132
ALGERIA                 1992       54628034.713
ARGENTINA                 1998        30211185.708

… Additional rows deleted ….

UNITED STATES               1993        48029946.801
UNITED STATES               1992        48671944.498
VIETNAM                 1998       30442736.059
VIETNAM                 1997       50309179.794
VIETNAM                 1996       50488161.410
VIETNAM                 1995       49658284.612
VIETNAM                 1994       50596057.261
VIETNAM                 1993       50953919.152
VIETNAM                 1992       49613838.315


Number of rows retrieved is:    175
-----------------------------------------------
```

Qualification Query 10

```
-----------------------------------------------

-- Query 10 - Var_0 Rev_01 - Returned Item Reporting Query

Tag: Q10    Stream: -1    Sequence number: 18

select
c_custkey,
c_name,
sum(l_extendedprice * (1 - l_discount)) as revenue,
c_acctbal,
n_name,
c_address,
c_phone,
c_comment
from
tpcd.customer,
tpcd.orders,
tpcd.lineitem,
tpcd.nation
where
c_custkey = o_custkey
and l_orderkey = o_orderkey
and o_orderdate >= date ('1993-10-01')
and o_orderdate < date ('1993-10-01') + 3 month
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
fetch first 20 rows only

C_CUSTKEY  C_NAME              REVENUE         C_ACCTBAL
N_NAME          C_ADDRESS                      C_PHONE
C_COMMENT
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
----------
    57040  Customer#000057040              734235.245          632.870
JAPAN           Eioyzjf4pp                     22-895-641-3466
requests sleep blithely about the furiously i
   143347  Customer#000143347              721002.695          2557.470
EGYPT           1aReFYv,Kw4                    14-742-935-3718
fluffily bold excuses haggle finally after the u
    60838  Customer#000060838              679127.308          2454.770
BRAZIL          64EaJ5vMAHWJlBOxJklpNc2RJiWE   12-913-
494-9813  furiously even pinto beans integrate under the ruthless foxes;
ironic, even dolphins across the slyl
   101998  Customer#000101998              637029.567          3790.890
UNITED KINGDOM  01c9CILnNtfOQYmZj              33-593-
865-6378  accounts doze blithely! enticing, final deposits sleep blithely
special accounts. slyly express accounts pla
   125341  Customer#000125341              633508.086          4983.510
GERMANY         S29ODD6bceU8QSuuEJznkNaK       17-
582-695-5962  quickly express requests wake quickly blithely
    25501  Customer#000025501              620269.785          7725.040
ETHIOPIA        W556MXuoiaYCCZamJI,Rn0B4ACUGdkQ8DZ
15-874-808-6793  quickly special requests sleep evenly among the special
deposits. special deposi
   115831  Customer#000115831              596423.867          5098.100
FRANCE          rFeBbEEyk dl ne7zV5fDrmiq1oK09wV7pxqCgIc
16-715-386-3788  carefully bold excuses sleep alongside of the thinly idle
    84223  Customer#000084223              594998.024          528.650
UNITED KINGDOM  nAVZCs6BaWap rrM27N 2qBnzc5WBauxbA
33-442-824-8191  pending, final ideas haggle final requests. unusual, regular
asymptotes affix according to the even foxes.
    54289  Customer#000054289              585603.392          5583.020
IRAN            vXCxoCsU0Bad5JQI ,oobkZ        20-834-292-
4707  express requests sublate blithely regular requests. regular, even ideas
solve.
    39922  Customer#000039922              584878.113          7321.110
GERMANY         Zgy4s50l2GKN4pLDPBU8m342gIw6R  17-
147-757-8036  even pinto beans haggle. slyly bold accounts inte
     6226  Customer#000006226              576783.761          2230.090
UNITED KINGDOM  8gPu8,NPGkfyQQ0hcIYUGPIBWc,ybP5g,
33-657-701-3391  quickly final requests against the regular instructions wake
blithely final instructions. pa
     922  Customer#000000922              576767.533          3869.250
GERMANY         Az9RFaut7NkPnc5zSD2PwHgVwr4jRzq  17-
945-916-9648  boldly final requests cajole blith
   147946  Customer#000147946              576455.132          2030.130
ALGERIA         iANyZHjqhyy7Ajah0pTrYyhJ       10-886-
956-3143  furiously even accounts are blithely above the furiousl
   115640  Customer#000115640              569341.193          6436.100
ARGENTINA       Vtgfia9qI 7EpHgecU1X           11-411-543-
4901  final instructions are slyly according to the
    73606  Customer#000073606              568656.858          1785.670
JAPAN           xuR0Tro5yChDfOCrjkd2ol         22-437-653-
6966  furiously bold orbits about the furiously busy requests wake across the
furiously quiet theodolites. d
   110246  Customer#000110246              566842.981          7763.350
VIETNAM         7KzflgX MDOq7sOkI              31-943-426-
9837  dolphins sleep blithely among the slyly final
   142549  Customer#000142549              563537.237          5085.990
INDONESIA       ChqEoK43OysjdHbtKCp6dKqjNyvvi9 19-
955-562-2398  regular, unusual dependencies boost slyly; ironic attainments
nag fluffily into the unusual packages?
   146149  Customer#000146149              557254.987          1791.550
ROMANIA         s87fvzFQpU                     29-744-164-6487
silent, unusual requests detect quickly slyly regul
    52528  Customer#000052528              556397.351          551.790
ARGENTINA       NFztyTOR10UOJ                  11-208-192-
3205  unusual requests detect. slyly dogged theodolites use slyly. deposit
    23431  Customer#000023431              554269.536          3381.860
ROMANIA         HgiV0phqhaIa9aydNoIlb          29-915-458-
2654  instructions nag quickly. furiously bold accounts cajol


Number of rows retrieved is:     20
-------------------------------------------
```

Qualification Query 11

```
-------------------------------------------

-- Query 11 - Var_0 Rev_01 - Important Stock Identification Query

Tag: Q11    Stream: -1   Sequence number: 15

select
ps_partkey,
sum(ps_supplycost * ps_availqty) as value
from
tpcd.partsupp,
tpcd.supplier,
tpcd.nation
where
ps_suppkey = s_suppkey
and s_nationkey = n_nationkey
and n_name = 'GERMANY'
group by
ps_partkey having
sum(ps_supplycost * ps_availqty) > (
select
sum(ps_supplycost * ps_availqty) * 0.0001000000
from
tpcd.partsupp,
tpcd.supplier,
tpcd.nation
where
ps_suppkey = s_suppkey
and s_nationkey = n_nationkey
and n_name = 'GERMANY'
)
order by
value desc

PS_PARTKEY   VALUE
-----------------------------------
    129760        17538456.860
    166726        16503353.920
    191287        16474801.970
    161758        16101755.540
     34452       15983844.720
    139035        15907078.340

.... Additional rows removed ....

     27901        7892952.000
    128820         7892882.720
```

```
 25891          7890511.200
122819          7888881.020
154731          7888301.330
101674          7879324.600
 51968          7879102.210
 72073          7877736.110
  5182          7874521.730


Number of rows retrieved is:   1048
------------------------------------------------
```

Qualification Query 12

```
------------------------------------------------

-- Query 12 - Var_0 Rev_02 - Shipping Modes and Order Priority Query

Tag: Q12    Stream: -1   Sequence number: 22

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
tpcd.orders,
tpcd.lineitem
where
o_orderkey = l_orderkey
and l_shipmode in ('MAIL', 'SHIP')
and l_commitdate < l_receiptdate
and l_shipdate < l_commitdate
and l_receiptdate >= date ('1994-01-01')
and l_receiptdate < date ('1994-01-01') + 1 year
group by
l_shipmode
order by
l_shipmode

L_SHIPMODE  HIGH_LINE_COUNT  LOW_LINE_COUNT
------------------------------------------------
MAIL                6202          9324
SHIP                6200          9262


Number of rows retrieved is:      2
------------------------------------------------
```

Qualification Query 13

```
------------------------------------------------

-- Query 13 - Var_0 Rev_01 - Customer Distribution Query

Tag: Q13    Stream: -1   Sequence number: 10

select
c_count,
count(*) as custdist
from
(
select
c_custkey,
count(o_orderkey)
from
tpcd.customer left outer join tpcd.orders on
c_custkey = o_custkey
and o_comment not like '%special%requests%'
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       50004
      9        6641
     10        6566
     11        6058
      8        5949
     12        5553
     13        4989
     19        4748
      7        4707
     18        4625
     15        4552
     17        4530
     14        4484
     20        4461
     16        4323
     21        4217
     22        3730
      6        3334
     23        3129
     24        2622
     25        2079
      5        1972
     26        1593
     27        1185
      4        1033
     28         869
     29         559
      3         398
     30         373
     31         235
      2         144
     32         128
     33          71
     34          48
     35          33
      1          23
     36          17
     37           7
     40           4
     38           4
     39           2
     41           1


Number of rows retrieved is:     42
------------------------------------------------
```

Qualification Query 14

```
------------------------------------------------
--#SET ROWS_OUT -1 ROWS_FETCH -1
```

```
-- Query 14 - Var_0 Rev_01 - Promotion Effect Query

Tag: Q14    Stream: -1   Sequence number: 1

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
tpcd.lineitem,
tpcd.part
where
l_partkey = p_partkey
and l_shipdate >= date ('1995-09-01')
and l_shipdate < date ('1995-09-01') + 1 month

PROMO_REVENUE
---------------------
           16.381


Number of rows retrieved is:      1
-----------------------------------------------
```

Qualification Query 15

```
-----------------------------------------------

-- Query 15 - Var_a Rev_01 - Top Supplier Query

Tag: Q15a   Stream: -1   Sequence number: 16

with revenue (supplier_no, total_revenue) as (
select
l_suppkey,
sum(l_extendedprice * (1-l_discount))
from
tpcd.lineitem
where
l_shipdate >= date ('1996-01-01')
and l_shipdate < date ('1996-01-01') + 3 month
group by
l_suppkey
)
select
s_suppkey,
s_name,
s_address,
s_phone,
total_revenue
from
tpcd.supplier,
revenue
where
s_suppkey = supplier_no
and total_revenue = (
select
max(total_revenue)
from
revenue
)
order by
s_suppkey

S_SUPPKEY    S_NAME                 S_ADDRESS
S_PHONE         TOTAL_REVENUE
---------- ------------------------- ----------------------------------------
---------------
      8449  Supplier#000008449        Wp34zim9qYFbVctdW
20-469-856-8873          1772627.209


Number of rows retrieved is:      1
-----------------------------------------------
```

Qualification Query 16

```
-----------------------------------------------

-- Query 16 - Var_0 Rev_01 - Parts/Supplier Relationship Query

Tag: Q16    Stream: -1   Sequence number: 13

select
p_brand,
p_type,
p_size,
count(distinct ps_suppkey) as supplier_cnt
from
tpcd.partsupp,
tpcd.part
where
p_partkey = ps_partkey
and p_brand <> 'Brand#45'
and p_type not like 'MEDIUM POLISHED%'
and p_size in (49, 14, 23, 45, 19, 3, 36, 9)
and ps_suppkey not in (
select
s_suppkey
from
tpcd.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

P_BRAND    P_TYPE                    P_SIZE      SUPPLIER_CNT
---------- ------------------------- ----------- ------------
Brand#41   MEDIUM BRUSHED TIN                3           28
Brand#54   STANDARD BRUSHED COPPER          14           27
Brand#11   STANDARD BRUSHED TIN             23           24
Brand#11   STANDARD BURNISHED BRASS         36           24
Brand#15   MEDIUM ANODIZED NICKEL            3           24
Brand#15   SMALL ANODIZED BRASS             45           24
Brand#15   SMALL BURNISHED NICKEL            19           24
Brand#21   MEDIUM ANODIZED COPPER            3           24
Brand#22   SMALL BRUSHED NICKEL              3           24
Brand#22   SMALL BURNISHED BRASS             19           24

....Additional rows removed .....

Brand#25   MEDIUM BURNISHED COPPER          36           24
Brand#31   PROMO POLISHED COPPER            36           24
Brand#33   LARGE POLISHED TIN               23           24
Brand#33   PROMO POLISHED STEEL             14           24
Brand#35   PROMO BRUSHED NICKEL             14           24
Brand#41   ECONOMY BRUSHED STEEL             9           24
Brand#41   ECONOMY POLISHED TIN              19           24
```

```
Brand#41    LARGE PLATED COPPER          36          24
Brand#42    ECONOMY PLATED BRASS          3          24
Brand#33    SMALL ANODIZED BRASS          9           3
Brand#35    MEDIUM ANODIZED TIN          19           3
Brand#51    SMALL PLATED BRASS           23           3
Brand#52    MEDIUM BRUSHED BRASS         45           3
Brand#53    MEDIUM BRUSHED TIN           45           3
Brand#54    ECONOMY POLISHED BRASS        9           3
Brand#55    PROMO PLATED BRASS           19           3
Brand#55    STANDARD PLATED TIN          49           3


Number of rows retrieved is:  18314
------------------------------------------------
```

Qualification Query 17

```
------------------------------------------------

-- Query 17 - Var_0 Rev_01 - Small-Quantity-Order Revenue Query

Tag: Q17    Stream: -1   Sequence number: 6

select
sum(l_extendedprice) / 7.0 as avg_yearly
from
tpcd.lineitem,
tpcd.part
where
p_partkey = l_partkey
and p_brand = 'Brand#23'
and p_container = 'MED BOX'
and l_quantity < (
select
0.2 * avg(l_quantity)
from
tpcd.lineitem
where
l_partkey = p_partkey
)

AVG_YEARLY
----------------------
       348406.054


Number of rows retrieved is:     1
------------------------------------------------
```

Qualification Query 18

```
------------------------------------------------

-- Query 18 - Var_0 Rev_01 - Large Volume Customer Query

Tag: Q18    Stream: -1   Sequence number: 7

select
c_name,
c_custkey,
o_orderkey,
o_orderdate,
o_totalprice,
sum(l_quantity)
from
tpcd.customer,
tpcd.orders,
tpcd.lineitem
where
o_orderkey in (
select
l_orderkey
from
tpcd.lineitem
group by
l_orderkey having
sum(l_quantity) > 300
)
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
fetch first 100 rows only

C_NAME                 C_CUSTKEY    O_ORDERKEY
O_ORDERDATE  O_TOTALPRICE         6
------------------------------------------------------------------------------------------
------------------------
Customer#000128120          128120           4722021  1994-04-07
544089.090           323.000
Customer#000144617          144617           3043270  1997-02-12
530604.440           317.000
Customer#000013940           13940           2232932  1997-04-13
522720.610           304.000
Customer#000066790           66790           2199712  1996-09-30
515531.820           327.000
Customer#000046435           46435           4745607  1997-07-03
508047.990           309.000
Customer#000015272           15272           3883783  1993-07-28
500241.330           302.000

…. Additional rows deleted ……

Customer#000113131          113131            967334  1995-12-15
432957.750           301.000
Customer#000141098          141098            565574  1995-09-24
430986.690           301.000
Customer#000093392           93392           5200102  1997-01-22
425487.510           304.000
Customer#000015631           15631           1845057  1994-05-12
419879.590           302.000
Customer#000149842          149842           5156581  1994-05-30
411329.350           302.000
Customer#000010129           10129           5849444  1994-03-21
409129.850           309.000
Customer#000069904           69904           1742403  1996-10-19
408513.000           305.000
Customer#000017746           17746              6882  1997-04-09
408446.930           303.000
Customer#000013072           13072           1481925  1998-03-15
399195.470           301.000
Customer#000082441           82441            857959  1994-02-07
382579.740           305.000
Customer#000088703           88703           2995076  1994-01-30
363812.120           302.000


Number of rows retrieved is:     57
------------------------------------------------
```

Qualification Query 19

-- Query 19 - Var_0 Rev_01 - Discounted Revenue Query

Tag: Q19 Stream: -1 Sequence number: 19

```
select
sum(l_extendedprice* (1 - l_discount)) as revenue
from
tpcd.lineitem,
tpcd.part
where
(
p_partkey = l_partkey
and p_brand = 'Brand#12'
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#23'
and p_container in ('MED BAG', 'MED BOX', 'MED PKG', 'MED PACK')
and l_quantity >= 10 and l_quantity <= 10 + 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#34'
and p_container in ('LG CASE', 'LG BOX', 'LG PACK', 'LG PKG')
and l_quantity >= 20 and l_quantity <= 20 + 10
and p_size between 1 and 15
and l_shipmode in ('AIR', 'AIR REG')
and l_shipinstruct = 'DELIVER IN PERSON'
)
```

```
REVENUE
---------------------
      3083843.058


Number of rows retrieved is:     1
```

Qualification Query 20

-- Query 20 - Var_0 Rev_01 - Potential Part Promotion Query

Tag: Q20 Stream: -1 Sequence number: 4

```
select
s_name,
s_address
from
tpcd.supplier,
tpcd.nation
where
s_suppkey in (
select
ps_suppkey
from
tpcd.partsupp
where
ps_partkey in (
select
p_partkey
from
tpcd.part
where
p_name like 'forest%'
)
and ps_availqty > (
select
0.5 * sum(l_quantity)
from
tpcd.lineitem
where
l_partkey = ps_partkey
and l_suppkey = ps_suppkey
and l_shipdate >= date ('1994-01-01')
and l_shipdate < date ('1994-01-01') + 1 year
)
)
and s_nationkey = n_nationkey
and n_name = 'CANADA'
order by
s_name
```

```
S_NAME                    S_ADDRESS
--------------------------------------------------------------------------
Supplier#000000020        iybAE,RmTymrZVYaFZva2SH,j
Supplier#000000091
YV45D7TkfdQanOOZ7q9QxkyGUapU1oOWU6q3
Supplier#000000197        YC2Acon6kjY3zj3Fbxs2k4Vdf7X0cd2F
Supplier#000000226        83qOdU2EYRdPQAQhEtn GRZEd
Supplier#000000285        Br7e1nnt1yxrw6ImgpJ7YdhFDjuBf
Supplier#000000378        FfbhyCxWvcPrO8ltp9
Supplier#000000402        i9Sw4DoyMhzhKXCH9By,AYSgmD
Supplier#000000530        0qwCMwobKY OcmLyfRXlagA8ukENJv,
Supplier#000000688        D fw5ocppmZpYBBIPI718hCihLDZ5KhKX
Supplier#000000710        f19YPvOyb QoYwjKC,oPycpGfieBAcwKJo
Supplier#000000736        l6i2nMwVuovfKnuVgaSGK2rDy65DlAFLegiL7
Supplier#000000761        zlSLelQUj2XrvTTFnv7WAcYZGvvMTx882d4
Supplier#000000884        bmhEShejaS

.... Additional rows deleted ....

Supplier#000000887        urEaTejH5POADP2ARrf
Supplier#000000935        ij98czM 2KzWe7dDTOxB8sq0UfCdvrX
Supplier#000000975        ,AC e,tBpNwKb5xMUzeohxlRn,
hdZJo73gFQF8y
Supplier#000001263        rQWr6nf8ZhB2TAiIDIvo5Io
Supplier#000001399        LmrocnIMSyYOWuANx7
Supplier#000001446        lch9HMNU1R7a0LIybsUodVknk6
Supplier#000001454        TOpimgu2TVXIjhiL93h,
Supplier#000009862        rJzweWeN58
Supplier#000009868        ROjGgx5gvtkmnUUoeyy7v
Supplier#000009869
ucLqxzrpBTRMewGSM29t0rNTM30g1Tu3Xgg3mKag
Supplier#000009899        7XdpAHrzr1t,UQFZE
Supplier#000009974        7wJ,J5DKcxSU4Kp1cQLpbcAvB5AsvKT


Number of rows retrieved is:    204
```

Qualification Query 21

```
-- Query 21 - Var_0 Rev_01 - Suppliers Who Kept Orders Waiting Query

Tag: Q21    Stream: -1   Sequence number: 9

select
s_name,
count(*) as numwait
from
tpcd.supplier,
tpcd.lineitem l1,
tpcd.orders,
tpcd.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
tpcd.lineitem l2
where
l2.l_orderkey = l1.l_orderkey
and l2.l_suppkey <> l1.l_suppkey
)
and not exists (
select
*
from
tpcd.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 = 'SAUDI ARABIA'
group by
s_name
order by
numwait desc,
s_name
fetch first 100 rows only
```

S_NAME	NUMWAIT
Supplier#000002829	20
Supplier#000005808	18
Supplier#000000262	17
Supplier#000000496	17
Supplier#000002160	17
Supplier#000002301	17
Supplier#000002540	17
Supplier#000003063	17
Supplier#000005178	17
Supplier#000008331	17
Supplier#000002005	16
Supplier#000002095	16
Supplier#000005799	16
Supplier#000005842	16

… Additional rows deleted ….

Supplier#000000673	12
Supplier#000000762	12
Supplier#000000811	12
Supplier#000000821	12
Supplier#000001337	12
Supplier#000001916	12
Supplier#000001925	12
Supplier#000002039	12
Supplier#000002357	12
Supplier#000002483	12

Number of rows retrieved is: 100

Qualification Query 22

```
-- Query 22 - Var_0 Rev_01 - Global Sales Opportunity Query

Tag: Q22    Stream: -1   Sequence number: 12

select
cntrycode,
count(*) as numcust,
sum(c_acctbal) as totacctbal
from
(
select
substr(c_phone, 1, 2) as cntrycode,
c_acctbal
from
tpcd.customer
where
substr(c_phone, 1, 2) in
('13', '31', '23', '29', '30', '18', '17')
and c_acctbal > (
select
avg(c_acctbal)
from
tpcd.customer
where
c_acctbal > 0.00
and substr(c_phone, 1, 2) in
('13', '31', '23', '29', '30', '18', '17')
)
and not exists (
select
*
from
tpcd.orders
where
o_custkey = c_custkey
)
) as custsale
group by
cntrycode
order by
cntrycode
```

CNTRYCODE	NUMCUST	TOTACCTBAL
13	888	6737713.990
17	861	6460573.720
18	964	7236687.400
23	892	6701457.950
29	948	7158866.630
30	909	6808436.130
31	922	6806670.180

Number of rows retrieved is: 7

C.2 First 10 Rows of Test Database Tables

SELECT * FROM TPCD.REGION FETCH FIRST 10 ROWS ONLY

R_REGIONKEY R_NAME R_COMMENT

---

0 AFRICA special Tiresias about the furiously even dolphins are furi

1 AMERICA even, ironic theodolites according to the bold platelets wa

4 MIDDLE EAST furiously unusual packages use carefully above the unusual, exp

2 ASIA silent, bold requests sleep slyly across the quickly sly dependencies. furiously silent instructions alongside

3 EUROPE special, bold deposits haggle foxes. platelet

5 record(s) selected.

SELECT * FROM TPCD.NATION FETCH FIRST 10 ROWS ONLY

N_NATIONKEY N_NAME N_REGIONKEY N_COMMENT

---

0 ALGERIA 0 final accounts wake quickly. special reques

1 ARGENTINA 1 idly final instructions cajole stealthily. regular instructions wake carefully blithely express accounts. fluffi

2 BRAZIL 1 always pending pinto beans sleep sil

3 CANADA 1 foxes among the bold requests

4 EGYPT 4 pending accounts haggle furiously. furiously bold accounts detect. platelets at the packages haggle caref

5 ETHIOPIA 0 fluffily ruthless requests integrate fluffily. pending ideas wake blithely acco

6 FRANCE 3 even requests detect near the pendin

7 GERMANY 3 blithely ironic foxes grow. quickly pending accounts are b

8 INDIA 2 ironic packages should have to are slyly around the special, ironic accounts. iron

9 INDONESIA 2 unusual excuses are quickly requests. slyly ironic accounts haggle carefully above the pendin

10 record(s) selected.

SELECT * FROM TPCD.PART FETCH FIRST 10 ROWS ONLY

P_PARTKEY P_NAME P_MFGR P_BRAND P_TYPE P_SIZE P_CONTAINER P_RETAILPRICE P_COMMENT

10458 pink papaya coral green bisque Manufacturer#1 Brand#12 MEDIUM BRUSHED NICKEL 25 JUMBO DRUM +1.36845000000000E+003 blithely ironic depos

10487 puff seashell grey thistle ivory Manufacturer#4 Brand#45 ECONOMY ANODIZED NICKEL 30 MED BOX +1.39748000000000E+003 blithely unusual th

10601 chocolate deep maroon turquoise beige Manufacturer#4 Brand#45 PROMO PLATED STEEL 39 MED JAR +1.51160000000000E+003 quietly special fox

10615 chocolate navajo azure khaki peach Manufacturer#5 Brand#53 LARGE POLISHED STEEL 36 LG BAG +1.52561000000000E+003 pinto beans are f

10647 rose goldenrod lavender coral wheat Manufacturer#1 Brand#15 SMALL BRUSHED BRASS 28 JUMBO CASE +1.55764000000000E+003 unusual platelet

10740 honeydew antique lawn light yellow Manufacturer#2 Brand#24 SMALL ANODIZED NICKEL 20 JUMBO BAG +1.65074000000000E+003 fluffily fina

10761 brown navajo dark moccasin burlywood Manufacturer#2 Brand#25 PROMO POLISHED NICKEL 29 MED BOX +1.67176000000000E+003 boldly expre

10771 salmon khaki ghost magenta wheat Manufacturer#1 Brand#15 STANDARD BRUSHED STEEL 37 WRAP PACK +1.68177000000000E+003 ruthle

10773 cornflower spring smoke blush floral Manufacturer#3 Brand#31 SMALL BRUSHED COPPER 26 WRAP CASE +1.68377000000000E+003 final packages

10794 blush orchid dark rose olive Manufacturer#2 Brand#25 ECONOMY PLATED STEEL 13 SM BOX +1.70479000000000E+003 carefully

10 record(s) selected.

SELECT * FROM TPCD.SUPPLIER FETCH FIRST 10 ROWS ONLY

S_SUPPKEY S_NAME S_ADDRESS S_NATIONKEY S_PHONE S_ACCTBAL S_COMMENT

---------- ------------------------- -- ---------- --------------- ---------- --

43 Supplier#000000043 Z5mLuAoTUEeKY5v22VnnA4D87Ao6jF2LvMYnlX8h 12 22-421-568-4862 +7.77341000000000E+003 slyly final accounts wake blithely slyly regular requests. sl

89 Supplier#000000089 fhtzZcSorhud1 9 19-259-876-1014 +1.63802000000000E+003 bold, even instructions print carefully even courts. ironic,

98 Supplier#000000098 ogHn8dpXB5Q 21 31-914-775-1978 +5.87307000000000E+003 slyly regular requests mold slyly regular depo

122 Supplier#000000122 2RUSHHspScCVTWC6z vw2XVR 16 26-432-258-4986 +2.73295000000000E+003 fluffily silent asymptotes along the accounts ha

144 Supplier#000000144 f8tddEKps816HHqNwsKdn3 20 30-726-423-7363 +9.80629000000000E+003 even, fluffy somas cajole ironically. even instructions are after the bold deposits. silent ac

169 Supplier#000000169 ycymrfB5JV1vU,swPXggAt 13 23-698-509-1073 -9.27500000000000E+002 even, ironic packages boost regularly at the carefully unusual inst

178 Supplier#000000178 VJ9DInoVjbDg 16 26-471-122-2582 +4.69327000000000E+003 ironic ideas wake carefully. ironic packages wake carefully inside the blithely bold accounts.

232 Supplier#000000232 90YJjotHlfwyieaTfuBJ8kohU5Oc83bESout,p 7 17-478-427-3811 +3.00800000000000E+002 carefully express asymptotes use among the accounts: final foxes c

242 Supplier#000000242 cpZMlI77TRq 11 21-489-286-5908 +3.73664000000000E+003 quickly express deposits sleep furiously regular accounts. quickly even accounts above the slyl

244 Supplier#000000244 c6fBN9a 6EOcB1ZjbImMBAQMwI BKScDNVRP8 1 11-556-986-9638 +5.48908000000000E+003 fluffily pending requests haggle carefully express theodolite

10 record(s) selected.

SELECT * FROM TPCD.PARTSUPP FETCH FIRST 10 ROWS ONLY

PS_PARTKEY PS_SUPPKEY PS_AVAILQTY PS_SUPPLYCOST PS_COMMENT

---------- ---------- ---------- ---------------------- --

695 15000696 1343 +5.22150000000000E+002 quickly bold packages use quickly. even, careful deposits nag slyly above th

695 22500696 5336 +7.79460000000000E+002 furiously final ideas above the even instructions sleep above the foxes. carefully regular dolphins cajole. s

728 729 3215 +4.52100000000000E+002 carefully pending depths among the blithely fluffy ideas are across the furiously bold packages; carefully final packages use furiously p

728 7500729 4964 +1.56870000000000E+002 unusual, unusual packages against the final, special forges should nag blithely along the carefully regular packages. quickly final patterns boo

728 15000729 871 +3.95570000000000E+002 even ideas across the ruthlessly final deposits haggle against the quick asymptotes. packages haggle beneath the blithely special c

728 22500729 4646 +2.61170000000000E+002 foxes try to wake among the quickly pending requests. close, even deposi

949 950 1436 +4.34580000000000E+002 carefully ironic accounts use against the carefully even epitaphs: permane

949 7500950 8090 +5.63000000000000E+002 carefully silent accounts are. furiously regular accounts behind the unusual

949 15000950 1929 +9.64680000000000E+002 requests cajole slyly regular deposits. furiously regular excuses around the silent pinto beans haggle slyly even, unusual platelets. carefully final accounts above the dinos

949 22500950 9139 +7.87560000000000E+002 quickly ironic deposits affix. ironically final warhorses boost slyly among

10 record(s) selected.

SELECT * FROM TPCD.CUSTOMER FETCH FIRST 10 ROWS ONLY

C_CUSTKEY C_NAME C_ADDRESS C_NATIONKEY C_PHONE C_ACCTBAL C_MKTSEGMENT C_COMMENT

---------- ------------------------- -- ---------- --------------- ---------- ---------- --

2522 Customer#000002522 UxxF9Yc7bZs 7 17-369-270-8550 +6.08869000000000E+003 AUTOMOBILE even, ironic deposits boost furiously alongside of the pending excuses? unusual

deposits haggle a

2546 Customer#000002546 Oagdm2Z,gN3zVeeK28MJ,t3SBQnRK3pwCKaGk 22 32-950-755-3353 +7.91838000000000E+003 MACHINERY packages integrate. slyly regula

2552 Customer#000002552 pc8ZX2OIpv3cM9qTmfkWy20d0yDk 20 30-136-111-3822 +1.07045000000000E+003 BUILDING regular packages boost furiously. furiously ironic pinto beans cajole slyly regular

2612 Customer#000002612 vGNT,nmS4rhBf 2 12-982-176-5085 +8.87059000000000E+003 BUILDING furiously silent warhorses sleep fluffily blithely regula

2745 Customer#000002745 NW7hADgzVOBvy1 6 16-376-838-3915 +9.21143000000000E+003 MACHINERY slyly final accounts across the slyly fin

2760 Customer#000002760 rBp4g8qSuOUdGDJ7gcIWulqHomATSRpukHd 16 26-241-420-9650 +9.99634000000000E+003 AUTOMOBILE final theodolites haggle furiously express, regular frets. regular accounts boost quickly bold deposits. sl

2764 Customer#000002764 DJLmHNuxmdhMmNltdwUq J 4 14-746-536-6472 +4.13116000000000E+003 HOUSEHOLD final asymptotes according to the pending, thin attainments sleep furiously around the

2783 Customer#000002783 ,XqGFFo4OL7r 4OsI8U 17 27-823-508-3247 +5.44146000000000E+003 BUILDING blithely ironic dependencies wake blithely against the deposits. q

2817 Customer#000002817 mOvqMcQxlAkDjC 24 34-704-720-7916 +3.29690000000000E+003 BUILDING regular accounts are slyly blithely brave

2818 Customer#000002818 kT5VhlF3uJy9ujnfHniV88vbJ15craIrS0 3 13-337-313-1465 +1.99561000000000E+003 BUILDING even, ironic asymptotes against the carefully even packages caj

10 record(s) selected.

SELECT * FROM TPCD.ORDERS FETCH FIRST 10 ROWS ONLY

O_ORDERKEY O_CUSTKEY O_ORDERSTATUS O_TOTALPRICE O_ORDERDATE O_ORDERPRIORITY O_CLERK O_SHIPPRIORITY O_COMMENT

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116282625 204842695 F +1.95898140000000E+005 01/01/1992 1-URGENT Clerk#001461382 0 final, unusual deposits sle

116617313 60406789 F +2.13792500000000E+004 01/01/1992 1-URGENT Clerk#000531491 0 deposits sleep fluffily-- furiously pending ideas sleep caref

116660931 269963893 F +7.61070900000000E+004 01/01/1992 3-MEDIUM Clerk#000506275 0 special dolphins haggle furiously among the slyly unusual acc

117089280 260661967 F +1.71436360000000E+005 01/01/1992 3-MEDIUM Clerk#000771897 0 blithely pending excuses haggle even, regu

117819873 325654912 F +2.13069850000000E+005 01/01/1992 3-MEDIUM Clerk#000765632 0 ironic packages nag. unusual platelets above the quickly exp

118158434 269048983 F +9.28018600000000E+004 01/01/1992 3-MEDIUM Clerk#000334564 0 slyly even theodolites sleep carefully. slyly bold ideas sle

118583783 439042726 F +1.65580680000000E+005 01/01/1992 3-MEDIUM Clerk#001677410 0 special pinto beans cajole furiously with the perman

118662790 408822508 F +1.02909920000000E+005 01/01/1992 4-NOT SPECIFIED Clerk#002097125 0 ironic, even deposits are silently alo

118938087 302308940 F +2.19347010000000E+005 01/01/1992 4-NOT SPECIFIED Clerk#000332110 0 quickly pending theodolites boost slyly along the even instructions! r

118957604 255530776 F +2.31283440000000E+005 01/01/1992 2-HIGH Clerk#001986420 0 ironic instructions cajo

10 record(s) selected.

SELECT * FROM TPCD.LINEITEM FETCH FIRST 10 ROWS ONLY

L_ORDERKEY L_PARTKEY L_SUPPKEY L_LINENUMBER L_QUANTITY L_EXTENDEDPRICE L_DISCOUNT L_TAX L_RETURNFLAG L_LINESTATUS L_SHIPDATE L_COMMITDATE L_RECEIPTDATE L_SHIPINSTRUCT L_SHIPMODE L_COMMENT

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1078598085 423651126 11151141 3 +2.30000000000000E+001 +2.42866200000000E+004 +5.00000000000000E-002 +7.00000000000000E-002 A F 01/02/1992 03/11/1992 01/27/1992 NONE RAIL pending, regular requests a

1101872321 289078486 11578514 1 +4.40000000000000E+001 +6.38013200000000E+004 +6.00000000000000E-002 +4.00000000000000E-002 A F 01/02/1992 02/22/1992 01/18/1992 COLLECT COD RAIL ironic theodolit

```
        1112516355   425723721    13223736          4
+1.10000000000000E+001   +1.89578400000000E+004
+5.00000000000000E-002   +7.00000000000000E-002 R          F
01/02/1992 03/07/1992   01/11/1992    NONE                 RAIL       bold
attainmen

        1119399271   259483424    11983449          1
+3.30000000000000E+001   +4.60168500000000E+004
+4.00000000000000E-002   +7.00000000000000E-002 A          F
01/02/1992 03/29/1992   01/06/1992    DELIVER IN PERSON        MAIL
carefully exp

        1132148067   394221058    19221085          3
+1.60000000000000E+001   +1.53494400000000E+004
+6.00000000000000E-002   +8.00000000000000E-002 A          F
01/02/1992 03/26/1992   01/09/1992    DELIVER IN PERSON        RAIL
special requests affix

        1154011744   271215258    16215277          4
+3.00000000000000E+001   +3.47907000000000E+004
+2.00000000000000E-002   +5.00000000000000E-002 A          F
01/02/1992 02/20/1992   01/19/1992    TAKE BACK RETURN         REG
AIR    ironic excuses wake quickly through

        1158063846   195930206     930219          2
+6.00000000000000E+000   +7.35846000000000E+003
+1.00000000000000E-001   +7.00000000000000E-002 A          F
01/02/1992 02/18/1992   01/17/1992    COLLECT COD              AIR
regularly ironic deposit

        1163495716   307951012     451043          1
+9.00000000000000E+000   +9.42858000000000E+003
+1.00000000000000E-002   +2.00000000000000E-002 R          F
01/02/1992 02/23/1992   01/06/1992    NONE                 FOB        fluffily
regular platelets wake slyly. r

        1169854179   248708267    16208276          6
+3.20000000000000E+001   +4.04105600000000E+004
+6.00000000000000E-002   +6.00000000000000E-002 R          F
01/02/1992 03/10/1992   01/30/1992    DELIVER IN PERSON        SHIP
blithely ironic pinto

