INTERGRAPH
COMPUTER SYSTEMS

TPC Benchmark™ C Full Disclosure Report

INTERGRAPH

InterServe

IS-625

Using
Microsoft SQL Server v. 6.5 (SP3)
and
Microsoft Windows NTS v. 4.0 (SP1)

First Edition
March 1997

First Printing March, 1997

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Trademarks

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Abstract

This report documents Intergraph Corporation's compliance with the specifications of the TPC Benchmark C version 3.2.3 on the InterServe 625.   The database software for the benchmark was Microsoft SQL Server 6.5 (SP3), and the operating system was Microsoft Windows NT Server 4.0 (SP1).

The benchmark was completed on March 4, 1997, and resulted in a score of 3961.00 tpmC, a price performance of $63.34 /tpmC with an availability date of March 1997. The standard metrics of tpmC and $/tpmC are reported in accordance with the TPC Benchmark™ C standard.

Preface

According to the TPC Benchmark™ C Standard Specification, test sponsors are required to publish a full disclosure report in order to be compliant with the specification. This report documents Intergraph Corporation’s compliance with the specifications of the TPC Benchmark™ C.

According to the *TPC Benchmark™ C Standard Specification*, the performance metric reported by TPC-C is a “business throughput” measuring the number of orders processed per minute. Multiple transactions are used to simulate the business activity of processing an order, and each transaction is subject to a response time constraint. The performance metric for this benchmark is expressed in transactions-per-minute-C (tpmC). To be compliant with the TPC-C standard, all references to tpmC results must include the tpmC rate, the associated price-per-tpmC, and the availability date of the priced configuration. The purpose of TPC benchmarks is to provide relevant, objective performance data to industry users.

Requests for additional copies of this report should be sent to the following address:

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C/O Shanley Public Relations
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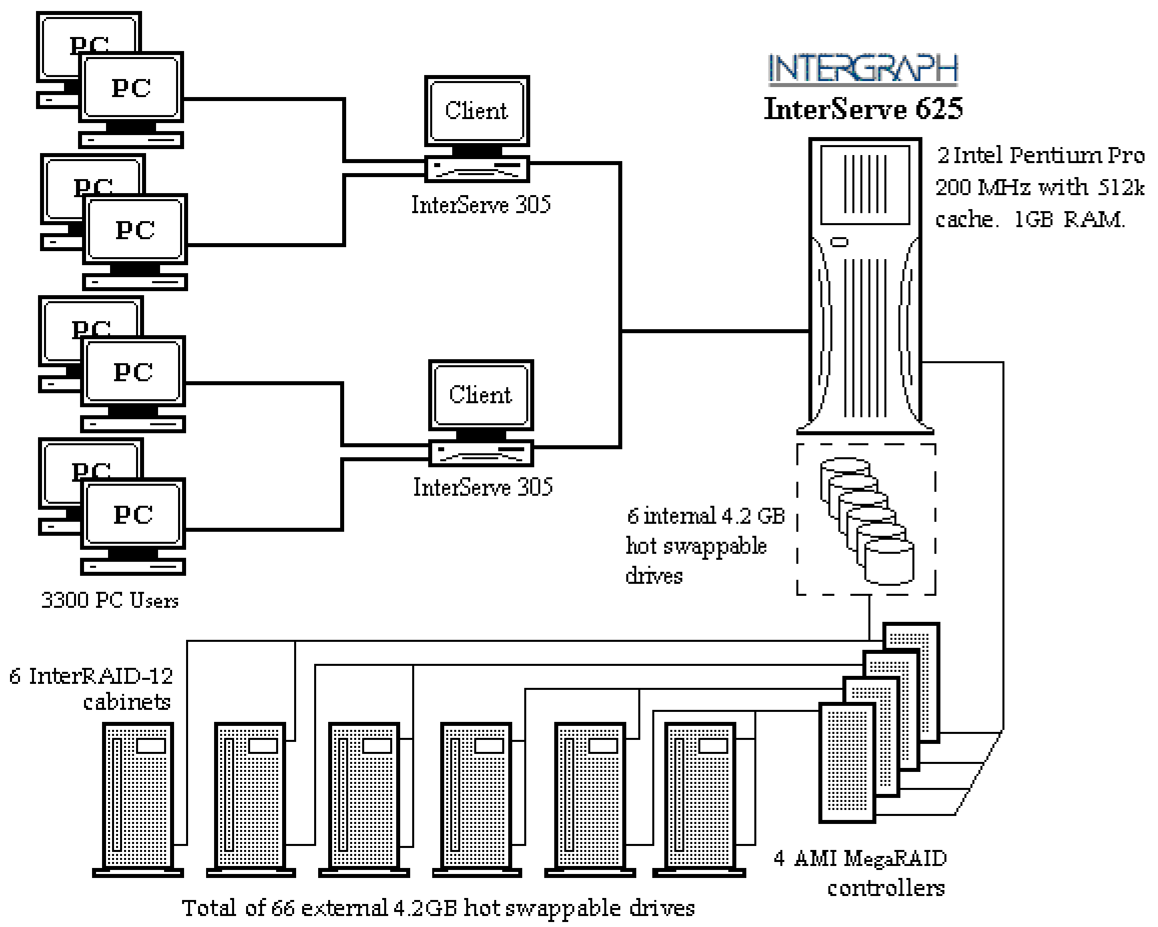
San Jose, CA 95112-6113
USA

INTERGRAPH COMPUTER SYSTEMS	InterServe 625 Server and InterServe 305	TPC-C Rev 3.2.3 Report Date: 04 Mar 1997

Total System Cost	TPC-C Throughput	Price /Performance	Availability Date
$250,927	**3961.00 tpmC**	**$63.34**	**March 1997**

Processor	Database Manager	Operating System	Other Software	Number of Users
2 Pentium® Pro 200MHz	**Microsoft SQL Server 6.5 (SP3)**	**Microsoft Windows NT 4.0 (SP1)**	**Microsoft Internet Information Server**	**3300**


PC
Client
InterServe 305
INTERGRAPH
InterServe 625
2 Intel Pentium Pro 200 MHz with 512k cache. 1GB RAM.
6 internal 4.2 GB hot swappable drives
3300 PC Users
6 InterRAID-12 cabinets
4 AMI MegaRAID controllers
Total of 66 external 4.2GB hot swappable drives

System Components	Server		Client	
	Qty	**Type**	**Qty**	**Type**
Processor	2	200 MHz Intel Pentium Pro 512k Cache	2	200 MHz Intel Pentium Pro 256k Cache
Memory	1	1024 MB	2	128 MB
Disk Controllers	4	AMI MegaRAID	2	Integrated Adaptec SCSI
Disk Drives	72	Seagate 4.2 GB Hot Swappable	2	Conner 2.1GB
Total Storage		302.4 GB		4.2 GB

INTERGRAPH COMPUTER SYSTEMS	InterServe 625 Server and InterServe 305	TPC-C Rev 3.2.3 Report Date: 04 Mar 1997

Description	Part Number	Third Party		Unit Price	Qty	Extended Price	5 yr. Maint. Price
		Brand	Pricing				
Server Hardware							
InterServe 625 (2x200/512,256MB,3x4GB)	FDPS413			$25,600	1	$25,600	6,160
InterRAID12 + RAID Controller (three)	FDSK443			$6,800	3	$20,400	11,559
InterRAID12 Without Controller	FDSK463			$4,800	3	$14,400	6,425
256MB Memory Upgrade	FMEM155			$4,999	3	$14,997	
4mm Tape Drive	FMTP160			$1,399	1	$1,399	
15" VGA Monitor	FOPT099			$399	1	$399	188
4GB Hot Swap Drive	FDSK461			$1,495	69	$103,155	
UPS (900Va)	FPWS006			$900	1	$900	
					Subtotal	$181,250	24,332
Server Software							
MS SQL Server 6.5 Database		Microsoft		1,399	1	1,399	10,475
MS SQL Server Internet Connector license		Microsoft		2,999	1	2,999	Included above
MS SQL Server Pgrs Toolkit		Microsoft		499	1	499	Included above
Visual C++ 32 Bit Edition (subscription)		Microsoft		499	1	499	Included above
Microsoft NTS 4.0 included with server							
					Subtotal	5,396	10,475
Client Hardware							
InterServe 305 (32MB,2GB)	FDPS320			5,620	2	11,240	2,716
32MB Memory Upgrade	FMEM134			399	6	2,394	
Intel 10/100BaseT PCI Ethernet Controller	FINF920			150	4	600	
15" SVGA Monitor	FOPT099			399	1	399	188
					Subtotal	14,633	2,904
Client Software							
Microsoft NTS 4.0 included on Web server (includes 5 user licenses)							
					Subtotal	0	0
User Connectivity							
34 Port 100BaseT Hub (includes 10% spares) (for 3300 users + 10% spares)	AT-3024TR-15	PC Importers		297	108	32,076	NA
8 Port 100BaseT Hub (includes spare) (for server + 2 clients + spares)	AEF-8TX	CompuStar		529	3	1,587	NA
					Subtotal	33,663	0
					*** Other Discounts**	($21,726)	
					Total	**$213,216**	**$37,711**

Notes: * Reseller Discount

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

The benchmark results and test methodology were audited by Francois Raab of Information Paradigm, Inc.

Five Year Cost of Ownership:	**$250,927**
tpmC Rating:	**3961.00**
$ / tpmC:	**$63.34**

Numerical Quantities Summary

MQTH, Computed Maximum Qualified Throughput	3961.00 tpmC
% throughput difference, reported and reproducibility runs	1.77%

Response Times (seconds)	Average	90%	Maximum
New-Order	0.7	1.0	5.4
Payment	0.5	0.6	5.0
Order-Status	0.8	1.6	6.2
Delivery (interactive)	0.4	0.5	3.1
Delivery (deferred)	0.7	1.1	31.8
Stock-Level	4.2	6.6	11.3
Menu	0.4	0.5	4.6
Response time delay added for emulated components (included in response times above)			0.1

Transaction Mix, in percent of total transaction	
New-Order	43.99
Payment	43.47
Order-Status	4.35
Delivery	4.10
Stock-Level	4.09

Keying/Think Times (seconds)	Min.	Average	Max
New-Order	18.0 / 0.1	18.0 / 12.0	18.0 / 120.1
Payment	3.0 / 0.1	3.0 / 12.1	3.0 / 120.1
Order-Status	2.0 / 0.1	2.0 / 10.0	2.0 / 100.1
Delivery (interactive)	2.0 / 0.1	2.0 / 5.0	2.0 / 50.1
Stock-Level	2.0 / 0.1	2.0 / 5.0	2.0 / 49.5

Test Duration (minutes)	
Ramp-up time	52.5
Measurement interval	30
Transactions (all types) completed during measurement interval	270155
Ramp down time	28.34

Checkpointing	
Number of checkpoints	1
Checkpoint interval	30 minutes

General Items

Application Code and Definition Statements

The application program (as defined in Clause 2.1.7) must be disclosed. This includes, but is not limited to, the code implementing the five transactions and the terminal input and output functions.

Appendix A lists the application code used to implement this benchmark.

Test Sponsor

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

This benchmark was sponsored and executed by Intergraph Corporation. The benchmark was developed by Intergraph Corporation and Microsoft Corporation.

Parameter Settings

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

- *Database tuning options.*
- *Recovery/commit options.*
- *Consistency/locking options.*
- *Operating system and application configuration parameters.*
- *Compilation and linkage options and run-time optimizations used to create/install applications, OS, and/or databases.*

This requirement can be satisfied by providing a full list of all parameters and options.

Appendix D contains the tunable parameters used in this benchmark.

Configuration Diagrams

Diagrams of both measured and priced configurations must be provided, accompanied by a description of the differences.

The configuration diagrams for the priced and benchmarked systems are provided on the following pages.

The differences between the benchmarked configuration and the priced configuration include the following:

- Priced configuration contains the hardware required for additional network segments on the clients.
- Priced configuration utilizes the IS-625 six internal RAID drives.

Figure 1: Priced Configuration

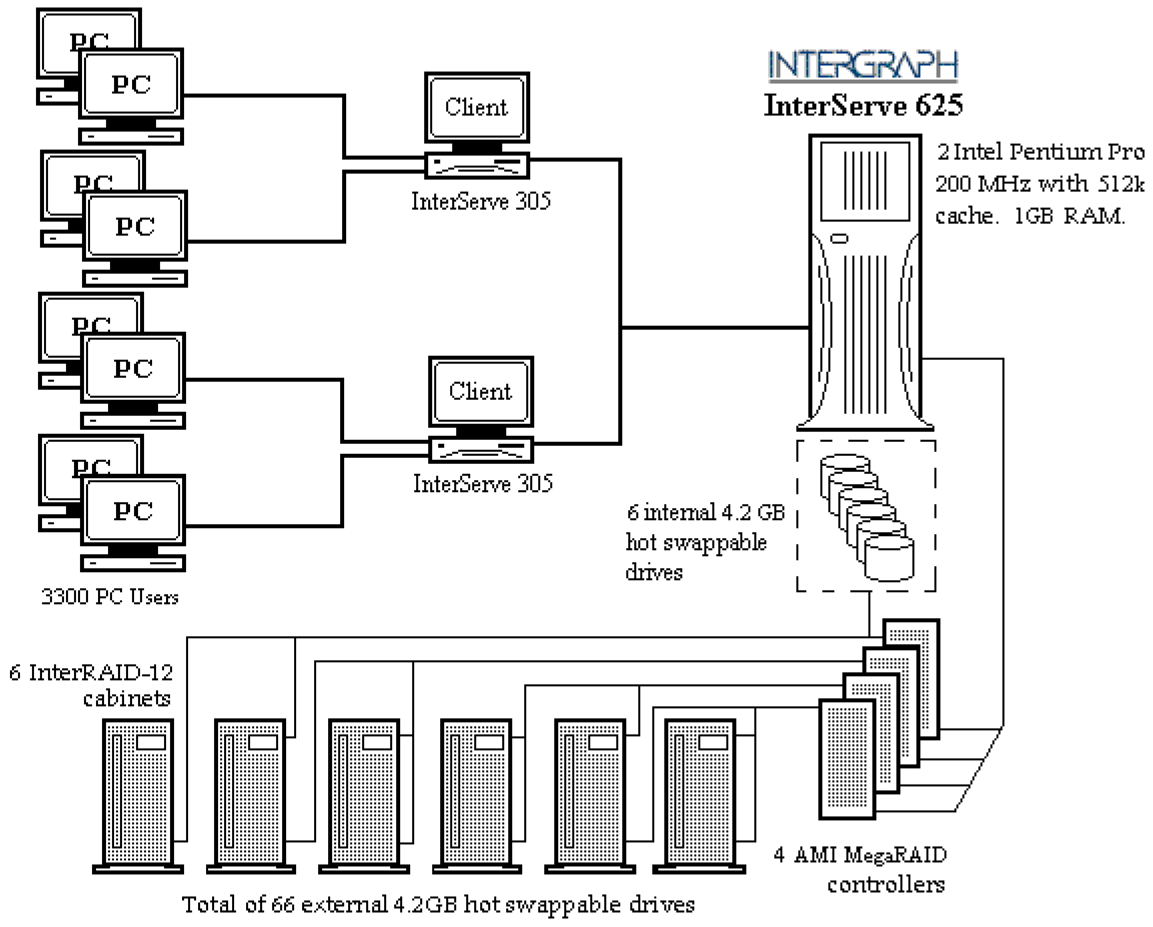
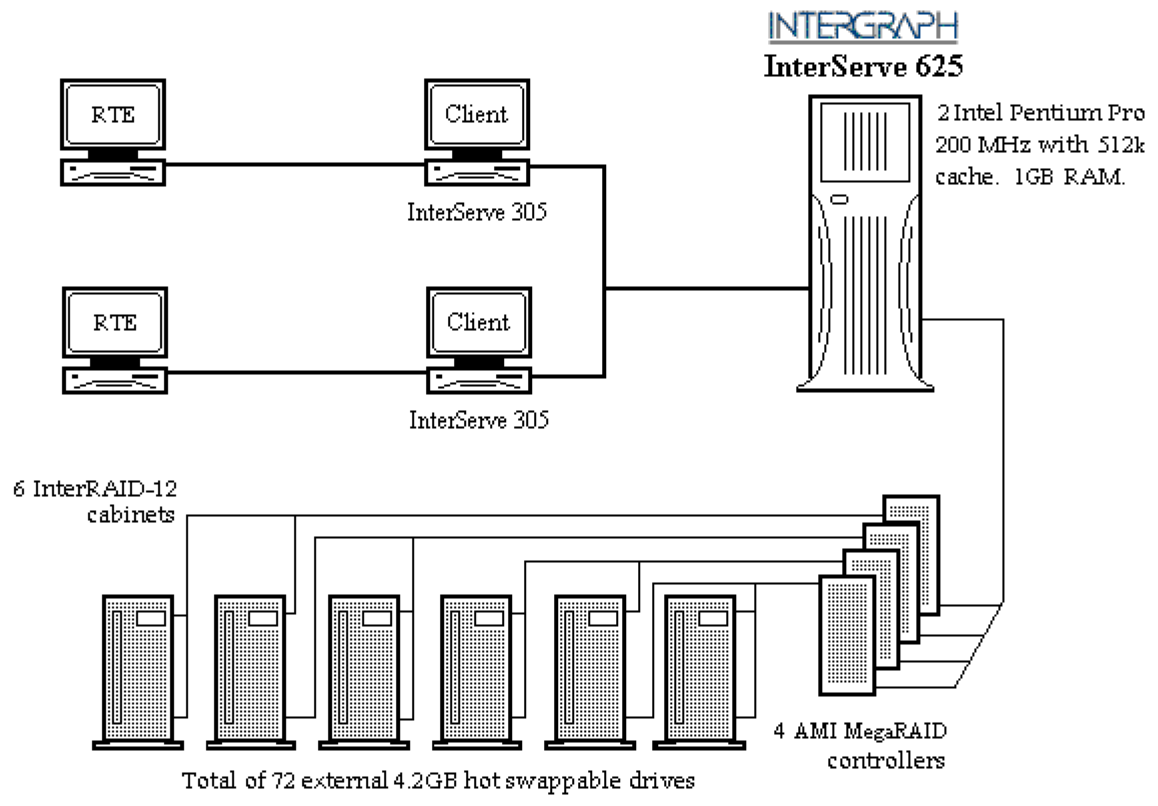

INTERGRAPH
InterServe 625
2 Intel Pentium Pro 200 MHz with 512k cache. 1GB RAM.
PC
Client
InterServe 305
Client
InterServe 305
3300 PC Users
6 internal 4.2 GB hot swappable drives
6 InterRAID-12 cabinets
4 AMI MegaRAID controllers
Total of 66 external 4.2GB hot swappable drives

Figure 2: Benchmarked Configuration


INTERGRAPH
InterServe 625
2 Intel Pentium Pro 200 MHz with 512k cache. 1GB RAM.
RTE
Client
InterServe 305
RTE
Client
InterServe 305
6 InterRAID-12 cabinets
4 AMI MegaRAID controllers
Total of 72 external 4.2GB hot swappable drives

Clause 1 Logical Database Design Related Items

Table Definitions

Listings must be provided for all table definition statements and all other statements used to set-up the database.

Appendix B contains the database definition files that were used to set up the database in this benchmark.

Physical Organization of Database

The physical organization of tables and indices, within the database, must be disclosed.

Appendix B contains information detailing the organization and distribution of the database.

Insert and Delete Operations

It must be ascertained that insert and/or delete operations to any of the tables can occur concurrently with the TPC-C transaction mix. Furthermore, any restriction in the SUT database implementation that precludes inserts beyond the limits defined in Clause 1.4.11 must be disclosed. This includes the maximum number of rows that can be inserted and the maximum key value for these new rows.

There were no restrictions on insert or delete operations to any tables in the database.

Partitioning

While there are a few restrictions placed upon horizontal or vertical partitioning of tables and rows in the TPC-C benchmark (see Clause 1.6), any such partitioning must be disclosed.

Partitioning was not used for this benchmark.

Table Replication

Replication of tables, if used, must be disclosed (see Clause 1.4.6).

No replications were used in this benchmark.

Table Attributes

Additional and/or duplicated attributes in any table must be disclosed along with a statement on the impact on performance (see Clause 1.4.7).

No additional or duplicated attributes were used in this benchmark.

Clause 2 Transaction and Terminal Profiles Related Items

Random Number Generation

The method of verification for the random number generation must be described.

RTE

Random numbers were generated using the drand48() call. This function generates pseudo-random numbers using the well-known linear congruential algorithm and 48-bit integer arithmetic. Function drand48() returns non-negative double-precision floating-point values uniformly distributed over the interval [0.0, 1.0). Function srand48() is an initialization entry point, which is invoked before drand48() is called.

Database Load

The loader program implements a pseudo random number generator. This generator will run the complete period before repeating. Copied from: Random Numbers Generators: Good Ones Are Hard to Find. Communications of the ACM - October 1988 Volume 31 Number 10.

Input/Output Screen Layout

The actual layouts of the terminal input/output screens must be disclosed.

All screen layouts match the TPC-C Benchmark Specification.

Priced Terminal Feature Verification

The method used to verify that the emulated terminals provide all the features described in Clause 2.2.2.4 must be explained. Although not specifically priced, the type and model of the terminals used for the demonstration in 8.1.3.3 must be disclosed and commercially available (including supporting software and maintenance).

The terminal emulator meets the specification. These features were manually verified using a Microsoft Internet Explorer HTTP connection from an Intergraph TD-300 workstation.

Presentation Manager or Intelligent Terminal

Any usage of presentation managers or intelligent terminals must be explained.

Application code on the client machine implemented the TPC-C user interface. No presentation manager software or intelligent terminal features were used. The source code for the user interface is listed in Appendix A.

Transaction Statistics

Table 1 lists the numerical quantities required by Clauses 8.1.3.5 to 8.1.3.11.

Table 1: Transaction Statistics

Transaction Type	Statistics	Percentage
New Order	Home warehouse	98.98%
	Remote warehouse	1.02%
	Rolled back transactions	0.99%
	Average items per order	10.02
Payment	Home warehouse	85.11%
	Remote warehouse	14.89%
	Last name access	59.78%
Order Status	Last name access	60.06%
Delivery	Skipped transactions	0%
Transaction Mix	New Order	43.99%
	Payment	43.47%
	Order status	4.35%
	Delivery	4.10%
	Stock level	4.09%

Queueing Mechanism

The queuing mechanism used to defer the execution of the Delivery transaction must be disclosed.

The source code for the delivery process is listed in Appendix A.

Clause 3 Transaction and System Properties Related Items

Transaction System Properties (ACID)

The results of the ACID tests must be disclosed along with a description of how the ACID requirements were met. This includes disclosing which case was followed for the execution of Isolation Test 7.

Atomicity

The system under test must guarantee that the database transactions are atomic; the system will either perform all individual operations on the data or will assure that no partially completed operations leave any effects on the data.

Tests waived by auditor as previously performed.

Consistency

Consistency is the property of the application that requires any execution of a database transaction to take the database from one consistent state to another, assuming that the database is initially in a consistent state.

Tests waived by auditor as previously performed.

Isolation

Sufficient conditions must be enabled at either the system or application level to ensure the required isolation defined above (Clause 3.4.1) is obtained.

Tests waived by auditor as previously performed.

Durability

The tested system must guarantee durability: the ability to preserve the effects of committed transaction and insure database consistency after recovery from any one of the failures listed in Clause 3.5.3.

Loss of Log Drive and Loss of Memory

The following test was conducted on the fully scaled 330 warehouse database using 3300 emulated terminals:

1. The initial count of the total number of orders was found by the sum of d_next_o_id of all rows in the district table giving the initial count.
2. The test was started and allowed to run at steady state for 10 minutes.
3. The server was powered down.
4. The test was aborted on the driver.
5. The server was powered back on.
6. Database recovery was done.
7. Several "success" orders recorded by the RTE were verified in the database.
8. The first step was repeated to give the total number of orders. The difference from step 1 was calculated and compared to the number of “success” records in the RTE.

Loss of Data Drive

Tests waived by auditor as previously performed.

Clause 4 Scaling and Database Population Related Items

Initial Cardinality of Tables

The cardinality (e.g., the number of rows) of each table, as it existed at the start of the benchmark run (see Clause 4.2), must be disclosed. If the database was over-scaled and inactive rows of the WAREHOUSE table were deleted (see Clause 4.2.2), the cardinality of the WAREHOUSE table as initially configured and the number of rows deleted must be disclosed.

The number of rows in each table are shown in Table 2 below:

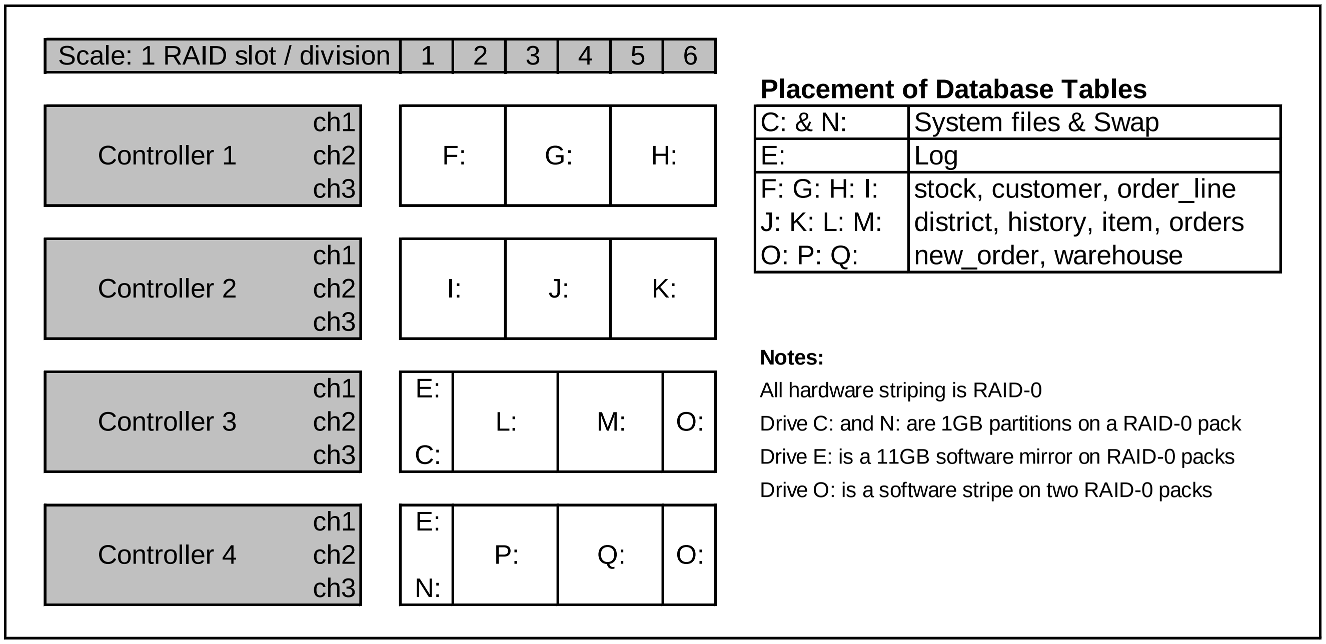
Table 2: Cardinality of Tables

Table	Occurrences
Warehouse	330
District	3,300
Customer	9,900,000
History	9,900,000
Order	9,900,000
New Order	2,970,000
Order Line	99,002,313
Stock	33,000,000
Item	100,000

Database Layout

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

Figure 2: Table Distributions Across Media



Placement of Database Tables

C: & N:	System files & Swap
E:	Log
F: G: H: I: J: K: L: M: O: P: Q:	stock, customer, order_line district, history, item, orders new_order, warehouse

Notes:
All hardware striping is RAID-0
Drive C: and N: are 1GB partitions on a RAID-0 pack
Drive E: is a 11GB software mirror on RAID-0 packs
Drive O: is a software stripe on two RAID-0 packs

The distribution of the database tables over the 72 disks in the priced configuration is an extension of the distribution in the tested system configuration. The one hundred eighty day storage requirements are satisified with the unused space on the priced system.

Type of Database

A statement must be provided that describes:

1. *The data model implemented by the DBMS used (e.g., relational, network, hierarchical)*
2. *The database interface (e.g., embedded, call level) and access language (e.g., SQL, DL/1, COBOL read/write) used to implement the TPC-C transactions. If more than one interface/access language is used to implement TPC-C, each interface/access language must be described and a list of which interface/access language is used with which transaction type must be disclosed.*

Microsoft SQL Server version 6.5 (a relational database) was used in this benchmark.   SQL Server stored procedures were used and invoked through DB-Library function calls.

Database Mapping

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

No partitioning or replication was used.

180 Day Space Computations

Details of the 180 day space computations along with proof that the database is configured to sustain 8 hours of growth for the dynamic tables (Order, Order-Line, and History) must be disclosed (see Clause 4.2.3).

The details of the 180 day space computations and 8 hours of transaction log space requirements are shown in Appendix D

Clause 5 Performance Metrics and Response Time Related Items

Results

Measured tpmC must be reported.

Measured tpmC 3961.00 tpmC
Price per tpmC $63.34

Response Times

Ninetieth percentile, maximum and average response times must be reported for all transaction types as well as for the Menu response time.

Table 3: Response Times

Type	Average	Maximum	90th percentile
New-Order	0.7	5.4	1.0
Payment	0.5	5.0	0.6
Order-Status	0.8	6.2	1.6
Interactive Delivery	0.4	3.1	0.5
Deferred Delivery	0.7	31.8	1.1
Stock-Level	4.2	11.3	6.6
Menu	0.4	4.6	0.5

Keying and Think Times

The minimum, the average, and the maximum keying and think times must be reported for each transaction type.

Table 4: Keying Times

Type	Minimum	Average	Maximum
New-Order	18.0	18.0	18.0
Payment	3.0	3.0	3.0
Order-Status	2.0	2.0	2.0
Interactive Delivery	2.0	2.0	2.0
Stock-Level	2.0	2.0	2.0

Table 5: Think Times

Type	Minimum	Average	Maximum
New-Order	0.1	12.0	120.1
Payment	0.1	12.1	120.1
Order-Status	0.1	10.0	100.1
Interactive Delivery	0.1	5.0	50.1
Stock-Level	0.1	5.0	49.5

An additional time of 100 milliseconds was added to the terminal emulation software to reflect real time latency within a web browser.

Response Time Frequency Distribution Curves

Response Time frequency distribution curves (see Clause 5.6.1) must be reported for each transaction type.

Figure 3: New Order Response Time Distribution

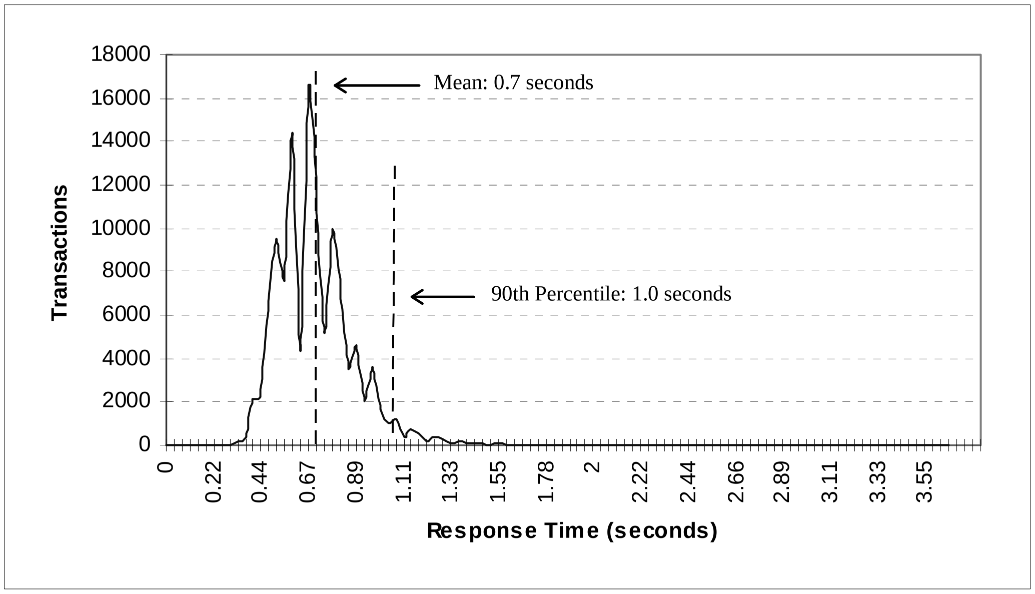


Figure 4: Payment Response Time Distribution

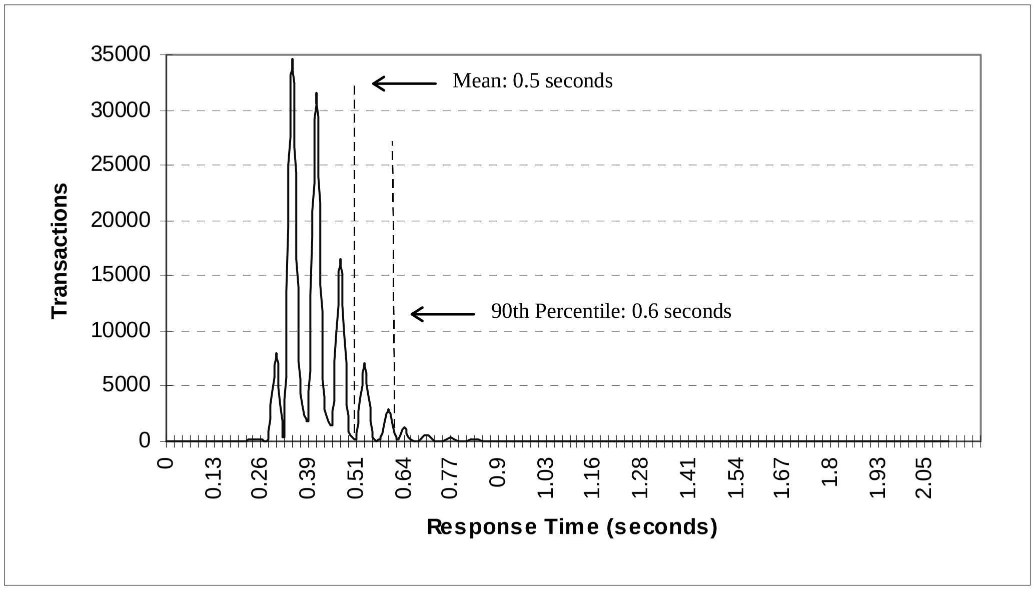


Figure 5: Order Status Response Time Distribution

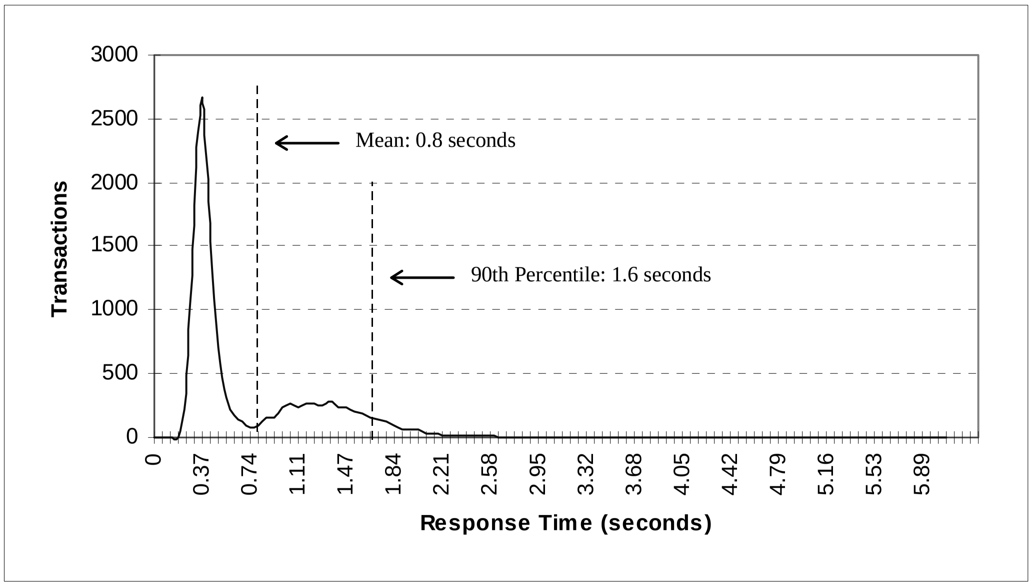


Figure 6: Delivery Response Time Distribution

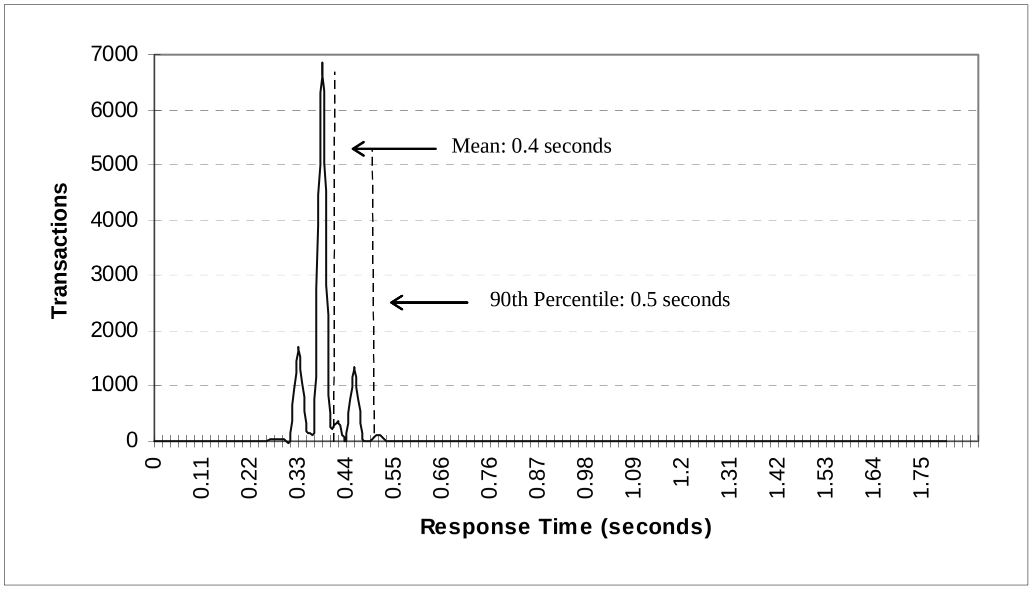
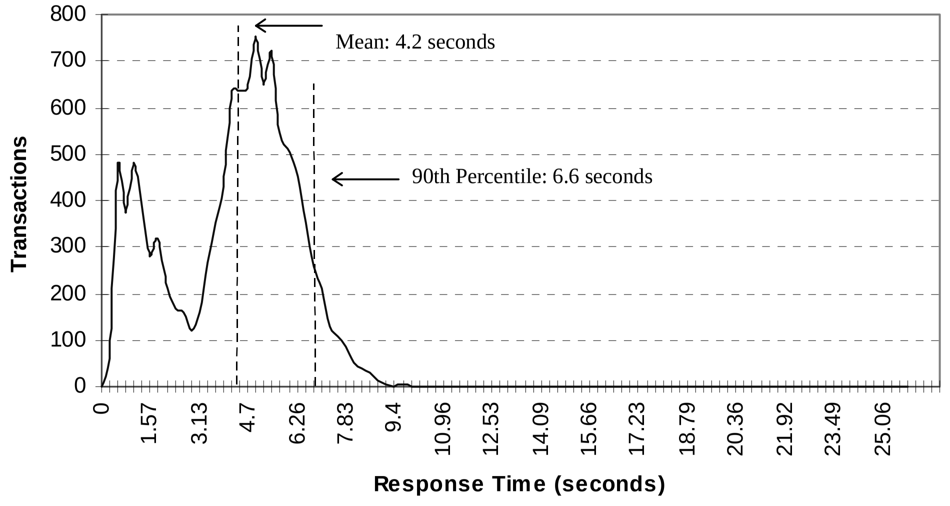


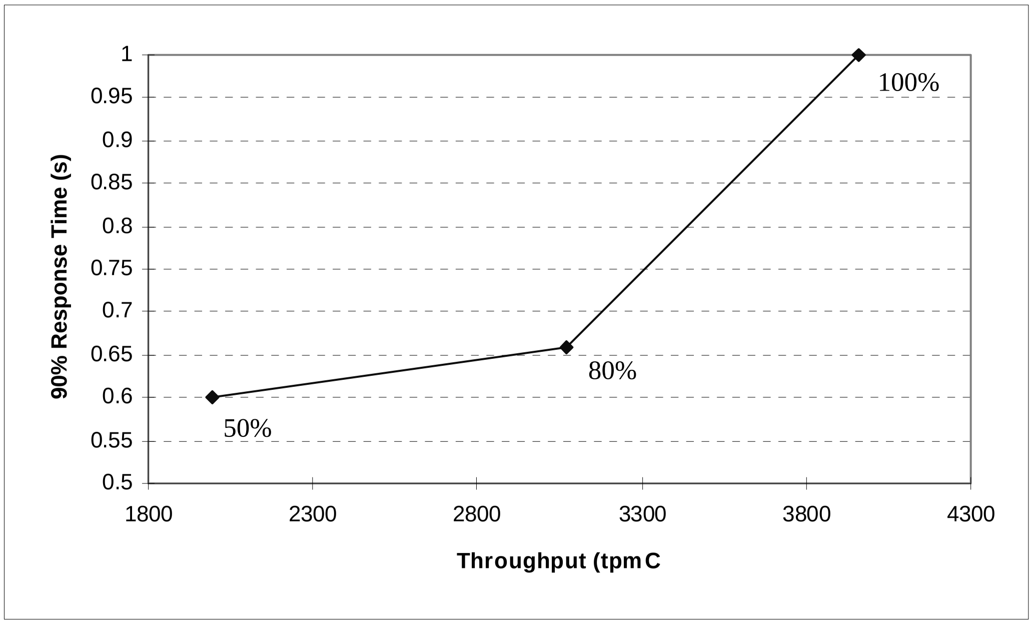
Figure 7: Stock Level Response Time Distribution



Response Time Versus Throughput

The performance curve for response times versus throughput (see Clause 5.6.2) must be reported for the New-Order transaction.

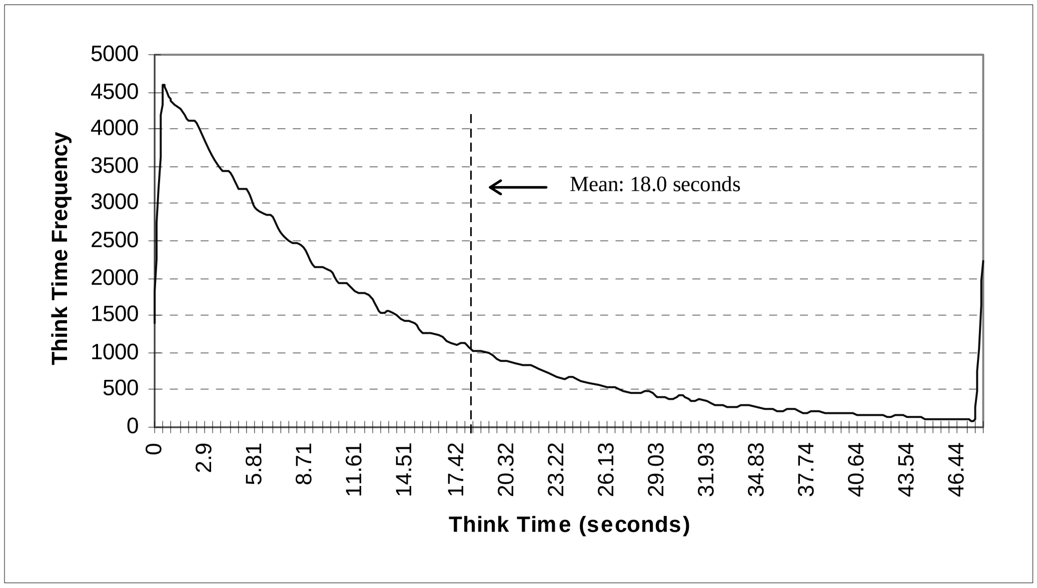
Figure 8: Response Time Versus Throughput



Think Time Frequency Distribution Curves

Think Time frequency distribution curves (see Clause 5.6.3) must be reported for each transaction type.

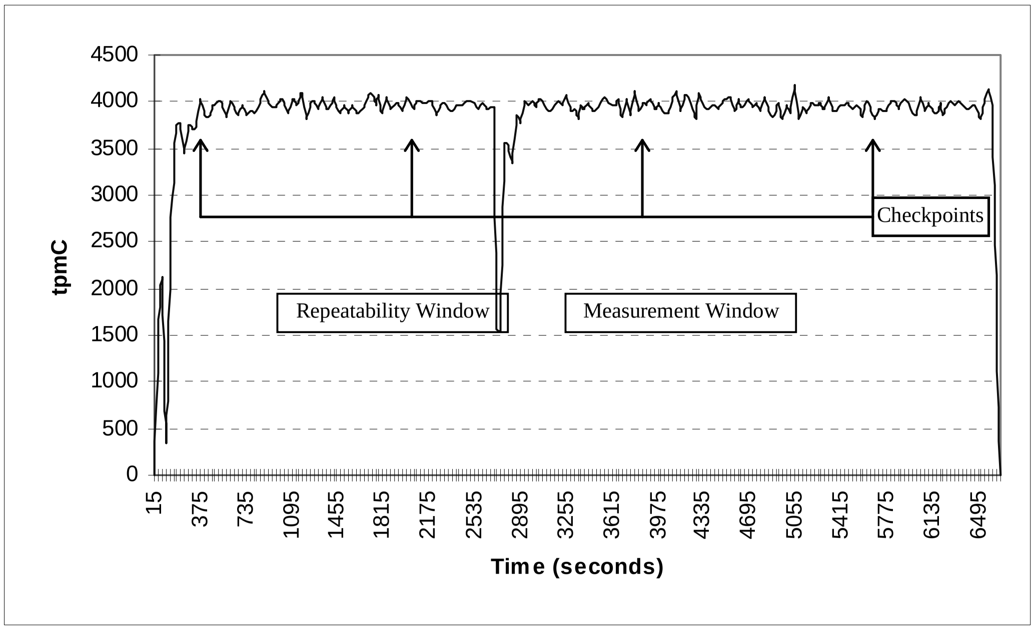
Figure 9: New Order Think Time Distribution



Throughput Versus Elapsed Time

A graph of throughput versus elapsed time (see Clause 5.6.5) must be reported for the New-Order transaction.

Figure 10: Throughput Versus Elapsed Time



Steady State Determination

The method used to determine that the SUT had reached a steady state prior to commencing the measurement interval (see Clause 5.5) must be described.

Figure 10, New-Order throughput versus time graph, shows that the system was in steady state at the beginning of the measurement interval. The dip in performance noticed near the 45 minute mark is due to a NT Performance Monitor session being started on the client machine to collect the number of user connections.

Work Performed During Steady State

A description of how the work normally performed during a sustained test (for example checkpointing, writing redo/undo log records, etc.), actually occurred during the measurement interval must be reported.

In Microsoft SQL Server, a checkpoint writes all dirty pages that have been modified to the disks. During this test, SQL Server's recovery interval configuration option was set to the maximum allowable value. Checkpoints were performed by using a Visual Basic application which issued a specified number of checkpoints at specified time intervals.

Reproducibility

A description of the method used to determine the reproducibility of the measurement results must be reported.

A repeatability measurement was taken on the same system for the same length of time as the measured run. The computed throughput for the reproducibility run was within 1.77% of the reported tpmC.

Measurement Period Duration

A statement of the duration of the measurement interval for the reported Maximum Qualified Throughput (tpmC) must be included.

The measurement interval for the reported Maximum Qualified Throughput (tpmC) was 30 minutes.

Regulation of Transaction Mix

The method of regulation of the transaction mix (e.g., card decks or weighted random distribution) must be described. If weighted distribution is used and the RTE adjusts the weights associated with each transaction type, the maximum adjustments to the weight from the initial value must be disclosed.

The "weighted" method used in this benchmark was as described in the specification. The maximum weights were within 5% of the initial value.

Transaction Statistics

The percentage of the total mix for each transaction type must be disclosed.
The percentage of New-Order transactions rolled back as a result of invalid item number must be disclosed.
The average number of order-lines entered per New-Order transaction must be disclosed.
The percentage of remote order-lines entered per New-Order transaction must be disclosed.
The percentage of remote Payment transactions must be disclosed.
The percentage of customer selections by customer last name in the Payment and Order-Status transactions must be disclosed.
The percentage of Delivery transactions skipped due to there being fewer than necessary orders in the New-Order table must be disclosed.

Table 1 lists the statistics required by 8.1.6.14 to 8.1.6.20

Checkpoints

The number of checkpoints in the Measurement Interval, the time in seconds from the start of the Measurement Interval to the first checkpoint and the Checkpoint Interval must be disclosed.

The first checkpoint was performed 300 seconds after the start of the benchmark. The second checkpoint was performed 1800 seconds after the start of the test. The third checkpoint was performed 1800 seconds after the second checkpoint and was within the Measurement Interval. This checkpoint occurred 754 seconds after the start of the Measurement Interval.

Clause 6 SUT, Driver, and Communication Definition Related Items

RTE Description

If the RTE is commercially available, then its inputs must be specified. Otherwise, a description must be supplied of what inputs (e.g., scripts) to the RTE had been used.

A proprietary RTE was used in this benchmark. Appendix A includes a listing of a sample input script.

Emulated Components

It must be demonstrated that the functionality and performance of the components being emulated in the Driver System are equivalent to that of the priced system. The results of the test described in Clause 6.6.3.4 must be disclosed.

No emulated components were used in this benchmark.

Configuration Diagrams

A complete functional diagram of both the benchmark configuration and the configuration of the proposed (target) system must be disclosed. A detailed list of all software and hardware functionality being performed on the Driver System, and its interface to the SUT must be disclosed (see Clause 6.6.3.6).

See "Configuration Diagrams" section under General Items at the beginning of this report.

Network Configuration

The network configurations of both the tested services and the proposed (target) services which are being represented and a thorough explanation of exactly which parts of the proposed configuration are being replaced with the Driver System must be disclosed (see Clause 6.6.4).

In the tested configuration, two (2) 10 megabits/second LAN segments were used to connect two RTE machines to two client machines. One (1) 100 megabits/second LAN segment was used to connect the client machines to the database server.

In the priced configuration three thousand three hundred (3300) users were spread over four (4) 10 megabits/second network segments, as opposed to two segments in the tested configuration. Both client machines were connected to the server by one (1) 100 megabits/second LAN segment.

Network Bandwidth

The bandwidth of the network(s) used in the tested/priced configuration must be disclosed.

The bandwidth of the network segments in the tested and priced configurations were 10 megabits/second between the users and the clients and 100 megabits/second between the clients and the server. The network utilized and priced is capable of supporting the traffic generated by this benchmark.

Operator Intervention

If the configuration requires operator intervention (see Clause 6.6.6), the mechanism and the frequency of this intervention must be disclosed.

No operator intervention was required.

Clause 7 Pricing Related Items

System Pricing

A detailed list of hardware and software used in the priced system must be reported. Each separately orderable 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, vendor part number of the package and a description uniquely identifying each of the components of the package must be disclosed. Pricing source(s) and effective date(s) of price(s) must also be reported.

The detailed list of all hardware and programs for the priced configuration is listed in the executive summary section. All third party price quotations are listed in Appendix E.

Support Pricing

The total 5-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.

The total 5-year price support and maintenance price of all hardware and software is listed in the executive summary section. All third party price quotations are listed in Appendix E.

Availability

The committed delivery date for general availability (availability date) of products used in the price calculations must be reported. When the priced system includes products with different availability dates, the reported availability date for the priced system must be the date at which all components are committed to be available.

The software and hardware availability is March 1997.

Throughput and Price Performance

A statement of the measured tpmC, as well as the respective calculations for 5-year pricing, price/performance (price/tpmC), and the availability date must be included.

tpmC	5-Year System Cost	Price/Performance	Availability
3961.00	$250,927	$63.34/tpmC	March 1997

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.

All items in this system are priced for the United States of America.

Usage Pricing

For any usage pricing, the sponsor must disclose:

- *Usage level at which the component was priced.*
- *A statement of the company policy allowing such pricing.*

- Windows NT Server pricing policy for users is not dependent upon HTTP connections. Intergraph ships an OEM version of Windows NT which includes 5 user licenses. However, internet connections are not considered users under the license agreement.
- Microsoft Internet Information Server 2.0 is bundled with Windows NT Server 4.0, and Microsoft Internet Explorer is bundled with Windows NT Workstation and Server 4.0 and with Windows 95. Basically, the web server and web browsers come with the operating systems.
- We used the Internet Database Connection license for unlimited access to SQL Server via the Internet.

Clause 9 Audit Related Items

Auditor’s Report

The auditor’s name, address, phone number, and a copy of the auditor’s attestation letter indicating compliance must be included in the Full Disclosure Report.

The author’s name, address, phone number and a copy of his attestation letter appears on the next page.

Information Paradigm

TPC TRANSACTION PROCESSING PERFORMANCE COUNCIL

Certified Auditor

Sponsor:	Cindy Evans Intergraph Computer Systems 1 Madison Industrial Park Huntsville, Al 35894

March 5, 1997

I remotely verified the TPC Benchmark™ C performance of the following Client Server configuration:

Platform:	InterServe 625 Server c/s
Operating system:	Microsoft Windows NT 4.0
Database Manager:	Microsoft SQL Server 6.5
Other Software:	Microsoft Internet Information Server

The results were:

CPU's Speed	Memory	Disks	NewOrder 90% Response Time	tpmC
Server: InterServe 625 Server				
2 x Pentium Pro (200 MHz - 512K Cache)	1024 MB	72 x 4.2 GB	1.0 Seconds	3961.00
(2) Clients: InterServe 305 (Specification for each)				
1 x Pentium Pro (200 MHz - 256K Cache)	128 MB	1 x 1.0 GB	n/a	n/a

In my opinion, these performance results were produced in compliance with the TPC requirements for Revision 3.2.3 of the benchmark. The following verification items were given special attention:

- The transactions were correctly implemented
- The database records were the proper size
- The database was properly scaled and populated
- The ACID properties were met
- Input data was generated according to the specified percentages
- The transaction cycle times included the required keying and think times

- The reported response times were correctly measured.
- At least 90% of all delivery transactions met the 80 Second completion time limit
- All 90% response times were under the specified maximums
- The measurement interval was representative of steady state conditions
- The reported measurement interval was 30 minutes (1800 seconds)
- One checkpoint was taken during the measurement interval
- Measurement repeatability was verified
- The 180 day storage requirement was correctly computed
- The system pricing was verified for major components and maintenance

Additional Audit Notes:

For availability reasons the 1.0 GB client system disks used in the testing were substituted with 2.1 GB disks for pricing. Based on the characteristics of the disks, and its use as client system disk, it is my opinion that this substitution had no impact on the reported performance.

As documented in the Full Disclosure Report, a dip in performance can be seen on the New-Order throughput versus time graph. It was verified that this dip was the result of starting the NT Performance Monitor on the clients for the purpose of collecting the number of connected users. As such, this dip is not included in the reported measurement interval.

Respectfully Yours,

[illegible]

François Raab
President

InterServe 625 Server (2-cpu)

Appendix A: Source Code

SAMPLE USER SCRIPT

```
/s 719
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=New+Order HTTP/1.0
/E 101
/D </HTML>
/s 1800
/S
GET
/scripts/tools/tpcc.dll?f=N&c=99&D=6&CI=2274&OS01=10&OI01=65682&O
Q01=4&OS02=10&OI02=49348&OQ02=10&OS03=10&OI03=90210&OQ03
=2&OS04=10&OI04=93252&OQ04=10&OS05=10&OI05=43221&OQ05=4&
OS06=10&OI06=7909&OQ06=7&OS07=10&OI07=45236&OQ07=2&OS08=
10&OI08=31714&OQ08=7&OS09=10&OI09=47300&OQ09=10&OS10=10&
OI10=40158&OQ10=6&OS11=&OI11=&OQ11=&OS12=&OI12=&OQ12=&O
S13=&OI13=&OQ13=&OS14=&OI14=&OQ14=&OS15=&OI15=&OQ15=
HTTP/1.0
/E 1010
/s 516
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=Payment HTTP/1.0
/E 201
/D </HTML>
/s 300
/S
GET
/scripts/tools/tpcc.dll?f=P&c=99&D=2&CI=&CW=10&CD=2&CL=ANTIANTIE
ING&H=2307.74 HTTP/1.0
/E 203
/s 1232
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=New+Order HTTP/1.0
/E 101
/D </HTML>
/s 1800
/S
GET
/scripts/tools/tpcc.dll?f=N&c=99&D=1&CI=1062&OS01=10&OI01=48222&O
Q01=3&OS02=10&OI02=49242&OQ02=6&OS03=10&OI03=48925&OQ03=
5&OS04=10&OI04=53394&OQ04=7&OS05=10&OI05=72724&OQ05=10&O
S06=10&OI06=40006&OQ06=7&OS07=10&OI07=23782&OQ07=4&OS08=
10&OI08=98022&OQ08=3&OS09=10&OI09=61670&OQ09=8&OS10=10&O
I10=80964&OQ10=1&OS11=10&OI11=87885&OQ11=3&OS12=10&OI12=9
6355&OQ12=4&OS13=10&OI13=90077&OQ13=7&OS14=10&OI14=48341
&OQ14=4&OS15=10&OI15=43702&OQ15=1 HTTP/1.0
/E 1015
/s 1799
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=Payment HTTP/1.0
/E 201
/D </HTML>
/s 300
/S
GET
/scripts/tools/tpcc.dll?f=P&c=99&D=10&CI=&CW=10&CD=10&CL=PRESATI
ONPRES&H=810.41 HTTP/1.0
/E 203
/s 742
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=New+Order HTTP/1.0
/E 101
/D </HTML>
/s 1800
/S
GET
/scripts/tools/tpcc.dll?f=N&c=99&D=3&CI=2214&OS01=10&OI01=96956&O
Q01=5&OS02=10&OI02=70886&OQ02=1&OS03=10&OI03=82006&OQ03=
10&OS04=10&OI04=89830&OQ04=10&OS05=10&OI05=98530&OQ05=5&
OS06=10&OI06=65714&OQ06=2&OS07=10&OI07=72934&OQ07=3&OS08
=10&OI08=47141&OQ08=4&OS09=10&OI09=7268&OQ09=6&OS10=10&O
I10=16596&OQ10=7&OS11=10&OI11=87236&OQ11=1&OS12=10&OI12=4
4708&OQ12=8&OS13=10&OI13=31686&OQ13=6&OS14=&OI14=&OQ14=
&OS15=&OI15=&OQ15= HTTP/1.0
/E 1013
/s 1046
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=New+Order HTTP/1.0
/E 101
/D </HTML>
/s 1800
/S
GET
/scripts/tools/tpcc.dll?f=N&c=99&D=4&CI=220&OS01=10&OI01=8422&OQ0
1=5&OS02=10&OI02=79500&OQ02=6&OS03=10&OI03=65762&OQ03=4&
OS04=10&OI04=90262&OQ04=7&OS05=10&OI05=24629&OQ05=10&OS0
6=10&OI06=73892&OQ06=3&OS07=10&OI07=7136&OQ07=10&OS08=10
&OI08=49342&OQ08=6&OS09=&OI09=&OQ09=&OS10=&OI10=&OQ10=&
OS11=&OI11=&OQ11=&OS12=&OI12=&OQ12=&OS13=&OI13=&OQ13=&
OS14=&OI14=&OQ14=&OS15=&OI15=&OQ15= HTTP/1.0
/E 1008
/s 1303
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=Payment HTTP/1.0
/E 201
/D </HTML>
/s 300
/S
GET
/scripts/tools/tpcc.dll?f=P&c=99&D=9&CI=&CW=10&CD=9&CL=PRESOUG
HTPRI&H=3036.97 HTTP/1.0
/E 203
/s 1028
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=Order-Status HTTP/1.0
/E 301
/D </HTML>
/s 200
/S
GET /scripts/tools/tpcc.dll?f=O&c=99&D=3&CI=2276&CL= HTTP/1.0
/E 302
/s 204
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=New+Order HTTP/1.0
/E 101
/D </HTML>
/s 1800
/S
GET
/scripts/tools/tpcc.dll?f=N&c=99&D=1&CI=2982&OS01=10&OI01=81741&O
Q01=4&OS02=10&OI02=45027&OQ02=5&OS03=10&OI03=97510&OQ03=
7&OS04=10&OI04=71781&OQ04=2&OS05=10&OI05=63634&OQ05=8&OS
06=10&OI06=63398&OQ06=8&OS07=10&OI07=7872&OQ07=8&OS08=&O
I08=&OQ08=&OS09=&OI09=&OQ09=&OS10=&OI10=&OQ10=&OS11=&OI
11=&OQ11=&OS12=&OI12=&OQ12=&OS13=&OI13=&OQ13=&OS14=&OI1
4=&OQ14=&OS15=&OI15=&OQ15= HTTP/1.0
/E 1007
/s 1402
/D </HTML>
/S
GET /scripts/tools/tpcc.dll?c=99&b=Payment HTTP/1.0
/E 201
/D </HTML>
/s 300
/S
GET
/scripts/tools/tpcc.dll?f=P&c=99&D=3&CI=&CW=8&CD=8&CL=PRESESEP
RI&H=1285.41 HTTP/1.0
/E 205
/s 1421
```

RTE PROFILE

```
# sample profile
MAX_TPMC=3000           export MAX_TPMC
ENGINE_USERS=1650        export ENGINE_USERS
INPUT_DIR=‘pwd‘/_input   export INPUT_DIR
OUTPUT_DIR=‘pwd‘/output  export OUTPUT_DIR
LOGIN_PROMPT="Not used"  export LOGIN_PROMPT
LOGIN_TEXT="Not used"    export LOGIN_TEXT
PASSWD_PROMPT="Not used" export PASSWD_PROMPT
PASSWD_TEXT="Not used"   export PASSWD_TEXT
SHELL_PROMPT="Not used"  export SHELL_PROMPT
SHELL_TEXT="Not used"    export SHELL_TEXT
#export DUMP_CORE=1
```

CONTEXT.H

```
/* Audited: 28 February 1997 */

/* context.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __context_h__
#define __context_h__

#include <windows.h>
#include <tpcc/kit/src/tpcc.h>
#include "options.h"

#define E_MAXUSERS -1  /* Error: No free user slots. */
#define E_INVARGS -2      /* Error: Invalid arguments.  */

extern void e_log(char *);

typedef struct {
                                short   w_id;
```

```
				short	d_id;
#ifdef DB_PRESENT
				DBPROCESS *dbhandle;
#else
				long	dbhandle;
#endif DB_PRESENT
				CRITICAL_SECTION ucsec;
} context;

typedef context user_array[MAX_USERS];

user_array users;
CRITICAL_SECTION gcsec;

void init_user_array(void);
int create_user(short, short);
context *get_user(int);
void delete_user(int);
void cleanup_user_array(void);

#endif __context_h__
```

CONTEXT.C

```
/* Audited: 28 February 1997 */

/* context.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "context.h"

void init_user_array(void) {
				int i;
				InitializeCriticalSection(&gcsec);
				EnterCriticalSection(&gcsec);
				for(i = 0; i < MAX_USERS; i++)
					users[i].w_id = (short)0;
				LeaveCriticalSection(&gcsec);
}

int create_user(short w_id, short d_id) {
				int i;
#ifdef DB_PRESENT
				int spid;
#endif DB_PRESENT
				if(w_id < 1 || w_id > MAXWH || d_id < 1 || d_id >
10) {
					return E_INVARGS;
				}
				EnterCriticalSection(&gcsec);
				for(i = 0; i < MAX_USERS; i++) {
					if(!users[i].w_id) {
						users[i].w_id = w_id;
						LeaveCriticalSection(&gcsec);
						users[i].d_id = d_id;
						users[i].dbhandle = NULL;

				InitializeCriticalSection(&users[i].ucsec);
#ifdef DB_PRESENT

				if(!SQLOpenConnection(&(users[i].dbhandle),

SERVERNAME,

USEDB,

USERNAME,

USERPASSWD,

"Client",

&spid,

(long *)4096)) {
								users[i].dbhandle = NULL;
								return MAX_USERS +
TokenIndex;
							} else {

				SQLInitPrivate(users[i].dbhandle, NULL);
							}
#endif DB_PRESENT
							return i + TokenIndex;
						}
				}
				LeaveCriticalSection(&gcsec);
				return E_MAXUSERS;
}

context *get_user(int user) {
  return &users[user - TokenIndex];
}

void delete_user(int index) {
				index -= TokenIndex;
				if(users[index].w_id) {
#ifdef DB_PRESENT
					EnterCriticalSection(&users[index].ucsec);
					SQLExit(users[index].dbhandle);
#endif DB_PRESENT

				LeaveCriticalSection(&users[index].ucsec);

				DeleteCriticalSection(&users[index].ucsec);
					users[index].d_id = 0;
					users[index].w_id = 0;
				}
}

void cleanup_user_array(void) {
				int i;
				for(i = 0; i < MAX_USERS; i++)
					delete_user(i);
				DeleteCriticalSection(&gcsec);
}
```

DEFAULTFUNC.C

```
/* Audited: 28 February 1997 */

/* defaultfunc.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "defaultfunc.h"

int default_validate(assoc *a, default_data *data, char *output) {
				int i = 0;
				char errstr[256];
				errstr[0] = '\0';
				data->anumber = -3;
				data->afloat = HUGE_VAL;
				data->astring = 0;
				while((*a)[0][i]) {
					switch((*a)[0][i][0]) {
						case 'n':
							data->anumber =
VerifyInt((*a)[1][i], 3);
							break;
						case 'd':
							data->afloat =
VerifyDouble((*a)[1][i], 4);
							break;
						case 's':
							data->astring =
VerifyString((*a)[1][i], 25);
							break;
						default: break;
					}
					i++;
				}
				if(data->anumber < 0) {
					switch(data->anumber) {
						case -1:
							strcat(errstr, "The Number
field must contain 3 or fewer digits.\r\n");
							break;
						case -2:
							strcat(errstr, "The Number
field must not contain any nondigit characters.\r\n");
							break;
						case -3:
							strcat(errstr, "You must fill in
the Number field.\r\n");
							break;
						default:
							strcat(errstr, "Unknown error
in the Number field.\r\n");
							break;
					}
				}
				if(data->afloat == HUGE_VAL) {
					strcat(errstr, "The Float field must be a
decimal number of up to 2 digit precision, with up to 4 characters
overall.\r\n");
				}
				if(!data->astring) {
					strcat(errstr, "You must enter a string of 25
or fewer characters in the String field.\r\n");
				}
				if(errstr[0]) {
					sprintf(output, errorpage, errstr);
					return 0;
				} else return 1;

}


void default_process(default_data *data) {
				return;
}

void default_format(default_data *data, char *output) {
				sprintf(output, defaultpage, data->anumber, data-
>afloat, data->astring);
}
```

```
void default_func_main(assoc *a, char *output) {
				default_data data;
				data.anumber = 0;
				data.afloat = 0.0;
				data.astring = 0;
				if(!default_validate(a, &data, output)) return;
				default_process(&data);
				default_format(&data, output);
}
```

DEFAULTFUNC.H

```
/* Audited: 28 February 1997 */

/* defaultfunc.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __defaultfunc_h__
#define __defaultfunc_h__

#include "inputparser.h"
#include "functions.h"
#include "errors.h"

#define DEFAULT_FUNC 1

typedef struct {
				int anumber;
				char *astring;
				double afloat;
} default_data;

static char defaultpage[] =
"<HTML><HEAD><TITLE>Default Page</TITLE></HEAD><BODY>"
"<P><H3>This is the Default Page</H3></P><HR>"
"<P>It contains a number, which is %d.</P>"
"<P>It is worth approximately $%lf.</P>"
"<P>The only comment I have is %s.</P>"
"</BODY></HTML>\r\n";

void default_func_main(assoc *, char *);

#endif __defaultfunc_h__
```