        1172045539   406026531    16026532          2
+4.10000000000000E+001   +5.89264300000000E+004
+2.00000000000000E-002   +6.00000000000000E-002 R          F
01/02/1992 03/09/1992   01/21/1992    NONE                 REG AIR
ironic instructions cajole qu


 10 record(s) selected.
```

C.3 Query Substitution Parameters

```
"Power stream    Seed = 131000328"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000328 as a seed to the RNG
Q1  DELTA       83
Q2  SIZE        3
   TYPE        BRASS
   REGION      MIDDLE EAST
Q3  SEGMENT     HOUSEHOLD
   DATE        1995-03-27
Q4  DATE        1997-03-01
Q5  REGION      AMERICA
   DATE        1993-01-01
Q6  DATE        1993-01-01
   DISCOUNT    0.06
   QUANTITY    25
Q7  NATION1     KENYA
   NATION2     UNITED STATES
Q8  NATION      UNITED STATES
   REGION      AMERICA
   TYPE        PROMO POLISHED BRASS
Q9  COLOR       turquoise
Q10 DATE        1994-12-01
Q11 NATION      BRAZIL
   FRACTION    0.0000000333
Q12 SHIPMODE1   SHIP
   SHIPMODE2   FOB
   DATE        1996-01-01
Q13 WORD1       express
   WORD2       accounts
Q14 DATE        1996-09-01
Q15 DATE        1993-05-01
Q16 BRAND       Brand#35
   TYPE        STANDARD ANODIZED
   SIZE1       2
   SIZE2       4
   SIZE3       22
   SIZE4       20
   SIZE5       3
   SIZE6       10
   SIZE7       36
   SIZE8       43
Q17 BRAND       Brand#51
   CONTAINER   SM BOX
Q18 QUANTITY    312
Q19 BRAND1      Brand#13
   BRAND2      Brand#32
   BRAND3      Brand#51
   QUANTITY1   7
   QUANTITY2   19
   QUANTITY3   26
Q20 COLOUR      moccasin
   DATE        1995-01-01
   NATION      INDONESIA
Q21 NATION      KENYA
Q22 I1          19
   I2          28
   I3          14
   I4          27
   I5          18
   I6          23
   I7          24

"Throughput Stream = 1    Seed = 131000329"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000329 as a seed to the RNG
Q1  DELTA       91
Q2  SIZE        41
   TYPE        NICKEL
   REGION      AMERICA
Q3  SEGMENT     AUTOMOBILE
   DATE        1995-03-12
Q4  DATE        1994-12-01
Q5  REGION      ASIA
   DATE        1994-01-01
Q6  DATE        1994-01-01
   DISCOUNT    0.04
   QUANTITY    25
Q7  NATION1     FRANCE
   NATION2     MOZAMBIQUE
Q8  NATION      MOZAMBIQUE
   REGION      AFRICA
   TYPE        PROMO BURNISHED BRASS
Q9  COLOR       snow
Q10 DATE        1993-09-01
Q11 NATION      MOROCCO
   FRACTION    0.0000000333
```

Q12 SHIPMODE1 FOB
SHIPMODE2 MAIL
DATE 1993-01-01
Q13 WORD1 express
WORD2 deposits
Q14 DATE 1996-12-01
Q15 DATE 1995-12-01
Q16 BRAND Brand#15
TYPE MEDIUM BURNISHED
SIZE1 8
SIZE2 37
SIZE3 16
SIZE4 32
SIZE5 13
SIZE6 14
SIZE7 12
SIZE8 48
Q17 BRAND Brand#52
CONTAINER SM PACK
Q18 QUANTITY 313
Q19 BRAND1 Brand#11
BRAND2 Brand#25
BRAND3 Brand#51
QUANTITY1 3
QUANTITY2 20
QUANTITY3 22
Q20 COLOUR almond
DATE 1994-01-01
NATION UNITED STATES
Q21 NATION FRANCE
Q22 I1 34
I2 27
I3 33
I4 15
I5 11
I6 31
I7 30

"Throughput Stream = 2 Seed = 131000330"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000330 as a seed to the RNG
Q1 DELTA 99
Q2 SIZE 28
TYPE TIN
REGION MIDDLE EAST
Q3 SEGMENT HOUSEHOLD
DATE 1995-03-29
Q4 DATE 1997-07-01
Q5 REGION EUROPE
DATE 1994-01-01
Q6 DATE 1994-01-01
DISCOUNT 0.09
QUANTITY 24
Q7 NATION1 UNITED KINGDOM
NATION2 INDIA
Q8 NATION INDIA
REGION ASIA
TYPE ECONOMY BRUSHED BRASS
Q9 COLOR sandy
Q10 DATE 1994-06-01
Q11 NATION CANADA
FRACTION 0.0000000333
Q12 SHIPMODE1 TRUCK
SHIPMODE2 SHIP
DATE 1997-01-01
Q13 WORD1 express
WORD2 deposits
Q14 DATE 1997-03-01
Q15 DATE 1993-09-01
Q16 BRAND Brand#45
TYPE ECONOMY POLISHED
SIZE1 9
SIZE2 10
SIZE3 48
SIZE4 29
SIZE5 43
SIZE6 45
SIZE7 38
SIZE8 31
Q17 BRAND Brand#54
CONTAINER SM CAN
Q18 QUANTITY 315
Q19 BRAND1 Brand#13
BRAND2 Brand#53
BRAND3 Brand#55
QUANTITY1 8
QUANTITY2 10
QUANTITY3 29
Q20 COLOUR khaki
DATE 1997-01-01
NATION KENYA
Q21 NATION UNITED KINGDOM
Q22 I1 16
I2 31
I3 32
I4 28
I5 10
I6 18
I7 25

"Throughput Stream = 3 Seed = 131000331"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000331 as a seed to the RNG
Q1 DELTA 107
Q2 SIZE 16
TYPE COPPER
REGION ASIA
Q3 SEGMENT AUTOMOBILE
DATE 1995-03-14
Q4 DATE 1995-03-01
Q5 REGION MIDDLE EAST
DATE 1994-01-01
Q6 DATE 1994-01-01
DISCOUNT 0.06
QUANTITY 24
Q7 NATION1 MOROCCO
NATION2 ALGERIA
Q8 NATION ALGERIA
REGION AFRICA
TYPE ECONOMY PLATED BRASS
Q9 COLOR red
Q10 DATE 1993-04-01
Q11 NATION MOZAMBIQUE
FRACTION 0.0000000333
Q12 SHIPMODE1 RAIL
SHIPMODE2 SHIP
DATE 1997-01-01
Q13 WORD1 express
WORD2 deposits
Q14 DATE 1997-07-01
Q15 DATE 1996-04-01
Q16 BRAND Brand#35
TYPE STANDARD BRUSHED
SIZE1 15
SIZE2 19
SIZE3 7
SIZE4 29
SIZE5 40
SIZE6 1
SIZE7 44

```
   SIZE8       28
Q17 BRAND      Brand#51
   CONTAINER   LG BOX
Q18 QUANTITY   312
Q19 BRAND1     Brand#25
   BRAND2      Brand#41
   BRAND3      Brand#44
   QUANTITY1   3
   QUANTITY2   11
   QUANTITY3   25
Q20 COLOUR     sienna
   DATE        1996-01-01
   NATION      EGYPT
Q21 NATION     MOZAMBIQUE
Q22 I1         25
   I2          20
   I3          18
   I4          17
   I5          16
   I6          22
   I7          19

"Throughput Stream = 4    Seed = 131000332"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000332 as a seed to the RNG
Q1  DELTA      115
Q2  SIZE       4
   TYPE        STEEL
   REGION      MIDDLE EAST
Q3  SEGMENT    FURNITURE
   DATE        1995-03-31
Q4  DATE       1997-10-01
Q5  REGION     AFRICA
   DATE        1994-01-01
Q6  DATE       1994-01-01
   DISCOUNT    0.04
   QUANTITY    25
Q7  NATION1    GERMANY
   NATION2     PERU
Q8  NATION     PERU
   REGION      AMERICA
   TYPE        ECONOMY ANODIZED BRASS
Q9  COLOR      peru
Q10 DATE       1994-01-01
Q11 NATION     EGYPT
   FRACTION    0.0000000333
Q12 SHIPMODE1  AIR
   SHIPMODE2   SHIP
   DATE        1997-01-01
Q13 WORD1      express
   WORD2       deposits
Q14 DATE       1997-10-01
Q15 DATE       1993-12-01
Q16 BRAND      Brand#15
   TYPE        LARGE BURNISHED
   SIZE1       7
   SIZE2       31
   SIZE3       15
   SIZE4       38
   SIZE5       36
   SIZE6       30
   SIZE7       41
   SIZE8       21
Q17 BRAND      Brand#53
   CONTAINER   LG PACK
Q18 QUANTITY   314
Q19 BRAND1     Brand#22
   BRAND2      Brand#24
   BRAND3      Brand#43
   QUANTITY1   9
   QUANTITY2   12
   QUANTITY3   21
Q20 COLOUR     dim
   DATE        1994-01-01
   NATION      CHINA
Q21 NATION     INDIA
Q22 I1         10
   I2          21
   I3          24
   I4          11
   I5          14
   I6          15
   I7          22

"Throughput Stream = 5    Seed = 131000333"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000333 as a seed to the RNG
Q1  DELTA      62
Q2  SIZE       42
   TYPE        NICKEL
   REGION      ASIA
Q3  SEGMENT    AUTOMOBILE
   DATE        1995-03-16
Q4  DATE       1995-07-01
Q5  REGION     AMERICA
   DATE        1994-01-01
Q6  DATE       1994-01-01
   DISCOUNT    0.09
   QUANTITY    24
Q7  NATION1    UNITED STATES
   NATION2     INDONESIA
Q8  NATION     INDONESIA
   REGION      ASIA
   TYPE        LARGE POLISHED STEEL
Q9  COLOR      olive
Q10 DATE       1994-10-01
Q11 NATION     PERU
   FRACTION    0.0000000333
Q12 SHIPMODE1  REG AIR
   SHIPMODE2   SHIP
   DATE        1997-01-01
Q13 WORD1      express
   WORD2       deposits
Q14 DATE       1998-01-01
Q15 DATE       1996-07-01
Q16 BRAND      Brand#55
   TYPE        PROMO PLATED
   SIZE1       13
   SIZE2       34
   SIZE3       19
   SIZE4       48
   SIZE5       40
   SIZE6       15
   SIZE7       17
   SIZE8       32
Q17 BRAND      Brand#55
   CONTAINER   LG CAN
Q18 QUANTITY   315
Q19 BRAND1     Brand#24
   BRAND2      Brand#12
   BRAND3      Brand#43
   QUANTITY1   4
   QUANTITY2   13
   QUANTITY3   28
Q20 COLOUR     peach
   DATE        1993-01-01
   NATION      INDIA
Q21 NATION     ALGERIA
Q22 I1         14
   I2          12
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   I3          21
   I4          15
   I5          17
   I6          30
   I7          32

"Throughput Stream = 6    Seed = 131000334"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000334 as a seed to the RNG
Q1  DELTA       71
Q2  SIZE        29
   TYPE        TIN
   REGION      AFRICA
Q3  SEGMENT     FURNITURE
   DATE        1995-03-02
Q4  DATE        1993-04-01
Q5  REGION      ASIA
   DATE        1995-01-01
Q6  DATE        1995-01-01
   DISCOUNT    0.07
   QUANTITY    24
Q7  NATION1     MOZAMBIQUE
   NATION2     ARGENTINA
Q8  NATION      ARGENTINA
   REGION      AMERICA
   TYPE        LARGE BURNISHED STEEL
Q9  COLOR       midnight
Q10 DATE        1993-07-01
Q11 NATION      ETHIOPIA
   FRACTION    0.0000000333
Q12 SHIPMODE1   SHIP
   SHIPMODE2   REG AIR
   DATE        1993-01-01
Q13 WORD1       special
   WORD2       packages
Q14 DATE        1993-04-01
Q15 DATE        1994-04-01
Q16 BRAND       Brand#35
   TYPE        SMALL BRUSHED
   SIZE1       25
   SIZE2       28
   SIZE3       36
   SIZE4       11
   SIZE5       29
   SIZE6       14
   SIZE7       41
   SIZE8       15
Q17 BRAND       Brand#52
   CONTAINER   MED BOX
Q18 QUANTITY    313
Q19 BRAND1      Brand#31
   BRAND2      Brand#45
   BRAND3      Brand#32
   QUANTITY1   9
   QUANTITY2   14
   QUANTITY3   25
Q20 COLOUR      blue
   DATE        1996-01-01
   NATION      UNITED KINGDOM
Q21 NATION      PERU
Q22 I1          34
   I2          17
   I3          16
   I4          15
   I5          20
   I6          21
   I7          23

"Throughput Stream = 7    Seed = 131000335"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000335 as a seed to the RNG
Q1  DELTA       79
Q2  SIZE        17
   TYPE        COPPER
   REGION      ASIA
Q3  SEGMENT     MACHINERY
   DATE        1995-03-18
Q4  DATE        1995-11-01
Q5  REGION      EUROPE
   DATE        1995-01-01
Q6  DATE        1995-01-01
   DISCOUNT    0.04
   QUANTITY    25
Q7  NATION1     INDIA
   NATION2     CHINA
Q8  NATION      CHINA
   REGION      ASIA
   TYPE        MEDIUM BRUSHED STEEL
Q9  COLOR       lime
Q10 DATE        1994-04-01
Q11 NATION      CHINA
   FRACTION    0.0000000333
Q12 SHIPMODE1   MAIL
   SHIPMODE2   REG AIR
   DATE        1993-01-01
Q13 WORD1       special
   WORD2       packages
Q14 DATE        1993-08-01
Q15 DATE        1996-11-01
Q16 BRAND       Brand#15
   TYPE        ECONOMY ANODIZED
   SIZE1       16
   SIZE2       37
   SIZE3       19
   SIZE4       27
   SIZE5       14
   SIZE6       10
   SIZE7       9
   SIZE8       42
Q17 BRAND       Brand#54
   CONTAINER   MED PACK
Q18 QUANTITY    314
Q19 BRAND1      Brand#33
   BRAND2      Brand#23
   BRAND3      Brand#31
   QUANTITY1   4
   QUANTITY2   15
   QUANTITY3   21
Q20 COLOUR      magenta
   DATE        1994-01-01
   NATION      JORDAN
Q21 NATION      INDONESIA
Q22 I1          33
   I2          25
   I3          20
   I4          15
   I5          21
   I6          19
   I7          27

"Throughput Stream = 8    Seed = 131000336"
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 131000336 as a seed to the RNG
Q1  DELTA       87
Q2  SIZE        5
   TYPE        STEEL
   REGION      AFRICA
Q3  SEGMENT     BUILDING
   DATE        1995-03-04
Q4  DATE        1993-08-01
```

Q5 REGION MIDDLE EAST
DATE 1995-01-01
Q6 DATE 1995-01-01
DISCOUNT 0.02
QUANTITY 24
Q7 NATION1 ALGERIA
NATION2 IRAN
Q8 NATION IRAN
REGION MIDDLE EAST
TYPE MEDIUM PLATED STEEL
Q9 COLOR khaki
Q10 DATE 1993-02-01
Q11 NATION FRANCE
FRACTION 0.0000000333
Q12 SHIPMODE1 TRUCK
SHIPMODE2 REG AIR
DATE 1993-01-01
Q13 WORD1 special
WORD2 packages
Q14 DATE 1993-11-01
Q15 DATE 1994-07-01
Q16 BRAND Brand#55
TYPE STANDARD PLATED
SIZE1 12
SIZE2 47
SIZE3 42
SIZE4 6
SIZE5 10
SIZE6 1
SIZE7 46
SIZE8 21
Q17 BRAND Brand#51
CONTAINER MED CAN
Q18 QUANTITY 312
Q19 BRAND1 Brand#35
BRAND2 Brand#11
BRAND3 Brand#35
QUANTITY1 10
QUANTITY2 16
QUANTITY3 28
Q20 COLOUR thistle
DATE 1993-01-01
NATION BRAZIL
Q21 NATION ARGENTINA
Q22 I1 28
I2 20
I3 14
I4 32
I5 24
I6 16
I7 17

Appendix D: Implementation Specific Layer and Driver Source Code

D.1 tpcdbatch.h

```
/************************************************************************
*
*   TPCDBATCH.H
*
*  Revision History:
*
*  27 may 99 bbe from (24 nov 98 jen) fixNTtimestamp - fixed NT
timestamp to print millisecond correctly
*  27 may 99 bbe from (10 dec 98 jen) SUN - added Haider's changes
necessary for SUN
*  17 jun 99 jen  Increased version to 5.1
*  10 aug 99 bbe  Increased version to 5.2
*  13 aug 99 bbe  Increased version to 5.3
************************************************************************/

/** Necessary header files **/

/** System header files **/
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <math.h>
#include <fcntl.h>              /* SUN bbe */

#include <time.h>
#include <ctype.h>
#if (defined(SQLAIX) || defined(SQLPTX) || defined(LINUX) ||
defined(SQLHP))
#include <unistd.h>             /* SUN */
#include <sys/stat.h>             /* SUN */
#endif
#if ((defined(SQLAIX) || defined(SQLPTX)) && !defined(LINUX))
#include <sys/vnode.h>              /* SUN */
#endif
#ifndef SQLWINT
#include <sys/time.h>                           /*@d33143aha*/
#include <sys/ipc.h>
#include <sys/sem.h>
#if (!defined(SQLPTX) && !defined(LINUX)&& !defined(SQLHP))
#include <sys/mode.h>
#endif
#include <sys/timeb.h>
#include <sys/types.h>
#else
#include <windows.h>
#include <sys\timeb.h>
#endif
#include <errno.h>


/** External header files **/
#include "sqlda.h"
#include "sqlenv.h"
#include "sql.h"
#include "sqlmon.h"
#include "sqlca.h"
#include "sqlutil.h"
#include "sqlcodes.h"

/** Internal header files **/
/** #ifdef __cplusplus **/
/** #include "sqlz.h" **/
/** #include "sqlzcopy.h" **/
/** #endif **/


/************************************************************************
*********/
/* Define synonyms here                                                 */
/************************************************************************
*********/
#define TPCDBATCH_VERSION "5.6"

#define TPCDBATCH_NONSQL      10                        /* @d23684 tjg
*/
#define TPCDBATCH_SELECT      20
#define TPCDBATCH_NONSELECT   30
#define TPCDBATCH_EOBLOCK     40                        /* @d30369 tjg
*/
#define TPCDBATCH_INSERT      50
#define TPCDBATCH_DELETE      60

#define TPCDBATCH_MAX_COLS    100                       /* @d30369
tjg */

#define TPCDBATCH_CHAR char

#define TPCDBATCH_PRINT_FLOAT_WIDTH  20
  /* kmw - allow 15 whole digit for %#.3f format */
  /*     - note: use > 18, size of long indentifier so that it will */
  /*       be larger than any column heading                        */
#define TPCDBATCH_PRINT_FLOAT_MAX    1e15  /* kmw */
/* #define TPCD_PREPARETIME 1 */      /* for separate prep/exec on uf
jen 1106 */

#ifdef SQLWINT
#define PATH_DELIM '\\'
#define sleep(a) Sleep((a)*1000)
#else
#define PATH_DELIM '/'
#endif

#define PARALLEL_UPDATES 1

#ifdef PARALLEL_UPDATES
#define UF1OUTSTREAMPATTERN "%s%cuf1.%02d.%d.out"
#ifdef TPCD_NONPARTITIONED
#define UF2OUTSTREAMPATTERN "%s%cuf2.%02d.%d.out"
#else
/* kelly add same as NONPART. */
#define UF2OUTSTREAMPATTERN "%s%cuf2.%02d.%d.out"
/*  kelly ... take this out ... should be same name as for non-paritioned
#define UF2OUTSTREAMPATTERN "%s%cuf2.%02d.%d.%d.out"   */
/*DELjen add delchunk*/
#endif
#define BUFSIZE 1024
#endif
```

```
#define T_STAMP_FORM_1 1
#define T_STAMP_FORM_2 2
/* jen TIME_ACC start */
#define T_STAMP_FORM_3 3
#define T_STAMP_1LEN 17
#if defined (SQLUNIX) || defined (SQLAIX)
#define T_STAMP_3LEN 24
#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
#define T_STAMP_3LEN 21    /* WIN NT timestamp fix bbe */
#else
#error Unknown operating system
#endif
/* jen TIME_ACC start */



#define BLANKS      "\0"
#define READMODE    "r\0"
#define WRITEMODE   "w\0"
#define APPENDMODE  "a\0"
#define mem_error(xx)                                   \
{ fprintf(stderr,"\n--Out of memory when %s.\n",xx); }
/* Display out-of-memory and end */

#define     TPCDBATCH_MIN(x,y)       ((x) < (y) ? (x) : (y))
/** Returns the smaller of both x and y **/
#define     TPCDBATCH_MAX(x,y)       ((x) > (y) ? (x) : (y))  /* @d22817
tjg */
/** Returns the larger of both x and y **/




/** Defines needed for decimal conversion **/
#define SQLZ_DYNLINK
#define TRUE 1
#define LEFT 1
#define RIGHT 0
#define FALSE 0
#define sqlrx_get_left_nibble(byte) (((unsigned char)(byte)) >> 4)

#define sqlrx_get_right_nibble(byte) ((unsigned char) (byte & '\x0f'))
#define SQL_MAXDECIMAL        31
#define  SQLRX_PREFERRED_PLUS  0x0c

/** Timer-necessary defines for portability **/
#if (defined (SQLOS2) || defined(SQLWINT)) || defined(SQLWIN) ||
defined(SQLDOS)
typedef struct timeb Timer_struct;
#elif (defined (SQLUNIX) || defined(SQLAIX))              /*TIMER jen*/
typedef struct timeval Timer_struct;
#else
#error Unknown operating system
#endif

/* sleep time between starting subsequent tpcdbatches running UF1 and UF2
*/
#define UF1_SLEEP 1
#define UF2_SLEEP 1
#define UF_DEADLOCK_SLEEP 1 /* sleep between deadlock retries in
UF1,UF2 */

#define MAXWAIT 50 /* maximum retries for deadlock encounters */

#define DEBUG 0    /* to be set to 1 for diagnostic purposes if needed */
/* #define UF1DEBUG 1   */
/* #define UF2DEBUG 1   */
```

D.2 tpcdbatch.sqc

```
/*************************************************************
**********
*
*   TPCDBATCH.SQC
*
*  Revision History:
*
*  21 Dec 95 jen  Corrected calculation of geometric mean to include in the
*              count of statements the update functions.
*  03 Jan 96 jen  Corrected calculation of arithmetic mean to not include the
*              timings for the update functions. (only want query timings
*              as part of arithmetic mean)
*  15 Jan 96 jen  Added extra timestamps to the update functions.
*  22 Jan 96 jen  Get rid of checking of short_time....we always use the long
*              timings.
*              Fixed timings to print query/uf times rounded up to 0.1 seconds
*              and uses these rounded time values in subsequent calculations
*              Fixed bug where last seed in mseedme file wasn't getting read
*              correctly - EOF processing done too soon.
*
*  22 Feb 96 kbs  port to NT
*  26 Mar 96 kbs  Fix to avoid countig UFs as queries for min max
*  27 Jun 97 wlc Temporarily fixed deadlock problems when doing UF1,
UF2
*  30 Jul 97 wlc Add in support for load_update and
TPCD_SPLIT_DELETES
*  13 Aug 97 wlc fixed UF1 log file formatting problem,
*               using TPCD_TMP_DIR for temp files instead of /tmp,
*               make summary table fit in 80-column,
*               fixed UF2 # of deleted rows reporting problem
*  18 Aug 97 wlc added command line support for inlistmax
*  20 Aug 97 wlc added support for runthroughput without UF
*  27 Aug 97 aph Replaced hardcoded 'tpcdaudit' with
getenv("TPCD_AUDIT_DIR")
*  05 Sep 97 wlc fixing free() problem in NT
*  26 Sep 97 kmw change FLOAT processing in echo_sqlda and
print_headings
*  10 oct 97 jen  add lock table in share mode for staging tables
*  21 oct 97 jen added explicit rollback on failure of uf1
*  27 oct 97 jen don't update TPCD.xxxx.update.pair.num if not running UFs
in
*              throughput run
*  01 nov 97 jen temp code to do a prep then execute stmt in UFs so we can
*              get timings
*  03 nov 97 jen realligned UF code for readablility
*              pushed UF2 commit into loop for inlistmax
*              fixed UF2 code so rollback performed
*  04 nov 97 jen Added code to handle vldb
*  06 nov 97 jen Commented out temp code for prep then execute stmts using
*              TPCD_PREPARETIME def
*              Updated version number to 2.2
*              send all output during update functiosn to output files, not
*              stderr
*  10 nov 97 jen jenCI Updated version number to 2.3
*              Added handling of TPCD_CONCURRENT_INSERTS. Change
control of
*              chunk processing to use the concurrent_inserts value as the
*              control.  Now the inserts will be run in
TPCD_CONCURRENT_INSERTS
*              sets, each having concurrent_inserts/
*  13 nov 97 jen jen DEADLOCK.  FIxed bug that Alex found where
deadlock count
*              (maxwait) was incremented on every execution of the stmt as
*              opposed to just when deadlock really happened.
*  14 nov 97 jen jenSEM - fix up error reporting on semaphore failure
*              sem_op now returns failure to caller so caller can report where
*              failure has happened.
*              Forced dbname to be upper case, an all other parts of update
```

```
*               pair number to be lowercase
*  15 nov 97 jen SEED Reworked code to grab the seed from the seed file.
Now
*               reusing seeds between runs, so power run will always use first
*               seed, throughput will use the 2nd - #stream+1 seeds
*
*  13 jan 98 jen LONG  Increase stmt_str to be able to hold inlists with larger
*               order key numbers
*  04 mar 98 jen IMPORT added support for TPCD_UPDATE_IMPORT to
chose whether
*               using import or load api's for loading data into the staging
*               tables
*  04 mar 98 jen TIMER changed from using gettimer to gettimeofday for
unix
*  01 apr 98 jen Fixed IMPORT code to do the proper checking on strcmp (ie
!strcmp)
*  01 apr 98 jen removed code to handle vldb - not needed
*               Upgraded version to 2.4         for ( chunk
*  01 apr 98 jen Fixed up import code on NT so the variable is recognized in
the
*               children
*  25 may 98 sks Reworked some of the environment variable code so
consolidate as
*               much as possible.  Not all complete because of differences in
*               the way nt and AIX calls (and starts stuff in background) for UFs
*  29 may 98 jen REUSE_STAGE Changed UF1 so we reuse the same
staging tables
*               instead of having a new set for each update pair
*  06 jul 98 jen Removed locking of staging tables since they are created
with
*               locksize table now
*  06 jul 98 jen 912RETRY - added code to retry query execution on 912 as
well
*               as 911
*  07 jul 98 jen Fixed summary_table() so 1000x adjustment not based on UF
(setting
*               of max and min pointers
*               Added generic SleepSome function to handle NT vs AIX sleep
differences
*  01 apr 98 djd Added change to permit the use of table functions for UF1.
*               to enable this set TPCD_UPDATE_IMPORT to tf in
TPCD.SETUP file.
*               MERGED this into base copy on Jul 07
*  10 jul 98 jen haider's fix for 'outstream' var for error processing in
*               runUF1_fn and runUF2_fn
*               Updated version to 2.5
*  25 sep 98 jen Added stream number printing into mpqry* files and
increases
*               accuracy of timestamp in mpqry (and mts*qry*) files
*  06 oct 98 jen TIME_ACC Added accuracy of timestamp in mpqry (and
mts*qry*)
*               files. Cleaned up misuse of Sleep and flushed buffers on
*               deadlocks
*  19 oct 98 kbs fix UF2_fn to correctly count rows deleted in case of
deadlock
*  20 oct 98 kbs rewrite UF2 and UF2_fn for static SQL with staging table
*  23 oct 98 jen Cleaned up retrying of order/lineitem on lineitem deadlock in
UF1
*  24 oct 98 jen Used load_uf1 and load_uf2 instead of general load_updates
*  26 oct 98 kbs inject the UF1 with a single staging table
*  02 nov 98 jen Fixed processing of multiple chunks in uf2 so don't
duplicate
*  21 nov 98 kmw Fixed BIGINT
*  05 dec 98 aph Moved runUF1_fn() and runUF2_fn() into a separate file
tpcdUF.sqc
*               so that it can be bound separately with a different isolation level.
*  21 dec 98 aph Integrated Jennifer's QppD calculation (rounding &
adjustment) fixes.
*  22 dec 98 aph For UFs during Throughput run, defer CONNECT until
children launched.
*  28 dec 98 aph Removed error_check() call after CONNECT RESET
*  29 dec 98 aph For UFs do not COMMIT in tpcdbatch.sqc.  COMMITs
happen in tpcdUF.sqc.
*  18 jan 99 kal replaced header with #include "tpcdbatch.h"
*  27 may 99 bbeaton from (03 mar 99 jen) Fixed SUN fix that wasn't
compatible with
*               NT (using %D %T instead of %x %X for strftime)
*  16 jun 99 jen Added missing LPCTSTR cast of semaphore file name for
NT
*  17 jun 99 jen SEMA Changes semaphore file for update functions to look
for tpcd.setup
*               not for the orders.***  update data file
*  21 jul 99 bbeaton Added semaphore control that allows runpower to be run
as two
*               separate streams (update and query).  This involves the use of
*               two semaphores to be used as it executes in three different
*               sections.  The first is the update inserts.  The next is the query
*               stream which is started with the update stream, but waits until
*               the inserts are complete.  The third section is the update deletes
*               which execute after the queries are complete.
*  21 jul 99 bbeaton Added functions to handle semaphore creation, control,
etc.
*  21 jul 99 bbeaton Modified output to mp*inter files.  It now only outputs
*               intermediate data that will be calculated by calcmetricp.pl.  This
*               is a result of the runpower being split into two streams and thus
*               tpcdbatch not having access to all data.
*  21 jul 99 bbeaton The start time for runpower UF2 now does not start until
after
*               the query stream is complete so that its wait time is not included
*               NOTE: The wait time that the first UF1 in runthroughput still
*               includes the wait period that occurs waiting on queries.
****************************************************************
****************/

/* included in tpcdbatch.sqc and tpcdUF.sqc */

#include "tpcdbatch.h"

/****************************************************************
***************/
/* global structure containing elements passed between different functions */
/****************************************************************
***************/
struct global_struct
{
  struct stmt_info     *s_info_ptr;          /* ptr to stmt_info list       */
  struct stmt_info     *s_info_stop_ptr;     /* ptr to last struct in list  */
  struct comm_line_opt *c_l_opt;             /* ptr to comm_line_opt struct */
  struct ctrl_flags    *c_flags;             /* ptr to ctrl_flags struct    */
  Timer_struct         stream_start_time;    /* start time for stream
TIME_ACC */
  Timer_struct         stream_end_time;      /* end time for stream
TIME_ACC  */
  char                 file_time_stamp[50];  /* time stamp for output files */
  double               scale_factor;         /* scale factor of database    */
  char                 run_dir[150];         /* directory for output files  */
  int                  copy_on_load;         /* indication of whether or not */
                                             /* to do use a copy directory   */
                                             /* (equiv to COPY YES) on load  */
                                             /* default is FALSE */
  long                 lSeed;                /* seed used to generate the    */
                                             /* queries for this particular  */
                                             /* run.                         */
  FILE                 *stream_list;         /* ptr to query list file      */
  char                 update_num_file[150]; /* name of file that keeps track */
                                             /* of which update pairs have run*/
  char                 sem_file[150];        /* semaphore name */
  char                 sem_file2[150];       /* semaphore name bbe */
  FILE                 *stream_report_file;  /* file to report start stop */
                                             /* progress of the stream */
```

```
};


/************************************************************
*********/
/* New type declaration to store details about SQL statement        */
/************************************************************
*********/

struct stmt_info
{
  long            max_rows_fetch;
  long            max_rows_out;
  int            query_block;                    /* @d30369 tjg */
  unsigned int      stmt_num;                      /* @d24993 tjg */
  double           elapse_time;                    /* @d24993 tjg */
  double           adjusted_time;
  char            start_stamp[50];      /* start time stamp for block  */
  char            end_stamp[50];       /* end time stamp for block    */
  char            tag[50];            /* block tag                */
  char            qry_description[100];
  struct stmt_info    *next;                      /* @d24993 tjg */

};


/************************************************************
*********/
/* Structure containing command line options                        */
/************************************************************
*********/
struct comm_line_opt
{                                       /* @d22275 tjg */

  char             str_file_name[256];    /* output filename    */
  char             infile[256];     /* input filename     */
  int             intStreamNum;    /* integer version of stream number */
  int             a_commit;       /* auto-commit flag   */
  int             short_time;     /* time interval flag */
  int             update;
  int             outfile;
};


/************************************************************
*********/
/* Structure used to hold precision for decimal numbers             */
/************************************************************
*********/
struct declen
{/* kmw */
  unsigned char m;       /* # of digits left of decimal */
  unsigned char n;       /* # of digits right of decimal */
};


/************************************************************
*********/
/* Structure containing control flags passed between functions      */
/************************************************************
*********/
struct ctrl_flags
{                                       /* @d25594 tjg */
  int eo_infile;
  int time_stamp;
  int eo_block;                                 /* @d30369 tjg */
  int select_status;
};
```

```
/************************************************************
*********/
/* Function Prototypes                                              */
/************************************************************
*********/
int SleepSome( int amount );
int get_env_vars(void);
int Get_SQL_stmt(struct global_struct *g_struct);

void print_headings (struct sqlda *sqlda, int *col_lengths);  /* @d22817 tjg
*/
void echo_sqlda(struct sqlda *sqlda, int *col_lengths);
void allocate_sqlda(struct sqlda *sqlda);

void get_start_time(Timer_struct *start_time);
double get_elapsed_time (Timer_struct *start_time);

long error_check(void);                                 /* @d28763 tjg */
void dumpCa(struct sqlca*);       /*kmw*/

void display_usage(void);
char *uppercase(char *string);
char *lowercase(char *string);
void comm_line_parse(int agrc, char *argv[], struct global_struct *g_struct);
int sqlrxd2a(char *decptr,char *asciiptr,short prec,short scal);
void init_setup(int argc, char *argv[], struct global_struct *g_struct);
void runUF1( struct global_struct *g_struct, int updatePair );
void runUF2( struct global_struct *g_struct, int updatePair );

/* These need to be extern because they're in another SQC file.   aph 981205
*/
/*extern void runUF1_fn( int updatePair, int i );*/               /* aph 981205 */
/*extern void runUF2_fn( int updatePair, int i, int numChunks );*/ /* aph
981205 */
/* Added four new arguments because SQL host vars can't be global.  aph
981205 */
extern void runUF1_fn ( int updatePair, int i, char *dbname, char *userid,
char *passwd );
extern void runUF2_fn ( int updatePair, int thisConcurrentDelete, int
numChunks, char *dbname, char *userid, char *passwd );

int sem_op (int semid, int semnum, int value);

char *get_time_stamp(int form, Timer_struct *timer_pointer);      /*
TIME_ACC jen */
void summary_table (struct global_struct *g_struct);
void free_sqlda (struct sqlda *sqlda, int select_status);     /* @d30369 tjg */
void output_file(struct global_struct *g_struct);
int PreSQLprocess(struct global_struct *g_struct, Timer_struct *start_time);
void SQLprocess(struct global_struct *g_struct);
int PostSQLprocess(struct global_struct *g_struct, Timer_struct *start_time);
int cleanup(struct global_struct *g_struct);

/* Semaphore control functions */
void create_semaphores(struct global_struct *g_struct);
void throughput_wait(struct global_struct *g_struct);
void runpower_wait(struct global_struct *g_struct, int sem_num);
void release_semaphore(struct global_struct *g_struct, int sem_num);
#ifdef SQLWINT
HANDLE open_semaphore(struct global_struct *g_struct, int num);
#else
int open_semaphore(struct global_struct *g_struct);
#endif


EXEC SQL INCLUDE SQLCA;

/************************************************************
******/
/* Declare the SQL host variables.                                  */
```

```
/*************************************************************
******/
EXEC SQL BEGIN DECLARE SECTION;

char    stmt_str1[4000] = "\0";      /* Assume max SQL statment
                                of 4000 char  */
struct {                          /* jen LONG */
       short len;
       char data[32700];
      } stmt_str;                 /* jen LONG */
char    dbname[9] = "\0";
char    userid[9] = "\0";
char    passwd[9] = "\0";
char    sourcefile[256];            /* used for semaphores and table functions?*/
sqlint32 chunk = 0;               /* jenCI counter for within the set of chunks*/

EXEC SQL END DECLARE SECTION;


/*************************************************************
******/
/* Declare the global variables.                             */
/*************************************************************
******/
struct sqlda   *sqlda;                  /* SQL Descriptor area  */

/* Global environment variables (sks May 25 98)*/
char env_tpcd_dbname[100];
char env_user[100];
char env_tpcd_audit_dir[150];
char env_tpcd_path_delim[2];
char env_tpcd_tmp_dir[150];
char env_tpcd_run_on_multiple_nodes[10];
char env_tpcd_copy_dir[150];
char env_tpcd_update_import[10];

/* Other globals */
FILE            *instream, *outstream;  /* File pointers             */
int             verbose = 0;            /* Verbose option flag       */
int             semcontrol = 1;         /* allows/disallows smaphores usage */
int             updatePairStart;        /* update pair to start at   */
int             currentUpdatePair;      /* update pair running       */
int             updatePairStop;         /* update pair to stop before */
char            newtime[50]="\0";       /* Des - moved from get_time_stamp */
char            outstreamfilename[256]; /* store filename of outstream
                                        wlc 081397 */
int             inlistmax = 400;        /* define # of keys to delete at a time
                                        wlc 081897 */
int             sqlda_allocated = 0;    /* fixing free() problem in NT
                                        wlc 090597 */
int             iImportStagingTbl=0;    /* IMPORT use import or load (default)
*/
char            temp_time_stamp[50];    /* holds end timestamp to be copied
into start_time_stamp of next query bbeaton */
Timer_struct      temp_time_struct;       /* holds end time value to be copied
into start_time of next query bbeaton */

/* constants for the semaphores used; 1 for throughput and 2 for power */
#define INSERT_POWER_SEM 1
#define QUERY_POWER_SEM 2
#define THROUGHPUT_SEM 1

/*************************************************************
******/
/* Start main program processing.                            */
/*************************************************************
******/
int main(int argc, char *argv[])
{
  struct comm_line_opt c_l_opt = { "\0","\0", 0, 1, 0, 0, 0 };
  /* command line options         */
  Timer_struct        start_time;         /* start point for elapsed time */


  struct stmt_info     s_info = { -1, -1, 0, 1, -1, -1, "\0", "\0", "\0", "\0", NULL
};
  /* first stmt_info structure */

  struct ctrl_flags    c_flags = { 0, 1, 0, TPCDBATCH_SELECT };
  /* structure holding ctrl flags
     passed between functions  */

  /* TIME_ACC jen start */
#if defined (SQLUNIX) || defined (SQLAIX)
  struct global_struct g_struct =
  { NULL, NULL, NULL, NULL, {0,0}, {0,0}, "\0", 0.1, "\0", FALSE, 0,
    NULL, "\0", "\0", "\0", NULL };

#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
  struct global_struct g_struct =
  { NULL, NULL, NULL, NULL, {0,0,0,0}, {0,0,0,0}, "\0", 0.1, "\0",
FALSE, 0,
    NULL, "\0", "\0", "\0", NULL };
#else
#error Unknown operating system
#endif
  /* TIME_ACC jen end */


  /* Get environment variables */
  if (get_env_vars() != 0)
    return -1;


  /* perform setup and initialization and get process id of agent */
  outstream = stdout;
  g_struct.c_flags = &c_flags;

  g_struct.s_info_ptr = &s_info;
  g_struct.c_l_opt = &c_l_opt;

  init_setup(argc,argv,&g_struct);              /* @d22275 tjg */

  if ((g_struct.c_l_opt->update == 1) && (semcontrol == 1))
  /* runpower: wait for insert function to complete */
  /* waiting on the INSERT_POWER_SEM semaphore */
    runpower_wait(&g_struct, INSERT_POWER_SEM);

  strcpy(temp_time_stamp, "0");

/*************************************************************
*****************
   *                                                           *
   *   This is the transition from the "driver" to the "SUT"               *
   *                                                           *

*************************************************************
***************/


/*************************************************************
**********/
  /* Read in each statement, prepare, execute, and send output to file.  */

/*************************************************************
**********/

  while (!c_flags.eo_infile) {  /* Check to see if there's no more input */
```

```
   c_flags.eo_block = 0;

   if (c_l_opt.outfile)
     output_file(&g_struct); /* determine appropriate name for output files */
   if ((g_struct.c_l_opt->update != 3) && (g_struct.c_l_opt->update != 4))
   {
    if (!strcmp(temp_time_stamp, "0")) /* if first query, get timestamp */
    {
      get_start_time(&start_time);
      strcpy(g_struct.s_info_ptr->start_stamp,
            get_time_stamp(T_STAMP_FORM_3,&start_time ));  /*
TIME_ACC jen*/
     }
     else   /* else get the end timestamp of previous query */
     {
      strcpy(g_struct.s_info_ptr->start_stamp, temp_time_stamp);
      start_time = temp_time_struct;
     }
     /* write the start timestamp to the file...if this is not a qualification */
     /* run, then write the seed used as well */

     fprintf( outstream,"Start timestamp %*.*s \n",
            T_STAMP_3LEN,T_STAMP_3LEN,                  /* TIME_ACC
jen*/
            g_struct.s_info_ptr->start_stamp);
     if (c_l_opt.intStreamNum >= 0)
     {
      if (g_struct.lSeed == -1)
        {
         fprintf( outstream,"Using default qgen seed file");
        }
       else
         fprintf( outstream,"Seed used = %ld",g_struct.lSeed);

      fprintf( outstream,"\n");
     }
   }
   do {  /* Loop through these statements as long as we haven't reached
          the end of the input file or the end of a block of statements
         */

     /** Read in the next statment **/
     c_flags.select_status=Get_SQL_stmt(&g_struct);

     if (PreSQLprocess(&g_struct, &start_time) == FALSE)
      /* if after reading the next statement we see that we should
         exit this loop (i.e. eof, update functions, etc...), get out
       */
       break;


/*****************************************************************
******************
     *                                                   *
     *   The SQLprocess function implements the implementation specific
layer.    *
     *   It can handle arbitrary SQL statements.                 *
     *                                                   *

*****************************************************************
*****************/

     /* If we've got up to here then processing
        a regular SQL statement */
     SQLprocess(&g_struct);

   } while ((!c_flags.eo_block) && (!c_flags.eo_infile));     /* @d30369 tjg
*/

   if (PostSQLprocess(&g_struct,&start_time) == FALSE)
     /* if we've reached the end of the input file, then get out
        of this loop (i.e. no more statements).  Otherwise get
        elapsed times and display info about rows */
     break;


  }  /* end of for loop for multiple SQL statements  */


  g_struct.s_info_ptr = &s_info;  /* set the global pointer to start of
                                     linked list */

  cleanup(&g_struct); /* finish some semaphore stuff, cleanup files,
                         and print out summary table */


/*****************************************************************
******************
   *                                                   *
   *   In cleanup we make the transition back from the "SUT" to the "driver"
*
   *                                                   *

*****************************************************************
*****************/

  return(0);

}  /* end of main  */

/*****************************************************************
**********/
/* Generic form of Sleep */
int SleepSome( int amount)
{
#ifndef SQLWINT
   sleep (amount);
#else
   Sleep (amount*1000);          /* 10x for NT DJD Changed "sleep" to
"Sleep" */
#endif
   return 0;
}

/*****************************************************************
**********/

/*****************************************************************
******/
/* Get environment variables.  (sks May 25 98)                   */
/*****************************************************************
******/
int get_env_vars(void) {
  if (strcpy(env_tpcd_dbname, getenv("TPCD_DBNAME")) == NULL) {
     fprintf(stderr, "\n The environment variable $TPCD_DBNAME is not
setup correctly.\n");
     return -1;
   }
  if (strcpy(env_user, getenv("USER")) == NULL) {
     fprintf(stderr, "\n The environment variable $USER is not setup
correctly.\n");
     return -1;
   }
  if (strcpy(env_tpcd_audit_dir, getenv("TPCD_AUDIT_DIR")) == NULL)
{
     fprintf(stderr, "\n The environment variable $TPCD_AUDIT_DIR is not
setup correctly.\n");
     return -1;
```

```
  }
  if (strcpy(env_tpcd_tmp_dir, getenv("TPCD_TMP_DIR")) == NULL) {
    fprintf(stderr, "\n The environment variable $TPCD_TMP_DIR is not
setup correctly.\n");
    return -1;
  }
#if 0
  if (strcpy(env_tpcd_path_delim, getenv("TPCD_PATH_DELIM")) ==
NULL ||
     (strcmp(env_tpcd_path_delim, "/") && strcmp(env_tpcd_path_delim,
"\\"))){
    fprintf(stderr, "\n The environment variable $TPCD_PATH_DELIM is
not setup correctly , env_tpcd_path_delim'%s'.\n", env_tpcd_path_delim);

    return -1;
  }
#endif
  strcpy( env_tpcd_path_delim , "/" );  /*kmw*/
  if (strcpy(env_tpcd_run_on_multiple_nodes,
getenv("TPCD_RUN_ON_MULTIPLE_NODES")) == NULL) {
    fprintf(stderr, "\n The environment variable
$TPCD_RUN_ON_MULTIPLE_NODES");
    fprintf(stderr, "\n is not setup correctly.\n");
    return -1;
  }
  if (strcpy(env_tpcd_copy_dir, getenv("TPCD_COPY_DIR")) == NULL) {
    fprintf(stderr, "\n The environment variable $TPCD_COPY_DIR is not
setup correctly.\n");
    return -1;
  }
  /* If TPCD_UPDATE_IMPORT is not set then, the default is set to false,
*/
  /* which is done in init_setup subroutine                          */
  strcpy(env_tpcd_update_import, getenv("TPCD_UPDATE_IMPORT"));

  return 0;
}

/*****************************************************************
******/
/* Get the SQL statement and any control statements from input.    */
/*****************************************************************
******/
int Get_SQL_stmt(struct global_struct *g_struct)

{
  char input_ln[256]    = "\0";    /* buffer for 1 line of text        */
  char temp_str[4000]   = "\0";    /* temp string for SQL stmt         */
  char control_str[256] = "\0";    /* control string                   */

  char *test_semi;               /* ptr to test for semicolon        */
  char *control_opt;              /* ptr used in control_str parsing  */
  char *select_status;            /* ptr to first word in query       */
  char *temp_ptr;                /* general purpose temp ptr         */

  int good_sql = 0;              /* good-sql stmt flag   @d23684 tjg */
  int stmt_num_flag = 1;          /* first line of SQL stmt flag      */
  int eostmt = 0;               /* flag to signal end of statement  */


  stmt_str.data[0]='\0';          /* Initialize statement buffer      */

  if (verbose)
    fprintf (stderr,"\n----------------------------------------------\n");
  fprintf (outstream,"\n----------------------------------------------\n");

  do {
    /** Read in lines from input one at a time **/
    fscanf(instream, "\n%[^\n]\n", input_ln);

    if (strstr(input_ln,"--") == input_ln) {    /* Skip all -- comments */

      if (strstr(input_ln,"--#SET") == input_ln) {
                              /* Store control string but
                                 keep going to find SQL stmt */
        strcpy(control_str,input_ln);
        if (verbose)
          fprintf(stderr,"%s\n", uppercase(control_str));
        fprintf(outstream,"%s\n", uppercase(control_str));

        /** Start parsing control str. and update appropriate vars. **/
        control_opt = strtok(control_str," ");
        while (control_opt != NULL) {
          if (strcmp(control_opt,"--#SET")) { /* Skip the #SET token */
            if (!strcmp(control_opt,"ROWS_FETCH"))
              g_struct->s_info_ptr->max_rows_fetch = atoi(strtok(NULL,"
"));

            if (!strcmp(control_opt,"ROWS_OUT"))
              g_struct->s_info_ptr->max_rows_out = atoi(strtok(NULL," "));
          }

          control_opt = strtok(NULL," ");
        }
      }

      /* if the block option has been set, then check if we've
        reached the end of a block of statements */
      if (g_struct->s_info_ptr->query_block)              /* @d30369 tjg */
        if (strstr(input_ln,"--#EOBLK") == input_ln) {
          g_struct->c_flags->eo_block = 1;
          return TPCDBATCH_EOBLOCK;
        }
      if (strstr(input_ln, "-- Query") == input_ln)
        strcpy(g_struct->s_info_ptr->qry_description,input_ln);

      if (strstr(input_ln, "--#TAG") == input_ln)
        strcpy(g_struct->s_info_ptr->tag,(input_ln+sizeof("--#TAG")));

      /* if we're using update functions, return that info
        appropriately */
      if (g_struct->c_l_opt->update != 0) {
        if (strstr(input_ln, "--#INSERT") == input_ln)
          return TPCDBATCH_INSERT;

        if (strstr(input_ln, "--#DELETE") == input_ln)
          return TPCDBATCH_DELETE;
      }

      if (strstr(input_ln, "--#COMMENT") == input_ln) {    /* @d25594 tjg
*/
        temp_ptr = (input_ln + 11);   /* User-specified comments go to
                                 the outfile */
        if (verbose)
          fprintf (stderr,"%s\n",temp_ptr);
        fprintf (outstream,"%s\n",temp_ptr);
      }

      eostmt=0;
    }

    /* Need this hack here to check if there's any more empty lines left
      in the input file.  Continue only if there are aren't any */
    else if (strcmp(input_ln, "\0")) /* HACK */ {   /* A regular SQL
statement */
      if (stmt_num_flag) {  /* print this out only if it's the first line
                           of the SQL statement.  We only want this
                           line to appear once per statement */
        if (verbose)
          fprintf(stderr,"\n%s\n", g_struct->s_info_ptr->qry_description);
```

```
        fprintf(outstream,"\n%s\n", g_struct->s_info_ptr->qry_description);

        if (verbose)
          fprintf(stderr,"\nTag: %-5.5s  Stream: %d   Sequence number:
%d\n",
                g_struct->s_info_ptr->tag,g_struct->c_l_opt->intStreamNum,
                g_struct->s_info_ptr->stmt_num);   /*jen0925*/
        fprintf(outstream,"\nTag: %-5.5s  Stream: %d   Sequence number:
%d\n",
              g_struct->s_info_ptr->tag,g_struct->c_l_opt->intStreamNum,
              g_struct->s_info_ptr->stmt_num);     /*jen0925*/


        /* Turn off this flag once the number has been printed */
        stmt_num_flag = 0;

      }  /** Print out this heading the first time you encounter a
          non-comment statement **/

      /* Test to see if we've reached the end of a statement */
      good_sql = TRUE;                          /* @d23684 tjg */
      test_semi = strstr (input_ln,";");
      if (test_semi == NULL) {   /* if there's no semi-colon keep on going */
        strcat (stmt_str.data,input_ln);              /* jen LONG */
        strcat (stmt_str.data," ");                   /* jen LONG */
        stmt_str.len = strlen( stmt_str.data );       /* jen LONG */
        eostmt = 0;
      }

      else {                  /* else replace the ; with a \0 and continue */
        *test_semi = '\0';
        strcat (stmt_str.data,input_ln);              /* jen LONG */
        stmt_str.len = strlen( stmt_str.data );       /* jen LONG */
        eostmt = 1;
      }

      fprintf(outstream, "\n%s", input_ln);
      if (verbose)
        fprintf(stderr,"\n%s", input_ln);
    }

    /** Test to see if we've reached the EOF.  Get out if that's the case **/
    if (feof(instream)) {
      eostmt = TRUE;
      g_struct->c_flags->eo_infile = TRUE;            /* @d22275 tjg */
    }

  }  while (!eostmt);

  fprintf(outstream, "\n");
  if (verbose)
    fprintf(stderr,"\n");

  /** erase the old control string **/
  strcpy(control_str,"\0");

  /** Determine whether statement is a SELECT or other SQL **/
  if (good_sql) {
    strcpy(temp_str,stmt_str.data);               /* jen LONG */
    uppercase(temp_str);  /* Make sure that select is made to SELECT */
    select_status=strtok(temp_str," ");
    if ( (stmt_str.data[0] == '(') || (!strcmp(select_status,"SELECT")) ||
         (!strcmp(select_status,"VALUES")) ||
         (!strcmp(select_status,"WITH")) )
      return TPCDBATCH_SELECT;
    else
      return TPCDBATCH_NONSELECT;
  }

  /** If you go through a file with just comments or control statments
     with no SQL, there's nothing to process...Exit TPCDBATCH **/

  else                                        /* @d23684 tjg */
    return TPCDBATCH_NONSQL;

}  /*  Get_SQL_stmt */



/*************************************************************
******/
/* allocate_sqlda -- This routine allocates space for the SQLDA.   */
/*************************************************************
******/

void allocate_sqlda(struct sqlda *sqlda)
{
  int   loopvar;                          /* Loop counter */

  for (loopvar=0; loopvar<sqlda->sqld; loopvar++)
  {
    switch (sqlda->sqlvar[loopvar].sqltype)
    {
     case SQL_TYP_INTEGER:                        /* INTEGER */
     case SQL_TYP_NINTEGER:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)malloc(sizeof(sqlint32))) == NULL)
        mem_error("allocating INTEGER");
      break;
     case SQL_TYP_BIGINT:                         /* BIGINT */
/*kmwBIGINT*/
     case SQL_TYP_NBIGINT:
//DJD Re activated the IFDef
#ifdef SQLWINT
       if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)malloc(sizeof(__int64))) == NULL)
#else
       if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)malloc(sizeof(sqlint64))) == NULL)
#endif
         mem_error("allocating BIGINT");
       break;
     case SQL_TYP_CHAR:                           /* CHAR */
     case SQL_TYP_NCHAR:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(256,sizeof(char))) == NULL)
        mem_error("allocating CHAR/VARCHAR");
      break;
     case SQL_TYP_VARCHAR:                        /* VARCHAR */
     case SQL_TYP_NVARCHAR:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(4002,sizeof(char))) == NULL)
        mem_error("allocating CHAR/VARCHAR");
      break;
     case SQL_TYP_LONG:                           /* LONG VARCHAR */
     case SQL_TYP_NLONG:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(32702,sizeof(char))) ==
NULL)
        mem_error("allocating VARCHAR/LONG VARCHAR");
      break;
     case SQL_TYP_FLOAT:                          /* FLOAT */
     case SQL_TYP_NFLOAT:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)malloc(sizeof(double))) == NULL)
        mem_error("allocating FLOAT");
      break;
     case SQL_TYP_SMALL:                          /* SMALLINT */
     case SQL_TYP_NSMALL:
      if ((sqlda->sqlvar[loopvar].sqldata=
```

```
            (TPCDBATCH_CHAR *)malloc(sizeof(short))) == NULL)
        mem_error("allocating SMALLINT");
      break;
    case SQL_TYP_DECIMAL:                    /* DECIMAL */
    case SQL_TYP_NDECIMAL:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)malloc(20)) == NULL)
        mem_error("allocating DECIMAL");
      break;
    case SQL_TYP_CSTR:                  /* VARCHAR (null terminated) */
    case SQL_TYP_NCSTR:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(4001,sizeof(char))) == NULL)
        mem_error("allocating CHAR/VARCHAR");
      break;
    case SQL_TYP_DATE:                    /* DATE */
    case SQL_TYP_NDATE:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(13,sizeof(char))) == NULL)
        mem_error("allocating DATE");
      break;
    case SQL_TYP_TIME:                    /* TIME */
    case SQL_TYP_NTIME:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(11,sizeof(char))) == NULL)
        mem_error("allocating TIME");
      break;
    case SQL_TYP_STAMP:                    /* TIMESTAMP */
    case SQL_TYP_NSTAMP:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(29,sizeof(char))) == NULL)
        mem_error("allocating TIMESTAMP");
      break;
   }
   if ((sqlda->sqlvar[loopvar].sqlind=
          (short *)calloc(1,sizeof(short))) == NULL)
     mem_error("allocating indicator");

  }
  sqlda_allocated = 1; /* fix free() problem on NT
                  wlc 090597 */
  return;    /* allocate_sqlda  */
}


/*****************************************************************
**************/
/* echo_sqlda -- This routine displays the contents of an SQLDA.          */
/*****************************************************************
**************/


void echo_sqlda(struct sqlda *sqlda, int *col_lengths)
{
  int    col;                    /* Column counter           */

  int    col_type;                /* Type of column           */

  char   temp_string[100] = "\0";      /* Temporary string          */
  char   decimal_string[100] = "\0";    /* String holding decimals    */
  char   *temp_ptr;

  TPCDBATCH_CHAR   m,n;              /* precision and accuracy
                                for decimal conversion     */


  for (col=0; col<sqlda->sqld; col++)    /* Loop through column count  */
  {
    col_type=sqlda->sqlvar[col].sqltype;              /* @d22817 tjg */
    if (*(sqlda->sqlvar[col].sqlind))                 /* @d30369 tjg */
      fprintf(outstream, "%* n/a  ",(col_lengths[col]-3));
    else
      switch (col_type)
      {
       case SQL_TYP_INTEGER:
       case SQL_TYP_NINTEGER:

        fprintf(outstream, "%*ld  ",col_lengths[col],
              *(sqlint32 *)(sqlda->sqlvar[col].sqldata));
        break;

       case SQL_TYP_BIGINT:  /*kmwBIGINT*/
       case SQL_TYP_NBIGINT:
#ifdef SQLWINT
        fprintf(outstream, "%*I64d ",col_lengths[col],
              *(__int64 *)(sqlda->sqlvar[col].sqldata));
#else
        fprintf(outstream, "%*lld  ",col_lengths[col],
              *(sqlint64 *)(sqlda->sqlvar[col].sqldata));
#endif
        break;

       case SQL_TYP_CHAR:
       case SQL_TYP_NCHAR:

        fprintf(outstream, "%-*s  ",col_lengths[col],sqlda-
>sqlvar[col].sqldata);
        break;
       case SQL_TYP_VARCHAR:
       case SQL_TYP_NVARCHAR:
       case SQL_TYP_LONG:
       case SQL_TYP_NLONG:                            /* @d30369 tjg */
        ((struct sqlchar *)sqlda->sqlvar[col].sqldata)->
          data[((struct sqlchar *)sqlda->sqlvar[col].sqldata)->length] = '\0';
        fprintf(outstream, "%-*s  ",
              col_lengths[col],
              ((struct sqlchar *)sqlda->sqlvar[col].sqldata)->data);
        break;
       case SQL_TYP_FLOAT:
       case SQL_TYP_NFLOAT:
       { /* kmw */
        if ( fabs(*(double *)(sqlda->sqlvar[col].sqldata))
                      < TPCDBATCH_PRINT_FLOAT_MAX  )
          fprintf(outstream, "%#*.3f  ",col_lengths[col],
                *(double *)(sqlda->sqlvar[col].sqldata));
        else
          fprintf(outstream, "%*e  ",col_lengths[col],
                *(double *)(sqlda->sqlvar[col].sqldata));
        break;
       }

       case SQL_TYP_SMALL:
       case SQL_TYP_NSMALL:

        fprintf(outstream, "%*hd  ",col_lengths[col],
              *(short *)(sqlda->sqlvar[col].sqldata));
        break;
       case SQL_TYP_DECIMAL:
       case SQL_TYP_NDECIMAL:

        m=(*(struct declen *)&sqlda->sqlvar[col].sqllen).m;
        n=(*(struct declen *)&sqlda->sqlvar[col].sqllen).n;
        if (sqlrxd2a((char *)sqlda->sqlvar[col].sqldata,temp_string,m,n) != 0)
        {
          fprintf(stderr, "\nThe decimal value could not be converted.\n");
          exit (-1);
        }
        else {
```

```
          temp_ptr = temp_string;

          if (*temp_ptr == '-')
            strcpy(decimal_string, "-");

          else
            strcpy(decimal_string, " ");

          for (temp_ptr = temp_string + 1; *temp_ptr == '0'; temp_ptr++)
            ;

          strcat(decimal_string,temp_ptr);
          fprintf(outstream, "%*s  ",col_lengths[col],decimal_string);
        }

        break;

      case SQL_TYP_CSTR:
      case SQL_TYP_NCSTR:
      case SQL_TYP_DATE:
      case SQL_TYP_NDATE:
      case SQL_TYP_TIME:
      case SQL_TYP_NTIME:
      case SQL_TYP_STAMP:
      case SQL_TYP_NSTAMP:
        sqlda->sqlvar[col].sqldata[sqlda->sqlvar[col].sqllen+1]='\0';
        strcpy(temp_string,(char *)sqlda->sqlvar[col].sqldata);
        fprintf(outstream, "%-*s  ",(col_lengths[col]),temp_string);
        break;

      default:
        fprintf(stderr,"--Unknown column type (%d).  Aborting.\n",col_type);
        break;
      }
  }

  fprintf(outstream, "\n");

  return;
}


/************************************************************/
/* Calculate the elapsed time.                              */
/************************************************************/

void get_start_time(Timer_struct *start_time)
{
  int rc = 0;

#if defined (SQLOS2) || defined (SQLWINT)  || defined (SQLWIN) ||
defined (SQLDOS)
  /*@d33143aha*/
  ftime (start_time);
#elif defined(SQLSNI)
  rc = gettimeofday(start_time);
#elif defined(SQLPTX)
  gettimeofday_mapped(start_time);
  rc = 0;       /* gettimeofday_mapped returns void */
#elif defined (SQLUNIX) || defined (SQLAIX)                  /*TIMER jen*/
  rc = gettimeofday(start_time,NULL);
#else
#error Unknown operating system
#endif

  if (rc != 0) {
    fprintf(stderr,"Timer call failed, aborting test\nExiting tpcdbatch..\n");
    exit(-1);
  }
}


/************************************************************
*********/
/* Calculate and return the elapsed time given a starting time.       */
/************************************************************
*********/
double get_elapsed_time ( Timer_struct *start_time)
{
  int               status = 0;
  Timer_struct        end_time;
  double             result = -1.0;
#ifndef SQLWINT
  long int           result_sec;
  long int           result_usec;
#endif


#if defined(SQLSNI)
  status = gettimeofday(&end_time);
#elif defined(SQLPTX)
  gettimeofday_mapped(&end_time);
  status = 0;   /* gettimeofday_mapped returns void */
#elif defined (SQLUNIX) || defined (SQLAIX)
  status = gettimeofday(&end_time,NULL);                    /*TIMER jen*/
#elif defined (SQLOS2) || defined (SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS)
  ftime(&end_time);
#else                         /** If another operating system **/
#error Unknown operating system
#endif

  if (status != 0)
    fprintf(stderr,"Bad return from gettimeofday, don't trust timer
results...\n");

  else
  {
#if defined (SQLUNIX) || defined (SQLAIX)
    result_sec = end_time.tv_sec - start_time->tv_sec;
    result = (double) result_sec;
    /* TIMER used micro seconds with timeval (not nanoseconds) */
    if ((start_time->tv_usec > 0) && \
       (start_time->tv_usec < 1000000) && \
       (end_time.tv_usec > 0) && \
       (end_time.tv_usec < 1000000))
    {
      result_usec = end_time.tv_usec - start_time->tv_usec;
      result = (double) result_sec + ((double) result_usec/1000000);
    }
#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
    result = (double) (end_time.time - start_time->time);
    result = result * 1000 + (end_time.millitm - start_time->millitm);
    result = result/1000;
#else
#error Unknown operating system
#endif

  }

  /*
   * translate the time to that rounded to the CLOSEST 0.1 seconds as
   * required by the TPC-D spec.   ROUNDING
   */
  /*   result = (double)(((long)((result + 0.099999) * 10))/10.0);*/
  result = (double)(((long)((result + 0.05) * 10))/10.0);
  return (result);
}
```

```
void dumpCa(struct sqlca *ca)
{
  int i;
  fprintf(outstream,"********************  DUMP OF SQLCA
********************\n");
  fprintf(outstream,"SQLCAID   : %.8s\n", ca->sqlcaid);
  fprintf(outstream,"SQLCABC   : %d\n", ca->sqlcabc);
  fprintf(outstream,"SQLCODE   : %d\n", ca->sqlcode);
  fprintf(outstream,"SQLERRML  : %d\n", ca->sqlerrml);
  fprintf(outstream,"SQLERRMC  : %.*s\n", ca->sqlerrml, ca->sqlerrmc);
  fprintf(outstream,"SQLERRP   : %.8s\n", ca->sqlerrp);

  for (i = 0; i < 6; i++)
  {
  fprintf(outstream,"SQLERRD[%d]: %d\n", i, ca->sqlerrd[i] );
  }
  fprintf(outstream,"SQLWARN   : %.11s\n", ca->sqlwarn);
  fprintf(outstream,"SQLSTATE  : %.5s\n", ca->sqlstate);
  fprintf(outstream,"********************  END OF SQLCA DUMP
********************\n");
  return;
}


/*****************************************************************
*****************/
/* error_check                                                   */
/* This function prints the contents of the sqlca error information          */
/* structure.                                                    */
/*****************************************************************
*****************/
long error_check(void)
{
  char          buffer[512]="\0";
  unsigned short i;
  struct sqlca   temp_sqlca;      /* temporary sqlca */     /* @d30369 tjg */

  temp_sqlca.sqlcode = 0;          /* initialize the temporary sqlca to
                                  avoid any memory problems */

  if (sqlca.sqlcode != 0) {
    sqlaintp(buffer, sizeof(buffer), 80, &sqlca);
    fprintf(stderr, "\n%0.200s\n", buffer);
    fprintf(outstream, "\n%0.200s\n", buffer);

    /* Decode the SQLCA in more detail  KBS 98/09/28 */
    if ((sqlca.sqlerrml)   /*  there's one or more tokens   */
       && (sqlca.sqlerrml < sizeof(sqlca.sqlerrmc)) /* and field not full */
       )
    {
      char *tokptr;
      int  tokl;
      *(sqlca.sqlerrmc + sqlca.sqlerrml) = '\0';  /*  prevent strtok from
scanning beyond end */
      fprintf(stderr,"\n     SQLCA:   tokens:\n");
      fprintf(outstream,"\n     SQLCA:   tokens:\n");
      tokptr=strtok(sqlca.sqlerrmc, "\xff");
      while (  tokptr                          &&
             ( (tokl = (sizeof(sqlca.sqlerrmc) - (tokptr-sqlca.sqlerrmc))) > 0)
             )
      {
        fprintf(stderr, "%.*s\n", tokl, tokptr);
        fprintf(outstream, "%.*s\n", tokl, tokptr);
        tokptr=strtok(NULL, "\xff");
      }
    }
    fprintf(stderr, "\n     SQLCA:   errp= %.8s, errd 1-6= %d %d %d %d %d
%d\n",
          sqlca.sqlerrp, sqlca.sqlerrd[0], sqlca.sqlerrd[1], sqlca.sqlerrd[2],
          sqlca.sqlerrd[3], sqlca.sqlerrd[4], sqlca.sqlerrd[5]);
    fprintf(outstream, "\n     SQLCA:   errp= %.8s, errd 1-6= %d %d %d %d
%d %d\n",
          sqlca.sqlerrp, sqlca.sqlerrd[0], sqlca.sqlerrd[1], sqlca.sqlerrd[2],
          sqlca.sqlerrd[3], sqlca.sqlerrd[4], sqlca.sqlerrd[5]);

    temp_sqlca = sqlca; /* Make a copy of sqlca in case it gets changed
                        in the next statement below */   /* @d30369 tjg */

    /** Determine if the error is critical or a connection can be made **/

    EXEC SQL CONNECT ;                                  /* @d28763 tjg */

    if (sqlca.sqlcode == SQLE_RC_NOSUDB ) { /* no connection exists */

      /*Print out header for DUMP*/
      fprintf(outstream, "*****************************************\n");
      fprintf(outstream, "*        CONTENTS OF SQLCA         *\n");
      fprintf(outstream,
"*****************************************\n\n");

      /*Print out contents of SQLCA variables*/
      fprintf(outstream, "SQLCABC  = %ld\n", temp_sqlca.sqlcabc);
      fprintf(outstream, "SQLCODE  = %ld\n", temp_sqlca.sqlcode);
      fprintf(outstream, "SQLERRMC = %0.70s\n", temp_sqlca.sqlerrmc);
      fprintf(outstream, "SQLERRP  =  %0.8s\n", temp_sqlca.sqlerrp);

      for (i = 0; i < 6; i++)
      {
        fprintf(outstream, "sqlerrd[%d] = %lu \n", i, temp_sqlca.sqlerrd[i]);
      }

      fprintf(outstream, "SQLWARN  = %0.11s\n", temp_sqlca.sqlwarn);
      fprintf(outstream, "SQLSTATE = %0.5s\n", temp_sqlca.sqlstate);

      fprintf(stderr, "\nCritical SQLCODE.  Exiting TPCDBATCH\n");
      exit(-1);

    }
  }
  return (temp_sqlca.sqlcode);

}  /* error_check */



/*****************************************************/
/* Displays a help screen                            */
/*****************************************************/
void display_usage()
{
  printf("\ntpcdbatch  --  version %s",TPCDBATCH_VERSION);
  printf("\n\nSyntax is:\n");
  printf("tpcdbatch [-d dbname] [-f file_name] [-l file_name] [-r on/off]");
  printf("\n        [-v on/off] [-b on/off] [-u p/t/t1/t2]");
  printf("\n        [-s scale_factor] [-n stream_num] [-m inlistmax] [-h]\n");
  printf("\n  where: -d  Database name");
  printf("\n               Default - dbname set in $DB2DBDFT");
  printf("\n         -f  Input file containing SQL statements");
  printf("\n               Default - stdin ");
  printf("\n         -l  Input file containing list of statement numbers");
  printf("\n         -r  Create set of output files containing query results");
  printf("\n               Default - off");
  printf("\n         -v  Verbose.  Sends information to stderr during");
  printf("\n             query processing");
  printf("\n               Default - off");
  printf("\n         -b  Process groups of statements as blocks ");
  printf("\n             instead of individually.");
  printf("\n               Default - off");
```

```
   printf("\n        -u  Update streams: p    - for power test");
   printf("\n                            t    - for throughput test without");
   printf("\n                                 UFs (run this instead of t2)");
   printf("\n                            t1   - for throughput test step 1");
   printf("\n                                 only running queries");
   printf("\n                            t2   - for throughput test step 2");
   printf("\n                                 running update functions");
   printf("\n        -s  Scale factor");
   printf("\n                Default - 0.1");
   printf("\n        -n  Stream number");
   printf("\n                    Default - 0");
   printf("\n                  Qualification - -1");
   printf("\n                        Power - 0");
   printf("\n                   Throughput - >= 1 (actual number depends on the
current query stream");
   printf("\n        -m  Maximum number of keys to delete at a time");
   printf("\n                Default - 400");
   printf("\n        -h  Display this help screen");
   printf("\n        -p  turns smeaphores on or off");
   printf("\n                Default - off");

   printf("\n\nControl statements specifying output and performance details");
   printf("\ncan be included before SQL statements; they will apply for");
   printf("\nthat and subsequent statements until updated.");

   printf("\n\nSyntax:    --#SET <control option> <value>");
   printf("\n\n  option      value    default");
   printf("\nROWS_FETCH   -1 to n     -1  (all rows fetched from answer
set)");
   printf("\nROWS_OUT     -1 to n     -1  (all fetched rows sent to output)");
   printf("\n\n--#TAG       tag             (user specified tag name for
sequence#)");
   printf("\n--#COMMENT   comment         (user specified comments for
output)");
   printf("\nNote:  All statements executed with ISOLATION LEVEL RR");
   printf("\n       and must be terminated with semi-colons.\n");
   exit (1);
}


/***************************************************/
/* Converts a string to upper case characters   */
/***************************************************/
char *uppercase( char *string )
{
   char   *c;     /* temp char used to convert word to upper case */

   for ( c = string; *c != '\0'; c++)
      *c = (char) toupper( (int) *c );

   return (string);
}

/***************************************************/
/* Converts a string to lower case characters   */
/***************************************************/
char *lowercase( char *string )
{
   char   *c;     /* temp char used to convert word to lower case */

   for ( c = string; *c != '\0'; c++)
      *c = (char) tolower( (int) *c );

   return (string);
}


/***************************************************/
/* Parses and processes command line options.      */
/***************************************************/

void comm_line_parse(int argc, char *argv[], struct global_struct *g_struct)
{
   char authent_info[40] = "\0";
   char *testptr;
   int loopvar = 0;

   int comm_opt = 0;
#ifdef PARALLEL_UPDATES
   int running_updates=0;
   int updatePair=-1;
   int updateStream=-1;
   int function;
   int copyOnOrOff;
   int deleteChunk=0;        /*DELjen */
#endif

   while ((loopvar < argc) && (argc != 1)) {

      if (*argv[loopvar] == '-') {

         switch(*(argv[loopvar]+1)) {

            case 'f' :                              /* @d26350 tjg */
            case 'F' :
                     strcpy(g_struct->c_l_opt->infile,argv[++loopvar]);
                     break;

            case 'l' :                              /* @d26350 tjg */
            case 'L' :    strcpy(g_struct->c_l_opt->str_file_name,argv[++loopvar]);
                     break;

            case 'r' :                              /* @d26350 tjg */
            case 'R' :
              if (!strcmp(uppercase(argv[++loopvar]),"ON"))
                g_struct->c_l_opt->outfile=1;
              else
                g_struct->c_l_opt->outfile=0;
              break;

            case 'd' :                              /* @d26350 tjg */
            case 'D' :
                     strcpy(dbname,argv[++loopvar]);
                     break;

            case 'v' :                              /* @d26350 tjg */
            case 'V' :
              if (!strcmp(uppercase(argv[++loopvar]),"ON"))
                verbose=1;
              else
                verbose=0;
              break;

            case 'u' :                              /* @d26350 tjg */
            case 'U' :
              g_struct->c_l_opt->update=-1; /* init to invalid number */
              if (!strcmp(uppercase(argv[++loopvar]),"P1"))
                g_struct->c_l_opt->update=1; /* power query stream*/
              if (!strcmp(uppercase(argv[loopvar]),"P2"))
                   g_struct->c_l_opt->update=3; /* power update with updates*/
              if (!strcmp(uppercase(argv[loopvar]),"P"))
                g_struct->c_l_opt->update=4; /* power update without updates*/
              if (!strcmp(uppercase(argv[loopvar]),"T1"))
                   g_struct->c_l_opt->update=0; /*throughput query stream */
              if (!strcmp(uppercase(argv[loopvar]),"T2"))
                   g_struct->c_l_opt->update=2; /* throughput update with updates
*/
              if (!strcmp(uppercase(argv[loopvar]),"T"))
                   g_struct->c_l_opt->update=5; /* throughput update without
updates */
```