DELIVER.C

```
#include <process.h>
#include "tpcc.h"
#include "deliver.h"

#define INCLUDE_DATABASE_CODE

/*
** This program issues the "delivery" transactions.  It receives requests
** through a mailslot from the client processes.  The mailslot is the
** "queue" as required by the spec.
*/

CRITICAL_SECTION ResultsCriticalSection;

DBPROCESS **dbproc;
BOOL *channel_busy;
struct delivery_node *incoming;
int delay;
HANDLE results_file;

void ThreadMain(int index)
{
				DELIVERY_DATA DeliveryData;
				SYSTEMTIME now;
				int i, bytes_read;
				char output_buffer[80];
				DeliveryData.w_id = incoming[index].w_id;
				DeliveryData.o_carrier_id =
incoming[index].o_carrier_id;
#ifdef INCLUDE_DATABASE_CODE
				SQLInlineDelivery(dbproc[index],&DeliveryData,
DEADLOCK_RETRY,0);
#endif
				//log the results
				EnterCriticalSection(&ResultsCriticalSection);
				sprintf(output_buffer,"QUEUED %04d-%02d-
%02d %02d:%02d:%02d.%03d\r\n",
						incoming[index].queue_time.wYear,

				incoming[index].queue_time.wMonth,
						incoming[index].queue_time.wDay,
						incoming[index].queue_time.wHour,

				incoming[index].queue_time.wMinute,

				incoming[index].queue_time.wSecond,

				incoming[index].queue_time.wMilliseconds);
				WriteFile(results_file,output_buffer,strlen(output_
buffer),&bytes_read,NULL);
				sprintf(output_buffer,"W_ID:%d
Carrier:%d\r\n",incoming[index].w_id,incoming[index].o_carrier_id);
				WriteFile(results_file,output_buffer,strlen(output_
buffer),&bytes_read,NULL);
				for (i=0;i<10;i++)
				{
					sprintf(output_buffer,"D_ID:%02d
O_ID:%d\r\n",i+1,DeliveryData.DelItems[i].o_id);

				WriteFile(results_file,output_buffer,strlen(output_
buffer),&bytes_read,NULL);
				}
				sprintf(output_buffer,"Status:
%s\r\n",DeliveryData.execution_status);
				WriteFile(results_file,output_buffer,strlen(output_
buffer),&bytes_read,NULL);
				sprintf(output_buffer,"THREAD: %d\r\n",index);
				WriteFile(results_file,output_buffer,strlen(output_
buffer),&bytes_read,NULL);
				GetLocalTime(&now);
				sprintf(output_buffer,"FINISHED %04d-%02d-
%02d %02d:%02d:%02d.%03d\r\n",
						now.wYear,
						now.wMonth,
						now.wDay,
						now.wHour,
						now.wMinute,
						now.wSecond,
						now.wMilliseconds);
				WriteFile(results_file,output_buffer,strlen(output_
buffer),&bytes_read,NULL);
				sprintf(output_buffer,"DELTA
%d\r\n",GetTickCount() - incoming[index].tran_start_time);
				WriteFile(results_file,output_buffer,strlen(output_
buffer),&bytes_read,NULL);
				LeaveCriticalSection(&ResultsCriticalSection);
				channel_busy[index] = FALSE;
				return;
}

int main(int argc, char **argv)
{
				HANDLE message_handle;
				int i, bytes_read;
				char server_name[SERVER_NAME_LEN+1]="";
				char results_file_name[MAX_PATH+1]="";
				static int spid;
				static int thread_count=1;
				//error handling initialization
				IngrUtilInit("delivery.err");
				//parse the arguments
				for (i=1;i<argc;i++)
				{
					if (argv[i][0] != '-' && argv[i][0] != '/')
continue;
					switch (argv[i][1])
					{
						case 's':
						case 'S':
							i++;

				strncpy(server_name,argv[i],sizeof
server_name);
							break;
						case 'f':
						case 'F':
							i++;

				strncpy(results_file_name,argv[i],sizeof
results_file_name);
							break;
						case 't':
						case 'T':
							i++;
							thread_count = atoi(argv[i]);
							break;
						default:
							printf("Invalid option:
%s\n",argv[i]);
							printf("Usage:\n\t%s -S
server_name -F results_file_name [-T threads]\n",argv[0]);
							return -1;
					}
				}
				if (server_name[0] == '\0')
				{
					printf("Server name switch required\n");
					return -1;
				}
				if (results_file_name[0] == '\0')
				{
					printf("Results file name switch
required\n");
					return -1;
				}
				if (thread_count < 1)
				{
					printf("Invalid thread count\n");
					return -1;
				}
				//attach to the database
				dbproc = (DBPROCESS **) malloc(thread_count
* sizeof (DBPROCESS *));
				channel_busy = (BOOL *) malloc(thread_count *
sizeof (BOOL));
				for (i=0;i<thread_count;i++) channel_busy[i] =
FALSE;
#ifdef INCLUDE_DATABASE_CODE
				SQLInit(NULL);
				dbsetmaxprocs((short)thread_count);
				for (i=0;i<thread_count;i++)
				{
					SQLOpenConnection(&dbproc[i],
						server_name,//database server
name
						"tpcc",		//database name
						"sa",		//database username
						"",			//database
password
						"Delivery",	//application name???
						&spid,//?? output field ??
						4096);		//packet size
					SQLInitPrivate(dbproc[i],NULL); //error
and message handling
				}
#endif
				//open up the communications for the client
processes to use
				message_handle =
CreateMailslot(DELIVERY_FILE_NAME,

				sizeof (struct delivery_node), //max message size

				10, //wait time ... needed to allow control-c to kill
the process??

				NULL); //security attributes
				if (message_handle ==
INVALID_HANDLE_VALUE)
				{
					char *message;
					message =
TranslateErrorCode(GetLastError());

				UtilFatalError(0,"CreateMailslot()",message);
				}
				//create our statistics file
				InitializeCriticalSection(&ResultsCriticalSecti on);
				results_file = CreateFile(results_file_name,

				GENERIC_WRITE,

				FILE_SHARE_READ, //so we can type it out
								NULL,
//security

				CREATE_ALWAYS,

				FILE_ATTRIBUTE_NORMAL,
								NULL);
				if (results_file == INVALID_HANDLE_VALUE)
				{
					char *message;
					message =
TranslateErrorCode(GetLastError());
					UtilFatalError(0,"CreateFile()",message);
				}
				//process incoming messages
				incoming = (struct delivery_node *)
malloc(thread_count * sizeof (struct delivery_node));
				do
				{
					for (i=0;i<thread_count;i++)
					{
						if (!channel_busy[i])
						{
							channel_busy[i] = TRUE;
timeout_retry:
							if
(!ReadFile(message_handle,&incoming[i],sizeof (struct
delivery_node),&bytes_read,NULL))
							{//error
								if (GetLastError() ==
ERROR_SEM_TIMEOUT) goto timeout_retry; //timeout allows a control-c to
kill the process??
								else
								{
									char *message;
									message =
TranslateErrorCode(GetLastError());

				UtilFatalError(0,"ReadFile() on
Mailslot",message);
								}
							}
							if (bytes_read == 0) return 0;
//all done???

				_beginthread(ThreadMain,0,i);
							break;
						}
					}
					if (i >= thread_count) Sleep(1000); //one
second before trying again to find a free channel
				} while(1);
}
```

DELIVER.H

```
/* Audited: 28 February 1997 */

/* delivery.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __delivery_h__
#define __delivery_h__

#include "context.h"
#include <tpcc/kit/src/tpcc.h>
#include "inputparser.h"
#include "output.h"
#include "errors.h"
#include "mailslot.h"
#include "options.h"

#define DELIVERY_FUNC 5

static char dresp[] =
"<HTML><HEAD><TITLE>TPC-C:
Delivery</TITLE></HEAD><BODY><PRE>"
"                          Delivery\r\n"
"Warehouse: XXXX\r\n"
"\r\n"
"Carrier Number: XX\r\n"
"\r\n"
"Execution Status: XXXXXXXXXXXXXXXXXXXXXXXXX"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"</PRE><P><FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\">"
"<INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"New Order\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Payment\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Delivery\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Order-Status\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Stock-Level\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Exit\">"
"</FORM></P></BODY></HTML>\r\n";

#define DW 118
#define DC 142
#define DE 166

extern void e_log(char *);
void delivery_func_main(assoc *, char *);
int delivery_func_parse(assoc *, int *, struct delivery_node *, char *);
int delivery_func_process(struct delivery_node *, int);
void delivery_func_format(char *, struct delivery_node *, int, int);

#endif __delivery_h__
```

ERRORS.H

```
/* Audited: 28 February 1997 */

/* errors.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __errors_h__
#define __errors_h__

static char errorpage[] =
"<HTML><HEAD><TITLE>TPC-C: Error</TITLE></HEAD><BODY>"
"<p>You did something bad.  The error message was:</p>"
"<PRE>\r\n"
"%s</PRE>"
"<p>Either hit the \"back\" button on your browser and fix the problem, "
"or hit the \"Exit\" button below to terminate this session.  If you believe your
"
"input was not in error, send email to <a
href=\"mailto:rothomas@ingr.com\">Robert "
"Thomas</a> explaining the error you received and the situation that led up
to it.</P>"
"<HR>"
```

```
"<P><FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"cookie\" VALUE=\"%d\">"
" <INPUT TYPE=\"submit\" NAME=\"button\" VALUE=\"Exit\">"
"</FORM></P></BODY></HTML>\r\n";

static char dberrpage[] =
"<HTML><HEAD><TITLE>TPC-C: Database
Error</TITLE></HEAD><BODY>"
"<P>The database could not process your request.</P>"
"<P>Press the \"exit\" button below to abort this session.</P><HR>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\">"
"<INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Exit\">"
"</FORM></BODY></HTML>";

#define BAD_COOKIE_MSG "o The user authentication is not valid.\r\n
The session cannot proceed.\r\n  Press the 'Exit' button below.\r\n"
#define TOO_LONG_MSG "o The \"%s\" field contained too many
characters.\r\n  The maximum is %d.\r\n"
#define NOT_ISDIGIT_MSG "o The \"%s\" field contained nondigit
characters.\r\n"
#define NO_INPUT_MSG "o You did not fill in the \"%s\" field.\r\n  The field
is required.\r\n"


#endif __errors_h__
```

EXTENSIONS.C

```
/* Audited: 28 February 1997 */

/* extensions.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "extensions.h"

void register_extensions(void) {
                        register_function(default_func_main,
DEFAULT_FUNC);
                        register_function(login_func_main,
LOGIN_FUNC);
                        register_function(processlogin_func_main,
PROCESSLOGIN_FUNC);
                        register_function(query_form_func_main,
QUERY_FORM_FUNC);
                        register_function(stock_level_func_main,
STOCKLVL_FUNC);
                        register_function(delivery_func_main,
DELIVERY_FUNC);
                        register_function(payment_func_main,
PAYMENT_FUNC);
                        register_function(order_status_func_main,
ORDERSTAT_FUNC);
                        register_function(new_order_func_main,
NEWORDER_FUNC);
                        register_function(no_mailslot_func_main,
NOMAILSLOT_FUNC);
}

void init_extensions(void) {
                        int rc=0;
                        GetRegistryValues();
                        init_user_array();
#ifdef DB_PRESENT
                        IngrUtilInit("C:\\USERS\\DEFAULT\\DBERR.LOG
");
                        rc=dbsetmaxprocs((short)MAX_USERS);
                        SQLInit(NULL);
                        open_mailslot();
#else
                        service_available = 1;
#endif
}

void cleanup_extensions(void) {
                        cleanup_user_array();
}
```

EXTENSIONS.H

```
/* Audited: 28 February 1997 */

/* extensions.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __extensions_h__
#define __extensions_h__

extern void IngrUtilInit(char *);

/* #include headers for your extensions below. */

#include "login.h"
#include "defaultfunc.h"
#include "processlogin.h"
#include "query_form.h"
#include "stocklevel.h"
#include "delivery.h"
#include "payment.h"
#include "orderstatus.h"
#include "neworder.h"
#include "mailslot.h"


/*---- Don't modify anything below this point--------------- */
#include "functions.h"
#include "options.h"

void register_extensions(void);
void init_extensions(void);
void cleanup_extensions(void);


#endif __extensions_h__
```

FUNCTIONS.C

```
/* Audited: 28 February 1997 */

/* functions.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "functions.h"

void init_function_array(void) {
                        int i;
                        for(i = 0; i < MAX_FUNCS; i++)
                              function_array[i] = (pbfunc)0;
}

int register_function(pbfunc function, int index) {
                        if(index > MAX_FUNCS) return
E_OUT_OF_RANGE;
                        else if(function_array[index]) return
E_ALREADY_DEFINED;
                        else function_array[index] = function;
                        return index;
}

/* This function should be modified to correctly select a
   function based on the input. */
int identify_function_index(assoc *a) {
                        int i = 0;
                        if(!service_available) return
NOMAILSLOT_FUNC;
                        while((*a)[0][i]) {
                              if((*a)[0][i][0] == 'f') {
                                    switch((*a)[1][i][0]) {
                                          case 'N': return
NEWORDER_FUNC;
                                          case 'D': return
DELIVERY_FUNC;
                                          case 'L': return
PROCESSLOGIN_FUNC;
                                          case 'S': return
STOCKLVL_FUNC;
                                          case 'P': return
PAYMENT_FUNC;
                                          case 'O': return
ORDERSTAT_FUNC;
                                          case 'M': break;
                                      default:  return
DEFAULT_FUNC;
                                    }
                              }
                              if((*a)[0][i][0] == 'b') {
                                    switch((*a)[1][i][0]) {
                                          case 'E':      return
LOGIN_FUNC;
                                          case 'N':
                                          case 'P':
                                          case 'O':
                                          case 'S':
                                          case 'D':      return
QUERY_FORM_FUNC;
                                          default:       return
DEFAULT_FUNC;
                                    }
                              }
                              i++;
                        }
                        return LOGIN_FUNC;
}
```

FUNCTIONS.H

```
/* Audited: 28 February 1997 */

/* functions.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */
```

```
#ifndef __functions_h__
#define __functions_h__

#include "inputparser.h"
#include "extensions.h"


#define MAX_FUNCS 255
#define E_OUT_OF_RANGE -1
#define E_ALREADY_DEFINED -2

typedef void bfunc(assoc *, char *);
typedef bfunc *pbfunc;

pbfunc function_array[MAX_FUNCS];

typedef enum {
} functions;

void init_function_array(void);
int register_function(pbfunc, int);
int identify_function_index(assoc *);



#endif __functions_h__
```

INPUTPARSER.C

```
/* Audited: 28 February 1997 */

/* inputparser.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "inputparser.h"

char *split(char *first, char sp) {
        int i;
        for(i = 0; i < (int)strlen(first) && first[i] != sp; i++);
        if(i == (int)strlen(first)) return (char *)0;
        else {
                first[i] = '\0';
                return &(first[i+1]);
        }
}

void init_assoc(assoc *a) {
                                int i = 0;
                                for(i = 0; i < MAX_KEYS; i++) {
                                        (*a)[0][i] = (char *)0;
                                        (*a)[1][i] = (char *)0;
                                }
}

void fill_assoc(assoc *a, char *query) {
                                char *val, *rest;
                                int index = 0;
                                if(!query) return;
                                while(query) {
                                        rest = split(query, '&');
                                        val = split(query, '=');
                                        (*a)[0][index] = query;
                                        (*a)[1][index++] = val;
                                        query = rest;
                                }
}

/* The following are useful generic validation type functions. */

long VerifyLong(char *str, int maxlen) {
        int x;
        if(!str || !(x = strlen(str))) return -3;
        if(x > maxlen) return -1;
        else for(;x;x--) if(!isdigit(str[x-1])) return -2;
        else return atol(str);
                                        return 0L;
}



int VerifyInt(char *str, int maxlen) {
                                        int x;
                                        if(!str || !(x = strlen(str))) return -3;
                                        if(x > maxlen) return -1;
                                        else for(;x;x--) if(!isdigit(str[x-1])) return -2;
                                        else return atoi(str);
                                        return 0;
}

short VerifyShort(char *str, int maxlen) {
        int x;
        if(!str || !(x = strlen(str))) return -3;
        if(x > maxlen) return -1;
        else for(;x;x--) if(!isdigit(str[x-1])) return -2;
        else {
                x = atoi(str);
                return (short)x;
        }
                                        return (short)0;
}

char *VerifyString(char *str, int maxlen) {
        int x;
        if(!str) return (char *)0;
        x = strlen(str);
        if(x > maxlen) return (char *)0;
        else return str;
}


double VerifyDouble(char *str, int maxlen) {
        int x;
        if(!str) return HUGE_VAL;
        x = strlen(str);
        if(x > maxlen) return HUGE_VAL;
        else for(;x;x--) {
                if(isdigit(str[x-1]));
                else if((str[x-1] == '.') && (strlen(str)-x < 3));
                else if((str[x-1] == '-') && (x == 1));
                else if((str[x-1] == '+') && (x == 1));
                else return HUGE_VAL;
        }
        return atof(str);
}
```

INPUTPARSER.H

```
/* Audited: 28 February 1997 */

/* inputparser.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __inputparser_h__
#define __inputparser_h__

#include <string.h>
#include <ctype.h>
#include <stdlib.h>
#include <stdio.h>
#include <math.h>

#define MAX_KEYS 100

extern void e_log(char *);

typedef char *assoc[2][MAX_KEYS];

char *split(char *, char);
void init_assoc(assoc *);
void fill_assoc(assoc *, char *);

/* The following are useful generic validation type functions. */

long VerifyLong(char *, int);
int VerifyInt(char *, int);
short VerifyShort(char *, int);
char *VerifyString(char *, int);
double VerifyDouble(char *, int);

#endif __inputparser_h__
```

LOGIN.C

```
/* Audited: 28 February 1997 */

/* login.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "login.h"

int login_validate(assoc *a) {
                                int i = 0;
                                while((*a)[0][i]) {
                                        switch((*a)[0][i][0]) {
                                                case 'c':
                                                        return VerifyInt((*a)[1][i], 4);
                                                        break;
                                                default:
                                                        break;
                                        }
                                        ++i;
                                }
                                return -1;
}

void login_func_main(assoc *a, char *output) {
                                int cookie = login_validate(a);
                                if(cookie >= 0)
                                        delete_user(cookie);
                                strcpy(output, loginpage);
}
```

LOGIN.H

```
/* Audited: 28 February 1997 */

/* login.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __login_h__
#define __login_h__

#include "context.h"
#include "inputparser.h"

static char loginpage[] =
"<HTML><HEAD><TITLE>Welcome to TPC-C</TITLE></HEAD><BODY>"
"<P>Please identify your Warehouse and District for this session.</P>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"f\" VALUE=\"L\">"
"Your Warehouse ID: <INPUT NAME=\"W\" SIZE=4><BR>"
"Your District ID:  <INPUT NAME=\"d\" SIZE=2><BR><HR>"
"<INPUT TYPE=\"submit\">"
"</FORM></BODY></HTML>\r\n";

#define LOGIN_FUNC 0

extern void e_log(char *);

void login_func_main(assoc *, char *);

#endif __login_h__
```

MAILSLOT.C

```
/* Audited: 28 February 1997 */

/* mailslot.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "mailslot.h"


void open_mailslot(void) {
                                delivery_handle =
CreateFile(DELIVERY_FILE_NAME,

                                GENERIC_WRITE,

                                FILE_SHARE_WRITE | FILE_SHARE_READ,

                                NULL,//security

                                OPEN_EXISTING,

                                FILE_ATTRIBUTE_NORMAL,

                                NULL);//template file
                                if(delivery_handle ==
INVALID_HANDLE_VALUE) {
                                        service_available = 0;
                                } else {
                                        service_available = 1;
                                }
}

void no_mailslot_func_main(assoc *a, char *output) {
                                sprintf(output, enosvcdmb);
}
```

MAILSLOT.H

```
/* Audited: 28 February 1997 */

/* mailslot.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __mailslot_h__
#define __mailslot_h__

#include <windows.h>
#include <tpcc/kit/src/tpcc.h>
#include "inputparser.h"
#include "options.h"

#define NOMAILSLOT_FUNC 9
#define DELIVERY_FILE_NAME "\\\\.\\mailslot\\TPCCdelivery"

HANDLE delivery_handle;

int service_available;

static char enosvcdmb[] =
"<HTML><HEAD><TITLE>TPC-C: Service
Unavailable</TITLE></HEAD><BODY>"
"<P>Sorry, the service is unavailable at this time.  The server failed
attempting to open"
" a connection to the delivery process mailbox.  As a result, no transactions
can be"
" performed.  Please try again in an hour.  If the problem persists, email "
"<a href=\"mailto:rothomas@ingr.com\">Robert Thomas</a> and report
seeing this message.</P>"
"</BODY></html>";

void open_mailslot(void);
void no_mailslot_func_main(assoc *, char *);

#endif __mailslot_h__
```

MSTPCC.H

```
#ifndef __damien_tpcc_h__
#define __damien_tpcc_h__

#define DBNTWIN32
// TPC-C Benchmark Kit
//
// Module:  TPCC.H
// Author:  DamienL


// Build number of TPC Benchmark Kit
#define TPCKIT_VER        "2.04"

// General headers
#include <windows.h>
#include <winbase.h>
#include <stdlib.h>
#include <stdio.h>
#include <process.h>
#include <stddef.h>
#include <stdarg.h>
#include <string.h>
#include <signal.h>
#include <time.h>
#include <timeb.h>
#include <types.h>
#include <wincon.h>

#ifdef USE_ODBC
// ODBC headers
#include <sql.h>
#include <sqlext.h>
HENV                                                    henv;
#endif

// DB-Library headers
#include <sqlfront.h>
#include <sqldb.h>

// Critical section declarations
CRITICAL_SECTION                ConsoleCritSec;
CRITICAL_SECTION                QueuedDeliveryCritSec;
CRITICAL_SECTION                WriteDeliveryCritSec;
CRITICAL_SECTION                DroppedConnectionsCritSec;
CRITICAL_SECTION                ClientErrorLogCritSec;

// General constants
#define SQLCONN DBPROCESS
#define DUMB_MESSAGE                    5701
#define ABORT_ERROR                     6104
#define INVALID_ITEM_ID                         0
#define MILLI                       1000
#define MAX_THREADS                     2510
#define STATS_MSG_LOW                           3600
#define STATS_MSG_HIGH                          3700
#define SHOWPLAN_MSG_LOW                        6200
#define SHOWPLAN_MSG_HIGH                       6300
#define FALSE                          0
#define TRUE                           1
#define DEADLOCKWAIT                     10
#define UNDEF                                           -1
#define MINPRINTASCII                    32
#define MAXPRINTASCII                   126

// Default environment constants
#define SERVER                         "argus1"
#define DATABASE                       "tpcc"
#define USER                           "sa"
#define PASSWORD                   ""
#define SYNCH_SERVERNAME                    ""

// Statistic constants
#define INTERVAL                    20   // Total interval of buckets, in sec
#define UNIT                        .1   // Time period of each bucket
#define HIST_MAX                   200   // Num of histogram buckets =
INTERVAL/UNIT
#define BUCKET                     100   // Division factor for response time

// Default master arguments
#define ADMIN_DATABASE                 "tpcc_admin"
#define RAMP_UP                    600
#define STEADY_STATE              1200
```

```
#define RAMP_DOWN               120
#define NUM_USERS               10
#define NUM_WAREHOUSES                  1
#define THINK_TIMES                             0
#define DISPLAY_DATA                    0
#define DEFMSPACKSIZE                   4096
#define TRANSACTION                     0
#define CLIENT_MODE                     1
#define DEF_WW_T                                120
#define DEF_WW_a                                1
#define DEADLOCK_RETRY                          4
#define DELIVERY_BACKOFF                        2
#define DELIVERY_MODE                           0
#define NEWORDER_MODE                           0
#define DEF_LOAD_MULTIPLIER             1.0
#define DEF_CHECKPOINT_INTERVAL         960
#define DEF_FIRST_CHECKPOINT            240
#define DISABLE_90TH                            0
#define                         RESFILENAME
                                "results.txt"
#define SQLSTAT_FILENAME                        "sqlstats.txt"
#define ENABLE_SQLSTAT                          0
#define SQLSTAT_PERIOD                          100
#define SHUTDOWN_SERVER                         0
#define AUTO_RUN                                0

// Default client arguments
#define NUM_THREADS                     10
#define DEFCLPACKSIZE                   4096
#define X_FLAG                  0
#define Y_FLAG                  1
#define NUM_DELIVERIES                          2
#define CLIENT_NURAND_C_LAST_C  200
#define CLIENT_NURAND_C_ID_C    500
#define CLIENT_NURAND_OL_I_ID_C 5000
#define DISABLE_DELIVERY_RESFILES 1

// Globals for queued delivery handling
typedef struct          delivery_node *DELIVERY_PTR;
DELIVERY_PTR            delivery_head, delivery_tail;
short                           queued_delivery_cnt;
HANDLE                          hDeliveryMonPipe;
struct delivery_node
{
                        short                   w_id;
                        short                   o_carrier_id;
                        SYSTEMTIME                      queue_time;
                        long                    tran_start_time;
                        struct                  delivery_node
*next_delivery;
};

// Default loader arguments
#define BATCH                   10000
#define DEFLDPACKSIZE                   4096
#define ORDERS_PER_DIST                 3000
#define LOADER_RES_FILE    "load.out"
#define LOADER_NURAND_C                         123
#define DEF_STARTING_WAREHOUSE                  1
#define CASE_SENSITIVITY                        0

// String length constants
#define SERVER_NAME_LEN         20
#define DATABASE_NAME_LEN       20
#define USER_NAME_LEN           20
#define PASSWORD_LEN            20
#define TABLE_NAME_LEN          20
#define I_NAME_LEN              24
#define I_DATA_LEN              50
#define W_NAME_LEN              10
#define ADDRESS_LEN             20
#define STATE_LEN               2
#define ZIP_LEN                 9
#define S_DIST_LEN              24
#define S_DATA_LEN              50
#define D_NAME_LEN              10
#define FIRST_NAME_LEN          16
#define MIDDLE_NAME_LEN         2
#define LAST_NAME_LEN           16
#define PHONE_LEN               16
#define DATETIME_LEN            30
#define CREDIT_LEN              2
#define C_DATA_LEN              250
#define H_DATA_LEN              24
#define DIST_INFO_LEN           24
#define MAX_OL_NEW_ORDER_ITEMS    15
#define MAX_OL_ORDER_STATUS_ITEMS  15
#define BRAND_LEN               1
#define STATUS_LEN              25
#define OL_DIST_INFO_LEN                24

// Transaction types
#define EMPTY                   0
#define NEW_ORDER_TRAN                  1
#define PAYMENT_TRAN                    2
#define ORDER_STATUS_TRAN               3
#define DELIVERY_TRAN                   4
#define STOCK_LEVEL_TRAN                5

// Statistic structures
typedef struct
{
   long                                 tran_count;
   long                                 total_time;
   long                                 resp_time;
   long                                 resp_min;
   long                                 resp_max;
   long                                 rolled_back;
   long                                 tran_2sec;
   long                                 tran_5sec;
   long                                 tran_sqr;
                        long                    num_deadlocks;
   long                                 resp_hist[HIST_MAX];
} TRAN_STATS;

typedef struct
{
   TRAN_STATS                   NewOrderStats;
   TRAN_STATS                   PaymentStats;
   TRAN_STATS                   OrderStatusStats;
   TRAN_STATS                   QueuedDeliveryStats;
                        TRAN_STATS              DeliveryStats;
   TRAN_STATS                   StockLevelStats;
} CLIENT_STATS;

// driver structures
typedef struct
{
   char                                 *server;
   char                                 *database;
   char                                 *user;
   char                                 *password;
   char                                 *table;
   long                                 num_warehouses;
   long                                 batch;
   long                                 verbose;
                        long                    pack_size;
                        char                    *loader_res_file;
                        char                    *synch_servername;
                        long                    case_sensitivity;
                        long                    starting_warehouse;
} TPCCLDR_ARGS;

typedef struct
{
   char                         *server;
   char                         *user;
   char                         *password;
                        char                    *admin_database;
   char                         *sqlstat_filename;
                        long                    run_id;
} SQLSTAT_ARGS;

typedef struct
{
   SQLCONN                      *sqlconn;
   char                         *server;
   char                         *database;
                        char                    *admin_database;
   char                         *user;
   char                         *password;
   long                         ramp_up;
   long                         steady_state;
   long                         ramp_down;
   long                         num_users;
   long                         num_warehouses;
   long                         think_times;
   long                         display_data;
                        long                    client_mode;
                        long                    tran;
                        long                    deadlock_retry;
                        long                    delivery_backoff;
                        long                    num_deliveries;
                        char                    *comment;
                        double                          load_multiplier;
                        long                    checkpoint_interval;
                        long                    first_checkpoint;
                        long                    disable_90th;
                        char                    *resfilename;
                        char                    *sqlstat_filename;
                        long                    enable_sqlstat;
                        long                    sqlstat_period;
                        long                    shutdown_server;
                        long                    auto_run;
                        long                    dropped_connections;
   short                        spid;
} MASTER_DATA;

typedef struct
{
                        long                    num_threads;
   char                         *server;
   char                         *database;
                        char                    *admin_database;
   char                         *user;
   char                         *password;
                        long                    pack_size;
                        short                   x_flag;
                        char                    *synch_servername;
                        long
                        disable_delivery_resfiles;
#ifdef USE_CONMON
                        HANDLE                          hConMon;
                        short                   con_id;
```

```
		short		con_x;
		short		con_y;
#endif
} GLOBAL_CLIENT_DATA;

typedef struct
{
#ifdef USE_ODBC
		HDBC		hdbc;
		HSTMT			hstmt;
#else
   SQLCONN		*sqlconn;
#endif
		short		threadid;
   char		*server;
   char		*database;
		char		*admin_database;
   char		*user;
   char		*password;
		long		ramp_up;
		long		steady_state;
   long		ramp_down;
   long		num_warehouses;
		long		client_mode;
		long		tran;
		long		deadlock_retry;
		long		think_times;
		long		pack_size;
   long		tran_start_time;
   long		tran_end_time;
   long		display_data;
		long		id;
		short		w_id;
   short		spid;
		long		disable_90th;
		double			load_multiplier;
		long		num_deliveries;

#ifdef USE_CONMON
		HANDLE			hConMon;
		short		con_id;
		short		con_x;
		short		con_y;
		short		fTimerStat;
#endif
} CLIENT_DATA;

typedef struct
{
   long				o_id;
} DEL_ITEM;

typedef struct
{
#ifdef USE_ODBC
		HDBC		hdbc;
		HSTMT			hstmt;
#else
		SQLCONN		*sqlconn;
#endif
		SYSTEMTIME		queue_time;
		SYSTEMTIME
		completion_time;
   long		tran_start_time;
   long		tran_end_time;
		short		threadid;
		FILE		*fDelivery;
   short		spid;
```

```
   short			w_id;
			short		d_id;
			short		o_carrier_id;
			DEL_ITEM	DelItems[10];
			char		*server;
   char			*database;
			char		*admin_database;
   char			*user;
   char			*password;
			long		ramp_up;
   long			steady_state;
   long			ramp_down;
			long		pack_size;
			long		id;
			long		disable_90th;
			long		delivery_backoff;
			long
			disable_delivery_resfiles;
} DELIVERY;

typedef struct
{
			long		pipe_num;
} DELIVERY_ARGS;

// transaction structures
typedef struct
{
   short				ol_supply_w_id;
   long				ol_i_id;
   char				ol_i_name[I_NAME_LEN+1];
   short				ol_quantity;
   char
			ol_brand_generic[BRAND_LEN+1];
   double				ol_i_price;
   double				ol_amount;
   short				ol_stock;
   short				num_warehouses;
} OL_NEW_ORDER_DATA;

typedef struct
{
   short		w_id;
   short		d_id;
   long		c_id;
   short		o_ol_cnt;
			char	c_last[LAST_NAME_LEN+1];
   char		c_credit[CREDIT_LEN+1];
   double		c_discount;
   double		w_tax;
   double		d_tax;
   long			o_id;
			short		o_commit_flag;
#ifdef USE_ODBC
			TIMESTAMP_STRUCT	o_entry_d;
#else
			DBDATEREC	o_entry_d;
#endif
   short		o_all_local;
   double		total_amount;
			long	num_deadlocks;
			char
			execution_status[STATUS_LEN];
   OL_NEW_ORDER_DATA Ol[MAX_OL_NEW_ORDER_ITEMS];
} NEW_ORDER_DATA;

typedef struct
{
```

```
   short			w_id;
   short			d_id;
   long			c_id;
   short			c_d_id;
   short			c_w_id;
   double			h_amount;
#ifdef USE_ODBC
		TIMESTAMP_STRUCT	h_date;
#else
   DBDATEREC		h_date;
#endif
   char			w_street_1[ADDRESS_LEN+1];
   char			w_street_2[ADDRESS_LEN+1];
   char			w_city[ADDRESS_LEN+1];
   char			w_state[STATE_LEN+1];
   char			w_zip[ZIP_LEN+1];
   char			d_street_1[ADDRESS_LEN+1];
   char			d_street_2[ADDRESS_LEN+1];
   char			d_city[ADDRESS_LEN+1];
   char			d_state[STATE_LEN+1];
   char		d_zip[ZIP_LEN+1];
   char			c_first[FIRST_NAME_LEN+1];
   char			c_middle[MIDDLE_NAME_LEN +
1];
   char		c_last[LAST_NAME_LEN+1];
   char			c_street_1[ADDRESS_LEN+1];
   char			c_street_2[ADDRESS_LEN+1];
   char			c_city[ADDRESS_LEN+1];
   char			c_state[STATE_LEN+1];
   char			c_zip[ZIP_LEN+1];
   char			c_phone[PHONE_LEN+1];
#ifdef USE_ODBC
		TIMESTAMP_STRUCT	c_since;
#else
   DBDATEREC		c_since;
#endif
   char			c_credit[CREDIT_LEN+1];
   double			c_credit_lim;
   double			c_discount;
   double			c_balance;
   char			c_data[200+1];
		long			num_deadlocks;
		char
execution_status[STATUS_LEN];
} PAYMENT_DATA;

typedef struct
{
		long			ol_i_id;
   short			ol_supply_w_id;
   short			ol_quantity;
   double			ol_amount;
#ifdef USE_ODBC
		TIMESTAMP_STRUCT	ol_delivery_d;
#else
   DBDATEREC			ol_delivery_d;
#endif
} OL_ORDER_STATUS_DATA;

typedef struct
{
   short		w_id;
   short		d_id;
   long		c_id;
   char		c_first[FIRST_NAME_LEN+1];
   char		c_middle[MIDDLE_NAME_LEN+1];
   char		c_last[LAST_NAME_LEN+1];
   double		c_balance;
   long              o_id;
#ifdef USE_ODBC
                              TIMESTAMP_STRUCT      o_entry_d;
#else
   DBDATEREC          o_entry_d;
#endif
   short             o_carrier_id;
   OL_ORDER_STATUS_DATA
OlOrderStatusData[MAX_OL_ORDER_STATUS_ITEMS];
   short             o_ol_cnt;
                              long              num_deadlocks;
                              char
execution_status[STATUS_LEN];
} ORDER_STATUS_DATA;

typedef struct
{
   short                         w_id;
   short                         o_carrier_id;
   SYSTEMTIME                    queue_time;
                              long                 num_deadlocks;
                              DEL_ITEM                DelItems[10];
                              char
                              execution_status[STATUS_LEN];
} DELIVERY_DATA;


typedef struct
{
   short                                   w_id;
   short                                   d_id;
   short                                   thresh_hold;
   long                                    low_stock;
                              long                    num_deadlocks;
                              char
                              execution_status[STATUS_LEN];
} STOCK_LEVEL_DATA;


// For client synchronization
#define LINE_LEN   80
#define NAME_SIZE  25
#define IN_BUF_SIZE       1000
#define OUT_BUF_SIZE      1000
#define TIME_OUT          0
#define PLEASE_READ       1000
#define PLEASE_WRITE      1000

typedef struct _WRTHANDLE
{                             HANDLE            hPipe;
   DWORD                         threadID;
                              CHAR          Name[NAME_SIZE];
                              struct        _WRTHANDLE *     next;
}WRTHANDLE;

// For client console monitor
#ifdef USE_CONMON
#define                       CON_LINE_SIZE           40
#define                       DEADLOCK_X                    17
#define DEADLOCK_Y                    4
#define CUR_STATE_X                   15
#define CUR_STATE_Y                   3
#define                       YELLOW                        0
#define                       RED                           1
#define                       GREEN                         2
int                              total_deadlocks;
#endif

// Functions in random.c
void                       seed();
long                       irand();
double                     drand();
void                       WUCreate();
short                      WURand();

// Functions in getargs.c;
void                       GetArgsLoader();
void                       GetArgsLoaderUsage();
void                       GetArgsMaster();
void                       GetArgsMasterUsage();
void                       GetArgsClient();
void                       GetArgsClientUsage();
void                       GetArgsDelivery();
void                       GetArgsDeliveryUsage();
void                       GetArgsSQLStat();
void                       GetArgsSQLStatUsage();

// Functions in master.c
void                       ReadClientDone();
BOOL    CtrlHandler();

// Functions in client.c
void                       ClientMain();
void                       DeliveryMain();
void                       Delivery();
void                       ClientEmulate();
short                      ClientSelectTransaction();
void                       ClientShuffleDeck();

//Functions in tran.c
BOOL                       TranNewOrder();
BOOL                       TranPayment();
BOOL                       TranOrderStatus();
BOOL                       TranDelivery();
BOOL                       TranStockLevel();

// Functions in data.c
void                       DataNewOrder();
void                       DataPayment();
void                       DataOrderStatus();
void                       DataDelivery();
void                       DataStockLevel();
short                      DataRemoteWarehouse();

// Functions in time.c
long                       TimeNow();
void                       TimeInit();
void                       TimeKeying();
void                       TimeThink();

// Functions in stats.c
void                       StatsInit();
void                       StatsInitTran();
void                       StatsGeneral();
void                       StatsDelivery();

// Functions in sqlfuncs.c
BOOL                       SQLExec();
BOOL                       SQLExecCmd();
BOOL                       SQLOpenConnection();
void                       SQLClientInit();
int                        SQLMasterInit();
void                       SQLDeliveryInit();
int                        SQLClientStats();
int                        SQLDeliveryStats();
void                       SQLTranStats();
void                       SQLMasterStats();
void                       SQLMasterTranStats();
void                       SQLIOStats();
void                       SQLCheckpointStats();
void                       SQLInitResFile();
void                       SQLGetRunId();
BOOL                       SQLNewOrder();
BOOL                       SQLPayment();
BOOL                       SQLOrderStatus();
BOOL                       SQLStockLevel();
void   SQLDelivery();
int                        SQLGetCustId();
void                       SQLExit();
void                       SQLInit();
void                       SQLInitPrivate();
void                       SQLClientInitPrivate();
void                       SQLDeliveryInitPrivate();
int                        SQLMsgHandler();
int                        SQLErrHandler();
int                        SQLClientMsgHandler();
int                        SQLClientErrHandler();
int                        SQLDeliveryMsgHandler();
int                        SQLDeliveryErrHandler();
void                       SQLInitDate();
void                       SQLShutdown();
#ifdef USE_ODBC
void                       ODBCOpenConnection();
void                       ODBCOpenDeliveryConnection();
BOOL                       ODBCError();
void                       ODBCExit();
#endif

// Functions in util.c
void                       UtilSleep();
void                       UtilPrintNewOrder();
void                       UtilPrintPayment();
void                       UtilPrintOrderStatus();
void                       UtilPrintDelivery();
void                       UtilPrintStockLevel();
void                       UtilPrintOlTable();
void                       UtilError();
void                       UtilFatalError();
void                       UtilStrCpy();
#ifdef USE_CONMON
void                       WriteConsoleString();
#endif
void                       WriteDeliveryString();
BOOL                       AddDeliveryQueueNode();
BOOL                       GetDeliveryQueueNode();


// Functions in strings.c
void                       MakeAddress();
void                       LastName();
int                        MakeAlphaString();
int                        MakeOriginalAlphaString();
int                        MakeNumberString();
int                        MakeZipNumberString();
void                       InitString();
void                       InitAddress();
void                       PaddString();

// Functions in delivery.c
void                       DeliveryHMain();
void                       DeliveryH();

#endif __damien_tpcc_h__
```

NEWORDER.C

```
/* Audited: 28 February 1997 */

/* neworder.c
  Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "neworder.h"

int new_order_func_parse(assoc *a, int *cookie, NEW_ORDER_DATA
*data, char *output) {
                int i = 0;
                int n = 0;
                neworder_line lines[15];
                char errstr[128];
                char all_errors[1024];
                errstr[0] = '\0';
                all_errors[0] = '\0';
                for(n = 0; n < 15; n++) {
                    lines[n].supply_w_id = -3;
                    lines[n].item_id = -3;
                    lines[n].quantity = -3;
                }
                while((*a)[0][i]) {
                    switch((*a)[0][i][0]) {
                        case 'c':
                            *cookie = VerifyInt((*a)[1][i],
4);
                            break;
                        case 'D':
                            data->d_id =
VerifyShort((*a)[1][i], 2);
                            break;
                        case 'C':
                            if((*a)[0][i][1] == 'I') {
                                data->c_id =
VerifyLong((*a)[1][i], 4);
                            }
                            break;
                        case 'O':
                            n = atoi(&((*a)[0][i][2]));
                            if(n < 1 || n > 15) break;
                            switch((*a)[0][i][1]) {
                                case 'S':
                                    lines[n - 1].swid
= (*a)[1][i];
                                    lines[n -
1].supply_w_id = VerifyShort(lines[n - 1].swid, 4);
                                    break;
                                case 'I':
                                    lines[n - 1].iid =
(*a)[1][i];
                                    lines[n -
1].item_id = VerifyLong(lines[n - 1].iid, 6);
                                    break;
                                case 'Q':
                                    lines[n -
1].quan = (*a)[1][i];
                                    lines[n -
1].quantity = VerifyShort(lines[n - 1].quan, 2);
                                    break;
                                default: break;
                            }
                            break;
                        default: break;
                    }
                    ++i;
                }
                if(*cookie < 0 || !get_user(*cookie)->w_id) {
                    sprintf(errstr, BAD_COOKIE_MSG);
                    strcat(all_errors, errstr);
                }
                switch(data->d_id) {
                    case -1:
                        sprintf(errstr, TOO_LONG_MSG,
"District ID", 2);
                        strcat(all_errors, errstr);
                        break;
                    case -2:
                        sprintf(errstr, NOT_ISDIGIT_MSG,
"District ID");
                        strcat(all_errors, errstr);
                        break;
                    case -3:
                        sprintf(errstr, NO_INPUT_MSG,
"District ID");
                        strcat(all_errors, errstr);
                        break;
                    default:break;
                }
                switch(data->c_id) {
                    case -1:
                        sprintf(errstr, TOO_LONG_MSG,
"Customer ID", 2);
                        strcat(all_errors, errstr);
                        break;
                    case -2:
                        sprintf(errstr, NOT_ISDIGIT_MSG,
"Customer ID");
                        strcat(all_errors, errstr);
                        break;
                    case -3:
                        sprintf(errstr, NO_INPUT_MSG,
"Customer ID");
                        strcat(all_errors, errstr);
                        break;
                    default:break;
                }
                data->o_ol_cnt = 0;
                for(n = 0; n < 15; n++) {
                    if(lines[n].supply_w_id == -3 &&
lines[n].item_id == -3 && lines[n].quantity == -3)
                        continue;
                    switch(lines[n].supply_w_id) {
                        case -1:
                            sprintf(errstr,
NLINE_TOO_LONG, n + 1, "Supply Warehouse ID", 4);
                            strcat(all_errors, errstr);
                            break;
                        case -2:
                            sprintf(errstr,
NLINE_NOT_ISDIGIT, n + 1, "Supply Warehouse ID");
                            strcat(all_errors, errstr);
                            break;
                        case -3:
                            sprintf(errstr,
NLINE_NO_INPUT, n + 1, "Supply Warehouse ID");
                            strcat(all_errors, errstr);
                            break;
                        default: break;
                    }
                    switch(lines[n].item_id) {
                        case -1:
                            sprintf(errstr,
NLINE_TOO_LONG, n + 1, "Item ID", 6);
                            strcat(all_errors, errstr);
                            break;
                        case -2:
                            sprintf(errstr,
NLINE_NOT_ISDIGIT, n + 1, "Item ID");
                            strcat(all_errors, errstr);
                            break;
                        case -3:
                            sprintf(errstr,
NLINE_NO_INPUT, n + 1, "Item ID");
                            strcat(all_errors, errstr);
                            break;
                        default: break;
                    }
                    switch(lines[n].quantity) {
                        case -1:
                            sprintf(errstr,
NLINE_TOO_LONG, n + 1, "Quantity", 2);
                            strcat(all_errors, errstr);
                            break;
                        case -2:
                            sprintf(errstr,
NLINE_NOT_ISDIGIT, n + 1, "Quantity");
                            strcat(all_errors, errstr);
                            break;
                        case -3:
                            sprintf(errstr,
NLINE_NO_INPUT, n + 1, "Quantity");
                            strcat(all_errors, errstr);
                            break;
                        default: break;
                    }
                    data->Ol[data->o_ol_cnt].ol_supply_w_id
= lines[n].supply_w_id;
                    data->Ol[data->o_ol_cnt].ol_i_id =
lines[n].item_id;
                    data->Ol[data->o_ol_cnt].ol_quantity =
lines[n].quantity;
                    data->o_ol_cnt++;
                }
                data->w_id = get_user(*cookie)->w_id;
                data->o_all_local = 1;
                for(i = 0; i < data->o_ol_cnt; i++) {
                    if(data->Ol[i].ol_supply_w_id != data-
>w_id) {
                        data->o_all_local = 0;
                        break;
                    }
                }
                if(all_errors[0]) {
                    sprintf(output, errorpage, all_errors);
                    return 0;
                } else return 1;
}

int new_order_func_process(NEW_ORDER_DATA *data, int cookie) {
#ifdef DB_PRESENT
                return SQLNewOrder(get_user(cookie)-
>dbhandle, data, DEADLOCK_RETRY);
#else
                int x;
                data->o_id = 0;
                data->o_commit_flag = 1;
                data->o_entry_d.day = 15;
                data->o_entry_d.month = 4;
                data->o_entry_d.year = 1996;
```

```
                        data->o_entry_d.hour = 17;
                        data->o_entry_d.minute = 21;
                        data->o_entry_d.second = 49;
                        strcpy(data->c_last, "Johnson");
                        strcpy(data->c_credit, "B5");
                        data->c_discount = 0.2135;
                        data->w_tax = 8.00;
                        data->d_tax = 3.50;
                        data->o_id = 54658876L;
                        strcpy(data->execution_status, "This thing is
executing");
                        for(x = 0; x < data->o_ol_cnt; x++) {
                              if(data->Ol[x].ol_supply_w_id) {
                                    strcpy(data->Ol[x].ol_i_name,
"Some kind of widget");
                                    strcpy(data-
>Ol[x].ol_brand_generic, "B");
                                    data->Ol[x].ol_i_price = 12.34;
                                    data->Ol[x].ol_amount = data-
>Ol[x].ol_quantity * data->Ol[x].ol_i_price;
                                    data->total_amount += data-
>Ol[x].ol_amount;
                                    data->Ol[x].ol_stock = 321;
                                    data->Ol[x].num_warehouses = 5;
                              }
                        }
                        return 1;
#endif DB_PRESENT
}

void new_order_func_format(char *output, NEW_ORDER_DATA *data, int
cookie) {
                        char buf[3000];
                        int x;
                        data->c_discount *= 100;
                        data->w_tax *= 100;
                        data->d_tax *= 100;
                        sprintf(buf, nresp, cookie);
                        for(x = 0; x < data->o_ol_cnt; x++)
                              NewOrderLine(&buf[nlin[x]], &data->Ol[x]);
                        for(; x < 15; x++)
                              AlphaField(&buf[nlin[x]], 78, " ");
                        IntField(&buf[NW], 4, data->w_id);
                        IntField(&buf[ND], 2, data->d_id);
                        DateTimeField(&buf[NDAT], &data->o_entry_d);
                        IntField(&buf[NC], 4, data->c_id);
                        AlphaField(&buf[NN], 16, data->c_last);
                        AlphaField(&buf[NCRED], 2, data->c_credit);
                        DecField(&buf[NDISC], 5, data->c_discount);
                        IntField(&buf[NON], 8, data->o_id);
                        IntField(&buf[NOL], 2, data->o_ol_cnt);
                        DecField(&buf[NWT], 5, data->w_tax);
                        DecField(&buf[NDT], 5, data->d_tax);
                        AlphaField(&buf[NEX], 24, data-
>execution_status);
                        DecField(&buf[NTOT], 8, data->total_amount);
                        FormatHtmlPage(buf, output);
}

void new_order_func_error(char *output, NEW_ORDER_DATA *data, int
cookie) {
                        int x;
                        char buf[3000];
                        sprintf(buf, nresp, cookie);
                        for(x = 0; x < 15; x++)
                              AlphaField(&buf[nlin[x]], 78, " ");
                        IntField(&buf[NW], 4, data->w_id);
                        IntField(&buf[ND], 2, data->d_id);
                        AlphaField(&buf[NDAT], 19, " ");
                        IntField(&buf[NC], 4, data->c_id);
                        AlphaField(&buf[NN], 16, data->c_last);
                        AlphaField(&buf[NCRED], 2, data->c_credit);
                        AlphaField(&buf[NDISC], 5, " ");
                        IntField(&buf[NON], 8, data->o_id);
                        AlphaField(&buf[NOL], 2, " ");
                        AlphaField(&buf[NWT], 5, " ");
                        AlphaField(&buf[NDT], 5, " ");
                        AlphaField(&buf[NEX], 24, data-
>execution_status);
                        AlphaField(&buf[NTOT], 8, " ");
                        FormatHtmlPage(buf, output);
}

void new_order_func_main(assoc *a, char *output) {
                        int cookie;
                        NEW_ORDER_DATA data;
                        if(!new_order_func_parse(a, &cookie, &data,
output)) return;
                        if(!new_order_func_process(&data, cookie)) {
                              new_order_func_error(output, &data,
cookie);
                              return;
                        }
                        new_order_func_format(output, &data, cookie);
}
```

NEWORDER.H

```
/* Audited: 28 February 1997 */

/* neworder.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __neworder_h__
#define __neworder_h__

#include "context.h"
#include <tpcc/kit/src/tpcc.h>
#include "inputparser.h"
#include "output.h"
#include "errors.h"
#include "options.h"

#define NEWORDER_FUNC 8

typedef struct {
                        char *swid;
                        char *iid;
                        char *quan;
                        short supply_w_id;
                        long  item_id;
                        short quantity;
} neworder_line;

#define NLINE_TOO_LONG "o Order Line %d: The \"%s\" field contains too
many characters.\r\n  The maximum is %d.\r\n"
#define NLINE_NOT_ISDIGIT "o Order Line %d: The \"%s\" field contained
nondigit characters.\r\n"
#define NLINE_NO_INPUT "o Order Line %d: You did not fill in the \"%s\"
field.\r\n  The field is required.\r\n"

static char nresp[] =
"<HTML><HEAD><TITLE>TPC-C: New
Order</TITLE></HEAD><BODY><PRE>"
"                              New Order\r\n"
"Warehouse: XXXX   District: XX                    Date:
XXXXXXXXXXXXXXXXXXX\r\n"
"Customer:  XXXX   Name: XXXXXXXXXXXXXXXX   Credit: XX   %%Disc:
XXXXX\r\n"
"Order Number: XXXXXXXX  Number of Lines: XX        W_tax: XXXXX
D_tax: XXXXX\r\n"
"\r\n"
" Supp_W  Item_Id  Item Name                Qty  Stock  B/G  Price
Amount\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"  XXXX   XXXXXX   XXXXXXXXXXXXXXXXXXXXXXXX  XX    XXX    X
$XXXXXX  $XXXXXXX\r\n"
"Execution Status: XXXXXXXXXXXXXXXXXXXXXXXX                  Total:
$XXXXXXXX"
"</PRE><P><FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\">"
"<INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"New Order\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Payment\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Delivery\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Order-Status\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Stock-Level\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Exit\">"
"</FORM></P></BODY></HTML>\r\n";

#define NW 118
#define ND 135
#define NDAT 167
#define NC 199
#define NN 212
#define NCRED 239
#define NDISC 251
#define NON 272
#define NOL 299
#define NWT 316
#define NDT 331
static int nlin[15] = {418, 498, 578, 658, 738, 818, 898, 978, 1058, 1138,
1218, 1298, 1378, 1458, 1538};
#define NEX 1636
```

```
#define NTOT 1688

extern void e_log(char *);
void new_order_func_main(assoc *, char *);
int new_order_func_parse(assoc *, int *, NEW_ORDER_DATA *, char *);
int new_order_func_process(NEW_ORDER_DATA *, int);
void new_order_func_format(char *, NEW_ORDER_DATA *, int);
void new_order_func_error(char *, NEW_ORDER_DATA *, int);

#endif __neworder_h__
```

OPTIONS.C

```
/* Audited: 28 February 1997 */

/* options.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "options.h"


void GetRegistryValues(void) {
                int i;
                DWORD how;
                HKEY hRegKey;
                int def_index = 0;
                int def_warehouse = 100;
                DWORD type;
                DWORD size = (DWORD)32;
                union dtg {BYTE b[32]; char c[32]; DWORD d[8];}
data;

                RegOpenKeyEx(HKEY_LOCAL_MACHINE,
"SOFTWARE", 0, KEY_READ | KEY_WRITE, &hRegKey);
                RegCreateKeyEx(hRegKey, "Intergraph", 0,
NULL, REG_OPTION_NON_VOLATILE, KEY_READ | KEY_WRITE, NULL,
&hRegKey, &how);
                RegCreateKeyEx(hRegKey, "TPC-C ISAPI
Application", 0, NULL, REG_OPTION_NON_VOLATILE, KEY_READ |
KEY_WRITE, NULL, &hRegKey, &how);
                if(how == REG_CREATED_NEW_KEY) {
                    RegSetValueEx(hRegKey, "ServerName",
0, REG_SZ, (const unsigned char *)"SERVER", 7);
                    RegSetValueEx(hRegKey, "TokenIndex",
0, REG_DWORD, (const unsigned char *)&def_index, 4);
                    RegSetValueEx(hRegKey,
"NumWarehouses", 0, REG_DWORD, (const unsigned char
*)&def_warehouse, 4);
                }

                for(i = 0; i < 8; data.d[i++] = (DWORD)0);
                RegQueryValueEx(hRegKey, "ServerName", 0,
&type, (unsigned char *)&data.b, &size);
                strcpy(SERVERNAME, data.c);
                size = (DWORD)32;
                for(i = 0; i < 8; data.d[i++] = (DWORD)0);
                RegQueryValueEx(hRegKey, "TokenIndex", 0,
&type, (unsigned char *)&data.b, &size);
                TokenIndex = data.d[0];
                size = (DWORD)32;
                for(i = 0; i < 8; data.d[i++] = (DWORD)0);
                RegQueryValueEx(hRegKey,
"NumWarehouses", 0, &type, (unsigned char *)&data.b, &size);
                MAXWH = data.d[0];
}
```

OPTIONS.H

```
/* Audited: 28 February 1997 */

/* options.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __options_h__
#define __options_h__

#define MAX_USERS 4000
#define DB_PRESENT
#define USEDB "tpcc"
#define USERNAME "sa"
#define USERPASSWD ""
//#define SERVERNAME "SPAT"
//#define MAXWH 10
//#define TokenIndex 0


extern char                 SERVERNAME[32];
extern int                  MAXWH;
extern int                  TokenIndex;

char SERVERNAME[32];
int MAXWH;
int TokenIndex;

/* Do not modify anything below this point. */
#include <windows.h>
#include <winreg.h>
#include <stdio.h>

void GetRegistryValues(void);


#endif __options_h__
```

ORDERSTATUS.C

```
/* Audited: 28 February 1997 */

/* orderstatus.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "orderstatus.h"

int order_status_func_parse(assoc *a, int *cookie, ORDER_STATUS_DATA
*data, char *output) {
                int i = 0;
                int cid = 0;
                char errstr[128];
                char all_errors[1024];
                errstr[0] = '\0';
                all_errors[0] = '\0';
                data->c_last[0] = '\0';
                while((*a)[0][i]) {
                    switch((*a)[0][i][0]) {
                        case 'c':
                                    *cookie = VerifyInt((*a)[1][i],
4);
                                    break;
                            case 'C':
                                    switch((*a)[0][i][1]) {
                                        case 'I':

                if(strlen((*a)[1][i])) cid++;
                                                data->c_id =
VerifyLong((*a)[1][i], 4);
                                                break;
                                        case 'L':

                if(strlen((*a)[1][i])) cid++;

                if(VerifyString((*a)[1][i], 16))

                strcpy(data->c_last, (*a)[1][i]);
                                                break;
                                        default: break;
                                    }
                                    break;
                            case 'D':
                                    data->d_id =
VerifyShort((*a)[1][i], 2);
                                    break;
                            default: break;
                        }
                        ++i;
                }
                if(*cookie < 0 || !get_user(*cookie)->w_id) {
                        sprintf(errstr, BAD_COOKIE_MSG);
                        strcat(all_errors, errstr);
                }
                switch(data->d_id) {
                        case -1:
                            sprintf(errstr, TOO_LONG_MSG,
"District ID", 2);
                            strcat(all_errors, errstr);
                            break;
                        case -2:
                            sprintf(errstr, NOT_ISDIGIT_MSG,
"District ID");
                            strcat(all_errors, errstr);
                            break;
                        case -3:
                            sprintf(errstr, NO_INPUT_MSG,
"District ID");
                            strcat(all_errors, errstr);
                            break;
                        default:break;
                }
                if(cid != 1)
                        strcat(all_errors, "o You must fill in one
(and only one) of \"Customer ID\" and \"Customer Last Name\".\r\n");
                else if(!data->c_last[0]) {
                        switch(data->c_id) {
                            case -1:
                                    sprintf(errstr,
TOO_LONG_MSG, "Customer ID", 4);
                                    strcat(all_errors, errstr);
                                    break;
                            case -2:
                                    sprintf(errstr,
NOT_ISDIGIT_MSG, "Customer ID");
                                    strcat(all_errors, errstr);
                                    break;
                            case -3:
```

```
                                        sprintf(errstr,
TOO_LONG_MSG, "Customer Last Name", 16);
                                        strcat(all_errors, errstr);
                                        break;
                                default: break;
                        }
                }
                data->w_id = get_user(*cookie)->w_id;
                if(all_errors[0]) {
                        sprintf(output, errorpage, all_errors);
                        return 0;
                } else return 1;
}

int order_status_func_process(ORDER_STATUS_DATA *data, int cookie) {
#ifdef DB_PRESENT
                return SQLOrderStatus(get_user(cookie)-
>dbhandle, data, DEADLOCK_RETRY);
#else
                int i;
                if(!data->c_last[0]) strcpy(data->c_last,
"Johnson");
                else data->c_id = 123;
                strcpy(data->c_first, "Frederick");
                strcpy(data->c_middle, "J.");
                data->o_entry_d.day = 15;
                data->o_entry_d.month = 4;
                data->o_entry_d.year = 1996;
                data->o_entry_d.hour = 11;
                data->o_entry_d.minute = 37;
                data->o_entry_d.second = 25;
                data->c_balance = -12345.67;
                data->o_carrier_id = 16;
                data->o_id = 87654321;
                data->o_ol_cnt = 15;
                for(i = 0; i < 15; i++) {
                        data-
>OlOrderStatusData[i].ol_supply_w_id = 5423;
                        data->OlOrderStatusData[i].ol_i_id = 863;
                        data->OlOrderStatusData[i].ol_quantity =
6;
                        data->OlOrderStatusData[i].ol_amount =
0.50;
                        data-
>OlOrderStatusData[i].ol_delivery_d.day = 21;
                        data-
>OlOrderStatusData[i].ol_delivery_d.month = 11;
                        data-
>OlOrderStatusData[i].ol_delivery_d.year = 1996;
                }
                return 1;
#endif DB_PRESENT
}

void order_status_func_format(char *output, ORDER_STATUS_DATA
*data, int cookie) {
                int x;
                char buf[3000];
                sprintf(buf, oresp, cookie);
                IntField(&buf[OW], 4, data->w_id);
                IntField(&buf[OD], 2, data->d_id);
                IntField(&buf[OC], 4, data->c_id);
                AlphaField(&buf[OF], 16, data->c_first);
                AlphaField(&buf[OM], 2, data->c_middle);
                AlphaField(&buf[OL], 16, data->c_last);
                SignedDecField(&buf[OBAL], 9, data-
>c_balance);
                IntField(&buf[ONUM], 8, data->o_id);
                DateTimeField(&buf[ODAT], &data->o_entry_d);
                IntField(&buf[OCAR], 2, data->o_carrier_id);
                for(x = 0; x < data->o_ol_cnt; x++)
                        OrderStatusLine(&buf[olin[x]], &data-
>OlOrderStatusData[x]);
                for(;x < 15; x++)
                        AlphaField(&buf[olin[x]], 56, " ");
                FormatHtmlPage(buf, output);
}

void order_status_func_main(assoc *a, char *output) {
                int cookie;
                ORDER_STATUS_DATA data;
                if(!order_status_func_parse(a, &cookie, &data,
output)) return;
                if(!order_status_func_process(&data, cookie)) {
                        sprintf(output, dberrpage, cookie);
                        return;
                }
                order_status_func_format(output, &data, cookie);
}
```

ORDERSTATUS.H

```
/* Audited: 28 February 1997 */

/* orderstatus.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __orderstatus_h__
#define __orderstatus_h__

#include "context.h"
#include <tpcc/kit/src/tpcc.h>
#include "inputparser.h"
#include "output.h"
#include "errors.h"
#include "options.h"

#define ORDERSTAT_FUNC 7

static char oresp[] =
"<HTML><HEAD><TITLE>TPC-C: Order-
Status</TITLE></HEAD><BODY><PRE>"
"                              Order-Status\r\n"
"Warehouse: XXXX   District: XX\r\n"
"Customer: XXXX   Name: XXXXXXXXXXXXXXXX XX
XXXXXXXXXXXXXXXX\r\n"
"Cust-Balance: $XXXXXXXXX\r\n"
"\r\n"
"Order-Number: XXXXXXXX   Entry-Date: XXXXXXXXXXXXXXXXXXX
Carrier-Number: XX\r\n"
"Supply-W     Item-Id   Qty     Amount      Delivery-Date\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX\r\n"
"  XXXX       XXXXXX    XX    $XXXXXXXX     XXXXXXXXXX"
"</PRE><P><FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\">"
"<INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"New Order\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Payment\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Delivery\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Order-Status\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Stock-Level\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Exit\">"
"</FORM></P></BODY></HTML>\r\n";

#define OW 123
#define OD 140
#define OC 154
#define OF 167
#define OM 184
#define OL 187
#define OBAL 220
#define ONUM 247
#define ODAT 270
#define OCAR 308
static int olin[15] = {371, 429, 487, 545, 603, 661, 719, 777, 835, 893, 951,
1009, 1067, 1125, 1183};

extern void e_log(char *);
void order_status_func_main(assoc *, char *);
int order_status_func_parse(assoc *, int *, ORDER_STATUS_DATA *, char
*);
int order_status_func_process(ORDER_STATUS_DATA *, int);
void order_status_func_format(char *, ORDER_STATUS_DATA *, int);

#endif __orderstatus_h__
```

OUTPUT.C

```
/* Audited: 28 February 1997 */

/* output.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "output.h"

void AlphaField(char *field, int field_size, char *string)
{
                int i;
                for (i=0;i<field_size;i++)
                {
                        if (string[i] == '\0') break;//end of string
                        field[i] = string[i];
                }
                for (;i<field_size;i++) field[i] = ' '; //space fill the
field
}

void IntField(char *field, int field_size, int value)
{
                int i;
                for (i=field_size-1;i>=0;i--)
                {
                        field[i] = (value % 10) + '0';
                        value /= 10;
                }
}
```

```
void DecField(char *field, int field_size, double value)
{
                int dec, sign, i;
                char *string;
                string = _ecvt(value, field_size-1, &dec, &sign);
                for (i=0;i<(field_size-3)-(dec>=0?dec:0);i++)
                {
                    field[i] = ’0’;
                }
                for (;i<(field_size-3);i++)
                {
                    field[i] = *(string++);
                }
                field[i] = ’.’;
                i++;
                for (;dec<0&&i<field_size;dec++,i++)
                {
                    field[i] = ’0’;
                }
                for (;i<field_size;i++)
                {
                    field[i] = *(string++);
                }
}

void SignedDecField(char *field, int field_size, double value)
{
                if (value >= 0.0) {
                    field[0] = ’ ’;
                    DecField(&field[1],field_size-1,value);
                } else {
                    field[0] = ’-’;
                    DecField(&field[1],field_size-1,-value);
                }
}

void DateField(char *field, DBDATEREC *date)
{
                IntField(field,2,date->day);
                field[2] = ’-’;
                IntField(&field[3],2,date->month);
                field[5] = ’-’;
                IntField(&field[6],4,date->year);
}

void DateTimeField(char *field, DBDATEREC *date)
{
                DateField(field,date);
                field[10] = ’ ’;
                IntField(&field[11],2,date->hour);
                field[13] = ’:’;
                IntField(&field[14],2,date->minute);
                field[16] = ’:’;
                IntField(&field[17],2,date->second);
}

void ZipField(char *field, char *zip)
{
                AlphaField(field,5,zip);
                field[5] = ’-’;
                AlphaField(&field[6],4,&zip[5]);
}

void PhoneField(char *field, char *phone)
{
                AlphaField(field,6,phone);
                field[6] = ’-’;
                AlphaField(&field[7],3,&phone[6]);
                field[10] = ’-’;
                AlphaField(&field[11],3,&phone[9]);
                field[14] = ’-’;
                AlphaField(&field[15],4,&phone[12]);
}

BOOL NewOrderLine(char *field, OL_NEW_ORDER_DATA *oline)
{
                if(!oline->ol_i_id) {
                    AlphaField(field, 78, " ");
                    return FALSE;
                } else {
                    IntField(&field[2], 4, oline-
>ol_supply_w_id);
                    IntField(&field[9], 6, oline->ol_i_id);
                    AlphaField(&field[18], 24, oline-
>ol_i_name);
                    IntField(&field[44], 2, oline->ol_quantity);
                    IntField(&field[50], 3, oline->ol_stock);
                    AlphaField(&field[57], 1, oline-
>ol_brand_generic);
                    field[70] = field[61] = ’$’;
                    DecField(&field[62], 6, oline->ol_i_price);
                    DecField(&field[71], 7, oline->ol_amount);
                    return TRUE;
                }
                return FALSE;
}

BOOL OrderStatusLine(char *field, OL_ORDER_STATUS_DATA *oline)
{
                if(!oline->ol_i_id) {
                    AlphaField(field, 57, " ");
                    return FALSE;
                } else {
                    IntField(&field[2], 4, oline-
>ol_supply_w_id);
                    IntField(&field[13], 6, oline->ol_i_id);
                    IntField(&field[24], 2, oline->ol_quantity);
                    field[31] = ’$’;
                    DecField(&field[32], 8, oline->ol_amount);
                    DateField(&field[46], &oline-
>ol_delivery_d);
                    return TRUE;
                }
                return FALSE;
}

int FormatHtmlPage(char *page, char *dest) {
                enum stag {COPY, SCAN} state = COPY;
                int sx = 0, dx = 0;
                while(page[sx]) {
                    switch(page[sx]) {
                        case ’<’:
                            switch(state) {
                                case COPY:
                                    if(page[sx+1]
== ’P’ && page[sx+2] == ’R’ && page[sx+3] == ’E’ && page[sx+4] == ’>’) {

                while(page[sx++] != ’>’) dest[dx++] = page[sx-1];

                dest[dx++] = page[sx-1];
                                        state =
SCAN;
                                    } else {

                dest[dx++] = page[sx++];
                                    }
                                    break;
                                case SCAN:
                                    if(page[sx+1]
== ’/’ && page[sx+2] == ’P’ && page[sx+3] == ’R’ && page[sx+4] == ’E’ &&
page[sx+5] == ’>’) {

                while(page[sx++] != ’>’) dest[dx++] = page[sx-1];

                dest[dx++] = page[sx-1];
                                        state =
COPY;
                                    } else
if(page[sx+1] == ’I’ && page[sx+2] == ’N’ && page[sx+3] == ’P’ &&
page[sx+4] == ’U’ && page[sx+5] == ’T’) {

                while(page[sx++] != ’>’) dest[dx++] = page[sx-1];

                dest[dx++] = page[sx-1];
                                    } else {

                dest[dx++] = ’&’;

                dest[dx++] = ’l’;

                dest[dx++] = ’t’;

                dest[dx++] = ’;’;
                                        sx++;
                                    }
                                    break;
                            }
                            break;
                        case ’>’:
                            switch(state) {
                                case COPY:
                                    dest[dx++] =
page[sx++];
                                    break;
                                case SCAN:
                                    dest[dx++] =
’&’;
                                    dest[dx++] =
’g’;
                                    dest[dx++] = ’t’;
                                    dest[dx++] = ’;’;
                                    sx++;
                                    break;
                            }
                            break;
                        case ’&’:
                            dest[dx++] = ’&’;
                            dest[dx++] = ’a’;
                            dest[dx++] = ’m’;
                            dest[dx++] = ’p’;
                            dest[dx++] = ’;’;
                            sx++;
                            break;
                        case ’\"’:
                            switch(state) {
                                case COPY:
                                    dest[dx++] =
page[sx++];
                                    break;
                                case SCAN:
                                    dest[dx++] =
’&’;
```

```
                                    dest[dx++] =
’q’;
                                    dest[dx++] =
’u’;
                                    dest[dx++] =
’o’;
                                    dest[dx++] = ’t’;
                                    dest[dx++] = ’;’;
                                    sx++;
                                    break;
                            }
                            break;
                        default:
                            dest[dx++] = page[sx++];
                            break;
                    }
                }
                dest[dx] = ’\0’;
                return dx;
}
```