```
          break;

        case 'b' :                              /* @d26350 tjg */
        case 'B' :
          if (!strcmp(uppercase(argv[++loopvar]),"ON"))
            g_struct->s_info_ptr->query_block=1;
          else
            g_struct->s_info_ptr->query_block=0;
          break;

        case 'n' :                              /* @d26350 tjg */
        case 'N' :
          g_struct->c_l_opt->intStreamNum = atoi(argv[++loopvar]);
          break;

        case 's' :                              /* @d26350 tjg */
        case 'S' :    g_struct->scale_factor=atof(argv[++loopvar]); break;

        case 'h':
        case 'H' :                               /* @d26350 tjg */
          display_usage();
          break;

        case 'm' :
        case 'M' :
          inlistmax = atoi(argv[++loopvar]); /* wlc 081897 */
          break;

        case 'p' :
        case 'P' :
           if (!strcmp(uppercase(argv[++loopvar]),"ON")) /* bbe 072599 */
             semcontrol = 1;
           else
             semcontrol = 0;
           break;


#ifdef PARALLEL_UPDATES
        case 'i':
          updatePair = atoi (argv[++loopvar]);
#ifdef UF2DEBUG
          fprintf (stderr, "updatePair = %d\n",updatePair);
          fflush(stderr);
#endif
          break;

        case 'j':
          function = atoi (argv[++loopvar]);
#ifdef UF2DEBUG
          fprintf (stderr, "function = %d\n",function);
          fflush(stderr);
#endif
          break;

        case 'k':
          updateStream = atoi (argv [++loopvar]);
#ifdef UF2DEBUG
          fprintf (stderr, "updateStream = %d\n",updateStream);
          fflush(stderr);
#endif
          break;

        case 'x':                               /*DEL jen -x is chunk*/
          deleteChunk = atoi (argv[++loopvar]);       /* to delete for this */
#ifdef UF2DEBUG
          fprintf (stderr, "DelChunk = %d\n",deleteChunk);
          fflush(stderr);
#endif
          break;                                /* invocation */

        case 'z':
          running_updates = 1;
          break;
#endif
         default :
          fprintf(stderr,"An invalid option has been set\n");
          display_usage();
          break;

        }  /** end switch **/
      } /** end if **/

      loopvar ++;
    } /** end while **/

    /* checking if -u option is set */
    if (g_struct->c_l_opt->update == -1) {
      fprintf(stderr, "-u option is not set, exiting ...\n");
      exit(-1);
    }


#ifdef PARALLEL_UPDATES
    if (running_updates) {
      if (updatePair == -1) {
        fprintf (stderr, "The parameters to tpcdbatch have not been passed
correctly\n");
        exit (-1);
      }
      else {
        /* check to see if we are to use copy on for the load */
        if (( getenv("TPCD_LOG") != NULL ) &&
            (!strcmp(uppercase(getenv("TPCD_LOG")),"YES")))
        {
          /* okay, we have set LOG_RETAIN on so we need to use copy
directory */
          copyOnOrOff = TRUE;
        }
        else
        {
          /* log retain off don't use copy directory */
          copyOnOrOff = FALSE;
        }

        if (function == 1)
          /* runUF1_fn (updatePair, updateStream);  aph 981205 */
          runUF1_fn (updatePair, updateStream, dbname, userid, passwd);
        else
          if (function == 2) {
            /*
            fprintf(stderr, "A-Calling runUF2_fn  %d   %d   %d ...\n",
                            updatePair, updateStream, deleteChunk);
            */
            /* runUF2_fn (updatePair, updateStream, deleteChunk);    aph
981205 */
            runUF2_fn (updatePair, updateStream, deleteChunk, dbname,
userid, passwd);
          }
        else {
          fprintf (stderr, "Wrong function to tpcdbatch\n");
          exit (-1);
        }
        exit (0);
      }
    }
#endif /* PARALLEL_UPDATES */

    /* If no database name is given, then use the one specified in the
       environment variable DB2DBDFT, otherwise error */
```

```
  if (!strcmp(dbname,"\0")) {
    testptr = getenv("DB2DBDFT");
    if (testptr == NULL) {
      fprintf(stderr, "\nNo database name has been specified on command ");
      fprintf(stderr, "line\nnor in environment variable DB2DBDFT.");
      display_usage();
    }
    else
      strcpy(dbname,testptr);

  }

  if (g_struct->c_l_opt->outfile &&
     !strcmp(g_struct->c_l_opt->str_file_name,"\0")) {
    fprintf(stderr, "\nMust specify input file for statement list.\n");
    display_usage();
  }

}



/*****************************************************/
/* Converts DECIMAL values to ASCII text             */
/*****************************************************/
int sqlrxd2a(                           /*kmw*/
                                        /* C++ */char *decptr,
                                        /* C++ */char *asciiptr,
                                        short prec,
                                        short scal)
{/* */
  int allzero = TRUE;
  /* C++ */char *srcptr;
  unsigned char sign;
  /* C++ */char *targptr, decimal_point = '.';
  int rc = 0;                           /*kmw*/
  int tmpint, src_nibble;
  int count, j, limit[3];

  targptr = &asciiptr[ prec + 1];
  *(1 + targptr) = '\0';
  srcptr = decptr + prec/2;


  /* Validity check sign nibble */
  if (((sign = sqlrx_get_right_nibble( *srcptr )) < 0x0a)
     || (prec > SQL_MAXDECIMAL) || (prec < scal ))
  {
    goto exit;
  }/** end end if invalid sign value **/


  limit[ 0 ] = scal; limit[ 1 ] = prec - scal; limit[ 2 ] = 0;
  src_nibble = LEFT;
  for( j = 0 ; j < 2 ; j++ )
  {
    for( count = limit[ j ] ; count > 0 ; count-- )
    {
      tmpint = ( (src_nibble == LEFT)?
               sqlrx_get_left_nibble( *srcptr-- ) :
               sqlrx_get_right_nibble( *srcptr ) );
      if( tmpint > 9 )
      {
        goto exit;
      }
      else
        *targptr-- = (/* C++ */char)tmpint + '0';
      src_nibble = ((src_nibble == LEFT) ? RIGHT : LEFT);
      if ( tmpint != 0 ) allzero = FALSE;
    } /** end for scal > 0 **/

    if( j == 0 )
      *targptr-- = decimal_point;
    else
      *targptr = (/* C++ */char)((allzero
                          || (sign == SQLRX_PREFERRED_PLUS)
                          || (sign == 0x0a)
                          || (sign == 0x0e)
                          || (sign == 0x0f)) ?
                         '+' : '-' );
  } /** end for limit[ j++ ] > 0 **/

  exit :
  if( rc < 0 )
  {
    printf ("The decimal conversion has failed\n");
    exit (-1);

  }

  return(rc);
} /** sqlrxd2a **/



/*****************************************************************
****/
/* Does some setup and initialization like parsing command line  */
/* and connecting to database.  Returns process id of agent.     */
/*****************************************************************
****/

void init_setup(int argc, char *argv[], struct global_struct *g_struct)
{
  int connect=0;
#ifndef SQLWINT
  char *pid;
#endif
  char temparray[256]="\0";
  int loopvar=0;
  FILE *updateFP;
  FILE *fpSeed;
  char file_name[256] = "\0";
  short seedEntry;
  long  lSeed;
  int i;

  /** Parse and process command line options **/
  comm_line_parse (argc,argv,g_struct);

/*****************************************************************
**********/
/* Start the mainline report processing.                         */
/*****************************************************************
**********/
  if (!strcmp(g_struct->c_l_opt->infile,"\0")) {
    instream=stdin;
  }
  else {
    instream=NULL;
    if ( (instream = fopen(g_struct->c_l_opt->infile, READMODE)) ==
NULL ) {
      fprintf(outstream, "The input file could not be opened.\n\n");
      fprintf(stdout,"Make sure that the filename is correct.\n");
      fprintf(stdout,"filename = %s\n",g_struct->c_l_opt->infile);
      exit(-1);

    }  /* open the input file if specified  */
  }
```

```
  /* IMPORT (begin) - determine whether we should use the IMPORT api or
*/
  /* LOAD api for loading into the staging tables, default is load      */
  if (env_tpcd_update_import != NULL)
  {
    if (!strcmp(uppercase(env_tpcd_update_import),"TRUE"))
    {
      iImportStagingTbl = 1;   /* use import */
    }
    /* DJD */
    else if (!strcmp(uppercase(env_tpcd_update_import),"TF"))
    {
      iImportStagingTbl = 2;   /* Table Functions */
    }
  }



  /* IMPORT (end) */

  /* we want to print the seed in the output files to show what seed was */
  /* used to generate the queries.  */
  /* if intStreamNum is -1 then we are running a qualification database */
  /* and the default seed has been used so skip this section */
  if (g_struct->c_l_opt->intStreamNum >= 0)
  {
    /* check to make sure the TPCD_RUNNUMBER environment variable
is set. We */
    /* use this and the stream number to determine which seed was used to
*/
    /* generate the current set of queries */
    if (getenv("TPCD_RUNNUMBER") == NULL)
    {
      fprintf(stderr,"\nThe TPCD_RUNNUMBER environment variable is
not set");
      fprintf(stderr,"....exiting\n");
      exit(-1);
    }
    if (getenv("TPCD_NUMSTREAM") == NULL)
    {
      fprintf(stderr,"\nThe TPCD_NUMSTREAM environment variable is
not set");
      fprintf(stderr,"....exiting\n");
      exit(-1);
    }


/*****************************************************************
*************
     * SEED jen
     * we want to print the seed used in the output files.  For the seed usage
     * we can now reuse the seeds from run to run, therefore all the power
runs
     * will use the 1st seed in the file, and the throughput streams will use
     * the 2nd to #streams+1 seeds.
     * determine the seed to use...e.g. given 3 streams will have the
following:
     *                          Entry in seed file
     *     TEST       Stream Number     Run 1    Run 2
     *     power      0              1       1
     *     throughput  1              2       2
     *                2              3       3
     *                3              4       4

*****************************************************************
***********/
    seedEntry = g_struct->c_l_opt->intStreamNum + 1;
    /* end SEED jen */
    /* open the generated seed file...if not there, try the default */
    sprintf(file_name, "%s%sauditruns%smseedme", env_tpcd_audit_dir,
          env_tpcd_path_delim, env_tpcd_path_delim);

    if ((fpSeed = fopen(file_name,READMODE)) == NULL )
    {
      fprintf(stderr,"\nCannot open the seed file, please ensure that\n");
      fprintf(stderr,"the file exists.  filename = %s\n",file_name);
      exit(-1);
    }
    for (i = 1; i <= seedEntry; i++)
    {
      if (feof(fpSeed))
      {
        lSeed = -1;   /* seed not available for some reason */
      }
      fscanf(fpSeed,"%ld\n",&lSeed);
    }
    g_struct->lSeed = lSeed;
    fclose(fpSeed);
  }

  /* check to see if we are to use copy on for the load */
  if (( getenv("TPCD_LOG") != NULL ) &&
     (!strcmp(uppercase(getenv("TPCD_LOG")),"YES")))
  {
    /* okay, we have set LOG_RETAIN on so we need to use copy directory
*/
    g_struct->copy_on_load = TRUE;
  }
  else
  {
    /* log retain off don't use copy directory */
    g_struct->copy_on_load = FALSE;
  }

/*****************************************************************
****/
/* Make sure that DB2 is started.                                 */
/* CONNECT now unless this is a UF stream for a Throughput test. */
/* (aph 98/12/22)                                                 */
/*****************************************************************
****/

  if (g_struct->c_l_opt->update > 1)
  {
    /* This is an update function stream in a throughput run. */
    /* Just make sure that DB2 is started.  Each UF child will CONNECT
itself. */
    if (verbose) fprintf(stderr,"\nStarting the DB2 Database Manager
Now\n");
    sqlestar ();
  }
  else
  {  /* In all other cases, CONNECT to the target database. */
    do
    {
      if (!strcmp(userid,"\0"))   /** No authentication provided **/
        EXEC SQL CONNECT TO :dbname;
      else EXEC SQL CONNECT TO :dbname USER :userid USING
:passwd;
      if (sqlca.sqlcode == SQLE_RC_NOSTARTG) {
        if (verbose)
          fprintf(stderr,"\nStarting the DB2 Database Manager Now\n");
        sqlestar ();
        connect=0;
      }
      else connect=1;
    } while (!connect);
    error_check();
  }
```

```
/*************************************************************
**************
 *  All session initialization is performed at connect time or immediately *
 *  following and is complete before starting the stream.                  *

*************************************************************
*************/

  /** Get start timestamp for stream **/
  get_start_time(&(g_struct->stream_start_time));     /* TIME_ACC jen*/
  strcpy(g_struct->file_time_stamp,
       get_time_stamp(T_STAMP_FORM_2,&(g_struct-
>stream_start_time))); /* TIME_ACC jen*/

  if (getenv("TPCD_RUN_DIR") != NULL)
    strcpy(g_struct->run_dir,getenv("TPCD_RUN_DIR"));
  else
    strcpy(g_struct->run_dir,".");

  /* if we are running a throughput test, then we must report the */
  /* stream count information...we will report one file per stream */
  /* and amalgamate them after all streams have completed */
  /* if the number of streams is greater than 0 then this is a throughput test*/
  switch (g_struct->c_l_opt->update)
  {
      case (2):
      case (5):
            /* update throughput function stream */
            sprintf(file_name,"%s%sstrcntuf.%s",g_struct->run_dir,
                  env_tpcd_path_delim, g_struct->file_time_stamp);
            break;
      case (3):
      case (4):
            /* update power function stream */
            sprintf(file_name,"%s%spstrcntuf.%s",g_struct->run_dir,
                  env_tpcd_path_delim, g_struct->file_time_stamp);
            break;
      case (1):
            /* power query stream */
            sprintf(file_name, "%s%spstrcnt%d.%s",g_struct->run_dir,
env_tpcd_path_delim,
                  g_struct->c_l_opt->intStreamNum,g_struct-
>file_time_stamp);
            break;
      case (0):
            /* throughput query stream */
            sprintf(file_name, "%s%sstrcnt%d.%s",g_struct->run_dir,
env_tpcd_path_delim,
                  g_struct->c_l_opt->intStreamNum,g_struct-
>file_time_stamp);
            break;
  }

  if( (g_struct->stream_report_file = fopen(file_name, WRITEMODE)) ==
NULL )
  {
    fprintf(stderr,"\nThe output file for the stream count information\n");
    fprintf(stderr,"could not be opened, make sure the filename is correct\n");
    fprintf(stderr,"filename = %s\n",file_name);
    exit(-1);
  }

  if (g_struct->c_l_opt->update > 1)
  {
   /* update function stream */
   fprintf(g_struct->stream_report_file,
         "Update function stream starting at %*.*s\n",
         T_STAMP_3LEN,T_STAMP_3LEN, /* TIME_ACC jen*/
         get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_start_time))); /* TIME_ACC jen*/
  }
  else
  {
    /* query stream */
   fprintf(g_struct->stream_report_file,
         "Stream number %d starting at %*.*s\n",
         g_struct->c_l_opt->intStreamNum,
         T_STAMP_3LEN,T_STAMP_3LEN,          /* TIME_ACC jen*/
         get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_start_time))); /* TIME_ACC jen*/
  }

#ifndef LINUX

  fclose(g_struct->stream_report_file);

#endif

  /* set up the update_num_file name so that if we do use semaphores, */
  /* we will have a filename to generate the semkey */

  sprintf(g_struct->update_num_file, "%s%s%s.%s.update.pair.num",
env_tpcd_audit_dir,
        env_tpcd_path_delim, uppercase(env_tpcd_dbname),
lowercase(env_user));
  sprintf(g_struct->sem_file, "%s.%s.semfile", env_tpcd_dbname, env_user);
  if (g_struct->c_l_opt->intStreamNum == 0)
  {
   sprintf(g_struct->sem_file2, "%s.%s.semfile2", env_tpcd_dbname,
env_user);
  }
  if (verbose) {   /* print out the update pair number file for debugging */
   fprintf(stderr,"\n init_setup: strem %d update pair numb file = %s\n",
         g_struct->c_l_opt->intStreamNum,g_struct->update_num_file);
  }

  /* update the
$TPCD_AUDIT_DIR/$TPCD_DBNAME.$USER.update.pair.num file */
  /* update pairs have been run */
  if (( g_struct->c_l_opt->update >= 1 ) && ( g_struct->c_l_opt->update < 4
))
       /* on or onl, but not  */ /* bbe or > 1 */
  {
    updateFP = fopen(g_struct->update_num_file,"r");
    if (updateFP != NULL )
    {
      fscanf(updateFP,"%d",&updatePairStart);
      fclose(updateFP);
      if (g_struct->c_l_opt->intStreamNum == 0)   /* on, 1 update pair */
        updatePairStop = updatePairStart + 1;
      else        /* only, multiple update pairs, stream number will be total */
        updatePairStop = updatePairStart + g_struct->c_l_opt-
>intStreamNum;
      currentUpdatePair = updatePairStart;

      if (updatePairStart <= 0)
      {
        fprintf(stderr,"updatePairStart is bogus!");
        exit(-1);
      }
    }
    else
    {
      fprintf(stderr,"\n %s not set up, set this \n",g_struct->update_num_file);
      fprintf(stderr,"file to contain the number of the update pair to  \n");
      fprintf(stderr,"run and resubmit\n");
      exit(-1);
    }
```

```
  }

  return ;

}

/*************************************************************
********/
/* A function to print out the column titles for a returned set      */
/*************************************************************
********/
void print_headings (struct sqlda *sqlda, int *col_lengths)
{
  int col = 0;                    /* Column number            */
  int col_width = 0;              /* width of column          */
  int max_col_width = 0;          /* maximum column width     */
  int col_name_length = 0;        /* sizeof column name string */
  int col_type = 0;               /* column type              */

  int total_length = 0;           /* accumulator var. for
                                  length of column headings */
  int loopvar = 0;

  char col_name[256] = "\0";
  unsigned char m,n;              /* precision and accuracy
                                  for decimal conversion    */

  fprintf (outstream,"\n");

  /** loop through for each column in solution set
    and determine the maximum column width  **/

  for (col = 0; col < sqlda->sqld; col++) {
    col_name_length=sqlda->sqlvar[col].sqlname.length;
    col_type = sqlda->sqlvar[col].sqltype;
    col_width = sqlda->sqlvar[col].sqllen;
    strncpy(col_name,(char *)sqlda-
>sqlvar[col].sqlname.data,col_name_length) ;

     switch (col_type)
     {
      case SQL_TYP_SMALL:
      case SQL_TYP_NSMALL:                          /* @d30369 tjg */
        col_lengths[col] = TPCDBATCH_MAX (col_name_length,6);
        break;
      case SQL_TYP_INTEGER:
      case SQL_TYP_NINTEGER:
        col_lengths[col] = TPCDBATCH_MAX (col_name_length,11);
        break;
      case SQL_TYP_BIGINT:   /*kmwBIGINT*/
      case SQL_TYP_NBIGINT:
        col_lengths[col] = TPCDBATCH_MAX (col_name_length,19);
        break;
      case SQL_TYP_CSTR:
      case SQL_TYP_NCSTR:
      case SQL_TYP_DATE:
      case SQL_TYP_NDATE:
      case SQL_TYP_TIME:
      case SQL_TYP_NTIME:
      case SQL_TYP_STAMP:
      case SQL_TYP_NSTAMP:
      case SQL_TYP_CHAR:
      case SQL_TYP_NCHAR:
      case SQL_TYP_VARCHAR:
      case SQL_TYP_NVARCHAR:
      case SQL_TYP_LONG:
      case SQL_TYP_NLONG:
        col_lengths[col] = TPCDBATCH_MAX (col_name_length,col_width);
        break;
      case SQL_TYP_FLOAT:
      case SQL_TYP_NFLOAT:
       /* kmw - note: TPCDBATCH_PRINT_FLOAT_WIDTH > max long
identifier */
        col_lengths[col] = TPCDBATCH_PRINT_FLOAT_WIDTH;
        break;

      case SQL_TYP_DECIMAL:
      case SQL_TYP_NDECIMAL:

        m=(*(struct declen *)&sqlda->sqlvar[col].sqllen).m;
        n=(*(struct declen *)&sqlda->sqlvar[col].sqllen).n;

        col_lengths[col] = TPCDBATCH_MAX ((int)(m+n),
col_name_length);
        /* Special handling for DECIMAL */    /* @d26350 tjg */
        break;

      default:
        fprintf(stderr,"--Unknown column type (%d).  Aborting.\n",col_type);
        break;
     }

     fprintf(outstream,"%-*.*s
",col_lengths[col],col_name_length,col_name);

     total_length += (col_lengths[col] + 2);  /* 2 is from padding spaces */
  }

  fprintf(outstream,"\n");
  for (loopvar=0; loopvar < total_length; loopvar++)
    fprintf(outstream,"-");
  fprintf(outstream,"\n");

}


/*************************************************************
******/
/* Gets the current system time and prints it out                */
/*************************************************************
******/
char *get_time_stamp(int form, Timer_struct *time_pointer)
{
  Timer_struct temp_stamp;  /* TIME_ACC jen */
  struct tm *tp;
  size_t timeLength = 0;

  /* TIME_ACC jen start */
  if (time_pointer == (Timer_struct *)NULL)
    get_start_time(&temp_stamp);
  else
   temp_stamp = *time_pointer;

#if defined (SQLUNIX) || defined (SQLAIX)
  tp = localtime((time_t *)&(temp_stamp.tv_sec));
#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
  tp = localtime(&(temp_stamp.time));
#else
#error Unknown operating system
#endif
  /* TIME_ACC jen stop*/

  if ((form == T_STAMP_FORM_1) || (form == T_STAMP_FORM_3))
  {
  /* SUN fix bbe start */
#if (defined (SQLWINT) || defined (SQLWIN) || defined (SQLOS2) ||
defined(SQLDOS))
    timeLength = strftime(newtime,50,"%x %X",tp);
```

```
#elif (defined (SQLUNIX) || defined (SQLAIX))
     timeLength = strftime(newtime,50,"%D %T",tp);  /* SUN  ...test this */
#else
#error Unknown operating system
#endif
   /* SUN fix bbe stop */
      /* TIME_ACC jen start*/
      if (form == T_STAMP_FORM_3)
      {
        /* concatenate the microsecond/milliseconds  on the end of the */
        /*timestamp jen1006 */
#if defined (SQLUNIX) || defined (SQLAIX)
        sprintf(newtime+timeLength,".%0.6d",temp_stamp.tv_usec);
#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
        sprintf(newtime+timeLength,".%0.3d",temp_stamp.millitm);
#else
#error Unknown operating system
#endif
        /* TIME_ACC jen stop*/
      }
   }
   else
      if (form == T_STAMP_FORM_2)
        strftime(newtime,50,"%y%m%d-%H%M%S",tp);

   return (newtime);

}



/*************************************************************
******/
/* Handle all the processing for the summary table               */
/*************************************************************
******/

void summary_table (struct global_struct *g_struct)
{
   double arith_mean = 0;
   double geo_mean   = 0;
   int    num_stmt   = 0;
   int    num_stmt_for_geo_mean   = 0;

   double adjusted_a_mean = 0;
   double adjusted_g_mean = 0;
   double adjusted_g_mean_intern;
   double adjusted_max_time = 0;

   double Ts   = 0;                  /* different TPC-D metrics */
   double Ts1;
   double Ts2;
/* double QppD = 0;                  MARK
   double QthD = 0;
   double QphD = 0; */

   double db_size_frac_part = 0;       /* stores the fractional part of db size */
   double db_size = 0;                 /* size in numbers */
   char db_size_qualifier[3] = "\0";   /* MB, GB or TB */

   struct stmt_info
     *s_info_ptr,
     *s_info_head_ptr,
     *max,
     *min;


   /* Determine the size of the database from the scale factor (1 SF = 1GB) */
   if (g_struct->scale_factor < 1.0) {
      db_size = g_struct->scale_factor * 1000;
      strcpy(db_size_qualifier, "MB");
   } else if (g_struct->scale_factor >= 1000.0) {
      db_size = g_struct->scale_factor / 1000;
      strcpy(db_size_qualifier, "TB");
   } else {
      db_size = g_struct->scale_factor;
      strcpy(db_size_qualifier, "GB");
   }


   /* computes the fractional part of db_size */
   db_size_frac_part = db_size - (int) db_size;

   s_info_ptr = g_struct->s_info_ptr;  /* Just use a local copy */
   s_info_head_ptr = s_info_ptr;

   max = s_info_head_ptr;
   /* ensure that we are not already setting max to the UF timings */
   while ( strstr(max->tag, "UF") != NULL )
     max = max->next;
   min = max;

   if (g_struct->c_l_opt->outfile)     /* create the appropriate output file */
     output_file(g_struct);

   /* write the seed used for this run unless it is a qualification run */
   /* (qualification runs use the default seed for their queries) or  */
   /* unless it is the update function stream (no seeds used for this) */
   /* (this is an update stream iff update is 2) */
   if ((g_struct->c_l_opt->intStreamNum >=0) &&
      (g_struct->c_l_opt->update != 2) )
   {
     if (g_struct->lSeed == -1)
     {
       fprintf( outstream,"\nUsing default qgen seed file");
     }
     else
       fprintf (outstream, "\nSeed used for current run = %ld",g_struct-
>lSeed);
     fprintf( outstream,"\n");
   }

   /* print out the stream number if we are in a throughput stream and if */
   /* this is not the update stream portion of the throughput test */
   if ( (g_struct->c_l_opt->intStreamNum > 0) &&
      (g_struct->c_l_opt->update != 2)  )
   {
     fprintf( outstream, "Stream number = %d\n",g_struct->c_l_opt-
>intStreamNum);
   }
   /* print the stream start timestamp to the inter file */
   fprintf (outstream, "Stream start time stamp %*.*s\n",
          T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_start_time))); /* TIME_ACC jen*/
   /* print the stream stop timestamp to the inter file */
   fprintf (outstream, "Stream stop time stamp %*.*s\n",
          T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_end_time)));  /* TIME_ACC jen*/

   fprintf (outstream, "\n\n\nSummary of
Results\n==================\n");
   fprintf (outstream,
          "\nSequence #     Elapsed Time   Adjusted Time Start Timestamp
End Timestamp\n\n");

   /* Go through the linked list and determine which statement had the
     highest and lowest elapsed times */
```

```
  while ( (s_info_ptr != NULL) && (s_info_ptr != g_struct->s_info_stop_ptr) ) {

    /* check if we are in an update function...if so, we do not want to */
    /* consider the update function times as the min or max time */
    if ( strstr(s_info_ptr->tag,"UF") == NULL )
    {
      /* we are not in an update function */
      if (s_info_ptr->elapse_time > max->elapse_time)
        max = s_info_ptr;
      else
        if ((s_info_ptr->elapse_time < min->elapse_time)
          && (s_info_ptr->elapse_time > -1))
          min = s_info_ptr;
    }

    s_info_ptr = s_info_ptr->next;

  }

  s_info_ptr = s_info_head_ptr;

  /** Start from the first structure and go through until the stop
    pointer is reached **/
  while ( (s_info_ptr != NULL) && (s_info_ptr != g_struct->s_info_stop_ptr) ) {

    if (s_info_ptr->elapse_time != -1)  {
      s_info_ptr->adjusted_time = s_info_ptr->elapse_time;
      /* determine whether the elapsed times have to be adjusted or not */
      /* if this is an update function, we do not adjust the elapsed time*/
      if ( strstr(s_info_ptr->tag,"UF") == NULL )
      {
        /* this is not an update function, adjust time if necessary */
        if (max->elapse_time/min->elapse_time > 1000)
        {
          /* jmc fix geo_mean calculation...round adjusted time properly ROUNDING*/
          adjusted_max_time = max->elapse_time/1000;
          if (s_info_ptr->elapse_time < adjusted_max_time)
          {
            s_info_ptr->adjusted_time =
              (double)(((long)((adjusted_max_time + 0.05) * 10))/10.0);
            if (s_info_ptr->adjusted_time < 0.1)
              s_info_ptr->adjusted_time = 0.1;
          }
          /*jmc fix geo_mean calculation...round adjusted time properly ROUNDING end*/
        }
      }

                                  /* a value was calculated */
      fprintf (outstream,
            "%-5d %-5.5s %15.1f %15.1f %*.*s %*.*s\n",
            s_info_ptr->stmt_num,s_info_ptr->tag,
            s_info_ptr->elapse_time,s_info_ptr->adjusted_time,
            T_STAMP_1LEN,T_STAMP_1LEN,s_info_ptr->start_stamp, /* TIME_ACC jen*/
            T_STAMP_1LEN,T_STAMP_1LEN,s_info_ptr->end_stamp); /* TIME_ACC jen*/

      /* Only update arithmetic mean for queries not update functions */
      if ( strstr(s_info_ptr->tag,"UF") == NULL )
      {
       arith_mean += s_info_ptr->elapse_time;
       adjusted_a_mean += s_info_ptr->adjusted_time;
      }

      if (s_info_ptr->elapse_time > 0) {  /* don't bother finding log of
                                    numbers < 0 */
        geo_mean += log(s_info_ptr->elapse_time);
        adjusted_g_mean += log(s_info_ptr->adjusted_time);
      }


      /* Only update num_stmt for queries not update functions */
      if ( strstr(s_info_ptr->tag,"UF") == NULL )
        num_stmt ++;
      num_stmt_for_geo_mean++;
    }

    else
      fprintf (outstream,"%-5d %-5.5s %-15s %-15s\n",
            s_info_ptr->stmt_num,
            s_info_ptr->tag,"Not Collected", "Not Collected");


    if (s_info_ptr != g_struct->s_info_stop_ptr)
      s_info_ptr=s_info_ptr->next;
  }

  fprintf(outstream, "\n\nNumber of statements: %d\n\n", s_info_ptr->stmt_num - 1);
  /* Calculate the arithmetic and geometric means */

  if (geo_mean != 0) {     /*Used to test if arith_mean != 0
                           Don't bother doing any of this if the
                           elapsed time mean is 0 */
    arith_mean = arith_mean / num_stmt;
    adjusted_a_mean = adjusted_a_mean / num_stmt;
    geo_mean = exp(geo_mean / num_stmt_for_geo_mean);
    adjusted_g_mean_intern = adjusted_g_mean; /*MARK*/
    adjusted_g_mean = exp(adjusted_g_mean / num_stmt_for_geo_mean);

  }


  /* print out all the appropriate information including the
    different TPC-D metrics */
  /* do not bother with this if we are in an update only stream */
  fprintf (outstream, "\nGeom.  mean queries %7.3f %15.3f\n",\
          geo_mean,adjusted_g_mean);
  if (g_struct->c_l_opt->update < 2)
  {
    fprintf (outstream, "Arith. mean queries %7.3f %15.3f\n",\
          arith_mean,adjusted_a_mean);


    fprintf (outstream,
          "\n\nMax Qry %-3.3s %15.1f %15.1f %*.*s %*.*s\n",
          max->tag,max->elapse_time,max->adjusted_time,
          T_STAMP_1LEN,T_STAMP_1LEN,max->start_stamp,  /* TIME_ACC jen*/
          T_STAMP_1LEN,T_STAMP_1LEN,max->end_stamp);  /* TIME_ACC jen*/
    fprintf (outstream,
          "Min Qry %-3.3s %15.1f %15.1f %*.*s %*.*s\n",
          min->tag,min->elapse_time,min->adjusted_time,
          T_STAMP_1LEN,T_STAMP_1LEN,min->start_stamp,  /* TIME_ACC jen*/
          T_STAMP_1LEN,T_STAMP_1LEN,min->end_stamp);  /* TIME_ACC jen*/
  }

  if (g_struct->c_l_opt->intStreamNum == 0) {
    /* fprintf (outstream, "\n\nMetrics\n=======\n\n"); */

    /* Increase the Ts measurement by one second since the accuracy of our */
    /* timestamps is only to 1 second and if the start was at 1.01 seconds, */
```

```
    /* and the end was at 5.99 seconds, we get a free second ... this will */
    /* be made explicit in the upcoming revision of the spec (after 1.0.1) */
     /* TIME_ACC jen start*/
    /* NOTE this can probably be better coded by changing
get_elapsed_time */
    /* to just calculate the elapsed time give a start and an end time, and */
    /* to also give a precision for the calculation (sec, 10ths....).  The */
    /* call then will grab a timestamp before calling. THen we can get rid */
    /* of the if def...and just call get_elapsed_time (whcih can handle the */
    /* os differences on its own */

#if defined (SQLUNIX) || defined (SQLAIX)
    Ts = g_struct->stream_end_time.tv_sec - g_struct-
>stream_start_time.tv_sec + 1;
    Ts1 = (double)g_struct->stream_start_time.tv_sec + ((double)g_struct-
>stream_start_time.tv_usec/1000000);
    Ts2 = (double)g_struct->stream_end_time.tv_sec + ((double)g_struct-
>stream_end_time.tv_usec/1000000);

#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
    Ts = g_struct->stream_end_time.time - g_struct->stream_start_time.time
+ 1;
    Ts1 = (double)g_struct->stream_start_time.time + ((double)g_struct-
>stream_start_time.millitm/1000);
    Ts2 = (double)g_struct->stream_end_time.time + ((double)g_struct-
>stream_end_time.millitm/1000);

#else
#error Unknown operating system
#endif

    /* TIME_ACC jen stop*/

   /* MARK
    ##Now do in calcmetricsp.pl##
    QppD = (3600 * g_struct->scale_factor) / adjusted_g_mean;
    QthD = (num_stmt * 3600 * g_struct->scale_factor) / Ts;
    QphD = sqrt(QppD*QthD);
   */
    /* if the decimal part has some meaningful value then print the database
size
    with decimal part; otherwise just print the integer part */

       fprintf (outstream,
           "\nGeometric mean interim value  = %10.3f\n\nStream Ts %11 =
%10.0f\n\nStream start int representation %11 = %f\n\nStream stop int
representation  %11 = %f",
           adjusted_g_mean_intern,Ts,Ts1,Ts2);
  }

}



/*************************************************************
**/
/* free up all the elements of the sqlda after done processing */
/*************************************************************
**/
void free_sqlda (struct sqlda *sqlda, int select_status)    /* @d30369 tjg */
{
  int loopvar;

  if (select_status == TPCDBATCH_SELECT)
    for (loopvar=0; loopvar<sqlda->sqld; loopvar++) {
      free(sqlda->sqlvar[loopvar].sqldata);
      free(sqlda->sqlvar[loopvar].sqlind);
    }

  free(sqlda);
  sqlda_allocated = 0; /* fix free() problem on NT
                  wlc 090597 */
}


/************************************************/
/* processing to run the insert update function */
/************************************************/
void runUF1 ( struct global_struct *g_struct, int updatePair )
{

  char statement[3000];
  char sourcedir[256];


  int split_updates = 2;      /* no. of ways update records are split */
  int concurrent_inserts = 2;  /* jenCI no of concurrent updates to be */
                    /* jenCI run at once*/
  int loop_updates = 1;       /* jenCI no of updates to be run in one  */
                    /* jenCI "concurrent" invocation.  should*/
                    /* jenCI be split_updates / concurrent_inserts*/
  int i;
  int streamNum;
#ifdef SQLWINT
  /* PROCESS_INFORMATION childprocess[100]; */
  char commandline[256];
  HANDLE            su_hSem;
  char              UF1_semfile[256];
#else
  int childpid[100];
  int               su_semid; /* semaphore for controlling split updates*/
  key_t             su_semkey; /* key to generate semid */
#endif
  if (g_struct->c_l_opt->intStreamNum == 0)
    streamNum = 0;
  else
    streamNum = currentUpdatePair - updatePairStart + 1;

  fprintf( outstream,"UF1 for update pair %d, stream %d,
starting\n",updatePair, streamNum);

  /* Start by loading the data into the staging table at each node */
  /* The orderkeys were split earlier by the split_updates program */
  if (env_tpcd_audit_dir != NULL)
    strcpy(sourcedir,env_tpcd_audit_dir);
  else
    strcpy(sourcedir,".");

  /* Load the orderkeys into the staging table */
  /* In SMP environments one could use a load command but by using a */
  /* script we can keep the code common */
#ifdef SQLWINT
  sprintf (statement, "perl %s\\tools\\ploaduf1 %d\n", sourcedir, updatePair);
#else
  sprintf (statement, "perl %s/tools/ploaduf1 %d 1", sourcedir, updatePair);
#endif
  if (system(statement))
  {
    fprintf (stderr, "ploaduf1 failed for UF1, examine UF1.log for cause.
Exiting.\n");
    if (verbose)
      fprintf (stderr,
          "ploaduf1 failed for UF1, examine UF1.log for cause. Exiting.\n");
    exit (-1);
  }

  fprintf (outstream, "load_update finished for UF1.\n");

  if (getenv ("TPCD_SPLIT_UPDATES") != NULL)
    split_updates = atoi (getenv ("TPCD_SPLIT_UPDATES"));
```

```
  if (getenv ("TPCD_CONCURRENT_INSERTS") != NULL)
/*jenCI*/
    concurrent_inserts = atoi (getenv
("TPCD_CONCURRENT_INSERTS"));  /*jenCI*/
  loop_updates = split_updates / concurrent_inserts;              /*jenCI*/

#ifndef SQLWINT
  /*    we will use the tpcd.setup file to generate the semaphore key */
  if (getenv("TPCD_AUDIT_DIR") != NULL)              /*begin SEMA */
  {
    /* this is assuming that you will be running this from 0th node */
    sprintf(sourcefile, "%s%ctools%ctpcd.setup",
          getenv("TPCD_AUDIT_DIR"), PATH_DELIM,PATH_DELIM);
  }
  else
  {
    fprintf (stderr, "runUF1 Can't open UF1 semaphore
file,TPCD_AUDIT_DIR is not defined.\n");
    exit (-1);
  }
  /*end SEMA */
  su_semkey = ftok (sourcefile, 'J');
  if ( (su_semid = semget (su_semkey, 1,
IPC_CREAT|S_IRUSR|S_IWUSR)) < 0)
  {
    fprintf (stderr, "Cannot get semaphore! semget failed: errno =
%d\n",errno);
    exit (-1);
  }
#else  /* SQLWINT */
  sprintf (UF1_semfile, "%s.%s.UF1.semfile", env_tpcd_dbname, env_user);
  su_hSem = CreateSemaphore(NULL, 0,
                    concurrent_inserts,              /*jenCI*/
                    (LPCTSTR)(UF1_semfile));
  if (su_hSem == NULL)
  {
    fprintf(stderr,
          "CreateSemaphore (ready semaphore) failed, GetLastError: %d,
quitting\n",
          GetLastError());
    exit(-1);
  }
#endif /* SQLWINT */
  if (verbose) fprintf(stderr,"Semaphore created successfully!\n");

  fclose(outstream); /* to prevent multiple header caused by forking
                wlc 081397 */

  for (i=0; i < concurrent_inserts; i++)                  /*jenCI*/
  {
#ifndef SQLWINT
    if ((childpid[i] = fork()) == 0)
    {
      /* runUF1_fn (updatePair, i);   aph 981205 */
      runUF1_fn (updatePair, i, dbname, userid, passwd);
    }
    else
    {
      /* This is the parent */
      if (verbose)
        fprintf (stderr, "stream #%d started with pid %d\n", i, childpid[i]);
    }
#else  /* SQLWINT */
    sprintf (commandline,
          "start /b %s\\auditruns\\tpcdbatch.exe -z -d %s -i %d -j 1 -k %d",
          env_tpcd_audit_dir, dbname, updatePair, i ); /* aph 082797 */

    system (commandline);
#endif /* SQLWINT */
    sleep (UF1_SLEEP);
  }

  /* All children have been created, now wait for them to finish */
#ifndef SQLWINT
  if (sem_op (su_semid, 0, concurrent_inserts * -1) != 0)          /*jenCI*/
  {                                                    /*jenSEM*/
    fprintf(stderr,
          "Failure to wait on insert semaphone with %d of children\n",
          concurrent_inserts);
    exit(1);
  }                                                    /*jenSEM*/
  semctl (su_semid, 0, IPC_RMID, 0);
#else
  for (i = 0; i < concurrent_inserts; i++)                      /*jenCI*/
  {
    if (verbose)
    {
      fprintf(stderr,"About to wait again ...Sets to wait for %d\n",
            concurrent_inserts - i);                          /*jenCI*/
    }
    if (WaitForSingleObject(su_hSem, INFINITE) == WAIT_FAILED)
    {
      fprintf(stderr,
            "WaitForSingleObject (su _hSem) failed in runUF1 on set %d,
error: %d, quitting\n",
            i, GetLastError());
      exit(-1);
    }
  }
  if (! CloseHandle(su_hSem))
  {
    fprintf(stderr,
          "RunUF1 Close Sem failed - Last Error: %d\n", GetLastError());
    /* no exit here */
  }
#endif

  if( (outstream = fopen(outstreamfilename, APPENDMODE)) == NULL )
  {
    fprintf(stderr,"\nThe output file could not be opened.  ");
    fprintf(stderr,"Make sure that the filename is correct.\n");
    fprintf(stderr,"filename = %s\n",outstreamfilename);
    exit(-1);
  }

  fprintf( outstream,"UF1 for update pair %d complete\n",updatePair);
}


/* runUF1_fn() moved to another SQC file                    aph 981205 */


/*************************************************/
/* processing to run the delete update function */
/*************************************************/
void runUF2 ( struct global_struct *g_struct, int updatePair )
{
  char statement[3000];
  char sourcedir[256];

  int split_deletes = 1;    /*   no. of ways update records are split
@dxxxxxhar */
  int concurrent_deletes  = 1;    /* number of database partitions DELjen */
  int chunks_per_concurrent_delete = 1;

  int i;
  int streamNum;
#ifdef SQLWINT
  char commandline[256];
  HANDLE              su_hSem;
```

```
  char              UF2_semfile[256];
#else
  int childpid[100];
  char sourcefile[256];
  int               su_semid; /* semaphore for controlling split updates*/
  key_t             su_semkey; /* key to generate semid */
#endif
   if (g_struct->c_l_opt->intStreamNum == 0)
     streamNum = 0;
  else
     streamNum = currentUpdatePair - updatePairStart + 1;

  fprintf( outstream,"UF2 for update pair %d, stream %d,
starting\n",updatePair, streamNum);

  /* We need to know both how many chunks there are and how many
chunks*/
  /* are to be executed by each concurrent UF2 process.   More chunks
means */
  /* both smaller transactions (less deadlock) and more potential concurrency
*/

  /* How many "chunks" have the orderkeys been divided into? */
  if (getenv ("TPCD_SPLIT_DELETES") != NULL)
    split_deletes = atoi (getenv ("TPCD_SPLIT_DELETES"));
  /* How many deletes should run concurrently */
  if (getenv ("TPCD_CONCURRENT_DELETES") != NULL)
    concurrent_deletes = atoi (getenv
("TPCD_CONCURRENT_DELETES"));
  /* How many chunks in each concurrently running delete process */
  chunks_per_concurrent_delete = split_deletes / concurrent_deletes;


  /* Start by loading the data into the staging table at each node */
  /* The orderkeys were split earlier by the split_updates program */
  if (env_tpcd_audit_dir != NULL)
    strcpy(sourcedir,env_tpcd_audit_dir);
  else
    strcpy(sourcedir,".");

  /* Load the orderkeys into the staging table */
  /* In SMP environments one could use a load command but by using a */
  /* script we can keep the code common */


#ifdef SQLWINT
  sprintf (statement, "perl %s\\tools\\ploaduf2 %d\n", sourcedir, updatePair);
#else
  sprintf (statement, "perl %s/tools/ploaduf2 %d 2", sourcedir, updatePair);
#endif
  if (system(statement))
  {
    fprintf (stderr, "ploaduf2 failed for UF2, examine UF2.log for cause.
Exiting.\n");
    exit (-1);
  }
  fprintf (outstream, "ploaduf2 finished for UF2.\n");

  fclose(outstream); /* to prevent multiple header caused by forking
                wlc 081397 */

  /* Next we need to get ready to launch a bunch of concurrent processes */
#ifndef SQLWINT
  /*    we will use the tpcd.setup file to generate the semaphore key    begin
SEMA */
  if (getenv("TPCD_AUDIT_DIR") != NULL)
  {
    sprintf(sourcefile, "%s%ctools%ctpcd.setup",
          getenv("TPCD_AUDIT_DIR"), PATH_DELIM, PATH_DELIM);
  }
  else
  {
    fprintf (stderr, "runUF2 Can't open UF2 semaphore file,
TPCD_AUDIT_DIR is not defined.\n");
    exit (-1);
  }

  su_semkey = ftok (sourcefile, 'D');   /* use D for deletes    */
  /* end SEMA */
  if ( (su_semid = semget (su_semkey, 1,
IPC_CREAT|S_IRUSR|S_IWUSR)) < 0)
  {
    fprintf (stderr, "UF2 Can't get semaphore! semget failed: errno = %d\n",
          errno);
    exit (-1);
  }
#else
  sprintf (UF2_semfile, "%s.%s.UF2.semfile", env_tpcd_dbname, env_user);
  fprintf(stderr,"UF2 semfile = %s\n",UF2_semfile);
  su_hSem = CreateSemaphore(NULL, 0,
                  concurrent_deletes,
                  (LPCTSTR)(UF2_semfile));
  if (su_hSem == NULL)
  {
    fprintf(stderr,
          "CreateSemaphore (ready semaphore) failed, GetLastError: %d,
quitting\n",
          GetLastError());
    exit(-1);
  }
  fprintf(stderr,"Semaphore created successfully!\n");
#endif

  for (i=0; i < concurrent_deletes; i++)
  {
#ifndef SQLWINT
    if ((childpid[i] = fork()) == 0)
    {
      fprintf(stderr, "B-Calling runUF2_fn  %d   %d   %d ...\n",
                    updatePair, i,chunks_per_concurrent_delete);
      /* runUF2_fn (updatePair, i, chunks_per_concurrent_delete);   aph
981205 */
      runUF2_fn (updatePair, i, chunks_per_concurrent_delete, dbname,
userid, passwd);
    }
    else
    {
      /* This is the parent */
      if (verbose)
        fprintf (stderr, "stream #%d started with pid %d\n", i, childpid[i]);
    }
#else
    {
      /*  SECURITY_ATTRIBUTES sec_process;
         SECURITY_ATTRIBUTES sec_thread; */
      /* NEED TO FIX THIS UP - KBS 98/10/20 */

      sprintf (commandline,
          "start /b %s\\auditruns\\tpcdbatch.exe -z -d %s -i %d -j 2 -k %d -x
%d",
          env_tpcd_audit_dir, dbname, updatePair, i,
chunks_per_concurrent_delete  ); /* aph */
      /* the -x parm should be passed at 0...not 100% sure of this jen */
      fprintf(stderr, "commandline= %s\n", commandline);
      system (commandline);
      sleep (UF2_SLEEP);
    }
#endif
  }
```

```
   /* All children have been created, now wait for them to finish */
#ifndef SQLWINT
   fprintf(stderr, "About to wait on the semaphore...\n");
   if (sem_op (su_semid, 0, concurrent_deletes * -1) != 0)
/*jenSEM*/
   {                                                /*jenSEM*/
     fprintf(stderr,
           "Failure to update wait on delete semaphone with %d children\n",
           concurrent_deletes);
     exit(1);
   }                                                /*jenSEM*/
   semctl (su_semid, 0, IPC_RMID, 0);
#else
// for (i = 0; i < split_deletes; i++)   //DJD Waits forever.....
   for (i = 0; i < concurrent_deletes; i++)
   {
     if (verbose)
     {
//       fprintf(stderr,"About to wait again ...Sets to wait for %d\n",
//               split_deletes - i);
       fprintf(stderr,"About to wait again ...Sets to wait for %d\n",
             concurrent_deletes - i);
     }
     if (WaitForSingleObject(su_hSem, INFINITE) == WAIT_FAILED)
     {
       fprintf(stderr,
             "WaitForSingleObject (su_hSem) failed on set %d, error: %d,
quitting\n",
             i, GetLastError());
       exit(-1);
     }
   }
   if (! CloseHandle(su_hSem))
   {
     fprintf(stderr, "Close Sem failed - Last Error: %d\n", GetLastError());
     /* no exit here */
   }
#endif

   if( (outstream = fopen(outstreamfilename, APPENDMODE)) == NULL )
   {
     fprintf(stderr,"\nThe output file could not be opened.  ");
     fprintf(stderr,"Make sure that the filename is correct.\n");
     fprintf(stderr,"filename = %s\n",outstreamfilename);
     exit(-1);
   }

   fprintf( outstream,"UF2 for update pair %d complete\n",updatePair);

}


/* runUF2_fn() moved to another SQC file                    aph 981205 */


/*-----------------------------------------------------------------*/
/*       General semaphore function.                               */
/*-----------------------------------------------------------------*/
#ifndef SQLWINT
int sem_op (int semid, int semnum, int value)
{
   struct sembuf sembuf;    /* = {semnum ,value,0}; */
   sembuf.sem_num = semnum;
   sembuf.sem_op  = value;
   sembuf.sem_flg = 0;

   if (semop(semid,&sembuf,1) < 0)
   {
     fprintf(stderr,"ERROR*** sem_op errorno = %d\n", errno);
     return(-1);
     /*  exit(1); */
   }
   return (0);       /* successful return  jenSEM */
}
#endif

/*****************************************************************
*****/
/* Determines the proper name for the output file to
   be generated for a particular TPC-D query, update function, or
   interval summary                                              */
/*****************************************************************
*****/
void output_file(struct global_struct *g_struct)
{
   char file_name[256] = "\0";
   char run_dir[150]   = "\0";
   char time_stamp[50] = "\0";
   char delim[2]       = "\0";
   int qnum;


   strcpy(run_dir,g_struct->run_dir);
   sprintf(delim,"%s",env_tpcd_path_delim);
   strcpy(time_stamp,g_struct->file_time_stamp);

   if (g_struct->stream_list == NULL)
     if ((g_struct->stream_list =
               fopen(g_struct->c_l_opt->str_file_name, READMODE)) ==
NULL)
     {
       fprintf(stderr,"\nThe stream list file could not be opened.");
       fprintf(stderr,"Make sure that the filename is correct.\n");
       exit(-1);
     }

   fscanf(g_struct->stream_list,"%d",&qnum);

   switch (g_struct->c_l_opt->intStreamNum)
   {
    case -1: /* qualifiying */
      sprintf(file_name,
"%s%sqryqual%02d.%s",run_dir,delim,qnum,time_stamp);
      break;
    case 0: /* power tests */
       if (qnum < 0) /* update functions */
         sprintf(file_name,
"%s%smps00uf%d.%02d.%s",run_dir,delim,abs(qnum), \
               currentUpdatePair,time_stamp);
     else
         sprintf(file_name,
"%s%smpqry%02d.%s",run_dir,delim,qnum,time_stamp);
      break;

    default:
      /*      if (qnum < 0)  - replaced by berni 96/03/26 */
      if (g_struct->c_l_opt->update == 2 ||
          g_struct->c_l_opt->update == 5)
         sprintf(file_name, "%s%smts%02duf%d.%02d.%s",run_dir,delim, \
               currentUpdatePair - updatePairStart + 1,abs(qnum),
currentUpdatePair,time_stamp);
      else
         sprintf(file_name, "%s%smts%dqry%02d.%s",run_dir,delim, \
               g_struct->c_l_opt->intStreamNum,qnum,time_stamp);
      break;

   }

   if (g_struct->c_flags->eo_infile)
     if (g_struct->c_l_opt->update == 2 ||
```

```
        g_struct->c_l_opt->update == 5)
       sprintf(file_name, "%s%smtufinter.%s",run_dir,delim,time_stamp);
     else
       switch (g_struct->c_l_opt->intStreamNum) {
        case -1:
         sprintf(file_name,
"%s%sqryqualinter.%s",run_dir,delim,time_stamp);
          break;
        case 0:
         /*sprintf(file_name,
"%s%smpinter.%s",run_dir,delim,time_stamp);*/
          if (g_struct->c_l_opt->update == 1)
           sprintf(file_name, "%s%smpqinter.%s",run_dir,delim,time_stamp);
          else
           sprintf(file_name, "%s%smpufinter.%s",run_dir,delim,time_stamp);
          break;
        default:
          if (g_struct->c_l_opt->intStreamNum > 0)
            sprintf(file_name,
                  "%s%smts%dinter.%s",
                  run_dir,delim,g_struct->c_l_opt->intStreamNum,time_stamp);
          else
            fprintf(stderr,"Invalid stream number specified\n");
          break;
       }

  strcpy(outstreamfilename, file_name); /* wlc 081397 */

  if (!feof(instream) || g_struct->c_flags->eo_infile)
    /* Only create an output file if there are input
       statements left to process, or if we're all done
       and want to print out the summary table file */
    if( (outstream = fopen(file_name, WRITEMODE)) == NULL ) {
      fprintf(stderr,"\nThe output file could not be opened.  ");
      fprintf(stderr,"Make sure that the filename is correct.\n");
      fprintf(stderr,"filename = %s\n",file_name);
      exit(-1);
    }

  return;
}


/*****************************************************************
******/
/* Determine whether or not we should break out of the block loop
   because of an end of file, end of block, or update function.
   Also handle some semaphore stuff for update functions         */
/*****************************************************************
******/
int PreSQLprocess(struct global_struct *g_struct, Timer_struct *start_time)
{
  int               rc = 1;
  FILE              *updateFP;
#ifndef SQLWINT
  int               semid;              /* semaphore for controlling UFs*/
  key_t             semkey;             /* key to generate semid */
#else
  int               SemTimeout = 600000;    /* Des time out period of 1 minute
*/
#endif

  switch (g_struct->c_flags->select_status)
  {
   case TPCDBATCH_NONSQL:
    g_struct->s_info_stop_ptr = g_struct->s_info_ptr;
    /* if we're at the end of the input file, set the stop
       pointer to this structure */
    rc = FALSE;
    break;
  case TPCDBATCH_EOBLOCK:
   rc = FALSE;
   break;
  case TPCDBATCH_INSERT:
   /* we have to check whether or not this is a throughput */
   /* test, and if it is, we have to set up a semaphore to */
   /* control when the update functions are run.  We want  */
   /* them to be run after all the query streams have finished. */
   /* What we do is set up the semaphore here, decrement it */
   /* in the query streams, and wait for it to get cleared */
   /* before we allow the UFs to run.                      */
   /* Note: we only set up the semaphore if:               */
   /*       1. we are running the throughput test (num of */
   /*          streams > 0)                               */
   /*       2. we are at the first UF1 (i.e. this is the  */
   /*          case where currentUpdatePair = updatePairStart */
   /* we also want to check the sem_on element in the global */
   /* structure to see if we want to use semaphores or let */
   /* the calling script do the synchronization of the update */
   /* stream                                               */
   if ( semcontrol == 1 )
   {
     /* yes we are to be using semaphores */
     /* is this the 1st time into update function 1 (uf1)? */
     if (currentUpdatePair == updatePairStart )
     {
          /* create the semaphores */
          create_semaphores(g_struct);
          if (g_struct->c_l_opt->intStreamNum != 0)
          /* wait period for runthroughput updates */
                throughput_wait(g_struct);
     }
     /* otherwise continue to run*/
   }
   if ((g_struct->c_l_opt->update == 3) || (g_struct->c_l_opt->update == 4))
   {
    get_start_time(start_time);
    strcpy(g_struct->s_info_ptr->start_stamp,
          get_time_stamp(T_STAMP_FORM_3,start_time ));  /*
TIME_ACC jen*/
     /* write the start timestamp to the file...if this is not a qualification */
     /* run, then write the seed used as well */
     fprintf( outstream,"Start timestamp %*.*s \n",
            T_STAMP_3LEN,T_STAMP_3LEN,                /* TIME_ACC
jen*/
            g_struct->s_info_ptr->start_stamp);
     if (g_struct->c_l_opt->intStreamNum >= 0)
     {
      if (g_struct->lSeed == -1)
      {
       fprintf( outstream,"Using default qgen seed file");
      }
      else
       fprintf( outstream,"Seed used = %ld",g_struct->lSeed);
      fprintf( outstream,"\n");
     }
   }
   if (g_struct->c_l_opt->update < 4){
   /* run only if updates are enabled */
    runUF1(g_struct, currentUpdatePair);
   }

   rc = FALSE;
   if ((g_struct->c_l_opt->intStreamNum == 0) && (semcontrol == 1))
   /* RUNPOWER: release first semaphore so the queries can run */
    release_semaphore(g_struct, INSERT_POWER_SEM);
   break;
  case TPCDBATCH_DELETE:
   if ((g_struct->c_l_opt->intStreamNum == 0) && (semcontrol == 1))
   {
```

```
    /* RUNPOWER: wait for queries to finish */
    /* waiting on QUERY_POWER_SEM semaphore */
     runpower_wait(g_struct, QUERY_POWER_SEM);
    }
    if ((g_struct->c_l_opt->update == 3) || (g_struct->c_l_opt->update == 4))
    {
     get_start_time(start_time);
     strcpy(g_struct->s_info_ptr->start_stamp,
          get_time_stamp(T_STAMP_FORM_3,start_time ));  /*
TIME_ACC jen*/
     /* write the start timestamp to the file...if this is not a qualification */
     /* run, then write the seed used as well */
     fprintf( outstream,"Start timestamp %*.*s \n",
           T_STAMP_3LEN,T_STAMP_3LEN,              /* TIME_ACC
jen*/
           g_struct->s_info_ptr->start_stamp);
     if (g_struct->c_l_opt->intStreamNum >= 0)
     {
      if (g_struct->lSeed == -1)
      {
       fprintf( outstream,"Using default qgen seed file");
      }
      else
       fprintf( outstream,"Seed used = %ld",g_struct->lSeed);
      fprintf( outstream,"\n");
     }
    }
    if (g_struct->c_l_opt->update < 4){
    /* run only if updates are enabled */
     runUF2(g_struct, currentUpdatePair);
     if (g_struct->c_l_opt->intStreamNum == 0)
     {/* RUNPOWER */
      fprintf(stderr, "UF2 completed\n");
     }
    }
    currentUpdatePair += 1;
    /* update the update.pair.num file to reflect the successfully completed */
    /* update pair */
    if (g_struct->c_l_opt->update < 4)
    {   /*jen*/
#ifndef NO_INCREMENT
      /* don't update the pair, only for my testing - Haider */
      updateFP = fopen(g_struct->update_num_file,"w");
      fprintf(updateFP,"%d\n",currentUpdatePair);
      fclose(updateFP);
#endif
    }  /*jen*/
    rc = FALSE;
    break;

  }
  return(rc);
}


/*****************************************************************
********/
/* Handles actual processing of SQL statement.  Initializes the SQLDA
   for returned rows, does PREPARE, DECLARE, and OPEN statements and
   executed multiple FETCHes as needed.  If not a SELECT statement,
   goes into EXECUTE IMMEDIATE section                          */
/*****************************************************************
********/
void SQLprocess(struct global_struct *g_struct)
{
  int rc = 0;                        /* 912RETRY */
  int rows_fetch = 0;
  long sqlcode = SQL_RC_E911;             /* Temporary sqlcode to test
                                  for deadlocks */
  int max_wait = 1;                  /* Maximum number of retries
                                  for deadlock scenario */

  int col_lengths[TPCDBATCH_MAX_COLS];     /* array containing
widths of
                                  columns in returned set  */
  struct stmt_info *s_info_ptr;

  s_info_ptr = g_struct->s_info_ptr;
/*****************************************************************
**********/
/* grab storage for the SQLDA                                   */
/*****************************************************************
**********/
  if ((sqlda=(struct sqlda *)malloc(SQLDASIZE(100))) == NULL)
    mem_error("allocating sqlda");

  sqlda->sqln = TPCDBATCH_MAX_COLS;                  /* @d30369 tjg
*/


  /* Error-recovery code for errors resulting from multi-stream errors */

  while (((sqlcode == SQL_RC_E911) ||
        (sqlcode == SQL_RC_E912) ||
        (sqlcode == SQL_RC_E901)) &&
       (max_wait < MAXWAIT) &&
       (rc==0) )
  {

    sqlcode = 0;          /* Re-initialize sqlcode to avoid infinite-loop */
    if (g_struct->c_flags->select_status == TPCDBATCH_SELECT)
    {
      /* Enter this loop if SQL stmt is a SELECT   */
      EXEC SQL PREPARE STMT1 INTO :*sqlda FROM :stmt_str;

      sqlcode = error_check();
      if (sqlcode < 0)
      {
        fprintf (stderr,"\nPrepare failed. Stopping this query.\n");
        rc = -1;
      }
      else  /* print out the column headings for the answer set */
      {
        print_headings(sqlda,col_lengths);            /* @d22817 tjg */

        allocate_sqlda(sqlda);     /* This is where we set storage for the */
                                   /* SQLDA based on the column types in   */
                                   /* the answer set table.                */

        EXEC SQL DECLARE DYNCUR CURSOR FOR STMT1;

        EXEC SQL OPEN DYNCUR;
        sqlcode = error_check();

        if (sqlcode < 0)      /* we ran into an error of some kind KBS
98/09/28 */
        {
          max_wait ++;
          fprintf (stderr, "\nAn error has been detected on
open...Retrying...\n");
          SleepSome(10);
        }
        else
        {

/*****************************************************************
**********/
          /* Fetch appropriate number of rows and determine whether or not
to   */
          /* send them to file.                                    */
```

```
/*************************************************************
**********/

            rows_fetch = 0;

            do
            {
              /* Keep fetching as long as we haven't finished reading
              all the rows and we haven't gone past the limits set
              in the control string */

              EXEC SQL FETCH DYNCUR USING DESCRIPTOR :*sqlda;
              if (sqlca.sqlcode == 100)
              {
                sqlcode = sqlca.sqlcode;
              }
              else
              {
                sqlcode = error_check();
              }
              if (sqlcode == 0)
              {
                rows_fetch++;
                if ( (rows_fetch <= s_info_ptr->max_rows_out) ||
                     (s_info_ptr->max_rows_out == -1) )
                  echo_sqlda(sqlda,col_lengths);
              }
              else if (sqlcode < 0)
              {
                max_wait++;
                fprintf (stderr, "\nAn error has been detected on
fetch...Retrying...\n");
                SleepSome(10);
              }
            }  while ( (sqlcode == 0) && \
                    ( (s_info_ptr->max_rows_fetch == -1) || \
                      (rows_fetch < s_info_ptr->max_rows_fetch) ) );
          } /* end of successful open */
        } /* end of successful prepare */
      } /** End of block for handling SELECT statements **/

      else
      {         /** SQL statement is not a SELECT **/
        EXEC SQL EXECUTE IMMEDIATE :stmt_str;
        sqlcode = error_check();

        if (sqlcode < 0 )
        {
          max_wait ++;
          fprintf (stderr, "\nAn error has been detected on execute
immediate...Retrying...\n");
          SleepSome(10);
        }
      } /* end of block for handling NON-select statements */

      if ( (sqlcode >= 0 ) &&
           (g_struct->c_flags->select_status == TPCDBATCH_SELECT))
      {
        /* we opened a cursor before */
        EXEC SQL CLOSE DYNCUR;
        sqlcode = error_check();

        if ((s_info_ptr->max_rows_fetch == -1) ||
            (rows_fetch < s_info_ptr->max_rows_fetch))
#ifndef SQLPTX
          fprintf (outstream, "\n\nNumber of rows retrieved is: %6d",
                rows_fetch);
        else
          fprintf (outstream, "\n\nNumber of rows retrieved is: %6d",
                s_info_ptr->max_rows_fetch);
#else
          fprintf (outstream, "\n\nNumber of rows retrieved is: %6d",
                rows_fetch);
        else
          fprintf (outstream, "\n\nNumber of rows retrieved is: %6d",
                s_info_ptr->max_rows_fetch);
#endif
      }                                         /* @d28763 tjg */

      if (s_info_ptr->query_block == FALSE)  /* if block is off don't loop */
        g_struct->c_flags->eo_block = TRUE;

    } /* end of while loop to retry if needed */

} /* end of SQLprocess */

/*************************************************************
*****/
/* performs some operations after a statement has been processed,
   including doing a COMMIT if necessary, and calculating the
   elapsed time.  Also initializes a new stmt_info structure
   for the next block of statements                          */
/*************************************************************
*****/
int PostSQLprocess(struct global_struct *g_struct, Timer_struct *start_time)
{
  struct stmt_info *s_info_ptr;
  Timer_struct        end_t;          /* end point for elapsed time */

#if DEBUG
  fprintf (outstream, "In PostSQLprocess\n");
#endif

  s_info_ptr = g_struct->s_info_ptr;


  if (g_struct->c_flags->select_status == TPCDBATCH_NONSQL)
    return FALSE;  /* get out if we've reached the end of input file */

  if (g_struct->c_l_opt->update > 1)
  {
    /* This is an update function stream.  There is no need to COMMIT.  */
    /* Each UF child will COMMIT its own transactions. */
    ;
  }
  else
  {  /* For non-UF cases, COMMIT now. */
   if (g_struct->c_l_opt->a_commit) {
     EXEC SQL COMMIT WORK;
     error_check();                             /* @d22275 tjg */
   }
  }

  fflush(outstream);

  s_info_ptr->elapse_time = get_elapsed_time(start_time);

  if (g_struct->c_flags->time_stamp == TRUE)            /* @d25594 tjg */
    get_start_time(&end_t); /* Get the end time */
    strcpy(s_info_ptr->end_stamp,
    get_time_stamp(T_STAMP_FORM_3,&end_t) );
    /*get_time_stamp(T_STAMP_FORM_3,(time_t)NULL) );*/

  /* BBE: Pass on time stamp values for the next query */
  temp_time_struct = end_t;
  strcpy(temp_time_stamp, s_info_ptr->end_stamp);

  /* write the start timestamp to the file */
  fprintf( outstream,"\n\nStop timestamp %*.*s \n",
```

```
        T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
        s_info_ptr->end_stamp);

  /* DJD print elapsed time in seconds  */
  fprintf( outstream,"Query Time = %15.1f secs\n", s_info_ptr-
>elapse_time);


  /** Allocate space for a new stmt_info structure **/    /* @d24993 tjg */
  s_info_ptr->next =
    (struct stmt_info *) malloc(sizeof(struct stmt_info));
  if (s_info_ptr->next != NULL)  {
    memset(s_info_ptr->next, '\0', sizeof(struct stmt_info));
    /** Transfer details from one structure to another for
      to apply for the next statement **/
    s_info_ptr->next->stmt_num = s_info_ptr->stmt_num + 1;
    s_info_ptr->next->max_rows_fetch = s_info_ptr->max_rows_fetch;
    s_info_ptr->next->max_rows_out = s_info_ptr->max_rows_out;

    s_info_ptr->next->query_block = s_info_ptr->query_block;
    s_info_ptr->next->elapse_time = -1;

    s_info_ptr = s_info_ptr->next;

  }
  else {
    mem_error("allocating next stmt structure. Exiting\n");
    exit(-1);
  }

  /** Set the stop and travelling pointer to the current info structure **/
  g_struct->s_info_stop_ptr = g_struct->s_info_ptr = s_info_ptr;

  if (sqlda_allocated)
    free_sqlda(sqlda,g_struct->c_flags->select_status);
    /* fix free() problem on NT
      wlc 090597 */

  if (g_struct->c_l_opt->outfile != 0)
    fclose(outstream);

  return (TRUE);
}

/*****************************************************************
*****************/
/* Does some cleaning up once all the statements are processed.  Disconnects
   from the database, cleans up some semaphore stuff from the update
functions,
   prints out the summary table, and closes all file handles.              */
/*****************************************************************
*****************/
int cleanup(struct global_struct *g_struct)
{
#ifndef SQLWINT
  int              semid;          /* semaphore for controlling UFs*/
  key_t            semkey;         /* key to generate semid */
#endif
  char file_name[256] = "\0";

  /** End timestamp for stream **/
  /*g_struct->stream_end_time = time(NULL);*/
  get_start_time(&(g_struct->stream_end_time));  /* TIME_ACC jen */

  switch (g_struct->c_l_opt->update)
  {
     case (2):
     case (5):
          /* update throughput function stream */
          sprintf(file_name,"%s%sstrcntuf.%s",g_struct->run_dir,
                env_tpcd_path_delim, g_struct->file_time_stamp);
          break;
     case (3):
     case (4):
          /* update power function stream */
          sprintf(file_name,"%s%spstrcntuf.%s",g_struct->run_dir,
                env_tpcd_path_delim, g_struct->file_time_stamp);
          break;
     case (1):
          /* power query stream */
          sprintf(file_name, "%s%spstrcnt%d.%s",g_struct->run_dir,
env_tpcd_path_delim,
                g_struct->c_l_opt->intStreamNum,g_struct-
>file_time_stamp);
          break;
     case (0):
          /* throughput query stream */
          sprintf(file_name, "%s%sstrcnt%d.%s",g_struct->run_dir,
env_tpcd_path_delim,
                g_struct->c_l_opt->intStreamNum,g_struct-
>file_time_stamp);
          break;
  }

#ifndef LINUX

  if( (g_struct->stream_report_file = fopen(file_name, APPENDMODE)) ==
NULL )
  {
    fprintf(stderr,"\nThe output file for the stream count information\n");
    fprintf(stderr,"could not be opened, make sure the filename is correct\n");
    fprintf(stderr,"filename = %s\n",file_name);
    exit(-1);
  }

#endif

  /* print out the stream stop time in the stream count information file*/
  if (g_struct->c_l_opt->update > 1)
  {
    /* update function stream */
    fprintf(g_struct->stream_report_file,
          "Update function stream stopping at %*.*s\n",
          T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_end_time)));  /* TIME_ACC jen*/
  }
  else
  {
    /* query stream(s) */
    fprintf(g_struct->stream_report_file,
          "Stream number %d stopping at %*.*s\n",
          g_struct->c_l_opt->intStreamNum,
          T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_end_time)));  /* TIME_ACC jen*/
  }
  fclose(g_struct->stream_report_file);



  /* No need to check for errors here.
    Also, the UF stream in a Throughput run
    has no connection in tpcdbatch.sqc.          aph 98/12/26
  error_check();
  */

  /* if we are in a query stream AND this is a throughput test, then need */
  /* do to some semaphore stuff   (0 implies update functions are off) */
  /* AND we are supposed to be using semaphores */
```

```
  if ( ( semcontrol == 1 ) &&
       ( g_struct->c_l_opt->update < 2))
    /* only queries need to release the semaphore at this point */
  {
    if (g_struct->c_l_opt->intStreamNum == 0)
     release_semaphore(g_struct, QUERY_POWER_SEM); /* power stream
*/
    else
     release_semaphore(g_struct, THROUGHPUT_SEM); /* throughput
stream */

  EXEC SQL CONNECT RESET;
#ifndef SQLWINT
    if (verbose)
    {
     fprintf(stderr,
          "cleanup: semkey = %ld, semid = %d, file = %s, stream = %d\n",
          semkey,semid,g_struct->update_num_file,
          g_struct->c_l_opt->intStreamNum);
    }
#endif
  }


  /** Summary table processing **/                    /* @d24993 tjg */
  summary_table(g_struct);

  fprintf (outstream, "\n\n");

  fclose(outstream);          /* Close the output data stream.     */
  fclose(instream);           /* Close the SQL input stream.       */

  return (TRUE);
}

void create_semaphores(struct global_struct *g_struct)
{

#ifndef SQLWINT
  int             semid;          /* semaphore for controlling UFs*/
  key_t           semkey;         /* key to generate semid */
#else
  HANDLE          hSem;
  HANDLE          hSem2;
  int             SemTimeout = 600000;    /* Des time out period of 1 minute
*/
#endif
      fprintf(stderr,"numstreams = %d\n",g_struct->c_l_opt->intStreamNum);
      fprintf(stderr,"Update stream creating semaphore(s) for update and
query sequencing\n");
#ifdef SQLWINT

      fprintf(stderr,"semfile = %s\n",g_struct->sem_file);
      if (g_struct->c_l_opt->intStreamNum == 0)
      /*RUNPOWER*/
      {
          fprintf(stderr,"semfile2 = %s\n",g_struct->sem_file2);
          hSem = CreateSemaphore(NULL, 0,1,(LPCTSTR)(g_struct-
>sem_file));
          hSem2 = CreateSemaphore(NULL, 0,1,(LPCTSTR)(g_struct-
>sem_file2));
          if ((hSem == NULL) || (hSem2 == NULL))
          {
            fprintf(stderr,
                 "CreateSemaphores (ready semaphore) failed, GetLastError:
%d, quitting\n",
                 GetLastError());
            exit(-1);
          }
          fprintf(stderr,"Semaphores created successfully!\n");
      }
      else
      {
      /* RUNTHROUGHPUT creates semaphores based on the number of
query streams while the number of streams for runpower is constant */
          hSem = CreateSemaphore(NULL, 0,
                       g_struct->c_l_opt->intStreamNum,
                       (LPCTSTR)(g_struct->sem_file));

          if (hSem == NULL)
          {
              fprintf(stderr,
                   "CreateSemaphore (ready semaphore) failed,
GetLastError: %d, quitting\n",
                   GetLastError());
              exit(-1);
          }
          fprintf(stderr,"Semaphore created successfully!\n");