OUTPUT.H

```
/* Audited: 28 February 1997 */

/* output.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __output_h__
#define __output_h__

#include <tpcc/kit/src/tpcc.h>

void AlphaField(char *, int, char *);
void IntField(char *, int , int);
void DecField(char *, int , double);
void SignedDecField(char *, int, double);
void DateField(char *, DBDATEREC *);
void DateTimeField(char *, DBDATEREC *);
void ZipField(char *, char *);
void PhoneField(char *, char *);
BOOL NewOrderLine(char *, OL_NEW_ORDER_DATA *);
BOOL OrderStatusLine(char *, OL_ORDER_STATUS_DATA *);
int FormatHtmlPage(char *, char *);

#endif __output_h__
```

PAYMENT.C

```
/* Audited: 28 February 1997 */

/* payment.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "payment.h"

int payment_func_parse(assoc *a, int *cookie, PAYMENT_DATA *data, char
*output) {
                int i = 0;
                char errstr[128];
                char all_errors[1024];
                int cid = 0;
                errstr[0] = ’\0’;
                all_errors[0] = ’\0’;
                data->c_id = 0;
                data->c_last[0] = ’\0’;
                while((*a)[0][i]) {
                    switch((*a)[0][i][0]) {
                        case ’c’:
                            *cookie = VerifyInt((*a)[1][i],
4);
                            break;
                        case ’D’:
                            data->d_id =
VerifyShort((*a)[1][i], 2);
                            break;
                        case ’C’:
                            switch((*a)[0][i][1]) {
                                case ’I’:

                if(strlen((*a)[1][i])) cid++;
                                    data->c_id =
VerifyLong((*a)[1][i], 4);
                                    break;
                                case ’W’:
                                    data->c_w_id =
VerifyShort((*a)[1][i], 4);
                                    break;
                                case ’D’:
                                    data->c_d_id =
VerifyShort((*a)[1][i], 2);
                                    break;
                                case ’L’:

                if(strlen((*a)[1][i])) cid++;

                if(VerifyString((*a)[1][i], 16))

                strcpy(data->c_last, (*a)[1][i]);
                                    break;
                                default: break;
                            }
                            break;
                        case ’H’:
                            data->h_amount =
VerifyDouble((*a)[1][i], 7);
                            break;
                        default: break;
                    }
                    ++i;
                }
                if(*cookie < 0 || !get_user(*cookie)->w_id) {
                    sprintf(errstr, BAD_COOKIE_MSG);
                    strcat(all_errors, errstr);
                }
                if(cid != 1)
                    strcat(all_errors, "o You must fill in one
(and only one) of \"Customer ID\" and \"Customer Last Name\"\r\n");
                else if(!data->c_id && !data->c_last[0])
                    strcat(all_errors, "o The \"Customer Last
Name\" field is too long.  The maximum is 16.\r\n");
                switch(data->d_id) {
                    case -1:
                        sprintf(errstr, TOO_LONG_MSG,
"District ID", 2);
                        strcat(all_errors, errstr);
                        break;
                    case -2:
                        sprintf(errstr, NOT_ISDIGIT_MSG,
"District ID");
                        strcat(all_errors, errstr);
                        break;
                    case -3:
                        sprintf(errstr, NO_INPUT_MSG,
"District ID");
                        strcat(all_errors, errstr);
                        break;
                    default: break;
                }
                switch(data->c_id) {
                    case -1:
                        sprintf(errstr, TOO_LONG_MSG,
"Customer ID", 4);
                        strcat(all_errors, errstr);
                        break;
                    case -2:
                        sprintf(errstr, NOT_ISDIGIT_MSG,
"Customer ID");
                        strcat(all_errors, errstr);
                        break;
                    default:break;
                }
                switch(data->c_w_id) {
                    case -1:
                        sprintf(errstr, TOO_LONG_MSG,
"Customer Warehouse ID", 4);
                        strcat(all_errors, errstr);
                        break;
                    case -2:
                        sprintf(errstr, NOT_ISDIGIT_MSG,
"Customer Warehouse ID");
                        strcat(all_errors, errstr);
                        break;
                    case -3:
                        sprintf(errstr, NO_INPUT_MSG,
"Customer Warehouse ID");
                        strcat(all_errors, errstr);
                        break;
                    default:break;
                }
                switch(data->c_d_id) {
                    case -1:
                        sprintf(errstr, TOO_LONG_MSG,
"Customer District ID", 2);
                        strcat(all_errors, errstr);
                        break;
                    case -2:
                        sprintf(errstr, NOT_ISDIGIT_MSG,
"Customer District ID");
                        strcat(all_errors, errstr);
                        break;
                    case -3:
                        sprintf(errstr, NO_INPUT_MSG,
"Customer District ID");
                        strcat(all_errors, errstr);
                        break;
                    default:break;
                }
                if(data->h_amount == HUGE_VAL)
                    strcat(all_errors, "o The \"Amount Paid\"
field is invalid.\r\n  It should be a decimal number of at most two places,\r\n
without a dollar sign.\r\n  The field cannot contain more than 7
characters.\r\n");
                if(data->d_id >= 0 && (data->d_id < 1 || data-
>d_id > 10))
```

```
                        strcat(all_errors, "o The \"District ID\" field
must be in the range 1-10.\r\n");
                if(data->c_w_id >= 0 && (data->c_w_id < 1 ||
data->c_w_id > MAXWH)) {
                        sprintf(errstr, "o The \"Customer
Warehouse ID\" field must be in the range 1-%d.\r\n", MAXWH);
                        strcat(all_errors, errstr);
                }
                if(data->c_d_id >= 0 && (data->c_d_id < 1 ||
data->c_d_id > 10))
                        strcat(all_errors, "o The \"Customer
District ID\" field must be in the range 1-10.\r\n");
                data->w_id = get_user(*cookie)->w_id;
                if(all_errors[0]) {
                        sprintf(output, errorpage, all_errors);
                        return 0;
                } else return 1;
}

int payment_func_process(PAYMENT_DATA *data, int cookie) {
#ifdef DB_PRESENT
                return SQLPayment(get_user(cookie)-
>dbhandle, data, DEADLOCK_RETRY);
#else
                data->c_since.year = 1973;
                data->c_since.month = 1;
                data->c_since.day = 9;
                data->h_date.year = 1996;
                data->h_date.month = 4;
                data->h_date.day = 11;
                data->h_date.hour = 18;
                data->h_date.minute = 42;
                data->h_date.second = 9;
                strcpy(data->w_street_1, "1313 Mockingbird
Ln");
                strcpy(data->w_street_2, "Suite 666");
                strcpy(data->w_city, "Huntsville");
                strcpy(data->w_state, "AL");
                strcpy(data->w_zip, "358051234");
                strcpy(data->d_street_1, "1225 Fubar Drive");
                strcpy(data->d_street_2, "Blicky-Blecky");
                strcpy(data->d_city, "Hornswaggle");
                strcpy(data->d_state, "AL");
                strcpy(data->d_zip, "356259876");
                strcpy(data->c_first, "Frederick");
                strcpy(data->c_middle, "J.");
                if(!data->c_last[0]) strcpy(data->c_last,
"Johnson");
                else data->c_id = 123;
                strcpy(data->c_street_1, "6500 Fnord Street");
                strcpy(data->c_street_2, "Apartment 1492");
                strcpy(data->c_city, "Fizzywog");
                strcpy(data->c_state, "TN");
                strcpy(data->c_zip, "343875678");
                strcpy(data->c_phone, "ABCDEF3341234567");
                strcpy(data->c_credit, "D7");
                data->c_credit_lim = 1234567890.40;
                data->c_discount = 0.1234;
                data->c_balance = -12345.76;
                strcpy(data->c_data, "This customer is a freak.
He frequently carries  automatic weapons, and should be watched closely
at all times.  Hide the silverware.");
                return 1;
#endif DB_PRESENT
}

void payment_func_format(char *output, PAYMENT_DATA *data, int cookie)
{
                char buf[3000];
                sprintf(buf, presp, cookie);
                data->c_discount *= 100;
    DateTimeField(&buf[PDT], &data->h_date);
                IntField(&buf[PW], 4, data->w_id);
                IntField(&buf[PD], 2, data->d_id);
                AlphaField(&buf[PWA1], 20, data->w_street_1);
                AlphaField(&buf[PDA1], 20, data->d_street_1);
                AlphaField(&buf[PWA2], 20, data->w_street_2);
                AlphaField(&buf[PDA2], 20, data->d_stree t_2);
                AlphaField(&buf[PWCT], 20, data->w_city);
                AlphaField(&buf[PWST], 2, data->w_state);
                ZipField(&buf[PWZP], data->w_zip);
                AlphaField(&buf[PDCT], 20, data->d_city);
                AlphaField(&buf[PDST], 2, data->d_state);
                ZipField(&buf[PDZP], data->d_zip);
                IntField(&buf[PC], 4, data->c_id);
                IntField(&buf[PCW], 4, data->c_w_id);
                IntField(&buf[PCD], 2, data->c_d_id);
                AlphaField(&buf[PCF], 16, data->c_first);
                AlphaField(&buf[PCM], 2, data->c_middle);
                AlphaField(&buf[PCL], 16, data->c_last);
                DateField(&buf[PSINCE], &data->c_since);
                AlphaField(&buf[PCA1], 20, data->c_street_1);
                AlphaField(&buf[PCRED], 2, data->c_credit);
                AlphaField(&buf[PCA2], 20, data->c_street_2);
                DecField(&buf[PDSC], 5, data->c_discount);
                AlphaField(&buf[PCCT], 20, data->c_city);
                AlphaField(&buf[PCST], 2, data->c_state);
                ZipField(&buf[PCZP], data->c_zip);
                PhoneField(&buf[PPHN], data->c_phone);
                DecField(&buf[PAMT], 7, data->h_amount);
                SignedDecField(&buf[PBAL], 14, data-
>c_balance);
                DecField(&buf[PCLIM], 13, data->c_credit_lim);
                AlphaField(&buf[PCDAT1], 50, data->c_data);
                if(strlen(data->c_data) > 50)
                        AlphaField(&buf[PCDAT2], 50, &(data-
>c_data[50]));
                else AlphaField(&buf[PCDAT2], 50, " ");
                if(strlen(data->c_data) > 100)
                        AlphaField(&buf[PCDAT3], 50, &(data-
>c_data[100]));
                else AlphaField(&buf[PCDAT3], 50, " ");
                if(strlen(data->c_data) > 150)
                        AlphaField(&buf[PCDAT4], 50, &(data-
>c_data[150]));
                else AlphaField(&buf[PCDAT4], 50, " ");
                FormatHtmlPage(buf, output);
}

void payment_func_main(assoc *a, char *output) {
                int cookie;
                PAYMENT_DATA data;
                if(!payment_func_parse(a, &cookie, &data,
output)) return;
                if(!payment_func_process(&data, cookie)) {
                        sprintf(output, dberrpage, cookie);
                        return;
                }
                payment_func_format(output, &data, cookie);
}
```

PAYMENT.H

```
/* Audited: 28 February 1997 */

/* payment.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __payment_h__
#define __payment_h__

#include "context.h"
#include <tpcc/kit/src/tpcc.h>
#include "inputparser.h"
#include "output.h"
#include "errors.h"
#include "options.h"

#define PAYMENT_FUNC 6

static char presp[] =
"<HTML><HEAD><TITLE>TPC-C:
Payment</TITLE></HEAD><BODY><PRE>"
"                              Payment\r\n"
"Date: XXXXXXXXXXXXXXXXXXX\r\n"
"\r\n"
"Warehouse: XXXX                      District: XX\r\n"
"XXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX\r\n"
"XXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX\r\n"
"XXXXXXXXXXXXXXXXXXXX XX XXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX XX XXXXXXXXXX\r\n"
"\r\n"
"Customer: XXXX  Cust-Warehouse: XXXX  Cust-District: XX\r\n"
"Name:   XXXXXXXXXXXXXXXX XX XXXXXXXXXXXXXXXX     Since:
XXXXXXXXXX\r\n"
"       XXXXXXXXXXXXXXXXXXXX                  Credit: XX\r\n"
"       XXXXXXXXXXXXXXXXXXXX                  %%Disc:  XXXXX\r\n"
"       XXXXXXXXXXXXXXXXXXXX XX XXXXXXXXXX       Phone:
XXXXXXXXXXXXXXXXXXX\r\n"
"\r\n"
"Amount Paid:         $XXXXXXX      New Cust-Balance:
$XXXXXXXXXXXXXX\r\n"
"Credit Limit:   $XXXXXXXXXXXXX\r\n"
"\r\n"
"Cust-Data:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX\r\
n"
"
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX\r\
n"
"
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX\r\
n"
"
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX\r\
n"
"\r\n"
"</PRE><P><FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\">"
"<INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"New Order\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Payment\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Delivery\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Order-Status\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Stock-Level\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Exit\">"
"</FORM></P></BODY></HTML>\r\n";

/* Character indices of field locations */
#define PDT 111
```

```
#define PW 145
#define PD 185
#define PWA1 189
#define PDA1 230
#define PWA2 252
#define PDA2 293
#define PWCT 315
#define PWST 336
#define PWZP 339
#define PDCT 356
#define PDST 377
#define PDZP 380
#define PC 404
#define PCW 426
#define PCD 447
#define PCF 459
#define PCM 476
#define PCL 479
#define PSINCE 508
#define PCA1 528
#define PCRED 577
#define PCA2 589
#define PDSC 638
#define PCCT 653
#define PCST 674
#define PCZP 677
#define PPHN 702
#define PAMT 748
#define PBAL 780
#define PCLIM 813
#define PCDAT1 841
#define PCDAT2 904
#define PCDAT3 967
#define PCDAT4 1030

extern void e_log(char *);
void payment_func_main(assoc *, char *);
int payment_func_parse(assoc *, int *, PAYMENT_DATA *, char *);
int payment_func_process(PAYMENT_DATA *, int);
void payment_func_format(char *, PAYMENT_DATA *, int);

#endif __payment_h__
```

PROCESSLOGIN.C

```
/* Audited: 28 February 1997 */

/* processlogin.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "processlogin.h"

int processlogin_parse(assoc *a, short *w_id, short *d_id) {
                int i = 0;
                while((*a)[0][i]) {
                    switch((*a)[0][i][0]) {
                        case 'W':
                            *w_id = VerifyShort((*a)[1][i],
3);
                            break;
                        case 'd':
                            *d_id = VerifyShort((*a)[1][i],
2);
                            break;
                        default: break;
                    }
                    ++i;
                }
                if(*w_id < 1 || *d_id < 1 || *d_id > 10 || *w_id >
MAXWH)
                    return 0;
                else
                    return 1;
}

void processlogin_func_main(assoc *a, char *output) {
                short w_id, d_id;
                int cookie;
                if(!processlogin_parse(a, &w_id, &d_id))
                    sprintf(output, logerrpage, MAXWH);
                else if((cookie = create_user(w_id, d_id)) < 0)
                    sprintf(output, enosvcdbo);
                else if(cookie >= MAX_USERS + TokenIndex)
                    sprintf(output, noconnpage, MAX_USERS
+ TokenIndex);
                else
                    sprintf(output, menupage, cookie);
}
```

PROCESSLOGIN.H

```
/* Audited: 28 February 1997 */

/* processlogin.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __processlogin_h__
#define __processlogin_h__

#include "context.h"
#include "inputparser.h"

extern void e_log(char *);

#define PROCESSLOGIN_FUNC 2

static char logerrpage[] =
"<HTML><HEAD><TITLE>Welcome to TPC-C</TITLE></HEAD><BODY>"
"<P>The Warehouse and/or District ID that you entered is either absent or "
"invalid in some way.  You must provide data for both fields.  The
Warehouse "
"ID an integer in the range 1 to %d.  The District ID must be an integer "
"in the range 1 to 10.</P> "
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"f\" VALUE=\"L\">"
"Your Warehouse ID: <INPUT NAME=\"W\" SIZE=4><BR>"
"Your District ID:  <INPUT NAME=\"d\" SIZE=2><BR><HR>"
"<INPUT TYPE=\"submit\">"
"</FORM></BODY></HTML>\r\n";

static char menupage[] =
"<HTML><HEAD><TITLE>TPC-C: Main Menu</TITLE></HEAD><BODY>"
"<P>Please select an action from the menu of buttons below.</P><HR>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\">"
"<INPUT TYPE=\"hidden\" NAME=\"f\" VALUE=\"M\">"
"<INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"New Order\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Payment\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Delivery\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Order-Status\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Stock-Level\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Exit\">"
"</FORM></P></BODY></HTML>\r\n";

static char noconnpage[] =
"<HTML><HEAD><TITLE>TPC-C: Can't
Connect</TITLE></HEAD><BODY>"
"<P>Sorry, all %d database connections are currently in use."
"  Please try again later.</P>"
"</BODY></html>\r\n";

static char enosvcdbo[] =
"<HTML><HEAD><TITLE>TPC-C: Service
Unavailable</TITLE></HEAD><BODY>"
"<P>The TPC-C Application Program (TPCC.DLL) failed to establish a
connection to the database"
" for this session.  As a result, no transactions can be processed.  Please try
again later."
"  If the problem persists, email <a
href=\"mailto:rothomas@ingr.com\">Robert Thomas</a> and"
" report seeing this message.</BODY></html>";

void processlogin_func_main(assoc *, char *);
int processlogin_parse(assoc *, short *, short *);

#endif __processlogin_h__
```

QUERY_FORM.C

```
/* Audited: 28 February 1997 */

/* query_form.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "query_form.h"

void query_form_func_main(assoc *a, char *output) {
                int i = 0, cookie = -1;
                char *form = 0;
                char wid[5];
                while((*a)[0][i]) {
                    switch((*a)[0][i][0]) {
                        case 'b':
                            switch((*a)[1][i][0]) {
                                case 'N': form =
noform; break;
                                case 'P': form = pform;
break;
                                case 'O': form =
oform; break;
                                case 'D': form =
dform; break;
                                case 'S': form = sform;
break;
                                default: sprintf(output,
"Invalid Function Called"); return;
                            }
                            break;
                        case 'c':
                            cookie = VerifyInt((*a)[1][i],
4);
                            break;
                        default: break;
                    }
                    ++i;
                }
                if(cookie < TokenIndex || cookie > MAX_USERS
+ TokenIndex) {
                        sprintf(output, "Invalid cookie value.");
                        return;
                }
                if(!get_user(cookie)->w_id) {
                        sprintf(output, "Dead cookie value
recieved.");
                        return;
                }
                IntField(wid, 4, get_user(cookie)->w_id);
                wid[4] = '\0';
                sprintf(output, form, cookie, wid);
}
```

QUERY_FORM.H

```
/* Audited: 28 February 1997 */

/* query_form.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __query_form_h__
#define __query_form_h__

#include "context.h"
#include "inputparser.h"
#include "output.h"

#define QUERY_FORM_FUNC 3

extern void e_log(char *);

static char dform[] =
"<HTML><HEAD><TITLE>TPC-C: Delivery</TITLE></HEAD><BODY>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"f\" VALUE=\"D\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\"><PRE>"
"                                Delivery\r\n"
"Warehouse: %4s\r\n"
"\r\n"
"Carrier Number: <INPUT NAME=\"OC\" SIZE=2>\r\n"
"\r\n"
"Execution Status:"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n</PRE>"
"<HR><INPUT TYPE=\"submit\"></FORM></BODY></HTML>\r\n";

static char sform[] =
"<HTML><HEAD><TITLE>TPC-C: Stock-Level</TITLE></HEAD><BODY>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"f\" VALUE=\"S\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\"><PRE>"
"                              Stock-Level\r\n"
"Warehouse: %4s  District:\r\n"
"\r\n"
"Stock Level Threshold: <INPUT NAME=\"t\" SIZE=2>\r\n"
"\r\n"
"low stock:"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n</PRE>"
"<HR><INPUT TYPE=\"submit\"></FORM></BODY></HTML>\r\n";

static char pform[] =
"<HTML><HEAD><TITLE>TPC-C: Payment</TITLE></HEAD><BODY>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"f\" VALUE=\"P\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\"><PRE>"
"                                Payment\r\n"
"Date:\r\n"
"\r\n"
"Warehouse: %4s                      District: <INPUT NAME=\"D\"
SIZE=2>\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"Customer: <INPUT NAME=\"CI\" SIZE=4> Cust-Warehouse: <INPUT
NAME=\"CW\" SIZE=4> Cust-District: <INPUT NAME=\"CD\" SIZE=2>\r\n"
"Name:                     <INPUT NAME=\"CL\" SIZE=16>    Since:\r\n"
"                                             Credit:\r\n"
"                                             %%Disc:\r\n"
"                                             Phone:\r\n"
"\r\n"
"Amount Paid:          $<INPUT NAME=\"H\" SIZE=7>    New Cust-
Balance:\r\n"
"Credit Limit:\r\n"
"\r\n"
"Cust-Data:\r\n\r\n\r\n\r\n"
"\r\n"
"</PRE><HR><INPUT TYPE=\"submit\"></FORM></BODY></HTML>\r\n";

static char oform[] = "<HTML><HEAD><TITLE>TPC-C: Order-
Status</TITLE></HEAD><BODY>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"f\" VALUE=\"O\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\"><PRE>"
"                              Order-Status\r\n"
"Warehouse: %4s   District: <INPUT NAME=\"D\" SIZE=2>\r\n"
"Customer: <INPUT NAME=\"CI\" SIZE=4>  Name:                    <INPUT
NAME=\"CL\" SIZE=16>\r\n"
"Cust-Balance:\r\n"
"\r\n"
"Order-Number:           Entry-Date:                 Carrier-Number:\r\n"
"Supply-W     Item-Id    Qty     Amount      Delivery-Date\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"</PRE><HR><INPUT TYPE=\"submit\"></FORM></BODY></HTML>\r\n";

static char noform[] = "<HTML><HEAD><TITLE>TPC-C: New
Order</TITLE></HEAD><BODY>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"f\" VALUE=\"N\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\"><PRE>"
"                                New Order\r\n"
"Warehouse: %4s   District: <INPUT NAME=\"D\" SIZE=2>
Date:\r\n"
"Customer: <INPUT NAME=\"CI\" SIZE=4>  Name:                  Credit:
%%Disc:\r\n"
"Order Number:          Number of Lines:         W_tax:         D_tax:\r\n"
"\r\n"
" Supp_W  Item_Id  Item Name               Qty  Stock  B/G  Price
Amount\r\n"
"  <INPUT NAME=\"OS01\" SIZE=4>   <INPUT NAME=\"OI01\" SIZE=6>
<INPUT NAME=\"OQ01\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS02\" SIZE=4>   <INPUT NAME=\"OI02\" SIZE=6>
<INPUT NAME=\"OQ02\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS03\" SIZE=4>   <INPUT NAME=\"OI03\" SIZE=6>
<INPUT NAME=\"OQ03\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS04\" SIZE=4>   <INPUT NAME=\"OI04\" SIZE=6>
<INPUT NAME=\"OQ04\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS05\" SIZE=4>   <INPUT NAME=\"OI05\" SIZE=6>
<INPUT NAME=\"OQ05\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS06\" SIZE=4>   <INPUT NAME=\"OI06\" SIZE=6>
<INPUT NAME=\"OQ06\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS07\" SIZE=4>   <INPUT NAME=\"OI07\" SIZE=6>
<INPUT NAME=\"OQ07\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS08\" SIZE=4>   <INPUT NAME=\"OI08\" SIZE=6>
<INPUT NAME=\"OQ08\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS09\" SIZE=4>   <INPUT NAME=\"OI09\" SIZE=6>
<INPUT NAME=\"OQ09\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS10\" SIZE=4>   <INPUT NAME=\"OI10\" SIZE=6>
<INPUT NAME=\"OQ10\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS11\" SIZE=4>   <INPUT NAME=\"OI11\" SIZE=6>
<INPUT NAME=\"OQ11\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS12\" SIZE=4>   <INPUT NAME=\"OI12\" SIZE=6>
<INPUT NAME=\"OQ12\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS13\" SIZE=4>   <INPUT NAME=\"OI13\" SIZE=6>
<INPUT NAME=\"OQ13\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS14\" SIZE=4>   <INPUT NAME=\"OI14\" SIZE=6>
<INPUT NAME=\"OQ14\" SIZE=2>\r\n"
"  <INPUT NAME=\"OS15\" SIZE=4>   <INPUT NAME=\"OI15\" SIZE=6>
<INPUT NAME=\"OQ15\" SIZE=2>\r\n"
"Execution Status:                                   Total:  $"
"</PRE><HR><INPUT TYPE=\"submit\"></FORM></BODY></HTML>\r\n";

void query_form_func_main(assoc *, char *);
void query_form_func_parse(assoc *);

#endif __query_form_h__
```

SQLDB.H

```
#ifndef _INC_SQLDB
#define _INC_SQLDB

#ifdef __cplusplus
                            extern "C" {
#endif

/*****************************************************************************
*                                                                            *
*       SQLDB.H - DB-Library header file for the Microsoft SQL Server.       *
*                                                                            *
*     Copyright (c) 1989 - 1995 by Microsoft Corp.  All rights reserved.     *
*                                                                            *
*****************************************************************************/

// Macros for setting the PLOGINREC
#define DBSETLHOST(a,b)    dbsetlname   ((a), (b), DBSETHOST)
#define DBSETLUSER(a,b)    dbsetlname   ((a), (b), DBSETUSER)
#define DBSETLPWD(a,b)     dbsetlname   ((a), (b), DBSETPWD)
#define DBSETLAPP(a,b)     dbsetlname   ((a), (b), DBSETAPP)
#define BCP_SETL(a,b)      bcp_setl    ((a), (b))
#define DBSETLNATLANG(a,b) dbsetlname   ((a), (b), DBSETLANG)
#define DBSETLPACKET(a,b)  dbsetlpacket ((a), (b))
#define DBSETLSECURE(a)    dbsetlname   ((a), 0,   DBSETSECURE)
#define DBSETLVERSION(a,b) dbsetlname   ((a), 0,  (b))
#define DBSETLTIME(a,b)           dbsetlname    ((a), (LPCSTR)(ULONG)(b),
DBSETLOGINTIME)

/*****************************************************************************
* Windows 3.x and Non-Windows 3.x differences.                               *
*****************************************************************************/

#ifdef DBMSWIN

extern void SQLAPI dbwinexit(void);

void SQLAPI dblocklib (void);
void SQLAPI dbunlocklib (void);

#define DBLOCKLIB()   dblocklib()
#define DBUNLOCKLIB() dbunlocklib()

#define DBERRHANDLE_PROC FARPROC
#define DBMSGHANDLE_PROC FARPROC

extern DBERRHANDLE_PROC dberrhandle (DBERRHANDLE_PROC);
extern DBMSGHANDLE_PROC dbmsghandle (DBMSGHANDLE_PROC);

#else

#define dbwinexit()

#define DBLOCKLIB()
#define DBUNLOCKLIB()

typedef INT (SQLAPI *DBERRHANDLE_PROC)(PDBPROCESS, INT, INT,
INT, LPCSTR, LPCSTR);
typedef INT (SQLAPI *DBMSGHANDLE_PROC)(PDBPROCESS, DBINT,
INT, INT, LPCSTR, LPCSTR, LPCSTR, DBUSMALLINT);

extern DBERRHANDLE_PROC SQLAPI
dberrhandle(DBERRHANDLE_PROC);
extern DBMSGHANDLE_PROC SQLAPI
dbmsghandle(DBMSGHANDLE_PROC);
extern DBERRHANDLE_PROC SQLAPI dbprocerrhandle(PDBHANDLE,
DBERRHANDLE_PROC);
extern DBMSGHANDLE_PROC SQLAPI dbprocmsghandle(PDBHANDLE,
DBMSGHANDLE_PROC);


#endif


/*****************************************************************************
* Function Prototypes                                                        *
*****************************************************************************/

// Functions macros
#define DBCMDROW(a)      dbcmdrow(a)
#define DBCOUNT(a)       dbcount (a)
#define DBCURCMD(a)      dbcurcmd(a)
#define DBCURROW(a)      dbcurrow(a)
#define DBDEAD(a)        dbdead(a)
#define DBFIRSTROW(a)    dbfirstrow(a)
#define DBGETTIME()      dbgettime()
#define DBISAVAIL(a)     dbisavail(a)
#define DBLASTROW(a)     dblastrow(a)
#define DBMORECMDS(a)    dbmorecmds(a)
#define DBNUMORDERS(a)   dbnumorders(a)
#define dbrbuf(a)        ((DBINT)dbdataready(a))
#define DBRBUF(a)        ((DBINT)dbdataready(a))
#define DBROWS(a)        dbrows (a)
#define DBROWTYPE(a)     dbrowtype (a)

// Two-phase commit functions
extern RETCODE      SQLAPI abort_xact (PDBPROCESS, DBINT);
extern void         SQLAPI build_xact_string (LPCSTR, LPCSTR, DBINT,
LPSTR);
extern void         SQLAPI close_commit (PDBPROCESS);
extern RETCODE      SQLAPI commit_xact (PDBPROCESS, DBINT);
extern PDBPROCESS   SQLAPI open_commit (PLOGINREC, LPCSTR);
extern RETCODE      SQLAPI remove_xact (PDBPROCESS, DBINT, INT);
extern RETCODE      SQLAPI scan_xact (PDBPROCESS, DBINT);
extern DBINT        SQLAPI start_xact (PDBPROCESS, LPCSTR, LPCSTR,
INT);
extern INT          SQLAPI stat_xact (PDBPROCESS, DBINT);

// BCP functions
extern DBINT        SQLAPI bcp_batch (PDBPROCESS);
extern RETCODE      SQLAPI bcp_bind (PDBPROCESS, LPCBYTE, INT,
DBINT, LPCBYTE, INT, INT, INT);
extern RETCODE      SQLAPI bcp_colfmt (PDBPROCESS, INT, BYTE, INT,
DBINT, LPCBYTE, INT, INT);
extern RETCODE      SQLAPI bcp_collen (PDBPROCESS, DBINT, INT);
extern RETCODE      SQLAPI bcp_colptr (PDBPROCESS, LPCBYTE, INT);
extern RETCODE      SQLAPI bcp_columns (PDBPROCESS, INT);
extern RETCODE      SQLAPI bcp_control (PDBPROCESS, INT, DBINT);
extern DBINT        SQLAPI bcp_done (PDBPROCESS);
extern RETCODE      SQLAPI bcp_exec (PDBPROCESS, LPDBINT);
extern RETCODE      SQLAPI bcp_init (PDBPROCESS, LPCSTR, LPCSTR,
LPCSTR, INT);
extern RETCODE      SQLAPI bcp_moretext (PDBPROCESS, DBINT,
LPCBYTE);
extern RETCODE      SQLAPI bcp_readfmt (PDBPROCESS, LPCSTR);
extern RETCODE      SQLAPI bcp_sendrow (PDBPROCESS);
extern RETCODE      SQLAPI bcp_setl (PLOGINREC, BOOL);
extern RETCODE      SQLAPI bcp_writefmt (PDBPROCESS, LPCSTR);

// Standard DB-Library functions
extern LPCBYTE      SQLAPI dbadata (PDBPROCESS, INT, INT);
extern DBINT        SQLAPI dbadlen (PDBPROCESS, INT, INT);
extern RETCODE      SQLAPI dbaltbind (PDBPROCESS, INT, INT, INT,
DBINT, LPCBYTE);
extern INT          SQLAPI dbaltcolid (PDBPROCESS, INT, INT);
extern DBINT        SQLAPI dbaltlen (PDBPROCESS, INT, INT);
extern INT          SQLAPI dbaltop (PDBPROCESS, INT, INT);
extern INT          SQLAPI dbalttype (PDBPROCESS, INT, INT);
extern DBINT        SQLAPI dbaltutype (PDBPROCESS, INT, INT);
extern RETCODE      SQLAPI dbanullbind (PDBPROCESS, INT, INT,
LPCDBINT);
extern RETCODE      SQLAPI dbbind (PDBPROCESS, INT, INT, DBINT,
LPBYTE);
extern LPCBYTE      SQLAPI dbbylist (PDBPROCESS, INT, LPINT);
extern RETCODE      SQLAPI dbcancel (PDBPROCESS);
extern RETCODE      SQLAPI dbcanquery (PDBPROCESS);
extern LPCSTR       SQLAPI dbchange (PDBPROCESS);
extern RETCODE      SQLAPI dbclose (PDBPROCESS);
extern void         SQLAPI dbclrbuf (PDBPROCESS, DBINT);
extern RETCODE      SQLAPI dbclropt (PDBPROCESS, INT, LPCSTR);
extern RETCODE      SQLAPI dbcmd (PDBPROCESS, LPCSTR);
extern RETCODE      SQLAPI dbcmdrow (PDBPROCESS);
extern BOOL         SQLAPI dbcolbrowse (PDBPROCESS, INT);
extern RETCODE      SQLAPI dbcolinfo (PDBHANDLE, INT, INT, INT,
LPDBCOL);
extern DBINT        SQLAPI dbcollen (PDBPROCESS, INT);
extern LPCSTR       SQLAPI dbcolname (PDBPROCESS, INT);
extern LPCSTR       SQLAPI dbcolsource (PDBPROCESS, INT);
extern INT          SQLAPI dbcoltype (PDBPROCESS, INT);
extern DBINT        SQLAPI dbcolutype (PDBPROCESS, INT);
extern INT          SQLAPI dbconvert (PDBPROCESS, INT, LPCBYTE,
DBINT, INT, LPBYTE, DBINT);
extern DBINT        SQLAPI dbcount (PDBPROCESS);
extern INT          SQLAPI dbcurcmd (PDBPROCESS);
extern DBINT        SQLAPI dbcurrow (PDBPROCESS);
extern RETCODE      SQLAPI dbcursor (PDBCURSOR, INT, INT, LPCSTR,
LPCSTR);
extern RETCODE      SQLAPI dbcursorbind (PDBCURSOR, INT, INT,
DBINT, LPDBINT, LPBYTE);
extern RETCODE      SQLAPI dbcursorclose (PDBHANDLE);
extern RETCODE      SQLAPI dbcursorcolinfo (PDBCURSOR, INT, LPSTR,
LPINT, LPDBINT, LPINT);
extern RETCODE      SQLAPI dbcursorfetch (PDBCURSOR,  INT, INT);
extern RETCODE      SQLAPI dbcursorfetchex (PDBCURSOR, INT, DBINT,
DBINT, DBINT);
extern RETCODE      SQLAPI dbcursorinfo (PDBCURSOR, LPINT,
LPDBINT);
extern RETCODE      SQLAPI dbcursorinfoex (PDBCURSOR,
LPDBCURSORINFO);
extern PDBCURSOR    SQLAPI dbcursoropen (PDBPROCESS, LPCSTR,
INT, INT,UINT, LPDBINT);
extern LPCBYTE      SQLAPI dbdata (PDBPROCESS, INT);
extern BOOL         SQLAPI dbdataready (PDBPROCESS);
extern RETCODE      SQLAPI dbdatecrack (PDBPROCESS,
LPDBDATEREC, LPCDBDATETIME);
extern DBINT        SQLAPI dbdatlen (PDBPROCESS, INT);
extern BOOL         SQLAPI dbdead (PDBPROCESS);
extern void         SQLAPI dbexit (void);
extern RETCODE      SQLAPI dbfcmd (PDBPROCESS, LPCSTR, ...);
extern DBINT        SQLAPI dbfirstrow (PDBPROCESS);
extern void         SQLAPI dbfreebuf (PDBPROCESS);
extern void         SQLAPI dbfreelogin (PLOGINREC);
extern void         SQLAPI dbfreequal (LPCSTR);
extern LPSTR        SQLAPI dbgetchar (PDBPROCESS, INT);
extern SHORT        SQLAPI dbgetmaxprocs (void);
extern INT          SQLAPI dbgetoff (PDBPROCESS, DBUSMALLINT, INT);
extern UINT         SQLAPI dbgetpacket (PDBPROCESS);
extern STATUS       SQLAPI dbgetrow (PDBPROCESS, DBINT);
extern INT          SQLAPI dbgettime (void);
extern LPVOID       SQLAPI dbgetuserdata (PDBPROCESS);
extern BOOL        SQLAPI dbhasretstat (PDBPROCESS);
extern LPCSTR      SQLAPI dbinit (void);
extern BOOL        SQLAPI dbisavail (PDBPROCESS);
extern BOOL        SQLAPI dbiscount (PDBPROCESS);
extern BOOL        SQLAPI dbisopt (PDBPROCESS, INT, LPCSTR);
extern DBINT       SQLAPI dblastrow (PDBPROCESS);
extern PLOGINREC   SQLAPI dblogin (void);
extern RETCODE     SQLAPI dbmorecmds (PDBPROCESS);
extern RETCODE     SQLAPI dbmoretext (PDBPROCESS, DBINT,
LPCBYTE);
extern LPCSTR      SQLAPI dbname (PDBPROCESS);
extern STATUS      SQLAPI dbnextrow (PDBPROCESS);
extern RETCODE     SQLAPI dbnullbind (PDBPROCESS, INT, LPCDBINT);
extern INT         SQLAPI dbnumalts (PDBPROCESS, INT);
extern INT         SQLAPI dbnumcols (PDBPROCESS);
extern INT         SQLAPI dbnumcompute (PDBPROCESS);
extern INT         SQLAPI dbnumorders (PDBPROCESS);
extern INT         SQLAPI dbnumrets (PDBPROCESS);
extern PDBPROCESS  SQLAPI dbopen (PLOGINREC, LPCSTR);
extern INT         SQLAPI dbordercol (PDBPROCESS, INT);
extern RETCODE     SQLAPI dbprocinfo (PDBPROCESS,
LPDBPROCINFO);
extern void        SQLAPI dbprhead (PDBPROCESS);
extern RETCODE     SQLAPI dbprrow (PDBPROCESS);
extern LPCSTR      SQLAPI dbprtype (INT);
extern LPCSTR      SQLAPI dbqual (PDBPROCESS, INT, LPCSTR);
extern DBINT       SQLAPI dbreadpage (PDBPROCESS, LPCSTR, DBINT,
LPBYTE);
extern DBINT       SQLAPI dbreadtext (PDBPROCESS, LPVOID, DBINT);
extern RETCODE     SQLAPI dbresults (PDBPROCESS);
extern LPCBYTE     SQLAPI dbretdata (PDBPROCESS, INT);
extern DBINT       SQLAPI dbretlen (PDBPROCESS, INT);
extern LPCSTR      SQLAPI dbretname (PDBPROCESS, INT);
extern DBINT       SQLAPI dbretstatus (PDBPROCESS);
extern INT         SQLAPI dbrettype (PDBPROCESS, INT);
extern RETCODE     SQLAPI dbrows (PDBPROCESS);
extern STATUS      SQLAPI dbrowtype (PDBPROCESS);
extern RETCODE     SQLAPI dbrpcinit (PDBPROCESS, LPCSTR,
DBSMALLINT);
extern RETCODE     SQLAPI dbrpcparam (PDBPROCESS, LPCSTR,
BYTE, INT, DBINT, DBINT, LPCBYTE);
extern RETCODE     SQLAPI dbrpcsend (PDBPROCESS);
extern RETCODE     SQLAPI dbrpcexec (PDBPROCESS);
extern void        SQLAPI dbrpwclr (PLOGINREC);
extern RETCODE     SQLAPI dbrpwset (PLOGINREC, LPCSTR, LPCSTR,
INT);
extern INT         SQLAPI dbserverenum (USHORT, LPSTR, USHORT,
LPUSHORT);
extern void        SQLAPI dbsetavail (PDBPROCESS);
extern RETCODE     SQLAPI dbsetmaxprocs (SHORT);
extern RETCODE     SQLAPI dbsetlname (PLOGINREC, LPCSTR, INT);
extern RETCODE     SQLAPI dbsetlogintime (INT);
extern RETCODE     SQLAPI dbsetlpacket (PLOGINREC, USHORT);
extern RETCODE     SQLAPI dbsetnull (PDBPROCESS, INT, INT,
LPCBYTE);
extern RETCODE     SQLAPI dbsetopt (PDBPROCESS, INT, LPCSTR);
extern RETCODE     SQLAPI dbsettime (INT);
extern void        SQLAPI dbsetuserdata (PDBPROCESS, LPVOID);
extern RETCODE     SQLAPI dbsqlexec (PDBPROCESS);
extern RETCODE     SQLAPI dbsqlok (PDBPROCESS);
extern RETCODE     SQLAPI dbsqlsend (PDBPROCESS);
extern RETCODE     SQLAPI dbstrcpy (PDBPROCESS, INT, INT, LPSTR);
extern INT         SQLAPI dbstrlen (PDBPROCESS);
extern BOOL        SQLAPI dbtabbrowse (PDBPROCESS, INT);
extern INT         SQLAPI dbtabcount (PDBPROCESS);
extern LPCSTR      SQLAPI dbtabname (PDBPROCESS, INT);
extern LPCSTR      SQLAPI dbtabsource (PDBPROCESS, INT, LPINT);
extern INT         SQLAPI dbtsnewlen (PDBPROCESS);
extern LPCDBBINARY  SQLAPI dbtsnewval (PDBPROCESS);
extern RETCODE     SQLAPI dbtsput (PDBPROCESS, LPCDBBINARY,
INT, INT, LPCSTR);
extern LPCDBBINARY  SQLAPI dbtxptr (PDBPROCESS, INT);
extern LPCDBBINARY  SQLAPI dbtxtimestamp (PDBPROCESS, INT);
extern LPCDBBINARY  SQLAPI dbtxtsnewval (PDBPROCESS);
extern RETCODE     SQLAPI dbtxtsput (PDBPROCESS, LPCDBBINARY,
INT);
extern RETCODE     SQLAPI dbuse (PDBPROCESS, LPCSTR);
extern BOOL        SQLAPI dbvarylen (PDBPROCESS, INT);
extern BOOL        SQLAPI dbwillconvert (INT, INT);
extern RETCODE     SQLAPI dbwritepage (PDBPROCESS, LPCSTR,
DBINT, DBINT, LPBYTE);
extern RETCODE     SQLAPI dbwritetext (PDBPROCESS, LPCSTR,
LPCDBBINARY, DBTINYINT, LPCDBBINARY, BOOL, DBINT, LPCBYTE);
extern RETCODE     SQLAPI dbupdatetext(PDBPROCESS, LPCSTR,
LPCDBBINARY, LPCDBBINARY, INT, DBINT, DBINT, LPCSTR, DBINT,
LPCDBBINARY);

#ifdef __cplusplus
}
#endif

#endif // _INC_SQLDB
```

SQLFRONT.H

```
#ifndef _INC_SQLFRONT
#define _INC_SQLFRONT

#ifdef DBNTWIN32
                    #ifndef _WINDOWS_
                         #pragma message (__FILE__ " : db-library
error: windows.h must be included before sqlfront.h.")
                    #endif
#endif

#ifdef __cplusplus
                    extern "C" {
#endif

/*****************************************************************************
*                                                                            *
*     SQLFRONT.H - DB-Library header file for the Microsoft SQL Server.
*
*                                                                            *
*     Copyright (c) 1989 - 1995 by Microsoft Corp.  All rights reserved.     *
*                                                                            *
* All constant and macro definitions for DB-Library applications
programming *
* are contained in this file.  This file must be included before SQLDB.H and *
* one of the following #defines must be made, depending on the operating
*
* system: DBMSDOS, DBMSWIN or DBNTWIN32.                                     *
*                                                                            *
*****************************************************************************/


/*****************************************************************************
* Datatype definitions                                                       *
*****************************************************************************/

// Note this has changed because Windows 3.1 defines API as 'pascal far'

#if !defined(M_I86SM) && !defined(DBNTWIN32)
#define SQLAPI cdecl far
#else
#define SQLAPI _cdecl
#endif

#ifndef  API
#define  API  SQLAPI
#endif

#ifndef DOUBLE
typedef double DOUBLE;
#endif


/*****************************************************************************
* DBPROCESS, LOGINREC and DBCURSOR                                           *
*****************************************************************************/

#define DBPROCESS void   // dbprocess structure type
#define LOGINREC  void   // login record type
#define DBCURSOR  void   // cursor record type
#define DBHANDLE  void   // generic handle

// DOS Specific
#ifdef DBMSDOS
typedef DBPROCESS * PDBPROCESS;
typedef LOGINREC  * PLOGINREC;
typedef DBCURSOR  * PDBCURSOR;
typedef DBHANDLE  * PDBHANDLE;
#define PTR *
#endif


// WIN 3.x Specific.  The handle pointers are near for Windows 3.x
#ifdef DBMSWIN
typedef DBPROCESS near * PDBPROCESS;
typedef LOGINREC  near * PLOGINREC;
typedef DBCURSOR  near * PDBCURSOR;
typedef DBHANDLE  near * PDBHANDLE;
#define PTR far *
#endif


// Windows NT Specific
#ifdef DBNTWIN32
typedef DBPROCESS * PDBPROCESS;
typedef LOGINREC  * PLOGINREC;
typedef DBCURSOR  * PDBCURSOR;
typedef DBHANDLE  * PDBHANDLE;
#define PTR *
typedef int (SQLAPI *SQLFARPROC)();
#else
typedef long (far pascal *LGFARPROC)();  // Windows loadable driver fp
#endif


/*****************************************************************************
* Win32 compatibility datatype definitions                                   *
* Note: The following datatypes are provided for Win32 compatibility.        *
* Since some of the datatypes are already defined in unrelated include files
*
* there may definition duplication.  Every attempt has been made to check
*
* for such problems.                                                         *
*****************************************************************************/

#ifndef DBNTWIN32

#ifndef SHORT
typedef short SHORT;
```

```
#endif

#ifndef INT
typedef int INT;
#endif

#ifndef UINT
typedef unsigned int UINT;
#endif

#ifndef USHORT
typedef unsigned short USHORT;
#endif

#ifndef ULONG
typedef unsigned long ULONG;
#endif

#ifndef CHAR
typedef char CHAR;
#endif

#ifndef LPINT
typedef INT PTR LPINT;
#endif

typedef unsigned char BYTE;

typedef      CHAR PTR LPSTR;
typedef      BYTE PTR LPBYTE;
typedef      void PTR LPVOID;
typedef const CHAR PTR LPCSTR;

typedef int BOOL;

#endif


/*****************************************************************************
* DB-Library datatype definitions                                    *
*****************************************************************************/

#define DBMAXCHAR 256 // Max length of DBVARBINARY and
DBVARCHAR, etc.

#ifndef DBTYPEDEFS    // srv.h (Open Server include) not already included

#define DBTYPEDEFS

#define RETCODE INT
#define STATUS INT

// DB-Library datatypes
typedef char           DBCHAR;
typedef unsigned char   DBBINARY;
typedef unsigned char   DBTINYINT;
typedef short          DBSMALLINT;
typedef unsigned short  DBUSMALLINT;
typedef long           DBINT;
typedef double          DBFLT8;
typedef unsigned char   DBBIT;
typedef unsigned char   DBBOOL;
typedef float          DBFLT4;
typedef long           DBMONEY4;

typedef DBFLT4 DBREAL;
typedef UINT   DBUBOOL;

typedef struct dbdatetime4
{
                        USHORT numdays;      // No of days since Jan-
1-1900
                        USHORT nummins;      // No. of minutes since
midnight
} DBDATETIM4;


typedef struct dbvarychar
{
                        DBSMALLINT  len;
                        DBCHAR      str[DBMAXCHAR];
} DBVARYCHAR;

typedef struct dbvarybin
{
                        DBSMALLINT  len;
                        BYTE        array[DBMAXCHAR];
} DBVARYBIN;

typedef struct dbmoney
{
                        DBINT mnyhigh;
                        ULONG mnylow;
} DBMONEY;

typedef struct dbdatetime
{
                        DBINT dtdays;
                        ULONG dttime;
} DBDATETIME;

// DBDATEREC structure used by dbdatecrack
typedef struct dbdaterec
{
                        INT    year;        // 1753 - 9999
                        INT    quarter;     // 1 - 4
                        INT    month;       // 1 - 12
                        INT    dayofyear;   // 1 - 366
                        INT    day;         // 1 - 31
                        INT    week;        // 1 - 54 (for leap years)
                        INT    weekday;     // 1 - 7  (Mon - Sun)
                        INT    hour;        // 0 - 23
                        INT    minute;      // 0 - 59
                        INT    second;      // 0 - 59
                        INT    millisecond;  // 0 - 999
} DBDATEREC;

#define MAXNUMERICLEN 16
#define MAXNUMERICDIG 38

#define DEFAULTPRECISION 18
#define DEFAULTSCALE     0

typedef struct dbnumeric
{
                        BYTE precision;
                        BYTE scale;
                        BYTE sign; // 1 = Positive, 0 = Negative
                        BYTE val[MAXNUMERICLEN];
} DBNUMERIC;

typedef DBNUMERIC DBDECIMAL;


// Pack the following structures on a word boundary
#ifdef __BORLANDC__
#pragma option -a+
#else
                        #ifndef DBLIB_SKIP_PRAGMA_PACK   // Define
this if your compiler does not support #pragma pack()
                        #pragma pack(2)
                        #endif
#endif

#define MAXCOLNAMELEN 30
#define MAXTABLENAME  30

typedef struct
{
                        DBINT SizeOfStruct;
                        CHAR  Name[MAXCOLNAMELEN+1];
                        CHAR  ActualName[MAXCOLNAMELEN+1];
                        CHAR  TableName[MAXTABLENAME+1];
                        SHORT Type;
                        DBINT UserType;
                        DBINT MaxLength;
                        BYTE  Precision;
                        BYTE  Scale;
                        BOOL  VarLength;    // TRUE, FALSE
                        BYTE  Null;         // TRUE, FALSE or
DBUNKNOWN
                        BYTE  CaseSensitive; // TRUE, FALSE or
DBUNKNOWN
                        BYTE  Updatable;    // TRUE, FALSE or
DBUNKNOWN
                        BOOL  Identity;     // TRUE, FALSE
} DBCOL, PTR LPDBCOL;


#define MAXSERVERNAME 30
#define MAXNETLIBNAME 255
#define MAXNETLIBCONNSTR 255

typedef struct
{
                        DBINT  SizeOfStruct;
                        BYTE   ServerType;
                        USHORT ServerMajor;
                        USHORT ServerMinor;
                        USHORT ServerRevision;
                        CHAR   ServerName[MAXSERVERNAME+1];
                        CHAR   NetLibName[MAXNETLIBNAME+1];
                        CHAR
NetLibConnStr[MAXNETLIBCONNSTR+1];
} DBPROCINFO, PTR LPDBPROCINFO;

typedef struct
{
                        DBINT SizeOfStruct;   // Use
sizeof(DBCURSORINFO)
                        ULONG TotCols;       // Total Columns in cursor
                        ULONG TotRows;       // Total Rows in cursor
                        ULONG CurRow;        // Current actual row in
server
                        ULONG TotRowsFetched; // Total rows actually
fetched
                        ULONG Type;          // See CU_...
                        ULONG Status;        // See CU_...
} DBCURSORINFO, PTR LPDBCURSORINFO;

// Reset default alignment
#ifdef __BORLANDC__
#pragma option -a-
#else
```

```
                                #ifndef DBLIB_SKIP_PRAGMA_PACK   // Define
this if your compiler does not support #pragma pack()
                                #pragma pack()
                                #endif
#endif


#endif // End DBTYPEDEFS


/*****************************************************************************
* Pointer Datatypes                                                          *
*****************************************************************************/

typedef const LPINT          LPCINT;
typedef const LPBYTE         LPCBYTE ;
typedef       USHORT PTR     LPUSHORT;
typedef const LPUSHORT       LPCUSHORT;
typedef       DBINT PTR      LPDBINT;
typedef const LPDBINT        LPCDBINT;
typedef       DBBINARY PTR   LPDBBINARY;
typedef const LPDBBINARY     LPCDBBINARY;
typedef       DBDATEREC PTR  LPDBDATEREC;
typedef const LPDBDATEREC    LPCDBDATEREC;
typedef       DBDATETIME PTR LPDBDATETIME;
typedef const LPDBDATETIME   LPCDBDATETIME;


/*****************************************************************************
* General #defines                                                           *
*****************************************************************************/

#define TIMEOUT_IGNORE (ULONG)-1
#define TIMEOUT_INFINITE (ULONG)0
#define TIMEOUT_MAXIMUM (ULONG)1200 // 20 minutes maximum
timeout value

// Used for ServerType in dbgetprocinfo
#define SERVTYPE_UNKNOWN   0
#define SERVTYPE_MICROSOFT 1

// Used by dbcolinfo
enum CI_TYPES { CI_REGULAR=1, CI_ALTERNATE=2, CI_CURSOR=3 };

// Bulk Copy Definitions (bcp)
#define DB_IN           1         // Transfer from client to server
#define DB_OUT          2         // Transfer from server to client

#define BCPMAXERRS   1    // bcp_control parameter
#define BCPFIRST     2    // bcp_control parameter
#define BCPLAST      3    // bcp_control parameter
#define BCPBATCH     4    // bcp_control parameter
#define BCPKEEPNULLS 5    // bcp_control parameter

#ifndef TRUE
#define TRUE 1
#endif

#ifndef FALSE
#define FALSE 0
#endif

#define TINYBIND         1
#define SMALLBIND        2
#define INTBIND          3
#define CHARBIND         4
#define BINARYBIND       5
#define BITBIND          6
#define DATETIMEBIND     7
#define MONEYBIND        8
#define FLT8BIND         9
#define STRINGBIND      10
#define NTBSTRINGBIND   11
#define VARYCHARBIND    12
#define VARYBINBIND     13
#define FLT4BIND        14
#define SMALLMONEYBIND  15
#define SMALLDATETIBIND 16
#define DECIMALBIND     17
#define NUMERICBIND     18
#define SRCDECIMALBIND  19
#define SRCNUMERICBIND  20
#define MAXBIND         SRCNUMERICBIND

#define DBSAVE          1
#define DBNOSAVE        0

#define DBNOERR         -1
#define DBFINDONE       0x04  // Definately done
#define DBMORE          0x10  // Maybe more commands waiting
#define DBMORE_ROWS     0x20  // This command returned rows

#define MAXNAME         31


#define DBTXTSLEN       8     // Timestamp length

#define DBTXPLEN        16    // Text pointer length

// Error code returns
#define INT_EXIT        0
#define INT_CONTINUE    1
#define INT_CANCEL      2


// dboptions
#define DBBUFFER        0
#define DBOFFSET        1
#define DBROWCOUNT      2
#define DBSTAT          3
#define DBTEXTLIMIT     4
#define DBTEXTSIZE      5
#define DBARITHABORT    6
#define DBARITHIGNORE   7
#define DBNOAUTOFREE    8
#define DBNOCOUNT       9
#define DBNOEXEC        10
#define DBPARSEONLY     11
#define DBSHOWPLAN      12
#define DBSTORPROCID            13

#if defined(DBMSWIN) || defined(DBNTWIN32)
#define DBANSItoOEM             14
#endif

#ifdef DBNTWIN32
#define DBOEMtoANSI             15
#endif

#define DBCLIENTCURSORS 16
#define DBSETTIME 17

// Data Type Tokens
#define SQLTEXT         0x23
#define SQLVARBINARY    0x25
#define SQLINTN         0x26
#define SQLVARCHAR      0x27
#define SQLBINARY       0x2d
#define SQLIMAGE        0x22
#define SQLCHAR         0x2f
#define SQLINT1         0x30
#define SQLBIT          0x32
#define SQLINT2         0x34
#define SQLINT4         0x38
#define SQLMONEY        0x3c
#define SQLDATETIME     0x3d
#define SQLFLT8         0x3e
#define SQLFLTN         0x6d
#define SQLMONEYN       0x6e
#define SQLDATETIMN     0x6f
#define SQLFLT4         0x3b
#define SQLMONEY4       0x7a
#define SQLDATETIM4     0x3a
#define SQLDECIMAL      0x6a
#define SQLNUMERIC      0x6c

// Data stream tokens
#define SQLCOLFMT       0xa1
#define OLD_SQLCOLFMT   0x2a
#define SQLPROCID       0x7c
#define SQLCOLNAME      0xa0
#define SQLTABNAME      0xa4
#define SQLCOLINFO      0xa5
#define SQLALTNAME      0xa7
#define SQLALTFMT       0xa8
#define SQLERROR        0xaa
#define SQLINFO         0xab
#define SQLRETURNVALUE  0xac
#define SQLRETURNSTATUS 0x79
#define SQLRETURN       0xdb
#define SQLCONTROL      0xae
#define SQLALTCONTROL   0xaf
#define SQLROW          0xd1
#define SQLALTROW       0xd3
#define SQLDONE         0xfd
#define SQLDONEPROC     0xfe
#define SQLDONEINPROC   0xff
#define SQLOFFSET       0x78
#define SQLORDER        0xa9
#define SQLLOGINACK     0xad // NOTICE: change to real value

// Ag op tokens
#define SQLAOPCNT               0x4b
#define SQLAOPSUM       0x4d
#define SQLAOPAVG       0x4f
#define SQLAOPMIN       0x51
#define SQLAOPMAX       0x52
#define SQLAOPANY       0x53
#define SQLAOPNOOP      0x56

// Error numbers (dberrs) DB-Library error codes
#define SQLEMEM         10000
#define SQLENULL        10001
#define SQLENLOG        10002
#define SQLEPWD         10003
#define SQLECONN        10004
#define SQLEDDNE        10005
#define SQLENULLO       10006
#define SQLESMSG        10007
#define SQLEBTOK        10008
#define SQLENSPE        10009
#define SQLEREAD        10010
#define SQLECNOR        10011
#define SQLETSIT        10012
```

```
#define SQLEPARM       10013
#define SQLEAUTN       10014
#define SQLECOFL       10015
#define SQLERDCN       10016
#define SQLEICN        10017
#define SQLECLOS       10018
#define SQLENTXT       10019
#define SQLEDNTI       10020
#define SQLETMTD       10021
#define SQLEASEC       10022
#define SQLENTLL       10023
#define SQLETIME       10024
#define SQLEWRIT       10025
#define SQLEMODE       10026
#define SQLEOOB        10027
#define SQLEITIM       10028
#define SQLEDBPS       10029
#define SQLEIOPT       10030
#define SQLEASNL       10031
#define SQLEASUL       10032
#define SQLENPRM       10033
#define SQLEDBOP       10034
#define SQLENSIP       10035
#define SQLECNULL      10036
#define SQLESEOF       10037
#define SQLERPND       10038
#define SQLECSYN       10039
#define SQLENONET      10040
#define SQLEBTYP       10041
#define SQLEABNC       10042
#define SQLEABMT       10043
#define SQLEABNP       10044
#define SQLEBNCR       10045
#define SQLEAAMT       10046
#define SQLENXID       10047
#define SQLEIFNB       10048
#define SQLEKBCO       10049
#define SQLEBBCI       10050
#define SQLEKBCI       10051
#define SQLEBCWE       10052
#define SQLEBCNN       10053
#define SQLEBCOR       10054
#define SQLEBCPI       10055
#define SQLEBCPN       10056
#define SQLEBCPB       10057
#define SQLEVDPT       10058
#define SQLEBIVI       10059
#define SQLEBCBC       10060
#define SQLEBCFO       10061
#define SQLEBCVH       10062
#define SQLEBCUO       10063
#define SQLEBUOE       10064
#define SQLEBWEF       10065
#define SQLEBTMT       10066
#define SQLEBEOF       10067
#define SQLEBCSI       10068
#define SQLEPNUL       10069
#define SQLEBSKERR     10070
#define SQLEBDIO       10071
#define SQLEBCNT       10072
#define SQLEMDBP       10073
#define SQLINIT        10074
#define SQLCRSINV      10075
#define SQLCRSCMD      10076
#define SQLCRSNOIND    10077
#define SQLCRSDIS      10078
#define SQLCRSAGR      10079
#define SQLCRSORD      10080
#define SQLCRSMEM      10081
#define SQLCRSBSKEY    10082
#define SQLCRSNORES    10083
#define SQLCRSVIEW     10084
#define SQLCRSBUFR     10085
#define SQLCRSFROWN    10086
#define SQLCRSBROL     10087
#define SQLCRSFRAND    10088
#define SQLCRSFLAST    10089
#define SQLCRSRO       10090
#define SQLCRSTAB      10091
#define SQLCRSUPDTAB   10092
#define SQLCRSUPDNB    10093
#define SQLCRSVIIND    10094
#define SQLCRSNOUPD    10095
#define SQLCRSOS2      10096
#define SQLEBCSA       10097
#define SQLEBCRO       10098
#define SQLEBCNE       10099
#define SQLEBCSK       10100
#define SQLEUVBF       10101
#define SQLEBIHC       10102
#define SQLEBWFF       10103
#define SQLNUMVAL      10104
#define SQLEOLDVR      10105
#define SQLEBCPS       10106

// The severity levels are defined here
#define EXINFO          1  // Informational, non-error
#define EXUSER          2  // User error
#define EXNONFATAL      3  // Non-fatal error
#define EXCONVERSION    4  // Error in DB-LIBRARY data conversion
#define EXSERVER        5  // The Server has returned an error flag
#define EXTIME          6  // We have exceeded our timeout period while
                           // waiting for a response from the Server - the
                           // DBPROCESS is still alive
#define EXPROGRAM       7  // Coding error in user program
#define EXRESOURCE      8  // Running out of resources - the
DBPROCESS may be dead
#define EXCOMM          9  // Failure in communication with Server - the
DBPROCESS is dead
#define EXFATAL         10 // Fatal error - the DBPROCESS is dead
#define EXCONSISTENCY   11 // Internal software error  - notify MS
Technical Supprt

// Offset identifiers
#define OFF_SELECT      0x16d
#define OFF_FROM        0x14f
#define OFF_ORDER       0x165
#define OFF_COMPUTE     0x139
#define OFF_TABLE       0x173
#define OFF_PROCEDURE   0x16a
#define OFF_STATEMENT   0x1cb
#define OFF_PARAM       0x1c4
#define OFF_EXEC        0x12c

// Print lengths for certain fixed length data types
#define PRINT4     11
#define PRINT2     6
#define PRINT1     3
#define PRFLT8     20
#define PRMONEY    26
#define PRBIT      3
#define PRDATETIME 27
#define PRDECIMAL (MAXNUMERICDIG + 2)
#define PRNUMERIC (MAXNUMERICDIG + 2)

#define SUCCEED  1
#define FAIL     0

#define DBUNKNOWN 2

#define MORE_ROWS    -1
#define NO_MORE_ROWS -2
#define REG_ROW      MORE_ROWS
#define BUF_FULL     -3

// Status code for dbresults(). Possible return values are
// SUCCEED, FAIL, and NO_MORE_RESULTS.
#define NO_MORE_RESULTS 2
#define NO_MORE_RPC_RESULTS 3

// Macros for dbsetlname()
#define DBSETHOST 1
#define DBSETUSER 2
#define DBSETPWD  3
#define DBSETAPP  4
#define DBSETID   5
#define DBSETLANG 6
#define DBSETSECURE 7
#define DBVER42    8
#define DBVER60    9
#define DBSETLOGINTIME 10

// Standard exit and error values
#define STDEXIT  0
#define ERREXIT  -1

// dbrpcinit flags
#define DBRPCRECOMPILE  0x0001
#define DBRPCRESET      0x0004

// dbrpcparam flags
#define DBRPCRETURN     1


// Cursor related constants

// Following flags are used in the concuropt parameter in the dbcursoropen
function
#define CUR_READONLY 1 // Read only cursor, no data modifications
#define CUR_LOCKCC   2 // Intent to update, all fetched data locked when
                       // dbcursorfetch is called inside a transaction block
#define CUR_OPTCC    3 // Optimistic concurrency control, data
modifications
                       // succeed only if the row hasn't been updated since
                       // the last fetch.
#define CUR_OPTCCVAL 4 // Optimistic concurrency control based on
selected column values

// Following flags are used in the scrollopt parameter in dbcursoropen
#define CUR_FORWARD 0       // Forward only scrolling
#define CUR_KEYSET  -1      // Keyset driven scrolling
#define CUR_DYNAMIC 1       // Fully dynamic
#define CUR_INSENSITIVE -2  // Server-side cursors only

// Following flags define the fetchtype in the dbcursorfetch function
#define FETCH_FIRST    1  // Fetch first n rows
#define FETCH_NEXT     2  // Fetch next n rows
#define FETCH_PREV     3  // Fetch previous n rows
#define FETCH_RANDOM   4  // Fetch n rows beginning with given row #
#define FETCH_RELATIVE 5  // Fetch relative to previous fetch row #
#define FETCH_LAST     6  // Fetch the last n rows

// Following flags define the per row status as filled by dbcursorfetch and/or
dbcursorfetchex
```

```
#define FTC_EMPTY        0x00  // No row available
#define FTC_SUCCEED      0x01  // Fetch succeeded, (failed if not set)
#define FTC_MISSING      0x02  // The row is missing
#define FTC_ENDOFKEYSET  0x04  // End of the keyset reached
#define FTC_ENDOFRESULTS 0x08  // End of results set reached

// Following flags define the operator types for the dbcursor function
#define CRS_UPDATE   1  // Update operation
#define CRS_DELETE   2  // Delete operation
#define CRS_INSERT   3  // Insert operation
#define CRS_REFRESH  4  // Refetch given row
#define CRS_LOCKCC   5  // Lock given row

// Following value can be passed to the dbcursorbind function for NOBIND
type
#define NOBIND -2       // Return length and pointer to data

// Following are values used by DBCURSORINFO's Type parameter
#define CU_CLIENT       0x00000001
#define CU_SERVER       0x00000002
#define CU_KEYSET       0x00000004
#define CU_MIXED        0x00000008
#define CU_DYNAMIC      0x00000010
#define CU_FORWARD      0x00000020
#define CU_INSENSITIVE  0x00000040
#define CU_READONLY     0x00000080
#define CU_LOCKCC       0x00000100
#define CU_OPTCC        0x00000200
#define CU_OPTCCVAL     0x00000400

// Following are values used by DBCURSORINFO's Status parameter
#define CU_FILLING      0x00000001
#define CU_FILLED       0x00000002


// Following are values used by dbupdatetext's type parameter
#define UT_TEXTPTR      0x0001
#define UT_TEXT         0x0002
#define UT_MORETEXT     0x0004
#define UT_DELETEONLY   0x0008
#define UT_LOG          0x0010


// The following values are passed to dbserverenum for searching criteria.
#define NET_SEARCH  0x0001
#define LOC_SEARCH  0x0002

// These constants are the possible return values from dbserverenum.
#define ENUM_SUCCESS         0x0000
#define MORE_DATA            0x0001
#define NET_NOT_AVAIL        0x0002
#define OUT_OF_MEMORY        0x0004
#define NOT_SUPPORTED        0x0008
#define ENUM_INVALID_PARAM   0x0010


// Netlib Error problem codes.  ConnectionError() should return one of
// these as the dblib-mapped problem code, so the corresponding string
// is sent to the dblib app's error handler as dberrstr.  Return NE_E_NOMAP
// for a generic DB-Library error string (as in prior versions of dblib).

#define NE_E_NOMAP           0   // No string; uses dblib default.
#define NE_E_NOMEMORY        1   // Insufficient memory.
#define NE_E_NOACCESS        2   // Access denied.
#define NE_E_CONNBUSY        3   // Connection is busy.
#define NE_E_CONNBROKEN      4   // Connection broken.
#define NE_E_TOOMANYCONN     5   // Connection limit exceeded.
#define NE_E_SERVERNOTFOUND     6   // Specified SQL server not
found.
#define NE_E_NETNOTSTARTED      7   // The network has not been
started.
#define NE_E_NORESOURCE         8   // Insufficient network resources.
#define NE_E_NETBUSY            9   // Network is busy.
#define NE_E_NONETACCESS        10  // Network access denied.
#define NE_E_GENERAL            11  // General network error.  Check your
documentation.
#define NE_E_CONNMODE           12  // Incorrect connection mode.
#define NE_E_NAMENOTFOUND       13  // Name not found in directory
service.
#define NE_E_INVALIDCONN        14  // Invalid connection.
#define NE_E_NETDATAERR         15  // Error reading or writing network
data.
#define NE_E_TOOMANYFILES       16  // Too many open file handles.
#define NE_E_CANTCONNECT                17  // SQL Server does not exist or
access denied.

#define NE_MAX_NETERROR         17

#ifdef __cplusplus
}
#endif

#endif // _INC_SQLFRONT
```