      }
#else             /* AIX, SUN, etc. */
      /* create a semaphore key...use the name of a file that */
      /* you know exists */
      fprintf(stderr,"semfile = %s\n", g_struct->update_num_file);
      semkey = ftok(g_struct->update_num_file,'J');
      if (g_struct->c_l_opt->intStreamNum == 0)
      /* RUNPOWER */
      {

          if ( (semid =
semget(semkey,2,IPC_CREAT|S_IRUSR|S_IWUSR)) < 0)
          {
              fprintf(stderr,
                   "Throughput can't get initial semaphore! semget failed
errno = %d\n",
                   errno);
              exit(1);
          }
      }
      else
      /* THROUGHPUT */
      {

          if ( (semid =
semget(semkey,1,IPC_CREAT|S_IRUSR|S_IWUSR)) < 0)
          {
              fprintf(stderr,
                   "Throughput can't get initial semaphore! semget failed
errno = %d\n",
                   errno);
              exit(1);
          }
          if (verbose)
          {
              fprintf(stderr,
                   "insert: semkey = %ld, semid = %d, file = %s, value =
%d\n",
                   semkey,semid,g_struct->update_num_file,
                   (g_struct->c_l_opt->intStreamNum * -1));
          }
      }


#endif
}

/*throughput update */
void throughput_wait(struct global_struct *g_struct)
```

```
{
#ifndef SQLWINT
  int             semid;          /* semaphore for controlling
UFs*/
  key_t           semkey;         /* key to generate semid */
#else
  HANDLE          hSem;
  int             j;
  int             SemTimeout = 600000;    /* Des time out
period of 1 minute */
#endif

#ifdef SQLWINT
      hSem = open_semaphore(g_struct,
THROUGHPUT_SEM);
      for (j = 0; j < g_struct->c_l_opt->intStreamNum; j++)
      {
            if (verbose)
              fprintf(stderr,"About to wait again ...\n");
            if (WaitForSingleObject(hSem, INFINITE) ==
WAIT_FAILED)
            {
                fprintf(stderr,
                    "WaitForSingleObject (hSem) failed on
stream %d, error: %d, quitting\n",
                    j, GetLastError());
                exit(-1);
            }
            if (verbose)
                fprintf(stderr,"Streams to wait for  %d\n", j);
      }
      fprintf(stderr,"finished waiting on stream semaphore!
Ready to run updates!\n");
      /* close the semaphore handle */
      if (! CloseHandle(hSem)) {
        fprintf(stderr, "Close Sem failed - Last Error: %d\n",
GetLastError());
        /* no exit here */
      }
#else
      semid = open_semaphore(g_struct);
      /* call the sem_op routine to decrement the semaphore
by */
      /* however many streams .... by calling this function
with*/
      /* a negative number, this stream is forced to wait until
*/
      /* the semaphore gets back to 0 */
      if (sem_op(semid, 0, (g_struct->c_l_opt->intStreamNum
* -1)) != 0)
      {                                       /*jenSEM*/
            fprintf(stderr,
                "Failure to wait on throughput semaphone for
%d streams\n",
                g_struct->c_l_opt->intStreamNum);
            exit(1);
      }                                       /*jenSEM*/
      fprintf(stderr,"finished waiting on stream semaphore!
Ready to run updates!\n");
      semctl(semid,0,IPC_RMID,0);  /* we've finished
waiting, now */
                        /* remove the semaphore */
#endif
}

void runpower_wait(struct global_struct *g_struct, int
sem_num)
{
   char semfile[150];
#ifdef SQLWINT
   HANDLE hSem;


   if (sem_num == 1)
      strcpy (semfile, g_struct->sem_file);
   else
      strcpy (semfile, g_struct->sem_file2);


#else    /* AIX */
   int             semid;          /* semaphore for controlling
UFs*/
   key_t           semkey;         /* key to generate semid
*/

   strcpy (semfile, g_struct->update_num_file);

#endif

  if (g_struct->c_l_opt->update == 1)
    fprintf(stderr,"querystream waiting for update stream
(UF1) to signal semaphore based on %s\n", semfile);
  else
    fprintf(stderr,"updatestream (UF2) waiting on querystream
semaphore to signal semaphore based on %s\n", semfile);

#ifdef SQLWINT

   hSem = open_semaphore(g_struct, sem_num);
   if (verbose)
     fprintf(stderr,"Runpower queries about to wait ...\n");
   if (WaitForSingleObject(hSem, INFINITE) ==
WAIT_FAILED)
   {
     fprintf(stderr,
       "WaitForSingleObject (hSem) failed on stream 0, error:
%d, quitting\n",
       GetLastError());
       exit(-1);
   }
   if (! CloseHandle(hSem))
   {
```

```
        fprintf(stderr, "Close Sem failed - Last Error: %d\n",
GetLastError());
        /* no exit here */
    }

#else

    semid = open_semaphore(g_struct);

    /* call the sem_op routine to decrement the semaphore by
*/
    /* however many streams .... by calling this function with*/
    /* a negative number, this stream is forced to wait until */
    /* the semaphore gets back to 0 */
    /* aix semaphores start at 0, not 1, so sem_num -1 is used
*/
    if (sem_op(semid, sem_num - 1, -1) != 0)
    {                                       /*jenSEM*/
        fprintf(stderr,
            "Failure to wait on runpower semaphone for %d
streams\n",
            g_struct->c_l_opt->intStreamNum);
        exit(1);
    }                                       /*jenSEM*/
#endif
    if (g_struct->c_l_opt->update == 1)
     fprintf(stderr,"querystream finished waiting on updatestream
semaphore\n");
    else
     fprintf(stderr,"updatestream finished waiting on querystream
semaphore\n");
}

void release_semaphore(struct global_struct *g_struct, int sem_num)
{
#ifndef SQLWINT
   int              semid;          /* semaphore for controlling UFs*/
   key_t            semkey;         /* key to generate semid */
#else
   HANDLE           hSem;
   int              SemTimeout = 600000;    /* Des time out period of 1 minute
*/
#endif

#ifdef SQLWINT
      hSem = open_semaphore(g_struct, sem_num); /* query */
      if (! ReleaseSemaphore(hSem,
                        1,
                        (LPLONG)(NULL)))
      {
          fprintf(stderr, "ReleaseSemaphore failed, Sem#: %d LastError: %d,
quit\n",
                sem_num, GetLastError());
          exit(-1);
      }
#else
      semid = open_semaphore(g_struct); /* query */
      /* aix semaphores start at 0, not 1, so sem_num -1 is used */
      if (sem_op(semid, sem_num - 1, 1) != 0)           /*jenSEM*/
       {                                      /*jenSEM*/
          fprintf(stderr,
              "Failed to increment semaphore %d for throughput stream
%d\n",
              sem_num, g_struct->c_l_opt->intStreamNum);
          fprintf(stderr,
              "file for generation of semaphore is: %s\n",
              g_struct->update_num_file);
          exit(1);
       }

#endif
      if (g_struct->c_l_opt->intStreamNum == 0)
      {  /* RUNPOWER */
        if (sem_num == 1)
        {
          fprintf(stderr, "UF1 completed.\n");
        }
        else
        {
          fprintf(stderr, "query stream completed.\n");
        }
      }
}

#ifdef SQLWINT /* Compile only in NT */
HANDLE open_semaphore(struct global_struct *g_struct, int num)
{
      HANDLE  hSem;
      LPCTSTR semfile;

      if (num == 1)
          semfile = (LPCTSTR)g_struct->sem_file;
      else
          semfile = (LPCTSTR)g_struct->sem_file2;

      while ((hSem = OpenSemaphore(SEMAPHORE_ALL_ACCESS |
                          SEMAPHORE_MODIFY_STATE |
                          SYNCHRONIZE,
                        TRUE,
                        semfile))
                == (HANDLE)(NULL))
      {
        /*
        ** if cannot open the semaphore, wait for 0.1 second
        */
        fprintf(stderr,"Retry Open semaphore %s\n",semfile);

        Sleep(1000);
      }
      return hSem;
}

#else  /* Compile only in non-NT (i.e. AIX) */
int open_semaphore(struct global_struct *g_struct)
{
      int              semid;          /* semaphore for controlling UFs*/
      key_t            semkey;         /* key to generate semid */
      int num;

      if (g_struct->c_l_opt->intStreamNum == 0)
          num = 2;
      else
          num = 1;

      semkey = ftok(g_struct->update_num_file,'J');
      while ((semid = semget(semkey,num,0)) < 0)
      {
          if (errno == ENOENT)
          {
              sleep(2);
              fprintf(stderr,"cleanUp: looping for access to semaphore
stream %d  ",
                  g_struct->c_l_opt->intStreamNum);
              fprintf(stderr,"semkey=%ld semid = %d
```

```
file=%s\n",semkey,semid,
                        g_struct->update_num_file);
            }
            else
            {
                fprintf(stderr,"query stream %d semget failed errno = %d\n",
                        g_struct->c_l_opt->intStreamNum,errno);
                exit(1);
            }
        }
        return semid;
}
#endif
```

D.3 tpcdUF.sqc

```
/*************************************************************
*****************
*
*  TPCDUF.SQC
*
*  Revision History:
*
*  05 dec 98 aph Created tpcdUF.sqc containing runUF1_fn() and
runUF2_fn()
*               so that it can be bound separately with a different isolation level.
*  15 may 99 bbe Added cast (short) for type conversion between a long and
a short.
*  16 jun 99 jen Added in proper connect reset code for UF functions
(mistakenly
*               removed
*  17 jun 99 jen SEMA Changes semaphore file for update functions to look
for tpcd.setup
*               not for the orders.***  update data file  (AIX  only )
*  21 jul 99 bbe Commented out conditions in SQL statments that searched
on fields
*               other than app_id.
*
*************************************************************
*****************/

#define UF1DEBUG
#define UF2DEBUG

#if (defined(SQLPTX) && defined(SQLSUN))
#define exit(rc) _exit(rc)
#else
#define exit(rc) exit(rc)
#endif /* SQLPTX & SQLSUN*/

#include "tpcdbatch.h"
/** EXEC SQL INCLUDE SQLCA; **/

#include "sqlca.h"
extern struct sqlca sqlca;

/*************************************************************
***********/
/* Function Prototypes                                       */
/*************************************************************
***********/
extern int SleepSome( int amount );
extern long error_check(void);                          /* @d28763 tjg */
extern void dumpCa(struct sqlca*);      /*kmw*/
extern int sem_op (int semid, int semnum, int value);
extern char *get_time_stamp(int form, Timer_struct *timer_pointer);     /*
TIME_ACC jen */

/*************************************************************
******/
/* Declare the SQL host variables.                           */
/*************************************************************
******/
EXEC SQL BEGIN DECLARE SECTION;
  char UF_dbname[9] = "\0";
  char UF_userid[9] = "\0";
  char UF_passwd[9] = "\0";
  sqlint32 UF_chunk = 0;
  short month = 0;
EXEC SQL END DECLARE SECTION;

/*************************************************************
******/
/* Declare the global variables.                             */
/*************************************************************
******/
extern char env_tpcd_tmp_dir[150];
extern FILE *instream, *outstream;  /* File pointers */
extern char sourcefile[256];    /* Used for semaphores and table functions?*/
extern struct {                         /* jen LONG */
            short len;
            char data[32700];
           } stmt_str;                  /* jen LONG */


/*************************************************************
******/
/* UF1 child                                                 */
/* (i is the application number.)                            */
/*************************************************************
******/
void runUF1_fn ( int updatePair, int i, char *dbname, char *userid, char
*passwd )
{
  int rc = 0;
  int split_updates = 2;       /* no. of ways update records are split */
  int concurrent_inserts = 2;  /* jenCI no of concurrent updates to be */
                               /* jenCI run at once*/
  int loop_updates = 1;        /* jenCI no of updates to be run in one  */
                               /* jenCI "concurrent" invocation.  should*/
                               /* jenCI be split_updates / concurrent_inserts*/
  int startChunk = 0;          /* jenCI number of first chunk to insert for */
                               /* jenCI this child */
  int stopChunk = 0;           /* jenCI number of last chunk to insert for */
                               /* jenCI this child */
  long insertedLineitem = 0;  /*kmw*/
  long insertedOrders = 0;    /*kmw*/
  long saveInsertedOrders = 0; /*kbs*/

  long sqlcode;
  int maxwait;

#ifndef SQLWINT
  int               su_semid;
  key_t             su_semkey;
#else
  HANDLE            su_hSem;
  char              UF1_semfile[256];
#endif

  char myoutstreamfile[256];
  FILE *myoutstream;

  strcpy(UF_dbname, dbname);
  strcpy(UF_userid, userid);
  strcpy(UF_passwd, passwd);

  /* Get ready to start logging diagnostic output */
  sprintf (myoutstreamfile, UF1OUTSTREAMPATTERN,
env_tpcd_tmp_dir, PATH_DELIM,
          updatePair, i);
```

```
  if ( (myoutstream = fopen (myoutstreamfile, WRITEMODE)) == NULL)
  {
    fprintf (stderr, "\nThe output file '%s' for update pair %d set %d could not
be opened. runUF1_fn\n",
            myoutstreamfile,updatePair,i);
    rc=-1;
    goto UF1_exit;
  }
  outstream=myoutstream;    /* initialize outstream for error_check
dxxxxhar*/

  fprintf( myoutstream,"\nUF1 for update pair %d set %d starting at
%*.*s\n",
          updatePair, i,
          T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));    /*
TIME_ACC jen*/


  if (getenv ("TPCD_SPLIT_UPDATES") != NULL)
    split_updates = atoi (getenv ("TPCD_SPLIT_UPDATES"));
  if (getenv ("TPCD_CONCURRENT_INSERTS") != NULL)
/*jenCI*/
    concurrent_inserts = atoi (getenv
("TPCD_CONCURRENT_INSERTS"));  /*jenCI*/
  loop_updates = split_updates / concurrent_inserts;              /*jenCI*/

  /* determine the starting and stopping point of the chunks that this  jenCI*/
  /* invocation will apply. i is starting chunk number with range 0     jenCI*/
  /* through (concurrent_inserts -1)                                    jenCI*/
  startChunk = i * loop_updates;                                    /*jenCI*/
  stopChunk = startChunk + (loop_updates - 1);                      /*jenCI*/


  /* Establish a connection to the database */
  if (!strcmp(userid,"\0"))   /** No authentication provided **/
    EXEC SQL CONNECT TO :UF_dbname;
  else
    EXEC SQL CONNECT TO :UF_dbname USER :UF_userid USING
:UF_passwd;
  error_check();
  if (sqlca.sqlcode < 0)
  {
    rc=-1;
    goto UF1_exit;
  }

  /* Start processing each chunk in my range */
#ifdef UF1DEBUG
  fprintf (myoutstream,"Before loop_a startChunk = %d, stopChunk =
%d\n", startChunk, stopChunk);
  fflush(myoutstream);
#endif
  for ( UF_chunk = startChunk; UF_chunk <= stopChunk; UF_chunk++ )
/*jenCI*/
  {                                                    /*jenCI*/
    /* wlc  062797 */
    sqlcode = SQL_RC_E911;
    month = (short)UF_chunk;  /* Cast 'short' added bbe */
    maxwait = 1;
    rc = 0;

#ifdef UF1DEBUG
  fprintf (myoutstream, "Before While_a Chunk= %d \n",UF_chunk);
  fflush(myoutstream);
#endif
    /* Loop to handle any deadlocks */
    while (sqlcode == SQL_RC_E911 && maxwait <= MAXWAIT &&
rc==0)
    {
#ifdef UF1DEBUG
  fprintf (myoutstream, "in loop before orders exec sql %d\n", sqlcode);
  fflush(myoutstream);
#endif
      sqlcode = 0;
      EXEC SQL INSERT INTO TPCD.ORDERS
           SELECT
O_ORDERKEY,O_CUSTKEY,O_ORDERSTATUS,O_TOTALPRICE,

O_ORDERDATE,O_ORDERPRIORITY,O_CLERK,O_SHIPPRIORITY,O
_COMMENT
           FROM TPCDTEMP.ORDERS_NEW
           WHERE APP_ID = :UF_chunk;
           /*AND 12*(YEAR(O_ORDERDATE)-
1992)+MONTH(O_ORDERDATE)-01 = :month;*/

      fprintf(myoutstream,
           "Insert into orders pair %d chunk %d Return sqlcode=%ld\n",
           updatePair,UF_chunk,sqlca.sqlcode);

      if (sqlca.sqlcode < 0)
        sqlcode = error_check();

      if (sqlcode == SQL_RC_E911)
      {       /* we've hit a deadlock */
        fprintf (myoutstream,
             "\nDeadlock detected inserting from tpcdtemp.orders_new for
chunk %d for pair %d..Retrying...\n",UF_chunk,updatePair);
        SleepSome(UF_DEADLOCK_SLEEP);
        maxwait++;                          /* jen DEADLOCK */
      }
      else if (sqlcode < 0)
      {
        fprintf(myoutstream,
             "Insert into orders pair %d chunk %d failed sqlcode=%d\n",
             updatePair,UF_chunk,sqlcode);
        dumpCa(&sqlca);
        rc = -1;
      }
      else
      {
        /* Everything worked with ORDERS, proceed with LINEITEM */
        saveInsertedOrders = sqlca.sqlerrd[2];

        sqlcode = 0;
#ifdef UF1DEBUG
        fprintf (myoutstream, "in lineitem for update pair number %d set %d
chunk %d\n",
             updatePair, i,UF_chunk);
        fflush(myoutstream);
#endif

        EXEC SQL INSERT INTO TPCD.LINEITEM
          SELECT
L_ORDERKEY,L_PARTKEY,L_SUPPKEY,L_LINENUMBER,L_QUAN
TITY,
          L_EXTENDEDPRICE,L_DISCOUNT,L_TAX,

L_RETURNFLAG,L_LINESTATUS,L_SHIPDATE,L_COMMITDATE,L_
RECEIPTDATE,
          L_SHIPINSTRUCT,L_SHIPMODE,L_COMMENT
          FROM TPCDTEMP.LINEITEM_NEW WHERE APP_ID =
:UF_chunk;
          /*(AND L_ORDERKEY IN
            (SELECT O_ORDERKEY FROM TPCD.ORDERS
              WHERE 12*(YEAR(O_ORDERDATE)-
1992)+MONTH(O_ORDERDATE)-01 = :month);*/

        fprintf(myoutstream,
             "Insert into Lineitem  pair %d chunk %d Return
```

```
sqlcode=%ld\n",
                updatePair,UF_chunk,sqlca.sqlcode);

        if (sqlca.sqlcode < 0)
          sqlcode = error_check();

        if (sqlcode == SQL_RC_E911)
        {       /* we've hit a deadlock */
          fprintf (myoutstream,
                "\nA deadlock has been detected inserting from
tpcdtemp.lineitem%d_%d...Retrying...\n",
                updatePair, UF_chunk);
          SleepSome(UF_DEADLOCK_SLEEP);
          maxwait++;                    /* jen DEADLOCK */
        }
        else if (sqlcode < 0)
        {
          fprintf(myoutstream,
              "Insert into lineitem pair %d chunk %d failed sqlcode=%d\n",
              updatePair,UF_chunk,sqlcode);
          dumpCa(&sqlca);
          rc = -1;
        }
        else
        {
#ifdef UF1DEBUG
          fprintf (myoutstream, "lineitem insert succeeded\n");
          fflush(myoutstream);
#endif
          /* accumulate the number of row inserted */
          /* Order count ONLY updated if both orders and lineitem */
          /* go through */
          insertedOrders += saveInsertedOrders;         /* kbs */
          insertedLineitem += sqlca.sqlerrd[2];
          rc=0;
          EXEC SQL COMMIT WORK;
          error_check();

#ifdef UF1DEBUG
          /* report the number of row inserted */
          fprintf(myoutstream, "    interim %ld rows for chunk %d into
TPCD.ORDERS at %*.*s\n",

insertedOrders,UF_chunk,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
                get_time_stamp(T_STAMP_FORM_1,(Timer_struct
*)NULL));  /* TIME_ACC jen*/
          /* report the number of row deleted *s inserted */
          fprintf(myoutstream,
                "    interim %ld rows for chunk %d into TPCD.LINEITEM at
%*.*s\n",
                insertedLineitem,UF_chunk,
                T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
                get_time_stamp(T_STAMP_FORM_1,
                        (Timer_struct *)NULL));  /* TIME_ACC jen*/

          fprintf( myoutstream,
                "    inserts for update pair %d chunk %d complete at
%*.*s\n\n",
                updatePair, UF_chunk,
                T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
                get_time_stamp(T_STAMP_FORM_1,
                        (Timer_struct *)NULL));  /* TIME_ACC jen*/

#endif
        }
      } /* process lineitem INSERTs */
    } /* while loop for deadlocks */
  } /* while processing chunks */

  /* report the number of row deleted */
  fprintf(myoutstream, "%ld rows inserted into TPCD.ORDERS at %*.*s\n",
        insertedOrders,T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC
jen*/
        get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));  /*
TIME_ACC jen*/
  fprintf(myoutstream, "%ld rows inserted into TPCD.LINEITEM at
%*.*s\n",
        insertedLineitem,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
        get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));  /*
TIME_ACC jen*/

  if (sqlcode < 0)
  {
    if (sqlcode == SQL_RC_E911)
    {
      fprintf (myoutstream,"# of deadlocks exceeds %i\n", MAXWAIT);
    }
    rc=-1;
    EXEC SQL ROLLBACK WORK;
    error_check();              /* @d22275 tjg */

    goto UF1_exit;
  }

/* UF1_conn_reset:  */
  EXEC SQL CONNECT RESET;
  error_check();              /* @d22275 tjg */


UF1_exit:
  fclose (myoutstream);
  /* exiting, increment the semaphore */

  /* we used the first flat file to generate the semaphore key */

#ifndef SQLWINT
  /*    we will use the tpcd.setup file to generate the semaphore key   begin
SEMA */
  if (getenv("TPCD_AUDIT_DIR") != NULL)
  {
    /* this is assuming that you will be running this from 0th node */
    sprintf(sourcefile, "%s%ctools%ctpcd.setup",
          getenv("TPCD_AUDIT_DIR"), PATH_DELIM,PATH_DELIM);
  }
  else
  {
    fprintf (stderr, "Can't open UF1 semaphore file TPCD_AUDIT_DIR is
not defined.\n");
    exit (-1);
  }
  /* end SEMA */

  su_semkey = ftok (sourcefile, 'J');
  while ( (su_semid = semget (su_semkey, 1, 0)) < 0)
  {
    if (errno == ENOENT) {
      sleep(2);
    }
    else {
      fprintf(stderr,"update set %d: semget failed errno = %d\n",
            i, errno);
      exit(1);
    }
  }
  if (sem_op (su_semid, 0, 1) != 0)                     /*jen SEM*/
  {
    fprintf(stderr,"Failure to increment semaphore UF1 set %d\n",i);
    fprintf(stderr,"  semaphore sourcefile = %s  su_semid =
```

```
su_semid\n",sourcefile);
      exit(1);
   }                                                    /*jenSEM*/

#else  /* SQLWINT */
   sprintf (UF1_semfile, "%s.%s.UF1.semfile",
          getenv("TPCD_DBNAME"), getenv("USER"));
   fprintf(stderr,"UF1 semfile = %s\n",UF1_semfile);
   while ((su_hSem = OpenSemaphore(SEMAPHORE_ALL_ACCESS |
                              SEMAPHORE_MODIFY_STATE |
                              SYNCHRONIZE,
                              TRUE,
                              UF1_semfile))
         == (HANDLE)(NULL))
   {
     /*
     ** if cannot open the semaphore, wait for 0.1 second
     */
     fprintf(stderr,"Retry Open semaphore %s\n", UF1_semfile);

     sleep(1);
   }

   if (! ReleaseSemaphore(su_hSem,
                     1,
                     (LPLONG)(NULL)))
   {
     fprintf(stderr, "ReleaseSemaphore failed, LastError: %d, quit\n",
           GetLastError());
     exit(-1);
   }
#endif /* SQLWINT */
   exit(rc);                    /* child exiting after finishing up */
}



/*************************************************************
******/
/* UF2 child                                                 */
/*************************************************************
******/
void runUF2_fn ( int updatePair, int thisConcurrentDelete, int numChunks,
char *dbname, char *userid, char *passwd )
{
   int rc = 0;
   long sqlcode;
   int maxwait;
   int startChunk = thisConcurrentDelete*numChunks; /* where do we start?
*/
   long deletedLineitems = 0; /*kmw*/
   long deletedOrders = 0;    /*kmw*/
   long savedDeletedLineitems = 0; /*kbs*/

#ifndef SQLWINT
   int               su_semid; /* semaphore for controlling split updates*/
   key_t             su_semkey; /* key to generate semid */
#else
   HANDLE               su_hSem;
   char              UF2_semfile[256];
#endif

   char myoutstreamfile[256];
   FILE *myoutstream, *src_fh=NULL;

   strcpy(UF_dbname, dbname);
   strcpy(UF_userid, userid);
   strcpy(UF_passwd, passwd);

   /* Generate the unique filename for this concurrent delete process */
   sprintf (myoutstreamfile, UF2OUTSTREAMPATTERN,
env_tpcd_tmp_dir, PATH_DELIM,
          updatePair, thisConcurrentDelete);
   if ( (myoutstream = fopen (myoutstreamfile, WRITEMODE)) == NULL)
   {
     fprintf (stderr,
           "\nThe output file '%s' for update pair %d set %d could not be
opened runUF2_fn.\n",
           myoutstreamfile,updatePair,thisConcurrentDelete);
     rc=-1;
     goto UF2_exit;
   }

   outstream=myoutstream;    /* initialize outstream for error_check
dxxxxhar*/

#ifdef UF2DEBUG
   fprintf (myoutstream, "RunUF2 Called %d   %d   %d\n",
                  updatePair, thisConcurrentDelete, numChunks );
   fflush(myoutstream);
#endif
   fprintf( myoutstream,
          "\nUF2 for update pair %d set %d starting at %*.*s\n",
          updatePair, thisConcurrentDelete,
T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));  /*
TIME_ACC jen*/

#ifdef UF2DEBUG
   fprintf (myoutstream, "before connect\n");
   fflush(myoutstream);
#endif

   if (!strcmp(userid,"\0"))   /** No authentication provided **/
     EXEC SQL CONNECT TO :UF_dbname;
   else
     EXEC SQL CONNECT TO :UF_dbname USER :UF_userid USING
:UF_passwd;
   error_check();

#ifdef UF2DEBUG
   fprintf (myoutstream, "after connect  startchunk= %d, EndChunk = %d\n",
                        startChunk, startChunk+numChunks);
   fflush(myoutstream);
#endif

   /* Start processing each chunk in my range */
   for ( UF_chunk = startChunk; UF_chunk < startChunk+numChunks;
UF_chunk++ )
   {

     /* Set things up for the loop which will retry if there is a deadlock */
     sqlcode = SQL_RC_E911;
     month = (short)UF_chunk;
     maxwait = 1;
     rc = 0;

#ifdef UF2DEBUG
   fprintf (myoutstream, "Chunk = %d\n", UF_chunk);
   fflush(myoutstream);
#endif
     while (sqlcode == SQL_RC_E911 && maxwait <= MAXWAIT && rc
== 0)
     {

#ifdef UF2DEBUG
   fprintf (myoutstream, "in loop before orders exec sql\n");
   fflush(myoutstream);
#endif
```

```
        sqlcode = 0;

        EXEC SQL DELETE FROM TPCD.LINEITEM
                WHERE L_ORDERKEY IN
                 (SELECT O_ORDERKEY FROM
TPCDTEMP.ORDERS_DEL
                  WHERE APP_ID = :UF_chunk);
                  /*AND O_ORDERKEY IN
                   (SELECT O_ORDERKEY FROM TPCD.ORDERS
                    WHERE 12*(YEAR(O_ORDERDATE)-
1992)+MONTH(O_ORDERDATE)-01 = :month));*/
        if (sqlca.sqlcode < 0)
          sqlcode = error_check();

        if (sqlcode == SQL_RC_E911)
        {       /* we've hit a deadlock */
          fprintf (myoutstream,
            "\nA deadlock detected while deleting from LINEITEM: update
pair %d set %d chunk %d.  Retrying.\n",
            updatePair, thisConcurrentDelete, UF_chunk);
          dumpCa(&sqlca);
          SleepSome(UF_DEADLOCK_SLEEP);
          maxwait++;     /* jen DEADLOCK */
        }
        else if (sqlcode < 0)
        {
          fprintf (myoutstream,"\n%s\n", stmt_str.data);
          fprintf (myoutstream,"\nsqlcode %d occurred deleting from
TPCD.LINEITEM\n", sqlca.sqlcode);
          dumpCa(&sqlca);
          fprintf (myoutstream,
                "for update pair number %d set %d chunk %d..Exiting\n",
                updatePair, thisConcurrentDelete,UF_chunk);
          rc=-1;
        }
        else
        {
          /* accumulate the number of row deleted */
          savedDeletedLineitems = sqlca.sqlerrd[2];   /*kbs*/

#ifdef UF2DEBUG
          fprintf (myoutstream, "in loop for update pair number %d set %d
chunk %d\n",
                updatePair, thisConcurrentDelete,UF_chunk);
          fflush(myoutstream);
#endif

          /* delete the orders now */

          EXEC SQL DELETE FROM TPCD.ORDERS
          WHERE O_ORDERKEY IN
           (SELECT O_ORDERKEY FROM TPCDTEMP.ORDERS_DEL
WHERE APP_ID = :UF_chunk);
            /*AND 12*(YEAR(O_ORDERDATE)-
1992)+MONTH(O_ORDERDATE)-01 = :month;*/

          if (sqlca.sqlcode < 0)
            sqlcode = error_check();

          if (sqlcode == SQL_RC_E911)
          {       /* we've hit a deadlock */
#ifdef UF2DEBUG
  fprintf (myoutstream, "orders deadlocked\n");
  fflush(myoutstream);
#endif
            fprintf (myoutstream,
            "\nA deadlock detected while deleting from ORDERS: update pair
%d set %d chunk %d.  Retrying.\n",
            updatePair, thisConcurrentDelete, UF_chunk);
            dumpCa(&sqlca);
            SleepSome(UF_DEADLOCK_SLEEP);
            maxwait++;     /* jen DEADLOCK */
          }
          else if (sqlcode < 0)
          {
#ifdef UF2DEBUG
  fprintf (myoutstream, "orders failed\n");
  fflush(myoutstream);
#endif
            fprintf (myoutstream,"\nAn error %d occurred deleting from
TPCD.ORDERS\n",sqlca.sqlcode);
            dumpCa(&sqlca);
            fprintf (myoutstream,"for update pair number %d set %d chunk
%d..Exiting\n",
                  updatePair, thisConcurrentDelete,UF_chunk);
            rc=-1;
          }
          else
          {
#ifdef UF2DEBUG
  fprintf (myoutstream, "orders succeeded\n");
  fflush(myoutstream);
#endif
            /* accumulate the number of row deleted */
            /* Order count ONLY updated if both orders and lineitem */
            /* go through */
            deletedLineitems += savedDeletedLineitems;   /* kbs */
            deletedOrders += sqlca.sqlerrd[2];
            rc=0;
            EXEC SQL COMMIT WORK;
            error_check();
#ifdef UF2DEBUG
            /* report the number of rows deleted */
            fprintf(myoutstream, "    interim %ld rows for chunk %d from
TPCD.ORDERS at %*.*s\n",

deletedOrders,UF_chunk,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
                  get_time_stamp(T_STAMP_FORM_1,(Timer_struct
*)NULL));  /* TIME_ACC jen*/
            fprintf(myoutstream, "    interim %ld rows for chunk %d from
TPCD.LINEITEM at %*.*s\n",

deletedLineitems,UF_chunk,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
                  get_time_stamp(T_STAMP_FORM_1,(Timer_struct
*)NULL));  /* TIME_ACC jen*/
            fprintf( myoutstream,
                  "    deletes for update pair %d chunk %d complete at
%*.*s\n\n",
                  updatePair, UF_chunk,
                  T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
                  get_time_stamp(T_STAMP_FORM_1,
                        (Timer_struct *)NULL));  /* TIME_ACC jen*/
#endif
          }
        } /* process orders  deletes */
      } /* while trying to delete one chunk loop */
    } /* while there are more chunks */

#ifdef UF2DEBUG
  fprintf (myoutstream, "after loop\n");
  fflush(myoutstream);
#endif
  /* report the number of row deleted */
  fprintf(myoutstream, "%ld rows deleted from TPCD.ORDERS at %*.*s\n",
        deletedOrders,T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC
jen*/
        get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));  /*
TIME_ACC jen*/
```

```
  fprintf(myoutstream, "%ld rows deleted from TPCD.LINEITEM at
%*.*s\n",
        deletedLineitems,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
        get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));  /*
TIME_ACC jen*/

  if (sqlca.sqlcode < 0)
  {
    fprintf (myoutstream,"# of deadlocks %d exceeds %i\n",
maxwait,MAXWAIT);
    rc=-1;
    EXEC SQL ROLLBACK WORK;
    error_check();                /* @d22275 tjg */
  }

/* UF2_conn_reset:  */                  /*971101jen*/
  EXEC SQL CONNECT RESET;
  error_check();                /* @d22275 tjg */


UF2_exit:
  fclose (myoutstream);

  /* exiting, increment the semaphore */
#ifndef SQLWINT
  /* we used the tpcd.setup file to generate the semaphore key      begin
SEMA */
  if (getenv("TPCD_AUDIT_DIR") != NULL)
  {
    sprintf(sourcefile, "%s%ctools%ctpcd.setup",
          getenv("TPCD_AUDIT_DIR"), PATH_DELIM, PATH_DELIM);
  }
  else
  {
    fprintf (stderr, "Can't open UF2 semaphore file TPCD_AUDIT_DIR is
not defined.\n");
    exit (-1);
  }

  su_semkey = ftok (sourcefile, 'D');   /* use D for deletes */
  /* end SEMA */
  while ((su_semid = semget(su_semkey,1,0)) < 0)
  {
    if (errno == ENOENT)
      sleep(2);
    else {
      fprintf(stderr,"UF2 update stream %d: semget failed errno = %d\n",
            updatePair, errno);
      exit(1);
    }
  }
  if (sem_op (su_semid, 0, 1) != 0 )     /*jenSEM*/
  {                                  /*jenSEM*/
    fprintf(stderr,"Failure to increment semaphone UF2 set %d\n",
thisConcurrentDelete);
    exit(1);
  }                                                 /*jenSEM*/

#else
  sprintf (UF2_semfile, "%s.%s.UF2.semfile",
        getenv("TPCD_DBNAME"), getenv("USER"));
  fprintf(stderr,"UF2 semfile = %s\n",UF2_semfile);
  while ((su_hSem = OpenSemaphore(SEMAPHORE_ALL_ACCESS |
                        SEMAPHORE_MODIFY_STATE |
                        SYNCHRONIZE,
                        TRUE,
                        UF2_semfile))
      == (HANDLE)(NULL)) {
    /*
    ** if cannot open the semaphore, wait for 0.1 second
    */
    fprintf(stderr,"Retry Open semaphore %s\n", UF2_semfile);

    SleepSome(1);
  }

  if (! ReleaseSemaphore(su_hSem,
                  1,
                  (LPLONG)(NULL)))
  {
    fprintf(stderr, "ReleaseSemaphore failed, LastError: %d, quit\n",
          GetLastError());
    exit(-1);
  }
#endif

  exit(rc);                  /* child exiting after finishing up */
}
```

D.4 runpower

```
:  # -*-Perl-*-
eval 'exec perl5 -S $0 ${1+"$@"}' # Horrible kludge to convert this
   if 0;                    # into a "portable" perl script

# usage  runpower [UF]
# where UF is the optional parameter that says to run the power test
# with the update functions.  By default, the update functions are not
# run

push(@INC, split(':', $ENV{'PATH'}));

# Get TPC-D specific environment variables
require 'getvars';

# Use the macros in here so that they can handle the platform differences.
# macro.pl should be sourced from cmvc, other people wrote and maintain it.
require "macro.pl";
require "tpcdmacro.pl";

# Make output unbuffered.
select(STDOUT);
$| = 1 ;

if (@ARGV > 0)
{
   $runUF=$ARGV[0];
}
else
{
   $runUF="no";
}

if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
{
 die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_RUN_DIR"}) <= 0)
{
 die "TPCD_RUN_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_DBNAME"}) <= 0)
{
 die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_RUNNUMBER"}) <= 0)
{
 die "TPCD_RUNNUMBER environment variable not set\n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
```