SQLFUNCS.C

```
// TPC-C Benchmark Kit
//
// Module:  SQLFUNCS.C
// Author:  DamienL

// Includes
#include "tpcc.h"

long                        client_threads_dropped;
long                        delivery_threads_dropped;

//=======================================================
==============
// Function name: SQLMasterInit
//
//=======================================================
==============

int SQLMasterInit(MASTER_DATA *pMaster)
{
    long                    num_users;
    long                    num_delivery_hdlrs;
    char                    msg[80];
    int                             rc;
                    int             i;
                    char            dbname[30];
                    float           log_size_mb;
                    float           log_used_pct;

#ifdef DEBUG
                    printf("[%ld]DBG: Entering SQLMasterInit()...\n",
(int) GetCurrentThreadId());
#endif

                    // make sure advanced config options are turned
on
                    SQLExecCmd(pMaster->sqlconn,"exec
sp_configure 'show advanced option',1 reconfigure with override");

                    printf("Initializing synchronization tables...\n");

    SQLExecCmd(pMaster->sqlconn,"exec tpcc_sp_master_init");


                    dbcmd(pMaster->sqlconn,
                            "insert into
tpcc_master_sync(ramp_up, steady_state, ramp_down, "
                            "num_warehouses, think_times,
display_data, deadlock_retries, "
                            "client_mode, transaction_type,
next_client_id, next_delivery_id, load_multiplier, "
                            "delivery_backoff, disable_90th,
num_delivery_threads) ");
                    dbfcmd(pMaster->sqlconn,"values (%ld, %ld,
%ld, %ld, %ld, %ld, %ld, %ld, %ld, 0, 0, %f, %ld, %ld, %ld)",
                            pMaster->ramp_up,
                            pMaster->steady_state,
                            pMaster->ramp_down,
                            pMaster->num_warehouses,
                            pMaster->think_times,
                            pMaster->display_data,
                            pMaster->deadlock_retry,
                            pMaster->client_mode,
                            pMaster->tran,
                            pMaster->load_multiplier,
                            pMaster->delivery_backoff,
                            pMaster->disable_90th,
                            pMaster->num_deliveries);
                    SQLExec(pMaster->sqlconn);

}


//=======================================================
==============
//
// Function name: SQLClientInit
//
//=======================================================
==============

void SQLClientInit(CLIENT_DATA *pClient)
{
    char            buffer[400];
                    char                    cmd[30];
                    RETCODE         rc;
#ifdef USE_CONMON
                    char            linebuf[CON_LINE_SIZE+1];
#endif

#ifdef DEBUG
                    printf("[%ld]DBG: Entering SQLClientInit()...\n",
(int) GetCurrentThreadId());
#endif

                    sprintf(buffer,"begin tran update
tpcc_master_sync set next_client_id = next_client_id + 1 "
                            "select ramp_up, steady_state,
ramp_down, num_warehouses, "
                            "think_times, display_data,
deadlock_retries, client_mode, "
                            "transaction_type, next_client_id,
load_multiplier, "
```

```
						"disable_90th,
num_delivery_threads from tpcc_master_sync commit tran ");

#ifdef USE_ODBC

				sprintf(cmd,"use %s", pClient->admin_database);
				rc = SQLExecDirect(pClient->hstmt, cmd,
SQL_NTS);

    if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientStats", "SQLExecDirect() failed.");
				}

				SQLFreeStmt(pClient->hstmt, SQL_CLOSE);

				rc = SQLExecDirect(pClient->hstmt, buffer,
SQL_NTS);
    if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLExecDirect() failed.");
				}


				/* removed becuase of the addition of the set
nocount option on ODBCOpenConnection

				rc = SQLMoreResults(pClient->hstmt);
    if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLMoreResults() failed.");
				}
    */

				rc = SQLBindCol(pClient->hstmt, 1,
SQL_C_SLONG, &pClient->ramp_up, 0 , NULL);
    if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 2,
SQL_C_SLONG, &pClient->steady_state, 0 , NULL);
				if (rc == SQL_ERROR)
    {
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 3,
SQL_C_SLONG, &pClient->ramp_down, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 4,
SQL_C_SLONG, &pClient->num_warehouses, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 5,
SQL_C_SLONG, &pClient->think_times, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 6,
SQL_C_SLONG, &pClient->display_data, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 7,
SQL_C_SLONG, &pClient->deadlock_retry, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 8,
SQL_C_SLONG, &pClient->client_mode, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 9,
SQL_C_SLONG, &pClient->tran, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 10,
SQL_C_SLONG, &pClient->id, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 11,
SQL_C_DOUBLE, &pClient->load_multiplier, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 12,
SQL_C_SLONG, &pClient->disable_90th, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(pClient->hstmt, 13,
SQL_C_SLONG, &pClient->num_deliveries, 0 , NULL);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLBindCol() failed.");
				}

				rc = SQLFetch(pClient->hstmt);
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientInit", "SQLFetch() failed.");
				}

				SQLFreeStmt(pClient->hstmt, SQL_CLOSE);


				sprintf(cmd,"use %s", pClient->database);
				rc = SQLExecDirect(pClient->hstmt, cmd,
SQL_NTS);

    if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
				{
					ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLClientStats", "SQLExecDirect() failed.");
				}

				SQLFreeStmt(pClient->hstmt, SQL_CLOSE);
#else

				sprintf(cmd,"use %s",pClient->admin_database);
				SQLExecCmd(pClient->sqlconn, cmd);
```

```
                         dbcmd(pClient->sqlconn, buffer);
   dbsqlexec(pClient->sqlconn);

   while (dbresults(pClient->sqlconn) != NO_MORE_RESULTS)
   {
                              if (DBROWS(pClient->sqlconn))
                              {
                                   dbbind(pClient->sqlconn, 1,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>ramp_up);
                                   dbbind(pClient->sqlconn, 2,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>steady_state);
                                   dbbind(pClient->sqlconn, 3,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>ramp_down);
                                   dbbind(pClient->sqlconn, 4,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>num_warehouses);
                                   dbbind(pClient->sqlconn, 5,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>think_times);
                                   dbbind(pClient->sqlconn, 6,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>display_data);
                                   dbbind(pClient->sqlconn, 7,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>deadlock_retry);
                                   dbbind(pClient->sqlconn, 8,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>client_mode);
                                   dbbind(pClient->sqlconn, 9,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient->tran);
                                   dbbind(pClient->sqlconn, 10,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient->id);
                                   dbbind(pClient->sqlconn, 11,
FLT8BIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>load_multiplier);
                                   dbbind(pClient->sqlconn, 12,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>disable_90th);
                                   dbbind(pClient->sqlconn, 13,
INTBIND, (DBINT) 0,
                                        (BYTE *) &pClient-
>num_deliveries);
                              }

                              while (dbnextrow(pClient->sqlconn) !=
NO_MORE_ROWS)
                                   ;
                         }

                         sprintf(cmd,"use %s",pClient->database);
                         SQLExecCmd(pClient->sqlconn, cmd);
#endif

   return;
}


//=========================================================
==============
//
// Function name: SQLDeliveryInit
//
//=========================================================
==============

void SQLDeliveryInit(DELIVERY *pDeliveryHdlr)
{

   char          buffer[300];
                         char                 cmd[30];
                         RETCODE        rc;

#ifdef DEBUG
                         printf("[%ld]DBG: Entering SQLDeliveryInit()...\n",
(int) GetCurrentThreadId());
#endif

                         strcpy(buffer,"begin tran update
tpcc_master_sync set next_delivery_id = next_delivery_id + 1 "
                                        "select ramp_up,
steady_state, ramp_down, next_delivery_id, delivery_backoff, "
                                        "disable_90th from
tpcc_master_sync commit tran");

#ifdef USE_ODBC

                         sprintf(cmd,"use %s", pDeliveryHdlr-
>admin_database);
                         rc = SQLExecDirect(pDeliveryHdlr->hstmt, cmd,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                         {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryStats", "SQLExecDirect() failed.");
                         }

                         SQLFreeStmt(pDeliveryHdlr->hstmt,
SQL_CLOSE);

                         rc = SQLExecDirect(pDeliveryHdlr->hstmt, buffer,
SQL_NTS);
   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                         {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLExecDirect() failed.");
                         }

                         /* removed becuase of the addition of the set
nocount option on ODBCOpenConnection

                         rc = SQLMoreResults(pDeliveryHdlr->hstmt);
   if (rc == SQL_ERROR)
                         {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLExecDirect() failed.");
                         }
                         */

                         rc = SQLBindCol(pDeliveryHdlr->hstmt, 1,
SQL_C_SLONG, &pDeliveryHdlr->ramp_up, 0 , NULL);
   if (rc == SQL_ERROR)
                         {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLBindCol() failed.");
                         }

                         rc = SQLBindCol(pDeliveryHdlr->hstmt, 2,
SQL_C_SLONG, &pDeliveryHdlr->steady_state, 0 , NULL);
                         if (rc == SQL_ERROR)
   {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLBindCol() failed.");
                         }

                         rc = SQLBindCol(pDeliveryHdlr->hstmt, 3,
SQL_C_SLONG, &pDeliveryHdlr->ramp_down, 0 , NULL);
                         if (rc == SQL_ERROR)
                         {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLBindCol() failed.");
                         }

                         rc = SQLBindCol(pDeliveryHdlr->hstmt, 4,
SQL_C_SLONG, &pDeliveryHdlr->id, 0 , NULL);
                         if (rc == SQL_ERROR)
                         {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLBindCol() failed.");
                         }

                         rc = SQLBindCol(pDeliveryHdlr->hstmt, 5,
SQL_C_SLONG, &pDeliveryHdlr->delivery_backoff, 0 , NULL);
                         if (rc == SQL_ERROR)
                         {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLBindCol() failed.");
                         }

                         rc = SQLBindCol(pDeliveryHdlr->hstmt, 6,
SQL_C_SLONG, &pDeliveryHdlr->disable_90th, 0 , NULL);
                         if (rc == SQL_ERROR)
                         {
                              ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLBindCol() failed.");
                         }

                         rc = SQLFetch(pDeliveryHdlr->hstmt);
```

```
				if (rc == SQL_ERROR)
				{
					ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryInit", "SQLFetch() failed.");
				}

				SQLFreeStmt(pDeliveryHdlr->hstmt,
SQL_CLOSE);

				sprintf(cmd,"use %s", pDeliveryHdlr->database);
				rc = SQLExecDirect(pDeliveryHdlr->hstmt, cmd,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
				{
					ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryStats", "SQLExecDirect() failed.");
				}

				SQLFreeStmt(pDeliveryHdlr->hstmt,
SQL_CLOSE);

#else

				sprintf(cmd,"use %s",pDeliveryHdlr-
>admin_database);
				SQLExecCmd(pDeliveryHdlr->sqlconn, cmd);

				dbfcmd(pDeliveryHdlr->sqlconn, buffer);
   dbsqlexec(pDeliveryHdlr->sqlconn);

   while (dbresults(pDeliveryHdlr->sqlconn) != NO_MORE_RESULTS)
   {

					if (DBROWS(pDeliveryHdlr->sqlconn))
					{
						dbbind(pDeliveryHdlr->sqlconn, 1,
INTBIND, (DBINT) 0,
							(BYTE *) &pDeliveryHdlr-
>ramp_up);
						dbbind(pDeliveryHdlr->sqlconn, 2,
INTBIND, (DBINT) 0,
						(BYTE *) &pDeliveryHdlr-
>steady_state);
						dbbind(pDeliveryHdlr->sqlconn, 3,
INTBIND, (DBINT) 0,
						(BYTE *) &pDeliveryHdlr-
>ramp_down);
						dbbind(pDeliveryHdlr->sqlconn, 4,
INTBIND, (DBINT) 0,
							(BYTE *) &pDeliveryHdlr-
>id);
						dbbind(pDeliveryHdlr->sqlconn, 5,
INTBIND, (DBINT) 0,
							(BYTE *) &pDeliveryHdlr-
>delivery_backoff);
						dbbind(pDeliveryHdlr->sqlconn, 6,
INTBIND, (DBINT) 0,
							(BYTE *) &pDeliveryHdlr-
>disable_90th);
					}

				while (dbnextrow(pDeliveryHdlr->sqlconn) !=
NO_MORE_ROWS)
							;
   }

					sprintf(cmd,"use %s",pDeliveryHdlr->database);
					SQLExecCmd(pDeliveryHdlr->sqlconn, cmd);

#endif

   return;
}


//==========================================================
==============
//
// Function name: SQLNewOrder
//
//==========================================================
==============

#ifdef USE_ODBC
BOOL SQLNewOrder(HDBC		hdbc,
							HSTMT		hstmt,
#else
BOOL SQLNewOrder(DBPROCESS	*dbproc,
#endif
#ifdef USE_CONMON
							NEW_ORDER_DATA
*pNewOrder,
							short		id,
						short		w_id,
							HANDLE		hConMon,
							short		con_x,
							short		con_y,
							short		deadlock_retry)
#else
							NEW_ORDER_DATA
*pNewOrder,
							short		deadlock_retry)
#endif

{

   RETCODE		rc;
   int		i;
					int		j;
   DBINT		status;
					DBINT				commit_flag;
					int		tryit;
					char		printbuf[25];
					char				tmpbuf[30];
#ifdef USE_CONMON
					char		linebuf[CON_LINE_SIZE+1];
#endif
#ifdef USE_ODBC
					char		buffer[255];
					BOOL		deadlock_detected;
#else
					DBDATETIME	datetime;
					BYTE		*pData;
#endif


#ifdef DEBUG
					printf("[%ld]DBG: Entering SQLNewOrder()...\n",
(int) GetCurrentThreadId());
#endif

				pNewOrder->num_deadlocks = 0;

				strcpy(tmpbuf, "tpcc_neworder");

   for (tryit=0; tryit < deadlock_retry; tryit++)
   {

#ifdef DEBUG
					printf("[%ld]DBG: Executing NewOrder
transaction...\n", (int) GetCurrentThreadId());
#endif

#ifdef USE_ODBC

					deadlock_detected = FALSE;

					sprintf(buffer,"{call %s(?,?,?,?,?,",tmpbuf);
					for (i = 1; i <= (pNewOrder->o_ol_cnt - 1);
i++)
							strcat(buffer, "?,?,?,");
					strcat(buffer, "?,?,?)}");

					// Bind Parameters
					rc = SQLBindParameter(hstmt, 1,
SQL_PARAM_INPUT, SQL_C_SSHORT,

				SQL_SMALLINT, 0, 0, &pNewOrder->w_id, 0,
NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindParameter() failed.");
					}

					rc = SQLBindParameter(hstmt, 2,
SQL_PARAM_INPUT, SQL_C_STINYINT,

				SQL_TINYINT, 0, 0, &pNewOrder->d_id, 0,
NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindParameter() failed.");
					}

					rc = SQLBindParameter(hstmt, 3,
SQL_PARAM_INPUT, SQL_C_SLONG,

				SQL_INTEGER, 0, 0, &pNewOrder->c_id, 0,
NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindParameter() failed.");
					}

					rc = SQLBindParameter(hstmt, 4,
SQL_PARAM_INPUT, SQL_C_STINYINT,

				SQL_TINYINT, 0, 0, &pNewOrder->o_ol_cnt, 0,
NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindParameter() failed.");
					}

					rc = SQLBindParameter(hstmt, 5,
SQL_PARAM_INPUT, SQL_C_STINYINT,

				SQL_TINYINT, 0, 0, &pNewOrder->o_all_local,
0, NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindParameter() failed.");
					}

					j=0;
					for (i = 0; i < (pNewOrder->o_ol_cnt * 3);
i=i+3)
					{

						rc = SQLBindParameter(hstmt, i+6,
SQL_PARAM_INPUT, SQL_C_SLONG,

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindParameter() failed.");
						}

						rc = SQLBindParameter(hstmt, i+7,
SQL_PARAM_INPUT, SQL_C_SSHORT,

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindParameter() failed.");
						}

						rc = SQLBindParameter(hstmt, i+8,
SQL_PARAM_INPUT, SQL_C_SSHORT,

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindParameter() failed.");
						}

						j++;

					}

					rc = SQLExecDirect(hstmt, buffer,
SQL_NTS);
```

```
					if (rc != SQL_SUCCESS && rc !=
SQL_SUCCESS_WITH_INFO)
					{
						deadlock_detected = ODBCError
(henv, hdbc, hstmt);
						if (!deadlock_detected)

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLExecDirect() failed.");
					}

					pNewOrder->total_amount=0;

					for (i = 0; i<pNewOrder->o_ol_cnt &&
!deadlock_detected; i++)
					{

						// Now bind order line results

						rc = SQLBindCol(hstmt, 1,
SQL_C_CHAR, &pNewOrder->Ol[i].ol_i_name, sizeof(pNewOrder-
>Ol[i].ol_i_name), NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);
SQL_INTEGER, 0, 0, &pNewOrder->Ol[j].ol_i_id, 0, NULL);
				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 2,
SQL_C_SSHORT, &pNewOrder->Ol[i].ol_stock, 0 , NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);
SQL_SMALLINT, 0, 0, &pNewOrder->Ol[j].ol_supply_w_id, 0, NULL);
				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 3,
SQL_C_CHAR, &pNewOrder->Ol[i].ol_brand_generic, sizeof(pNewOrder-
>Ol[i].ol_brand_generic), NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);
SQL_SMALLINT, 0, 0, &pNewOrder->Ol[j].ol_quantity, 0, NULL);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 4,
SQL_C_DOUBLE, &pNewOrder->Ol[i].ol_i_price, 0 , NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
						}
```

```
						rc = SQLBindCol(hstmt, 5,
SQL_C_DOUBLE, &pNewOrder->Ol[i].ol_amount, 0 , NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
						}

						// Fetch next row
						rc = SQLFetch(hstmt);

						if (rc == SQL_ERROR)
						{
							deadlock_detected =
ODBCError (henv, hdbc, hstmt);
							if (!deadlock_detected)

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLFetch() failed.");
						}

						pNewOrder->total_amount =
pNewOrder->total_amount
												+ pNe

						if (!deadlock_detected)
						{

							rc = SQLMoreResults(hstmt);

							if (rc == SQL_ERROR)
							{
								deadlock_detected =
ODBCError (henv, hdbc, hstmt);
								if
(!deadlock_detected)

				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLMoreResults() failed.");
							}

						}

					}

					if (!deadlock_detected)
					{

						// Bind return cols
						rc = SQLBindCol(hstmt, 1,
SQL_C_DOUBLE, &pNewOrder->w_tax, 0, NULL);
						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);
				UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 2,
SQL_C_DOUBLE, &pNewOrder->d_tax, 0, NULL);
						if (rc == SQL_ERROR)
```

```
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                        UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
                                        }

                                        rc = SQLBindCol(hstmt, 3,
SQL_C_SLONG, &pNewOrder->o_id, 0, NULL);
                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                        UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
                                        }

                                        rc = SQLBindCol(hstmt, 4,
SQL_C_CHAR, &pNewOrder->c_last, sizeof(pNewOrder->c_last), NULL);
                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                        UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
                                        }

                                        rc = SQLBindCol(hstmt, 5,
SQL_C_DOUBLE, &pNewOrder->c_discount, 0, NULL);
                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                        UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
                                        }

                                        rc = SQLBindCol(hstmt, 6,
SQL_C_CHAR, &pNewOrder->c_credit, sizeof(pNewOrder->c_credit),
NULL);
                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                        UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
                                        }

                                        rc = SQLBindCol(hstmt, 7,
SQL_C_TIMESTAMP, &pNewOrder->o_entry_d, 0, NULL);
                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                        UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
                                        }

                                        rc = SQLBindCol(hstmt, 8,
SQL_C_SLONG, &commit_flag, 0, NULL);
                                        if (rc == SQL_ERROR)
                                        {
```

```
                                                ODBCError (henv, hdbc,
hstmt);
                        UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLBindCol() failed.");
                                        }

                                        // Now fetch results
                                        rc = SQLFetch(hstmt);
                                        if (rc == SQL_ERROR)
                                        {
                                                deadlock_detected =
ODBCError (henv, hdbc, hstmt);
                                                if (!deadlock_detected)

                        UtilFatalError(GetCurrentThreadId(),
"SQLNewOrder", "SQLFetch() failed.");
                                        }

                                }

                                SQLFreeStmt(hstmt, SQL_CLOSE);

#else
                                if (dbrpcinit(dbproc, tmpbuf, 0) ==
SUCCEED)
                                {
                                        dbrpcparam(dbproc, NULL, 0,
SQLINT2, -1, -1, (BYTE *) &pNewOrder->w_id);
                                        dbrpcparam(dbproc, NULL, 0,
SQLINT1, -1, -1, (BYTE *) &pNewOrder->d_id);
                                        dbrpcparam(dbproc, NULL, 0,
SQLINT4, -1, -1, (BYTE *) &pNewOrder->c_id);
                                        dbrpcparam(dbproc, NULL, 0,
SQLINT1, -1, -1, (BYTE *) &pNewOrder->o_ol_cnt);
                                        dbrpcparam(dbproc, NULL, 0,
SQLINT1, -1, -1, (BYTE *) &pNewOrder->o_all_local);

                                        for (i = 0; i < pNewOrder->o_ol_cnt;
i++)
                                        {
                                                dbrpcparam(dbproc, NULL,
0, SQLINT4, -1, -1, (BYTE *) &pNewOrder->Ol[i].ol_i_id);
                                                dbrpcparam(dbproc, NULL,
0, SQLINT2, -1, -1, (BYTE *) &pNewOrder->Ol[i].ol_supply_w_id);
                                                dbrpcparam(dbproc, NULL,
0, SQLINT2, -1, -1, (BYTE *) &pNewOrder->Ol[i].ol_quantity);
                                        }

                                        if (dbrpcexec(dbproc) ==
SUCCEED)
                                        {
                                                pNewOrder-
>total_amount=0;

                                                // Get resutls from order line

                                                for (i = 0; i<pNewOrder-
>o_ol_cnt; i++)
                                                {

                                                        if (((rc =
dbresults(dbproc)) != NO_MORE_RESULTS) && (rc != FAIL))
                                                        {
                                                                if
(DBROWS(dbproc) && (dbnumcols(dbproc) == 5))
                                                                {
```

```
                                                                        while
(dbnextrow(dbproc) != NO_MORE_ROWS)
                                                                        {
                                        if(pData=dbdata(dbproc, 1))
                                                                                UtilStrCpy(p

                                        if(pData=dbdata(dbproc, 2))
                                                                                pNewOrder-

                                        if(pData=dbdata(dbproc, 3))
                                                                                UtilStrCpy(p

                                        if(pData=dbdata(dbproc, 4))
                                                                                pNewOrder-

                                        if(pData=dbdata(dbproc, 5))
                                                                                pNewOrder-

                                        pNewOrder->total_amount = pNewOrder-
>total_amount
                                                                                + pNewOrde
                                                                        }
                                                                }
                                                        }
                                                }

                                                while (((rc =
dbresults(dbproc)) != NO_MORE_RESULTS) && (rc != FAIL))
                                                {
                                                        if (DBROWS(dbproc)
&& (dbnumcols(dbproc) == 8))
                                                        {
                                                                while (((rc =
dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc != FAIL))
                                                                {

                                        if(pData=dbdata(dbproc, 1))

                                        pNewOrder->w_tax = (*(DBFLT8 *) pData);


                                        if(pData=dbdata(dbproc, 2))

                                        pNewOrder->d_tax = (*(DBFLT8 *) pData);


                                        if(pData=dbdata(dbproc, 3))

                                        pNewOrder->o_id = (*(DBINT *) pData);


                                        if(pData=dbdata(dbproc, 4))

                                        UtilStrCpy(pNewOrder->c_last, pData,
dbdatlen(dbproc, 4));


                                        if(pData=dbdata(dbproc, 5))

                                        pNewOrder->c_discount = (*(DBFLT8 *) pData);
```

```
                                if(pData=dbdata(dbproc, 6))

                                UtilStrCpy(pNewOrder->c_credit, pData,
dbdatlen(dbproc, 6));


                                if(pData=dbdata(dbproc, 7))
                                                                {

                                datetime = *((DBDATETIME *) pData);

                                dbdatecrack(dbproc, &pNewOrder->o_entry_d,
&datetime);
                                                                }


                                if(pData=dbdata(dbproc, 8))

                                commit_flag = (*(DBTINYINT *) pData);
                                                        }
                                                }
                                        }
                                        }
                                }

#endif

#ifdef USE_ODBC
                                if (deadlock_detected)
#else
                                if (SQLDetectDeadlock(dbproc))
#endif
                                {
                                        pNewOrder->num_deadlocks++;
#ifdef USE_CONMON
                                        sprintf(linebuf,"[%04ld:%04ld]
NewOrder: deadlock:%ld", (int) id,
                                                (int) w_id, (int) pNewOrder-
>num_deadlocks);
                                        WriteConsoleString(hConMon,
linebuf, con_x, con_y,RED,TRUE);
                                        total_deadlocks++;
                                        sprintf(linebuf,"%d",
total_deadlocks);
                                        WriteConsoleString(hConMon,
linebuf, DEADLOCK_X, DEADLOCK_Y,RED,TRUE);
#else
                                sprintf(printbuf,"deadlock: retry:
%d",pNewOrder->num_deadlocks);

                                UtilError(GetCurrentThreadId(),"SQLNewOrder",
printbuf);
#endif
                                        Sleep(DEADLOCKWAIT*tryit);

                                }
                                else
                                {
                                        if (commit_flag == 1)
                                        {
                                                pNewOrder->total_amount =
pNewOrder->total_amount *
                                                                ((1 +
pNewOrder->w_tax + pNewOrder->d_tax) * (1 - pNewOrder->c_discount));

                                                strcpy(pNewOrder-
>execution_status,"Transaction commited.");
                                                return TRUE;
                                        }
                                        else
                                        {
                                                strcpy(pNewOrder-
>execution_status,"Item number is not valid.");
                                                return FALSE;
                                        }
                                }
   }

   // If we reached here, it means we quit after MAX_RETRY deadlocks
                                strcpy(pNewOrder->execution_status,"Hit
deadlock max.  ");
#ifdef USE_CONMON
                                sprintf(linebuf,"[%04ld:%04ld] NewOrder:
deadlock max", (int) id, (int) w_id);
                                WriteConsoleString(hConMon, linebuf, con_x,
con_y,RED,TRUE);
#else
                                UtilError(GetCurrentThreadId(),"SQLNewOrder","
deadlock max retry reached!");
#endif

   return FALSE;
}


//=======================================================
=============
//
// Function name: SQLPayment
//
//=======================================================
=============

#ifdef USE_ODBC
BOOL SQLPayment(HDBC            hdbc,
                                                HSTMT           hstmt,
#else
BOOL SQLPayment(DBPROCESS       *dbproc,
#endif
#ifdef USE_CONMON
                                                PAYMENT_DATA
*pPayment,
                                                short           id,
                                                short           w_id,
                                                HANDLE          hConMon,
                                                short           con_x,
                                                short           con_y,
                                                short           deadlock_retry)
#else
                                        PAYMENT_DATA            *pPayment,

                                                short           deadlock_retry)
#endif
{
   RETCODE              rc;
                                int             i;
   int                  tryit;
                                char            cmd_buf[255];
                                char            printbuf[25];
                                BOOL            by_name;
#ifdef USE_CONMON
                                char            linebuf[CON_LINE_SIZE+1];
#endif
#ifdef USE_ODBC
                                char            buffer[255];
                                BOOL            deadlock_detected;
#else
                                DBDATETIME      datetime;
                                BYTE            *pData;
#endif


#ifdef DEBUG
                                printf("[%ld]DBG: Entering SQLPayment()...\n",
(int) GetCurrentThreadId());
#endif

   pPayment->num_deadlocks = 0;

                                if (pPayment->c_id == 0)
                                {
                                        by_name = TRUE;
                                }
                                else
                                {
                                        by_name = FALSE;
                                }

   for (tryit=0; tryit < deadlock_retry; tryit++)
   {

#ifdef USE_ODBC
                                        deadlock_detected = FALSE;
#endif

#ifdef USE_ODBC

                                        strcpy(buffer,"{call
tpcc_payment(?,?,?,?,?,?");
                                        if (pPayment->c_id == 0)
                                        {
                                                strcat(buffer,",?");
                                        }
                                        strcat(buffer,")}");

                                        // Bind Parameters
                                        rc = SQLBindParameter(hstmt, 1,
SQL_PARAM_INPUT, SQL_C_SSHORT,

                                SQL_SMALLINT, 0, 0, &pPayment->w_id, 0,
NULL);
                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc, hstmt);

                                UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindParameter() failed.");
                                        }

                                        rc = SQLBindParameter(hstmt, 2,
SQL_PARAM_INPUT, SQL_C_SSHORT,

                                SQL_SMALLINT, 0, 0, &pPayment->c_w_id, 0,
NULL);
                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc, hstmt);

                                UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindParameter() failed.");
                                        }
```

```
					rc = SQLBindParameter(hstmt, 3,
SQL_PARAM_INPUT, SQL_C_DOUBLE,

				SQL_NUMERIC, 6, 2, &pPayment->h_amount, 0,
NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindParameter() failed.");
					}

					rc = SQLBindParameter(hstmt, 4,
SQL_PARAM_INPUT, SQL_C_STINYINT,

				SQL_TINYINT, 0, 0, &pPayment->d_id, 0,
NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindParameter() failed.");
					}

					rc = SQLBindParameter(hstmt, 5,
SQL_PARAM_INPUT, SQL_C_STINYINT,

				SQL_TINYINT, 0, 0, &pPayment->c_d_id, 0,
NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindParameter() failed.");
					}

					rc = SQLBindParameter(hstmt, 6,
SQL_PARAM_INPUT, SQL_C_SLONG,

					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindParameter() failed.");
					}

					if (pPayment->c_id == 0)
					{
						rc = SQLBindParameter(hstmt, 7,
SQL_PARAM_INPUT, SQL_C_CHAR,

				SQL_CHAR, SQL_NTS, 0, &pPayment->c_last,
sizeof(pPayment->c_last), NULL);
						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindParameter() failed.");
						}
					}
```

```
					rc = SQLExecDirect(hstmt, buffer,
SQL_NTS);

					if (rc != SQL_SUCCESS && rc !=
SQL_SUCCESS_WITH_INFO)
					{
						deadlock_detected = ODBCError
(henv, hdbc, hstmt);
						if (!deadlock_detected)

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLExecDirect() failed.");
					}

#else
					//  Execute transaction

				if (dbrpcinit(dbproc, "tpcc_payment", 0) ==
SUCCEED)
					{
						dbrpcparam(dbproc, NULL, 0,
SQLINT2, -1, -1, (BYTE *) &pPayment->w_id);
						dbrpcparam(dbproc, NULL, 0,
SQLINT2, -1, -1, (BYTE *) &pPayment->c_w_id);
						dbrpcparam(dbproc, NULL, 0,
SQLFLT8, -1, -1, (BYTE *) &pPayment->h_amount);
						dbrpcparam(dbproc, NULL, 0,
SQLINT1, -1, -1, (BYTE *) &pPayment->d_id);
						dbrpcparam(dbproc, NULL, 0,
SQLINT1, -1, -1, (BYTE *) &pPayment->c_d_id);
						dbrpcparam(dbproc, NULL, 0,
SQLINT4, -1, -1, (BYTE *) &pPayment->c_id);
						if (pPayment->c_id == 0)
						{
							dbrpcparam(dbproc, NULL,
0, SQLCHAR, -1, strlen(pPayment->c_last), pPayment->c_last);
						}
					}
#endif

#ifdef USE_ODBC
SQL_INTEGER, SQL_NTS, 0, &pPayment->c_id, 0, NULL);
					if (!deadlock_detected)
					{

						rc = SQLBindCol(hstmt, 1,
SQL_C_SLONG, &pPayment->c_id, 0, NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 2,
SQL_C_CHAR, &pPayment->c_last, sizeof(pPayment->c_last) , NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
						}
```

```
						rc = SQLBindCol(hstmt, 3,
SQL_C_TIMESTAMP, &pPayment->h_date, 0, NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 4,
SQL_C_CHAR, &pPayment->w_street_1, sizeof(pPayment->w_street_1),
NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 5,
SQL_C_CHAR, &pPayment->w_street_2, sizeof(pPayment->w_street_2),
NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 6,
SQL_C_CHAR, &pPayment->w_city, sizeof(pPayment->w_city), NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 7,
SQL_C_CHAR, &pPayment->w_state, sizeof(pPayment->w_state) , NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 8,
SQL_C_CHAR, &pPayment->w_zip, sizeof(pPayment->w_zip), NULL);

						if (rc == SQL_ERROR)
						{
```

```
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 9,
SQL_C_CHAR, &pPayment->d_street_1, sizeof(pPayment->d_street_1) ,
NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 10,
SQL_C_CHAR, &pPayment->d_street_2, sizeof(pPayment->d_street_2),
NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 11,
SQL_C_CHAR, &pPayment->d_city, sizeof(pPayment->d_city), NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 12,
SQL_C_CHAR, &pPayment->d_state, sizeof(pPayment->d_state), NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 13,
SQL_C_CHAR, &pPayment->d_zip, sizeof(pPayment->d_zip), NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 14,
SQL_C_CHAR, &pPayment->c_first, sizeof(pPayment->c_first), NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 15,
SQL_C_CHAR, &pPayment->c_middle, sizeof(pPayment->c_middle),
NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 16,
SQL_C_CHAR, &pPayment->c_street_1, sizeof(pPayment->c_street_1),
NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 17,
SQL_C_CHAR, &pPayment->c_street_2, sizeof(pPayment->c_street_2),
NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 18,
SQL_C_CHAR, &pPayment->c_city, sizeof(pPayment->c_city), NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 19,
SQL_C_CHAR, &pPayment->c_state, sizeof(pPayment->c_state), NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 20,
SQL_C_CHAR, &pPayment->c_zip, sizeof(pPayment->c_zip), NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 21,
SQL_C_CHAR, &pPayment->c_phone, sizeof(pPayment->c_phone) ,
NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 22,
SQL_C_TIMESTAMP, &pPayment->c_since, 0, NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 23,
SQL_C_CHAR, &pPayment->c_credit, sizeof(pPayment->c_credit), NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}

				rc = SQLBindCol(hstmt, 24,
SQL_C_DOUBLE, &pPayment->c_credit_lim, 0 , NULL);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, hdbc,
hstmt);

			UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
				}
```

```
                                        rc = SQLBindCol(hstmt, 25,
SQL_C_DOUBLE, &pPayment->c_discount, 0, NULL);

                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                                UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
                                        }

                                        rc = SQLBindCol(hstmt, 26,
SQL_C_DOUBLE, &pPayment->c_balance, 0, NULL);

                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                                UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
                                        }

                                        rc = SQLBindCol(hstmt, 27,
SQL_C_CHAR, &pPayment->c_data, sizeof(pPayment->c_data), NULL);

                                        if (rc == SQL_ERROR)
                                        {
                                                ODBCError (henv, hdbc,
hstmt);

                                UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLBindCol() failed.");
                                        }

                                        rc = SQLFetch(hstmt);

                                        if (rc == SQL_ERROR)
                                        {
                                                deadlock_detected =
ODBCError (henv, hdbc, hstmt);
                                                if (!deadlock_detected)

                                UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLFetch() failed.");
                                        }

                                }

                                SQLFreeStmt(hstmt, SQL_CLOSE);

#else
                                if (dbrpcexec(dbproc) == SUCCEED)
                                {
                                        while (((rc = dbresults(dbproc)) !=
NO_MORE_RESULTS) && (rc != FAIL))
                                        {
                                                if (DBROWS(dbproc) &&
(dbnumcols(dbproc) == 27))
                                                {
                                                        while (((rc =
dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc != FAIL))
                                                        {

if(pData=dbdata(dbproc, 1))

                        pPayment->c_id = *((DBINT *) pData);

                        if(pData=dbdata(dbproc, 2))

                        UtilStrCpy(pPayment->c_last, pData,
dbdatlen(dbproc, 2));


                        if(pData=dbdata(dbproc, 3))
                                                {
                                                        datetime
= *((DBDATETIME *) pData);

                        dbdatecrack(dbproc, &pPayment->h_date,
&datetime);
                                                }


                        if(pData=dbdata(dbproc, 4))

                        UtilStrCpy(pPayment->w_street_1, pData,
dbdatlen(dbproc, 4));


                        if(pData=dbdata(dbproc, 5))

                        UtilStrCpy(pPayment->w_street_2, pData,
dbdatlen(dbproc, 5));


                        if(pData=dbdata(dbproc, 6))

                        UtilStrCpy(pPayment->w_city, pData,
dbdatlen(dbproc, 6));


                        if(pData=dbdata(dbproc, 7))

                        UtilStrCpy(pPayment->w_state, pData,
dbdatlen(dbproc, 7));


                        if(pData=dbdata(dbproc, 8))

                        UtilStrCpy(pPayment->w_zip, pData,
dbdatlen(dbproc, 8));


                        if(pData=dbdata(dbproc, 9))

                        UtilStrCpy(pPayment->d_street_1, pData,
dbdatlen(dbproc, 9));


                        if(pData=dbdata(dbproc, 10))

                        UtilStrCpy(pPayment->d_street_2, pData,
dbdatlen(dbproc, 10));


                        if(pData=dbdata(dbproc, 11))

                        UtilStrCpy(pPayment->d_city, pData,
dbdatlen(dbproc, 11));

                        if(pData=dbdata(dbproc, 12))

                        UtilStrCpy(pPayment->d_state, pData,
dbdatlen(dbproc, 12));

                        if(pData=dbdata(dbproc, 13))

                        UtilStrCpy(pPayment->d_zip, pData,
dbdatlen(dbproc, 13));


                        if(pData=dbdata(dbproc, 14))

                        UtilStrCpy(pPayment->c_first, pData,
dbdatlen(dbproc, 14));


                        if(pData=dbdata(dbproc, 15))

                        UtilStrCpy(pPayment->c_middle, pData,
dbdatlen(dbproc, 15));


                        if(pData=dbdata(dbproc, 16))

                        UtilStrCpy(pPayment->c_street_1, pData,
dbdatlen(dbproc, 16));


                        if(pData=dbdata(dbproc, 17))

                        UtilStrCpy(pPayment->c_street_2, pData,
dbdatlen(dbproc, 17));


                        if(pData=dbdata(dbproc, 18))

                        UtilStrCpy(pPayment->c_city, pData,
dbdatlen(dbproc, 18));


                        if(pData=dbdata(dbproc, 19))

                        UtilStrCpy(pPayment->c_state, pData,
dbdatlen(dbproc, 19));


                        if(pData=dbdata(dbproc, 20))

                        UtilStrCpy(pPayment->c_zip, pData,
dbdatlen(dbproc, 20));


                        if(pData=dbdata(dbproc, 21))

                        UtilStrCpy(pPayment->c_phone, pData,
dbdatlen(dbproc, 21));


                        if(pData=dbdata(dbproc, 22))
                                                {
                                                        datetime
= *((DBDATETIME *) pData);

                        dbdatecrack(dbproc, &pPayment->c_since,
&datetime);
```

```
                                                            }

                        if(pData=dbdata(dbproc, 23))

                        UtilStrCpy(pPayment->c_credit, pData,
dbdatlen(dbproc, 23));


                        if(pData=dbdata(dbproc, 24))

                        pPayment->c_credit_lim = (*(DBFLT8 *) pData);


                        if(pData=dbdata(dbproc, 25))

                        pPayment->c_discount = (*(DBFLT8 *) pData);


                        if(pData=dbdata(dbproc, 26))

                        pPayment->c_balance = (*(DBFLT8 *) pData);


                        if(pData=dbdata(dbproc, 27))

                        UtilStrCpy(pPayment->c_data, pData,
dbdatlen(dbproc, 27));
                                                      }
                                                }
                                          }
                                    }
#endif

#ifdef USE_ODBC
                              if (deadlock_detected)
#else
                              if (SQLDetectDeadlock(dbproc))
#endif
                              {

                                    pPayment->num_deadlocks++;
#ifdef USE_CONMON
                                    sprintf(linebuf,"[%04ld:%04ld]
Payment: deadlock:%ld",
                                          (int) id, (int) w_id, (int)
pPayment->num_deadlocks);
                                    WriteConsoleString(hConMon,
linebuf, con_x, con_y,RED,TRUE);
                                    total_deadlocks++;
                                    sprintf(linebuf,"%d",
total_deadlocks);
                                    WriteConsoleString(hConMon,
linebuf, DEADLOCK_X, DEADLOCK_Y,RED,TRUE);
#else
                                    sprintf(printbuf,"deadlock: retry:
%d",pPayment->num_deadlocks);

                        UtilError(GetCurrentThreadId(),"SQLPayment",pr
intbuf);
#endif

                                    Sleep(DEADLOCKWAIT*tryit);

                              }
                              else
                              {
```

```
                                                strcpy(pPayment-
>execution_status,"Transaction commited.");
                                                return TRUE;
                                          }
   }

   // If we reached here, it means we quit after MAX_RETRY deadlocks
                              strcpy(pPayment->execution_status,"Hit
deadlock max.  ");
#ifdef USE_CONMON
                              sprintf(linebuf,"[%04ld:%04ld] Payment: deadlock
max",
                                    (int) id, (int) w_id);
                              WriteConsoleString(hConMon, linebuf, con_x,
con_y,RED,TRUE);
#else
                              UtilError(GetCurrentThreadId(),"SQLPayment","d
eadlock max retry reached!");
#endif
   return FALSE;

}


//=======================================================
==============
//
// Function name: SQLOrderStatus
//
//=======================================================
==============

#ifdef USE_ODBC
BOOL SQLOrderStatus(HDBC        hdbc,
                                                HSTMT       hstmt,
#else
BOOL SQLOrderStatus(DBPROCESS   *dbproc,
#endif
#ifdef USE_CONMON
                                    ORDER_STATUS_DATA
*pOrderStatus,
                                    short             id,
                                          short             w_id,
                                    HANDLE            hConMon,
                                    short             con_x,
                                    short             con_y,
                                    short             deadlock_retry)
#else
                                    ORDER_STATUS_DATA
*pOrderStatus,
                                          short             deadlock_retry)
#endif
{
   RETCODE              rc;
   int            tryit;
   int            i;
                              BOOL              not_done;
                              char              cmd_buf[255];
                              char              printbuf[25];
                              BOOL              by_name;
#ifdef USE_CONMON
                              char              linebuf[CON_LINE_SIZE+1];
#endif
#ifdef USE_ODBC
                              char              buffer[255];
                              BOOL              deadlock_detected;
#else
                              DBDATETIME        datetime;
```

```
                              BYTE              *pData;
#endif

#ifdef DEBUG
                              printf("[%ld]DBG: Entering
SQLOrderStatus()...\n", (int) GetCurrentThreadId());
#endif

                              pOrderStatus->num_deadlocks = 0;

                              if (pOrderStatus->c_id == 0)
                              {
                                    by_name = TRUE;
                              }
                              else
                              {
                                    by_name = FALSE;
                              }

   for (tryit=0; tryit < deadlock_retry; tryit++)
   {

#ifdef USE_ODBC
                                    deadlock_detected = FALSE;
#endif


#ifdef USE_ODBC


                                    strcpy(buffer,"{call
tpcc_orderstatus(?,?,?");
                                    if (pOrderStatus->c_id == 0)
                                    {
                                          strcat(buffer,",?");
                                    }
                                    strcat(buffer,")}");

                                    // Bind Parameters

                                    rc = SQLBindParameter(hstmt, 1,
SQL_PARAM_INPUT, SQL_C_SSHORT,

                              SQL_SMALLINT, 0, 0, &pOrderStatus->w_id, 0,
NULL);
                                    if (rc == SQL_ERROR)
                                    {
                                          ODBCError (henv, hdbc, hstmt);

                              UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindParameter() failed.");
                                    }

                                    rc = SQLBindParameter(hstmt, 2,
SQL_PARAM_INPUT, SQL_C_STINYINT,

                              SQL_TINYINT, 0, 0, &pOrderStatus->d_id, 0,
NULL);
                                    if (rc == SQL_ERROR)
                                    {
                                          ODBCError (henv, hdbc, hstmt);

                              UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindParameter() failed.");
                                    }

                                    rc = SQLBindParameter(hstmt, 3,
SQL_PARAM_INPUT, SQL_C_SLONG,
				SQL_INTEGER, 0, 0, &pOrderStatus->c_id, 0,
NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, hdbc, hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindParameter() failed.");
					}

					if (pOrderStatus->c_id == 0)
					{

						rc = SQLBindParameter(hstmt, 4,
SQL_PARAM_INPUT, SQL_C_CHAR,

				SQL_CHAR, SQL_NTS, 0, &pOrderStatus-
>c_last, sizeof(pOrderStatus->c_last), NULL);
						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindParameter() failed.");
						}
					}

					rc = SQLExecDirect(hstmt, buffer,
SQL_NTS);

					if (rc != SQL_SUCCESS && rc !=
SQL_SUCCESS_WITH_INFO)
					{
						deadlock_detected = ODBCError
(henv, hdbc, hstmt);
						if (!deadlock_detected)

				UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLExecDirect() failed.");
					}

#else
					if (dbrpcinit(dbproc, "tpcc_orderstatus", 0)
== SUCCEED)
					{
						dbrpcparam(dbproc, NULL, 0,
SQLINT2, -1, -1, (BYTE *) &pOrderStatus->w_id);
						dbrpcparam(dbproc, NULL, 0,
SQLINT1, -1, -1, (BYTE *) &pOrderStatus->d_id);
						dbrpcparam(dbproc, NULL, 0,
SQLINT4, -1, -1, (BYTE *) &pOrderStatus->c_id);
						if (pOrderStatus->c_id == 0)
						{
							dbrpcparam(dbproc, NULL,
0, SQLCHAR, -1, strlen(pOrderStatus->c_last), pOrderStatus->c_last);
						}
				}
#endif

#ifdef USE_ODBC

					not_done = TRUE;
					i=0;

					while (not_done && !deadlock_detected)
					{
```

```
						rc = SQLBindCol(hstmt, 1,
SQL_C_SSHORT, &pOrderStatus->OlOrderStatusData[i].ol_supply_w_id, 0
, NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

					UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 2,
SQL_C_SLONG, &pOrderStatus->OlOrderStatusData[i].ol_i_id, 0 , NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

					UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 3,
SQL_C_SSHORT, &pOrderStatus->OlOrderStatusData[i].ol_quantity, 0 ,
NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

					UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 4,
SQL_C_DOUBLE, &pOrderStatus->OlOrderStatusData[i].ol_amount, 0 ,
NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

					UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
						}

						rc = SQLBindCol(hstmt, 5,
SQL_C_TIMESTAMP, &pOrderStatus->OlOrderStatusData[i].ol_delivery_d,
0 , NULL);

						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc,
hstmt);

					UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
						}

						rc = SQLFetch(hstmt);

						if (rc == SQL_ERROR)
```

```
							{
								deadlock_detected =
ODBCError (henv, hdbc, hstmt);
								if (!deadlock_detected)

						UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLFetch() failed.");
							}

							if (rc == SQL_NO_DATA_FOUND)
								not_done = FALSE;

							i++;
						}

						pOrderStatus->o_ol_cnt = i-1;

						if (i==0)
						{
#ifdef USE_CONMON
							sprintf(linebuf,"[%04ld:%04ld]
SQLOrderStatus: no orders",
									(int) id, (int) w_id);
							WriteConsoleString(hConMon,
linebuf, con_x, con_y,GREEN,TRUE);
#else

						UtilError(GetCurrentThreadId(),"SQLOrderStatus
","No orders found for customer");
#endif
						}
						else
						{

							if (!deadlock_detected)
							{

								rc = SQLMoreResults(hstmt);

								if (rc == SQL_ERROR)
								{
									deadlock_detected =
ODBCError (henv, hdbc, hstmt);
									if
(!deadlock_detected)

						UtilFatalError(GetCurrentThreadId(),
"SQLPayment", "SQLMoreResults() failed.");
								}
								else
								{

									if
(!deadlock_detected)
									{

										rc =
SQLBindCol(hstmt, 1, SQL_C_SLONG, &pOrderStatus->c_id, 0 , NULL);

										if (rc ==
SQL_ERROR)
										{

						ODBCError (henv, hdbc, hstmt);

						UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
										}
```

```
	rc =
SQLBindCol(hstmt, 2, SQL_C_CHAR, &pOrderStatus->c_last,
sizeof(pOrderStatus->c_last), NULL);

	if (rc ==
SQL_ERROR)
	{

		ODBCError (henv, hdbc, hstmt);

		UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
	}

	rc =
SQLBindCol(hstmt, 3, SQL_C_CHAR, &pOrderStatus->c_first,
sizeof(pOrderStatus->c_first), NULL);

	if (rc ==
SQL_ERROR)
	{

		ODBCError (henv, hdbc, hstmt);

		UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
	}

	rc =
SQLBindCol(hstmt, 4, SQL_C_CHAR, &pOrderStatus->c_middle,
sizeof(pOrderStatus->c_middle), NULL);

	if (rc ==
SQL_ERROR)
	{

		ODBCError (henv, hdbc, hstmt);

		UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
	}

	rc =
SQLBindCol(hstmt, 5, SQL_C_TIMESTAMP, &pOrderStatus->o_entry_d, 0,
NULL);

	if (rc ==
SQL_ERROR)
	{

		ODBCError (henv, hdbc, hstmt);

		UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
	}

	rc =
SQLBindCol(hstmt, 6, SQL_C_SSHORT, &pOrderStatus->o_carrier_id, 0,
NULL);

	if (rc ==
SQL_ERROR)
	{

		ODBCError (henv, hdbc, hstmt);

		UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
	}

	rc =
SQLBindCol(hstmt, 7, SQL_C_DOUBLE, &pOrderStatus->c_balance, 0,
NULL);

	if (rc ==
SQL_ERROR)
	{

		ODBCError (henv, hdbc, hstmt);

		UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
	}

	rc =
SQLBindCol(hstmt, 8, SQL_C_SLONG, &pOrderStatus->o_id, 0, NULL);

	if (rc ==
SQL_ERROR)
	{

		ODBCError (henv, hdbc, hstmt);

		UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLBindCol() failed.");
	}

	rc =
SQLFetch(hstmt);

	if (rc ==
SQL_ERROR)

	{

		deadlock_detected = ODBCError (henv, hdbc,
hstmt);
			if
(!deadlock_detected)

		UtilFatalError(GetCurrentThreadId(),
"SQLOrderStatus", "SQLFetch() failed.");
	}
			}
		}
	}
}

	SQLFreeStmt(hstmt, SQL_CLOSE);
#else

	if (dbrpcexec(dbproc) == SUCCEED)
	{

		while (((rc = dbresults(dbproc)) !=
NO_MORE_RESULTS) && (rc != FAIL))
		{

			if (DBROWS(dbproc) &&
(dbnumcols(dbproc) == 5))
			{
				i=0;

				while (((rc =
dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc != FAIL))
				{

					if(pData=dbdata(dbproc, 1))

					pOrderStatus-
>OlOrderStatusData[i].ol_supply_w_id = (*(DBSMALLINT *) pData);

					if(pData=dbdata(dbproc, 2))

					pOrderStatus->OlOrderStatusData[i].ol_i_id =
(*(DBINT *) pData);

					if(pData=dbdata(dbproc, 3))

					pOrderStatus->OlOrderStatusData[i].ol_quantity
= (*(DBSMALLINT *) pData);

					if(pData=dbdata(dbproc, 4))

					pOrderStatus->OlOrderStatusData[i].ol_amount
= (*(DBFLT8 *) pData);

					if(pData=dbdata(dbproc, 5))
					{
						datetime
= *((DBDATETIME *) pData);

					dbdatecrack(dbproc, &pOrderStatus-
>OlOrderStatusData[i].ol_delivery_d, &datetime);
					}

					i++;
				}

				pOrderStatus-
>o_ol_cnt = i;
			}
			else if (DBROWS(dbproc)
&& (dbnumcols(dbproc) == 8))
			{
			while (((rc =
dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc != FAIL))
				{

					if(pData=dbdata(dbproc, 1))

					pOrderStatus->c_id = (*(DBINT *) pData);

					if(pData=dbdata(dbproc, 2))

					UtilStrCpy(pOrderStatus->c_last, pData,
dbdatlen(dbproc,2));

					if(pData=dbdata(dbproc, 3))

					UtilStrCpy(pOrderStatus->c_first, pData,
dbdatlen(dbproc,3));

					if(pData=dbdata(dbproc, 4))
				UtilStrCpy(pOrderStatus->c_middle, pData,
dbdatlen(dbproc, 4));

				if(pData=dbdata(dbproc, 5))
							{
								datetime
= *((DBDATETIME *) pData);

				dbdatecrack(dbproc, &pOrderStatus->o_entry_d,
&datetime);
							}

				if(pData=dbdata(dbproc, 6))

				pOrderStatus->o_carrier_id = (*(DBSMALLINT *)
pData);

				if(pData=dbdata(dbproc, 7))

				pOrderStatus->c_balance = (*(DBFLT8 *)
pData);

				if(pData=dbdata(dbproc, 8))

				pOrderStatus->o_id = (*(DBINT *) pData);

						}
					}

					if (i==0)
						{
#ifdef USE_CONMON

				sprintf(linebuf,"[%04ld:%04ld] SQLOrderStatus:
no orders",
							(int) id, (int)
w_id);

				WriteConsoleString(hConMon, linebuf, con_x,
con_y,GREEN,TRUE);
#else

				UtilError(GetCurrentThreadId(),"SQLO rderStatus
","No orders found for customer");
#endif
						}

					}
				}
#endif

#ifdef USE_ODBC
					if (deadlock_detected)
#else
					if (SQLDetectDeadlock(dbproc))
#endif
					{

						pOrderStatus->num_deadlocks++;
#ifdef USE_CONMON
						sprintf(linebuf,"[%04ld:%04ld]
OrderStatus: deadlock:%ld",
								(int) id, (int) w_id, (int)
pOrderStatus->num_deadlocks);
							WriteConsoleString( hConMon,
linebuf, con_x, con_y,RED,TRUE);
							total_deadlocks++;
							sprintf(linebuf,"%d",
total_deadlocks);
							WriteConsoleString(hConMon,
linebuf, DEADLOCK_X, DEADLOCK_Y,RED,TRUE);
#else
							sprintf(printbuf,"deadlock: retry:
%d",pOrderStatus->num_deadlocks);

					UtilError(GetCurrentThreadId(),"SQLOrderStatus
",printbuf);
#endif

							Sleep(DEADLOCKWAIT*tryit);

						}
						else
						{
							strcpy(pOrderStatus-
>execution_status,"Transaction commited.");
							return TRUE;
						}
   }

   // If we reached here, it means we quit after MAX_RETRY deadlocks
					strcpy(pOrderStatus->execution_status,"Hit
deadlock max.  ");
#ifdef USE_CONMON
					sprintf(linebuf,"[%04ld:%04ld] OrderStatus:
deadlock max",
						(int) id, (int) w_id);
					WriteConsoleString(hConMon, linebuf, con_x,
con_y,RED,TRUE);
#else
					UtilError(GetCurrentThreadId(),"SQLOrderStatus
","deadlock max retry reached!");
#endif
   return FALSE;

}


//=========================================================
==============
//
// Function name: SQLStockLevel
//
//=========================================================
==============

#ifdef USE_ODBC
BOOL SQLStockLevel(HDBC			hdbc,
							HSTMT	hstmt,
#else
BOOL SQLStockLevel(DBPROCESS	*dbproc,
#endif
#ifdef USE_CONMON
						STOCK_LEVEL_DATA
					*pStockLevel,
						short				id,
						short				w_id,
						HANDLE
					hConMon,
						short				con_x,
						short				con_y,
						short
					deadlock_retry)
#else
						STOCK_LEVEL_DATA
					*pStockLevel,
						short
					deadlock_retry)
#endif
{
   int			tryit;
					RETCODE		rc;
					char		printbuf[25];
#ifdef USE_CONMON
					char		linebuf[CON_LINE_SIZE+1];
#endif
#ifdef USE_ODBC
					char		buffer[255];
					BOOL		deadlock_detected;
#else
					BYTE		*pData;
#endif


#ifdef DEBUG
					printf("[%ld]DBG: Entering SQLStockLevel()...\n",
(int) GetCurrentThreadId());
#endif

					pStockLevel->num_deadlocks = 0;

   for (tryit=0; tryit < deadlock_retry; tryit++)
   {

#ifdef DEBUG
						printf("[%ld]DBG: Executing StockLevel
transaction...\n", (int) GetCurrentThreadId());
#endif

#ifdef USE_ODBC

						deadlock_detected = FALSE;

						strcpy(buffer,"{call
tpcc_stocklevel(?,?,?)}");

						// Bind Parameters
						rc = SQLBindParameter(hstmt, 1,
SQL_PARAM_INPUT, SQL_C_SSHORT,

					SQL_SMALLINT, 0, 0, &pStockLevel->w_id, 0,
NULL);
						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc, hstmt);

					UtilFatalError(GetCurrentThreadId(),
"SQLStockLevel", "SQLBindParameter() failed.");
						}

						rc = SQLBindParameter(hstmt, 2,
SQL_PARAM_INPUT, SQL_C_STINYINT,

					SQL_TINYINT, 0, 0, &pStockLevel->d_id, 0,
NULL);
						if (rc == SQL_ERROR)
						{
							ODBCError (henv, hdbc, hstmt);
```

```
                    UtilFatalError(GetCurrentThreadId(),
"SQLStockLevel", "SQLBindParameter() failed.");
                         }

                         rc = SQLBindParameter(hstmt, 3,
SQL_PARAM_INPUT, SQL_C_SSHORT,

                    SQL_SMALLINT, 0, 0, &pStockLevel-
>thresh_hold, 0, NULL);
                         if (rc == SQL_ERROR)
                         {
                              ODBCError (henv, hdbc, hstmt);

                    UtilFatalError(GetCurrentThreadId(),
"SQLStockLevel", "SQLBindParameter() failed.");
                         }

                         rc = SQLExecDirect(hstmt, buffer,
SQL_NTS);

                         if (rc != SQL_SUCCESS && rc !=
SQL_SUCCESS_WITH_INFO)
                         {
                              deadlock_detected = ODBCError
(henv, hdbc, hstmt);
                              if (!deadlock_detected)

                    UtilFatalError(GetCurrentThreadId(),
"SQLStockLevel", "SQLExecDirect() failed.");
                         }

                         if (!deadlock_detected)
                         {

                              rc = SQLBindCol(hstmt, 1,
SQL_C_SSHORT, &pStockLevel->low_stock, 0, NULL);

                              if (rc == SQL_ERROR)
                              {
                                   ODBCError (henv, hdbc,
hstmt);

                    UtilFatalError(GetCurrentThreadId(),
"SQLStockLevel", "SQLBindCol() failed.");
                              }

                              rc = SQLFetch(hstmt);

                              if (rc == SQL_ERROR)
                              {
                                   deadlock_detected =
ODBCError (henv, hdbc, hstmt);
                                   if (!deadlock_detected)

                    UtilFatalError(GetCurrentThreadId(),
"SQLStockLevel", "SQLFetch() failed.");
                              }

                         }

                         SQLFreeStmt(hstmt, SQL_CLOSE);
#else

                         if (dbrpcinit(dbproc, "tpcc_stocklevel",  0)
== SUCCEED)
                         {
                              dbrpcparam(dbproc, NULL, 0,
SQLINT2, -1, -1, (BYTE *) &pStockLevel->w_id);
                              dbrpcparam(dbproc, NULL, 0,
SQLINT1, -1, -1, (BYTE *) &pStockLevel->d_id);
                              dbrpcparam(dbproc, NULL, 0,
SQLINT2, -1, -1, (BYTE *) &pStockLevel->thresh_hold);

                              if (dbrpcexec(dbproc) ==
SUCCEED)
                              {
                                   while (((rc =
dbresults(dbproc)) != NO_MORE_RESULTS) && (rc != FAIL))
                                   {
                                        if (DBROWS(dbproc))
                                        {
                                             while (((rc =
dbnextrow(dbproc)) != NO_MORE_ROWS) && (rc != FAIL))
                                             {

                    if(pData=dbdata(dbproc, 1))

                    pStockLevel->low_stock = *((long *) pData);
                                             }
                                        }
                                   }
                              }
                         }

#endif

#ifdef USE_ODBC
                         if (deadlock_detected)
#else
                         if (SQLDetectDeadlock(dbproc))
#endif
                         {
                              pStockLevel->num_deadlocks++;
#ifdef USE_CONMON
                              sprintf(linebuf,"[%04ld:%04ld]
StockLevel: deadlock:%ld",
                                   (int) id, (int) w_id, (int)
pStockLevel->num_deadlocks);
                              WriteConsoleString(hConMon,
linebuf, con_x, con_y,RED,TRUE);
                              total_deadlocks++;
                              sprintf(linebuf,"%d",
total_deadlocks);
                              WriteConsoleString(hConMon,
linebuf, DEADLOCK_X, DEADLOCK_Y,RED,TRUE);
#else
                              sprintf(printbuf,"deadlock: retry:
%d",pStockLevel->num_deadlocks);

                    UtilError(GetCurrentThreadId(),"SQLStockLevel",
printbuf);
#endif
                         Sleep(DEADLOCKWAIT*tryit);

                         }
                         else
                         {
                              strcpy(pStockLevel-
>execution_status, "Transaction commited.");
                              return TRUE;
                         }
   }

   // If we reached here, it means we quit after MAX_RETRY deadlocks
                    strcpy(pStockLevel->execution_status, "Hit
deadlock max. ");
#ifdef USE_CONMON
                    sprintf(linebuf,"[%04ld:%04ld] StockLevel:
deadlock max",
                         (int) id, (int) w_id);
                    WriteConsoleString(hConMon, linebuf, con_x,
con_y,RED,TRUE);
#else
                    UtilError(GetCurrentThreadId(),"SQLStockLevel",
"deadlock max retry reached!");
#endif
   return FALSE;

}


//=======================================================
==============
//
// Function name: SQLDelivery
//
//=======================================================
==============

void SQLDelivery(DELIVERY      *pDeliveryHdlr,
                                   TRAN_STATS
                    *pDeliveryStats)
{
                    RETCODE                       rc;
                    int                           i;
                    int
                    deadlock_count;
                    BOOL                     not_done;
                    int
                    deadlock_detected;
                    struct delivery_node     get_node;
                    char                          buf[255];
#ifndef USE_ODBC
                    BYTE                          *pData;
#endif


#ifdef DEBUG
                    printf("[%ld]DBG: Entering SQLDelivery()...\n",
(int) GetCurrentThreadId());
#endif

#ifdef DEBUG
                    sprintf(buf, "[%ld] Retrieving from delivery queue:
Handler(%ld)\n",
                                   (int) GetCurrentThreadId(),
                                   (int) pDeliveryHdlr->id);
                    WriteDeliveryString(buf);
#endif

                    rc = GetDeliveryQueueNode(&get_node);

                    deadlock_count = 0;

                    if (rc==FALSE)
                    {

#ifdef DEBUG
                         sprintf(buf, "[%ld] Sleeping %ld seconds
before attempting another delivery...\n",
                              (int) GetCurrentThreadId(),
pDeliveryHdlr->delivery_backoff);
```

```
					WriteDeliveryString(buf);
#endif

					UtilSleep(pDeliveryHdlr-
>delivery_backoff);
					return;
				}

				pDeliveryHdlr->w_id = get_node.w_id;
				pDeliveryHdlr->o_carrier_id =
get_node.o_carrier_id;
				pDeliveryHdlr->queue_time =
get_node.queue_time;
				pDeliveryHdlr->tran_start_time =
get_node.tran_start_time;

#ifdef DEBUG
				sprintf(buf, "[%ld] Starting delivery: Handler(%ld),
w_id(%ld), o_carrier_id(%ld), queue_time (%d/%d/%d %d:%d:%d:%d)\n",
						(int) GetCurrentThreadId(),
						(int) pDeliveryHdlr->id,
						(int) pDeliveryHdlr->w_id,
					(int) pDeliveryHdlr->o_carrier_id,
						pDeliveryHdlr-
>queue_time.wMonth,
						pDeliveryHdlr->queue_time.wDay,
						pDeliveryHdlr->queue_time.wYear,
						pDeliveryHdlr->queue_time.wHour,
						pDeliveryHdlr-
>queue_time.wMinute,
						pDeliveryHdlr-
>queue_time.wSecond,
						pDeliveryHdlr-
>queue_time.wMilliseconds);
				WriteDeliveryString(buf);
#endif

				not_done = TRUE;

				// Start new delivery
				while (not_done)
				{

					deadlock_detected = FALSE;

#ifdef USE_ODBC

					rc = SQLBindParameter(pDeliveryHdlr-
>hstmt, 1, SQL_PARAM_INPUT, SQL_C_SSHORT,

					if (rc == SQL_ERROR)
					{
						ODBCError (henv, pDeliveryHdlr-
>hdbc, pDeliveryHdlr->hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLDelivery", "SQLBindParameter() failed.");
					}

					rc = SQLBindParameter(pDeliveryHdlr-
>hstmt, 2, SQL_PARAM_INPUT, SQL_C_SSHORT,

				SQL_SMALLINT, 0, 0, &pDeliveryHdlr-
>o_carrier_id, 0, NULL);
					if (rc == SQL_ERROR)
					{
						ODBCError (henv, pDeliveryHdlr-
>hdbc, pDeliveryHdlr->hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLDelivery", "SQLBindParameter() failed.");
					}

					rc = SQLExecDirect(pDeliveryHdlr->hstmt,
"{call tpcc_delivery (?, ?)}", SQL_NTS);

					if (rc == SQL_ERROR)
					{
						deadlock_detected = ODBCError
(henv, pDeliveryHdlr->hdbc, pDeliveryHdlr->hstmt);
						if (!deadlock_detected)

				UtilFatalError(GetCurrentThreadId(),
"SQLDelivery", "SQLExecDirect() failed.");
					}

					if (!deadlock_detected)
					{

						for (i=0;i<10;i++)
						{
							rc =
SQLBindCol(pDeliveryHdlr->hstmt, i+1, SQL_C_SLONG, &pDeliveryHdlr-
>DelItems[i].o_id, 0 , NULL);

							if (rc == SQL_ERROR)
							{
								ODBCError (henv,
pDeliveryHdlr->hdbc, pDeliveryHdlr->hstmt);

				UtilFatalError(GetCurrentThreadId(),
"SQLDelivery", "SQLBindCol() failed.");
							}
						}

						// Fetch next row
						rc = SQLFetch(pDeliveryHdlr-
>hstmt);

						if (rc == SQL_ERROR)
						{
							deadlock_detected =
ODBCError (henv, pDeliveryHdlr->hdbc, pDeliveryHdlr->hstmt);
							if (!deadlock_detected)

				UtilFatalError(GetCurrentThreadId(),
"SQLDelivery", "SQLFetch() failed.");
SQL_SMALLINT, 0, 0, &pDeliveryHdlr->w_id, 0, NULL);
						}

					}

					SQLFreeStmt(pDeliveryHdlr->hstmt,
SQL_CLOSE);

#else
					if (dbrpcinit(pDeliveryHdlr->sqlconn,
"tpcc_delivery", 0) == SUCCEED)
					{
						dbrpcparam(pDeliveryHdlr-
>sqlconn, NULL, 0, SQLINT2, -1, -1, (BYTE *) &pDeliveryHdlr->w_id);
						dbrpcparam(pDeliveryHdlr-
>sqlconn, NULL, 0, SQLINT1, -1, -1, (BYTE *) &pDeliveryHdlr-
>o_carrier_id);

						if (dbrpcexec(pDeliveryHdlr-
>sqlconn) == SUCCEED)
						{
							while (((rc =
dbresults(pDeliveryHdlr->sqlconn)) != NO_MORE_RESULTS)
								&& (rc != FAIL))
							{
								while (((rc =
dbnextrow(pDeliveryHdlr->sqlconn)) != NO_MORE_ROWS)
									&& (rc !=
FAIL))
								{
									for
(i=0;i<10;i++)
									{

				if(pData=dbdata(pDeliveryHdlr->sqlconn, i+1))

				pDeliveryHdlr->DelItems[i].o_id = *((DBINT *)
pData);
										else

				UtilError(GetCurrentThreadId(),"SQLDelivery","d
bdata() failed");
									}
								}
							}
						}
					}
#endif

#ifdef USE_ODBC
					if (deadlock_detected)
#else
					if (SQLDetectDeadlock(pDeliveryHdlr-
>sqlconn))
#endif
				{
						deadlock_count++;
						pDeliveryStats->num_deadlocks++;

						sprintf(buf, "[%ld] Deadlock
detected, retrying... (w_id(%ld), o_carrier(%ld))\n",
								pDeliveryHdlr-
>id,
								pDeliveryHdlr-
>w_id,
								pDeliveryHdlr-
>o_carrier_id);
						WriteDeliveryString(buf);


				Sleep(DEADLOCKWAIT*deadlock_count);
#ifdef USE_ODBC
						SQLFreeStmt(pDeliveryHdlr-
>hstmt, SQL_CLOSE);
#endif
					}
					else
					{
						not_done = FALSE;
					}

				}

				pDeliveryHdlr->tran_end_time = TimeNow();
				GetLocalTime(&pDeliveryHdlr-
>completion_time);
```

```
#ifdef DEBUG
                              sprintf(buf, "[%ld] Deliveries completed:
Handler(%ld), w_id(%ld), o_carrier_id(%ld)\n",
                                                      (int) GetCurrentThreadId(),
                                                      (int) pDeliveryHdlr->id,
                                                      (int) pDeliveryHdlr->w_id,
                                                      (int) pDeliveryHdlr-
>o_carrier_id);
                              WriteDeliveryString(buf);
#endif DEBUG

                              sprintf(buf, "[%ld] w_id(%ld), o_carrier(%ld),
queue depth(%ld), response time(%ld ms)\n",
                                                      pDeliveryHdlr->id,
                                                      pDeliveryHdlr->w_id,
                                               pDeliveryHdlr->o_carrier_id,
                                                      queued_delivery_cnt,
                                                      pDeliveryHdlr-
>tran_end_time - pDeliveryHdlr->tran_start_time);
                              WriteDeliveryString(buf);

                              StatsDelivery(pDeliveryHdlr,
                                                       pDeliveryStats);

}


//=========================================================
=============
//
// Function name: SQLDetectDeadlock
//
//=========================================================
=============

BOOL SQLDetectDeadlock(DBPROCESS *dbproc)
{

#ifdef DEBUG
                              printf("[%ld]DBG: Entering
SQLDetectDeadlock()...\n", (int) GetCurrentThreadId());
#endif

   if (*((BOOL *) dbgetuserdata(dbproc)) == TRUE)
   {
                                     *((BOOL *) dbgetuserdata(dbproc)) =
FALSE;
                                     return TRUE;
   }
   else
                                     return FALSE;
}


//=========================================================
=============
//
// Function name: SQLExec
//
//=========================================================
=============

BOOL SQLExec(DBPROCESS *dbproc)
{
   int rc;

#ifdef DEBUG
                              printf("[%ld]DBG: Entering SQLExec()...\n", (int)
GetCurrentThreadId());
#endif

   if (DBDEAD(dbproc))
                                     UtilFatalError(GetCurrentThreadId(),
"SQLExec","dead dbproc");
   rc = dbsqlexec(dbproc);
   while((rc = dbresults(dbproc)) != NO_MORE_RESULTS)
                                     while ((rc = dbnextrow(dbproc)) !=
NO_MORE_ROWS)
                                     ;

   return TRUE;
}


//=========================================================
=============
//
// Function name: SQLExecCmd
//
//=========================================================
=============

BOOL SQLExecCmd(DBPROCESS *dbproc, char *cmd)
{
   int rc;

#ifdef DEBUG
                              printf("[%ld]DBG: Entering SQLExecCmd()...\n",
(int) GetCurrentThreadId());
#endif

   if (DBDEAD(dbproc))
                                     UtilFatalError(GetCurrentThreadId(),
"SQLExecCmd","dead dbproc");
   rc = dbcmd(dbproc, cmd);
   rc = dbsqlexec(dbproc);
   while((rc = dbresults(dbproc)) != NO_MORE_RESULTS)
                                     while ((rc = dbnextrow(dbproc)) !=
NO_MORE_ROWS)
                                     ;

   return TRUE;
}


//=========================================================
=============
//
// Function name: SQLOpenConnection
//
//=========================================================
=============

BOOL SQLOpenConnection(DBPROCESS **dbproc,
                                                  char     *server,
                                                  char     *database,
                                                char     *user,
                                                char     *password,
                                                char     *app,
                                                int      *spid,
                                                long     *pack_size)
{
   LOGINREC   *login;

#ifdef DEBUG
                              printf("[%ld]DBG: Entering
SQLOpenConnection()...\n", (int) GetCurrentThreadId());
#endif

   login = dblogin();
   DBSETLUSER(login, user);
   DBSETLPWD(login,  password);
   DBSETLHOST(login, app);

   DBSETLPACKET(login, (unsigned short) pack_size);

   if ((*dbproc = dbopen(login, server )) == NULL) {
                                     UtilFatalError(GetCurrentThrea dId(),
"SQLOpenConnection", "Could not open connection");
                                     return 0;
                              }

   // Use the the right database

   dbuse(*dbproc, database);

   dbsetuserdata(*dbproc, malloc(sizeof(BOOL)));
                              *((BOOL *) dbgetuserdata(*dbproc)) = FALSE;
   dbcmd(*dbproc, "select @@spid");
   dbsqlexec(*dbproc);

   while (dbresults(*dbproc) != NO_MORE_RESULTS)
   {
                                     dbbind(*dbproc, 1, SMALLBIND, (DBINT)
0, (BYTE *) spid);
                                     while (dbnextrow(*dbproc) !=
NO_MORE_ROWS)
                                     ;
   }
   dbcmd(*dbproc, "set nocount on");
   dbsqlexec(*dbproc);
   while (dbresults(*dbproc) != NO_MORE_RESULTS)
   {
                                     while (dbnextrow(*dbproc) !=
NO_MORE_ROWS)
                                     ;
   }
#ifdef PROFILE
                              SQLExecCmd(*dbproc,"set showplan on set
statistics time on set statistics io on");
#endif
   return TRUE;

};


//=========================================================
=============
//
// Function name: SQLClientStats
//
//=========================================================
=============

int SQLClientStats(CLIENT_DATA         *pClient,
                                                  CLIENT_STATS   *pStats)
{

                              char           cmd[30];
                              RETCODE    rc;

#ifdef DEBUG
```

```
                                printf("[%ld]DBG: Entering SQLClientStats()...\n",
(int) GetCurrentThreadId());
#endif

#ifdef USE_ODBC

                                sprintf(cmd,"use %s", pClient->admin_database);
                                rc = SQLExecDirect(pClient->hstmt, cmd,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                                {
                                        ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLClientStats", "SQLExecDirect() failed.");
                                }

                                SQLFreeStmt(pClient->hstmt, SQL_CLOSE);

                                SQLTranStats(pClient->hdbc, pClient->hstmt,
&pStats->NewOrderStats,
                                        "tpcc_neworder_stats",
"tpcc_neworder_resp_hist", pClient->disable_90th);

   SQLTranStats(pClient->hdbc, pClient->hstmt, &pStats->PaymentStats,
                                        "tpcc_payment_stats",
"tpcc_payment_resp_hist", pClient->disable_90th);

   SQLTranStats(pClient->hdbc, pClient->hstmt, &pStats-
>OrderStatusStats,
                                        "tpcc_orderstatus_stats",
"tpcc_orderstatus_resp_hist", pClient->disable_90th);

   SQLTranStats(pClient->hdbc, pClient->hstmt, &pStats-
>QueuedDeliveryStats,
                                        "tpcc_queued_delivery_stats",
"tpcc_queued_delivery_resp_hist", pClient->disable_90th);

   SQLTranStats(pClient->hdbc, pClient->hstmt, &pStats->StockLevelStats,
                                        "tpcc_stocklevel_stats",
"tpcc_stocklevel_resp_hist", pClient->disable_90th);

                                sprintf(cmd,"use %s", pClient->database);
                                rc = SQLExecDirect(pClient->hstmt, cmd,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                                {
                                        ODBCError (henv, pClient->hdbc, pClient-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLClientStats", "SQLExecDirect() failed.");
                                }

#else

                                sprintf(cmd,"use %s",pClient->admin_database);
                                SQLExecCmd(pClient->sqlconn, cmd);

   SQLTranStats(pClient->sqlconn, &pStats->NewOrderStats,
                                        "tpcc_neworder_stats",
"tpcc_neworder_resp_hist", pClient->disable_90th);

   SQLTranStats(pClient->sqlconn, &pStats->PaymentStats,
                                        "tpcc_payment_stats",
"tpcc_payment_resp_hist", pClient->disable_90th);

   SQLTranStats(pClient->sqlconn, &pStats->OrderStatusStats,
                                        "tpcc_orderstatus_stats",
"tpcc_orderstatus_resp_hist", pClient->disable_90th);

   SQLTranStats(pClient->sqlconn, &pStats->QueuedDeliveryStats,
                                        "tpcc_queued_delivery_stats",
"tpcc_queued_delivery_resp_hist", pClient->disable_90th);

   SQLTranStats(pClient->sqlconn, &pStats->StockLevelStats,
                                        "tpcc_stocklevel_stats",
"tpcc_stocklevel_resp_hist", pClient->disable_90th);

                                sprintf(cmd,"use %s",pClient->database);
                                SQLExecCmd(pClient->sqlconn, cmd);

#endif

}


//=========================================================
=============
//
// Function name: SQLDeliveryStats
//
//=========================================================
=============

int SQLDeliveryStats(DELIVERY     *pDeliveryHdlr,
                                        TRAN_STATS   *pStats)
{

                                char    cmd[30];
                                RETCODE    rc;

#ifdef DEBUG
                                printf("[%ld]DBG: Entering
SQLDeliveryStats()...\n", (int) GetCurrentThreadId());
#endif

#ifdef USE_ODBC

                                sprintf(cmd,"use %s", pDeliveryHdlr-
>admin_database);
                                rc = SQLExecDirect(pDeliveryHdlr->hstmt, cmd,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                                {
                                        ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryStats", "SQLExecDirect() failed.");
                                }

                                SQLTranStats(pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt, pStats,
                                        "tpcc_delivery_stats",
"tpcc_delivery_resp_hist", pDeliveryHdlr->disable_90th);

                                sprintf(cmd,"use %s", pDeliveryHdlr->database);
                                rc = SQLExecDirect(pDeliveryHdlr->hstmt, cmd,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                                {
                                        ODBCError (henv, pDeliveryHdlr->hdbc,
pDeliveryHdlr->hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLDeliveryStats", "SQLExecDirect() failed.");
                                }

#else

                                sprintf(cmd,"use %s",pDeliveryHdlr-
>admin_database);
                                SQLExecCmd(pDeliveryHdlr->sqlconn, cmd);

   SQLTranStats(pDeliveryHdlr->sqlconn, pStats,
                                        "tpcc_delivery_stats",
"tpcc_delivery_resp_hist", pDeliveryHdlr->disable_90th);

                                sprintf(cmd,"use %s",pDeliveryHdlr->database);
                                SQLExecCmd(pDeliveryHdlr->sqlconn, cmd);

#endif

}


//=========================================================
=============
//
// Function name: SQLTranStats
//
//=========================================================
=============

#ifdef USE_ODBC
void SQLTranStats(HDBC   hdbc,
                                        HSTMT  hstmt,
#else
void SQLTranStats(DBPROCESS   *dbproc,
#endif
                                        TRAN_STATS
*pTranStats,
                                        char        *StatsTable,
                                        char        *RespHistTable,
                                        long        disable_90th)
{
   int         i;
#ifdef USE_ODBC
                                RETCODE    rc;
                                char              buffer[255];
#endif

#ifdef DEBUG
                                printf("[%ld]DBG: Entering SQLTranStats()...\n",
(int) GetCurrentThreadId());
#endif

#ifdef USE_ODBC

                                sprintf(buffer,"insert into %s
values(%ld,%ld,%d,%d,%ld,%ld,%ld,%ld,%ld)",
                                        StatsTable,
                                        pTranStats->tran_count,
                                        pTranStats->total_time,
                                        pTranStats->resp_time,
                                        pTranStats->resp_min,
                                        pTranStats->resp_max,
                                        pTranStats->rolled_back,
                                        pTranStats->tran_2sec,
                                        pTranStats->tran_5sec,
                                        pTranStats-
>num_deadlocks);
```

```
                        rc = SQLExecDirect(hstmt, buffer, SQL_NTS);
   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                        {
                              ODBCError (henv, hdbc, hstmt);
                              UtilFatalError(GetCurrentThreadId(),
"SQLTranStats", "SQLExecDirect() failed.");
                        }

                        SQLFreeStmt(hstmt, SQL_CLOSE);

                        if (!disable_90th)
                        {
                              for(i = 0; i < HIST_MAX; i++)
                              {

                                    sprintf(buffer,"insert into %s
values(%ld, %ld)",
                                                      RespHistTable,
                                                      i,
                                                      pTranStats-
>resp_hist[i]);

                                    rc = SQLExecDirect(hstmt, buffer,
SQL_NTS);

                                    if (rc != SQL_SUCCESS && rc !=
SQL_SUCCESS_WITH_INFO)
                                    {
                                          ODBCError (henv, hdbc,
hstmt);

                        UtilFatalError(GetCurrentThreadId(),
"SQLTranStats", "SQLExecDirect() failed.");
                                    }

                          }

                              SQLFreeStmt(hstmt, SQL_CLOSE);
                        }

#else

   dbfcmd(dbproc," insert into %s values(%ld,%ld,%d,%d,",
                                          StatsTable,
                                          pTranStats->tran_count,
                                          pTranStats->total_time,
                                          pTranStats->resp_time,
                                          pTranStats->resp_min);

                        dbfcmd(dbproc,"%ld,%ld,%ld,%ld,%ld)",
                                          pTranStats->resp_max,
                                          pTranStats->rolled_back,
                                          pTranStats->tran_2sec,
                                          pTranStats->tran_5sec,
                                          pTranStats-
>num_deadlocks);

   SQLExec(dbproc);

                        if (!disable_90th)
                        {

                              // Write response histogram
                              for(i = 0; i < HIST_MAX; i++)
                              {
                                    dbfcmd(dbproc, "insert into %s
values(%ld, %ld)",
                                                RespHistTable, i, pTranStats-
>resp_hist[i]);
                                                SQLExec(dbproc);
                                          }
                                    }

#endif

}


//==========================================================
==============
//
// Function name: SQLInitResFile
//
//==========================================================
==============

void SQLInitResFile(MASTER_DATA *pMaster,
                                                      long       RunId)
{
                              typedef struct
                              {
                                    char   name[25];
                                    long   value;
                              } CONFIG_STRUCT;

                              char                    configure_name[25];
                              long                    configure_value;
                              int                           i;
                              int                           j;
                              int                           len;
                              char                    date[30];
   char                                   version[150];
   FILE                                   *fp1;
                              CONFIG_STRUCT  configure_array[100];
                              char                    cmd[250];

#ifdef DEBUG
                              printf("[%ld]DBG: Entering SQLInitResFile()...\n",
(int) GetCurrentThreadId());
#endif

   fp1 = fopen(pMaster->resfilename,"a");
   if (fp1 == NULL)
                                    printf("Error in opening result file.\n");

   // Server version
   dbcmd(pMaster->sqlconn,"select convert(char(150),@@version) ");
   dbsqlexec(pMaster->sqlconn);
   while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
   {
                                    dbbind(pMaster->sqlconn, 1,
NTBSTRINGBIND, 0, version);
                                    while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                    ;
   }

                              // Server date/time
   dbcmd(pMaster->sqlconn,"select convert(char(30), getdate()) ");
   dbsqlexec(pMaster->sqlconn);
   while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
   {
                                    dbbind(pMaster->sqlconn, 1,
NTBSTRINGBIND, 0, date);
                              while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                              ;
   }

   // Append the results to the file results.dat
   if (fp1 != NULL)
   {

                              fprintf(fp1, "\n\nTPCC BENCHMARK
TEST RUN DETAILED RESULTS\n");
                              fprintf(fp1,
"=======================================\n\n");

                              fprintf(fp1, "Test run id: %ld\n\n",  RunId);

                              if (pMaster->comment)
                                    fprintf(fp1,"Run Comment:
%s\n\n",pMaster->comment);

                              fprintf(fp1,"SQL Server Configuration
Parameters\n");
                              fprintf(fp1,"-----------------------------------
\n\n");
                              fprintf(fp1, "Server time: %s\n\n", date);
                              fprintf(fp1, "%s\n",  version);

                              // Get configuration run parameters
                              dbcmd(pMaster->sqlconn,"sp_configure
");
                              dbsqlexec(pMaster->sqlconn);
                              while (dbresults(pMaster->sqlconn) !=
NO_MORE_RESULTS)
                              {
                                    dbbind(pMaster->sqlconn, 1,
NTBSTRINGBIND, 0, configure_name);
                                    dbbind(pMaster->sqlconn, 5,
INTBIND, 0, (BYTE *) &configure_value);
                                    j=0;
                                    while (dbnextrow(pMaster-
>sqlconn) != NO_MORE_ROWS)
                                    {
                                          len =
strlen(configure_name);

                                          for (i=1;i<=(25 - len);i++)

                        strcat(configure_name, " ");

                                          fprintf(fp1,
"%s%ld\n",configure_name, configure_value);

                        strcpy(configure_array[j].name, configure_name);
                                          configure_array[j].value =
configure_value;

                                          j++;
                                    }
                              }

                              for (i=0;i<j-1;i++)
                              {
                                    sprintf(cmd, "insert into tpcc_config
values ('%s', %ld, %ld) ",

                        configure_array[i].name, configure_array[i].value,
RunId);
```

```
                                        SQLExecCmd(pMaster-
>sqlconn,cmd);
                                        }

                                fclose(fp1);

    }
}


//=========================================================
==============
//
// Function name: SQLMasterStats
//
//=========================================================
==============

void SQLMasterStats(MASTER_DATA *pMaster,
                                                long        RunId)
{
                                int   i;
                                char  version[160];
    long   interval;
    long   tran_2sec;
    long   count;
    long   total_tran_cnt;
    long   neworder_tran_cnt;
    long   payment_tran_cnt;
    long   orderstatus_tran_cnt;
                                long   queued_delivery_tran_cnt;
    long   delivery_tran_cnt;
    long   stocklevel_tran_cnt;
                                long   tot_read = 0;
                                long   tot_write = 0;
                                long   total_deadlock_cnt;
    long   neworder_num_deadlocks;
    long   payment_num_deadlocks;
    long   orderstatus_num_deadlocks;
    long   queued_delivery_num_deadlocks;
    long   delivery_num_deadlocks;
    long   stocklevel_num_deadlocks;
    float  neworder_percent;
    float  payment_percent;
    float  orderstatus_percent;
    float  queued_delivery_percent;
    float  stocklevel_percent;
                                FILE   *fp1;
    char   msg[80];

#ifdef DEBUG
                                printf("[%ld]DBG: Entering
SQLMasterStats()...\n", (int) GetCurrentThreadId());
#endif

    fp1 = fopen(pMaster->resfilename,"a");
    if (fp1 == NULL)
                                        printf("Error in opening result file.\n");

    count = 20000;

    // Server version
    dbcmd(pMaster->sqlconn,"select convert(char(160),@@version) ");
    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
    {
                                        dbbind(pMaster->sqlconn, 1,
NTBSTRINGBIND, 0, version);
                                        while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                        ;
    }

    // Caculate Transaction percentage mix

                                dbcmd(pMaster->sqlconn,"select
sum(tran_count), sum(num_deadlocks) "
                                                " from tpcc_neworder_stats");
    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
    {
                                        dbbind(pMaster->sqlconn, 1, INTBIND, 0,
(BYTE *) &neworder_tran_cnt);
                                        dbbind(pMaster->sqlconn, 2, INTBIND, 0,
(BYTE *) &neworder_num_deadlocks);
                                        while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                        ;
    }

                                dbcmd(pMaster->sqlconn,"select
sum(tran_count), sum(num_deadlocks) "
                                                " from tpcc_payment_stats");

    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
    {
                                        dbbind(pMaster->sqlconn, 1, INTBIND, 0,
(BYTE *) &payment_tran_cnt);
                                        dbbind(pMaster->sqlconn, 2, INTBIND, 0,
(BYTE *) &payment_num_deadlocks);
                                        while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                          ;
    }

    dbcmd(pMaster->sqlconn,"select sum(tran_count), sum(num_deadlocks)
"
                                                " from tpcc_orderstatus_stats");

    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
    {
                                        dbbind(pMaster->sqlconn, 1, INTBIND, 0,
(BYTE *) &orderstatus_tran_cnt);
                                        dbbind(pMaster->sqlconn, 2, INTBIND, 0,
(BYTE *) &orderstatus_num_deadlocks);
                                        while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                        ;
    }

    dbcmd(pMaster->sqlconn,"select sum(tran_count), sum(num_deadlocks)
"
                                                " from
tpcc_queued_delivery_stats");

    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
    {
                                        dbbind(pMaster->sqlconn, 1, INTBIND, 0,
(BYTE *) &queued_delivery_tran_cnt);
                                        dbbind(pMaster->sqlconn, 2, INTBIND, 0,
(BYTE *) &queued_delivery_num_deadlocks);
                                        while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                        ;
    }

    dbcmd(pMaster->sqlconn,"select sum(tran_count), sum(num_deadlocks)
"
                                                " from tpcc_delivery_stats");

    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
    {
                                        dbbind(pMaster->sqlconn, 1, INTBIND, 0,
(BYTE *) &delivery_tran_cnt);
                                        dbbind(pMaster->sqlconn, 2, INTBIND, 0,
(BYTE *) &delivery_num_deadlocks);
                                        while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                        ;
    }

    dbcmd(pMaster->sqlconn,"select sum(tran_count), sum(num_deadlocks)
"
                                                " from tpcc_stocklevel_stats");
    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
    {
                                        dbbind(pMaster->sqlconn, 1, INTBIND, 0,
(BYTE *) &stocklevel_tran_cnt);
                                        dbbind(pMaster->sqlconn, 2, INTBIND, 0,
(BYTE *) &stocklevel_num_deadlocks);
                                        while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                        ;
    }

                                // Get total reads and writes
                                dbfcmd(pMaster->sqlconn,"select total_read,
total_write from tpcc_results"
                                                " where run_id = %ld", RunId);
    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
    {
                                        dbbind(pMaster->sqlconn, 1, INTBIND, 0,
(BYTE *) &tot_read);
                                        dbbind(pMaster->sqlconn, 2, INTBIND, 0,
(BYTE *) &tot_write);
                                        while (dbnextrow(pMaster->sqlconn) !=
NO_MORE_ROWS)
                                        ;
    }

    total_tran_cnt = neworder_tran_cnt +
                                                payment_tran_cnt         +
                                                orderstatus_tran_cnt     +
                                                queued_delivery_tran_cnt  +
                                                stocklevel_tran_cnt;

                                total_deadlock_cnt = neworder_num_deadlocks
+
                                                payment_num_deadlocks
+
                                                orderstatus_num_deadlocks
+
                                                queued_delivery_num_deadlocks
+
                                                delivery_num_deadlocks           +
                                                stocklevel_num_deadlocks;

    if (total_tran_cnt == 0)
```

```
                                        total_tran_cnt = 1;

    neworder_percent    =
                                        ((float) neworder_tran_cnt        / (float)
total_tran_cnt) * 100.0;
    payment_percent     =
                                        ((float) payment_tran_cnt         / (float)
total_tran_cnt) * 100.0;
    orderstatus_percent =
                                        ((float) orderstatus_tran_cnt     / (float)
total_tran_cnt) * 100.0;
    queued_delivery_percent    =
                                        ((float) queued_delivery_tran_cnt / (float)
total_tran_cnt) * 100.0;
    stocklevel_percent  =
                                        ((float) stocklevel_tran_cnt      / (float)
total_tran_cnt) * 100.0;

    // Update the result row with summary data
    dbcmd(pMaster->sqlconn,"update tpcc_results ");
    dbcmd(pMaster->sqlconn,"set date_time  = getdate(), ");
    dbfcmd(pMaster->sqlconn," version = '%s', ", version);
    dbfcmd(pMaster->sqlconn," users = %ld, ", pMaster->num_users);
    dbfcmd(pMaster->sqlconn," num_warehouses = %ld, ", pMaster-
>num_warehouses);
                                   dbfcmd(pMaster->sqlconn," ramp_time = %ld, ",
pMaster->ramp_up);
                                   dbfcmd(pMaster->sqlconn," run_time = %ld, ",
pMaster->steady_state);
                                   dbfcmd(pMaster->sqlconn," down_time = %ld, ",
pMaster->ramp_down);
                                   dbfcmd(pMaster->sqlconn," first_checkpt = %ld,
", pMaster->first_checkpoint);
                                   dbfcmd(pMaster->sqlconn," checkpt_interval =
%ld, ", pMaster->checkpoint_interval);
    dbfcmd(pMaster->sqlconn," total_tran = %ld, ", total_tran_cnt);
                                   dbfcmd(pMaster->sqlconn," total_deadlocks =
%ld, ", total_deadlock_cnt);
    dbfcmd(pMaster->sqlconn," neworder_per = %f, ", (double)
neworder_percent);
    dbfcmd(pMaster->sqlconn," payment_per = %f, ", (double)
payment_percent);
    dbfcmd(pMaster->sqlconn," orderstatus_per = %f, ", (double)
orderstatus_percent);
    dbfcmd(pMaster->sqlconn," queued_delivery_per = %f, ", (double)
queued_delivery_percent);
    dbfcmd(pMaster->sqlconn," stocklevel_per  = %f, ", (double)
stocklevel_percent);
                                   dbfcmd(pMaster->sqlconn," comment = '%s', ",
pMaster->comment);
                                   dbfcmd(pMaster->sqlconn,"
dropped_connections = %ld ", pMaster->dropped_connections);
    dbfcmd(pMaster->sqlconn," where run_id   = %ld  ", RunId);

    dbsqlexec(pMaster->sqlconn);
    while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
                                        ;

    // Append the results to the file results.dat
    if (fp1 != NULL)
    {

                                    fprintf(fp1, "\nDetailed Test Results for Steady
State\n");
                                        fprintf(fp1, "--------------------------------------
\n\n");
                                        fprintf(fp1, "Number of users:
%17ld\n",  pMaster->num_users);
                                        fprintf(fp1, "Number of warehouses:
%17ld\n",  pMaster->num_warehouses);
                                        fprintf(fp1, "Ramp up time:
%17ld\n",  pMaster->ramp_up);
                                        fprintf(fp1, "Steady state time:
%17ld\n",  pMaster->steady_state);
                                        fprintf(fp1, "Ramp down time:
%17ld\n",  pMaster->ramp_down);
                                        fprintf(fp1, "First checkpoint:
%17ld\n",  pMaster->first_checkpoint);
                                        fprintf(fp1, "Checkpoint interval:
%17ld\n",  pMaster->checkpoint_interval);
                                        fprintf(fp1, "Total trans:            %17ld\n",
total_tran_cnt);
                                        fprintf(fp1, "Total deadlocks:
%17ld\n",  total_deadlock_cnt);
                                        fprintf(fp1, "New Order percent:
%17.2f%%\n", neworder_percent);
                                        fprintf(fp1, "Payment percent:
%17.2f%%\n", payment_percent);
                                        fprintf(fp1, "Order Status percent:
%17.2f%%\n", orderstatus_percent);
                                        fprintf(fp1, "Delivery percent:
%17.2f%%\n", queued_delivery_percent);
                                        fprintf(fp1, "Stock Level percent:
%17.2f%%\n", stocklevel_percent);
                                        fprintf(fp1, "Total Reads:            %17ld\n",
tot_read);
                                        fprintf(fp1, "Total Writes:           %17ld\n",
tot_write);

                                        fprintf(fp1, "\nTransaction  # tran    tpm
tpm/w     tps       Avg    90%%   ");
                                        fprintf(fp1, " Min    Max    RB    %%RB  > 2
sec > 5 sec DeadLk\n");
                                        fprintf(fp1, "------------ ------- -------- -------- --
-------- ------ ------ ");
                                        fprintf(fp1, "------ ------ ----- ----- ------- -------
-------\n");

                                        printf("\nTest Results for Steady State");
                                        printf("\n-----------------------------\n");

                                    printf("\nDetailed Test Results for Steady
State\n");
                                        printf("--------------------------------------\n\n");
                                        printf("Number of users:        %17ld\n",
pMaster->num_users);
                                        printf("Number of warehouses:    %17ld\n",
pMaster->num_warehouses);
                                        printf("Ramp up time:           %17ld\n",
pMaster->ramp_up);
                                        printf("Steady state time:       %17ld\n",
pMaster->steady_state);
                                        printf("Ramp down time:          %17ld\n",
pMaster->ramp_down);
                                        printf("First checkpoint:       %17ld\n",
pMaster->first_checkpoint);
                                        printf("Checkpoint interval:     %17ld\n",
pMaster->checkpoint_interval);
                                        printf("Total trans:            %17ld\n",
total_tran_cnt);
                                        printf("Total deadlocks:        %17ld\n",
total_deadlock_cnt);
                                        printf("New Order percent:
%17.2f%%\n", neworder_percent);
                                        printf("Payment percent:
%17.2f%%\n", payment_percent);
                                        printf("Order Status percent:
%17.2f%%\n", orderstatus_percent);
                                        printf("Delivery percent:       %17.2f%%\n",
queued_delivery_percent);
                                        printf("Stock Level percent:
%17.2f%%\n", stocklevel_percent);
                                        printf("Total Reads:            %17ld\n",
tot_read);
                                        printf("Total Writes:           %17ld\n",
tot_write);

                                        printf("\nTransaction  # tran    tpm     tpm/w
tps       Avg    90%%\n");
                                        printf("------------ ------- -------- -------- --------
-- ------ ------\n");

                                        // Read all the result rows from the 5
stat_tables
                                        SQLMasterTranStats(pMaster, fp1, RunId,
"NEW ORDER   ",
                                        "tpcc_neworder_stats",
"tpcc_neworder_results",
                                        "tpcc_neworder_resp_hist");
                                        SQLMasterTranStats(pMaster, fp1, RunId,
"PAYMENT     ",
                                        "tpcc_payment_stats",
"tpcc_payment_results",
                                        "tpcc_payment_resp_hist");
                                        SQLMasterTranStats(pMaster, fp1, RunId,
"ORDER STATUS",
                                        "tpcc_orderstatus_stats",
"tpcc_orderstatus_results",
                                        "tpcc_orderstatus_resp_hist");
                                        SQLMasterTranStats(pMaster, fp1, RunId,
"D DELIVERY  ",
                                        "tpcc_queued_delivery_stats",
"tpcc_queued_delivery_results",
                                        "tpcc_queued_delivery_resp_hist");
                                        SQLMasterTranStats(pMaster, fp1, RunId,
"DELIVERY    ",
                                        "tpcc_delivery_stats",
"tpcc_delivery_results",
                                        "tpcc_delivery_resp_hist");
                                        SQLMasterTranStats(pMaster, fp1, RunId,
"STOCK LEVEL ",
                                        "tpcc_stocklevel_stats",
"tpcc_stocklevel_results",
                                        "tpcc_stocklevel_resp_hist");
                                    }

                                    fclose(fp1);

                                    sprintf(msg, "\n\nDetailed results written to the
file: %s\n\n", pMaster->resfilename);
    printf(msg);

}


//=========================================================
==============
//
// Function name: SQLMasterTranStats
//
//=========================================================
==============

void SQLMasterTranStats(MASTER_DATA *pMaster,
                                                FILE       *fp1,
                                                long
RunId,
                                                char
*TranName,
                                                char
*SelTable,
                                                char
*UpdTable,
                                                char
*RespHistTable)
{
    long   tran_count;
    long   total_time;
    long   resp_time;
    long   resp_min;
    long   resp_max;
    long   rolled_back;
    long   tran_2sec;
    long   tran_5sec;
                        long   num_deadlocks;
    long   bucket;
    long   value;
    long   per_90;
    double tps;
    double tpm;
    double avg_res;
    double ninety_percentile;
                        double rolled_back_percent;
    char   msg[80];
                        char   cvtbuf[20];
                        char   fail_flag[8];

#ifdef DEBUG
                        printf("[%ld]DBG: Entering
SQLMasterTranStats()...\n", (int) GetCurrentThreadId());
#endif

                        tran_count = 0;
    total_time = 0;
    resp_time = 0;
    resp_min = 0;
    resp_max = 0;
    rolled_back = 0;
    tran_2sec = 0;
    tran_5sec = 0;
                        num_deadlocks = 0;

    dbcmd(pMaster->sqlconn,"select sum(tran_count), sum(total_time),");
    dbcmd(pMaster->sqlconn,"min(resp_min), max(resp_max),
sum(rolled_back),");
    dbcmd(pMaster->sqlconn,"sum(tran_2sec), sum(tran_5sec),
sum(num_deadlocks) ");
    dbfcmd(pMaster->sqlconn," from %s", SelTable);

    dbsqlexec(pMaster->sqlconn);
    dbresults(pMaster->sqlconn);

    dbbind(pMaster->sqlconn, 1, INTBIND,  0, (BYTE  *) &tran_count);
    dbbind(pMaster->sqlconn, 2, INTBIND,  0, (BYTE  *) &total_time);
    dbbind(pMaster->sqlconn, 3, INTBIND,  0, (BYTE  *) &resp_min);
    dbbind(pMaster->sqlconn, 4, INTBIND,  0, (BYTE  *) &resp_max);
    dbbind(pMaster->sqlconn, 5, INTBIND,  0, (BYTE  *) &rolled_back);
    dbbind(pMaster->sqlconn, 6, INTBIND,  0, (BYTE  *) &tran_2sec);
    dbbind(pMaster->sqlconn, 7, INTBIND,  0, (BYTE  *) &tran_5sec);
                        dbbind(pMaster->sqlconn, 8, INTBIND,  0, (BYTE
*) &num_deadlocks);

    while (dbnextrow(pMaster->sqlconn) != NO_MORE_ROWS)
                                    ;

    // Compute TPS and avg response time
    tps = (float) tran_count / (float) pMaster->steady_state;
    tpm = tps * 60.0;
    if (tran_count == 0)
                                    avg_res = 0.0;
    else
                                    avg_res = ((float) total_time / (float)
tran_count)/1000.0;

                        if (tran_count != 0)
                        {
                                    rolled_back_percent =  (double)
rolled_back/tran_count;
                        }
                        else
                        {
                                    rolled_back_percent = (double) 0L;
                        }

    // Read histogram of response time
    per_90 = 0;
    dbfcmd(pMaster->sqlconn, "select bucket, sum(bucket_value) from %s ",
                        RespHistTable);
    dbcmd(pMaster->sqlconn, "group by bucket");
    dbsqlexec(pMaster->sqlconn);
    dbresults(pMaster->sqlconn);

    dbbind(pMaster->sqlconn, 1, INTBIND, 0, (BYTE *) &bucket);
    dbbind(pMaster->sqlconn, 2, INTBIND, 0, (BYTE *) &value);

    while (dbnextrow(pMaster->sqlconn) != NO_MORE_ROWS)
    {
                                    per_90 = per_90 + value;
                                    if (per_90 >= (tran_count * .9))
                                    {
                                    ninety_percentile = (double)
(bucket+1)*0.1;
                                    per_90 = 0;
                                    }
    }

                        strcpy(fail_flag,"(Pass)");

                        if (avg_res > ninety_percentile)
                        {
                                    strcpy(fail_flag,"(Fail)");
                        }
                        else
                        {

                                    if ((strcmp(TranName, "NEW ORDER   ")
== 0) &&
                                                (ninety_percentile > 5))
                                    {
                                                strcpy(fail_flag,"(Fail)");
                                    }

                                    if ((strcmp(TranName, "PAYMENT     ") ==
0) &&
                                                (ninety_percentile > 5))
                                    {
                                                strcpy(fail_flag,"(Fail)");
                                    }

                                    if ((strcmp(TranName, "ORDER STATUS")
== 0) &&
                                                (ninety_percentile > 5))
                                    {
                                                strcpy(fail_flag,"(Fail)");
                                    }

                                    if ((strcmp(TranName, "D DELIVERY  ")
== 0) &&
                                                (ninety_percentile > 5))
                                    {
                                                strcpy(fail_flag,"(Fail)");
                                    }

                                    if ((strcmp(TranName, "DELIVERY") == 0)
&&
                                                (ninety_percentile > 80))
                                    {
                                                strcpy(fail_flag,"(Fail)");
                                    }

                                    if ((strcmp(TranName, "STOCK LEVEL ")
== 0) &&
                                                (ninety_percentile > 20))
                                    {
                                                strcpy(fail_flag,"(Fail)");
                                    }
                        }

    dbfcmd(pMaster->sqlconn,"update %s set ", UpdTable);
    dbfcmd(pMaster->sqlconn,"     total_tran      = %ld, ", tran_count);
    dbfcmd(pMaster->sqlconn,"     avg_res         = %f,  ", (double) avg_res);
                        dbfcmd(pMaster->sqlconn,"     ninetyth_per    =
%f,  ", (double) ninety_percentile);
    dbfcmd(pMaster->sqlconn,"     tps             = %f,  ", (double) tps);
    dbfcmd(pMaster->sqlconn,"     tpm             = %f,  ", (double) tpm);
    dbfcmd(pMaster->sqlconn,"     min_res         = %f,  ", (double)
resp_min/1000.0);
    dbfcmd(pMaster->sqlconn,"     max_res         = %f,  ", (double)
resp_max/1000.0);
    dbfcmd(pMaster->sqlconn,"     rolled_back     = %ld, ", rolled_back);
                        dbfcmd(pMaster->sqlconn,"     rolled_back_per =
%f, ",  (double) rolled_back_percent);
    dbfcmd(pMaster->sqlconn,"     tran_2sec       = %ld, ", tran_2sec);
    dbfcmd(pMaster->sqlconn,"     tran_5sec       = %ld, ", tran_5sec);
                        dbfcmd(pMaster->sqlconn,"     num_deadlocks
= %ld  ", num_deadlocks);
    dbfcmd(pMaster->sqlconn," where run_id   = %ld  ", RunId);

    SQLExec(pMaster->sqlconn);

                        fprintf(fp1,"%s %7ld %8.2f %8.2f %10.2f %6.2f
%6.2f %6.2f %6.2f %5ld %5.2f %7ld %7ld %7ld  %s\n",
                                    TranName,
                                    tran_count,
                                    tpm,
                                    (float) tpm/pMaster-
>num_warehouses,
                                    tps,
                                    avg_res,
                                    ninety_percentile,
                                    (double) resp_min/1000.0,
                                    (double) resp_max/1000.0,
                                    rolled_back,
                                    rolled_back_percent,
                                    tran_2sec,
                                    tran_5sec,
                                    num_deadlocks,
                                        fail_flag);

                          printf("%s %7ld %8.2f %8.2f %10.2f %6.2f %6.2f
%s\n",
                                        TranName,
                                        tran_count,
                                        tpm,
                                        (float) tpm/pMaster-
>num_warehouses,
                                        tps,
                                        avg_res,
                                        ninety_percentile,
                                        fail_flag);

}


//======================================================
==============
//
// Function name: SQLMasterIOStats
//
//======================================================
==============

void SQLIOStats(MASTER_DATA *pMaster, int RunId, char *msg)
{
                          char           stat_name[30];
                          char                          tmpbuf[30];
                          float          value;
                          char           dbname[30];
                          float          log_size_mb;
                          float          log_used_pct;
                          int                                         i;
                          FILE                          *fp1;

#ifdef DEBUG
                          printf("[%ld]DBG: Entering
SQLMasterIOStats()...\n", (int) GetCurrentThreadId());
#endif

   dbcmd(pMaster->sqlconn,"update tpcc_results ");
   dbcmd(pMaster->sqlconn,"set total_read = @@total_read -
isnull(total_read, 0), ");
   dbcmd(pMaster->sqlconn,"  total_write = @@total_write -
isnull(total_write,0) ");
   dbfcmd(pMaster->sqlconn," where run_id = %ld", RunId);
   dbsqlexec(pMaster->sqlconn);
   while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
                               ;

   fp1 = fopen(pMaster->resfilename,"a");
   if (fp1 == NULL)
                               printf("Error in opening result file.\n");

                          printf("%s",msg);
                          fprintf(fp1,"%s",msg);

                          dbcmd(pMaster->sqlconn, "dbcc
sqlperf(iostats)");
                          dbsqlexec(pMaster->sqlconn);
                          while (dbresults(pMaster->sqlconn) !=
NO_MORE_RESULTS)
                          {
                               if (dbnumcols(pMaster->sqlconn) == 2)
                               {
                                    dbbind(pMaster->sqlconn, 1,
NTBSTRINGBIND, 0, stat_name);
                                    dbbind(pMaster->sqlconn, 2,
FLT4BIND, 0, (BYTE *) &value);
                                    while (dbnextrow(pMaster-
>sqlconn) != NO_MORE_ROWS)
                                    {
                                         strcpy(tmpbuf,"");
                                         if (strlen(stat_name) < 30)
                                         {
                                              for(i=0;i< (30 -
strlen(stat_name)); i++)
                                                   strcat(tmpbuf,"
");
                                              strcat(stat_name,
tmpbuf);
                                         }

                                         printf("%s%12.4f\n",
stat_name, value);
                                         fprintf(fp1,"%s%12.4f\n",
stat_name, value);
                                    }
                               }
                          }

                          dbcmd(pMaster->sqlconn, "dbcc
sqlperf(logspace)");
                          dbsqlexec(pMaster->sqlconn);
                          while (dbresults(pMaster->sqlconn) !=
NO_MORE_RESULTS)
                          {
                               if (dbnumcols(pMaster->sqlconn) == 4)
                               {
                                    dbbind(pMaster->sqlconn, 1,
NTBSTRINGBIND, 0, dbname);
                                    dbbind(pMaster->sqlconn, 2,
FLT4BIND, 0, (BYTE *) &log_size_mb);
                                    dbbind(pMaster->sqlconn, 3,
FLT4BIND, 0, (BYTE *) &log_used_pct);
                                    while (dbnextrow(pMaster-
>sqlconn) != NO_MORE_ROWS)
                                    {
                                         if
(strcmp(dbname,"tpcc")==0)
                                         {
                                              printf("Database tpcc
log size (MB)   %12.4f\n",log_size_mb);
                                              printf("Database tpcc
log used (%%)    %12.4f\n\n",log_used_pct);
                                              fprintf(fp1, "Database
tpcc log size (MB)   %12.4f\n",log_size_mb);
                                              fprintf(fp1, "Database
tpcc log used (%%)    %12.4f\n",log_used_pct);
                                         }
                                    }
                               }
                          }

                          fclose(fp1);

}


//======================================================
==============
//
// Function name: SQLShutdown
//
//======================================================
==============

void SQLShutdown(MASTER_DATA *pMaster)
{
                          char           cmd[255];

#ifdef DEBUG
                          printf("[%ld]DBG: Entering SQLShutdown()...\n",
(int) GetCurrentThreadId());
#endif

                          sprintf(cmd, "use %s checkpoint use master
dump tran %s with no_log shutdown ",
                                        pMaster->database,
                                        pMaster->database);

   dbcmd(pMaster->sqlconn,cmd);
   dbsqlexec(pMaster->sqlconn);
   while (dbresults(pMaster->sqlconn) != NO_MORE_RESULTS)
                               ;

}


//======================================================
==============
//
// Function name: SQLCheckpointStats
//
//======================================================
==============

void SQLCheckpointStats(MASTER_DATA *pMaster, char *msg)
{
                          FILE                          *fp1;

#ifdef DEBUG
                          printf("[%ld]DBG: Entering
SQLCheckpointStats()...\n", (int) GetCurrentThreadId());
#endif

   fp1 = fopen(pMaster->resfilename,"a");
   if (fp1 == NULL)
                               printf("Error in opening result file.\n");

                          fprintf(fp1,"%s",msg);

                          fclose(fp1);

}

//======================================================
==============
//
// Function name: SQLGetRunId
//
//======================================================
==============

void SQLGetRunId(DBPROCESS *sqlconn,
                                        int      *pRunId)
{

#ifdef DEBUG
                          printf("[%ld]DBG: Entering SQLGetRunId()...\n",
(int) GetCurrentThreadId());
#endif
```

```
   dbcmd(sqlconn,"update tpcc_run_id set val=val + 1 ");
   dbsqlexec(sqlconn);
   dbresults(sqlconn);
   dbcmd(sqlconn,"select val from tpcc_run_id");
   dbsqlexec(sqlconn);
   dbresults(sqlconn);
   dbbind(sqlconn, 1, INTBIND, 0, (BYTE *) pRunId);
   while (dbnextrow(sqlconn) != NO_MORE_ROWS)
                                        ;

   // Insert run_id into results table
   dbfcmd(sqlconn,"insert into tpcc_results(run_id) values(%ld) ",
                              *pRunId);
   dbfcmd(sqlconn,"insert into tpcc_neworder_results(run_id) values(%ld) ",
*pRunId);
   dbfcmd(sqlconn,"insert into tpcc_payment_results(run_id) values(%ld) ",
*pRunId);
   dbfcmd(sqlconn,"insert into tpcc_orderstatus_results(run_id) values(%ld)
",                            *pRunId);
   dbfcmd(sqlconn,"insert into tpcc_delivery_results(run_id) values(%ld) ",
*pRunId);
   dbfcmd(sqlconn,"insert into tpcc_queued_delivery_results(run_id)
values(%ld) ",                *pRunId);
   dbfcmd(sqlconn,"insert into tpcc_stocklevel_results(run_id) values(%ld) ",
*pRunId);
   dbsqlexec(sqlconn);
   while (dbresults(sqlconn) != NO_MORE_RESULTS)
                                             ;

}


//=======================================================
=============
//
// Function name: SQLErrHandler
//
//=======================================================
=============

int SQLErrHandler(SQLCONN *dbproc,
                                             int     severity,
                                             int     err,
                                             int     oserr,
                                             char    *dberrstr,
                                         char    *oserrstr)
{

                              char msg[256];

#ifdef DEBUG
                              printf("[%ld]DBG: Entering SQLErrHandler()...\n",
(int) GetCurrentThreadId());
#endif

                              sprintf(msg, "(%ld) : %s\n", err, dberrstr);
   UtilError(GetCurrentThreadId(), "DB-Library",msg);

   if (oserr != DBNOERR)
   {
                                   sprintf(msg, "(%ld) : %s\n", oserr,
oserrstr);
                                   UtilError(GetCurrentThreadId(), "OS
Error",msg);
   }

                              if ((dbproc == NULL) || (DBDEAD(dbproc)))
                              {
//                                        ExitThread(-1);
                              }

                              return (INT_CANCEL);

}


//=======================================================
=============
//
// Function name: SQLMsgHandler
//
//=======================================================
=============

int SQLMsgHandler(SQLCONN   *dbproc,
                                             DBINT     msgno,
                                             int       msgstate,
                                             int       severity,
                                             char      *msgtext)
{
   char msg[256];

 #ifdef DEBUG
                              printf("[%ld]DBG: Entering
SQLClientMsgHandler()...\n", (int) GetCurrentThreadId());
                              printf("[%ld]DBG: \tmsgno = %ld\n", (int)
GetCurrentThreadId(), (int) msgno);
                              printf("[%ld]DBG: \tmsgstate = %ld\n", (int)
GetCurrentThreadId(), (int) msgstate);
                              printf("[%ld]DBG: \tseverity = %ld\n", (int)
GetCurrentThreadId(), (int) severity);
                              printf("[%ld]DBG: \t%s\n", (int)
GetCurrentThreadId(), msgtext);
 #endif

   if ( (msgno == 5701) || (msgno == 2528) || (msgno == 5703) || (msgno ==
6006) )
                              {
                                        return(INT_CONTINUE);
                              }


   // deadlock message
   if (msgno == 1205)
   {

                                        // set the deadlock indicator
                                        if (dbgetuserdata(dbproc) != NULL)
                                        *((BOOL *) dbgetuserdata(dbproc)) =
TRUE;
                                        else
                                        {
                                        printf("\nError, dbgetuserdata returned
NULL.\n");
                                        }

                                        return(INT_CONTINUE);

   }

#ifdef PROFILE
   if ( (msgno == 0) ||
                                        ((msgno > STATS_MSG_LOW) &&
(msgno < STATS_MSG_HIGH)) ||
                                        ((msgno > SHOWPLAN_MSG_LOW) &&
(msgno < SHOWPLAN_MSG_HIGH)))
   {
                                        printf("[%ld] %s\n",  (int)
GetCurrentThreadId(), msgtext);

                                        return (INT_CONTINUE);
   }
   else
   {
#endif

                                        if (msgno == 0)
                                        {
                                                  return(INT_CONTINUE);
                                        }
                                        else
                                        {
                                                  sprintf(msg, "(%ld) : %s\n", msgno,
msgtext);
                                                  UtilError(GetCurrentThreadId(),
"SQL Server Message", msg);
                                                  //ExitThread(-1);
                                        }

#ifdef PROFILE
   }
#endif

                                   return (INT_CANCEL);
}


//=======================================================
=============
//
// Function name: SQLClientErrHandler
//
//=======================================================
=============

int SQLClientErrHandler(SQLCONN *dbproc,
                                                  int     severity,
                                                  int     err,
                                                  int     oserr,
                                                  char    *dberrstr,
                                              char    *oserrstr)
{

                                   char msg[256];
                                   FILE *fp1;
                                   char timebuf[128];
                                   char datebuf[128];

#ifdef DEBUG
                                   printf("[%ld]DBG: Entering
SQLClientErrHandler()...\n", (int) GetCurrentThreadId());
#endif

                                   _strtime(timebuf);
                                   _strdate(datebuf);

                                   sprintf(msg, "%s %s : DBLibrary (%ld) %s\n",
datebuf, timebuf, err, dberrstr);
   UtilError(GetCurrentThreadId(), "DB-Library",msg);

                                   EnterCriticalSection(&ClientErrorLogCritSec);
                                   fp1 = fopen("client.err","a");
                                   if (fp1 == NULL)
                                        printf("Error in opening errorlog file.\n");
                                   fprintf(fp1, msg);
```

```
                    fclose(fp1);
                    LeaveCriticalSection(&ClientErrorLogCritSec);

    if (oserr != DBNOERR)
    {
                         sprintf(msg, "%s %s : OSError (%ld)
%s\n", datebuf, timebuf, oserr, oserrstr);
                         UtilError(GetCurrentThreadId(), "OS
Error",msg);


                    EnterCriticalSection(&ClientErrorLogCritSec);
                         fp1 = fopen("client.err","a");
                         if (fp1 == NULL)
                              printf("Error in opening errorlog
file.\n");
                         fprintf(fp1, msg);
                         fclose(fp1);

                    LeaveCriticalSection(&ClientErrorLogCritSec);
    }

                    if ((dbproc == NULL) || (DBDEAD(dbproc)))
                    {

                    InterlockedIncrement(&client_threads_dropped);
                         //ExitThread(-1);
                    }

                    return (INT_CANCEL);

}


//=======================================================
=============
//
// Function name: SQLClientMsgHandler
//
//=======================================================
=============

int SQLClientMsgHandler(SQLCONN   *dbproc,
                                             DBINT     msgno,
                                             int       msgstate,
                                             int       severity,
                                         char      *msgtext)
{
    char msg[256];
                    FILE   *fp1;
                    char timebuf[128];
                    char datebuf[128];

 #ifdef DEBUG
                    printf("[%ld]DBG: Entering
SQLClientMsgHandler()...\n", (int) GetCurrentThreadId());
                    printf("[%ld]DBG: \tmsgno = %ld\n", (int)
GetCurrentThreadId(), (int) msgno);
                    printf("[%ld]DBG: \tmsgstate = %ld\n", (int)
GetCurrentThreadId(), (int) msgstate);
                    printf("[%ld]DBG: \tseverity = %ld\n", (int)
GetCurrentThreadId(), (int) severity);
                    printf("[%ld]DBG: \t%s\n", (int)
GetCurrentThreadId(), msgtext);
 #endif

    if ( (msgno == 5701) || (msgno == 2528) || (msgno == 5703) || (msgno ==
6006) )
                    {
                         return(INT_CONTINUE);
                    }

    // deadlock message
    if (msgno == 1205)
    {

                         // set the deadlock indicator
                         if (dbgetuserdata(dbproc) != NULL)
                         *((BOOL *) dbgetuserdata(dbproc)) =
TRUE;
                         else
                         {
                         printf("\nError, dbgetuserdata returned
NULL.\n");
                         }

                         return(INT_CONTINUE);

    }

#ifdef PROFILE
    if ( (msgno == 0) ||
                         ((msgno > STATS_MSG_LOW) &&
(msgno < STATS_MSG_HIGH)) ||
                         ((msgno > SHOWPLAN_MSG_LOW) &&
(msgno < SHOWPLAN_MSG_HIGH)))
    {
                         printf("[%ld] %s\n",  (int)
GetCurrentThreadId(), msgtext);

                         return (INT_CONTINUE);
    }
    else
    {
#endif

                         if (msgno == 0)
                         {
                              return(INT_CONTINUE);
                         }
                         else
                         {
                              _strtime(timebuf);
                              _strdate(datebuf);


                              sprintf(msg, "%s %s : SQLServer
(%ld) %s\n", datebuf, timebuf, msgno, msgtext);
                              UtilError(GetCurrentThreadId(),
"SQL Server Message", msg);


                    EnterCriticalSection(&ClientErrorLogCritSec);
                              fp1 = fopen("client.err","a");
                              if (fp1 == NULL)
                                   printf("Error in opening
errorlog file.\n");
                              fprintf(fp1, msg);
                              fclose(fp1);

                    LeaveCriticalSection(&ClientErrorLogCritSec);


                    InterlockedIncrement(&client_threads_dropped);
                              //ExitThread(-1);
                         }
#ifdef PROFILE
    }
#endif


                    return (INT_CANCEL);
}


//=======================================================
=============
//
// Function name: SQLDeliveryErrHandler
//
//=======================================================
=============

int SQLDeliveryErrHandler(SQLCONN *dbproc,
                                             int     severity,
                                             int     err,
                                             int     oserr,
                                             char    *dberrstr,
                                         char    *oserrstr)
{

                    char msg[256];
                    FILE   *fp1;
                    char timebuf[128];
                    char datebuf[128];

#ifdef DEBUG
                    printf("[%ld]DBG: Entering
SQLClientErrHandler()...\n", (int) GetCurrentThreadId());
#endif

                    _strtime(timebuf);
                    _strdate(datebuf);

                    sprintf(msg, "%s %s : DBLibrary (%ld) %s\n",
datebuf, timebuf, err, dberrstr);
    UtilError(GetCurrentThreadId(), "DB-Library",msg);

                    EnterCriticalSection(&ClientErrorLogCritSec);
                    fp1 = fopen("delivery.err","a");
                    if (fp1 == NULL)
                         printf("Error in opening errorlog file.\n");
                    fprintf(fp1, msg);
                    fclose(fp1);
                    LeaveCriticalSection(&ClientErrorLogCritSec);

    if (oserr != DBNOERR)
    {
                         sprintf(msg, "%s %s : OSError (%ld)
%s\n", datebuf, timebuf, oserr, oserrstr);
                         UtilError(GetCurrentThreadId(), " OS
Error",msg);


                    EnterCriticalSection(&ClientErrorLogCritSec);
                         fp1 = fopen("delivery.err","a");
                         if (fp1 == NULL)
                              printf("Error in opening errorlog
file.\n");
                         fprintf(fp1, msg);
                         fclose(fp1);

                    LeaveCriticalSection(&ClientErrorLogCritSec);

    }
				if ((dbproc == NULL) || (DBDEAD(dbproc)))
				{
				InterlockedIncrement(&delivery_threads_droppe
d);
					//ExitThread(-1);
				}

				return (INT_CANCEL);

}


//=======================================================
==============
//
// Function name: SQLDeliveryMsgHandler
//
//=======================================================
==============

int SQLDeliveryMsgHandler(SQLCONN   *dbproc,
								DBINT     msgno,
								int       msgstate,
								int       severity,
							char      *msgtext)
{
    char msg[256];
				FILE   *fp1;
				char timebuf[128];
				char datebuf[128];

 #ifdef DEBUG
				printf("[%ld]DBG: Entering
SQLClientMsgHandler()...\n", (int) GetCurrentThreadId());
				printf("[%ld]DBG: \tmsgno = %ld\n", (int)
GetCurrentThreadId(), (int) msgno);
				printf("[%ld]DBG: \tmsgstate = %ld\n", (int)
GetCurrentThreadId(), (int) msgstate);
				printf("[%ld]DBG: \tseverity = %ld\n", (int)
GetCurrentThreadId(), (int) severity);
				printf("[%ld]DBG: \t%s\n", (int)
GetCurrentThreadId(), msgtext);
 #endif

    if ( (msgno == 5701) || (msgno == 2528) || (msgno == 5703) || (msgno ==
6006) )
				{
					return(INT_CONTINUE);
				}

    // deadlock message
    if (msgno == 1205)
    {

					// set the deadlock indicator
					if (dbgetuserdata(dbproc) != NULL)
					*((BOOL *) dbgetuserdata(dbproc)) =
TRUE;
					else
					{
					printf("\nError, dbgetuserdata returned
NULL.\n");
					}

					return(INT_CONTINUE);
    }

#ifdef PROFILE
    if ( (msgno == 0) ||
					((msgno > STATS_MSG_LOW) &&
(msgno < STATS_MSG_HIGH)) ||
					((msgno > SHOWPLAN_MSG_LOW) &&
(msgno < SHOWPLAN_MSG_HIGH)))
    {
					printf("[%ld] %s\n",  (int)
GetCurrentThreadId(), msgtext);

					return (INT_CONTINUE);
    }
    else
    {
#endif

					if (msgno == 0)
					{
						return(INT_CONTINUE);
					}
					else
					{
						_strtime(timebuf);
						_strdate(datebuf);

						sprintf(msg, "%s %s : SQLServer
(%ld) %s\n", datebuf, timebuf, msgno, msgtext);
						UtilError(GetCurrentThreadId(),
"SQL Server Message", msg);


				EnterCriticalSection(&ClientErrorLogCritSec);
						fp1 = fopen("delivery.err","a");
						if (fp1 == NULL)
							printf("Error in opening
errorlog file.\n");
						fprintf(fp1, msg);
						fclose(fp1);

				LeaveCriticalSection(&ClientErrorLogCritSec);


				InterlockedIncrement(&delivery_threads_droppe
d);
						//ExitThread(-1);
					}

#ifdef PROFILE
    }
#endif

				return (INT_CANCEL);
}


//=======================================================
==============
//
// Function name: SQLExit
//
//=======================================================
==============

void SQLExit(SQLCONN    *dbproc)
{
#ifdef DEBUG
				printf("[%ld]DBG: Entering SQLExit()...\n", (int)
GetCurrentThreadId());
#endif
				dbclose(dbproc);
}


//=======================================================
==============
//
// Function name: SQLInit
//
//=======================================================
==============

void SQLInit(HINSTANCE hInst)
{

#ifdef DEBUG
				printf("[%ld]DBG: Entering SQLInit()...\n", (int)
GetCurrentThreadId());
#endif

    dbinit();
    dbmsghandle((DBMSGHANDLE_PROC)SQLMsgHandler);
    dberrhandle((DBERRHANDLE_PROC)SQLErrHandler);
}


//=======================================================
==============
//
// Function name: SQLInitPrivate
//
//=======================================================
==============

void SQLInitPrivate(PDBPROCESS dbproc, HINSTANCE hInst)
{

#ifdef DEBUG
				printf("[%ld]DBG: Entering SQLInitPrivate()...\n",
(int) GetCurrentThreadId());
#endif

    dbprocmsghandle(dbproc, (DBMSGHANDLE_PROC)SQLMsgHandler);
    dbprocerrhandle(dbproc, (DBERRHANDLE_PROC)SQLErrHandler);
}


//=======================================================
==============
//
// Function name: SQLClientInitPrivate
//
//=======================================================
==============

void SQLClientInitPrivate(PDBPROCESS dbproc, HINSTANCE hInst)
{

#ifdef DEBUG
				printf("[%ld]DBG: Entering SQLInitPrivate()...\n",
(int) GetCurrentThreadId());
#endif
```

```
    dbprocmsghandle(dbproc,
(DBMSGHANDLE_PROC)SQLClientMsgHandler);
    dbprocerrhandle(dbproc,
(DBERRHANDLE_PROC)SQLClientErrHandler);
}


//==========================================================
==============
//
// Function name: SQLDeliveryPrivate
//
//==========================================================
==============

void SQLDeliveryInitPrivate(PDBPROCESS dbproc, HINSTANCE hInst)
{

#ifdef DEBUG
                                printf("[%ld]DBG: Entering SQLInitPrivate()...\n",
(int) GetCurrentThreadId());
#endif

    dbprocmsghandle(dbproc,
(DBMSGHANDLE_PROC)SQLDeliveryMsgHandler);
    dbprocerrhandle(dbproc,
(DBERRHANDLE_PROC)SQLDeliveryErrHandler);
}


//==========================================================
==============
//
// Function name: SQLInitDate
//
//==========================================================
==============

#ifdef USE_ODBC
void SQLInitDate(TIMESTAMP_STRUCT *pDate)
#else
void SQLInitDate(DBDATEREC *pDate)
#endif
{

#ifdef DEBUG
                                printf("[%ld]DBG: Entering SQLInitDate()...\n",
(int) GetCurrentThreadId());
#endif

    pDate->month = 1;
    pDate->day   = 1;
    pDate->year  = 1990;
                                pDate->hour = 0;
                                pDate->minute = 0;
                                pDate->second = 0;
}



#ifdef USE_ODBC
//==========================================================
==============
//
// Function name: ODBCOpenConnection
//
//==========================================================
==============

void ODBCOpenConnection(CLIENT_DATA *Client)
{

                                RETCODE         rc;
                                char            buffer[30];

#ifdef DEBUG
                                printf("[%ld]DBG: Entering
ODBCOpenConnection()...\n", (int) GetCurrentThreadId());
#endif

                                rc = SQLAllocConnect(henv, &Client->hdbc);

                                if (rc == SQL_ERROR)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentTh readId(),
"ODBCOpenConnection", "SQLAllocConnect() failed.");
                                }

                                rc = SQLSetConnectOption (Client->hdbc,
SQL_PACKET_SIZE, Client->pack_size);

                                if (rc == SQL_ERROR)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"ODBCOpenConnection", "SQLSetConnectOption() failed.");
                                }

                                rc = SQLConnect(Client->hdbc,
                                                                Client->server,
                                                                SQL_NTS,
                                                                Client->user,
                                                                SQL_NTS,
                                                                Client->password,
                                                                SQL_NTS);

    if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"ODBCOpenConnection", "Could not open connection");
                                }

                                rc = SQLAllocStmt(Client->hdbc, &Client-
>hstmt);

                                if (rc == SQL_ERROR)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLAllocStmt() failed.");
                                }

                                sprintf(buffer,"use %s", Client->database);

                                rc = SQLExecDirect(Client->hstmt, buffer,
SQL_NTS);

    if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLExecDirect() failed.");
                                }

                                SQLFreeStmt(Client->hstmt, SQL_CLOSE);

                                sprintf(buffer,"set nocount on");

                                rc = SQLExecDirect(Client->hstmt, buffer,
SQL_NTS);

    if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLExecDirect() failed.");
                                }

                                SQLFreeStmt(Client->hstmt, SQL_CLOSE);

                                sprintf(buffer,"select @@spid");

                                rc = SQLExecDirect(Client->hstmt, buffer,
SQL_NTS);

    if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLExecDirect() failed.");
                                }

                                rc = SQLBindCol(Client->hstmt, 1,
SQL_C_SSHORT, &Client->spid, 0, NULL);

    if (rc == SQL_ERROR)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLBindCol() failed.");
                                }

                                rc = SQLFetch(Client->hstmt);

                                if (rc == SQL_ERROR)
                                {
                                        ODBCError (henv, Client->hdbc, Client-
>hstmt);
                                        UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLFetch() failed.");
                                }

                                SQLFreeStmt(Client->hstmt, SQL_CLOSE);

}


//==========================================================
==============
//
// Function name: ODBCOpenDeliveryConnection
//
```

```
//=======================================================
==============

void ODBCOpenDeliveryConnection(DELIVERY *DeliveryHdlr)
{

				RETCODE		rc;
				char		buffer[30];

#ifdef DEBUG
				printf("[%ld]DBG: Entering
ODBCOpenDeliveryConnection()...\n", (int) GetCurrentThreadId());
#endif

				rc = SQLAllocConnect(henv, &DeliveryHdlr-
>hdbc);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"ODBCOpenConnection", "SQLAllocConnect() failed.");
				}

				rc = SQLSetConnectOption (DeliveryHdlr->hdbc,
SQL_PACKET_SIZE, DeliveryHdlr->pack_size);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"ODBCOpenConnection", "SQLSetConnectOption() failed.");
				}

				rc = SQLConnect(DeliveryHdlr->hdbc,
						DeliveryHdlr->server,
						SQL_NTS,
						DeliveryHdlr->user,
						SQL_NTS,
						DeliveryHdlr-
>password,
						SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"ODBCOpenConnection", "Could not open connection");
				}

				rc = SQLAllocStmt(DeliveryHdlr->hdbc,
&DeliveryHdlr->hstmt);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLAllocStmt() failed.");
				}

				sprintf(buffer,"use %s", DeliveryHdlr->database);

				rc = SQLExecDirect(DeliveryHdlr->hstmt, buffer,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLExecDirect() failed.");
				}

				SQLFreeStmt(DeliveryHdlr->hstmt,
SQL_CLOSE);

				sprintf(buffer,"set nocount on", DeliveryHdlr-
>database);

				rc = SQLExecDirect(DeliveryHdlr->hstmt, buffer,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLExecDirect() failed.");
				}

				SQLFreeStmt(DeliveryHdlr->hstmt,
SQL_CLOSE);

				sprintf(buffer,"select @@spid");

				rc = SQLExecDirect(DeliveryHdlr->hstmt, buffer,
SQL_NTS);

   if (rc != SQL_SUCCESS && rc != SQL_SUCCESS_WITH_INFO)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLExecDirect() failed.");
				}

				rc = SQLBindCol(DeliveryHdlr->hstmt, 1,
SQL_C_SSHORT, &DeliveryHdlr->spid, 0, NULL);

   if (rc == SQL_ERROR)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLBindCol() failed.");
				}

				rc = SQLFetch(DeliveryHdlr->hstmt);

				if (rc == SQL_ERROR)
				{
					ODBCError (henv, DeliveryHdlr->hdbc,
DeliveryHdlr->hstmt);
					UtilFatalError(GetCurrentThreadId(),
"SQLOpenConnection", "SQLFetch() failed.");
				}

				SQLFreeStmt(DeliveryHdlr->hstmt,
SQL_CLOSE);

}

//=======================================================
==============
//
// Function name: ODBCError
//
//=======================================================
==============

BOOL ODBCError (HENV henv,
							HDBC hdbc,
							HSTMT hstmt)

{
				RETCODE		rc;
				SDWORD		lNativeError;
				char		szState[6];
				char
szMsg[SQL_MAX_MESSAGE_LENGTH];
				BOOL		deadlock_detected;
				char		timebuf[128];
				char		datebuf[128];
				FILE		*fp1;
				char		msg[255];
				BOOL		bKillThread;

				deadlock_detected = FALSE;
				bKillThread = FALSE;

				rc = SQLError(henv, hdbc, hstmt,
							szState,
&lNativeError,
							szMsg, sizeof(szMsg),
NULL);

				while(rc == SQL_SUCCESS)
				{

					if (lNativeError == 1205)
					{
						deadlock_detected = TRUE;
					}
					else
					{
						_strtime(timebuf);
						_strdate(datebuf);

						sprintf(msg, "%s %s : ODBC Error:
State=%s, Error=%ld, %s\n",
								datebuf,
timebuf, szState, lNativeError, szMsg);


				EnterCriticalSection(&ClientErrorLogCritSec);
						fp1 = fopen("client.err","a");
						if (fp1 == NULL)
							printf("Error in opening
errorlog file.\n");
						fprintf(fp1, msg);
						fclose(fp1);

				LeaveCriticalSection(&ClientErrorLogCritSec);

						printf("%s", msg);

						bKillThread = TRUE;
					}
					rc = SQLError(henv, hdbc, hstmt,
							szState, &lNativeError,
							szMsg, sizeof(szMsg),
NULL);
				}


				if (bKillThread == TRUE)
				{

				InterlockedIncrement(&client_threads_dropped);
					//ExitThread(-1);
				}

				return deadlock_detected;

}


//=======================================================
==============
//
// Function name: ODBCExit
//
//=======================================================
==============
void ODBCExit(HDBC    hdbc,
						HSTMT   hstmt)
{

#ifdef DEBUG
				printf("[%ld]DBG: Entering ODBCExit()...\n", (int)
GetCurrentThreadId());
#endif

				SQLFreeStmt(hstmt, SQL_DROP);
				SQLDisconnect(hdbc);
				SQLFreeConnect(hdbc);
}

#endif
```

STOCKLEVEL.C

```
/* Audited: 28 February 1997 */

/* stocklevel.c
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#include "stocklevel.h"

int stock_level_func_parse(assoc *a, int *cookie, STOCK_LEVEL_DATA
*data, char *output) {
				int i = 0;
				char errstr[128];
				char all_errors[1024];
				errstr[0] = '\0';
				all_errors[0] = '\0';
				while((*a)[0][i]) {
					switch((*a)[0][i][0]) {
						case 'c':
							*cookie = VerifyInt((*a)[1][i],
4);
							break;
						case 't':
							data->thresh_hold =
VerifyShort((*a)[1][i], 2);
							break;
						default: break;
					}
					++i;
				}
				if(*cookie < 0 || !get_user(*cookie)->w_id) {
					sprintf(errstr, BAD_COOKIE_MSG);
					strcat(all_errors, errstr);
				}
				switch(data->thresh_hold) {
					case -1:
						sprintf(errstr, TOO_LONG_MSG,
"threshhold", 2);
						strcat(all_errors, errstr);
						break;
					case -2:
						sprintf(errstr, NOT_ISDIGIT_MSG,
"threshhold");
						strcat(all_errors, errstr);
						break;
					case -3:
						sprintf(errstr, NO_INPUT_MSG,
"threshhold");
						strcat(all_errors, errstr);
						break;
					default:break;
				}
				data->w_id = get_user(*cookie)->w_id;
				data->d_id = get_user(*cookie)->d_id;
				if(all_errors[0]) {
					sprintf(output, errorpage, all_errors);
					return 0;
				} else return 1;
}

int stock_level_func_process(STOCK_LEVEL_DATA *data, int cookie) {
#ifdef DB_PRESENT
				return SQLStockLevel(get_user(cookie)-
>dbhandle, data, DEADLOCK_RETRY);
#else
				data->low_stock = 123;
				return 1;
#endif DB_PRESENT
}

void stock_level_func_format(char *output, STOCK_LEVEL_DATA *data, int
cookie) {
				char buf[3000];
				sprintf(buf, sresp, cookie);
				IntField(&buf[SW], 4, data->w_id);
				IntField(&buf[SD], 2, data->d_id);
				IntField(&buf[ST], 2, data->thresh_hold);
				IntField(&buf[SL], 3, data->low_stock);
				FormatHtmlPage(buf, output);
}

void stock_level_func_main(assoc *a, char *output) {
				int cookie;
				STOCK_LEVEL_DATA data;
				if(!stock_level_func_parse(a, &cookie, &data,
output)) return;
				if(!stock_level_func_process(&data, cookie)) {
					sprintf(output, dberrpage, cookie);
					return;
				}
				stock_level_func_format(output, &data, cookie);
}
```