```
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
if (length($ENV{"TPCD_PATH_DELIM"}) <= 0)
{
  die "TPCD_PATH_DELIM environment variable not set\n";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
  die "TPCD_PRODUCT environment variable not set\n";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
   die "Must set TPCD_AUDIT env't var.  Real audit timing sequence run if
yes\n";
}
if (length($ENV{"TPCD_PHYS_NODE"}) <= 0)
{
   die "TPCD_PHYS_NODE env't var not set\n";
}
if (length($ENV{"TPCD_LOG_DIR"}) <= 0)
{
   $ENV{"TPCD_LOG_DIR"} = "NULL";
}
if (length($ENV{"TPCD_MODE"}) <= 0)
{
  die "TPCD_MODE environment variable not set - uni/smp/mln \n";
}
if (length($ENV{"TPCD_ROOTPRIV"}) <= 0)
{
  die "TPCD_ROOTPRIV environment variable not set - yes/no \n";
}

#set up local variables
$runNum=$ENV{"TPCD_RUNNUMBER"};
$runDir=$ENV{"TPCD_RUN_DIR"};
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$dbname=$ENV{"TPCD_DBNAME"};
$sf=$ENV{"TPCD_SF"};
$platform=$ENV{"TPCD_PLATFORM"};
$delim=$ENV{"TPCD_PATH_DELIM"};
$gatherstats=$ENV{"TPCD_GATHER_STATS"};
$product=$ENV{"TPCD_PRODUCT"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$inlistmax=$ENV{"TPCD_INLISTMAX"};
$pn=$ENV{"TPCD_PHYS_NODE"};
$logDir=$ENV{"TPCD_LOG_DIR"};
$rootPriv=$ENV{"TPCD_ROOTPRIV"};
$mode=$ENV{"TPCD_MODE"};
if (( $mode eq "uni" ) || ( $mode eq "smp" ))
{
  $all_ln="once";
  $all_pn="once";
  $once="once";
}
else
{
  $all_ln="all_ln";
  $all_pn="all_pn";
  $once="once";
}


if ($inlistmax eq "default")
{
  $inlistmax = 400;
}

# the auditruns directory is where we have already generate the sql files for
the
# updates and the power tests

# append isolation level information about tpcdbatch to the miso file
# the miso file is created here but appended to for power and throughput
#information

$misofile="$runDir${delim}miso$runNum";
if ( -e $misofile )
{
   &rm("$misofile");
}
# if we are in real audit mode then we must start the db manager now since
# there must be no activity on the database between the time the build script
# has finished and the time the power test is started
if ( $RealAudit eq "yes" )
{
   system("db2start");
   system("db2 activate database $dbname");
}

# do not activate the database
#if ( $RealAudit ne "yes" )
#{
#    system("db2 activate database $dbname");
#}



#Report current log info to the run# directory in a file called startLog.Info
system("perl getLogInfo.pl startLog");

open(MISO, ">$misofile") || die "Can't open $misofile: $!\n";
$curTs = `perl gettimestamp "long"`;
print MISO "Timestamp and isolation level of tpcdbatch before power run at
: $curTs\n";
close(MISO);
if ( $product eq "pe" )
{
   system("db2 \"connect to $dbname\"; db2 \"select
name,creator,valid,unique_id,isolation from sysibm.sysplan where name like
'TPCD%'\"; db2 connect reset; db2 terminate  >>
$runDir${delim}miso$runNum ");
}
else
{
   &verifyTPCDbatch("$misofile","$dbname");
}

if ($platform eq "aix")
{

  # Create the sysunused file.  This reports what disks are attached, and which
  # ones are being used.  Its use spans both the runpower and runthroughtput
tests
  system("echo \"The following disks are assigned to the indicated volume
groups\" > $runDir/sysunused$runNum") && die "cannot create
$runDir/sysunused$runNum";

  system("lspv >> $runDir/sysunused$runNum");
  system("echo \"The following volume groups are currently online\" >>
$runDir/sysunused$runNum");
  $curTs = `perl gettimestamp "long"`;
  system("echo \"$curTs\" >> $runDir/sysunused$runNum");
  system("lsvg -o >> $runDir/sysunused$runNum");
  # show the disks that are used/unused
  system("getdisks \"Before the start of the Power Test\"");
```

```
}
else
{
  # for all other platforms
  system("echo Assume that all portions of the system are used >>
$runDir${delim}sysunused$runNum");
}

&getConfig("p");
if ( $rootPriv eq "yes" )
{
   # get the o/s tuning parameters...currently AIX only and only if your
   # user has root privileges to run this
   &getOSTune("p");
}
if ($gatherstats eq "on")
{
   # gather vm io and net stats
   if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx" ||
       $platform eq "hp" || $platform eq "linux")
   {
     # gather vmstats and iostats (and net stats if in mpp mode)
     system("perl getstats p &");
   }
   else
   {
      print "Stats gather not set up for current platform $platform\n";
   }
}

# print to screen what type of run is running and set variables to run
# the query and update streams in parallel
if ($runUF ne "UF")
{
   $semcontrol = "off";
   print "Beginning power stream....no update functions\n";

   $streamEx = "";
   $streamExNT = "";
}
else
{
   $semcontrol = "on";
   print "Beginning power stream....with update functions\n";
   if ( $platform eq "nt" )
   {
     $streamExNT = "start ";
     $streamEx = "";
   }
   else
   {
     $streamExNT = "";
     $streamEx = "&";
   }
}

# bbe This new line (below) runs queries for power test

print "Starting tpcdbatch...\n";
$ret=system("$streamExNT $auditDir${delim}auditruns${delim}tpcdbatch -
d $dbname -f $runDir${delim}qtextpow.sql -r on -b on -s $sf -u p1 -m
$inlistmax -n 0 -l
$auditDir${delim}auditruns${delim}querytext${delim}streampow.list -p
$semcontrol $streamEx");


if ( $runUF eq "UF" )
{
  $ret2 = system("$auditDir${delim}auditruns${delim}tpcdbatch -d
$dbname -f $runDir${delim}qtextquf.sql -r on -b on -s $sf -u p2 -m
$inlistmax -n 0 -l
$auditDir${delim}auditruns${delim}querytext${delim}streampuf.list");
}
else
{
   $ret2 = 0; # If UFs were not running, then the stream cannot fail
}


if (($ret2 == 0) && ($ret == 0))
{
   print "Power stream completed succesfully.\n";
}
else
{
   print "Power stream failed. ret=$ret\n";
}

if ($platform eq "aix")
{
   # show that the same disks are still used or unused
   system("getdisks \"After completion of the Power Test\"");

   #clean up
}
if ($gatherstats eq "on")
{
   # gather vm io and net stats
   if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx" ||
$platform eq "linux")
   {
     # kill the stats that were being gathered
     if ($platform eq "ptx")
     {
        $rc= `perl5 zap "-f" "sar"`;
        $rc= `perl5 zap "-f" "sadc"`;
     }
     else
     {
        $rc= `perl5 zap "-f" "vmstat"`;
        $rc= `perl5 zap "-f" "iostat"`;
     }
     if ( $pn > 1 )
     {
        $rc= `perl5 zap "-f" "netstat"`;
     }
     $rc= `perl5 zap "-f" "getstats"`;
   }
}

open(MISO, ">>$misofile") || die "Can't open $misofile: $!\n";
$curTs = `perl gettimestamp "long"`;
print MISO "Timestamp and isolation level of tpcdbatch after power run at :
$curTs\n";
close(MISO);

if ( $product eq "pe" )
{
   system("db2 \"connect to $dbname\"; db2 \"select
name,creator,valid,unique_id,isolation from sysibm.sysplan where name like
'TPCD%'\";db2 connect reset;db2 terminate  >>
$runDir${delim}miso$runNum");
}
else
{
   &verifyTPCDbatch("$misofile","$dbname");
}
if ( $RealAudit ne "yes" )
{
```

```
   $curTs = `perl gettimestamp "short"`;
   # grab the db and dbm snapshot before we deactivate
   system("db2 get snapshot for all on $dbname >
$runDir${delim}dbrun$runNum.snap.$curTs");
   system("db2 get snapshot for database manager >>
$runDir${delim}dbrun$runNum.snap.$curTs");
}

######################

# now copy the reports from the count of streams files into one final file
&cat("$runDir${delim}pstrcnt*","$runDir${delim}mpstrcnt$runNum");
#(NOTE: there is a dependancy that this mpstrcnt file exist before the
# calcmetrics.pl script is called, both because it is used as input for
# calcmetrics.pl, and because the output from calcmetrics is used as
# the trigger for watchstreams to complete, and watchstreams cats its
# output at the end of the mstrcnt file.

# generate the mpinter?.metrics file in the run directory
#require 'calcmetricsp.pl';
if ( $runUF eq "UF")
{
  system("perl calcmetricsp.pl UF");
}
else
{
   system("perl calcmetricsp.pl");
}

# concatenate all the throughput inter files that were used to
# generate these results into the calcmetrics output file (mpinterX.metrics)
#cd $TPCD_RUN_DIR
&cat("$runDir${delim}mpqinter*","$runDir${delim}mpinter$runNum.metri
cs");

if ($runUF eq "UF") {

&cat("$runDir${delim}mpufinter*","$runDir${delim}mpinter$runNum.metr
ics");
}

#if ($runUF eq "no") {
#  &rm("$runDir${delim}mpuf*");
#}

######################

# no longer activate/deactivate the database
#if ( $RealAudit ne "yes" )
#{
#    # deactivate the database
#    system("db2 deactivate database $dbname");
#}

# do not stop the database after the power test
#if ( $RealAudit ne "yes" )
#{
#    system("db2stop");
#}

1;

sub getConfig
{
  $testtype=$_[0];
  print "Getting database configuration.\n";
  $dbtunefile="$runDir${delim}m${testtype}dbtune${runNum}";
  open(DBTUNE, ">$dbtunefile") || die "Can't open $dbtunefile: $!\n";
  $timestamp=`perl gettimestamp "long"`;
  print DBTUNE "Database and Database manager configuration taken at :
$timestamp";
  close(DBTUNE);
  system("db2level >> $dbtunefile");
  system("db2 get database configuration for $dbname >> $dbtunefile");
  system("db2 get database manager configuration >> $dbtunefile");
  system("db2set >> $dbtunefile");
  if (( $mode eq "mln" ) || ( $mode eq "mpp"))
  {
    $cfgfile="$runDir${delim}dbtune${runNum}.";
    #removed by Alex due to hang
    #system("db2_all '||\" typeset -i ln=##; db2 get db cfg for $dbname >
$cfgfile\${ln} ; db2 get dbm cfg >> $cfgfile\${ln}; db2set >> $cfgfile\${ln};
db2 terminate '");
  }

}

sub getOSTune
{
  $testtype=$_[0];
  if ( $platform eq "aix" )
  {
     print "Getting OS and VMdatabase configuration.\n";
     $ostunefile="$runDir${delim}m${testtype}ostune${runNum}";
     open(OSTUNE, ">$ostunefile") || die "Can't open $ostunefile: $!\n";
     $timestamp=`perl gettimestamp "long"`;
     print OSTUNE "Operating System and Virtual Memory configuration
taken at : $timestamp";
     close(OSTUNE);
     system("${delim}usr${delim}samples${delim}kernel${delim}schedtune
>> $ostunefile");
     system("${delim}usr${delim}samples${delim}kernel${delim}vmtune
>> $ostunefile");
  }
  else
  {
     print "OS parameters retrieval not supported for $platform \n";
  }

}

sub verifyTPCDbatch
{
  $logfile=$_[0];
  $dbname=$_[1];
  $file="verifytpcdbatch.clp";
  open(VERTBL, ">$file") || die "Can't open $file: $!\n";
  print VERTBL "connect to $dbname;\n";
  print VERTBL "select name,creator,valid,last_bind_time,isolation from
sysibm.sysplan where name like 'TPCD%';\n";
  print VERTBL "connect reset;\n";
  print VERTBL "terminate;\n";
  close(VERTBL);
  system("db2 -vtf $file >> $logfile");
}
```

D.5 runthroughput

```
:   # -*-Perl-*-
eval 'exec perl5 -S $0 ${1+"$@"}' # Horrible kludge to convert this
    if 0;                       # into a "portable" perl script

# usage  runthroughput [UF]
# where UF is the optional parameter that says to run the throughput test
# with the update functions.  By default, the update functions are not
# run
# If UF is not supplied and a number is supplied, then that number is taken
# as the number of concurrent throughput streams to run.  This is also
```

```
optional

push(@INC, split(':', $ENV{'PATH'}));

# Get TPC-D specific environment variables
require 'getvars';

# Use the macros in here so that they can handle the platform differences.
# macro.pl should be sourced from cmvc, other people wrote and maintain it.
require "macro.pl";
require "tpcdmacro.pl";

$runUF="no";
if (@ARGV > 0)
{
  if ($ARGV[0] eq "UF")
  {
    $runUF=$ARGV[0];
  }
}

if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
{
  die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_RUN_DIR"}) <= 0)
{
  die "TPCD_RUN_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_DBNAME"}) <= 0)
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_RUNNUMBER"}) <= 0)
{
  die "TPCD_RUNNUMBER environment variable not set\n";
}
if (length($ENV{"TPCD_NUMSTREAM"}) <= 0)
{
  die "TPCD_NUMSTREAM environment variable not set\n";
}
if (length($ENV{"TPCD_RUN_ON_MULTIPLE_NODES"}) <= 0)
{
  die "TPCD_RUN_ON_MULTIPLE_NODES environment variable not
set\n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
  die "TPCD_PRODUCT environment variable not set\n";
}
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
   die "Must set TPCD_AUDIT env't var.  Real audit timing sequence run if
yes\n";
}
if (length($ENV{"TPCD_LOG_DIR"}) <= 0)
{
   $ENV{"TPCD_LOG_DIR"} = "NULL";
}
if (length($ENV{"TPCD_MODE"}) <= 0)
{
  die "TPCD_MODE environment variable not set - uni/smp/mln \n";
}
if (length($ENV{"TPCD_ROOTPRIV"}) <= 0)
{
  die "TPCD_ROOTPRIV environment variable not set - yes/no \n";
}

#set up local variables
$runNum=$ENV{"TPCD_RUNNUMBER"};
$numStream=$ENV{"TPCD_NUMSTREAM"};
$runDir=$ENV{"TPCD_RUN_DIR"};
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$dbname=$ENV{"TPCD_DBNAME"};
$sf=$ENV{"TPCD_SF"};
$product=$ENV{"TPCD_PRODUCT"};
$multinode=$ENV{"TPCD_RUN_ON_MULTIPLE_NODES"};
$platform=$ENV{"TPCD_PLATFORM"};
$delim=$ENV{"TPCD_PATH_DELIM"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$inlistmax=$ENV{"TPCD_INLISTMAX"};
$gatherstats=$ENV{"TPCD_GATHER_STATS"};
$logDir=$ENV{"TPCD_LOG_DIR"};
$rootPriv=$ENV{"TPCD_ROOTPRIV"};
$mode=$ENV{"TPCD_MODE"};

$path="$auditDir${delim}auditruns";

if (( $mode eq "uni" ) || ( $mode eq "smp" ))
{
  $all_ln="once";
  $all_pn="once";
  $once="once";
}
else
{
  $all_ln="all_ln";
  $all_pn="all_pn";
  $once="once";
}

# return 1 if the given pattern(parameter $_[0]) matches any file
sub existfile {
  if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx" || $platform
eq "linux")
  {
    `ls $_[0] 2> /dev/null | wc -l` + 0 != 0;
  }
  else
  {
    `dir /b $_[0] 2> NUL | wc -l` + 0 != 0;
  }
}

if ($inlistmax eq "default")
{
   $inlistmax = 400;
}

# no longer stop and start the dbm between runs when not in realaudit mode
#if ( $RealAudit ne "yes" )
#{
#    # if we are not in real audit mode then we must start the db manager now
#    system("db2start");
#    # activate the database
#    system("db2 activate database $dbname");
#}

$misofile="$runDir${delim}miso$runNum";
# append isolation level information about tpcdbatch to the miso file
open(MISO, ">>$misofile") || die "Can't open $misofile: $!\n";
$curTs = `perl gettimestamp "long"`;
```

```
print MISO "Timestamp and isolation level of tpcdbatch before throughput
run at : $curTs\n";
close(MISO);

if ( $product eq "pe" )
{
   system("db2 \"connect to $dbname\"; db2 \"select
name,creator,valid,unique_id,isolation from sysibm.sysplan where name like
'TPCD%'\" >> $runDir${delim}miso$runNum ");
}
else
{
   &verifyTPCDbatch("$misofile","$dbname");
}

# kick off the script that will monitor for the database applications during
# the running of the throughput tests.  This will quit when the
mtinterX.metrics
# (where X=runnumber) file has been created.

# set variables to run streams in parallel
if ( $platform eq "nt" )
{
  $streamExNT = "start /b";
  $streamEx = "";
}
else
{
  $streamExNT = "";
  $streamEx = "&";
}
if ( $platform eq "aix"  || $platform eq "sun" || $platform eq "nt" || $platform
eq "hp" || $platform eq "linux")
{
   system("$streamExNT perl watchstreams $streamEx");
}
else
{
   die "platform not supported, can't start watchstreams in background";
}

# show the disks that are used/unused
if ($platform eq "aix")
{
   system("getdisks \"Before the start of the Throughput Test\"");
}
if ($gatherstats eq "on")
{
   # gather vm io and net stats
   if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx" ||
$platform eq "hp" || $platform eq "linux")
   {
     # gather vmstats and iostats (and net stats if in mpp mode)
     system("perl getstats t &");
   }
   else
   {
      print "Stats gather not set up for current platform $platform\n";
   }
}

if ( $multinode ne "yes" )
{
  # we are running the query streams and update stream from the same node
or
  # from a serial db....use semaphores for control of the update stream

  # the auditruns directory is where we have already generated the sql files
  # for the updates and the power tests

  $loopStream=1;

  for ( $loopStream = 1; $loopStream <= $numStream; $loopStream++)
  {
    print "starting stream $loopStream\n";
    system("echo Executing stream $loopStream out of $numStream.");
    # run the queries
    if ( $platform eq "aix" || $platform eq "sun" || $platform eq "nt" ||
$platform eq "ptx" ||
        $platform eq "hp" || $platform eq "linux")
    {
       system("$streamExNT $path${delim}tpcdbatch -d $dbname -f
$runDir${delim}qtextt$loopStream.sql -r on -b on -s $sf -u t1 -m $inlistmax
-n $loopStream -l $path${delim}querytext${delim}stream$loopStream.list
$streamEx");
    }
    else
    {
       die "platform $platform not supported yet";
    }
  }

  # run the update function stream....this will wait until the queries have
  # completed to kick off the updates
    print "starting update stream\n";

  if ($runUF eq "no") {
    $ret=system("$auditDir${delim}auditruns${delim}tpcdbatch -d $dbname
-f $runDir${delim}quft.sql -r on -b on -s $sf -u t -m $inlistmax -n
$numStream -l $runDir${delim}streamuf.list");
  }
  else {
    $ret=system("$auditDir${delim}auditruns${delim}tpcdbatch -d $dbname
-f $runDir${delim}quft.sql -r on -b on -s $sf -u t2 -m $inlistmax -n
$numStream -l $runDir${delim}streamuf.list");
  }
  print "update stream done\n";


  &getConfig("t");
  if ( $rootPriv eq "yes" )
  {
     # get the o/s tuning parameters...currently AIX only and only if your
     # user has root privileges to run this
     &getOSTune("t");
  }
}
else
{
  # we are running the query streams and update stream from different nodes,
use
  # files and rksh to control the update stream
  system("runthru.pe");
}

if ($platform eq "aix")
{
   # show the disks that are used/unused
   system("getdisks \"After the completion of the Throughput Test\"");
}
if ($gatherstats eq "on")
{
   # gather vm io and net stats
   if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx" ||
$platform eq "linux")
   {
     # kill the stats that were being gathered
      if ($platform eq "ptx")
      {
         $rc= `perl5 zap "-f" "sar"`;
```

```
        $rc= `perl5 zap "-f" "sadc"`;
      }
      else
      {
        $rc= `perl5 zap "-f" "vmstat"`;
        $rc= `perl5 zap "-f" "iostat"`;
      }
      if ( $pn > 1 )
      {
        $rc= `perl5 zap "-f" "netstat"`;
      }
      $rc= `perl5 zap "-f" "getstats"`;
   }
}

open(MISO, ">>$misofile") || die "Can't open $misofile: $!\n";
$curTs = `perl gettimestamp "long"`;
print MISO "Timestamp and isolation level of tpcdbatch after throughput run
at : $curTs\n";
close(MISO);

if ( $product eq "pe" )
{
   system("db2 \"connect to $dbname\"; db2 \"select
name,creator,valid,unique_id,isolation from sysibm.sysplan where name like
'TPCD%'\" >> $runDir${delim}miso$runNum");
}
else
{
  &verifyTPCDbatch("$misofile","$dbname");
}

if ( $RealAudit ne "yes" )
{
   $curTs = `perl gettimestamp "short"`;
   # grab the db and dbm snapshot before we deactivate
   system("db2 get snapshot for all on $dbname >
$runDir${delim}dbTrun$runNum.snap.$curTs");
   system("db2 get snapshot for database manager >>
$runDir${delim}dbTrun$runNum.snap.$curTs");
}

# now copy the reports from the count of streams files into one final file
&cat("$runDir${delim}strcnt*","$runDir${delim}mstrcnt$runNum");
#(NOTE: there is a dependancy that this mstrcnt file exist before the
# calcmetrics.pl script is called, both because it is used as input for
# calcmetrics.pl, and because the output from calcmetrics is used as
# the trigger for watchstreams to complete, and watchstreams cats its
# output at the end of the mstrcnt file.

# generate the mtinter?.metrics file in the run directory
#require 'calcmetrics.pl';

if ( $runUF ne "no")
{
 system("perl calcmetrics.pl $numStream UF");
}
else
{
 system("perl calcmetrics.pl $numStream");
}

# concatenate all the throughput inter files that were used to
# generate these results into the calcmetrics output file (mtinterX.metrics)
#cd $TPCD_RUN_DIR
&cat("$runDir${delim}mts*inter*","$runDir${delim}mtinter$runNum.metri
cs");

if ($runUF ne "no") {
&cat("$runDir${delim}mtufinter*","$runDir${delim}mtinter$runNum.metri
cs");
}

if (&existfile("$runDir${delim}mp*")) {
 # generate the mplot stuff
 system("perl gen_mplot");

 # generate the mlog information file
 require 'buildmlog';
}

#if ($runUF eq "no") {
#  &rm("$runDir${delim}mtuf*");
#}

# deactivate the database  this needs to remain at the end of run throughput
so
# asynchronous writing of the log files completes.
system("db2 deactivate database $dbname");
$rc=&dodb_noconn("db2 get db cfg for $dbname | grep -i log >>
$runDir${delim}endLog.Info",$all_ln);
if ( $logDir ne "NULL" )
{
   $rc=&dodb_noconn("$dircmd $logDir >>
$runDir${delim}endLog.Info",$all_ln);
}

#system("db2_all \']}db2 get db cfg for tpcd | grep -i log >>
$runDir${delim}endLog.Info ; db2 terminate\' ");
#system("ls -ltra /node??vg.log/NODE00* >>
$runDir${delim}endLog.Info");

#Create Catalog info
$rc = system("perl catinfo.pl p");


if ( $rc != 0 )
{
 warn "catinfo failed!!!\n";
}

#Report current log info to the run# directory in a file called endLog.Info
system("perl getLogInfo.pl endLog");

# if we are in audit mode we must do a db2stop at the end of the
power/throughput run
if ( $RealAudit eq "yes" )
{
   system("db2stop");
}

1;

sub getConfig
{
 $testtype=$_[0];
 print "Getting database configuration.\n";
 $dbtunefile="$runDir${delim}m${testtype}dbtune${runNum}";
 open(DBTUNE, ">$dbtunefile") || die "Can't open $dbtunefile: $!\n";
 $timestamp=`perl gettimestamp "long"`;
 print DBTUNE "Database and Database manager configuration taken at :
$timestamp";
 close(DBTUNE);
 system("db2level >> $dbtunefile");
 system("db2 get database configuration for $dbname >> $dbtunefile");
 system("db2 get database manager configuration >> $dbtunefile");
 system("db2set >> $dbtunefile");

}
```

```
sub getOSTune
{
  $testtype=$_[0];
  if ( $platform eq "aix" || $platform eq "linux")
  {
     print "Getting OS and VMdatabase configuration.\n";
     $ostunefile="$runDir${delim}m${testtype}ostune${runNum}";
     open(OSTUNE, ">$ostunefile") || die "Can't open $ostunefile: $!\n";
     $timestamp=`perl gettimestamp "long"`;
     print OSTUNE "Operating System and Virtual Memory configuration
taken at : $timestamp";
     close(OSTUNE);
     system("${delim}usr${delim}samples${delim}kernel${delim}schedtune
>> $ostunefile");
     system("${delim}usr${delim}samples${delim}kernel${delim}vmtune
>> $ostunefile");
  }
  else
  {
     print "OS parameters retrieval not supported for $platform \n";
  }

}

sub verifyTPCDbatch
{
  $logfile=$_[0];
  $dbname=$_[1];
  $file="verifytpcdbatch.clp";
  open(VERTBL, ">$file") || die "Can't open $file: $!\n";
  print VERTBL "connect to $dbname;\n";
  print VERTBL "select name,creator,valid,last_bind_time,isolation from
sysibm.sysplan where name like 'TPCD%';\n";
  print VERTBL "connect reset;\n";
  print VERTBL "terminate;\n";
  close(VERTBL);
  system("db2 -vtf $file >> $logfile");
}
```

D.6 ploaduf1

```
:   # -*-Perl-*-
eval 'exec perl5 -S $0 ${1+"$@"}' # Horrible kludge to convert this
    if 0;                       # into a "portable" perl script

# usage  perl

push(@INC, split(':', $ENV{'PATH'}));

# Get TPC-D specific environment variables
require 'getvars';

# Use the macros in here so that they can handle the platform differences.
# macro.pl should be sourced from cmvc, other people wrote and maintain it.
require "macro.pl";
require "tpcdmacro.pl";

# Make output unbuffered.
select(STDOUT);
$| = 1 ;

if (@ARGV > 0)
{
   $PairNum=$ARGV[0];
}
else
{
   die "Update Pair not specified.\n";
}

if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
{
  die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_RUN_DIR"}) <= 0)
{
  die "TPCD_RUN_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_DBNAME"}) <= 0)
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_RUNNUMBER"}) <= 0)
{
  die "TPCD_RUNNUMBER environment variable not set\n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
if (length($ENV{"TPCD_PATH_DELIM"}) <= 0)
{
  die "TPCD_PATH_DELIM environment variable not set\n";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
  die "TPCD_PRODUCT environment variable not set\n";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
   die "Must set TPCD_AUDIT env't var.  Real audit timing sequence run if
yes\n";
}
if (length($ENV{"TPCD_PHYS_NODE"}) <= 0)
{
   die "TPCD_PHYS_NODE env't var not set\n";
}
if (length($ENV{"TPCD_MODE"}) <= 0)
{
   die "TPCD_MODE env't var not set\n";
}
if (length($ENV{"TPCD_DDLPATH"}) <= 0)
{
  die "TPCD_DDLPATH environment variable not set\n";
}

#set up local variables
$runNum=$ENV{"TPCD_RUNNUMBER"};
$runDir=$ENV{"TPCD_RUN_DIR"};
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$dbname=$ENV{"TPCD_DBNAME"};
$sf=$ENV{"TPCD_SF"};
$platform=$ENV{"TPCD_PLATFORM"};
$ddlpath=$ENV{"TPCD_DDLPATH"};
$delim=$ENV{"TPCD_PATH_DELIM"};
$gatherstats=$ENV{"TPCD_GATHER_STATS"};
$product=$ENV{"TPCD_PRODUCT"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$inlistmax=$ENV{"TPCD_INLISTMAX"};
$pn=$ENV{"TPCD_PHYS_NODE"};
$flatfilepath=$ENV{"TPCD_FLATFILES"};
$mode=$ENV{"TPCD_MODE"};
$coldel="|";

if ( $platform eq "nt" )
```

```
{
      $sep="&";
}
else
{
      $sep=";";
}

if (( $mode eq "uni" ) || ( $mode eq "smp" ))
{
  print "Beginning ....Load of Update Function Data for pair $PairNum \n";
  system("db2 connect to tpcd\n");
  $str="db2 \" load from  ";
  $str="$str$flatfilepath${delim}lineitem.tbl.u" ;
  $str="$str$PairNum.new of del modified by coldel| fastparse messages
line.msg.u";
  $str="$str$PairNum.new replace into TPCDTEMP.LINEITEM_NEW
nonrecoverable \" " ;
  print "$str \n";
  $ret=system($str);
  if ($ret == 0)
  {
     print "Lineitem updates Loaded successfully.\n";
  }
  else
  {
     print "Lineitem updates failed. ret=$ret\n";
     exit -1;
  }


  $str="db2 \" load from  ";
  $str="$str$flatfilepath${delim}orders.tbl.u" ;
  $str="$str$PairNum.new of del modified by coldel| fastparse messages
orders.msg.u";
  $str="$str$PairNum.new replace into TPCDTEMP.ORDERS_NEW
nonrecoverable \" " ;
  print "$str  \n";
  $ret=system($str);
  if ($ret == 0)
  {
     print "Orders updates Loaded successfully.\n";
  }
  else
  {
     print "Orders updates failed. ret=$ret\n";
     exit -2;
  }
  #system("db2 -tf $auditDir${delim}tools${delim}set_UF1_app_id.sql");
  system("db2 connect reset\n");
}
else
{
 # load_update_on_node loads for each node (update function 1)
 #DJD $function=1;
 #DJD &dodb_noconn("cd $auditDir${delim}tools $sep
$auditDir${delim}tools${delim}load_update_on_node $PairNum $function
$inlistmax", "all_ln");
 #DJD Added this line to do the loading....
 print "Calling system $ddlpath${delim}doUFload.bat 1 $PairNum";
 system("$ddlpath${delim}doUFload.bat 1 $PairNum");
}
exit (0);
```

D.7 ploaduf2

```
:   # -*-Perl-*-
eval 'exec perl5 -S $0 ${1+"$@"}' # Horrible kludge to convert this
    if 0;                       # into a "portable" perl script

# usage  perl ploadUF [pair_num]

push(@INC, split(':', $ENV{'PATH'}));

# Get TPC-D specific environment variables
require 'getvars';

# Use the macros in here so that they can handle the platform differences.
# macro.pl should be sourced from cmvc, other people wrote and maintain it.
require "macro.pl";
require "tpcdmacro.pl";

# Make output unbuffered.
select(STDOUT);
$| = 1 ;

if (@ARGV > 0)
{
   $PairNum=$ARGV[0];
}
else
{
   die "Update Pair not specified.\n";
}

if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
{
  die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_RUN_DIR"}) <= 0)
{
  die "TPCD_RUN_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_DBNAME"}) <= 0)
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_RUNNUMBER"}) <= 0)
{
  die "TPCD_RUNNUMBER environment variable not set\n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
if (length($ENV{"TPCD_PATH_DELIM"}) <= 0)
{
  die "TPCD_PATH_DELIM environment variable not set\n";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
  die "TPCD_PRODUCT environment variable not set\n";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
   die "Must set TPCD_AUDIT env't var.  Real audit timing sequence run if
yes\n";
}
if (length($ENV{"TPCD_PHYS_NODE"}) <= 0)
{
   die "TPCD_PHYS_NODE env't var not set\n";
}
if (length($ENV{"TPCD_MODE"}) <= 0)
{
   die "TPCD_MODE env't var not set\n";
}
if (length($ENV{"TPCD_DDLPATH"}) <= 0)
```

```
{
  die "TPCD_DDLPATH environment variable not set\n";
}

#set up local variables
$runNum=$ENV{"TPCD_RUNNUMBER"};
$runDir=$ENV{"TPCD_RUN_DIR"};
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$dbname=$ENV{"TPCD_DBNAME"};
$sf=$ENV{"TPCD_SF"};
$platform=$ENV{"TPCD_PLATFORM"};
$ddlpath=$ENV{"TPCD_DDLPATH"};
$delim=$ENV{"TPCD_PATH_DELIM"};
$gatherstats=$ENV{"TPCD_GATHER_STATS"};
$product=$ENV{"TPCD_PRODUCT"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$inlistmax=$ENV{"TPCD_INLISTMAX"};
$pn=$ENV{"TPCD_PHYS_NODE"};
$flatfilepath=$ENV{"TPCD_FLATFILES"};
$mode=$ENV{"TPCD_MODE"};
$coldel="|";
$dblquote="";

if ( $platform eq "nt" )
{
       $sep="&";
}
else
{
       $sep=";";
}

if (( $mode eq "uni" ) || ( $mode eq "smp" ))
{
  print "Beginning ....Load of Update Function Data for pair $PairNum \n";
  system("db2 connect to tpcd\n");
  $str="db2 \" load from ";
  $str="$str$flatfilepath${delim}\delete." ;
  $str="$str$PairNum.new of del modified by coldel| fastparse messages
del.msg.u";
  $str="$str$PairNum.new replace into TPCDTEMP.ORDERS_DEL
nonrecoverable \" " ;
  print "$str \n";
  $ret=system($str);
  if ($ret == 0)
  {
     print "Delete updates Loaded successfully.\n";
  }
  else
  {
     print "Delete updates failed. ret=$ret\n";
     exit -1;
  }

  #system("db2 -tf $auditDir${delim}tools${delim}set_UF2_app_id.sql");
}
else
{
 # load for each node
#DJD $function=2;
#DJD &dodb_noconn("cd $auditDir${delim}tools $sep
$auditDir${delim}tools${delim}load_update_on_node $PairNum $function
$inlistmax", "all_ln");
 print "Calling system $ddlpath${delim}doUFload.bat 2 $PairNum";
 system("$ddlpath${delim}doUFload.bat 2 $PairNum");
}
exit (0);
```

D.8 doufload.bat

```
REM Takes UFtype and update_pair as parameters.
set RAHSLEEPTIME=999999
db2_all "||\"" z: & cd \tpch\tools\ & doit_3params UFload.bat %1 %2 ##"
REM db2_all "||\""call z:\tpch\tools\doit_3params UFload.bat %1 %2 ##"
```

D.9 ufload.bat

```
REM Takes UFtype, update_pair and nodenum as parameters.
z:
cd \tpch\tools
echo "UFLOAD PARS" %1 %2 %3
perl load_UF%1_data %2 %3
```

D.10 load_uf1_data

```
:   # -*-Perl-*-
eval 'exec perl5 -S $0 ${1+"$@"}' # Horrible kludge to convert this
    if 0;                       # into a "portable" perl script

# usage  perl load_UF1_data [update pair number] [nodenumber]

push(@INC, split(':', $ENV{'PATH'}));

# Get TPC-D specific environment variables
require 'getvars';

# Use the macros in here so that they can handle the platform differences.
# macro.pl should be sourced from cmvc, other people wrote and maintain it.
require "macro.pl";


# Make output unbuffered.
select(STDOUT);
$| = 1 ;

if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
{
  die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_DBNAME"}) <= 0)
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
if (length($ENV{"TPCD_PATH_DELIM"}) <= 0)
{
  die "TPCD_PATH_DELIM environment variable not set\n";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
  die "TPCD_PRODUCT environment variable not set\n";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
    die "Must set TPCD_AUDIT env't var.  Real audit timing sequence run if
yes\n";
}
if (length($ENV{"TPCD_PHYS_NODE"}) <= 0)
{
    die "TPCD_PHYS_NODE env't var not set\n";
}

#set up local variables
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$dbname=$ENV{"TPCD_DBNAME"};
$lastpair = $ENV{"TPCD_GEN_UPDATEPAIRS"};
```

```
$sf=$ENV{"TPCD_SF"};
$platform=$ENV{"TPCD_PLATFORM"};
$delim=$ENV{"TPCD_PATH_DELIM"};
$gatherstats=$ENV{"TPCD_GATHER_STATS"};
$product=$ENV{"TPCD_PRODUCT"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$inlistmax=$ENV{"TPCD_INLISTMAX"};
$pn=$ENV{"TPCD_PHYS_NODE"};
$flatfilepath=$ENV{"TPCD_FLATFILES"};
$coldel="|";
$dblquote="";


$PairNum=$ARGV[0];
$current_node=$ARGV[1];
print("PairNum= $PairNum, Current_Node = $current_node\n");
for ($i=0, $nodestr="00000"; $i<$current_node; $i++,$nodestr++) {};

print "Beginning ....Preload of Update Function Data. Lineitem \n";
system("db2 connect to tpcd\n");
$str="db2 \" load from  ";
$str="$str$flatfilepath${delim}lineitem.tbl.u" ;
$str="$str$PairNum.";
$str="$str$nodestr.new of del modified by coldel| fastparse messages
c:\\temp\\line.msg.u";
$str="$str$PairNum.new replace into TPCDTEMP.LINEITEM_NEW
statistics yes nonrecoverable \" " ;
print "$str \n";
$ret=system($str);
system("db2 commit\n");
if ($ret == 0)
{
   print "Preload Lineitem updates completed successfully.\n";
}
else
{
   print "Preload Lineitem updates failed. ret=$ret\n";
   exit -1;
}

print "Beginning ....Preload of Update Function Data. Orders \n";
system("db2 connect to tpcd\n");
$str="db2 \" load from  ";
$str="$str$flatfilepath${delim}order.tbl.u" ;
$str="$str$PairNum.";
$str="$str$nodestr.new of del modified by coldel| fastparse messages
c:\\temp\\order.msg.u";
if ($PairNum == $lastpair) {
 $str="$str$PairNum.new replace into TPCDTEMP.ORDERS_NEW
statistics yes nonrecoverable using c:\\temp_tables \" " ;
}
else {
 $str="$str$PairNum.new replace into TPCDTEMP.ORDERS_NEW
statistics no nonrecoverable using c:\\temp_tables \" " ;
}
print "$str \n";
$ret=system($str);
system("db2 commit\n");
if ($ret == 0)
{
   print "Preload Orders updates completed successfully.\n";
}
else
{
   print "Preload Orders updates failed. ret=$ret\n";
   exit -1;
}
```

D.11 load_uf2_data

```
:  # -*-Perl-*-
eval 'exec perl5 -S $0 ${1+"$@"}' # Horrible kludge to convert this
   if 0;                    # into a "portable" perl script

# usage  perl loadUFD [update pair number] [nodenumber]

push(@INC, split(':', $ENV{'PATH'}));

# Get TPC-D specific environment variables
require 'getvars';

# Use the macros in here so that they can handle the platform differences.
# macro.pl should be sourced from cmvc, other people wrote and maintain it.
require "macro.pl";


# Make output unbuffered.
select(STDOUT);
$| = 1 ;

if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
{
  die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_DBNAME"}) <= 0)
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
if (length($ENV{"TPCD_PATH_DELIM"}) <= 0)
{
  die "TPCD_PATH_DELIM environment variable not set\n";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
  die "TPCD_PRODUCT environment variable not set\n";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
   die "Must set TPCD_AUDIT env't var.  Real audit timing sequence run if
yes\n";
}
if (length($ENV{"TPCD_PHYS_NODE"}) <= 0)
{
   die "TPCD_PHYS_NODE env't var not set\n";
}

#set up local variables
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$dbname=$ENV{"TPCD_DBNAME"};
$sf=$ENV{"TPCD_SF"};
$platform=$ENV{"TPCD_PLATFORM"};
$delim=$ENV{"TPCD_PATH_DELIM"};
$gatherstats=$ENV{"TPCD_GATHER_STATS"};
$product=$ENV{"TPCD_PRODUCT"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$inlistmax=$ENV{"TPCD_INLISTMAX"};
$pn=$ENV{"TPCD_PHYS_NODE"};
$flatfilepath=$ENV{"TPCD_FLATFILES"};
$coldel="|";
$dblquote="";


$PairNum=$ARGV[0];
```

```
$current_node=$ARGV[1];
print("current_node=$current_node\n");
for ($i=0, $nodestr="00000"; $i<$current_node; $i++,$nodestr++) {};


print "Beginning ....Preload of Update Function Data. Deletes \n";
system("db2 connect to tpcd\n");
$str="db2 \" load from  ";
$str="$str$flatfilepath${delim}delete." ;
$str="$str$PairNum.";
$str="$str$nodestr.new of del modified by coldel| fastparse messages
c:\\temp\\del.msg.u";
$str="$str$PairNum.new replace into TPCDTEMP.ORDERS_DEL statistics
yes nonrecoverable \" " ;
print "$str \n";
$ret=system($str);
system("db2 commit\n");
if ($ret == 0)
{
   print "Preload Deletes updates completed successfully.\n";
}
else
{
   print "Preload Deletes updates failed. ret=$ret\n";
   exit -1;
}
```

Appendix E: ACID Transaction Source Code

E.1 acid.sqc

```
/*************************************************************************
***********/
/*      File: acid.sqc                                                   */
/*************************************************************************
***********/

/*   changes:
 *
 *  961109  jel    add EXEC SQL CLOSE for each cursor in acidT
 *                 to avoid bug in db2pe v1r2
 *  980225  gav    port to NT
 *  981103  kal    added ast_acidQ  for isolation test 7
 *  981103  kal    changed ast query to be the same as that used in
 *                 consistency tests.  Fixed so the long lEprice is
 *                 cast to a double.  Changed so uses 3 decimal points of
 *                 precision.
 *
 */

#include "acid.h"

#if (defined(SQLPTX) || defined(SQLWINT) || defined(SQLSUN) ||
defined(Linux))
double nearest(double);
#endif /* SQLPTX */


#define DEADLOCK -911

/*
#define TRUNC2(d) ((floor((d)*100.0))/100.0)
*/
/*
#define TRUNC2(d) ((floor(nearest((d)*100.0)))*0.01)
*/
/*
#define TRUNC2(d)  ((floor(nearest((d)*1000.0)/10.0)/100.0))
*/
#define TRUNC2(d)  ((floor(nearest((d)*100000.0)/1000.0)/100.0))

void sqlerror(char * , struct sqlca *);

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char dbname[8];   /* = "tpcd"; */
EXEC SQL END DECLARE SECTION;

#ifdef SQLWINT

 /*
 ** redefine gettimeofday so I don't have to
 ** change too much aix-specific code
 */
/*#typedef struct timeval { unsigned tv_sec; unsigned tv_usec; }; */
typedef struct timezone { int dummy; };
struct timeb timer;

 void gettimeofday( struct timeval *tv, struct timezone *tz)
 {
   ftime(&timer);
   tv->tv_sec = timer.time;
   tv->tv_usec = timer.millitm  * 1000;
   tz->dummy = 0;
 }
#endif

/*---------------------------------------------------------------*/
/*       acidQ                                                   */
/*---------------------------------------------------------------*/
int acidQ (struct acidQ_struct *acid)
{
   time_t timeT;
   FILE *out;
   char out_fn[50];
   struct timeval tv;
   struct timezone tz;
   int mypid;
   int rc = 0;


   EXEC SQL BEGIN DECLARE SECTION;
   sqlint32    okey;
   sqlint32    lEprice;
   double  eprice;
   EXEC SQL END DECLARE SECTION;

   okey = acid->o_key;

   /* mypid = getpid(); */
   mypid = acid->tag;

   sprintf(out_fn,
"%s%cacidQ.out.%d",getenv("TPCD_TMP_DIR"),del(),mypid);
   out=fopen(out_fn,"a");
   if (out == NULL)
   {
     fprintf(stderr, "ERROR input file %s could not be appended
to!!\n",out_fn);
    }

   gettimeofday(&tv, &tz);
   time(&timeT);
   fprintf(out,"\n---------- START of acidQ tag: %d ----------\n\n",mypid);
   fprintf(out, "acidQ tag: %d, begin transaction time: (%us %06uu) %s",
         mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
   fprintf(out, "okey: %d\n", okey);

   gettimeofday(&tv, &tz);
   time(&timeT);
   fprintf(out,"acidQ tag: %d, before read of LINEITEM: (%us %06uu) %s",
         mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));

   /*
   ** use the same sql code as used in the consistsql.pl to
   ** run the consistency acid queries.  Note we assign an long int
   ** to lEprice (we make it 10s of pennies by * 1000).  Then divide
   ** by 1000.0 and cast it to a double (eprice) for printing
   */

   EXEC SQL
     SELECT

INTEGER(DECIMAL(SUM(DECIMAL(INTEGER(INTEGER(DECIMAL
       (INTEGER(100*DECIMAL(L_EXTENDEDPRICE,20,3)), 20,3) *
       (1-L_DISCOUNT)) * (1+L_TAX)),20,3)/100.0),20,3) * 1000)
      into :lEprice
```

```
    FROM
      TPCD.LINEITEM
    WHERE
      L_ORDERKEY = :okey;

  if (sqlca.sqlcode != 0) {
    rc = sqlca.sqlcode;
    fprintf(out,"acidQ **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    sqlerror("acidQ: select sum(l_extendedprice)", &sqlca);
    goto Qerror;
  }
  eprice = (double)lEprice / 1000.0;  /* translate to double for printout*/

  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"ACID tag: %d, after read of LINEITEM: (%us %06uu) %s",
        mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  fprintf(out, "okey: %d \t sum(l_extendedprice): %0.3f\n",
        okey, eprice);

  EXEC SQL COMMIT;
  if (sqlca.sqlcode != 0) {
    rc = sqlca.sqlcode;
    fprintf(out,"acidQ **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    sqlerror("acidQ: COMMIT", &sqlca);
    goto Qerror;
  }
  acid->l_extendedprice = eprice;

  rc = 0;
  goto Qexit;

 Qerror:
  EXEC SQL rollback work;
  if (sqlca.sqlcode != 0) sqlerror("acidQ: ROLLBACK FAILED", &sqlca);

 Qexit:
  fprintf(out,"\n---------- END of acidQ tag: %d ----------\n\n",mypid);
  fflush(out);fclose(out);
  return(rc);
}

/*-------------------------------------------------------------------*/
/*       ast_acidQ                                                   */
/*-------------------------------------------------------------------*/
int ast_acidQ (struct acidQ_struct *acid)
{
  time_t timeT;
  FILE *out;
  char out_fn[50];
  struct timeval tv;
  struct timezone tz;
  int mypid;
  int rc = 0;


  EXEC SQL BEGIN DECLARE SECTION;
  double    ast_lEprice;
  double    ast_eprice;
  EXEC SQL END DECLARE SECTION;


  /* mypid = getpid(); */
  mypid = acid->tag;

  sprintf(out_fn,
"%s%cast_acidQ.out.%d",getenv("TPCD_TMP_DIR"),del(),mypid);
  out=fopen(out_fn,"a");
  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"\n---------- START of ast_acidQ tag: %d ----------\n\n",mypid);
  fprintf(out, "ast_acidQ tag: %d, begin transaction time: (%us %06uu) %s",
        mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));

  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"ast_acidQ tag: %d, before read of LINEITEM: (%us %06uu)
%s",
        mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));

  /*
  ** use the same query acidQ except don't select for specfic okey.
  ** this ensures that the ast will be used instead of the base table
  ** Have to use ast_lEprice as double since this sum is so big
  */
  EXEC SQL
    SELECT
      SUM ( L_EXTENDEDPRICE*(1-L_DISCOUNT)*(1 + L_TAX))
      into :ast_lEprice
    FROM
      TPCD.LINEITEM;

  if (sqlca.sqlcode != 0) {
    rc = sqlca.sqlcode;
    fprintf(out,"ast_acidQ **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    sqlerror("ast_acidQ: select sum(l_extendedprice)", &sqlca);
    goto Qerror;
  }
  ast_eprice = ast_lEprice;  /* use ast_eprice  for printout to be consistent*/

  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"AST_ACID tag: %d, after read of LINEITEM: (%us %06uu)
%s",
        mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  fprintf(out, "sum(l_extendedprice): %0.3f\n",
        ast_eprice);

  EXEC SQL COMMIT;
  if (sqlca.sqlcode != 0) {
    rc = sqlca.sqlcode;
    fprintf(out,"ast_acidQ **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    sqlerror("ast_acidQ: COMMIT", &sqlca);
    goto Qerror;
  }
  acid->l_extendedprice = ast_eprice;

  rc = 0;
  goto Qexit;

 Qerror:
  EXEC SQL rollback work;
  if (sqlca.sqlcode != 0) sqlerror("ast_acidQ: ROLLBACK FAILED",
&sqlca);

 Qexit:
  fprintf(out,"\n---------- END of ast_acidQ tag: %d ----------\n\n",mypid);
  fflush(out);fclose(out);
  return(rc);
}
/*-------------------------------------------------------------------*/
/*       acidT                                                       */
/*-------------------------------------------------------------------*/
int acidT (struct acidT_struct *acid)
{

  time_t timeT;
  FILE *out;
  char out_fn[50];
  struct timeval tv;
```

```
  struct timezone tz;
  int mypid;
  int rc = 0;

  EXEC SQL BEGIN DECLARE SECTION;
  sqlint32      o_key, l_key, delta;
  sqlint32      l_partkey, l_suppkey;
  double    l_quantity, l_tax, l_discount, l_extendedprice;
  double    o_totalprice;
  double    new_quantity, rprice, cost, new_extprice, new_ototal, ototal;
  EXEC SQL END DECLARE SECTION;

  EXEC SQL DECLARE l_cursor CURSOR FOR
    SELECT l_partkey, l_suppkey, l_quantity,
    l_tax, l_discount,
    l_extendedprice
      FROM tpcd.lineitem
      WHERE l_orderkey = :o_key
      AND l_linenumber = :l_key
      FOR UPDATE OF l_extendedprice, l_quantity;

  EXEC SQL DECLARE o_cursor CURSOR FOR
    SELECT o_totalprice
      FROM tpcd.orders
      WHERE o_orderkey = :o_key
      FOR UPDATE OF o_totalprice;

  if (acid->termination < 0 || acid->termination > 3) acid->termination = 0;
  o_key = acid->o_key;
  l_key = acid->l_key;
  delta = acid->delta;

  if (acid->logging) {
    /* mypid = getpid(); */
    mypid = acid->tag;
    sprintf(out_fn,
"%s%cacidT.out.%d",getenv("TPCD_TMP_DIR"),del(),mypid);
    out=fopen(out_fn,"a");
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"\n---------- START of acidT tag: %d ----------\n\n",mypid);
    fprintf(out, "acidT tag: %d, begin transaction time: (%us %06uu) %s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "o_key: %d\tl_key: %d\tdelta: %d\n", o_key, l_key, delta);
  }
#ifdef DEBUG
  printf("o_key: %d\tl_key: %d\tdelta: %d\n", o_key, l_key, delta);
#endif

 retry_tran:

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, before read of LINEITEM: (%us %06uu)
%s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  EXEC SQL OPEN l_cursor;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: OPEN l_cursor", &sqlca);
    goto Terror;
  }

  EXEC SQL FETCH l_cursor INTO
    :l_partkey, :l_suppkey, :l_quantity, :l_tax,
    :l_discount, :l_extendedprice;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: FETCH l_cursor", &sqlca);
    goto Terror;
  }

#ifdef DEBUG
  printf("l_quantity = %0.3f\n",l_quantity);
  printf("l_tax = %0.3f  \n",l_tax);
  printf("l_discount = %0.3f \n",l_discount);
  printf("l_extendedprice = %0.3f \n", l_extendedprice);
#endif

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after read of LINEITEM: (%us %06uu) %s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "l_partkey: %d  l_suppkey: %d  l_quantity: %0.3f\nl_tax:
%0.3f  l_discount: %0.3f  l_extendedprice: %0.3f\n",
          l_partkey, l_suppkey, l_quantity, l_tax, l_discount,
l_extendedprice);
  }

  rprice = TRUNC2( l_extendedprice/l_quantity );
  cost = TRUNC2( rprice * delta );
  new_extprice = l_extendedprice + cost;
  new_quantity = l_quantity + delta;

#ifdef DEBUG
  printf("rprice = %0.3f\n", rprice );
  printf("cost = %0.3f\n", cost );
  printf("new_extprice = %0.3f\n", new_extprice );
  printf("new_quantity = %0.3f\n", new_quantity );
#endif

  EXEC SQL UPDATE tpcd.lineitem
    SET l_extendedprice = :new_extprice,
      l_quantity = :new_quantity
    WHERE CURRENT OF l_cursor;

  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: UPDATE l_cursor", &sqlca);
    goto Terror;
  }

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after update of LINEITEM: (%us %06uu)
%s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
```

```
    fprintf(out, "updated l_extendedprice: %0.3f\n", new_extprice );
    fprintf(out, "updated l_quantity: %0.3f\n", new_quantity );
  }

/* if (acid->termination == 0) {
    EXEC SQL CLOSE L_CURSOR;
    EXEC SQL CLOSE O_CURSOR;
    EXEC SQL COMMIT;
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      }
      sqlerror("acidT: COMMIT", &sqlca);
      goto Terror;
    }
  } */

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, before read of ORDER: (%us %06uu) %s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  EXEC SQL OPEN o_cursor;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: OPEN o_cursor", &sqlca);
    goto Terror;
  }

  EXEC SQL FETCH o_cursor INTO :o_totalprice;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging)
    {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    }
    else
    {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    }
    sqlerror("acidT: FETCH o_cursor", &sqlca);
    goto Terror;
  }

#ifdef DEBUG
  printf("o_totalprice = %0.3f\n",o_totalprice);
#endif

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after read of ORDER: (%us %06uu) %s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "o_totalprice: %0.3f\n", o_totalprice);
  }

#ifdef DEBUG
  {
    double zeroone= l_extendedprice * (1.0- l_discount);
    double zeroonetimes= (l_extendedprice * (1.0- l_discount))*100.0;
    double firstone = TRUNC2(l_extendedprice * (1.0-l_discount));
    double notone= TRUNC2 ( l_extendedprice * (1.0-l_discount)) *
(1.0+l_tax);
    double secondone= TRUNC2( TRUNC2( l_extendedprice * (1.0-
l_discount) ) * (1.0+l_tax) );
    printf("firstone=   %f\n", firstone);
    printf("zeroone=   %f\n", zeroone);
    printf("zeroonetimes=   %f\n", zeroonetimes);
    printf("notone=   %f\n", notone);
    printf("secondone=   %f\n", secondone);
  }
#endif
  ototal = o_totalprice -
            TRUNC2( TRUNC2( l_extendedprice * (1-l_discount) ) *
(1+l_tax) );
  new_ototal = TRUNC2( new_extprice * (1.0-l_discount) );
  new_ototal = TRUNC2( new_ototal * (1.0+l_tax) );
  new_ototal = ototal + new_ototal;

#ifdef DEBUG
  printf("o_totalprince= %f\n",o_totalprice);
  printf("ototal= %0.3f\n",ototal);
  printf("ototal= %f\n",ototal);
  printf("new_ototal= %0.3f\n",new_ototal);
#endif

  EXEC SQL UPDATE tpcd.orders
    SET o_totalprice = :new_ototal
    WHERE CURRENT OF o_cursor;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: UPDATE o_cursor", &sqlca);
    goto Terror;
  }

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after update of ORDER: (%us %06uu) %s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "updated o_totalprice: %0.3f\n", new_ototal) ;
  }

/*
** why is this code in here? we don't want to
** commit until the history table has been updated as well
  if (acid->termination == 0) {
    EXEC SQL CLOSE L_CURSOR;
    EXEC SQL CLOSE O_CURSOR;
    EXEC SQL COMMIT;
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      }
      sqlerror("acidT: COMMIT", &sqlca);
      goto Terror;
    }
```

```
  }
*/

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, before insert into HISTORY: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  EXEC SQL INSERT INTO tpcd.history values
    (:l_partkey, :l_suppkey, :o_key, :l_key, :delta, CURRENT
TIMESTAMP);
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: INSERT INTO history", &sqlca);
    goto Terror;
  }

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after insert into HISTORY: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  /* sleep for 1 second for 80% of the transactions */
#ifdef SQLWINT
  if ( ((rand() % (100)) + 1) < 80 ) sleep(1);
#else
  if ( ((random() % (100)) + 1) < 80 ) sleep(1);
#endif

  switch (acid->termination) {
   case 1:
    {
     if (acid->logging)
     {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, wait before COMMIT: (%us %06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
     }
    }
    sleep(60);
  case 0:
    // gjc@011214
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, immediately before closing cursors: (%us
%06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    EXEC SQL CLOSE L_CURSOR;
    // gjc@011214.
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: Close L_CURSOR", &sqlca);
      goto Terror;
    }

    EXEC SQL CLOSE O_CURSOR;
    // gjc@011214.
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: Close O_CURSOR", &sqlca);
      goto Terror;
    }

    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, immediately before COMMIT: (%us
%06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    EXEC SQL COMMIT;
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: COMMIT", &sqlca);
      goto Terror;
    }
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, after COMMIT: (%us %06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    break;
  case 3:
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, wait before ROLLBACK: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    sleep(60);
  case 2:
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, immediately before closing cursors: (%us
%06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    EXEC SQL CLOSE L_CURSOR;
    // gjc@011214.
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
```

```
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: Close L_CURSOR", &sqlca);
      goto Terror;
    }
    EXEC SQL CLOSE O_CURSOR;
    // gjc@011214.
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: Close O_CURSOR", &sqlca);
      goto Terror;
    }

    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, immediately before ROLLBACK: (%us
%06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    EXEC SQL rollback work;
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: ROLLBACK", &sqlca);
      goto Terror;
    }
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, after ROLLBACK: (%us %06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
      break;
  }

  acid->l_partkey = l_partkey;
  acid->l_suppkey = l_suppkey;
  acid->l_quantity = l_quantity;
  acid->l_tax = l_tax;
  acid->l_discount = l_discount;
  acid->l_extendedprice = l_extendedprice;
  acid->o_totalprice = o_totalprice;

  rc = 0;
  goto Texit;

 Terror:
    EXEC SQL CLOSE L_CURSOR;
    EXEC SQL CLOSE O_CURSOR;
  EXEC SQL rollback work;
  if (sqlca.sqlcode != 0) sqlerror("acidT: ROLLBACK FAILED", &sqlca);

 Texit:
  if (acid->logging) {
    fprintf(out,"\n---------- END of acidT tag: %d ----------\n\n",mypid);
    fflush(out);fclose(out);
  }
  return(rc);
}

/*------------------------------------------------------------*/
/*      updateQ                                               */
/*------------------------------------------------------------*/
int updateQ (struct update_struct *us)
{
  FILE *out;
  time_t timeT;
  struct timeval tv;
  struct timezone tz;
  int qnum;
  int rc = 0;
  int i;
  int secs2sleep;
  char buff[256];
  struct acidtype {int logging;} a, *acid;

  EXEC SQL BEGIN DECLARE SECTION;
  double    acctbal;
  double    discount;
  double    price;
  sqlint32      availqty;
  sqlint32      size;
  EXEC SQL END DECLARE SECTION;

  qnum = us->qnum;

  acid = &a;
  acid->logging= 1;

  sprintf(buff, "%s%cupdate.out",getenv("TPCD_TMP_DIR"),del());
  out=fopen(buff,"a");

  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"\n---------- START of update ----------\n\n");
  fprintf(out, "update query number: %d, begin transaction time: (%us
%06uu) %s",
        qnum, tv.tv_sec, tv.tv_usec, ctime(&timeT));

  sqlca.sqlcode = 0;
  discount = 0.25;
  price = 5000.50;
  acctbal = 1000.00;
  availqty = 10;
  size = 5;

  for (i=1; i <= 2; i++) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"update query number: %d, pass %d, immediately before
UPDATE: (%us %06uu) %s",
          qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));

    switch (qnum)
    {
     case 1:
     {
       EXEC SQL
         UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
         WHERE L_ORDERKEY IN (326,512,928,995);
       if (sqlca.sqlcode != 0) {
         rc = sqlca.sqlcode;
         if (acid->logging)
         {
           fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
```

```
                qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 1", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 2:
      {
        EXEC SQL
          UPDATE TPCD.SUPPLIER set S_ACCTBAL = S_ACCTBAL +
:acctbal
          WHERE S_NAME in
('Supplier#000000647','Supplier#000000070','Supplier#000000802');
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 2", &sqlca);
          goto Uerror;
        }
        acctbal = acctbal * (-1);
        secs2sleep = 90;
        break;
      }
      case 3:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
          WHERE L_ORDERKEY IN (260930, 402497, 457859, 509889,
58117,
                        538311, 588421, 416167, 97830, 90276);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 3", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 4:
      {
        if ( i ==1 ) {
          EXEC SQL
            UPDATE TPCD.ORDERS set O_ORDERDATE =
O_ORDERDATE - 6 MONTHS
            WHERE O_ORDERKEY =  67461;
          /* WHERE O_ORDERKEY IN
(22400,28515,34338,46596,67461,92644,98307);*/
        } else {
          EXEC SQL
            UPDATE TPCD.ORDERS set O_ORDERDATE =
O_ORDERDATE + 6 MONTHS
            WHERE O_ORDERKEY =  67461;
        }
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 4", &sqlca);
          goto Uerror;
        }
        secs2sleep = 300;
        break;
      }
      case 5:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
          WHERE L_ORDERKEY IN
(70976,566279,152897,84226,232483);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 5", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 6:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
```

```
        WHERE L_ORDERKEY in
(33,131,161,195,229,230,231,323,353,356);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 6", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 300;
      break;
    }
    case 7:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
        WHERE L_ORDERKEY IN
(562917,410659,16550,398401,157634,429920,45411);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 7", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 300;
      break;
    }
    case 8:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
        WHERE L_ORDERKEY IN
(129569,343591,270242,254983,98500,28963);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 8", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 300;
      break;
    }
    case 9:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
        WHERE L_ORDERKEY IN
(113509,232997,246691,379233,448162,32134);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 9", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 300;
      break;
    }
    case 10:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
        WHERE L_ORDERKEY IN
(516487,245411,265799,253025,6914,562020);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 10", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 300;
      break;
    }
    case 11:
    {
      EXEC SQL
        UPDATE TPCD.PARTSUPP set PS_AVAILQTY =
PS_AVAILQTY + :availqty
```

```
        WHERE PS_PARTKEY IN
(12098,5134,13334,17052,3452,12552,1084,5797);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 11", &sqlca);
        goto Uerror;
      }
      availqty = availqty * (-1);
      secs2sleep = 180;
      break;
    }
    case 12:
    {
      if ( i ==1 ) {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_RECEIPTDATE =
L_RECEIPTDATE - 3 YEARS
          WHERE L_ORDERKEY IN
(33,70,195,355,677,837,960,962,1028);
      } else {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_RECEIPTDATE =
L_RECEIPTDATE + 3 YEARS
          WHERE L_ORDERKEY IN
(33,70,195,355,677,837,960,962,1028);
      }
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 12", &sqlca);
        goto Uerror;
      }
      secs2sleep = 300;
      break;
    }
    case 13:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
        WHERE L_ORDERKEY IN (263,9476,32355,34854,53445,56901);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 13", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 90;
      break;
    }
    case 14:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
        WHERE L_ORDERKEY IN (32,225,326,448,449,483,512);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 14", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 180;
      break;
    }
    case 15:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT +
:discount
        WHERE L_ORDERKEY IN (1,4,7,35,135,131300);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 15", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 180;
      break;
    }
    case 16:
```

```
    {
      EXEC SQL
        UPDATE TPCD.PART set P_SIZE = P_SIZE + :size
        WHERE P_PARTKEY IN (4,7,15,1313);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
          fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
          fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 16", &sqlca);
        goto Uerror;
      }
      size = size * (-1);
      secs2sleep = 180;
      break;
    }
    case 17:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_EXTENDEDPRICE =
L_EXTENDEDPRICE + :price
        WHERE L_ORDERKEY IN (4065,110372,165061,265702,87138);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
          fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        else
        {
          fprintf(stderr,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 17", &sqlca);
        goto Uerror;
      }
      price = price * (-1);
      secs2sleep = 90;
      break;
    }
    default:
    {
      fprintf(out,"ERROR: Invalid query number specified %d\n", qnum);
      rc = 1;
      goto Uexit;
    }
    }

    gettimeofday(&tv, &tz);
    time(&timeT);

    if (acid->logging)
      fprintf(out,"update query number: %d, pass %d, after UPDATE: (%us
%06uu) %s",
          qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    else
      fprintf(stderr,"update query number: %d, pass %d, after UPDATE:
(%us %06uu) %s",
          qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));

    if ( i == 2 ) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"update query number: %d, pass %d, sleeping for %d
seconds: (%us %06uu) %s",
          qnum, i, secs2sleep, tv.tv_sec, tv.tv_usec, ctime(&timeT));
      fflush(out);
      system("touch /tmp/tpcd/update.sync.sleep");
      sleep(secs2sleep);
    }

    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"update query number: %d, pass %d, immediately before
COMMIT: (%us %06uu) %s",
        qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));

    EXEC SQL COMMIT;
    if (sqlca.sqlcode != 0) {
      rc = sqlca.sqlcode;
      fprintf(out,"update pass %d, **ERROR** sqlcode = %d\n", i,
sqlca.sqlcode);
      sqlerror("update: COMMIT", &sqlca);
      goto Uerror;
    }
    gettimeofday(&tv, &tz);
    time(&timeT);
    if (acid->logging)
      fprintf(out,"update query number: %d, pass %d, after COMMIT: (%us
%06uu) %s",
          qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    else
      fprintf(stderr,"update query number: %d, pass %d, after COMMIT:
(%us %06uu) %s",
          qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  rc = 0;
  goto Uexit;

 Uerror:
  EXEC SQL rollback work;
  if (sqlca.sqlcode != 0) sqlerror("update: ROLLBACK FAILED", &sqlca);
  system("touch /tmp/tpcd/update.sync.sleep");

 Uexit:
  fprintf(out,"\n---------- END of update ----------\n\n");
  fflush(out);fclose(out);
  return(rc);
}

/*---------------------------------------------------------------*/
/*      connect_to_TM                                            */
/*---------------------------------------------------------------*/
void connect_to_TM( void )
{
  char *dbname_ptr;
  if ((dbname_ptr = getenv("TPCD_QUAL_DBNAME")) != NULL) {
    fprintf(stderr,"********** %s **********\n",dbname_ptr);
    strcpy (dbname, dbname_ptr);
  }

  EXEC SQL CONNECT TO :dbname IN SHARE MODE;
  if (sqlca.sqlcode <  0) {
    fprintf(stderr, "CONNECT TO %s failed SQLCODE = %d\n", dbname,
sqlca.sqlcode);
    exit(-1);
  }
```

```
  return;
}

/*---------------------------------------------------------------*/
/*       disconnect_from_TM                                      */
/*---------------------------------------------------------------*/
void disconnect_from_TM ( void )
{
  EXEC SQL CONNECT RESET;
  if (sqlca.sqlcode <  0) {
     fprintf(stderr, "DISCONNECT failed SQLCODE = %d\n",
sqlca.sqlcode);
     exit(-1);
  }
  return;
}

/*---------------------------------------------------------------*/
/*       sqlerror                                                */
/*---------------------------------------------------------------*/
void sqlerror(char *msg, struct sqlca *psqlca)
{
  FILE *err_fp;


  char  err_fn[256];


  int j,k;

  sprintf(err_fn, "%s%cacid.sqlerrors",getenv("TPCD_TMP_DIR"),del());
  err_fp=fopen(err_fn,"a");
  fprintf(err_fp,"acid: sqlcode: %4d %s\n", psqlca->sqlcode, msg);
  fprintf(stderr,"acid: sqlcode: %4d %s\n", psqlca->sqlcode, msg);
  fflush(stderr);
  if (psqlca->sqlerrmc[0] != ' ' || psqlca->sqlerrmc[1] != ' ') {
    fprintf(err_fp,"acid: slerrmc:  ");
    for(j = 0; j < 5; j++)
    {
      for(k = 0; k < 14; k++) fprintf(err_fp,"%x ", psqlca-
>sqlerrmc[j*10+k]);
      fprintf(err_fp,"    ");
      for(k = 0; k < 14; k++) fprintf(err_fp,"%c",  psqlca-
>sqlerrmc[j*10+k]);
      fprintf(err_fp,"\n");
      if (j < 4) fprintf(err_fp,"          ");
    }
  }

  fprintf(err_fp,"acid: sqlerrp:  ");
  for(j = 0; j < 8; j++)    fprintf(err_fp,"%c", psqlca->sqlerrp[j]);
  fprintf(err_fp,"\n");

  fprintf(err_fp,"acid: sqlerrd: ");
  for(j = 0; j < 6; j++)    fprintf(err_fp," %d", psqlca->sqlerrd[j]);
  fprintf(err_fp,"\n");

  if (psqlca->sqlwarn[0] != ' ') {
    fprintf(err_fp,"acid: sqlwarn: ");
    for(j = 0; j < 8; j++)    fprintf(err_fp,"%c ", psqlca->sqlwarn[j]);
    fprintf(err_fp,"\n");
  }

  fprintf(err_fp,"\n");
  fflush(err_fp);fclose(err_fp);
}

#ifdef SQLWINT
void sleep(int sec)
{
  Sleep(sec * 1000);
}
#endif


char del(void)
{
#ifdef SQLWINT
  return '\\';
#else
  return '/';
#endif
}

#if defined(SQLPTX) || defined(SQLWINT) || defined(SQLSUN) ||
defined(Linux)
/* added fot PTX as this one is not there in libm */
double nearest(double x)
{
       double y, z;

       y = x;
       if (x < 0)
              y = -x;
       z = y - (int)y;
       if (z == 0.5) {
              if ((int)floor(y) % 2) {
                     return((x < 0) ? -ceil(y) : ceil(y));
              } else {
                     return((x < 0) ? -floor(y) : floor(y));
              }
       } else  if (z < 0.5)
                     return((x < 0) ? -floor(y) : floor(y));
              else
                     return((x < 0) ? -ceil(y) : ceil(y));
}
#endif /* SQLPTX */
```

E.2 acid.h

```
#include <math.h>

#define acidtime(tvsec,tvusec) tvsec*1000+tvusec/1000
#define TSLEN 20

#if 0 /* needed on NT, not on AIX */
typedef struct timeval {
       long    tv_sec;         /* seconds */
       long    tv_usec;        /* and microseconds */
};
#endif

struct update_struct {
  int     qnum;
};

struct acidQ_struct {
  int     tag;
  long    o_key;
  double  l_extendedprice;
};

struct acidT_struct {
  int     termination;
  int     tag;
  int     logging;
  long    o_key;
```

```
  long    l_key;
  long    delta;
  long    l_partkey;
  long    l_suppkey;
  double  l_quantity;
  double  l_tax;
  double  l_discount;
  double  l_extendedprice;
  double  o_totalprice;
};

/*
}
```

```
** in acid.sqc
*/

int updateQ (struct update_struct *us);

char del(void);

#ifdef SQLWINT
void sleep (int sec);
#endif
```

Appendix F: Price Quotations

CISCO SYSTEMS

Cisco Systems

Ph: 713.778.5640
Fax:

Price Quotation

Date: 1/3/2002
To: Compaq Computer

Attn: Michael
V. Nikolaiev

Ph:
Fax:

Quote Number: 85S-E1L
Total Price: $130,170.00

Product Number	Product Description	Qty	Unit List Price	Disc Price	Disc %	Extended Price
WS-C6509-1300AC=	Catalyst 6509 Chassis w/ 1300W AC Power Supply	1	$13,990.00		0.000%	$13,990.00
WS-X6K-S2-MSFC2	Catalyst 6500 Supervisor Engine-2, 2GE, plus MSFC-2 & PFC-2	1	$34,995.00		0.000%	$34,995.00
WS-X6416-GBIC	Catalyst 6000 16-port Gig-Ethernet Mod. (Req. GBICs)	2	$19,995.00		0.000%	$39,990.00
WS-X6408A-GBIC	Catalyst 6000 8-port GE, Enhanced QoS (Req. GBICs)	1	$9,995.00		0.000%	$9,995.00
CON-SNTP-WS-C6509	24x7x4 Service,Catalyst 6509	3	$10,400.00		0.000%	$31,200.00

FOB Point: Origin
Ship Date:
Quote Valid Until: For 60 Days

Payment Terms: Net 30
Installation: Available on Request and Billable
Warranty: 90 days

Signed:
Ramsey McCreary

Notes:

This price quotation does not constitute an offer by Cisco to sell products, but is instead an invitation to issue a purchase order to Cisco until the Quotation Valid date specified on this Price Quotation. Such a purchase order will be subject to Cisco's standard procedures, terms, and conditions

Route 100
Somers, NY 10589

January 15, 2003

Mr. Michael V. Nikolaiev
Director, ISS, Database Engineering
H P Company
20555 SH-249 - MS-150402
Houston, TX 77070

Via Facsimile 281-514-8375

Dear Mr. Nikolaiev

The table shown below lists the U.S. pricing for DB2 Universal Database Enterprise Extended Edition product that has been used in TPC-H Benchmark tests.

All prices shown are in U.S. Dollars:

DESCRIPTION	PRICE
DB2 Enterprise Extended Edition License With 1 Year Support (Per Processor) 128 Processors @ $22,153 Each	$2,835,584.00
DB2 Enterprise Extended Edition Support Renewal (Per Processor/Per Year) 2 Years for 128 Processors @$1,081 Each	$276,736.00

This quote is valid for 90 days.

If I can be of any further assistance, please contact me at 914/766-1325 or send me a note at privot@us.ibm.com.

Yours Truly,

Paul K. Rivot

Paul K. Rivot
Director, Database Servers &
Business Intelligence Software

CC: D. Daly