STOCKLEVEL.H

```
/* Audited: 28 February 1997 */

/* stocklevel.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __stocklevel_h__
#define __stocklevel_h__

#include "context.h"
#include <tpcc/kit/src/tpcc.h>
#include "inputparser.h"
#include "output.h"
#include "errors.h"
#include "options.h"

#define STOCKLVL_FUNC 4

static char sresp[] =
"<HTML><HEAD><TITLE>TPC-C: Stock-
Level</TITLE></HEAD><BODY><PRE>"
"                              Stock-Level\r\n"
"Warehouse: XXXX  District: XX\r\n"
"\r\n"
"Stock Level Threshold: XX\r\n"
"\r\n"
"low stock: XXX"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"\r\n"
"</PRE><P><FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"c\" VALUE=\"%d\">"
"<INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"New Order\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Payment\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Delivery\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Order-Status\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Stock-Level\">"
" <INPUT TYPE=\"submit\" NAME=\"b\" VALUE=\"Exit\">"
"</FORM></P></BODY></HTML>\r\n";

#define SW 121
#define SD 137
#define ST 166
#define SL 183

extern void e_log(char *);
void stock_level_func_main(assoc *, char *);
int stock_level_func_parse(assoc *, int *, STOCK_LEVEL_DATA *, char *);
int stock_level_func_process(STOCK_LEVEL_DATA *, int);
void stock_level_func_format(char *, STOCK_LEVEL_DATA *, int);

#endif __stocklevel_h__
```

STUBS.C

```
/* Audited: 2 May 1996 */

/* stubs.c */
/* Copyright 1996 Intergraph Corp.  Huntsville, AL  USA */

/*
**  This file contains routines which take the place of Microsoft routines.
**  For the most part, none of the routines in this file actually do anything,
**  but are here to make the linker happy.
*/

#include <windows.h>

/* First, the "delivery" routines */
void GetDeliveryQueueNode()
{
}

void StatsDelivery()
{
}

void TimeNow()
{
}

void WriteDeliveryString()
{
}

/* Some "utility" routines */
#include <stdio.h>
static FILE *error_file;
static char *unique_filename;
static SYSTEMTIME now;

void IngrUtilInit(char *filename)
{
                                unique_filename = filename;
}

void UtilError(int thread, char *msg1, char *msg2)
{
                                if (error_file == 0) error_file =
fopen(unique_filename,"w");
                                GetLocalTime(&now);
                                if (error_file != 0)
                                {
                                        fprintf(error_file,"%02d:%02d:%02d.%03d
%d/%d/%d\n",
                                                        now.wHour, now.wMinute,
now.wSecond, now.wMilliseconds,
                                                        now.wMonth, now.wDay,
now.wYear);
                                        fprintf(error_file,"%s: %s\n",msg1,msg2);
                                        fflush(error_file);
                                }
}

void UtilFatalError(int thread, char *msg1, char *msg2)
{
                                if (error_file == 0) error_file =
fopen(unique_filename,"w");
                                GetLocalTime(&now);
                                if (error_file != 0)
                                {
                                        fprintf(error_file,"%02d:%02d:%02d.%03d
%d/%d/%d\n",
                                                        now.wHour, now.wMinute,
now.wSecond, now.wMilliseconds,
                                                        now.wMonth, now.wDay,
now.wYear);
                                        fprintf(error_file,"%s: %s\n",msg1,msg2);
                                }
                                return;
}

void UtilSleep()
{
}

void UtilStatus()
{
}

void UtilStrCpy(char * destination, char * source, int length)
{
   strncpy(destination, source, length);
   destination[length] = '\0';
}


/* My own (somewhat) useful little routines. */
LPSTR TranslateErrorCode(ULONG errorcode)
{
   DWORD LanguageId;
   LPSTR SystemMessage = 0;
   LPVOID SystemMessageArray[1] = { &SystemMessage };
   static char default_buffer[32];

   LanguageId = MAKELANGID(LANG_ENGLISH,
SUBLANG_ENGLISH_US);

   /* Translate the System Error Code into a string. */
   FormatMessage(FORMAT_MESSAGE_FROM_SYSTEM |

FORMAT_MESSAGE_ALLOCATE_BUFFER,
                                         NULL,
                                         errorcode,
                                         LanguageId,
                                         (LPSTR) &SystemMessage,
                                         (unsigned long) NULL,
                                         NULL);

   if (SystemMessage != 0) return SystemMessage;
   else
   {
      HINSTANCE lib;
      lib = LoadLibrary("ntdll.dll");
                                if (lib != NULL)
                                {

                                FormatMessage(FORMAT_MESSAGE_ALLOCA
TE_BUFFER |

FORMAT_MESSAGE_FROM_HMODULE,
                                                     lib,
                                                     errorcode,
                                                     LanguageId,
                                                     (LPSTR) &SystemMessage,
                                                     (unsigned long) NULL,
                                                     NULL);
                                        if (SystemMessage != 0) return
SystemMessage;
                                }
   }

   sprintf(default_buffer, "error:%#x", errorcode);
   return default_buffer;
}
```

TPCC.C

```
/* Audited: 28 February 1997 */

/* tpcc.c
  Copyright (c) 1997 Intergraph Corp.
 */

#include "tpcc.h"

FILE *logfile;

void e_log(char *s) {
                                time_t timeval = time(0);
                                char ctimestr[26];
                                strcpy(ctimestr, ctime(&timeval));
                                ctimestr[24] = '\0';
                                fprintf(logfile, "%s | %s\n", ctimestr, s);
                                fflush(logfile);
}

BOOL APIENTRY DllMain(HANDLE hModule, ULONG reason, LPVOID
lpReserved) {
                                switch(reason) {
                                        case DLL_PROCESS_ATTACH:
                                                logfile =
fopen("C:\\USERS\\DEFAULT\\HTTPERR.LOG", "w+");
                                                init_function_array();
                                                register_extensions();
                                                init_extensions();
                                                break;
                                        case DLL_PROCESS_DETACH:
                                                cleanup_extensions();
                                                fclose(logfile);
                                                break;
                                        case DLL_THREAD_ATTACH:
                                                break;
                                        case DLL_THREAD_DETACH:
                                                break;
                                        default: break;
                                }
                                return TRUE;
}

BOOL WINAPI GetExtensionVersion(HSE_VERSION_INFO *version) {
                                version->dwExtensionVersion =
HSE_VERSION_MAJOR << 16 | HSE_VERSION_MINOR;
                                strcpy(version->lpszExtensionDesc, "Intergraph
TPC-C Web Client");
                                return TRUE;
}
```

```
DWORD WINAPI HttpExtensionProc(LPEXTENSION_CONTROL_BLOCK
ecb) {
				char querystring[1024];
				assoc a;
				char output[3000];
				char header[256];
				int length, hlen, function_index;
				init_assoc(&a);
				strcpy(querystring, ecb->lpszQueryString);
				fill_assoc(&a, querystring);
    function_index = identify_function_index(&a);
				if(function_array[function_index]) {
					(*function_array[function_index])(&a,
output);
				} else {
					strcpy(output, enofuncent);
				}
				length = strlen(output);
				sprintf(header, "Content-type:
text/html\r\nContent-length: %d\r\n\r\n", length);
				hlen = strlen(header);
				ecb->ServerSupportFunction(ecb->ConnID,
HSE_REQ_SEND_RESPONSE_HEADER, (LPVOID) NULL, &hlen,
(LPDWORD)header);
				ecb->WriteClient(ecb->ConnID, output, &length,
(DWORD) NULL);
				return
HSE_STATUS_SUCCESS_AND_KEEP_CONN;
}
```

TPCC.DEF

```
; Audited: 28 February 1997

; tpcc.def
;   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA


; TPCC.def : declares the module parameters for the DLL.

LIBRARY				"TPCC"

EXPORTS
				HttpExtensionProc
				GetExtensionVersion
```

TPCC.H

```
/* Audited: 28 February 1997 */

/* tpcc.h
   Copyright (c) 1997 Intergraph Corp.  Huntsville, AL USA
 */

#ifndef __tpcc2_h__
#define __tpcc2_h__

#include <windows.h>
#include <HttpExt.h>
#include <stdio.h>
#include <string.h>
#include <time.h>
#include "functions.h"
#include "inputparser.h"
#include "extensions.h"

static char enofuncent[] =
"<HTML><HEAD><TITLE>Function Not Found</TITLE></HEAD><BODY>"
"The URL you submitted contained an invalid query, which referenced a
nonexistent function."
"Don't do whatever it is you did.</BODY></HTML>";

#endif __tpcc2_h__
```

Appendix B: Database Design

CREATEDB.SQL

```
/*  TPC-C Benchmark Kit                          */
/*                                     */
/*  CREATEDB.SQL                                */
/*                                     */
/*  This script is used to create the database    */

use master
go

if exists ( select name from sysdatabases where name = "tpcc" )
                              drop database tpcc
go

create database tpcc

                              on
                                tpcdata1=1000,
                                tpcdata2=1000,
                                tpcdata3=1000,
                                tpcdata4=1000,
                                tpcdata5=1000,
                                tpcdata6=1000,
                                tpcdata7=1000,
                                tpcdata8=1000,
                                tpcdata9=1000,
                                tpcdata10=1000,
                                tpcdata11=1000,

                                tpcdata1=1000,
                                tpcdata2=1000,
                                tpcdata3=1000,
                                tpcdata4=1000,
                                tpcdata5=1000,
                                tpcdata6=1000,
                                tpcdata7=1000,
                                tpcdata8=1000,
                                tpcdata9=1000,
                                tpcdata10=1000,
                                tpcdata11=1000,

                                tpcdata1=3300,
                                tpcdata2=3300,
                                tpcdata3=3300,
                                tpcdata4=3300,
                                tpcdata5=3300,
                                tpcdata6=3300,
                                tpcdata7=3300,
                                tpcdata8=3300,
                                tpcdata9=3300

                                log on tpclog1=10240
go
```

DISKINIT.SQL

```
/*  TPC-C Benchmark Kit                          */
/*                                     */
/*  DISKINIT.SQL                                */
/*                                     */
/*  This script is used create devices           */


use master
go

/*  Log device  */

disk init name = "tpclog1",
                              physname = "e:\tpclog1",
                              vdevno   = 14,
                              size     = 5242880
go

/*  Database devices */

disk init name = "tpcdata1",
                              physname = "f:\tpcdata1",
                              vdevno   = 15,
                              size     =   3584000
go

disk init name = "tpcdata2",
                              physname = "g:\tpcdata2",
                              vdevno   = 16,
                              size     =2713600
go

disk init name = "tpcdata3",
                              physname = "h:\tpcdata3",
                              vdevno   = 17,
                              size     =2713600
go

disk init name = "tpcdata4",
                              physname = "i:\tpcdata4",
                              vdevno   = 18,
                              size     = 2713600
go

disk init name = "tpcdata5",
                              physname = "j:\tpcdata5",
                              vdevno   = 19,
                              size     = 2713600
go

disk init name = "tpcdata6",
                              physname = "k:\tpcdata6",
                              vdevno   = 20,
                              size     =2713600
go

disk init name = "tpcdata7",
                              physname = "l:\tpcdata7",
                              vdevno   = 21,
                              size     =2713600
go

disk init name = "tpcdata8",
                              physname = "m:\tpcdata8",
                              vdevno   = 22,
                              size     =2713600
go

disk init name = "tpcdata9",
                              physname = "o:\tpcdata9",
                              vdevno   = 23,
                              size     =2713600
go

disk init name = "tpcdata10",
                              physname = "p:\tpcdata10",
                              vdevno   = 24,
                              size     =2713600
go

disk init name = "tpcdata11",
                              physname = "q:\tpcdata11",
                              vdevno   = 25,
                              size     =2713600
go
```

DBOPT1.SQL

```
/*  TPC-C Benchmark Kit                              */
/*                                         */
/*  DBOPT1.SQL                                      */
/*                                         */
/*  Set database options for database load            */


use master
go

sp_dboption tpcc,'select into/bulkcopy',true
go

sp_dboption tpcc,'trunc. log on chkpt.',true
go

use tpcc
go

checkpoint
go

use tpcc_admin
go

sp_dboption tpcc,'trunc. log on chkpt.',true
go
```

DBOPT2.SQL

```
/*  TPC-C Benchmark Kit                              */
/*                                         */
/*  DBOPT2.SQL                                      */
/*                                         */
/*  Reset database options after database load        */


use master
go
```

```
sp_dboption tpcc,'select ',false
go

sp_dboption tpcc,'trunc. ',false
go

use tpcc
go

checkpoint
go
```

DEILVERY.SQL

```
/*  File:       DELIVERY.SQL                                    */
/*              Microsoft TPC-C Kit Ver. 3.00.000               */
/*              Audited 08/23/96, By Francois Raab              */
/*                                                              */
/*              Copyright Microsoft, 1996                       */
/*                                                              */
/*  Purpose:    Delivery transaction for Microsoft TPC-C Benchmark Kit     */
/*  Author:     Damien Lindauer                                 */
/*              damienl@Microsoft.com                           */


use tpcc
go

/* delivery transaction */

if exists (select name from sysobjects where name = "tpcc_delivery" )
                                    drop procedure tpcc_delivery
go

create proc tpcc_delivery           @w_id           smallint,
                                    @o_carrier_id   smallint
as

declare @d_id tinyint,
        @o_id int,
        @c_id int,
        @total numeric(12,2),
        @oid1 int,
        @oid2 int,
        @oid3 int,
        @oid4 int,
        @oid5 int,
        @oid6 int,
        @oid7 int,
        @oid8 int,
        @oid9 int,
        @oid10 int

select @d_id = 0

begin tran d

    while (@d_id < 10)
    begin

        select @d_id  = @d_id + 1,
               @total = 0,
               @o_id  = 0

        select @o_id = min(no_o_id)
        from new_order holdlock
        where no_w_id = @w_id and
                                        no_d_id = @d_id

        if (@@rowcount <> 0)
        begin

            /* claim the order for this district */

            delete new_order
            where no_w_id = @w_id and
                                        no_d_id = @d_id and
                                            no_o_id = @o_id

            /* set carrier_id on this order (and get customer id) */

            update orders
                                        set o_carrier_id = @o_carrier_id,
                @c_id       = o_c_id
            where o_w_id = @w_id and
                                        o_d_id = @d_id and
                                            o_id   = @o_id

            /* set date in all lineitems for this order (and sum amounts) */

            update order_line
                                        set ol_delivery_d = getdate(),
                                        @total       = @total + ol_amount
            where ol_w_id = @w_id and
                  ol_d_id = @d_id and
                                            ol_o_id = @o_id

            /* accummulate lineitem amounts for this order into customer */

                                        update customer
                                            set c_balance      = c_balance +
@total,
                                                c_delivery_cnt = c_delivery_cnt
+ 1
            where c_w_id = @w_id and
                                        c_d_id = @d_id and
                                            c_id   = @c_id

        end

        select @oid1 = case @d_id when  1  then @o_id else @oid1 end,
               @oid2 = case @d_id when  2  then @o_id else @oid2 end,
               @oid3 = case @d_id when  3  then @o_id else @oid3 end,
               @oid4 = case @d_id when  4  then @o_id else @oid4 end,
               @oid5 = case @d_id when  5  then @o_id else @oid5 end,
               @oid6 = case @d_id when  6  then @o_id else @oid6 end,
               @oid7 = case @d_id when  7  then @o_id else @oid7 end,
               @oid8 = case @d_id when  8  then @o_id else @oid8 end,
               @oid9 = case @d_id when  9  then @o_id else @oid9 end,
               @oid10 = case @d_id when 10 then @o_id else @oid10 end

    end

commit tran d

select @oid1,
       @oid2,
       @oid3,
       @oid4,
       @oid5,
       @oid6,
       @oid7,
       @oid8,
       @oid9,
       @oid10

go
```

IDXCUSCL.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXCUSCL.SQL                                           */
/*                                                         */
/*  Creates clustered index on customer (noseg)            */


use tpcc
go


if exists ( select name from sysindexes where name = 'customer_c1' )
                        drop index customer.customer_c1
go

select getdate()
go
create unique clustered index customer_c1 on customer(c_w_id, c_d_id,
c_id)
                        with sorted_data
go
select getdate()
go
```

IDXCUSNC.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXCUSNC.SQL                                           */
/*                                                         */
/*  Creates non-clustered index on customer (noseg)        */


use tpcc
go


if exists ( select name from sysindexes where  name = 'customer_nc1' )
   drop index customer.customer_nc1
go

select getdate()
go
create unique nonclustered index customer_nc1 on customer(c_w_id,
c_d_id, c_last, c_first, c_id)
go
select getdate()
go
```

IDXDISCL.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXDISCL.SQL                                           */
/*                                                         */
/*  Creates clustered index on district (noseg)            */


use tpcc
go


if exists ( select name from sysindexes where name = 'district_c1' )
                    drop index district.district_c1
go

select getdate()
go
create unique clustered index  district_c1 on district(d_w_id, d_id)
                    with fillfactor=1
go
select getdate()
go
```

IDXITMCL.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXITMCL.SQL                                           */
/*                                                         */
/*  Creates clustered index on item (noseg)                */


use tpcc
go


if exists ( select name from sysindexes where  name = 'item_c1' )
                    drop index item.item_c1
go

select getdate()
go
create unique clustered index item_c1 on item(i_id)
                    with sorted_data
go
select getdate()
go
```

IDXNODCL.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXNODCL.SQL                                           */
/*                                                         */
/*  Creates clustered index on new_order (noseg)           */

use tpcc
go


if exists ( select name from sysindexes where  name = 'new_order_c1' )
                    drop index new_order.new_order_c1
go

select getdate()
go
create unique clustered index new_order_c1 on new_order(no_w_id,
no_d_id, no_o_id)
                    with sorted_data
go
select getdate()
go
```

IDXODLCL.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXODLCL.SQL                                           */
/*                                                         */
/*  Creates clustered index on order_line (noseg)          */


use tpcc
go


if exists ( select name from sysindexes where  name = 'order_line_c1' )
                    drop index order_line.order_line_c1
go

select getdate()
go
create unique clustered index order_line_c1 on order_line(ol_w_id, ol_d_id,
ol_o_id, ol_number)
                    with sorted_data
go
select getdate()
go
```

IDXORDCL.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXORDCL.SQL                                           */
/*                                                         */
/*  Creates clustered index on orders (noseg)              */


use tpcc
go


if exists ( select name from sysindexes where  name = 'orders_c1' )
                    drop index orders.orders_c1
go

select getdate()
go
create unique clustered index orders_c1 on orders(o_w_id, o_d_id, o_id)
                    with sorted_data
go
select getdate()
go
```

IDXSTKCL.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXSTKCL.SQL                                           */
/*                                                         */
/*  Creates clustered index on stock (noseg)               */


use tpcc
go


if exists ( select name from sysindexes where  name = 'stock_c1' )
                    drop index stock.stock_c1
go

select getdate()
go
create unique clustered index stock_c1 on stock(s_i_id, s_w_id)
                    with sorted_data
go
select getdate()
go
```

IDXWARCL.SQL

```
/*  TPC-C Benchmark Kit                                    */
/*                                                         */
/*  IDXWARCL.SQL                                           */
/*                                                         */
/*  Creates clustered index on warehouse (noseg)           */


use tpcc
go


if exists ( select name from sysindexes where name = 'warehouse_c1' )
                    drop index warehouse.warehouse_c1
go

select getdate()
go
create unique clustered index warehouse_c1 on warehouse(w_id)
                    with fillfactor=1
go
select getdate()
go
```

NEWORD.SQL

```
/*  File:       NEWORD.SQL                                              */
/*              Microsoft TPC-C Kit Ver. 3.00.000                       */
/*              Audited 08/23/96, By Francois Raab                      */
/*                                                                      */
/*              Copyright Microsoft, 1996                               */
/*                                                                      */
/*  Purpose:    New-Order transaction for Microsoft TPC-C Benchmark Kit
*/
/*  Author:     Damien Lindauer                                         */
/*              damienl@Microsoft.com                                   */


use tpcc
go

/* new-order transaction stored procedure */

if exists ( select name from sysobjects where name = "tpcc_neworder" )
                        drop procedure tpcc_neworder
go

create proc tpcc_neworder
                                                        @w_id
smallint,
                                                        @d_id
tinyint,
                                                        @c_id
int,
                        @o_ol_cnt       tinyint,

                        @o_all_local    tinyint,
                                                        @i_id1
int = 0, @s_w_id1 smallint = 0, @ol_qty1 smallint = 0,
                                                        @i_id2
int = 0, @s_w_id2 smallint = 0, @ol_qty2 smallint = 0,
                                                        @i_id3
int = 0, @s_w_id3 smallint = 0, @ol_qty3 smallint = 0,
                                                        @i_id4
int = 0, @s_w_id4 smallint = 0, @ol_qty4 smallint = 0,
                                                        @i_id5
int = 0, @s_w_id5 smallint = 0, @ol_qty5 smallint = 0,
                                                        @i_id6
int = 0, @s_w_id6 smallint = 0, @ol_qty6 smallint = 0,
                                                        @i_id7
int = 0, @s_w_id7 smallint = 0, @ol_qty7 smallint = 0,
                                                        @i_id8
int = 0, @s_w_id8 smallint = 0, @ol_qty8 smallint = 0,
                                                        @i_id9
int = 0, @s_w_id9 smallint = 0, @ol_qty9 smallint = 0,
                                                        @i_id10
int = 0, @s_w_id10 smallint = 0, @ol_qty10 smallint = 0,
                                                        @i_id11
int = 0, @s_w_id11 smallint = 0, @ol_qty11 smallint = 0,
                                                        @i_id12
int = 0, @s_w_id12 smallint = 0, @ol_qty12 smallint = 0,
                                                        @i_id13
int = 0, @s_w_id13 smallint = 0, @ol_qty13 smallint = 0,
                                                        @i_id14
int = 0, @s_w_id14 smallint = 0, @ol_qty14 smallint = 0,
                                                        @i_id15
int = 0, @s_w_id15 smallint = 0, @ol_qty15 smallint = 0

as
declare @w_tax          numeric(4,4),
        @d_tax          numeric(4,4),
        @c_last         char(16),
        @c_credit       char(2),
        @c_discount     numeric(4,4),
        @i_price        numeric(5,2),
        @i_name         char(24),
        @i_data         char(50),
        @o_entry_d      datetime,
        @remote_flag    int,
        @s_quantity     smallint,
        @s_data         char(50),
        @s_dist         char(24),
                                @li_no          int,
                                @o_id                   int,
                                @commit_flag    tinyint,
        @li_id          int,
        @li_s_w_id      smallint,
        @li_qty         smallint,
                                @ol_number              int,
                                @c_id_local             int

begin

                        begin transaction n

    /* get order date */

    select @o_entry_d = getdate()

    /* get district tax and next availible order id and update */

    update district
                        set @d_tax      = d_tax,
                            @o_id       = d_next_o_id,
                                d_next_o_id = d_next_o_id + 1
                            where d_w_id = @w_id and
                                d_id   = @d_id

                        /*  process orderlines */

    select  @li_no = 0

                        /*  set commit flag */
                        select @commit_flag = 1

    while (@li_no < @o_ol_cnt)
                        begin

        select @li_no = @li_no + 1

                            /*  Set i_id, s_w_id, and qty for this lineitem */

                            select @li_id = case @li_no
                                when 1 then @i_id1
                                        when 2 then @i_id2
                                        when 3 then @i_id3
                                        when 4 then @i_id4
                                        when 5 then @i_id5
                                        when 6 then @i_id6
                                        when 7 then @i_id7
                                        when 8 then @i_id8
                                        when 9 then @i_id9
                                        when 10 then @i_id10
                                        when 11 then @i_id11
                                        when 12 then @i_id12
                                        when 13 then @i_id13
                                        when 14 then @i_id14
                                        when 15 then @i_id15
                                        end

                            select @li_s_w_id = case @li_no
                                        when 1 then @s_w_id1
                                        when 2 then @s_w_id2
                                        when 3 then @s_w_id3
                                        when 4 then @s_w_id4
                                        when 5 then @s_w_id5
                                        when 6 then @s_w_id6
                                        when 7 then @s_w_id7
                                        when 8 then @s_w_id8
                                        when 9 then @s_w_id9
                                        when 10 then @s_w_id10
                                        when 11 then @s_w_id11
                                        when 12 then @s_w_id12
                                        when 13 then @s_w_id13
                                        when 14 then @s_w_id14
                                        when 15 then @s_w_id15
                                        end

                            select @li_qty = case  @li_no
                                        when 1 then @ol_qty1
                                        when 2 then @ol_qty2
                                        when 3 then @ol_qty3
                                        when 4 then @ol_qty4
                                        when 5 then @ol_qty5
                                        when 6 then @ol_qty6
                                        when 7 then @ol_qty7
                                        when 8 then @ol_qty8
                                        when 9 then @ol_qty9
                                        when 10 then @ol_qty10
                                        when 11 then @ol_qty11
                                        when 12 then @ol_qty12
                                        when 13 then @ol_qty13
                                        when 14 then @ol_qty14
                                        when 15 then @ol_qty15
                                        end

        /* get item data (no one updates item) */

        select @i_price = i_price,
               @i_name  = i_name,
               @i_data  = i_data
        from item (tablock holdlock)
                                where i_id = @li_id

                                /* if there actually is an item with this id, go to
work */

                                if (@@rowcount > 0)
                                begin
          update stock set s_ytd        = s_ytd + @li_qty,
                        @s_quantity  = s_quantity,
                        s_quantity   = s_quantity - @li_qty +
                          case when (s_quantity - @li_qty < 10) then 91 else 0
end,
                        s_order_cnt  = s_order_cnt + 1,
                        s_remote_cnt = s_remote_cnt + case
                          when (@li_s_w_id = @w_id) then 0 else 1 end,
                        @s_data      = s_data,
                        @s_dist      = case @d_id
                                                when 1  then
s_dist_01
```

```
                                                        when 2  then
s_dist_02
                                                        when 3  then
s_dist_03
                                                        when 4  then
s_dist_04
                                                        when 5  then
s_dist_05
                                                        when 6  then
s_dist_06
                                                        when 7  then
s_dist_07
                                                        when 8  then
s_dist_08
                                                        when 9  then
s_dist_09
                                                        when 10 then
s_dist_10
                                                  end
       where s_i_id = @li_id and
                                               s_w_id = @li_s_w_id

                                           /* insert order_line data (using data
from item and stock) */

       insert into order_line values(@o_id,             /* from district update */
                                @d_id,                      /* input param          */
                                @w_id,              /* input param          */
                                @li_no,             /* orderline number     */
                                @li_id,            /* lineitem id          */
                                @li_s_w_id,         /* lineitem warehouse   */
                                "jan 1, 1900",      /* constant             */
                                @li_qty,            /* lineitem qty         */
                                @i_price * @li_qty, /* ol_amount            */
                                @s_dist)            /* from stock           */

       /* send line-item data to client */

                                          select @i_name,
           @s_quantity,
           b_g = case when ( (patindex("%ORIGINAL%",@i_data) > 0) and

(patindex("%ORIGINAL%",@s_data) > 0) )
               then "B" else "G" end,
           @i_price,
           @i_price * @li_qty

     end
     else
                                  begin

                                          /*  no item found - triggers rollback
condition */

                                             select "",0,"",0,0
                                             select @commit_flag = 0

                                  end
                           end

  /* get customer last name, discount, and credit rating */

  select @c_last     = c_last,
        @c_discount = c_discount,
        @c_credit   = c_credit,
                                        @c_id_local = c_id
  from customer holdlock
  where c_id   = @c_id and
        c_w_id = @w_id and
        c_d_id = @d_id

     /* insert fresh row into orders table */

     insert into orders values (@o_id,
                                              @d_id,
                                              @w_id,
                                                         @c_id_local,
                                                         @o_entry_d,
                                                           0,
                                                           @o_ol_cnt,
                                                           @o_all_local)

                                /* insert corresponding row into new-order table
*/

                                insert into new_order values (@o_id,

@d_id,

@w_id)

                                /*  select warehouse tax */

                                select @w_tax = w_tax
                                from warehouse holdlock
                                where w_id = @w_id

                                if (@commit_flag = 1)
                                        commit transaction n
                                else
                                        /* all that work for nuthin!!! */
                                        rollback transaction n

                                /* return order data to client */
                                select @w_tax,
                                    @d_tax,
                                        @o_id,
                                        @c_last,
                                        @c_discount,
                                        @c_credit,
                                        @o_entry_d,
                                        @commit_flag

end

go
```

ORDSTAT.SQL

```
/*  File:      ORDSTAT.SQL                                   */
/*            Microsoft TPC-C Kit Ver. 3.00.000                  */
/*            Audited 08/23/96, By Francois Raab                    */
/*                                                      */
/*            Copyright Microsoft, 1996                      */
/*                                                      */
/*  Purpose:    Order-Status transaction for Microsoft TPC-C Benchmark Kit
*/
/*  Author:     Damien Lindauer                                */
/*            damienl@Microsoft.com                             */


use tpcc
go

if exists ( select name from sysobjects where name = "tpcc_orderstatus" )
                                drop procedure   tpcc_orderstatus
go

create proc tpcc_orderstatus @w_id                smallint,
                                                                  @d_id                 tinyin
                                                                  @c_id                 int,
                                                                  @c_last       char(16) = ""
as

declare @c_balance                  numeric(12,2),
      @c_first                      char(16),
      @c_middle                     char(2),
      @o_id                               int,
      @o_entry_d                    datetime,
      @o_carrier_id           smallint,
      @val                                smallint,
      @cnt                                smallint

begin tran o

                                if (@c_id = 0)
                                      begin
                                      /* get customer id and info using last name
*/

                                      select @cnt = count(*)
                                      from customer holdlock
                                      where c_last = @c_last and
                                        c_w_id = @w_id and
                                  c_d_id = @d_id

                                      select @val = (@cnt + 1) / 2
                                      set rowcount @val

                                      select @c_id = c_id,
                                              @c_balance = c_balance,
                                              @c_first   = c_first,
                                              @c_last    = c_last,
                                              @c_middle  = c_middle
                                      from customer holdlock
                                      where c_last = @c_last and
                                        c_w_id = @w_id and
                                  c_d_id = @d_id
                                      order by c_w_id, c_d_id, c_last, c_first

                                      set rowcount 0
                                      end

                                else
                                      begin

                                      /*  get customer info if by id*/

                                      select @c_balance = c_balance,
                                          @c_first   = c_first,
                                          @c_middle  = c_middle,
                                          @c_last    = c_last
                                      from customer holdlock
                                      where c_id   = @c_id and
                                          c_d_id = @d_id and
                                          c_w_id = @w_id

                                      select @cnt = @@rowcount
```

```
                                        end

                                /* if no such customer */
                                if (@cnt = 0)
                                begin
                                        raiserror("Customer not found",18,1)
                                        goto custnotfound
                                end

                                /*  get order info */

                                select @o_id = o_id,
                                           @o_entry_d    = o_entry_d,
                                  @o_carrier_id = o_carrier_id
                                from orders holdlock
                                where o_c_id = @c_id and
        o_d_id = @d_id and
        o_w_id = @w_id

                                /*  select order lines for the current order */

                                select ol_supply_w_id,
                                  ol_i_id,
                                     ol_quantity,
                                     ol_amount,
                                     ol_delivery_d
                                from order_line holdlock
                                where ol_o_id = @o_id and
                                     ol_d_id = @d_id and
                                     ol_w_id = @w_id

custnotfound:

commit tran o

/*  return data to client  */

select @c_id,
                                  @c_last,
                                  @c_first,
                                  @c_middle,
                                  @o_entry_d,
                                  @o_carrier_id,
                                  @c_balance,
                                  @o_id

go
```

PAYMENT.SQL

```
/*  File:       PAYMENT.SQL                                    */
/*              Microsoft TPC-C Kit Ver. 3.00.000              */
/*              Audited 08/23/96, By Francois Raab             */
/*                                                             */
/*              Copyright Microsoft, 1996                      */
/*                                                             */
/*  Purpose:    Payment transaction for Microsoft TPC-C Benchmark Kit      */
/*  Author:     Damien Lindauer                                */
/*              damienl@Microsoft.com                          */


use tpcc
go

if exists (select name from sysobjects where name = "tpcc_payment" )
                                drop procedure tpcc_payment
go

create proc tpcc_payment @w_id          smallint,
                                                        @c_w_id
smallint,
                                                        @h_amount
numeric(6,2),
                                                        @d_id
tinyint,
                                                        @c_d_id
tinyint,
                                                        @c_id
int,
                                                        @c_last
char(16) = ""


as
declare  @w_street_1     char(20),
        @w_street_2     char(20),
        @w_city         char(20),
        @w_state        char(2),
        @w_zip          char(9),
        @w_name         char(10),
        @d_street_1     char(20),
        @d_street_2     char(20),
        @d_city         char(20),
        @d_state        char(2),
        @d_zip          char(9),
        @d_name         char(10),
        @c_first        char(16),
        @c_middle       char(2),
        @c_street_1     char(20),
        @c_street_2     char(20),
        @c_city         char(20),
        @c_state        char(2),
        @c_zip          char(9),
        @c_phone        char(16),
        @c_since        datetime,
        @c_credit       char(2),
        @c_credit_lim   numeric(12,2),
        @c_balance      numeric(12,2),
        @c_discount     numeric(4,4),
        @data1          char(250),
        @data2          char(250),
        @c_data_1       char(250),
        @c_data_2       char(250),
        @datetime       datetime,
        @w_ytd          numeric(12,2),
        @d_ytd          numeric(12,2),
        @cnt            smallint,
        @val            smallint,
        @screen_data            char(200),
                                @d_id_local  tinyint,
                                @w_id_local          smallint,
                                @c_id_local  int

select @screen_data = ""

begin tran p

                                /* get payment date */

                                select @datetime = getdate()

                                if (@c_id = 0)
                                begin
                                        /* get customer id and info using last name
*/

                                        select @cnt = count(*)
                                        from customer holdlock
                                        where c_last = @c_last and
                                           c_w_id = @c_w_id and
                                           c_d_id = @c_d_id

                                        select @val = (@cnt + 1) / 2
                                        set rowcount @val

                                        select @c_id = c_id
                                        from customer holdlock
                                        where c_last = @c_last and
                                           c_w_id = @c_w_id and
                                           c_d_id = @c_d_id
                                        order by c_w_id, c_d_id, c_last, c_first

                                        set rowcount 0
                                end

                                /* get customer info and update balances */

                                update customer set
                                        @c_balance     = c_balance = c_balance -
@h_amount,
                                        c_payment_cnt  = c_payment_cnt + 1,
                                        c_ytd_payment  = c_ytd_payment +
@h_amount,
                                        @c_first       = c_first,
                                        @c_middle      = c_middle,
                                  @c_last        = c_last,
                                  @c_street_1    = c_street_1,
                                        @c_street_2    = c_street_2,
                                        @c_city        = c_city,
                                        @c_state       = c_state,
                                        @c_zip         = c_zip,
                                        @c_phone       = c_phone,
                                        @c_credit      = c_credit,
                                        @c_credit_lim  = c_credit_lim,
                                        @c_discount    = c_discount,
                                        @c_since       = c_since,
                                        @data1         = c_data_1,
                                        @data2         = c_data_2,
                                        @c_id_local    = c_id
                                where c_id   = @c_id and
                                     c_w_id = @c_w_id and
                                     c_d_id = @c_d_id

                                /* if customer has bad credit get some more info
*/

                                if (@c_credit = "BC")
                                begin

                                        /* compute new info */

                                        select @c_data_2 =
substring(@data1,209,42) +
substring(@data2, 1, 208)
                                        select @c_data_1 =
convert(char(5),@c_id) +
convert(char(4),@c_d_id) +
convert(char(5),@c_w_id) +
convert(char(4),@d_id) +

convert(char(5),@w_id) +

convert(char(19),@h_amount) +
                                                    substring(@data1, 1,
208)

                                /* update customer info */

                                update customer set
                                    c_data_1 = @c_data_1,
                                        c_data_2 = @c_data_2
                                where c_id   = @c_id and
                                        c_w_id = @c_w_id and
                                    c_d_id = @c_d_id

                                select @screen_data = substring
(@c_data_1,1,200)
                          end


                          /* get district data and update year-to-date */

                          update district
                                set d_ytd       = d_ytd + @h_amount,
                                      @d_street_1 = d_street_1,
                                      @d_street_2 = d_street_2,
                                      @d_city     = d_city,
                                      @d_state    = d_state,
                                      @d_zip      = d_zip,
                                      @d_name     = d_name,
                                      @d_id_local = d_id
                                where d_w_id = @w_id and
                                    d_id   = @d_id

                          /* get warehouse data and update year-to-date */

                          update warehouse
                          set w_ytd       = w_ytd + @h_amount,
                                @w_street_1 = w_street_1,
                             @w_street_2 = w_street_2,
                             @w_city     = w_city,
                             @w_state    = w_state,
                             @w_zip      = w_zip,
                             @w_name     = w_name,
                                @w_id_local = w_id
                          where w_id = @w_id

                          /* create history record */

                          insert into history values  (@c_id_local,

@c_d_id,

@c_w_id,

@d_id_local,

@w_id_local,

@datetime,

@h_amount,

@w_name + "    " + @d_name)
```

```
commit tran p

/* return data to client */

select  @c_id,
                              @c_last,
                              @datetime,
                              @w_street_1,
                              @w_street_2,
                              @w_city,
                              @w_state,
                              @w_zip,
                              @d_street_1,
                              @d_street_2,
                              @d_city,
                              @d_state,
                              @d_zip,
                              @c_first,
                              @c_middle,
                              @c_street_1,
                              @c_street_2,
                              @c_city,
                              @c_state,
                              @c_zip,
                              @c_phone,
                              @c_since,
                              @c_credit,
                              @c_credit_lim,
                              @c_discount,
                              @c_balance,
                              @screen_data

go
```

PINTABLE.SQL

```
/*  TPC-C Benchmark Kit                                              */
/*                                                                   */
/*  PINTABLE.SQL                                                     */
/*                                                                   */
/*  This script file is used to 'pin' certain tables in the data cache       */

use tpcc
go

exec sp_tableoption "district","pintable",true
exec sp_tableoption "warehouse","pintable",true
exec sp_tableoption "new_order","pintable",true
exec sp_tableoption "item","pintable",true
go
```

RUNCFG.SQL

```
/*  TPC-C Benchmark Kit                                              */
/*                                                                   */
/*  RUNCFG.SQL                                                       */
/*                                                                   */
/*  This script file is used to set server configuration parameters for test runs
*/

exec sp_configure "show advanced option", 1
go

reconfigure with override
go

exec sp_configure "affinity mask",0
exec sp_configure "hash buckets",265003
exec sp_configure "logwrite sleep (ms)",-1
exec sp_configure "max async IO",64
exec sp_configure "max lazywrite IO",32
exec sp_configure "max worker threads",100
exec sp_configure "memory",30000
exec sp_configure "free buffers",2000
exec sp_configure "priority boost",0
exec sp_configure "procedure cache",2
exec sp_configure "RA worker threads",0
exec sp_configure "recovery interval",32767
exec sp_configure "set working set size",0
exec sp_configure "SMP concurrency",-1
exec sp_configure "spin counter",10000
exec sp_configure "tempdb in ram (MB)",5
exec sp_configure "user connections",150
go

reconfigure with override
go

shutdown
go
```

SHUTDOWN.SQL

```
/*  TPC-C Benchmark Kit                                              */
/*                                                                   */
/*  SHUTDOWN.SQL                                                     */
/*                                                                   */
/*  This script file is used to shutdown the server gracefully              */


use tpcc
go

checkpoint
go

use tpcc_admin
go

checkpoint
go

dump tran tpcc with no_log
go

dump tran tpcc_admin with no_log
go

shutdown
go
```

STOCKLEV.SQL

```
/*  File:       STOCKLEV.SQL                                         */
```

```
/*	Microsoft TPC-C Kit Ver. 3.00.000	*/
/*	Audited 08/23/96, By Francois Raab	*/
/*		*/
/*	Copyright Microsoft, 1996	*/
/*		*/
/*  Purpose:    Stock-Level transaction for Microsoft TPC-C Benchmark Kit  */
/*  Author:     Damien Lindauer	*/
/*	damienl@Microsoft.com	*/


use tpcc
go

/* stock-level transaction stored procedure */

if exists (select name from sysobjects where name = "tpcc_stocklevel" )
		drop procedure tpcc_stocklevel
go

create proc tpcc_stocklevel	@w_id	smallint,
					@d_id
		tinyint,
					@threshhold	smallint
as
declare @o_id_low int,
	@o_id_high int

    select @o_id_low  = (d_next_o_id - 20),
			@o_id_high = (d_next_o_id - 1)
    from district
    where d_w_id = @w_id and
			d_id   = @d_id

    select count(distinct(s_i_id))
		from  stock, order_line
    where ol_w_id    =  @w_id and
			ol_d_id    =  @d_id and
			ol_o_id between @o_id_low and @o_id_high
and
	s_w_id     =  ol_w_id and
			s_i_id     =  ol_i_id and
			s_quantity <  @threshhold

go
```

TABLES.SQL

```
/*  TPC-C Benchmark Kit	*/
/*	*/
/*  TABLES.SQL	*/
/*	*/
/*  Creates TPC-C tables (noseg)	*/


use tpcc
go

checkpoint
go


if exists ( select name from sysobjects where name = 'warehouse' )
		drop table warehouse
go

create table warehouse
(
		w_id		smallint,
		w_name		char(10),
		w_street_1	char(20),
		w_street_2	char(20),
		w_city		char(20),
		w_state		char(2),
		w_zip		char(9),
		w_tax		numeric(4,4),
		w_ytd		numeric(12,2)
)
go

if exists ( select name from sysobjects where name = 'district' )
		drop table district
go

create table district
(
		d_id		tinyint,
		d_w_id		smallint,
		d_name		char(10),
		d_street_1	char(20),
		d_street_2	char(20),
		d_city		char(20),
		d_state		char(2),
		d_zip		char(9),
		d_tax		numeric(4,4),
		d_ytd		numeric(12,2),
		d_next_o_id	int
)
go


if exists ( select name from sysobjects where name = 'customer' )
		drop table customer
go

create table customer
(
		c_id		int,
		c_d_id		tinyint,
		c_w_id		smallint,
		c_first		char(16),
		c_middle	char(2),
		c_last		char(16),
		c_street_1	char(20),
		c_street_2	char(20),
		c_city		char(20),
		c_state		char(2),
		c_zip		char(9),
		c_phone		char(16),
		c_since		datetime,
		c_credit	char(2),
		c_credit_lim	numeric(12,2),
		c_discount	numeric(4,4),
		c_balance	numeric(12,2),
		c_ytd_payment	numeric(12,2),
		c_payment_cnt	smallint,
		c_delivery_cnt	smallint,
		c_data_1	char(250),
		c_data_2	char(250)
)
go

if exists ( select name from sysobjects where name = 'history' )
		drop table history
go

create table history
(
		h_c_id		int,
		h_c_d_id	tinyint,
		h_c_w_id	smallint,
		h_d_id		tinyint,
		h_w_id		smallint,
		h_date		datetime,
		h_amount	numeric(6,2),
		h_data		char(24)
)
go


if exists ( select name from sysobjects where name = 'new_order' )
		drop table new_order
go

create table new_order
(
		no_o_id		int,
		no_d_id		tinyint,
		no_w_id		smallint
)
go


if exists ( select name from sysobjects where name = 'orders' )
		drop table orders
go

create table orders
(
		o_id		int,
		o_d_id		tinyint,
		o_w_id		smallint,
		o_c_id		int,
		o_entry_d	datetime,
		o_carrier_id	tinyint,
		o_ol_cnt	tinyint,
		o_all_local	tinyint
)
go


if exists ( select name from sysobjects where name = 'order_line' )
		drop table order_line
go

create table order_line
(
		ol_o_id		int,
		ol_d_id		tinyint,
		ol_w_id		smallint,
		ol_number	tinyint,
		ol_i_id		int,
		ol_supply_w_id	smallint,
		ol_delivery_d	datetime,
		ol_quantity	smallint,
		ol_amount	numeric(6,2),
		ol_dist_info	char(24)
)
go
```

```
if exists ( select name from sysobjects where name = 'item' )
                drop table item
go

create table item
(
                i_id                int,
                i_im_id                 int,
                i_name                  char(24),
                i_price                 numeric(5,2),
                i_data              char(50)
)
go


if exists ( select name from sysobjects where name = 'stock' )
                drop table stock
go

create table stock
(
                s_i_id              int,
                s_w_id                  smallint,
                s_quantity          smallint,
                s_dist_01           char(24),
                s_dist_02           char(24),
                s_dist_03           char(24),
                s_dist_04           char(24),
                s_dist_05           char(24),
                s_dist_06           char(24),
                s_dist_07           char(24),
                s_dist_08           char(24),
                s_dist_09           char(24),
                s_dist_10           char(24),
                s_ytd               int,
                s_order_cnt         smallint,
                s_remote_cnt        smallint,
                s_data                  char(50)
)
go
```

TPCCBCP.SQL

```
/*  TPC-C Benchmark Kit                                  */
/*                                                  */
/*  TPCCBCP.SQL                                      */
/*                                                  */
/*  This script file sets the table lock option for bulk load              */


use tpcc
go

exec sp_tableoption "warehouse","table lock on bulk load",true
exec sp_tableoption "district","table lock on bulk load",true
exec sp_tableoption "stock","table lock on bulk load",true
exec sp_tableoption "item","table lock on bulk load",true
exec sp_tableoption "customer","table lock on bulk load",true
exec sp_tableoption "history","table lock on bulk load",true
exec sp_tableoption "orders","table lock on bulk load",true
exec sp_tableoption "order_line","table lock on bulk load",true
exec sp_tableoption "new_order","table lock on bulk load",true
go
```

TPCCIRL.SQL

```
/*  TPC-C Benchmark Kit                                  */
/*                                                  */
/*  TPCCIRL.SQL                                      */
/*                                                  */
/*  This script file sets the insert row lock option on selected tables      */


use tpcc
go

exec sp_tableoption "history","insert row lock",true
exec sp_tableoption "new_order","insert row lock",true
exec sp_tableoption "orders","insert row lock",true
exec sp_tableoption "order_line","insert row lock",true
go
```

MAKEFILE.X86

```
!include $(TPC_DIR)\build\ntintel\tpc.inc

CUR_DIR = $(TPC_DIR)\src

CLIENT_EXE     = $(EXE_DIR)\client.exe
MASTER_EXE     = $(EXE_DIR)\master.exe
TPCCLDR_EXE    = $(EXE_DIR)\tpccldr.exe
DELIVERY_EXE   = $(EXE_DIR)\delivery.exe
sqlstat_EXE    = $(EXE_DIR)\sqlstat.exe

all : $(CLIENT_EXE) $(MASTER_EXE) $(TPCCLDR_EXE)
$(DELIVERY_EXE) $(sqlstat_EXE)

$(OBJ_DIR)\client.obj : $(CUR_DIR)\client.c $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\client.obj $(CUR_DIR)\client.c

$(OBJ_DIR)\master.obj : $(CUR_DIR)\master.c $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\master.obj $(CUR_DIR)\master.c

$(OBJ_DIR)\tpccldr.obj : $(CUR_DIR)\tpccldr.c $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\tpccldr.obj $(CUR_DIR)\tpccldr.c

$(OBJ_DIR)\stats.obj : $(CUR_DIR)\stats.c $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\stats.obj $(CUR_DIR)\stats.c

$(OBJ_DIR)\getargs.obj : $(CUR_DIR)\getargs.c   $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\getargs.obj $(CUR_DIR)\getargs.c

$(OBJ_DIR)\util.obj : $(CUR_DIR)\util.c  $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\util.obj $(CUR_DIR)\util.c

$(OBJ_DIR)\time.obj : $(CUR_DIR)\time.c $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\time.obj $(CUR_DIR)\time.c

$(OBJ_DIR)\random.obj : $(CUR_DIR)\random.c $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\random.obj $(CUR_DIR)\random.c

$(OBJ_DIR)\strings.obj : $(CUR_DIR)\strings.c $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\strings.obj $(CUR_DIR)\strings.c

$(OBJ_DIR)\sqlfuncs.obj : $(CUR_DIR)\sqlfuncs.c  $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\sqlfuncs.obj $(CUR_DIR)\sqlfuncs.c

$(OBJ_DIR)\tran.obj : $(CUR_DIR)\tran.c  $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\tran.obj $(CUR_DIR)\tran.c

$(OBJ_DIR)\data.obj : $(CUR_DIR)\data.c  $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\data.obj $(CUR_DIR)\data.c

$(OBJ_DIR)\delivery.obj : $(CUR_DIR)\delivery.c  $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\delivery.obj $(CUR_DIR)\delivery.c

$(OBJ_DIR)\sqlstat.obj : $(CUR_DIR)\sqlstat.c  $(INC_DIR)\tpcc.h
   $(CC) $(CFLAGS) /Fo$(OBJ_DIR)\sqlstat.obj $(CUR_DIR)\sqlstat.c

$(EXE_DIR)\client.exe : $(OBJ_DIR)\client.obj $(OBJ_DIR)\tran.obj
$(OBJ_DIR)\sqlfuncs.obj $(OBJ_DIR)\random.obj $(OBJ_DIR)\util.obj
$(OBJ_DIR)\data.obj $(OBJ_DIR)\getargs.obj $(OBJ_DIR)\time.obj
$(OBJ_DIR)\stats.obj $(OBJ_DIR)\strings.obj
   $(LL) -entry:mainCRTStartup -out:$(EXE_DIR)\client.exe          \
   $(OBJ_DIR)\client.obj $(OBJ_DIR)\tran.obj   $(OBJ_DIR)\sqlfuncs.obj   \
   $(OBJ_DIR)\random.obj $(OBJ_DIR)\util.obj   $(OBJ_DIR)\data.obj      \
   $(OBJ_DIR)\getargs.obj $(OBJ_DIR)\time.obj  $(OBJ_DIR)\stats.obj      \
   $(OBJ_DIR)\strings.obj                                         \
   $(DB_LIB)\ntwdblib.lib $(NTLIBS)

$(EXE_DIR)\master.exe : $(OBJ_DIR)\master.obj $(OBJ_DIR)\sqlfuncs.obj
$(OBJ_DIR)\util.obj $(OBJ_DIR)\getargs.obj $(OBJ_DIR)\time.obj
$(OBJ_DIR)\stats.obj
   $(LL) -entry:mainCRTStartup -out:$(EXE_DIR)\master.exe            \
   $(OBJ_DIR)\master.obj $(OBJ_DIR)\sqlfuncs.obj $(OBJ_DIR)\util.obj   \
   $(OBJ_DIR)\getargs.obj $(OBJ_DIR)\time.obj   $(OBJ_DIR)\stats.obj   \
   $(DB_LIB)\ntwdblib.lib $(NTLIBS)

$(EXE_DIR)\tpccldr.exe : $(OBJ_DIR)\tpccldr.obj $(OBJ_DIR)\getargs.obj
$(OBJ_DIR)\util.obj $(OBJ_DIR)\time.obj $(OBJ_DIR)\random.obj
$(OBJ_DIR)\strings.obj
   $(LL) -entry:mainCRTStartup -out:$(EXE_DIR)\tpccldr.exe            \
   $(OBJ_DIR)\tpccldr.obj $(OBJ_DIR)\getargs.obj $(OBJ_DIR)\strings.obj \
   $(OBJ_DIR)\util.obj $(OBJ_DIR)\time.obj $(OBJ_DIR)\random.obj       \
   $(DB_LIB)\ntwdblib.lib $(NTLIBS)

$(EXE_DIR)\delivery.exe : $(OBJ_DIR)\delivery.obj
$(OBJ_DIR)\sqlfuncs.obj $(OBJ_DIR)\util.obj $(OBJ_DIR)\getargs.obj
$(OBJ_DIR)\time.obj $(OBJ_DIR)\stats.obj
   $(LL) -entry:mainCRTStartup -out:$(EXE_DIR)\delivery.exe            \
   $(OBJ_DIR)\delivery.obj $(OBJ_DIR)\sqlfuncs.obj $(OBJ_DIR)\util.obj
\
   $(OBJ_DIR)\getargs.obj $(OBJ_DIR)\time.obj  $(OBJ_DIR)\stats.obj      \
   $(DB_LIB)\ntwdblib.lib $(NTLIBS)

$(EXE_DIR)\sqlstat.exe : $(OBJ_DIR)\sqlstat.obj $(OBJ_DIR)\sqlfuncs.obj
$(OBJ_DIR)\util.obj $(OBJ_DIR)\getargs.obj $(OBJ_DIR)\time.obj
$(OBJ_DIR)\stats.obj
   $(LL) -entry:mainCRTStartup -out:$(EXE_DIR)\sqlstat.exe              \
   $(OBJ_DIR)\sqlstat.obj $(OBJ_DIR)\sqlfuncs.obj $(OBJ_DIR)\util.obj     \
   $(OBJ_DIR)\getargs.obj $(OBJ_DIR)\time.obj  $(OBJ_DIR)\stats.obj      \
   $(DB_LIB)\ntwdblib.lib $(NTLIBS)
```

RANDOM.C

```
/*                    FILE:          RANDOM.C
 *                                   Microsoft TPC-C Kit Ver.
3.00.000
 *                                   Audited 08/23/96, By
Francois Raab
 *
 *                                   Copyright Microsoft, 1996
 *
 *                    PURPOSE:    Random number generation
functions for Microsoft TPC-C Benchmark Kit
 *                    Author:                  Damien Lindauer
 *                                                   damienl@Microsoft.com
 */

// Includes
#include "tpcc.h"
#include "math.h"

// Defines
#define A          16807
#define M      2147483647
#define Q          127773     /* M div A */
#define R            2836     /* M mod A */
#define Thread               __declspec(thread)

// Globals
long                         Thread Seed = 0;      /* thread local seed */

/*****************************************************************************
*                                                                   *
* random -                                                          *
*       Implements a GOOD pseudo random number generator.  This
generator    *
*       will/should? run the complete period before repeating.                *
*                                                                   *
* Copied from:                                                      *
*       Random Numbers Generators: Good Ones Are Hard to Find.
*
*       Communications of the ACM - October 1988 Volume 31 Number 10
*
*                                                                   *
* Machine Dependencies:                                             *
*       long must be 2 ^ 31 - 1 or greater.                         *
*                                                                   *
*****************************************************************************/

/*****************************************************************************
* seed - load the Seed value used in irand and drand.  Should be used
before  *
*       first call to irand or drand.                               *
*****************************************************************************/

void seed(long val)
{

#ifdef DEBUG
   printf("[%ld]DBG: Entering seed()...\n", (int) GetCurrentThreadId());
                              printf("Old Seed %ld New Seed %ld\n",Seed,
val);
#endif

   if ( val < 0 )
                              val = abs(val);

   Seed = val;

}


/*****************************************************************************
*                                                                   *
* irand - returns a 32 bit integer pseudo random number with a period of     *
*       1 to 2 ^ 32 - 1.                                            *
*                                                                   *
* parameters:                                                       *
*       none.                                                       *
*                                                                   *
* returns:                                                          *
*       32 bit integer - defined as long ( see above ).             *
*                                                                   *
* side effects:                                                     *
*       seed get recomputed.                                        *
*****************************************************************************/

long irand()
{
   register long    s;      /* copy of seed */
   register long    test;   /* test flag */
   register long    hi;     /* tmp value for speed */
   register long    lo;     /* tmp value for speed */

#ifdef DEBUG
   printf("[%ld]DBG: Entering irand()...\n", (int) GetCurrentThreadId());
#endif

   s = Seed;
   hi = s / Q;
   lo = s % Q;

   test = A * lo - R * hi;
   if ( test > 0 )
                              Seed = test;
   else
                              Seed = test + M;

   return( Seed );
}


/*****************************************************************************
*                                                                   *
* drand - returns a double pseudo random number between 0.0 and 1.0.
*
*       See irand.                                                  *
*****************************************************************************/
double drand()
{

#ifdef DEBUG
   printf("[%ld]DBG: Entering drand()...\n", (int) GetCurrentThreadId());
#endif

   return( (double)irand() / 2147483647.0);
}


//=======================================================
==============
// Function   : RandomNumber
//
// Description:
//=======================================================
==============
long RandomNumber(long lower, long upper)
{
   long rand_num;

#ifdef DEBUG
   printf("[%ld]DBG: Entering RandomNumber()...\n", (int)
GetCurrentThreadId());
#endif


                              if ( upper == lower ) /* pgd 08-13-96 perf
enhancement */
                              return lower;

                              upper++;

   if ( upper <= lower )
                              rand_num = upper;
   else
                              rand_num = lower + irand() % (upper -
lower); /* pgd 08-13-96 perf enhancement */


#ifdef DEBUG
   printf("[%ld]DBG: RandomNumber between %ld & %ld ==> %ld\n",
                                             (int) GetCurrentThreadId(),
lower, upper, rand_num);
#endif


   return rand_num;
}


#if 0

//Orginal code pgd 08/13/96

long RandomNumber(long lower,
                                             long upper)
{
   long rand_num;

#ifdef DEBUG
   printf("[%ld]DBG: Entering RandomNumber()...\n", (int)
GetCurrentThreadId());
#endif

                     upper++;

   if ((upper <= lower))
                              rand_num = upper;
   else
                              rand_num = lower + irand() % ((upper >
lower) ? upper - lower : upper);


#ifdef DEBUG
   printf("[%ld]DBG: RandomNumber between %ld & %ld ==> %ld\n",
                                             (int) GetCurrentThreadId(),
lower, upper, rand_num);
#endif


   return rand_num;
}
#endif

//=======================================================
==============
// Function   : NURand
//
// Description:
//=======================================================
==============
long NURand(int iConst,
                        long x,
                        long y,
                        long C)
{
   long rand_num;

#ifdef DEBUG
```

```
    printf("[%ld]DBG: Entering NURand()...\n", (int) GetCurrentThreadId());
#endif

    rand_num = (((RandomNumber(0,iConst) | RandomNumber(x,y)) + C) %
(y-x+1))+x;

#ifdef DEBUG
    printf("[%ld]DBG: NURand: num = %d\n", (int) GetCurrentThreadId(),
rand_num);
#endif

    return rand_num;
}
```

STRINGS.C

```
/*                    FILE:       STRINGS.C
 *                                   Microsoft TPC-C Kit Ver.
3.00.000
 *                                   Audited 08/23/96, By
Francois Raab
 *
 *                                   Copyright Microsoft, 1996
 *
 *                    PURPOSE:    String generation functions for
Microsoft TPC-C Benchmark Kit
 *                    Author:        Damien Lindauer
 *                                   damienl@Microsoft.com
 */

// Includes
#include "tpcc.h"
#include <string.h>
#include <ctype.h>

//=======================================================
=============
//
// Function name: MakeAddress
//
//=======================================================
=============

void MakeAddress(char *street_1,
                                    char *street_2,
                                    char *city,
                                    char *state,
                                    char *zip)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering MakeAddress()\n", (int) GetCurrentThreadId());
#endif

    MakeAlphaString (10, 20, ADDRESS_LEN, street_1);
    MakeAlphaString (10, 20, ADDRESS_LEN, street_2);
    MakeAlphaString (10, 20, ADDRESS_LEN, city);
    MakeAlphaString ( 2,  2, STATE_LEN, state);
    MakeZipNumberString( 9,  9, ZIP_LEN, zip);

#ifdef DEBUG
    printf("[%ld]DBG: MakeAddress: street_1: %s, street_2: %s, city: %s,
state: %s, zip: %s\n",
                                    (int) GetCurrentThreadId(),
street_1, street_2, city, state, zip);
#endif

    return;

}


//=======================================================
=============
//
// Function name: LastName
//
//=======================================================
=============

void LastName(int  num,
                                  char *name)
{
    int                                   i;
                        int                     len;
    static char *n[] =
    {
                                "BAR" , "OUGHT", "ABLE" , "PRI"  ,
"PRES",
                                "ESE" , "ANTI" , "CALLY", "ATION",
"EING"
    };

#ifdef DEBUG
    printf("[%ld]DBG: Entering LastName()\n", (int) GetCurrentThreadId());
#endif

    if ((num >= 0) && (num < 1000))
    {
                                strcpy(name, n[(num/100)%10]);
                                strcat(name, n[(num/10)%10]);
                                strcat(name, n[(num/1)%10]);

                                if (strlen(name) < LAST_NAME_LEN)
                                {
                                        PaddString(LAST_NAME_LEN,
name);
                                }

    }
    else
    {
                                printf("\nError in LastName()... num <%ld>
out of range (0,999)\n", num);
                                exit(-1);
    }


#ifdef DEBUG
    printf("[%ld]DBG: LastName: num = [%d] ==> [%d][%d][%d]\n",
                                        (int) GetCurrentThreadId(), num,
num/100, (num/10)%10, num%10);
                        printf("[%ld]DBG: LastName: String = %s\n", (int)
GetCurrentThreadId(), name);
#endif

    return;

}

//=======================================================
=============
//
// Function name: MakeAlphaString
//
//=======================================================
=============

//philipdu 08/13/96 Changed MakeAlphaString to use A-Z, a-z, and 0-9 in
//accordance with spec see below:
//The spec says:
//4.3.2.2                          The notation random a-string [x .. y]
//(respectively, n-string [x .. y]) represents a string of random alphanumeric
//(respectively, numeric) characters of a random length of minimum x,
maximum y,
//and mean (y+x)/2. Alphanumerics are A..Z, a..z, and 0..9.  The only other
//requirement is that the character set used "must be able to represent a
minimum
//of 128 different characters".  We are using 8-bit chars, so this is a non
issue.
//It is completely unreasonable to stuff non-printing chars into the text fields.
//-CLevine 08/13/96

int MakeAlphaString( int  x, int  y, int  z, char *str)
{
                        int            len;
                        int            i;
                        static  char chArray[] =
"0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstu
vwxyz";
                        static  int      chArrayMax = 61;

#ifdef DEBUG
    printf("[%ld]DBG: Entering MakeAlphaString()\n", (int)
GetCurrentThreadId());
#endif

                        len= RandomNumber(x, y);

                        for (i=0; i<len; i++)
                                str[i] = chArray[RandomNumber(0,
chArrayMax)];
                        if ( len < z )
                                memset(str+len, ' ', z - len);
                        str[len] = 0;

    return len;
}

#if 0
//philipdu 08/13/96 Orginal MakeAlphaString

int MakeAlphaString( int  x,
                                          int  y,
                                             int  z,
                                          char *str)
{

                        int            len;
                        int            i;

#ifdef DEBUG
    printf("[%ld]DBG: Entering MakeAlphaString()\n", (int)
GetCurrentThreadId());
#endif

                        len= RandomNumber(x, y);
				for (i=0; i<len; i++)
				{
					str[i] = RandomNumber(MINPRINTASCII,
MAXPRINTASCII);
				}

				str[len] = '\0';

				if (len < z)
				{
					PaddString(z, str);
				}

	return (len);
}
#endif


//=======================================================
==============
//
// Function name: MakeOriginalAlphaString
//
//=======================================================
==============

int MakeOriginalAlphaString(int  x,
								int  y,
									int  z,
								char *str,
							int  percent)
{
	int				len;
	int				val;
	int				start;

#ifdef DEBUG
	printf("[%ld]DBG: Entering MakeOriginalAlphaString()\n", (int)
GetCurrentThreadId());
#endif

	// verify prercentage is valid
	if ((percent < 0) || (percent > 100))
	{
				printf("MakeOrigianlAlphaString: Invalid
percentage: %d\n", percent);
				exit(-1);
	}

	// verify string is at least 8 chars in length
	if ((x + y) <= 8)
	{
				printf("MakeOriginalAlphaString: string
length must be >= 8\n");
				exit(-1);
	}

	// Make Alpha String
	len = MakeAlphaString(x,y, z, str);

	val = RandomNumber(1,100);
	if (val <= percent)
	{
				start = RandomNumber(0, len - 8);
				strncpy(str + start, "ORIGINAL", 8);
	}
```

```
#ifdef DEBUG
	printf("[%ld]DBG: MakeOriginalAlphaString: : %s\n",
								(int) GetCurrentThreadId(), str);
#endif

	return strlen(str);
}


//=======================================================
==============
//
// Function name: MakeNumberString
//
//=======================================================
==============
int MakeNumberString(int  x, int  y, int  z, char *str)
{
				char tmp[16];

				//MakeNumberString is always called
MakeZipNumberString(16, 16, 16, string)

				memset(str, '0', 16);
				itoa(RandomNumber(0, 99999999), tmp, 10);
				memcpy(str, tmp, strlen(tmp));

				itoa(RandomNumber(0, 99999999), tmp, 10);
				memcpy(str+8, tmp, strlen(tmp));

				str[16] = 0;

	return 16;
}

#if 0
int MakeNumberString(int  x,
								int  y,
									int  z,
								char *str)
{
	int				len;
	int				i;

#ifdef DEBUG
	printf("[%ld]DBG: Entering MakeNumberString()\n", (int)
GetCurrentThreadId());
#endif

	len = RandomNumber(x,y);


	for (i=0; i < len; i++)
	{
					str[i] = (char) (RandomNumber(48,57));
	}

	str[len] = '\0';

				PaddString(z, str);

	return strlen(str);
}

#endif

//=======================================================
==============
```

```
//
// Function name: MakeZipNumberString
//
//=======================================================
==============
int MakeZipNumberString(int  x, int  y, int  z, char *str)
{
				char tmp[16];

				//MakeZipNumberString is always called
MakeZipNumberString(9, 9, 9, string)

				strcpy(str, "000011111");

				itoa(RandomNumber(0, 9999), tmp, 10);
				memcpy(str, tmp, strlen(tmp));

	return 9;
}

#if 0
//pgd 08/14/96 Orginal Code Below
int MakeZipNumberString(int  x,
								int  y,
									int  z,
								char *str)
{
	int				len;
	int				i;

#ifdef DEBUG
	printf("[%ld]DBG: Entering MakeZipNumberString()\n", (int)
GetCurrentThreadId());
#endif

	len = RandomNumber(x-5,y-5);

	for (i=0; i < len; i++)
	{
					str[i] = (char) (RandomNumber(48,57));
	}

	str[len] = '\0';

				strcat(str, "11111");

				PaddString(z, str);

	return strlen(str);
}
#endif

//=======================================================
==============
//
// Function name: InitString
//
//=======================================================
==============
void InitString(char *str, int len)
{
	int i;

#ifdef DEBUG
	printf("[%ld]DBG: Entering InitString()\n", (int) GetCurrentThreadId());
#endif

				memset(str, ' ', len);
    str[len] = 0;
}

#if 0
//Orginal pgd 08/14/96
void InitString(char *str, int len)
{
    int i;

#ifdef DEBUG
    printf("[%ld]DBG: Entering InitString()\n", (int) GetCurrentThreadId());
#endif


    for (i=0; i< len; i++)
                                        str[i] = ' ';
    str[len] = '\0';
}

#endif

//=======================================================
==============
// Function name: InitAddress
//
// Description:
//
//=======================================================
==============

void InitAddress(char *street_1, char *street_2, char *city, char *state, char
*zip)
{
                                int i;


                                memset(street_1, ' ', ADDRESS_LEN+1);
                                memset(street_2, ' ', ADDRESS_LEN+1);
                                memset(city, ' ', ADDRESS_LEN+1);

    street_1[ADDRESS_LEN+1] = 0;
    street_2[ADDRESS_LEN+1] = 0;
    city[ADDRESS_LEN+1]     = 0;

                                memset(state, ' ', STATE_LEN+1);
    state[STATE_LEN+1] = 0;

                                memset(zip, ' ', ZIP_LEN+1);
    zip[ZIP_LEN+1] = 0;
}

#if 0
//Orginal pgd 08/14/96
void InitAddress(char *street_1,
                                                char *street_2,
                                                char *city,
                                                char *state,
                                                char *zip)
{
                                int i;

#ifdef DEBUG
    printf("[%ld]DBG: Entering InitAddress()\n", (int) GetCurrentThreadId());
#endif

    for (i=0; i< ADDRESS_LEN+1; i++)
    {
                                        street_1[i] = ' ';
                                        street_2[i] = ' ';
                                        city[i]     = ' ';
    }

    street_1[ADDRESS_LEN+1] = '\0';
    street_2[ADDRESS_LEN+1] = '\0';
    city[ADDRESS_LEN+1]     = '\0';

    for (i=0; i< STATE_LEN+1; i++)
                                        state[i] = ' ';
    state[STATE_LEN+1] = '\0';

    for (i=0; i< ZIP_LEN+1; i++)
                                        zip[i] = ' ';
    zip[ZIP_LEN+1] = '\0';
}

#endif
//=======================================================
==============
//
// Function name: PaddString
//
//=======================================================
==============

void PaddString(int max, char *name)
{
                                int             i;
                                int             len;

                                len = strlen(name);
                                if ( len < max )
                                        memset(name+len, ' ', max - len);
                                name[max] = 0;

                                return;
}

#if 0
                                //pgd 08/14/96 Orginal code below
                                void PaddString(int             max,
                                                                char    *name)
                                {

                                        int             i;
                                        int             len;

                                #ifdef DEBUG
                                        printf("[%ld]DBG: Entering
PaddString()\n", (int) GetCurrentThreadId());
                                #endif

                                        len = strlen(name);

                                        for (i=1;i<=(max - len);i++)
                                        {
                                                strcat(name, " ");
                                        }

                                }
#endif
```

TIME.C

```
// TPC-C Benchmark Kit
//
// Module:  TIME.C
// Author:  DamienL


// Includes
#include "tpcc.h"

// Globals
static long start_sec;


//=======================================================
==============
//
// Function name: TimeNow
//
//=======================================================
==============

long TimeNow()
{
   long                                 time_now;
   struct                       _timeb el_time;

#ifdef DEBUG
    printf("[%ld]DBG: Entering TimeNow()\n", (int) GetCurrentThreadId());
#endif

   _ftime(&el_time);

   time_now = ((el_time.time - start_sec) * 1000) + el_time.millitm;

   return time_now;
}


//=======================================================
==============
//
// Function name: TimeInit
//
// This function is used to normalize the seconds component of
// elapsed time so that it will not overflow, when converted to milli seconds
//
//=======================================================
==============

void TimeInit()
{

    struct  _timeb  norm_time;

#ifdef DEBUG
    printf("[%ld]DBG: Entering TimeInit()\n", (int) GetCurrentThreadId());
#endif

    _ftime(&norm_time);
    start_sec = norm_time.time;
}


//=======================================================
==============
//
// Function name: TimeKeying
//
```

```
//=======================================================
=============

void TimeKeying(int                  TranType,
                                              double          load_multiplier)
{

#ifdef DEBUG
   printf("[%ld]DBG: Entering TimeKeying()\n", (int) GetCurrentThreadId());
#endif
                              switch (TranType)
                              {
                                 case NEW_ORDER_TRAN:
                                            UtilSleepMs( (long)
((load_multiplier * 18)*1000) );
                                            break;

                                 case PAYMENT_TRAN:
                                            UtilSleepMs( (long)
((load_multiplier * 3)*1000) );
                                            break;

                                 case ORDER_STATUS_TRAN:
                                 case DELIVERY_TRAN:
                                 case STOCK_LEVEL_TRAN:
                                            UtilSleepMs( (long)
((load_multiplier * 2)*1000) );
                                            break;

                                 default:
                                            printf("TimeKeying: Error - default
reached!\n");

                              }
}


//=======================================================
=============
//
// Function name: TimeThink
//
//=======================================================
=============

void TimeThink(int                   TranType,
                                         double       load_multiplier)
{

#ifdef DEBUG
   printf("[%ld]DBG: Entering TimeThink()\n", (int) GetCurrentThreadId());
#endif

                              switch (TranType)
                              {
                                 case NEW_ORDER_TRAN:
                                 case PAYMENT_TRAN:
                                            UtilSleepMs( (long)
((load_multiplier * 12)*1000) );
                                            break;

                                 case ORDER_STATUS_TRAN:
                                            UtilSleepMs( (long)
((load_multiplier * 10)*1000) );
                                            break;

                                 case DELIVERY_TRAN:
                                 case STOCK_LEVEL_TRAN:
                                            UtilSleepMs( (long)
((load_multiplier * 5)*1000) );
                                            break;

                                 default:
                                            printf("TimeThink: Error - default
reached!\n");

                              }
}
```

TPCC.H

```
/*                         FILE:          TPCC.H
 *                                              Microsoft TPC-C Kit Ver.
3.00.000
 *                                              Audited 08/23/96, By
Francois Raab
 *
 *                                              Copyright Microsoft, 1996
 *
 *                         PURPOSE:    Header file for Microsoft TPC-C
Benchmark Kit
 *                         Author:              Damien Lindauer
 *                                              damienl@Microsoft.com
 */

// Build number of TPC Benchmark Kit
#define TPCKIT_VER        "3.00.02"

// General headers
#include <windows.h>
#include <winbase.h>
#include <stdlib.h>
#include <stdio.h>
#include <process.h>
#include <stddef.h>
#include <stdarg.h>
#include <string.h>
#include <signal.h>
#include <time.h>
#include <timeb.h>
#include <types.h>
#include <wincon.h>

#ifdef USE_ODBC
// ODBC headers
#include <sql.h>
#include <sqlext.h>
HENV                                                          henv;
#endif

// DB-Library headers
#include <sqlfront.h>
#include <sqldb.h>

#include "trans.h"                                   //pgd 5-6-96 split transaction
structs definations into own header

                           //for tpcform.c i.e. telnet application

// Critical section declarations
CRITICAL_SECTION                 ConsoleCritSec;
CRITICAL_SECTION                 QueuedDeliveryCritSec;
CRITICAL_SECTION                 WriteDeliveryCritSec;
CRITICAL_SECTION                 DroppedConnectionsCritSec;
CRITICAL_SECTION                 ClientErrorLogCritSec;

// General constants
#define SQLCONN DBPROCESS
#define DUMB_MESSAGE                    5701
#define ABORT_ERROR                     6104
#define INVALID_ITEM_ID                        0
#define MILLI                      1000
#define MAX_THREADS                     2510
#define STATS_MSG_LOW                          3600
#define STATS_MSG_HIGH                         3700
#define SHOWPLAN_MSG_LOW                       6200
#define SHOWPLAN_MSG_HIGH                      6300
#define FALSE                          0
#define TRUE                           1
#define UNDEF                                         -1
#define MINPRINTASCII                    32
#define MAXPRINTASCII                    126

// Default environment constants
#define SERVER                         ""
#define DATABASE                       "tpcc"
#define USER                           "sa"
#define PASSWORD                    ""
#define SYNCH_SERVERNAME                     ""

// Statistic constants
#define INTERVAL                    20    // Total interval of buckets, in sec
#define UNIT                        .1   // Time period of each bucket
#define HIST_MAX                   200    // Num of histogram buckets =
INTERVAL/UNIT
#define BUCKET                     100    // Division factor for response time

// Default master arguments
#define ADMIN_DATABASE                 "tpcc_admin"
#define RAMP_UP                    600
#define STEADY_STATE              1200
#define RAMP_DOWN                  120
#define NUM_USERS                   10
#define NUM_WAREHOUSES                        1
#define THINK_TIMES                                0
#define DISPLAY_DATA                   0
#define DEFMSPACKSIZE                   4096
#define TRANSACTION                    0
#define CLIENT_MODE                    1
#define DEF_WW_T                               120
#define DEF_WW_a                                   1
#define DEADLOCK_RETRY                        4
#define DELIVERY_BACKOFF                      2
#define DELIVERY_MODE                              0
#define NEWORDER_MODE                              0
#define DEF_LOAD_MULTIPLIER           1.0
#define DEF_CHECKPOINT_INTERVAL   960
#define DEF_FIRST_CHECKPOINT        240
#define DISABLE_90TH                          0
#define                        RESFILENAME
                               "results.txt"
#define SQLSTAT_FILENAME                      "sqlstats.txt"
#define ENABLE_SQLSTAT                             0
#define SQLSTAT_PERIOD                         100
#define SHUTDOWN_SERVER                            0
#define AUTO_RUN                                   0
#define DISABLE_SQLPERF                            0

// Default client arguments
#define NUM_THREADS                      10
#define X_FLAG                0
```

```
#define Y_FLAG                  1
#define NUM_DELIVERIES                          2
#define CLIENT_NURAND                   223
#define DISABLE_DELIVERY_RESFILES   1
#define ENABLE_QJ                               0

// Globals for queued delivery handling
typedef struct          delivery_node *DELIVERY_PTR;
DELIVERY_PTR            delivery_head, delivery_tail;
short                           queued_delivery_cnt;
HANDLE                          hDeliveryMonPipe;
struct delivery_node
{
                short                   w_id;
                short                   o_carrier_id;
                SYSTEMTIME                  queue_time;
                long                    tran_start_time;
                struct                  delivery_node
*next_delivery;
};

// Default loader arguments
#define BATCH                   10000
#define DEFLDPACKSIZE               4096
#define ORDERS_PER_DIST             3000
#define LOADER_RES_FILE     "load.out"
#define LOADER_NURAND_C                 123
#define DEF_STARTING_WAREHOUSE                  1
#define BUILD_INDEX                             1
#define INDEX_SCRIPT_PATH   "scripts"

// Transaction types
#define EMPTY                   0
#define NEW_ORDER_TRAN                  1
#define PAYMENT_TRAN                2
#define ORDER_STATUS_TRAN               3
#define DELIVERY_TRAN               4
#define STOCK_LEVEL_TRAN                5

// Statistic structures
typedef struct
{
   long                             tran_count;
   long                             total_time;
   long                             resp_time;
   long                             resp_min;
   long                             resp_max;
   long                             rolled_back;
   long                             tran_2sec;
   long                             tran_5sec;
   long                             tran_sqr;
                long                    num_deadlocks;
   long                             resp_hist[HIST_MAX];
} TRAN_STATS;

typedef struct
{
   TRAN_STATS                   NewOrderStats;
   TRAN_STATS                   PaymentStats;
   TRAN_STATS                   OrderStatusStats;
   TRAN_STATS                   QueuedDeliveryStats;
                TRAN_STATS              DeliveryStats;
   TRAN_STATS                   StockLevelStats;
} CLIENT_STATS;

// driver structures
typedef struct
{
   char                             *server;
   char                             *database;
   char                             *user;
   char                             *password;
   char                             *table;
   long                             num_warehouses;
   long                             batch;
   long                             verbose;
                long                    pack_size;
                char                    *loader_res_file;
                char                    *synch_servername;
                long                    case_sensitivity;
                long                    starting_warehouse;
                long                    build_index;
                char                    *index_script_path;
} TPCCLDR_ARGS;

typedef struct
{
   char                             *server;
   char                             *user;
   char                             *password;
                char                    *admin_database;
   char                             *sqlstat_filename;
                long                    run_id;
} SQLSTAT_ARGS;

typedef struct
{
   SQLCONN                      *sqlconn;
   char                         *server;
   char                         *database;
                char                    *admin_database;
   char                         *user;
   char                         *password;
   long                         ramp_up;
   long                         steady_state;
   long                         ramp_down;
   long                         num_users;
   long                         num_warehouses;
   long                         think_times;
   long                         display_data;
                long                    client_mode;
                long                    tran;
                long                    deadlock_retry;
                long                    delivery_backoff;
                long                    num_deliveries;
                char                    *comment;
                double                      load_multiplier;
                long                    checkpoint_interval;
                long                    first_checkpoint;
                long                    disable_90th;
                char                    *resfilename;
                char                    *sqlstat_filename;
                long                    enable_sqlstat;
                long                    sqlstat_period;
                long                    shutdown_server;
                long                    auto_run;
                long                    dropped_connections;
   short                        spid;
                long                    disable_sqlperf;
} MASTER_DATA;

typedef struct
{
                long                    num_threads;
   char                         *server;
   char                         *database;
                char                    *admin_database;
   char                         *user;
   char                         *password;
                long                    pack_size;
                short                   x_flag;
                char                    *synch_servername;
                long
                disable_delivery_resfiles;
                long                    enable_qj;
#ifdef USE_CONMON
                HANDLE                      hConMon;
                short                   con_id;
                short                   con_x;
                short                   con_y;
#endif
} GLOBAL_CLIENT_DATA;

typedef struct
{
#ifdef USE_ODBC
                HDBC                    hdbc;
                HSTMT                       hstmt;
#else
   SQLCONN                      *sqlconn;
#endif
                short                   threadid;
   char                         *server;
   char                         *database;
                char                    *admin_database;
   char                         *user;
   char                         *password;
                long                    ramp_up;
                long                    steady_state;
   long                         ramp_down;
   long                         num_warehouses;
                long                    client_mode;
                long                    tran;
                long                    deadlock_retry;
                long                    think_times;
                long                    pack_size;
   long                         tran_start_time;
   long                         tran_end_time;
   long                         display_data;
                long                    id;
                short                   w_id;
   short                        spid;
                long                    disable_90th;
                double                      load_multiplier;
                long                    num_deliveries;

                long                    enable_qj;
#ifdef USE_CONMON
                HANDLE                      hConMon;
                short                   con_id;
                short                   con_x;
                short                   con_y;
                short                   fTimerStat;
#endif
} CLIENT_DATA;

typedef struct
{
#ifdef USE_ODBC
                HDBC                    hdbc;
                HSTMT                       hstmt;
#else
                SQLCONN                 *sqlconn;
#endif
```

```
                        SYSTEMTIME              queue_time;
                        SYSTEMTIME
                        completion_time;
   long                         tran_start_time;
   long                         tran_end_time;
                        short                   threadid;
                        FILE                    *fDelivery;
   short                        spid;
   short                        w_id;
                        short                   d_id;
                        short                   o_carrier_id;
                        DEL_ITEM                DelItems[10];
                        char                    *server;
   char                         *database;
                        char                    *admin_database;
   char                         *user;
   char                         *password;
                        long                    ramp_up;
   long                         steady_state;
   long                         ramp_down;
                        long                    pack_size;
                        long                    id;
                        long                    disable_90th;
                        long                    delivery_backoff;
                        long
                        disable_delivery_resfiles;
                        long                    enable_qj;
} DELIVERY;

typedef struct
{
                        long                    pipe_num;
} DELIVERY_ARGS;

// For client synchronization
#define LINE_LEN   80
#define NAME_SIZE  25
#define IN_BUF_SIZE        1000
#define OUT_BUF_SIZE       1000
#define TIME_OUT          0
#define PLEASE_READ        1000
#define PLEASE_WRITE       1000

typedef struct _WRTHANDLE
{                       HANDLE          hPipe;
   DWORD                        threadID;
                        CHAR            Name[NAME_SIZE];
                        struct          _WRTHANDLE *    next;
}WRTHANDLE;

// For client console monitor
#ifdef USE_CONMON
#define                 CON_LINE_SIZE           40
#define                 DEADLOCK_X                      17
#define DEADLOCK_Y                      4
#define CUR_STATE_X                     15
#define CUR_STATE_Y                     3
#define                 YELLOW                          0
#define                 RED                             1
#define                 GREEN                           2
int                             total_deadlocks;
#endif

// Functions in random.c
void                    seed();
long                    irand();
double                  drand();
void                    WUCreate();
short                   WURand();

// Functions in getargs.c;
void                    GetArgsLoader();
void                    GetArgsLoaderUsage();
void                    GetArgsMaster();
void                    GetArgsMasterUsage();
void                    GetArgsClient();
void                    GetArgsClientUsage();
void                    GetArgsDelivery();
void                    GetArgsDeliveryUsage();
void                    GetArgsSQLStat();
void                    GetArgsSQLStatUsage();

// Functions in master.c
void                    ReadClientDone();
BOOL    CtrlHandler();

// Functions in client.c
void                    ClientMain();
void                    DeliveryMain();
void                    Delivery();
void                    ClientEmulate();
short                   ClientSelectTransaction();
void                    ClientShuffleDeck();

//Functions in tran.c
BOOL                    TranNewOrder();
BOOL                    TranPayment();
BOOL                    TranOrderStatus();
BOOL                    TranDelivery();
BOOL                    TranStockLevel();

// Functions in data.c
void                    DataNewOrder();
void                    DataPayment();
void                    DataOrderStatus();
void                    DataDelivery();
void                    DataStockLevel();
short                   DataRemoteWarehouse();

// Functions in time.c
long                    TimeNow();
void                    TimeInit();
void                    TimeKeying();
void                    TimeThink();

// Functions in stats.c
void                    StatsInit();
void                    StatsInitTran();
void                    StatsGeneral();
void                    StatsDelivery();

// Functions in sqlfuncs.c
BOOL                    SQLExec();
BOOL                    SQLExecCmd();
BOOL                    SQLOpenConnection();
void                    SQLClientInit();
int                     SQLMasterInit();
void                    SQLDeliveryInit();
int                     SQLClientStats();
int                     SQLDeliveryStats();
void                    SQLTranStats();
void                    SQLMasterStats();
void                    SQLMasterTranStats();
void                    SQLIOStats();
void                    SQLCheckpointStats();
void                    SQLInitResFile();
void                    SQLGetRunId();
BOOL                    SQLNewOrder();
BOOL                    SQLPayment();
BOOL                    SQLOrderStatus();
BOOL                    SQLStockLevel();
void    SQLDelivery();
int                     SQLGetCustId();
void                    SQLExit();
void                    SQLInit();
void                    SQLInitPrivate();
void                    SQLClientInitPrivate();
void                    SQLDeliveryInitPrivate();
int                     SQLMsgHandler();
int                     SQLErrHandler();
int                     SQLClientMsgHandler();
int                     SQLClientErrHandler();
int                     SQLDeliveryMsgHandler();
int                     SQLDeliveryErrHandler();
void                    SQLInitDate();
void                    SQLShutdown();
#ifdef USE_ODBC
void                    ODBCOpenConnection();
void                    ODBCOpenDeliveryConnection();
BOOL                    ODBCError();
void                    ODBCExit();
#endif

// Functions in util.c
void                    UtilSleep();
void                    UtilPrintNewOrder();
void                    UtilPrintPayment();
void                    UtilPrintOrderStatus();
void                    UtilPrintDelivery();
void                    UtilPrintStockLevel();
void                    UtilPrintOlTable();
void                    UtilError();
void                    UtilFatalError();
void                    UtilStrCpy();
#ifdef USE_CONMON
void                    WriteConsoleString();
#endif
void                    WriteDeliveryString();
BOOL                    AddDeliveryQueueNode();
BOOL                    GetDeliveryQueueNode();

// Functions in strings.c
void                    MakeAddress();
void                    LastName();
int                     MakeAlphaString();
int                     MakeOriginalAlphaString();
int                     MakeNumberString();
int                     MakeZipNumberString();
void                    InitString();
void                    InitAddress();
void                    PaddString();

// Functions in delivery.c
void                    DeliveryHMain();
void                    DeliveryH();
```

TPCCLDR.C

```
/*                      FILE:           TPCCLDR.C
```

```
 *                                        Microsoft TPC-C Kit Ver.
3.00.000
 *                                        Audited 08/23/96, By
Francois Raab
 *
 *                                        Copyright Microsoft, 1996
 *
 *                    PURPOSE:   Database loader for Microsoft TPC-
C Benchmark Kit
 *                    Author:             Damien Lindauer
 *                                        damienl@Microsoft.com
 */


// Includes
#include "tpcc.h"
#include "search.h"

// Defines
#define MAXITEMS              100000
#define CUSTOMERS_PER_DISTRICT  3000
#define DISTRICT_PER_WAREHOUSE  10
#define ORDERS_PER_DISTRICT     3000
#define MAX_CUSTOMER_THREADS    2
#define MAX_ORDER_THREADS       3
#define MAX_MAIN_THREADS        4

// Functions declarations
long NURand();
void LoadItem();
void LoadWarehouse();

void Stock();
void District();

void LoadCustomer();
void CustomerBufInit();
void CustomerBufLoad();
void LoadCustomerTable();
void LoadHistoryTable();

void LoadOrders();
void OrdersBufInit();
void OrdersBufLoad();
void LoadOrdersTable();
void LoadNewOrderTable();
void LoadOrderLineTable();
void GetPermutation();
void CheckForCommit();
void OpenConnections();

void BuildIndex();

void CurrentDate();

// Shared memory structures

typedef struct
{
   long          ol;
   long          ol_i_id;
   short         ol_supply_w_id;
   short         ol_quantity;
   double          ol_amount;
   char          ol_dist_info[DIST_INFO_LEN+1];
                     // Added to insure ol_delivery_d set properly
during load
                     char                    ol_delivery_d[30];
} ORDER_LINE_STRUCT;

typedef struct
{
   long          o_id;
   short         o_d_id;
   short         o_w_id;
   long          o_c_id;
   short         o_carrier_id;
   short         o_ol_cnt;
   short         o_all_local;
                          ORDER_LINE_STRUCT   o_ol[15];
} ORDERS_STRUCT;

typedef struct
{
   long                                          c_id;
   short                                         c_d_id;
   short                                         c_w_id;
                          char
                          c_first[FIRST_NAME_LEN+1];
   char
                          c_middle[MIDDLE_NAME_LEN+1];
   char
                          c_last[LAST_NAME_LEN+1];
   char
                          c_street_1[ADDRESS_LEN+1];
   char
                          c_street_2[ADDRESS_LEN+1];
   char                                          c_city[ADDRESS_LEN+1];
   char                                          c_state[STATE_LEN+1];
   char                                          c_zip[ZIP_LEN+1];
   char                                          c_phone[PHONE_LEN+1];
   char                                          c_credit[CREDIT_LEN+1];
   double                                        c_credit_lim;
   double                                        c_discount;
   double                                        c_balance;
   double                                        c_ytd_payment;
                          short                       c_payment_cnt;
                          short                       c_delivery_cnt;
                          char
                          c_data_1[C_DATA_LEN+1];
   char                                          c_data_2[C_DATA_LEN+1];
                          double                               h_amount;
   char                                          h_data[H_DATA_LEN+1];
} CUSTOMER_STRUCT;

typedef struct
{
                          char
                          c_last[LAST_NAME_LEN+1];
                          char
                          c_first[FIRST_NAME_LEN+1];
   long                                          c_id;
} CUSTOMER_SORT_STRUCT;

typedef struct
{
   long          time_start;
} LOADER_TIME_STRUCT;


// Global variables
char          errfile[20];
DBPROCESS     *i_dbproc1;
DBPROCESS     *w_dbproc1, *w_dbproc2;
DBPROCESS     *c_dbproc1, *c_dbproc2;
DBPROCESS     *o_dbproc1, *o_dbproc2, *o_dbproc3;
ORDERS_STRUCT   orders_buf[ORDERS_PER_DISTRICT];
CUSTOMER_STRUCT customer_buf[CUSTOMERS_PER_DISTRICT];
long          main_threads_completed;
long          customer_threads_completed;
long          order_threads_completed;
long          orders_rows_loaded;
long          new_order_rows_loaded;
long          order_line_rows_loaded;
long          history_rows_loaded;
long          customer_rows_loaded;
long          stock_rows_loaded;
long          district_rows_loaded;
long          item_rows_loaded;
long          warehouse_rows_loaded;
long          main_time_start;
long          main_time_end;
TPCCLDR_ARGS    *aptr, args;


//=======================================================
==============
//
// Function name: main
//
//=======================================================
==============

int main(int  argc, char **argv)
{

                          DWORD
dwThreadID[MAX_MAIN_THREADS];
                          HANDLE         hThread[MAX_MAIN_THREADS];
                          FILE           *fLoader;
                          char           buffer[255];
                          int            main_threads_started;
                          RETCODE    retcode;
                          LOGINREC *login;

   printf("\n*****************************************************");
                          printf("\n*                                   *");
                          printf("\n*  Microsoft SQL Server 6.5
*");
                          printf("\n*                                   *");
                          printf("\n*  TPC-C BENCHMARK KIT:  Database
loader         *");
                          printf("\n*  Version %s                       *",
TPCKIT_VER);
                          printf("\n*                                   *");
                          printf("\n*************************************************
****\n\n");

   // process command line arguments

   aptr = &args;
   GetArgsLoader(argc, argv, aptr);

                          if (aptr->build_index = 0)
                                 printf("data load only\n");
                          if (aptr->build_index = 1)
                                 printf("data load and index creation\n");

                          // install dblib error handlers

                          dbmsghandle((DBMSGHANDLE_PROC)SQLMs
gHandler);
                          dberrhandle((DBERRHANDLE_PROC)SQLErrHa
ndler);
```

```
                              // open connections to SQL Server

                              OpenConnections();

                              // open file for loader results
   fLoader = fopen(aptr->loader_res_file, "a");

   if (fLoader == NULL)
                              {
                                        printf("Error, loader result file open
failed.");
                                        exit(-1);
                              }

   // start loading data

   sprintf(buffer,"TPC-C load started for %ld warehouses:  ", aptr-
>num_warehouses);
                              if(aptr->build_index = 0)
                                        strcat(buffer, "data load only\n");
                              if (aptr->build_index = 1)
                                        strcat(buffer, "data load and index
creation\n");

                              printf("%s",buffer);
                              fprintf(fLoader,"%s",buffer);

                              main_time_start = (TimeNow() / MILLI);

                              // start parallel load threads

                              main_threads_completed = 0;
                              main_threads_started = 0;

                              if ((aptr->table == NULL) || !(strcmp(aptr-
>table,"item")))
                              {
                                        fprintf(fLoader, "\nStarting loader threads
for: item\n");

                                        hThread[0] = CreateThread(NULL,

0,

(LPTHREAD_START_ROUTINE) LoadItem,

NULL,

0,

&dwThreadID[0]);

                                        if (hThread[0] == NULL)
                                        {
                                                  printf("Error, failed in creating
creating thread = 0.\n");

                                                  exit(-1);
                                        }

                                        main_threads_started++;

                              }

                              if ((aptr->table == NULL) || !(strcmp(aptr-
>table,"warehouse")))
                              {
                                        fprintf(fLoader, "Starting loader threads
for: warehouse\n");

                                        hThread[1] = CreateThread(NULL,

0,

(LPTHREAD_START_ROUTINE) LoadWarehouse,

NULL,

0,

&dwThreadID[1]);

                                        if (hThread[1] == NULL)
                                        {
                                                  printf("Error, failed in creating
creating thread = 1.\n");

                                                  exit(-1);
                                        }

                                        main_threads_started++;
                              }

   if ((aptr->table == NULL) || !(strcmp(aptr->table,"customer")))
                              {
                                        fprintf(fLoader, "Starting loader threads
for: customer\n");

                                        hThread[2] = CreateThread(NULL,

0,

(LPTHREAD_START_ROUTINE) LoadCustomer,

NULL,

0,

&dwThreadID[2]);

                                        if (hThread[2] == NULL)
                                        {
                                                  printf("Error, failed in creating
creating main thread = 2.\n");

                                                  exit(-1);
                                        }

                                        main_threads_started++;
                              }

   if ((aptr->table == NULL) || !(strcmp(aptr->table,"orders")))
                              {
                                        fprintf(fLoader, "Starting loader threads
for: orders\n");

                                        hThread[3] = CreateThread(NULL,

0,

(LPTHREAD_START_ROUTINE) LoadOrders,

NULL,

0,

&dwThreadID[3]);

                                        if (hThread[3] == NULL)
                                        {
                                                  printf("Error, failed in creating
creating main thread = 3.\n");

                                                  exit(-1);
                                        }

                                        main_threads_started++;

                              }

                              while (main_threads_completed !=
main_threads_started)
                                        Sleep(1000L);

   main_time_end = (TimeNow() / MILLI);

   sprintf(buffer,"\nTPC-C load completed successfully in %ld minutes.\n",
                                                  (main_time_end -
main_time_start)/60);

                              printf("%s",buffer);
                              fprintf(fLoader, "%s", buffer);

                              fclose(fLoader);

                              dbexit();

   exit(0);
}


//=======================================================
==============
//
// Function name: LoadItem
//
//=======================================================
==============

void LoadItem()
{
   long   i_id;
                              long   i_im_id;
   char   i_name[I_NAME_LEN+1];
   double i_price;
   char   i_data[I_DATA_LEN+1];
                              char   name[20];
                              long   time_start;

                              printf("\nLoading item table...\n");

                              // Seed with unique number
                              seed(1);

                              InitString(i_name, I_NAME_LEN+1);
                              InitString(i_data, I_DATA_LEN+1);

                              sprintf(name, "%s..%s", aptr->database, "item");
                              bcp_init(i_dbproc1, name, NULL, "logs\\item.err",
DB_IN);

                              bcp_bind(i_dbproc1, (BYTE *) &i_id,      0, -1,
NULL, 0, 0, 1);
                              bcp_bind(i_dbproc1, (BYTE *) &i_im_id,   0, -1,
NULL, 0, 0, 2);
```

```
				bcp_bind(i_dbproc1, (BYTE *) i_name,     0,
I_NAME_LEN, NULL, 0, 0, 3);
				bcp_bind(i_dbproc1, (BYTE *) &i_price,   0, -1,
NULL, 0, SQLFLT8, 4);
				bcp_bind(i_dbproc1, (BYTE *) i_data,     0,
I_DATA_LEN, NULL, 0, 0, 5);

				time_start = (TimeNow() / MILLI);

				item_rows_loaded = 0;

				for (i_id = 1; i_id <= MAXITEMS; i_id++)
				{
					i_im_id = RandomNumber(1L, 10000L);

					MakeAlphaString(14, 24, I_NAME_LEN,
i_name);

					i_price = ((float) RandomNumber(100L,
10000L))/100.0;

					MakeOriginalAlphaString(26, 50,
I_DATA_LEN, i_data, 10);

					if (!bcp_sendrow(i_dbproc1))
						printf("Error, LoadItem() failed
calling bcp_sendrow().  Check error file.\n");
					item_rows_loaded++;
					CheckForCommit(i_dbproc1,
item_rows_loaded, "item", &time_start);
				}

				bcp_done(i_dbproc1);
				dbclose(i_dbproc1);

				printf("Finished loading item table.\n");

				if (aptr->build_index == 1)
					BuildIndex("idxitmcl");

				InterlockedIncrement(&main_threads_completed)
;
}


//=======================================================
==============
//
// Function   : LoadWarehouse
//
// Loads WAREHOUSE table and loads Stock and District as Warehouses
are created
//
//=======================================================
==============

void LoadWarehouse()
{
   short  w_id;
   char   w_name[W_NAME_LEN+1];
   char   w_street_1[ADDRESS_LEN+1];
   char   w_street_2[ADDRESS_LEN+1];
   char   w_city[ADDRESS_LEN+1];
   char   w_state[STATE_LEN+1];
   char   w_zip[ZIP_LEN+1];
   double w_tax;
   double w_ytd;
				char   name[20];
				long   time_start;


				printf("\nLoading warehouse table...\n");

				// Seed with unique number
				seed(2);

				InitString(w_name, W_NAME_LEN+1);
				InitAddress(w_street_1, w_street_2, w_city,
w_state, w_zip);

				sprintf(name, "%s..%s", aptr->database,
"warehouse");
				bcp_init(w_dbproc1, name, NULL,
"logs\\whouse.err", DB_IN);

				bcp_bind(w_dbproc1, (BYTE *) &w_id,         0, -1,
NULL, 0, 0, 1);
				bcp_bind(w_dbproc1, (BYTE *) w_name,        0,
W_NAME_LEN,   NULL, 0, 0, 2);
				bcp_bind(w_dbproc1, (BYTE *) w_street_1,    0,
ADDRESS_LEN,  NULL, 0, 0, 3);
				bcp_bind(w_dbproc1, (BYTE *) w_street_2,    0,
ADDRESS_LEN,  NULL, 0, 0, 4);
				bcp_bind(w_dbproc1, (BYTE *) w_city,        0,
ADDRESS_LEN,  NULL, 0, 0, 5);
				bcp_bind(w_dbproc1, (BYTE *) w_state,       0,
STATE_LEN,    NULL, 0, 0, 6);
				bcp_bind(w_dbproc1, (BYTE *) w_zip,         0,
ZIP_LEN,      NULL, 0, 0, 7);
				bcp_bind(w_dbproc1, (BYTE *) &w_tax,        0, -
1,           NULL, 0, SQLFLT8, 8);
				bcp_bind(w_dbproc1, (BYTE *) &w_ytd,        0, -
1,           NULL, 0, SQLFLT8, 9);

				time_start = (TimeNow() / MILLI);

				warehouse_rows_loaded = 0;

				for (w_id = aptr->starting_warehouse; w_id <
aptr->num_warehouses+1; w_id++)
				{

					MakeAlphaString(6,10, W_NAME_LEN,
w_name);

					MakeAddress(w_street_1, w_street_2,
w_city, w_state, w_zip);

					w_tax = ((float)
RandomNumber(0L,2000L))/10000.00;

					w_ytd = 300000.00;

					if (!bcp_sendrow(w_dbproc1))
					printf("Error, LoadWarehouse() failed
calling bcp_sendrow().  Check error file.\n");
					warehouse_rows_loaded++;
					CheckForCommit(i_dbproc1,
warehouse_rows_loaded, "warehouse", &time_start);
				}

				bcp_done(w_dbproc1);
				dbclose(w_dbproc1);

				printf("Finished loading warehouse table.\n");

				if (aptr->build_index == 1)
					BuildIndex("idxwarcl");

				stock_rows_loaded = 0;
				district_rows_loaded = 0;

				District(w_id);
				Stock(w_id);

				InterlockedIncrement(&main_threads_completed)
;
}


//=======================================================
==============
//
// Function   : District
//
//=======================================================
==============

void District()
{
   short  d_id;
   short  d_w_id;
   char   d_name[D_NAME_LEN+1];
   char   d_street_1[ADDRESS_LEN+1];
   char   d_street_2[ADDRESS_LEN+1];
   char   d_city[ADDRESS_LEN+1];
   char   d_state[STATE_LEN+1];
   char   d_zip[ZIP_LEN+1];
   double d_tax;
   double d_ytd;
				char   name[20];
   long   d_next_o_id;
   int    rc;
				long   time_start;
				int         w_id;

				for (w_id = aptr->starting_warehouse; w_id <
aptr->num_warehouses+1; w_id++)
				{

					printf("...Loading district table: w_id =
%ld\n", w_id);

					// Seed with unique number
					seed(4);

					InitString(d_name, D_NAME_LEN+1);

					InitAddress(d_street_1, d_street_2, d_city,
d_state, d_zip);

					sprintf(name, "%s..%s", aptr->database,
"district");
					rc = bcp_init(w_dbproc2, name, NULL,
"logs\\district.err", DB_IN);

					bcp_bind(w_dbproc2, (BYTE *) &d_id,
0, -1,           NULL, 0, 0, 1);
					bcp_bind(w_dbproc2, (BYTE *) &d_w_id,
0, -1,           NULL, 0, 0, 2);
					bcp_bind(w_dbproc2, (BYTE *) d_name,
0, D_NAME_LEN,    NULL, 0, 0, 3);
					bcp_bind(w_dbproc2, (BYTE *)
d_street_1,     0, ADDRESS_LEN,   NULL, 0, 0, 4);
```

```
					bcp_bind(w_dbproc2, (BYTE *)
d_street_2,	0, ADDRESS_LEN,	NULL, 0, 0, 5);
					bcp_bind(w_dbproc2, (BYTE *) d_city,
0, ADDRESS_LEN,	NULL, 0, 0, 6);
					bcp_bind(w_dbproc2, (BYTE *) d_state,
0, STATE_LEN,	NULL, 0, 0, 7);
					bcp_bind(w_dbproc2, (BYTE *) d_zip,
0, ZIP_LEN,	NULL, 0, 0, 8);
					bcp_bind(w_dbproc2, (BYTE *) &d_tax,
0, -1,		NULL, 0, SQLFLT8, 9);
					bcp_bind(w_dbproc2, (BYTE *) &d_ytd,
0, -1,		NULL, 0, SQLFLT8, 10);
					bcp_bind(w_dbproc2, (BYTE *)
&d_next_o_id,	0, -1,		NULL, 0, 0, 11);

					d_w_id = w_id;

					d_ytd  = 30000.0;

					d_next_o_id = 3001L;

					time_start = (TimeNow() / MILLI);

					for (d_id = 1; d_id <=
DISTRICT_PER_WAREHOUSE; d_id++)
					{

				MakeAlphaString(6,10,D_NAME_LEN, d_name);

						MakeAddress(d_street_1,
d_street_2, d_city, d_state, d_zip);

						d_tax = ((float)
RandomNumber(0L,2000L))/10000.00;

						if (!bcp_sendrow(w_dbproc2))
							printf("Error, District() failed
calling bcp_sendrow().  Check error file.\n");
						district_rows_loaded++;
						CheckForCommit(w_dbproc2,
district_rows_loaded, "district", &time_start);
					}

					rc = bcp_done(w_dbproc2);
				}

				printf("Finished loading district table.\n");

				if (aptr->build_index == 1)
					BuildIndex("idxdiscl");

   return;
}

//=======================================================
==============
//
// Function   : Stock
//
//=======================================================
==============

void Stock()
{
   long  s_i_id;
   short s_w_id;
   short s_quantity;
   char  s_dist_01[S_DIST_LEN+1];
   char  s_dist_02[S_DIST_LEN+1];
   char  s_dist_03[S_DIST_LEN+1];
   char  s_dist_04[S_DIST_LEN+1];
   char  s_dist_05[S_DIST_LEN+1];
   char  s_dist_06[S_DIST_LEN+1];
   char  s_dist_07[S_DIST_LEN+1];
   char  s_dist_08[S_DIST_LEN+1];
   char  s_dist_09[S_DIST_LEN+1];
   char  s_dist_10[S_DIST_LEN+1];
   long  s_ytd;
   short s_order_cnt;
   short s_remote_cnt;
   char  s_data[S_DATA_LEN+1];
   short i;
   short len;
   int   rc;
				char  name[20];
				long  time_start;

				// Seed with unique number
				seed(3);

				sprintf(name, "%s..%s", aptr->database, "stock");
				rc = bcp_init(w_dbproc2, name, NULL,
"logs\\stock.err", DB_IN);

				bcp_bind(w_dbproc2, (BYTE *) &s_i_id,	0, -1,
NULL, 0, 0, 1);
				bcp_bind(w_dbproc2, (BYTE *) &s_w_id,	0, -
1,	NULL, 0, 0, 2);
				bcp_bind(w_dbproc2, (BYTE *) &s_quantity,	0, -
1,	NULL, 0, 0, 3);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_01,	0,
S_DIST_LEN, NULL, 0, 0, 4);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_02,	0,
S_DIST_LEN, NULL, 0, 0, 5);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_03,	0,
S_DIST_LEN, NULL, 0, 0, 6);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_04,	0,
S_DIST_LEN, NULL, 0, 0, 7);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_05,	0,
S_DIST_LEN, NULL, 0, 0, 8);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_06,	0,
S_DIST_LEN, NULL, 0, 0, 9);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_07,	0,
S_DIST_LEN, NULL, 0, 0, 10);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_08,	0,
S_DIST_LEN, NULL, 0, 0, 11);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_09,	0,
S_DIST_LEN, NULL, 0, 0, 12);
				bcp_bind(w_dbproc2, (BYTE *) s_dist_10,	0,
S_DIST_LEN, NULL, 0, 0, 13);
				bcp_bind(w_dbproc2, (BYTE *) &s_ytd,	0, -1,
NULL, 0, 0, 14);
				bcp_bind(w_dbproc2, (BYTE *) &s_order_cnt,  0,
-1,	NULL, 0, 0, 15);
				bcp_bind(w_dbproc2, (BYTE *) &s_remote_cnt,
0, -1,	NULL, 0, 0, 16);
				bcp_bind(w_dbproc2, (BYTE *) s_data,	0,
S_DATA_LEN,	NULL, 0, 0, 17);

				s_ytd = s_order_cnt = s_remote_cnt = 0;

				time_start = (TimeNow() / MILLI);

				printf("...Loading stock table\n");

				for (s_i_id=1; s_i_id <= MAXITEMS; s_i_id++)
				{

					for (s_w_id = aptr->starting_warehouse;
s_w_id < aptr->num_warehouses+1; s_w_id++)
					{

						s_quantity =
RandomNumber(10L,100L);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_01);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_02);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_03);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_04);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_05);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_06);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_07);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_08);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_09);
						len =
MakeAlphaString(24,24,S_DIST_LEN, s_dist_10);

						len =
MakeOriginalAlphaString(26,50, S_DATA_LEN, s_data,10);

						if (!bcp_sendrow(w_dbproc2))
						printf("Error, Stock() failed calling
bcp_sendrow().  Check error file.\n");
						stock_rows_loaded++;
						CheckForCommit(w_dbproc2,
stock_rows_loaded, "stock", &time_start);

					}
				}

				bcp_done(w_dbproc2);
				dbclose(w_dbproc2);

				printf("Finished loading stock table.\n");

				if (aptr->build_index == 1)
					BuildIndex("idxstkcl");

				return;
}

//=======================================================
==============
//
// Function   : LoadCustomer
//
//=======================================================
==============

void LoadCustomer()
{
				LOADER_TIME_STRUCT
customer_time_start;
				LOADER_TIME_STRUCT	history_time_start;
```

```
	short			w_id;
	short			d_id;
	DWORD
	dwThreadID[MAX_CUSTOMER_THREADS];
	HANDLE
	hThread[MAX_CUSTOMER_THREADS];
	char			name[20];
	char				buf[250];

	printf("\nLoading customer and history
tables...\n");

	// Seed with unique number
	seed(5);

	// Initialize bulk copy
	sprintf(name, "%s..%s", aptr->database,
"customer");
	bcp_init(c_dbproc1, name, NULL,
"logs\\customer.err", DB_IN);

	sprintf(name, "%s..%s", aptr->database,
"history");
	bcp_init(c_dbproc2, name, NULL,
"logs\\history.err", DB_IN);

	customer_rows_loaded	= 0;
	history_rows_loaded	= 0;

	CustomerBufInit();

	customer_time_start.time_start = (TimeNow() /
MILLI);
	history_time_start.time_start = (TimeNow() /
MILLI);

	for (w_id = aptr->starting_warehouse; w_id <=
aptr->num_warehouses; w_id++)
	{
		for (d_id = 1L; d_id <=
DISTRICT_PER_WAREHOUSE; d_id++)
		{
			CustomerBufLoad(d_id, w_id);

			// Start parallel loading threads
here...

			customer_threads_completed=0;

			// Start customer table thread

			printf("...Loading customer table for:
d_id = %d, w_id = %d\n", d_id, w_id);

			hThread[0] = CreateThread(NULL,
0,
(LPTHREAD_START_ROUTINE) LoadCustomerTable,
&customer_time_start,
0,
&dwThreadID[0]);

			if (hThread[0] == NULL)
			{
				printf("Error, failed in
creating creating thread = 0.\n");
				exit(-1);
			}

			// Start History table thread

			printf("...Loading history table for:
d_id = %d, w_id = %d\n", d_id, w_id);

			hThread[1] = CreateThread(NULL,
0,
(LPTHREAD_START_ROUTINE) LoadHistoryTable,
&history_time_start,
0,
&dwThreadID[1]);

			if (hThread[1] == NULL)
			{
				printf("Error, failed in
creating creating thread = 1.\n");
				exit(-1);
			}

			while
(customer_threads_completed != 2)
				Sleep(1000L);
		}
	}

	// flush the bulk connection
	bcp_done(c_dbproc1);
	bcp_done(c_dbproc2);

   sprintf(buf,"update customer set c_first = 'C_LOAD = %d' where c_id = 1
and c_w_id = 1 and c_d_id = 1",LOADER_NURAND_C);
	dbcmd(c_dbproc1, buf);
	dbsqlexec(c_dbproc1);
	while (dbresults(c_dbproc1) !=
NO_MORE_RESULTS);

	dbclose(c_dbproc1);
	dbclose(c_dbproc2);

	printf("Finished loading customer table.\n");

	if (aptr->build_index == 1)
		BuildIndex("idxcuscl");

	if (aptr->build_index == 1)
		BuildIndex("idxcusnc");

	InterlockedIncrement(&main_threads_completed)
;

   return;

}

//=======================================================
==============
//
// Function	: CustomerBufInit
//
//=======================================================
==============

void CustomerBufInit()
{
	int	i;

	for (i=0;i<CUSTOMERS_PER_DISTRICT;i++)
	{
		customer_buf[i].c_id = 0;
		customer_buf[i].c_d_id = 0;
		customer_buf[i].c_w_id = 0;

		strcpy(customer_buf[i].c_first,"");
		strcpy(customer_buf[i].c_middle,"");
		strcpy(customer_buf[i].c_last,"");
		strcpy(customer_buf[i].c_street_1,"");
		strcpy(customer_buf[i].c_street_2,"");
		strcpy(customer_buf[i].c_city,"");
		strcpy(customer_buf[i].c_state,"");
		strcpy(customer_buf[i].c_zip,"");
		strcpy(customer_buf[i].c_phone,"");
		strcpy(customer_buf[i].c_credit,"");

		customer_buf[i].c_credit_lim = 0;
		customer_buf[i].c_discount = (float) 0;
		customer_buf[i].c_balance = 0;
		customer_buf[i].c_ytd_payment = 0;
		customer_buf[i].c_payment_cnt = 0;
		customer_buf[i].c_delivery_cnt = 0;

		strcpy(customer_buf[i].c_data_1,"");
		strcpy(customer_buf[i].c_data_2,"");

		customer_buf[i].h_amount = 0;

		strcpy(customer_buf[i].h_data,"");

	}

}

//=======================================================
==============
//
// Function	: CustomerBufLoad
//
// Fills shared buffer for HISTORY and CUSTOMER
//=======================================================
==============

void CustomerBufLoad(int d_id, int w_id)
{
	long				i;
   CUSTOMER_SORT_STRUCT	c[CUSTOMERS_PER_DISTRICT];

	for (i=0;i<CUSTOMERS_PER_DISTRICT;i++)
	{
		if (i < 1000)
			LastName(i, c[i].c_last);
		else

	LastName(NURand(255,0,999,LOADER_NURA
ND_C), c[i].c_last);

	MakeAlphaString(8,16,FIRST_NAME_LEN,
c[i].c_first);

		c[i].c_id = i+1;

	}
```

```
				printf("...Loading customer buffer for: d_id = %d,
w_id = %d\n",
					d_id, w_id);

				for (i=0;i<CUSTOMERS_PER_DISTRICT;i++)
				{

					customer_buf[i].c_d_id = d_id;
					customer_buf[i].c_w_id = w_id;
					customer_buf[i].h_amount = 10.0;
					customer_buf[i].c_ytd_payment  = 10.0;
					customer_buf[i].c_payment_cnt  = 1;
					customer_buf[i].c_delivery_cnt = 0;

					// Generate CUSTOMER and HISTORY
data

					customer_buf[i].c_id = c[i].c_id;

					strcpy(customer_buf[i].c_first, c[i].c_first);
					strcpy(customer_buf[i].c_last, c[i].c_last);

					customer_buf[i].c_middle[0] = 'O';
					customer_buf[i].c_middle[1] = 'E';

					MakeAddress(customer_buf[i].c_street_1,
customer_buf[i].c_street_2,
							customer_buf[i].c_city,
							customer_buf[i].c_state,
							customer_buf[i].c_zip);

					MakeNumberString(16, 16, PHONE_LEN,
customer_buf[i].c_phone);

					if (RandomNumber(1L, 100L) > 10)
						customer_buf[i].c_credit[0] = 'G';
					else
						customer_buf[i].c_credit[0] = 'B';
					customer_buf[i].c_credit[1] = 'C';

					customer_buf[i].c_credit_lim = 50000.0;
					customer_buf[i].c_discount = ((float)
RandomNumber(0L, 5000L)) / 10000.0;
					customer_buf[i].c_balance = -10.0;

					MakeAlphaString(250, 250,
C_DATA_LEN, customer_buf[i].c_data_1);
					MakeAlphaString(50, 250, C_DATA_LEN,
customer_buf[i].c_data_2);

					// Generate HISTORY data
					MakeAlphaString(12, 24, H_DATA_LEN,
customer_buf[i].h_data);

				}
}

//=======================================================
==============
//
// Function   : LoadCustomerTable
//
//=======================================================
==============

void LoadCustomerTable(LOADER_TIME_STRUCT *customer_time_start)
{
				int	i;
   long	c_id;
   short	c_d_id;
   short	c_w_id;
   char	c_first[FIRST_NAME_LEN+1];
   char	c_middle[MIDDLE_NAME_LEN+1];
   char	c_last[LAST_NAME_LEN+1];
   char	c_street_1[ADDRESS_LEN+1];
   char	c_street_2[ADDRESS_LEN+1];
   char	c_city[ADDRESS_LEN+1];
   char	c_state[STATE_LEN+1];
   char	c_zip[ZIP_LEN+1];
   char	c_phone[PHONE_LEN+1];
   char	c_credit[CREDIT_LEN+1];
   double	c_credit_lim;
   double	c_discount;
   double	c_balance;
   double	c_ytd_payment;
   short	c_payment_cnt;
   short	c_delivery_cnt;
   char	c_data_1[C_DATA_LEN+1];
   char	c_data_2[C_DATA_LEN+1];
				char	name[20];
				char		c_since[50];

   bcp_bind(c_dbproc1, (BYTE *) &c_id,		0, -1,		NULL,0,0, 1);
   bcp_bind(c_dbproc1, (BYTE *) &c_d_id,	0, -1,		NULL,0,0, 2);
   bcp_bind(c_dbproc1, (BYTE *) &c_w_id,	0, -1,		NULL,0,0, 3);
   bcp_bind(c_dbproc1, (BYTE *) c_first,	0, FIRST_NAME_LEN,
NULL,0,0, 4);
   bcp_bind(c_dbproc1, (BYTE *) c_middle,	0,
MIDDLE_NAME_LEN,NULL,0,0, 5);
   bcp_bind(c_dbproc1, (BYTE *) c_last,		0, LAST_NAME_LEN,
NULL,0,0, 6);
   bcp_bind(c_dbproc1, (BYTE *) c_street_1,	0, ADDRESS_LEN,
NULL,0,0, 7);
   bcp_bind(c_dbproc1, (BYTE *) c_street_2,	0, ADDRESS_LEN,
NULL,0,0, 8);
   bcp_bind(c_dbproc1, (BYTE *) c_city,		0, ADDRESS_LEN,
NULL,0,0, 9);
   bcp_bind(c_dbproc1, (BYTE *) c_state,	0, STATE_LEN,
NULL,0,0,10);
   bcp_bind(c_dbproc1, (BYTE *) c_zip,		0, ZIP_LEN,
NULL,0,0,11);
   bcp_bind(c_dbproc1, (BYTE *) c_phone,	0, PHONE_LEN,
NULL,0,0,12);
				bcp_bind(c_dbproc1, (BYTE *) c_since,	0,
50,		NULL,0,SQLCHAR,13);
   bcp_bind(c_dbproc1, (BYTE *) c_credit,	0, CREDIT_LEN,
NULL,0,0,14);
   bcp_bind(c_dbproc1, (BYTE *) &c_credit_lim,  0, -1,
NULL,0,SQLFLT8,15);
   bcp_bind(c_dbproc1, (BYTE *) &c_discount,	0, -1,
NULL,0,SQLFLT8,16);
   bcp_bind(c_dbproc1, (BYTE *) &c_balance,	0, -1,
NULL,0,SQLFLT8,17);
   bcp_bind(c_dbproc1, (BYTE *) &c_ytd_payment, 0, -1,
NULL,0,SQLFLT8,18);
   bcp_bind(c_dbproc1, (BYTE *) &c_payment_cnt, 0, -1,
NULL,0,0,19);
   bcp_bind(c_dbproc1, (BYTE *) &c_delivery_cnt,0, -1,
NULL,0,0,20);
   bcp_bind(c_dbproc1, (BYTE *) c_data_1,	0, C_DATA_LEN,
NULL,0,0,21);
   bcp_bind(c_dbproc1, (BYTE *) c_data_2,	0, C_DATA_LEN,
NULL,0,0,22);

   for (i = 0; i < CUSTOMERS_PER_DISTRICT; i++)
   {
					c_id = customer_buf[i].c_id;
					c_d_id = customer_buf[i].c_d_id;
					c_w_id = customer_buf[i].c_w_id;

					strcpy(c_first, customer_buf[i].c_first);
					strcpy(c_middle,
customer_buf[i].c_middle);
					strcpy(c_last, customer_buf[i].c_last);
					strcpy(c_street_1,
customer_buf[i].c_street_1);
					strcpy(c_street_2,
customer_buf[i].c_street_2);
					strcpy(c_city, customer_buf[i].c_city);
					strcpy(c_state, customer_buf[i].c_state);
					strcpy(c_zip, customer_buf[i].c_zip);
					strcpy(c_phone,
customer_buf[i].c_phone);
					strcpy(c_credit, customer_buf[i].c_credit);

					CurrentDate(&c_since);

					c_credit_lim =
customer_buf[i].c_credit_lim;
					c_discount = customer_buf[i].c_discount;
					c_balance = customer_buf[i].c_balance;
					c_ytd_payment =
customer_buf[i].c_ytd_payment;
					c_payment_cnt =
customer_buf[i].c_payment_cnt;
					c_delivery_cnt =
customer_buf[i].c_delivery_cnt;

					strcpy(c_data_1,
customer_buf[i].c_data_1);
					strcpy(c_data_2,
customer_buf[i].c_data_2);

					// Send data to server
					if (!bcp_sendrow(c_dbproc1))
					printf("Error, LoadCustomerTable() failed
calling bcp_sendrow().  Check error file.\n");
					customer_rows_loaded++;
					CheckForCommit(c_dbproc1,
customer_rows_loaded, "customer", &customer_time_start->time_start);
   }

				InterlockedIncrement(&customer_threads_compl
eted);

}


//=======================================================
==============
//
// Function   : LoadHistoryTable
//
//=======================================================
==============

void LoadHistoryTable(LOADER_TIME_STRUCT *history_time_start)
{
				int	i;
   long	c_id;
   short	c_d_id;
   short	c_w_id;
				double	h_amount;
    char        h_data[H_DATA_LEN+1];
                                char            h_date[50];

    bcp_bind(c_dbproc2, (BYTE *) &c_id,         0, -1,          NULL, 0, 0, 1);
    bcp_bind(c_dbproc2, (BYTE *) &c_d_id,       0, -1,          NULL, 0, 0, 2);
    bcp_bind(c_dbproc2, (BYTE *) &c_w_id,       0, -1,          NULL, 0, 0, 3);
    bcp_bind(c_dbproc2, (BYTE *) &c_d_id,       0, -1,          NULL, 0, 0, 4);
    bcp_bind(c_dbproc2, (BYTE *) &c_w_id,       0, -1,          NULL, 0, 0, 5);
    bcp_bind(c_dbproc2, (BYTE *) h_date,        0, 50,          NULL, 0,
SQLCHAR, 6);
    bcp_bind(c_dbproc2, (BYTE *) &h_amount,     0, -1,          NULL, 0,
SQLFLT8, 7);
    bcp_bind(c_dbproc2, (BYTE *) h_data,        0, H_DATA_LEN,  NULL, 0,
0, 8);

    for (i = 0; i < CUSTOMERS_PER_DISTRICT; i++)
    {
                                    c_id = customer_buf[i].c_id;
                                    c_d_id = customer_buf[i].c_d_id;
                                    c_w_id = customer_buf[i].c_w_id;
                                    h_amount = customer_buf[i].h_amount;
                                    strcpy(h_data, customer_buf[i].h_data);
                                    CurrentDate(&h_date);

                                    // send to server
                                    if (!bcp_sendrow(c_dbproc2))
                                    printf("Error, LoadHistoryTable() failed
calling bcp_sendrow().  Check error file.\n");
                                    history_rows_loaded++;
                                    CheckForCommit(c_dbproc2,
history_rows_loaded, "history", &history_time_start->time_start);
    }

                                InterlockedIncrement(&customer_threads_compl
eted);

}

//=======================================================
===-===============
//
// Function   : LoadOrders
//
//=======================================================
==================

void LoadOrders()
{
                                LOADER_TIME_STRUCT      orders_time_start;
                                LOADER_TIME_STRUCT
new_order_time_start;
                                LOADER_TIME_STRUCT
order_line_time_start;
                                short                   w_id;
    short                       d_id;
                                DWORD
                                dwThreadID[MAX_ORDER_THREADS];
                                HANDLE
                                hThread[MAX_ORDER_THREADS];
                                char                    name[20];


                                printf("\nLoading orders...\n");

                                // seed with unique number
                                seed(6);
```

```
                                // initialize bulk copy
                                sprintf(name, "%s..%s", aptr->database,
"orders");
                                bcp_init(o_dbproc1, name, NULL,
"logs\\orders.err", DB_IN);

                                sprintf(name, "%s..%s", aptr->database,
"new_order");
                                bcp_init(o_dbproc2, name, NULL,
"logs\\neword.err", DB_IN);

                                sprintf(name, "%s..%s", aptr->database,
"order_line");
                                bcp_init(o_dbproc3, name, NULL,
"logs\\ordline.err", DB_IN);

                                orders_rows_loaded      = 0;
                                new_order_rows_loaded   = 0;
                                order_line_rows_loaded  = 0;

                                OrdersBufInit();

                                orders_time_start.time_start = (TimeNow() /
MILLI);
                                new_order_time_start.time_start = (TimeNow() /
MILLI);
                                order_line_time_start.time_start = (TimeNow() /
MILLI);

                                for (w_id = aptr->starting_warehouse; w_id <=
aptr->num_warehouses; w_id++)
                                {
                                    for (d_id = 1L; d_id <=
DISTRICT_PER_WAREHOUSE; d_id++)
                                    {

                                        OrdersBufLoad(d_id, w_id);

                                        // start parallel loading threads
here...

                                        order_threads_completed=0;

                                        // start Orders table thread

                                        printf("...Loading Order Table for:
d_id = %d, w_id = %d\n", d_id, w_id);

                                        hThread[0] = CreateThread(NULL,
                                                                            0,
                                                                            (LPTHREAD_START_ROUTINE) LoadOrdersTable,
                                                                            &orders_time_start,
                                                                            0,
                                                                            &dwThreadID[0]);

                                        if (hThread[0] == NULL)
                                        {
                                            printf("Error, failed in
creating creating thread = 0.\n");
                                            exit(-1);
                                        }

                                        // start NewOrder table thread

                                        printf("...Loading New-Order Table
for: d_id = %d, w_id = %d\n", d_id, w_id);

                                        hThread[1] = CreateThread(NULL,
```

```
                                                                            0,
                                                                            (LPTHREA
                                                                            &new_orde
                                                                            0,
                                                                            &dwThread

                                        if (hThread[1] == NULL)
                                        {
                                            printf("Error, failed in
creating creating thread = 1.\n");
                                            exit(-1);
                                        }

                                        // start Order-Line table thread

                                        printf("...Loading Order-Line Table
for: d_id = %d, w_id = %d\n", d_id, w_id);

                                        hThread[2] = CreateThread(NULL,
                                                                            0,
                                                                            (LPTHREA
                                                                            &order_line
                                                                            0,
                                                                            &dwThread

                                        if (hThread[2] == NULL)
                                        {
                                            printf("Error, failed in
creating creating thread = 2.\n");
                                            exit(-1);
                                        }

                                        while (order_threads_completed !=
3)
                                            Sleep(1000L);

                                    }
                                }

                                printf("Finished loading orders.\n");

                                InterlockedIncrement(&main_threads_completed)
;

    return;
}

//=======================================================
==============
//
// Function   : OrdersBufInit
//
// Clears shared buffer for ORDERS, NEWORDER, and ORDERLINE
//
//=======================================================
==============

void OrdersBufInit()
{
                                int     i;
                                int             j;

                                for (i=0;i<ORDERS_PER_DISTRICT;i++)
                                {
                                    orders_buf[i].o_id = 0;
                                    orders_buf[i].o_d_id = 0;
                                    orders_buf[i].o_w_id = 0;
```

```
					orders_buf[i].o_c_id = 0;
					orders_buf[i].o_carrier_id = 0;
					orders_buf[i].o_ol_cnt = 0;
					orders_buf[i].o_all_local = 0;

					for (j=0;j<=14;j++)
					{
						orders_buf[i].o_ol[j].ol = 0;
						orders_buf[i].o_ol[j].ol_i_id = 0;
						orders_buf[i].o_ol[j].ol_supply_w_id
= 0;
						orders_buf[i].o_ol[j].ol_quantity = 0;
						orders_buf[i].o_ol[j].ol_amount = 0;

				strcpy(orders_buf[i].o_ol[j].ol_dist_info,"");
					}
				}

}

//=======================================================
==============
//
// Function   : OrdersBufLoad
//
// Fills shared buffer for ORDERS, NEWORDER, and ORDERLINE
//
//=======================================================
==============

void OrdersBufLoad(int d_id, int w_id)
{

				int     cust[ORDERS_PER_DIST+1];
				long    o_id;
				short   ol;

				printf("...Loading Order Buffer for: d_id = %d,
w_id = %d\n",
						d_id, w_id);

				GetPermutation(cust, ORDERS_PER_DIST);

				for
(o_id=0;o_id<ORDERS_PER_DISTRICT;o_id++)
				{

					// Generate ORDER and NEW-ORDER
data

					orders_buf[o_id].o_d_id = d_id;
					orders_buf[o_id].o_w_id = w_id;
					orders_buf[o_id].o_id = o_id+1;
					orders_buf[o_id].o_c_id = cust[o_id+1];
					orders_buf[o_id].o_ol_cnt =
RandomNumber(5L, 15L);

					if (o_id < 2100)
					{
						orders_buf[o_id].o_carrier_id =
RandomNumber(1L, 10L);

						orders_buf[o_id].o_all_local  = 1;
					}
					else
					{
						orders_buf[o_id].o_carrier_id = 0;
						orders_buf[o_id].o_all_local  = 1;
					}

					for
(ol=0;ol<orders_buf[o_id].o_ol_cnt;ol++)
					{

						orders_buf[o_id].o_ol[ol].ol = ol+1;
						orders_buf[o_id].o_ol[ol].ol_i_id =
RandomNumber(1L, MAXITEMS);

				orders_buf[o_id].o_ol[ol].ol_supply_w_id = w_id;

				orders_buf[o_id].o_ol[ol].ol_quantity = 5;
						MakeAlphaString(24, 24,
OL_DIST_INFO_LEN, &orders_buf[o_id].o_ol[ol].ol_dist_info);

						// Generate ORDER-LINE data
						if (o_id < 2100)
						{

				orders_buf[o_id].o_ol[ol].ol_amount = 0;
							// Added to insure
ol_delivery_d set properly during load

				CurrentDate(&orders_buf[o_id].o_ol[ol].ol_deliver
y_d);
						}
						else
						{

				orders_buf[o_id].o_ol[ol].ol_amount =
RandomNumber(1,999999)/100.0;
							// Added to insure
ol_delivery_d set properly during load

				strcpy(orders_buf[o_id].o_ol[ol].ol_delivery_d,"D
ec 31, 1889");
						}
					}
				}
}

//=======================================================
==============
//
// Function   : LoadOrdersTable
//
//=======================================================
==============

void LoadOrdersTable(LOADER_TIME_STRUCT *orders_time_start)
{
				int         i;
   long       o_id;
				short           o_d_id;
				short           o_w_id;
   long       o_c_id;
   short      o_carrier_id;
   short      o_ol_cnt;
   short      o_all_local;
				char            o_entry_d[50];

				// bind ORDER data
   bcp_bind(o_dbproc1, (BYTE *) &o_id,          0, -1,          NULL, 0, 0, 1);
   bcp_bind(o_dbproc1, (BYTE *) &o_d_id,        0, -1,          NULL, 0, 0, 2);
   bcp_bind(o_dbproc1, (BYTE *) &o_w_id,        0, -1,          NULL, 0, 0, 3);
   bcp_bind(o_dbproc1, (BYTE *) &o_c_id,        0, -1,          NULL, 0, 0, 4);
   bcp_bind(o_dbproc1, (BYTE *) o_entry_d,      0, 50,          NULL, 0,
SQLCHAR, 5);
   bcp_bind(o_dbproc1, (BYTE *) &o_carrier_id,  0, -1,          NULL, 0, 0, 6);
   bcp_bind(o_dbproc1, (BYTE *) &o_ol_cnt,      0, -1,          NULL, 0, 0, 7);
   bcp_bind(o_dbproc1, (BYTE *) &o_all_local,   0, -1,          NULL, 0, 0, 8);

   for (i = 0; i < ORDERS_PER_DISTRICT; i++)
   {
						o_id         = orders_buf[i].o_id;
						o_d_id       = orders_buf[i].o_d_id;
						o_w_id       = orders_buf[i].o_w_id;
						o_c_id       = orders_buf[i].o_c_id;
						o_carrier_id = orders_buf[i].o_carrier_id;
						o_ol_cnt     = orders_buf[i].o_ol_cnt;
						o_all_local  = orders_buf[i].o_all_local;
						CurrentDate(&o_entry_d);

						// send data to server
						if (!bcp_sendrow(o_dbproc1))
						printf("Error, LoadOrdersTable() failed
calling bcp_sendrow().  Check error file.\n");
						orders_rows_loaded++;
						CheckForCommit(o_dbproc1,
orders_rows_loaded, "ORDERS", &orders_time_start->time_start);
   }

					if ((o_w_id == aptr->num_warehouses) &&
(o_d_id == 10))
					{
						bcp_done(o_dbproc1);
						dbclose(o_dbproc1);

						if (aptr->build_index == 1)
							BuildIndex("idxordcl");
					}

					InterlockedIncrement(&order_threads_completed
);

}

//=======================================================
==============
//
// Function   : LoadNewOrderTable
//
//=======================================================
==============

void LoadNewOrderTable(LOADER_TIME_STRUCT
*new_order_time_start)
{
   int        i;
   long       o_id;
   short      o_d_id;
   short      o_w_id;

					// Bind NEW-ORDER data
   bcp_bind(o_dbproc2, (BYTE *) &o_id,          0, -1, NULL, 0, 0, 1);
   bcp_bind(o_dbproc2, (BYTE *) &o_d_id,        0, -1, NULL, 0, 0, 2);
   bcp_bind(o_dbproc2, (BYTE *) &o_w_id,        0, -1, NULL, 0, 0, 3);

					for (i = 2100; i < 3000; i++)
					{
						o_id    = orders_buf[i].o_id;
						o_d_id  = orders_buf[i].o_d_id;
						o_w_id  = orders_buf[i].o_w_id;
					if (!bcp_sendrow(o_dbproc2))
					printf("Error, LoadNewOrderTable() failed
calling bcp_sendrow().  Check error file.\n");
					new_order_rows_loaded++;
					CheckForCommit(o_dbproc2,
new_order_rows_loaded, "NEW_ORDER", &new_order_time_start-
>time_start);

				}

				if ((o_w_id == aptr->num_warehouses) &&
(o_d_id == 10))
				{
					bcp_done(o_dbproc2);
					dbclose(o_dbproc2);

					if (aptr->build_index == 1)
						BuildIndex("idxnodcl");
				}

				InterlockedIncrement(&order_threads_completed
);

}


//=========================================================
==============
//
// Function   : LoadOrderLineTable
//
//=========================================================
==============

void LoadOrderLineTable(LOADER_TIME_STRUCT *order_line_time_start)
{
				int	i,j;
   long	o_id;
				short		o_d_id;
				short		o_w_id;
   long	ol;
				long		ol_i_id;
   short	ol_supply_w_id;
   short	ol_quantity;
   double	ol_amount;
   short	o_all_local;
   char	ol_dist_info[DIST_INFO_LEN+1];
				char		ol_delivery_d[50];

				// bind ORDER-LINE data
   bcp_bind(o_dbproc3, (BYTE *) &o_id,		0, -1, NULL, 0, 0, 1);
   bcp_bind(o_dbproc3, (BYTE *) &o_d_id,		0, -1, NULL, 0, 0, 2);
   bcp_bind(o_dbproc3, (BYTE *) &o_w_id,		0, -1, NULL, 0, 0, 3);
   bcp_bind(o_dbproc3, (BYTE *) &ol,		0, -1, NULL, 0, 0, 4);
   bcp_bind(o_dbproc3, (BYTE *) &ol_i_id,		0, -1, NULL, 0, 0, 5);
   bcp_bind(o_dbproc3, (BYTE *) &ol_supply_w_id,	0, -1, NULL, 0, 0,
6);
				bcp_bind(o_dbproc3, (BYTE *) ol_delivery_d,
0, ~~50, NULL, 0, SQL~~CHAR, 7);
   bcp_bind(o_dbproc3, (BYTE *) &ol_quantity,	0, -1, NULL, 0, 0, 8);
   bcp_bind(o_dbproc3, (BYTE *) &ol_amount,	0, -1, NULL, 0,
SQLFLT8, 9);
   bcp_bind(o_dbproc3, (BYTE *) ol_dist_info,	0, DIST_INFO_LEN,
NULL, 0, 0, 10);

				for (i = 0; i < ORDERS_PER_DISTRICT; i++)
   {
					o_id	= orders_buf[i].o_id;
					o_d_id  = orders_buf[i].o_d_id;
					o_w_id  = orders_buf[i].o_w_id;

					for (j=0; j < orders_buf[i].o_ol_cnt; j++)
					{
						ol		= orders_buf[i].o_ol[j].ol;
						ol_i_id	=
orders_buf[i].o_ol[j].ol_i_id;
						ol_supply_w_id =
orders_buf[i].o_ol[j].ol_supply_w_id;
						ol_quantity	=
orders_buf[i].o_ol[j].ol_quantity;
						ol_amount	=
orders_buf[i].o_ol[j].ol_amount;
						//  Changed to insure ol_delivery_d
set properly (now set in OrdersBufLoad)
						//  CurrentDate(&ol_delivery_d);

				strcpy(ol_delivery_d,orders_buf[i].o_ol[j].ol_deliv
ery_d);


				strcpy(ol_dist_info,orders_buf[i].o_ol[j].ol_dist_inf
o);

						if (!bcp_sendrow(o_dbproc3))
							printf("Error,
LoadOrderLineTable() failed calling bcp_sendrow().  Check error file.\n");
						order_line_rows_loaded++;
						CheckForCommit(o_dbproc3,
order_line_rows_loaded, "ORDER_LINE", &order_line_time_start-
>time_start);
					}

				}

				if ((o_w_id == aptr->num_warehouses) &&
(o_d_id == 10))
				{
					bcp_done(o_dbproc3);
					dbclose(o_dbproc3);

					if (aptr->build_index == 1)
						BuildIndex("idxodlcl");
				}

				InterlockedIncrement(&order_threads_completed
);

}


//=========================================================
==============
//
// Function   : GetPermutation
//
//=========================================================
==============

void GetPermutation(int perm[], int n)
{
				int i, r, t;

				for (i=1;i<=n;i++)
					perm[i] = i;

				for (i=1;i<=n;i++)
				{
					r = RandomNumber(i,n);
					t = perm[i];
					perm[i] = perm[r];
					perm[r] = t;
				}

}


//=========================================================
==============
//
// Function   : CheckForCommit
//
//=========================================================
==============

void CheckForCommit(DBPROCESS *dbproc,
						int rows_loaded,
							char *table_name,
						long *time_start)
{

   long				time_end, time_diff;

   // commit every "batch" rows

   if ( !(rows_loaded % aptr->batch) )
   {
					bcp_batch(dbproc);

					time_end = (TimeNow() / MILLI);
					time_diff = time_end - *time_start;

					printf("-> Loaded %ld rows into %s in %ld
sec - Total = %d (%.2f rps)\n",
						aptr->batch,
						table_name,
							time_diff,
						rows_loaded,
							(float) aptr->batch / (time_diff
? time_diff : 1L));

					*time_start = time_end;
   }

   return;
}


//=========================================================
==============
//
// Function   : OpenConnections
//
//=========================================================
==============

void OpenConnections()
{
				RETCODE	retcode;

				LOGINREC *login;

   login = dblogin();

   retcode = DBSETLUSER(login, aptr->user);
```

```
				if (retcode == FAIL)
				{
					printf("DBSETLUSER failed.\n");
				}
				retcode = DBSETLPWD(login, aptr->password);
				if (retcode == FAIL)
				{
					printf("DBSETLPWD failed.\n");
				}

				retcode = DBSETLPACKET(login, (USHORT)
aptr->pack_size);
				if (retcode == FAIL)
				{
					printf("DBSETLPACKET failed.\n");
				}

				printf("DB-Library packet size: %ld\n",aptr-
>pack_size);

   // turn connection into a BCP connection
   retcode = BCP_SETL(login, TRUE);
				if (retcode == FAIL)
				{
					printf("BCP_SETL failed.\n");
				}

   // open connections to SQL Server */

   if ((i_dbproc1 = dbopen(login, aptr->server)) == NULL)
   {
					printf("Error on login 1 to server %s.\n",
aptr->server);
					exit(-1);
   }

   if ((w_dbproc1 = dbopen(login, aptr->server)) == NULL)
   {
					printf("Error on login 2 to server %s.\n",
aptr->server);
					exit(-1);
   }

   if ((w_dbproc2 = dbopen(login, aptr->server)) == NULL)
   {
					printf("Error on login 3 to server %s.\n",
aptr->server);
					exit(-1);
   }

   if ((c_dbproc1 = dbopen(login, aptr->server)) == NULL)
   {
					printf("Error on login 4 to server %s.\n",
aptr->server);
					exit(-1);
   }

   if ((c_dbproc2 = dbopen(login, aptr->server)) == NULL)
   {
					printf("Error on login 5 to server %s.\n",
aptr->server);
					exit(-1);
   }

   if ((o_dbproc1 = dbopen(login, aptr->server)) == NULL)
   {
					printf("Error on login 6 to server %s.\n",
aptr->server);
					exit(-1);
   }

   if ((o_dbproc2 = dbopen(login, aptr->server)) == NULL)
   {
					printf("Error on login 7 to server %s.\n",
aptr->server);
					exit(-1);
   }

   if ((o_dbproc3 = dbopen(login, aptr->server)) == NULL)
   {
					printf("Error on login 8 to server %s .\n",
aptr->server);
					exit(-1);
   }

}


//=========================================================
==============
//
// Function name: SQLErrHandler
//
//=========================================================
==============

int SQLErrHandler(SQLCONN *dbproc,
						int	severity,
						int	err,
						int	oserr,
						char	*dberrstr,
						char	*oserrstr)
{

				char msg[256];
				FILE *fp1;
				char timebuf[128];
				char datebuf[128];

				_strtime(timebuf);
				_strdate(datebuf);

				sprintf(msg, "%s %s : DBLibrary (%ld) %s\n",
datebuf, timebuf, err, dberrstr);
   printf("%s",msg);

				fp1 = fopen("logs\tpccldr.err","a");
				if (fp1 == NULL)
				{
					printf("Error in opening errorlog file.\n");
				}
				else
				{
					fprintf(fp1, msg);
					fclose(fp1);
				}

   if (oserr != DBNOERR)
   {
					sprintf(msg, "%s %s : OSError (%ld)
%s\n", datebuf, timebuf, oserr, oserrstr);
					printf("%s",msg);

					fp1 = fopen("logs\\tpccldr.err","a");
					if (fp1 == NULL)
					{
						printf("Error in opening errorlog
file.\n");
					}
					else
					{
						fprintf(fp1, msg);
						fclose(fp1);
					}
   }

				if ((dbproc == NULL) || (DBDEAD(dbproc)))
				{
					exit(-1);
				}

				return (INT_CANCEL);

}


//=========================================================
==============
//
// Function name: SQLMsgHandler
//
//=========================================================
==============

int SQLMsgHandler(SQLCONN   *dbproc,
						DBINT	msgno,
						int	msgstate,
						int	severity,
						char	*msgtext)
{
   char msg[256];
				FILE   *fp1;
				char timebuf[128];
				char datebuf[128];

   if ( (msgno == 5701) || (msgno == 2528) || (msgno == 5703) || (msgno ==
6006) )
				{
					return(INT_CONTINUE);
				}

				if (msgno == 0)
				{
					return(INT_CONTINUE);
				}
				else
				{
					_strtime(timebuf);
					_strdate(datebuf);

					sprintf(msg, "%s %s : SQLServer (%ld)
%s\n", datebuf, timebuf, msgno, msgtext);

					printf("%s",msg);

					fp1 = fopen("logs\\tpccldr.err","a");
					if (fp1 == NULL)
					{
						printf("Error in opening errorlog
file.\n");
					}
					else
					{
```

```
                        fprintf(fp1, msg);
                        fclose(fp1);
                    }

                    exit(-1);
                }

                return (INT_CANCEL);
}


//=======================================================
==============
//
// Function name: CurrentDate
//
//=======================================================
==============

void CurrentDate(char       *datetime)
{

                char timebuf[128];
                char datebuf[128];

                _strtime(timebuf);
                _strdate(datebuf);

                sprintf(datetime, "%s %s", datebuf, timebuf);

}


//=======================================================
==============
//
// Function name: BuildIndex
//
//=======================================================
==============

void BuildIndex(char        *index_script)
{
                char    cmd[256];

                printf("Starting index creation:
%s\n",index_script);

                sprintf(cmd, "isql -S%s -U%s -P%s -e -
i%s\\%s.sql >> logs\\%s.out",
                            aptr->server,
                            aptr->user,
                            aptr->password,
                            aptr->index_script_path,
                            index_script,
                            index_script);

                system(cmd);

                printf("Finished index creation:
%s\n",index_script);
}
```

UTIL.C

```
// TPC-C Benchmark Kit
//
// Module:  UTIL.C
// Author:  DamienL


// Includes
#include "tpcc.h"


//=======================================================
==============
//
// Function name: UtilSleep
//
//=======================================================
==============

void UtilSleep(long  delay)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilSleep()\n", (int) GetCurrentThreadId());
#endif

#ifdef DEBUG
    printf("[%ld]DBG: Sleeping for %ld seconds...\n", (int)
GetCurrentThreadId(), delay);
#endif

    Sleep(delay * 1000);

}


//=======================================================
==============
//
// Function name: UtilSleep
//
//=======================================================
==============

void UtilSleepMs(long  delay)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilSleepMs()\n", (int) GetCurrentThreadId());
#endif

#ifdef DEBUG
    printf("[%ld]DBG: Sleeping for %ld milliseconds...\n", (int)
GetCurrentThreadId(), delay);
#endif

    Sleep(delay);

}

//=======================================================
==============
//
// Function name: UtilPrintNewOrder
//
```

```
//=======================================================
==============
void UtilPrintNewOrder(NEW_ORDER_DATA *pNewOrder)
{
    int i;

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilPrintNewOrder()\n", (int)
GetCurrentThreadId());
#endif

                EnterCriticalSection(&ConsoleCritSec);

                printf("\n[%04ld]\tNewOrder Transaction\n\n",
(int) GetCurrentThreadId());

    printf("Warehouse: %ld\n"
                        "District: %ld\n"
                        "Date: %02ld/%02ld/%04ld
%02ld:%02ld:%02ld\n\n"
                        "Customer Number:  %ld\n"
                        "Customer Name: %s\n"
                        "Customer Credit: %s\n"
                        "Cusotmer Discount: %02.2f%%\n\n"
                        "Order Number: %ld\n"
                        "Warehouse Tax: %02.2f%%\n"
                        "District Tax: %02.2f%%\n\n"
                        "Number of Order Lines: %ld\n\n",
                            (int)    pNewOrder->w_id,
                            (int)    pNewOrder->d_id,
                            (char *) pNewOrder-
>o_entry_d.month,
                            (char *) pNewOrder-
>o_entry_d.day,
                            (char *) pNewOrder-
>o_entry_d.year,
                            (char *) pNewOrder-
>o_entry_d.hour,
                            (char *) pNewOrder-
>o_entry_d.minute,
                            (char *) pNewOrder-
>o_entry_d.second,
                            (int)    pNewOrder->c_id,
                            (char *) pNewOrder->c_last,
                            (char *) pNewOrder->c_credit,
                            (float)  pNewOrder->c_discount,
                            (int)    pNewOrder->o_id,
                            (float)  pNewOrder->w_tax,
                            (float)  pNewOrder->d_tax,
                            (int)    pNewOrder->o_ol_cnt);

                printf("Supp_W Item_Id Item Name
Qty Stock B/G Price    Amount   \n");
                printf("------ ------- -------------------------- --- ----- --- -
------- ---------\n");

    for (i=0;i < pNewOrder->o_ol_cnt;i++)
    {
                    printf("%04ld   %06ld  %24s   %02ld
%03ld   %1s  %8.2f %9.2f\n",
                    (int)    pNewOrder->Ol[i].ol_supply_w_id,
                    (int)    pNewOrder->Ol[i].ol_i_id,
                            (char *) pNewOrder-
>Ol[i].ol_i_name,
                    (int)    pNewOrder->Ol[i].ol_quantity,
                    (int)    pNewOrder->Ol[i].ol_stock,
                    (char *) pNewOrder-
>Ol[i].ol_brand_generic,
                                   (float)  pNewOrder->Ol[i].ol_i_price,
                                   (float)  pNewOrder->Ol[i].ol_amount);
   }

                              printf("\nTotal: $%05.2f\n\n",
                                        (float)  pNewOrder->total_amount);

                              printf("Execution Status: %s\n\n",
                                        (char *) pNewOrder-
>execution_status);

                              LeaveCriticalSection(&ConsoleCritSec);

}


//=======================================================
==============
//
// Function name: UtilPrintPayment
//
//=======================================================
==============

void UtilPrintPayment(PAYMENT_DATA *pPayment)
{

                              char    tmp_data[201];
   char    data_line_1[51];
                              char    data_line_2[51];
                              char    data_line_3[51];
                              char    data_line_4[51];

#ifdef DEBUG
   printf("[%ld]DBG: Entering UtilPrintPayment()\n", (int)
GetCurrentThreadId());
#endif

   EnterCriticalSection(&ConsoleCritSec);

                              printf("\n[%04ld]\tPayment Transaction\n\n", (in t)
GetCurrentThreadId());

   printf("Date: %02ld/%02ld/%04ld %02ld:%02ld:%02ld\n\n",
                                   (int)    pPayment->h_date.month,
                                        (int)    pPayment->h_date.day,
                                   (int)    pPayment->h_date.year,
                                        (int)    pPayment->h_date.hour,
                                        (int)    pPayment->h_date.minute,
                                        (int)    pPayment->h_date.second);

                              printf("Warehouse: %ld\n"
                                    "District: %ld\n\n",
                                        (int)    pPayment->w_id,
                                        (int)    pPayment->d_id);

                              printf("Warehouse Address Street 1: %s\n"
                                    "Warehouse Address Street 2: %s\n",
                                        (char *) pPayment->w_street_1,
                                        (char *) pPayment->w_street_2);

                              printf("Warehouse Address City: %s\n"
                                 "Warehouse Address State: %s\n"
                                 "Warehouse Address Zip: %s\n\n",
                                        (char *) pPayment->w_city,
                                        (char *) pPayment->w_state,
                                        (char *) pPayment->w_zip);
```

```
                              printf("District Address Street 1: %s\n"
                                    "District Address Street 2: %s\n",
                                        (char *) pPayment->d_street_1,
                                     (char *) pPayment->d_street_2);

                              printf("District Address City: %s\n"
                                 "District Address State: %s\n"
                                 "District Address Zip: %s\n\n",
                                     (char *) pPayment->d_city,
                                        (char *) pPayment->d_state,
                                        (char *) pPayment->d_zip);

                              printf("Customer Number: %ld\n"
                                    "Customer Warehouse: %ld\n"
                                    "Customer District: %ld\n",
                                        (int)    pPayment->c_id,
                                        (int)    pPayment->c_w_id,
                                        (int)    pPayment->c_d_id);

                              printf("Customer Name:   %s %s %s\n"
                                    "Customer Since:  %02ld-%02ld-
%04ld\n",
                                        (char *) pPayment->c_first,
                                        (char *) pPayment->c_middle,
                                        (char *) pPayment->c_last,
                                        (int)    pPayment->c_since.month,
                                        (int)    pPayment->c_since.day,
                                        (int)    pPayment->c_since.year);

                              printf("Customer Address Street 1: %s\n"
                                 "Customer Address Street 2: %s\n"
                                 "Customer Address City: %s\n"
                                 "Customer Address State: %s\n"
                                 "Customer Address Zip: %s\n"
                                    "Customer Phone Number: %s\n\n"
                                 "Customer Credit: %s\n"
                                 "Customer Discount: %02.2f%%\n",
                                        (char *) pPayment->c_street_1,
                                        (char *) pPayment->c_street_2,
                                        (char *) pPayment->c_city,
                                        (char *) pPayment->c_state,
                                        (char *) pPayment->c_zip,
                                        (char *) pPayment->c_phone,
                                        (char *) pPayment->c_credit,
                                        (double) pPayment->c_discount);

                              printf("Amount Paid: $%04.2f\n"
                                 "New Customer Balance: $%10.2f\n",
                                        (float)  pPayment->h_amount,
                                        (double) pPayment->c_balance);

   printf("Credit Limit: $%10.2f\n\n",
                                        (double) pPayment->c_credit_lim);

   if (strcmp(pPayment->c_data," ") != 0)
                              {
                                   strcpy(tmp_data, pPayment->c_data);
                                   strncpy(data_line_1, tmp_data, 50);
data_line_1[50] = '\0';
                                   strncpy(data_line_2, &tmp_data[50], 50);
data_line_2[50] = '\0';
                                   strncpy(data_line_3, &tmp_data[100], 50);
data_line_3[50] = '\0';
                                   strncpy(data_line_4, &tmp_data[150], 50);
data_line_4[50] = '\0';

                              }
                              else
```

```
                              {
                                   strcpy(data_line_1, " ");
strcpy(data_line_2, " ");
                                   strcpy(data_line_3, " ");
strcpy(data_line_4, " ");
                              }

                              printf("           ----------------------------- -------------
--------\n");
   printf("Customer Data: |%50s|\n", data_line_1);
                              printf("           |%50s|\n", data_line_2);
                              printf("           |%50s|\n", data_line_3);
                              printf("           |%50s|\n", data_line_4);
                              printf("           -----------------------------------------
--------\n\n");

                              printf("Execution Status: %s\n\n",
                                        (char *) pPayment-
>execution_status);

                              LeaveCriticalSection(&ConsoleCritSec);

}


//=======================================================
==============
//
// Function name: UtilPrintOrderStatus
//
//=======================================================
==============

void UtilPrintOrderStatus(ORDER_STATUS_DATA *pOrderStatus)
{
   int i;

#ifdef DEBUG
   printf("[%ld]DBG: Entering UtilPrintOrderStatus()\n", (int)
GetCurrentThreadId());
#endif

                              EnterCriticalSection(&ConsoleCritSec);

                              printf("\n[%04ld]\tOrder-Status Transaction\n\n",
(int) GetCurrentThreadId());

                              printf("Warehouse: %ld\n"
                                    "District: %ld\n\n",
                                        (int) pOrderStatus->w_id,
                                        (int) pOrderStatus->d_id);

                              printf("Customer Number: %ld\n"
                                    "Customer Name: %s %s %s\n\n",
                                        (int) pOrderStatus->c_id,
                                        (char *) pOrderStatus->c_first,
                                        (char *) pOrderStatus->c_middle,
                                        (char *) pOrderStatus->c_last);

                              printf("Customer Balance: $%5.2f\n\n",
                                        (double) pOrderStatus-
>c_balance);

                              printf("Order Number: %ld\n"
                                    "Entry Date: %02ld/%02ld/%04ld
%02ld:%02ld:%02ld\n"
                                    "Carrier Number: %ld\n\n"
                                    "Number of order lines: %ld\n\n",
                                        (int) pOrderStatus->o_id,
                                        (int) pOrderStatus-
>o_entry_d.month,
                                        (int) pOrderStatus->o_entry_d.day,
                                        (int) pOrderStatus->o_entry_d.year,
                                        (int) pOrderStatus->o_entry_d.hour,
                                        (int) pOrderStatus-
>o_entry_d.minute,
                                        (int) pOrderStatus-
>o_entry_d.second,
                                        (int) pOrderStatus->o_carrier_id,
                                        (int) pOrderStatus->o_ol_cnt);

    printf ("Supply-W    Item-Id    Delivery-Date    Qty   Amount    \n");
                            printf ("--------    -------    -------------    ---   ----------
\n");

    for (i=0;i < pOrderStatus->o_ol_cnt; i++)
    {
                                    printf("%04ld        %06ld
%02ld/%02ld/%04ld       %02ld     %9.2f\n",
                                            (int) pOrderStatus-
>OlOrderStatusData[i].ol_supply_w_id,
                                            (int) pOrderStatus-
>OlOrderStatusData[i].ol_i_id,
                                            (int) pOrderStatus-
>OlOrderStatusData[i].ol_delivery_d.month,
                                            (int) pOrderStatus-
>OlOrderStatusData[i].ol_delivery_d.day,
                                            (int) pOrderStatus-
>OlOrderStatusData[i].ol_delivery_d.year,
                                            (int) pOrderStatus-
>OlOrderStatusData[i].ol_quantity,
                                            (double) pOrderStatus-
>OlOrderStatusData[i].ol_amount);
    }

                            if (pOrderStatus->o_ol_cnt == 0)
                                    printf("\nNo Order-Status items.\n\n");

                            printf("\nExecution Status: %s\n\n",
                                        (char *) pOrderStatus-
>execution_status);

                            LeaveCriticalSection(&ConsoleCritSec);

}

//=========================================================
==============
//
// Function name: UtilPrintDelivery
//
//=========================================================
==============

void UtilPrintDelivery(DELIVERY_DATA *pQueuedDelivery)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilPrintDelivery()\n", (int)
GetCurrentThreadId());
#endif

                            EnterCriticalSection(&ConsoleCritSec);

                            printf("\n[%04ld]\tDelivery Transaction\n\n", (int)
GetCurrentThreadId());

    printf("Warehouse: %ld\n", (int) pQueuedDelivery->w_id);

                            printf("Carrier Number: %ld\n\n", (int)
pQueuedDelivery->o_carrier_id);

    printf("Execution Status: %s\n\n", (char *) pQueuedDelivery-
>execution_status);

                            LeaveCriticalSection(&ConsoleCritSec);

}

//=========================================================
==============
//
// Function name: UtilPrintStockLevel
//
//=========================================================
==============

void UtilPrintStockLevel(STOCK_LEVEL_DATA *pStockLevel)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilPrintStockLevel()\n", (int)
GetCurrentThreadId());
#endif

                            EnterCriticalSection(&ConsoleCritSec);

                            printf("\n[%04ld]\tStock-Level Transaction\n\n",
(int) GetCurrentThreadId());

                            printf("Warehouse: %ld\nDistrict: %ld\n",
                                        (int) pStockLevel->w_id,
                                        (int) pStockLevel->d_id);

                            printf("Stock Level Threshold: %ld\n\n", (int)
pStockLevel->thresh_hold);

                            printf("Low Stock Count: %ld\n\n", (int)
pStockLevel->low_stock);

                            printf("Execution Status: %s\n\n", (char *)
pStockLevel->execution_status);

                            LeaveCriticalSection(&ConsoleCritSec);
}

//=========================================================
==============
//
// Function name: UtilError
//
//=========================================================
==============
void UtilError(long threadid, char * header, char *msg)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilError()\n", (int) GetCurrentThreadId());
#endif

    printf("[%ld] %s: %s\n", (int) threadid, header, msg);
}

//=========================================================
==============
//
// Function name: UtilFatalError
//
//=========================================================
==============

void UtilFatalError(long threadid, char * header, char *msg)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilFatalError()\n", (int) GetCurrentThreadId());
#endif

    printf("[Thread: %ld]... %s: %s\n", (int) threadid, header, msg);
    exit(-1);
}

//=========================================================
==============
//
// Function name: UtilStrCpy
//
//=========================================================
============
void UtilStrCpy(char * pDest, char * pSrc, int n)
{

#ifdef DEBUG
    printf("[%ld]DBG: Entering UtilStrCpy()\n", (int) GetCurrentThreadId());
#endif

    strncpy(pDest, pSrc, n);
    pDest[n] = '\0';
}

#ifdef USE_CONMON
//=========================================================
==============
//
// Function name: WriteConsoleString
//
//=========================================================
============
void WriteConsoleString(HANDLE hConMon, char *str, short x, short y,
short color, BOOL pad)
{
                            COORD   dwWriteCoord = {0, 0};
                            DWORD   cCharsWritten;
                            LPVOID  dummy;
                            int     len, i;

#ifdef DEBUG
    printf("[%ld]DBG: Entering WriteConsoleString()\n", (int)
GetCurrentThreadId());
#endif

                            dwWriteCoord.X = x;
                            dwWriteCoord.Y = y;

                            if (pad)
                            {
```

```
					len = strlen(str);
					if (len < CON_LINE_SIZE)
					{
						for(i=1;i<CON_LINE_SIZE-len;i++)
						{
							strcat(str," ");
						}
					}
				}

				EnterCriticalSection(&ConsoleCritSec);

				switch (color)
   {
					case YELLOW:
						SetConsoleTextAttribute(hConMon,
							FOREGROUND_INTENSITY
| FOREGROUND_GREEN | FOREGROUND_RED |
BACKGROUND_BLUE);
					break;

					case RED:
						SetConsoleTextAttribute(hConMon,
							FOREGROUND_INTENSITY
| FOREGROUND_RED | BACKGROUND_BLUE);
					break;

					case GREEN:
						SetConsoleTextAttribute(hConMon,
							FOREGROUND_INTENSITY
| FOREGROUND_GREEN | BACKGROUND_BLUE);
						break;
   }

				SetConsoleCursorPosition(hConMon,
dwWriteCoord);
				WriteConsole(hConMon, str, strlen(str),
&cCharsWritten, dummy);

				LeaveCriticalSection(&ConsoleCritSec);

}
#endif


//=======================================================
==============
//
// Function name: AddDeliveryQueueNode
//
//=======================================================
==============

BOOL AddDeliveryQueueNode(DELIVERY_PTR node_to_add)
{

				DELIVERY_PTR	local_node;
#ifdef DEBUG
				DELIVERY_PTR	ptrtmp;
				short		i;
#endif

				EnterCriticalSection(&QueuedDeliveryCritSec);

				if ((local_node = malloc(sizeof(struct
delivery_node)) ) == NULL)
				{
						printf("ERROR:  problem allocating
memory for delivery queue.\n");
						exit(-1);
				}
				else
				{
						memcpy(local_node, node_to_add, sizeof
(struct delivery_node));

						if (queued_delivery_cnt == 0)
						{
							delivery_head = local_node;
							delivery_head->next_delivery =
NULL;
							delivery_tail = delivery_head;
						}
						else
						{
							local_node->next_delivery = NULL;
							delivery_tail->next_delivery =
local_node;
							delivery_tail = local_node;
						}
				}

				queued_delivery_cnt++;

#ifdef DEBUG
				i=0;
				printf("Add to delivery list:
%ld\n",queued_delivery_cnt);
				ptrtmp=delivery_head;
				while (ptrtmp != NULL)
				{
						i++;
						printf("%ld - w_id %ld - o_carrier_id %ld -
queue_time %d/%d/%d %d:%d:%d:%d\n",
								i, ptrtmp->w_id, ptrtmp-
>o_carrier_id,
								ptrtmp-
>queue_time.wMonth,
								ptrtmp->queue_time.wDay,
								ptrtmp->queue_time.wYear,
								ptrtmp->queue_time.wHour,
								ptrtmp-
>queue_time.wMinute,
								ptrtmp-
>queue_time.wSecond,
								ptrtmp-
>queue_time.wMilliseconds);

						ptrtmp=ptrtmp->next_delivery;
				}
#endif

				LeaveCriticalSection(&QueuedDeliveryCritSec);

   return TRUE;

}


//=======================================================
==============
//
// Function name: GetDeliveryQueueNode
//
//=======================================================
==============

BOOL GetDeliveryQueueNode(DELIVERY_PTR node_to_get)
{

				DELIVERY_PTR		local_node;
				BOOL			rc;
#ifdef DEBUG
				DELIVERY_PTR		ptrtmp;
				short			i;
#endif
				EnterCriticalSection(&QueuedDeliveryCritSec);

				if (queued_delivery_cnt == 0)
				{

#ifdef DEBUG
						printf("No delivery nodes found.\n");
#endif
						rc = FALSE;
				}
				else
				{

						memcpy(node_to_get, delivery_head,
sizeof(struct delivery_node));

						if (queued_delivery_cnt == 1)
						{
							free(delivery_head);
							delivery_head = NULL;
							queued_delivery_cnt = 0;
						}
						else
						{
							local_node = delivery_head;
							delivery_head = delivery_head-
>next_delivery;
							free(local_node);
							queued_delivery_cnt--;
						}

#ifdef DEBUG
						i=0;
						printf("Get from delivery list:
%ld\n",queued_delivery_cnt);
						ptrtmp=delivery_head;
						while (ptrtmp != NULL)
						{
							i++;
							printf("%ld - w_id %ld - o_carrier_id
%ld - queue_time %d/%d/%d %d:%d:%d:%d\n",
								i, ptrtmp->w_id,
ptrtmp->o_carrier_id,
								ptrtmp-
>queue_time.wMonth,
								ptrtmp-
>queue_time.wDay,
								ptrtmp-
>queue_time.wYear,
								ptrtmp-
>queue_time.wHour,
								ptrtmp-
>queue_time.wMinute,
								ptrtmp-
>queue_time.wSecond,
                                                            ptrtmp-
>queue_time.wMilliseconds);

                                             ptrtmp=ptrtmp->next_delivery;
                                      }
#endif

                                      rc = TRUE;

                              }

                              LeaveCriticalSection(&QueuedDeliveryCritSec);

   return rc;

}


//=======================================================
==============
//
// Function name: WriteDeliveryString
//
//=======================================================
==============

void WriteDeliveryString(char   buf[255])
{

                              DWORD   bytesWritten;
                              DWORD   retCode;

#ifdef DEBUG
   printf("[%ld]DBG: Entering UtilDeliveryMsg()\n", (int)
GetCurrentThreadId());
#endif

                              EnterCriticalSection(&WriteDeliveryCritSec);

   retCode = WriteFile (hDeliveryMonPipe, buf, PLEASE_WRITE,
                                               &bytesWritten, NULL);

                              LeaveCriticalSection(&WriteDeliveryCritSec);

}
```

Appendix C: Tunable Parameters

Microsoft Windows NT v4.0 Tunable Parameters:

System\CurrentControlSet\Control\SessionManager

```
Key Name:       SYSTEM\CurrentControlSet\Control\Session Manager
Class Name:     <NO CLASS>
Last Write Time:   1/15/97 - 2:38 PM
Value 0
  Name:         BootExecute
  Type:         REG_MULTI_SZ
  Data:         autocheck autochk *


Value 1
  Name:         CriticalSectionTimeout
  Type:         REG_DWORD
  Data:         0x278d00

Value 2
  Name:         EnableMCA
  Type:         REG_DWORD
  Data:         0x1

Value 3
  Name:         EnableMCE
  Type:         REG_DWORD
  Data:         0

Value 4
  Name:         ExcludeFromKnownDlls
  Type:         REG_MULTI_SZ
  Data:


Value 5
  Name:         GlobalFlag
  Type:         REG_DWORD
  Data:         0

Value 6
  Name:         HeapDeCommitFreeBlockThreshold
  Type:         REG_DWORD
  Data:         0

Value 7
  Name:         HeapDeCommitTotalFreeThreshold
  Type:         REG_DWORD
  Data:         0

Value 8
  Name:         HeapSegmentCommit
  Type:         REG_DWORD
  Data:         0

Value 9
  Name:         HeapSegmentReserve
  Type:         REG_DWORD
  Data:         0

Value 10
  Name:         LicensedProcessors
  Type:         REG_DWORD
  Data:         0x4

Value 11
  Name:         ObjectDirectories
  Type:         REG_MULTI_SZ
  Data:         \Windows
              \RPC Control


Value 12
  Name:         ProcessorControl
  Type:         REG_DWORD
  Data:         0x2

Value 13
  Name:         ProtectionMode
  Type:         REG_DWORD
  Data:         0

Value 14
  Name:         RegisteredProcessors
  Type:         REG_DWORD
  Data:         0x4

Value 15
  Name:         ResourceTimeoutCount
  Type:         REG_DWORD
  Data:         0x9e340


Key Name:       SYSTEM\CurrentControlSet\Control\Session
Manager\DOS Devices
Class Name:     <NO CLASS>
Last Write Time:   7/25/96 - 11:07 AM
Value 0
  Name:         AUX
  Type:         REG_SZ
  Data:         \DosDevices\COM1

Value 1
  Name:         MAILSLOT
  Type:         REG_SZ
  Data:         \Device\MailSlot

Value 2
  Name:         NUL
  Type:         REG_SZ
  Data:         \Device\Null

Value 3
  Name:         PIPE
  Type:         REG_SZ
  Data:         \Device\NamedPipe

Value 4
  Name:         PRN
  Type:         REG_SZ
  Data:         \DosDevices\LPT1

Value 5
  Name:         UNC
  Type:         REG_SZ
  Data:         \Device\Mup

Key Name:       SYSTEM\CurrentControlSet\Control\Session
Manager\Environment
Class Name:     <NO CLASS>
Last Write Time:   3/3/97 - 4:50 PM
Value 0
  Name:         ComSpec
  Type:         REG_EXPAND_SZ
  Data:         %SystemRoot%\system32\cmd.exe

Value 1
  Name:         NUMBER_OF_PROCESSORS
  Type:         REG_SZ
  Data:         2

Value 2
  Name:         OS
  Type:         REG_SZ
  Data:         Windows_NT

Value 3
  Name:         Os2LibPath
  Type:         REG_EXPAND_SZ
  Data:         %SystemRoot%\system32\os2\dll;

Value 4
  Name:         Path
  Type:         REG_EXPAND_SZ
  Data:         %SystemRoot%\system32;%SystemRoot%;;C:\MSSQL\BINN

Value 5
  Name:         PROCESSOR_ARCHITECTURE
  Type:         REG_SZ
  Data:         x86

Value 6
  Name:         PROCESSOR_IDENTIFIER
  Type:         REG_SZ
  Data:         x86 Family 6 Model 1 Stepping 7, GenuineIntel

Value 7
  Name:         PROCESSOR_LEVEL
  Type:         REG_SZ
  Data:         6

Value 8
  Name:         PROCESSOR_REVISION
  Type:         REG_SZ
  Data:         0107

Value 9
  Name:         windir
  Type:         REG_EXPAND_SZ
  Data:         %SystemRoot%


Key Name:       SYSTEM\CurrentControlSet\Control\Session
Manager\Executive
Class Name:     <NO CLASS>
Last Write Time:   12/4/96 - 2:04 PM
Value 0
  Name:         AdditionalCriticalWorkerThreads
  Type:         REG_DWORD
  Data:         0

Value 1
  Name:         AdditionalDelayedWorkerThreads
  Type:         REG_DWORD
  Data:         0
```

```
Value 2
 Name:          PriorityQuantumMatrix
 Type:          REG_BINARY
 Data:
00000000   66 3e 63 4e 00 00 00 00 - 1e e2 bb 01            f>cN........


Key Name:         SYSTEM\CurrentControlSet\Control\Session
Manager\FileRenameOperations
Class Name:       <NO CLASS>
Last Write Time:  7/25/96 - 11:07 AM

Key Name:         SYSTEM\CurrentControlSet\Control\Session
Manager\KnownDLLs
Class Name:       <NO CLASS>
Last Write Time:  7/25/96 - 11:07 AM
Value 0
 Name:          advapi32
 Type:          REG_SZ
 Data:          advapi32.dll

Value 1
 Name:          comdlg32
 Type:          REG_SZ
 Data:          comdlg32.dll

Value 2
 Name:          crtdll
 Type:          REG_SZ
 Data:          crtdll.dll

Value 3
 Name:          DllDirectory
 Type:          REG_EXPAND_SZ
 Data:          %SystemRoot%\system32

Value 4
 Name:          gdi32
 Type:          REG_SZ
 Data:          gdi32.dll

Value 5
 Name:          kernel32
 Type:          REG_SZ
 Data:          kernel32.dll

Value 6
 Name:          lz32
 Type:          REG_SZ
 Data:          lz32.dll

Value 7
 Name:          ole32
 Type:          REG_SZ
 Data:          ole32.dll

Value 8
 Name:          oleaut32
 Type:          REG_SZ
 Data:          oleaut32.dll

Value 9
 Name:          olecli32
 Type:          REG_SZ
 Data:          olecli32.dll

Value 10
 Name:          olecnv32
 Type:          REG_SZ
 Data:          olecnv32.dll

Value 11
 Name:          olesvr32
 Type:          REG_SZ
 Data:          olesvr32.dll

Value 12
 Name:          olethk32
 Type:          REG_SZ
 Data:          olethk32.dll

Value 13
 Name:          rpcrt4
 Type:          REG_SZ
 Data:          rpcrt4.dll

Value 14
 Name:          shell32
 Type:          REG_SZ
 Data:          shell32.dll

Value 15
 Name:          user32
 Type:          REG_SZ
 Data:          user32.dll

Value 16
 Name:          version
 Type:          REG_SZ
 Data:          version.dll


Key Name:         SYSTEM\CurrentControlSet\Control\Session
Manager\Memory Management
Class Name:       <NO CLASS>
Last Write Time:  12/30/96 - 2:25 PM
Value 0
 Name:          ClearPageFileAtShutdown
 Type:          REG_DWORD
 Data:          0

Value 1
 Name:          DisablePagingExecutive
 Type:          REG_DWORD
 Data:          0

Value 2
 Name:          IoPageLockLimit
 Type:          REG_DWORD
 Data:          0

Value 3
 Name:          LargeSystemCache
 Type:          REG_DWORD
 Data:          0

Value 4
 Name:          NonPagedPoolQuota
 Type:          REG_DWORD
 Data:          0

Value 5
 Name:          NonPagedPoolSize
 Type:          REG_DWORD
 Data:          0

Value 6
 Name:          PagedPoolQuota
 Type:          REG_DWORD
 Data:          0

Value 7
 Name:          PagedPoolSize
 Type:          REG_DWORD
 Data:          0

Value 8
 Name:          PagingFiles
 Type:          REG_MULTI_SZ
 Data:          C:\pagefile.sys 400 400
              N:\pagefile.sys 620 620


Value 9
 Name:          SecondLevelDataCache
 Type:          REG_DWORD
 Data:          0

Value 10
 Name:          SystemPages
 Type:          REG_DWORD
 Data:          0


Key Name:         SYSTEM\CurrentControlSet\Control\Session
Manager\SubSystems
Class Name:       <NO CLASS>
Last Write Time:  7/25/96 - 11:07 AM
Value 0
 Name:          Debug
 Type:          REG_EXPAND_SZ
 Data:

Value 1
 Name:          Kmode
 Type:          REG_EXPAND_SZ
 Data:          %SystemRoot%\system32\win32k.sys

Value 2
 Name:          Optional
 Type:          REG_MULTI_SZ
 Data:          Os2
              Posix


Value 3
 Name:          Os2
 Type:          REG_EXPAND_SZ
 Data:          %SystemRoot%\system32\os2ss.exe

Value 4
 Name:          Posix
 Type:          REG_EXPAND_SZ
 Data:          %SystemRoot%\system32\psxss.exe

Value 5
 Name:          Required
 Type:          REG_MULTI_SZ
 Data:          Debug
              Windows


Value 6
```

```
 Name:          Windows
 Type:          REG_EXPAND_SZ
 Data:          %SystemRoot%\system32\csrss.exe
ObjectDirectory=\Windows SharedSection=1024,3072 Windows=On
SubSystemType=Windows ServerDll=basesrv,1
ServerDll=winsrv:UserServerDllInitialization,3
ServerDll=winsrv:ConServerDllInitialization,2 ProfileControl=Off
MaxRequestThreads=16
```

CurrentControlSet\Services\InetInfo\Parameters

```
Key Name:       SYSTEM\CurrentControlSet\Services\InetInfo
Class Name:     <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM

Key Name:
SYSTEM\CurrentControlSet\Services\InetInfo\Parameters
Class Name:     <NO CLASS>
Last Write Time:   12/16/96 - 4:28 PM
Value 0
 Name:          BandwidthLevel
 Type:          REG_DWORD
 Data:          0xffffffff

Value 1
 Name:          ListenBackLog
 Type:          REG_DWORD
 Data:          0x19


Key Name:
SYSTEM\CurrentControlSet\Services\InetInfo\Parameters\Filter
Class Name:     <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM
Value 0
 Name:          FilterType
 Type:          REG_DWORD
 Data:          0

Value 1
 Name:          NumDenySites
 Type:          REG_DWORD
 Data:          0

Value 2
 Name:          NumGrantSites
 Type:          REG_DWORD
 Data:          0


Key Name:
SYSTEM\CurrentControlSet\Services\InetInfo\Parameters\MimeMap
Class Name:     <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM
Value 0
 Name:          application/envoy,evy,,5
 Type:          REG_SZ
 Data:

Value 1
 Name:          application/mac-binhex40,hqx,,4
 Type:          REG_SZ
 Data:

Value 2
 Name:          application/msword,doc,,5
 Type:          REG_SZ
 Data:

Value 3
 Name:          application/msword,dot,,5
 Type:          REG_SZ
 Data:

Value 4
 Name:          application/octet-stream,*,,5
 Type:          REG_SZ
 Data:

Value 5
 Name:          application/octet-stream,bin,,5
 Type:          REG_SZ
 Data:

Value 6
 Name:          application/octet-stream,exe,,5
 Type:          REG_SZ
 Data:

Value 7
 Name:          application/oda,oda,,5
 Type:          REG_SZ
 Data:

Value 8
 Name:          application/pdf,pdf,,5
 Type:          REG_SZ
 Data:

Value 9
 Name:          application/postscript,ai,,5
 Type:          REG_SZ
 Data:

Value 10
 Name:          application/postscript,eps,,5
 Type:          REG_SZ
 Data:

Value 11
 Name:          application/postscript,ps,,5
 Type:          REG_SZ
 Data:

Value 12
 Name:          application/rtf,rtf,,5
 Type:          REG_SZ
 Data:

Value 13
 Name:          application/winhlp,hlp,,5
 Type:          REG_SZ
 Data:

Value 14
 Name:          application/x-bcpio,bcpio,,5
 Type:          REG_SZ
 Data:

Value 15
 Name:          application/x-cpio,cpio,,5
 Type:          REG_SZ
 Data:

Value 16
 Name:          application/x-csh,csh,,5
 Type:          REG_SZ
 Data:

Value 17
 Name:          application/x-director,dcr,,5
 Type:          REG_SZ
 Data:

Value 18
 Name:          application/x-director,dir,,5
 Type:          REG_SZ
 Data:

Value 19
 Name:          application/x-director,dxr,,5
 Type:          REG_SZ
 Data:

Value 20
 Name:          application/x-dvi,dvi,,5
 Type:          REG_SZ
 Data:

Value 21
 Name:          application/x-gtar,gtar,,9
 Type:          REG_SZ
 Data:

Value 22
 Name:          application/x-hdf,hdf,,5
 Type:          REG_SZ
 Data:

Value 23
 Name:          application/x-latex,latex,,5
 Type:       REG_SZ
 Data:

Value 24
 Name:        application/x-msaccess,mdb,,5
 Type:       REG_SZ
 Data:

Value 25
 Name:        application/x-mscardfile,crd,,5
 Type:       REG_SZ
 Data:

Value 26
 Name:        application/x-msclip,clp,,5
 Type:       REG_SZ
 Data:

Value 27
 Name:        application/x-msexcel,xla,,5
 Type:       REG_SZ
 Data:

Value 28
 Name:        application/x-msexcel,xlc,,5
 Type:       REG_SZ
 Data:

Value 29
 Name:        application/x-msexcel,xlm,,5
 Type:       REG_SZ
 Data:

Value 30
 Name:        application/x-msexcel,xls,,5
 Type:       REG_SZ
 Data:

Value 31
 Name:        application/x-msexcel,xlt,,5
 Type:       REG_SZ
 Data:

Value 32
 Name:        application/x-msexcel,xlw,,5
 Type:       REG_SZ
 Data:

Value 33
 Name:        application/x-msmediaview,m13,,5
 Type:       REG_SZ
 Data:

Value 34
 Name:        application/x-msmediaview,m14,,5
 Type:       REG_SZ
 Data:

Value 35
 Name:        application/x-msmetafile,wmf,,5
 Type:       REG_SZ
 Data:

Value 36
 Name:        application/x-msmoney,mny,,5
 Type:       REG_SZ
 Data:

Value 37
 Name:        application/x-mspowerpoint,ppt,,5
 Type:       REG_SZ
 Data:

Value 38
 Name:        application/x-msproject,mpp,,5
 Type:       REG_SZ
 Data:

Value 39
 Name:        application/x-mspublisher,pub,,5
 Type:       REG_SZ
 Data:

Value 40
 Name:        application/x-msterminal,trm,,5
 Type:       REG_SZ
 Data:

Value 41
 Name:        application/x-msworks,wks,,5
 Type:       REG_SZ
 Data:

Value 42
 Name:        application/x-mswrite,wri,,5
 Type:       REG_SZ
 Data:

Value 43
 Name:        application/x-netcdf,cdf,,5
 Type:       REG_SZ
 Data:

Value 44
 Name:        application/x-netcdf,nc,,5
 Type:       REG_SZ
 Data:

Value 45
 Name:        application/x-perfmon,pma,,5
 Type:       REG_SZ
 Data:

Value 46
 Name:        application/x-perfmon,pmc,,5
 Type:       REG_SZ
 Data:

Value 47
 Name:        application/x-perfmon,pml,,5
 Type:       REG_SZ
 Data:

Value 48
 Name:        application/x-perfmon,pmr,,5
 Type:       REG_SZ
 Data:

Value 49
 Name:        application/x-perfmon,pmw,,5
 Type:       REG_SZ
 Data:

Value 50
 Name:        application/x-sh,sh,,5
 Type:       REG_SZ
 Data:

Value 51
 Name:        application/x-shar,shar,,5
 Type:       REG_SZ
 Data:

Value 52
 Name:        application/x-sv4cpio,sv4cpio,,5
 Type:       REG_SZ
 Data:

Value 53
 Name:        application/x-sv4crc,sv4crc,,5
 Type:       REG_SZ
 Data:

Value 54
 Name:        application/x-tar,tar,,5
 Type:       REG_SZ
 Data:

Value 55
 Name:        application/x-tcl,tcl,,5
 Type:       REG_SZ
 Data:

Value 56
 Name:        application/x-tex,tex,,5
 Type:       REG_SZ
 Data:

Value 57
 Name:        application/x-texinfo,texi,,5
 Type:       REG_SZ
 Data:

Value 58
```

```
 Name:      application/x-texinfo,texinfo,,5
 Type:      REG_SZ
 Data:

Value 59
 Name:      application/x-troff,roff,,5
 Type:      REG_SZ
 Data:

Value 60
 Name:      application/x-troff,t,,5
 Type:      REG_SZ
 Data:

Value 61
 Name:      application/x-troff,tr,,5
 Type:      REG_SZ
 Data:

Value 62
 Name:      application/x-troff-man,man,,5
 Type:      REG_SZ
 Data:

Value 63
 Name:      application/x-troff-me,me,,5
 Type:      REG_SZ
 Data:

Value 64
 Name:      application/x-troff-ms,ms,,5
 Type:      REG_SZ
 Data:

Value 65
 Name:      application/x-ustar,ustar,,5
 Type:      REG_SZ
 Data:

Value 66
 Name:      application/x-wais-source,src,,7
 Type:      REG_SZ
 Data:

Value 67
 Name:      application/zip,zip,,9
 Type:      REG_SZ
 Data:

Value 68
 Name:      audio/basic,au,,<
 Type:      REG_SZ
 Data:

Value 69
 Name:      audio/basic,snd,,<
 Type:      REG_SZ
 Data:

Value 70
 Name:      audio/x-aiff,aif,,<
 Type:      REG_SZ
 Data:

Value 71
 Name:      audio/x-aiff,aifc,,<
 Type:      REG_SZ
 Data:

Value 72
 Name:      audio/x-aiff,aiff,,<
 Type:      REG_SZ
 Data:

Value 73
 Name:      audio/x-pn-realaudio,ram,,<
 Type:      REG_SZ
 Data:

Value 74
 Name:      audio/x-wav,wav,,<
 Type:      REG_SZ
 Data:

Value 75
 Name:      image/bmp,bmp,,:
 Type:      REG_SZ
 Data:

Value 76
 Name:      image/cis-cod,cod,,5
 Type:      REG_SZ
 Data:

Value 77
 Name:      image/gif,gif,,g
 Type:      REG_SZ
 Data:

Value 78
 Name:      image/ief,ief,,:
 Type:      REG_SZ
 Data:

Value 79
 Name:      image/jpeg,jpe,,:
 Type:      REG_SZ
 Data:

Value 80
 Name:      image/jpeg,jpeg,,:
 Type:      REG_SZ
 Data:

Value 81
 Name:      image/jpeg,jpg,,:
 Type:      REG_SZ
 Data:

Value 82
 Name:      image/tiff,tif,,:
 Type:      REG_SZ
 Data:

Value 83
 Name:      image/tiff,tiff,,:
 Type:      REG_SZ
 Data:

Value 84
 Name:      image/x-cmu-raster,ras,,:
 Type:      REG_SZ
 Data:

Value 85
 Name:      image/x-cmx,cmx,,5
 Type:      REG_SZ
 Data:

Value 86
 Name:      image/x-portable-anymap,pnm,,:
 Type:      REG_SZ
 Data:

Value 87
 Name:      image/x-portable-bitmap,pbm,,:
 Type:      REG_SZ
 Data:

Value 88
 Name:      image/x-portable-graymap,pgm,,:
 Type:      REG_SZ
 Data:

Value 89
 Name:      image/x-portable-pixmap,ppm,,:
 Type:      REG_SZ
 Data:

Value 90
 Name:      image/x-rgb,rgb,,:
 Type:      REG_SZ
 Data:

Value 91
 Name:      image/x-xbitmap,xbm,,:
 Type:      REG_SZ
 Data:

Value 92
 Name:      image/x-xpixmap,xpm,,:
 Type:      REG_SZ
 Data:
```

```
Value 93
 Name:      image/x-xwindowdump,xwd,,:
 Type:     REG_SZ
 Data:

Value 94
 Name:      text/html,htm,,h
 Type:     REG_SZ
 Data:

Value 95
 Name:      text/html,html,,h
 Type:     REG_SZ
 Data:

Value 96
 Name:      text/html,stm,,h
 Type:     REG_SZ
 Data:

Value 97
 Name:      text/plain,bas,,0
 Type:     REG_SZ
 Data:

Value 98
 Name:      text/plain,c,,0
 Type:     REG_SZ
 Data:

Value 99
 Name:      text/plain,h,,0
 Type:     REG_SZ
 Data:

Value 100
 Name:      text/plain,txt,,0
 Type:     REG_SZ
 Data:

Value 101
 Name:      text/richtext,rtx,,0
 Type:     REG_SZ
 Data:

Value 102
 Name:      text/tab-separated-values,tsv,,0
 Type:     REG_SZ
 Data:

Value 103
 Name:      text/x-setext,etx,,0
 Type:     REG_SZ
 Data:

Value 104
 Name:      video/mpeg,mpe,,;
 Type:     REG_SZ
 Data:

Value 105
 Name:      video/mpeg,mpeg,,;
 Type:     REG_SZ
 Data:

Value 106
 Name:      video/mpeg,mpg,,;
 Type:     REG_SZ
 Data:

Value 107
 Name:      video/quicktime,mov,,;
 Type:     REG_SZ
 Data:

Value 108
 Name:      video/quicktime,qt,,;
 Type:     REG_SZ
 Data:

Value 109
 Name:      video/x-msvideo,avi,,<
 Type:     REG_SZ
 Data:

Value 110
 Name:      video/x-sgi-movie,movie,,<
 Type:     REG_SZ
 Data:

Value 111
 Name:      x-world/x-vrml,flr,,5
 Type:     REG_SZ
 Data:

Value 112
 Name:      x-world/x-vrml,wrl,,5
 Type:     REG_SZ
 Data:

Value 113
 Name:      x-world/x-vrml,wrz,,5
 Type:     REG_SZ
 Data:

Value 114
 Name:      x-world/x-vrml,xaf,,5
 Type:     REG_SZ
 Data:

Value 115
 Name:      x-world/x-vrml,xof,,5
 Type:     REG_SZ
 Data:

Key Name:
SYSTEM\CurrentControlSet\Services\InetInfo\Performance
Class Name:      <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM
Value 0
 Name:      Close
 Type:     REG_SZ
 Data:     CloseINFOPerformanceData

Value 1
 Name:      Collect
 Type:     REG_SZ
 Data:     CollectINFOPerformanceData

Value 2
 Name:      First Counter
 Type:     REG_DWORD
 Data:     0x738

Value 3
 Name:      First Help
 Type:     REG_DWORD
 Data:     0x739

Value 4
 Name:      Last Counter
 Type:     REG_DWORD
 Data:     0x756

Value 5
 Name:      Last Help
 Type:     REG_DWORD
 Data:     0x757

Value 6
 Name:      Library
 Type:     REG_SZ
 Data:     infoctrs.DLL

Value 7
 Name:      Open
 Type:     REG_SZ
 Data:     OpenINFOPerformanceData
```

CurrentControlSet\Services\W3SVC

```
Key Name:        SYSTEM\CurrentControlSet\Services\W3SVC
Class Name:      <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM
Value 0
 Name:      DependOnGroup
 Type:     REG_MULTI_SZ
 Data:

Value 1
 Name:      DependOnService
 Type:       REG_MULTI_SZ
 Data:       RPCSS
            NTLMSSP


Value 2
 Name:        DisplayName
 Type:       REG_SZ
 Data:       World Wide Web Publishing Service

Value 3
 Name:        ErrorControl
 Type:       REG_DWORD
 Data:       0

Value 4
 Name:        ImagePath
 Type:       REG_EXPAND_SZ
 Data:       C:\WINNT\System32\inetsrv\inetinfo.exe

Value 5
 Name:        ObjectName
 Type:       REG_SZ
 Data:       LocalSystem

Value 6
 Name:        Start
 Type:       REG_DWORD
 Data:       0x2

Value 7
 Name:        Type
 Type:       REG_DWORD
 Data:       0x20


Key Name:        SYSTEM\CurrentControlSet\Services\W3SVC\Enum
Class Name:      <NO CLASS>
Last Write Time:   3/3/97 - 2:16 AM
Value 0
 Name:        0
 Type:       REG_SZ
 Data:       Root\LEGACY_W3SVC\0000

Value 1
 Name:        Count
 Type:       REG_DWORD
 Data:       0x1

Value 2
 Name:        NextInstance
 Type:       REG_DWORD
 Data:       0x1


Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Parameters
Class Name:      <NO CLASS>
Last Write Time:   2/11/97 - 2:32 PM
Value 0
 Name:        AccessDeniedMessage
 Type:       REG_SZ
 Data:       Error: Access is Denied.

Value 1
 Name:        AdminEmail
 Type:       REG_SZ
 Data:       Admin@corp.com

Value 2
 Name:        AdminName
 Type:       REG_SZ
 Data:       Administrator

Value 3
 Name:        AnonymousUserName
 Type:       REG_SZ
 Data:       Administrator

Value 4
 Name:        Authorization
 Type:       REG_DWORD
 Data:       0x5

Value 5
 Name:        CacheExtensions
 Type:       REG_DWORD
 Data:       0x1

Value 6
 Name:        CheckForWAISDB
 Type:       REG_DWORD
 Data:       0

Value 7
 Name:        ConnectionTimeOut
 Type:       REG_DWORD
 Data:       0x4e20

Value 8
 Name:        DebugFlags
 Type:       REG_DWORD
 Data:       0x8

Value 9
 Name:        Default Load File
 Type:       REG_SZ
 Data:       Default.htm

Value 10
 Name:        Dir Browse Control
 Type:       REG_DWORD
 Data:       0x4000001e

Value 11
 Name:        Filter DLLs
 Type:       REG_SZ
 Data:       C:\WINNT\System32\inetsrv\sspifilt.dll

Value 12
 Name:        GlobalExpire
 Type:       REG_DWORD
 Data:       0xffffffff

Value 13
 Name:        InstallPath
 Type:       REG_SZ
 Data:       C:\WINNT\System32\inetsrv

Value 14
 Name:        LogFileDirectory
 Type:       REG_EXPAND_SZ
 Data:       %SystemRoot%\System32\LogFiles

Value 15
 Name:        LogFileFormat
 Type:       REG_DWORD
 Data:       0

Value 16
 Name:        LogFilePeriod
 Type:       REG_DWORD
 Data:       0x1

Value 17
 Name:        LogFileTruncateSize
 Type:       REG_DWORD
 Data:       0x1388000

Value 18
 Name:        LogSqlDataSource
 Type:       REG_SZ
 Data:       HTTPLOG

Value 19
 Name:        LogSqlPassword
 Type:       REG_SZ
 Data:       sqllog

Value 20
 Name:        LogSqlTableName
 Type:       REG_SZ
 Data:       Internetlog

Value 21
 Name:        LogSqlUserName
 Type:       REG_SZ
 Data:       InternetAdmin

Value 22
 Name:        LogType
 Type:       REG_DWORD
 Data:       0
```

```
Value 23
  Name:       MajorVersion
  Type:       REG_DWORD
  Data:       0x2

Value 24
  Name:       MaxConnections
  Type:       REG_DWORD
  Data:       0x186a0

Value 25
  Name:       MinorVersion
  Type:       REG_DWORD
  Data:       0

Value 26
  Name:       NTAuthenticationProviders
  Type:       REG_SZ
  Data:       NTLM

Value 27
  Name:       ScriptTimeout
  Type:       REG_DWORD
  Data:       0x384

Value 28
  Name:       SecurePort
  Type:       REG_DWORD
  Data:       0x1bb

Value 29
  Name:       ServerComment
  Type:       REG_SZ
  Data:

Value 30
  Name:       ServerSideIncludesEnabled
  Type:       REG_DWORD
  Data:       0x1

Value 31
  Name:       ServerSideIncludesExtension
  Type:       REG_SZ
  Data:       .stm


Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Parameters\Deny IP List
Class Name:    <NO CLASS>
Last Write Time:   12/16/96 - 4:28 PM

Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Parameters\Grant IP List
Class Name:    <NO CLASS>
Last Write Time:   12/16/96 - 4:28 PM

Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Parameters\Script Map
Class Name:    <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM
Value 0
  Name:       .idc
  Type:       REG_SZ
  Data:       C:\WINNT\System32\inetsrv\httpodbc.dll


Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Parameters\Virtual Roots
Class Name:    <NO CLASS>
Last Write Time:   12/16/96 - 4:28 PM
Value 0
  Name:       /,
  Type:       REG_SZ
  Data:       C:\InetPub\wwwroot,,1

Value 1
  Name:       /iisadmin,
  Type:       REG_SZ
  Data:       C:\WINNT\System32\inetsrv\iisadmin,,1

Value 2
  Name:       /Scripts,
  Type:       REG_SZ
  Data:       C:\InetPub\scripts,,5


Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Performance
Class Name:    <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM
Value 0
  Name:       Close
  Type:       REG_SZ
  Data:       CloseW3PerformanceData

Value 1
  Name:       Collect
  Type:       REG_SZ
  Data:       CollectW3PerformanceData

Value 2
  Name:       First Counter
  Type:       REG_DWORD
  Data:       0x758

Value 3
  Name:       First Help
  Type:       REG_DWORD
  Data:       0x759

Value 4
  Name:       Last Counter
  Type:       REG_DWORD
  Data:       0x790

Value 5
  Name:       Last Help
  Type:       REG_DWORD
  Data:       0x791

Value 6
  Name:       Library
  Type:       REG_SZ
  Data:       w3ctrs.DLL

Value 7
  Name:       Open
  Type:       REG_SZ
  Data:       OpenW3PerformanceData


Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\Security
Class Name:    <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM
Value 0
  Name:       Security
  Type:       REG_BINARY
  Data:
00000000   01 00 14 80 c0 00 00 00 - cc 00 00 00 14 00 00 00
................
00000010   34 00 00 00 02 00 20 00 - 01 00 00 00 02 80 18 00  4.....
.........
00000020   ff 01 0f 00 01 01 00 00 - 00 00 00 01 00 00 00 00
................
00000030   20 02 00 00 02 00 8c 00 - 05 00 00 00 00 00 18 00
...............
00000040   8d 01 02 00 01 01 00 00 - 00 00 00 01 00 00 00 00
................
00000050   ff ff ff ff 00 00 1c 00 - fd 01 02 00 01 02 00 00  ................
00000060   00 00 00 05 20 00 00 00 - 23 02 00 00 98 97 14 00  ....
...#.......
00000070   00 00 1c 00 ff 01 0f 00 - 01 02 00 00 00 00 00 05  ................
00000080   20 00 00 00 20 02 00 00 - 98 97 14 00 00 00 1c 00   ...
...........
00000090   ff 01 0f 00 01 02 00 00 - 00 00 00 05 20 00 00 00  ...........
...
000000a0   25 02 00 00 98 97 14 00 - 00 00 18 00 fd 01 02 00
%...............
000000b0   01 01 00 00 00 00 00 05 - 12 00 00 00 25 02 00 00
............%...
000000c0   01 01 00 00 00 00 00 05 - 12 00 00 00 01 01 00 00
................
000000d0   00 00 00 05 12 00 00 00 -                          ........


Key Name:
SYSTEM\CurrentControlSet\Services\W3SVC\W3SAMP
Class Name:    <NO CLASS>
Last Write Time:   12/16/96 - 9:21 AM
```

SOFTWARE\MICROSOFT\

MSSQLServer

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer]

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\Client]

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\Client\DB-
Lib]
"AutoAnsiToOem"="ON"
"UseIntlSettings"="ON"

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\MSSQLS
erver]
"ResourceMgrID"="{F72EEB70-67F5-11D0-8D97-00A0C92CA374}"
"Tapeloadwaittime"=dword:ffffffff
"LoginMode"=dword:00000000
"DefaultLogin"="guest"
"DefaultDomain"="ARGUS3"
"AuditLevel"=dword:00000000
"Map_"="\\"
"Map#"="-"
"Map$"=" "
"SetHostname"=dword:00000000
"ListenOn"=hex(7):53,53,4e,4d,50,4e,36,30,2c,5c,5c,2e,5c,70,69,70,65,5c,7
3,71,\
  6c,5c,71,75,65,72,79,00,53,53,4d,53,53,4f,36,30,2c,31,34,33,33,00,00

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\MSSQLS
erver\CurrentVersion]
"RegisteredOwner"="ingr"
"SerialNumber"=dword:81af0040
"CurrentVersion"="6.50.233"
"RegisteredOrganization"="ingr"
"RegisteredProductID"=""
"SoftwareType"="System"

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\MSSQLS
erver\Parameters]
"SQLArg0"="-dC:\\MSSQL\\DATA\\MASTER.DAT"
"SQLArg1"="-eC:\\MSSQL\\LOG\\ERRORLOG"

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\Replicatio
n]
"WorkingDirectory"="C:\\MSSQL\\REPLDATA"
"DistributionDB"=""

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\Setup]
"SQLPath"="C:\\MSSQL"
"CRC"="130875654"
"SetupStatus"="Installed"

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\SQL
Interface]

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\SQL
Interface\Graph Control]

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\SQL
Service Manager]
"Action Verify"=dword:00000000
"Services"=hex(7):4d,53,53,51,4c,53,65,72,76,65,72,00,53,51,4c,45,78,65,6
3,75,\
  74,69,76,65,00,4d,53,44,54,43,00,00
"DefaultSvc"="MSSQLServer"
"Remote"=dword:00000001
"Background Interval"=dword:00000005
"Foreground Interval"=dword:00000002
"WindowDimensions"="0,262,193,275,214"

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\SQLExec
utive]
"CmdExecAccount"=hex:56,8a,72,57,66,5f,12,62,dd,de,58,bb,ff,20,26,b7
"NonAlertableErrors"="1204,4002"
"TaskHistoryMaxRows"=dword:00000064
"RestartSQLServer"=dword:00000001
"RestartSQLServerInterval"=dword:00000005
"SyshistoryLimitRows"=dword:00000001
"SyshistoryMaxRows"=dword:000003e8
"MailAutoStart"=dword:00000001
"ServerHost"=""

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\MSSQLServer\SQLExec
utive\Subsystems]
"CmdExec"="C:\\MSSQL\\BINN\\CMDEXEC.DLL,CmdExecStart,CmdEvent,
CmdExecStop,10"
"Sync"="C:\\MSSQL\\BINN\\SQLREPL.DLL,sync_start,sync_event,sync_sto
p,100"
"LogReader"="C:\\MSSQL\\BINN\\SQLREPL.DLL,logreader_start,logreader
_event,logreader_stop,25"
"Distribution"="C:\\MSSQL\\BINN\\SQLREPL.DLL,distribution_start,distributi
on_event,distribution_stop,100"
```

Microsoft SQL Server 6.5 Tunable Parameters

```
name                         minimum     maximum    config_value
                              run_value
----------------------------------- ----------- ----------- ------------
                              -----------
affinity mask                      0  2147483647           0
                                   0
allow updates                      0           1           0
                                   0
backup buffer size                 1          32           1
                                   1
backup threads                     0          32           5
                                   5
cursor threshold                  -1  2147483647          -1
                                  -1
database size                      2       10000           2
                                   2
default language                   0        9999           0
                                   0
default sortorder id               0         255          50
                                  50
fill factor                        0         100           0
                                   0
free buffers                      20      524288        4000
                                4000
hash buckets                    4999      265003      265003
                              265003
language in cache                  3         100           3
                                   3
LE threshold maximum               2      500000         200
                                 200
LE threshold minimum               2      500000          20
                                  20
LE threshold percent               1         100           0
                                   0
locks                           5000  2147483647        5000
                                5000
LogLRU buffers                     0  2147483647         512
                                 512
logwrite sleep (ms)               -1         500          -1
                                  -1
max async IO                       1        1024           8
                                   8
max lazywrite IO                   1        1024         128
                                 128
max text repl size                 0  2147483647       65536
                               65536
max worker threads                10        1024         100
                                 100
media retention                    0         365           0
                                   0
memory                          2800     1048576      450000
                              450000
nested triggers                    0           1           1
                                   1
network packet size              512       32767        4096
                                4096
open databases                     5       32767          20
                                  20
open objects                     100  2147483647         500
                                 500
priority boost                     0           1           0
                                   0
procedure cache                    1          99           2
                                   2
Protection cache size              1        8192          15
                                  15
RA cache hit limit                 1         255           4
                                   4
RA cache miss limit                1         255           3
                                   3
RA delay                           0         500          15
                                  15
RA pre-fetches                     1        1000           3
                                   3
RA slots per thread                1         255           5
                                   5
RA worker threads                  0         255           0
                                   0
recovery flags                     0           1           0
                                   0
recovery interval                  1       32767       32767
                               32767
remote access                      0           1           1
                                   1
remote conn timeout               -1       32767          10
                                  10
remote login timeout               0  2147483647           5
                                   5
remote proc trans                  0           1           0
                                   0
remote query timeout               0  2147483647           0
                                   0
remote sites                       0         256          10
                                  10
resource timeout                   5  2147483647          10
                                  10
set working set size               0           1           0
                                   0
show advanced options              0           1           1
                                   1
SMP concurrency                   -1          64          -1
                                  -1
sort pages                        64         511          64
                                  64
spin counter                       1  2147483647       10000
                               10000
tempdb in ram (MB)                 0        2044           5
                                   5
```

```
time slice                     50       1000          100
                                100
user connections                    5       32767         3340
                               3340
user options                        0       4095           0
                                  0
```

Appendix D: Disk Storage Calculations

Disk Storage

Note: Numbers are in KB unless otherwise specified

Warehouse configured:	**330**			
Thoughput (tpmC):	**3,961.00**	**TpmC/Wh**	**12.00**	

Table	**Rows**	**Data**	**Index**	**5% Space**	**Daily Growth**
Warehouse	330	660	8	33	
District	3,300	6,600	32	332	
Customer	9,900,000	6,601,320	512,362	355,684	
Orders	9,900,000	257,400	1,556	0	49,732
Order_line	99,002,313	5,504,530	35,982	0	1,064,047
New_order	2,970,000	32,670	200	1,644	
Stock	33,000,000	11,002,200	60,790	553,150	
Item	100,000	9,100	46	457	
history	9,900,000	495,002	0	0	95,064
Total		**23,909,482**	**610,976**	**911,299**	**1,208,843**

Database	**Allocated**
Master DB & etc	29,696
TPCC DB	63,426,560.00
Total_Allocated	**63,456,256**

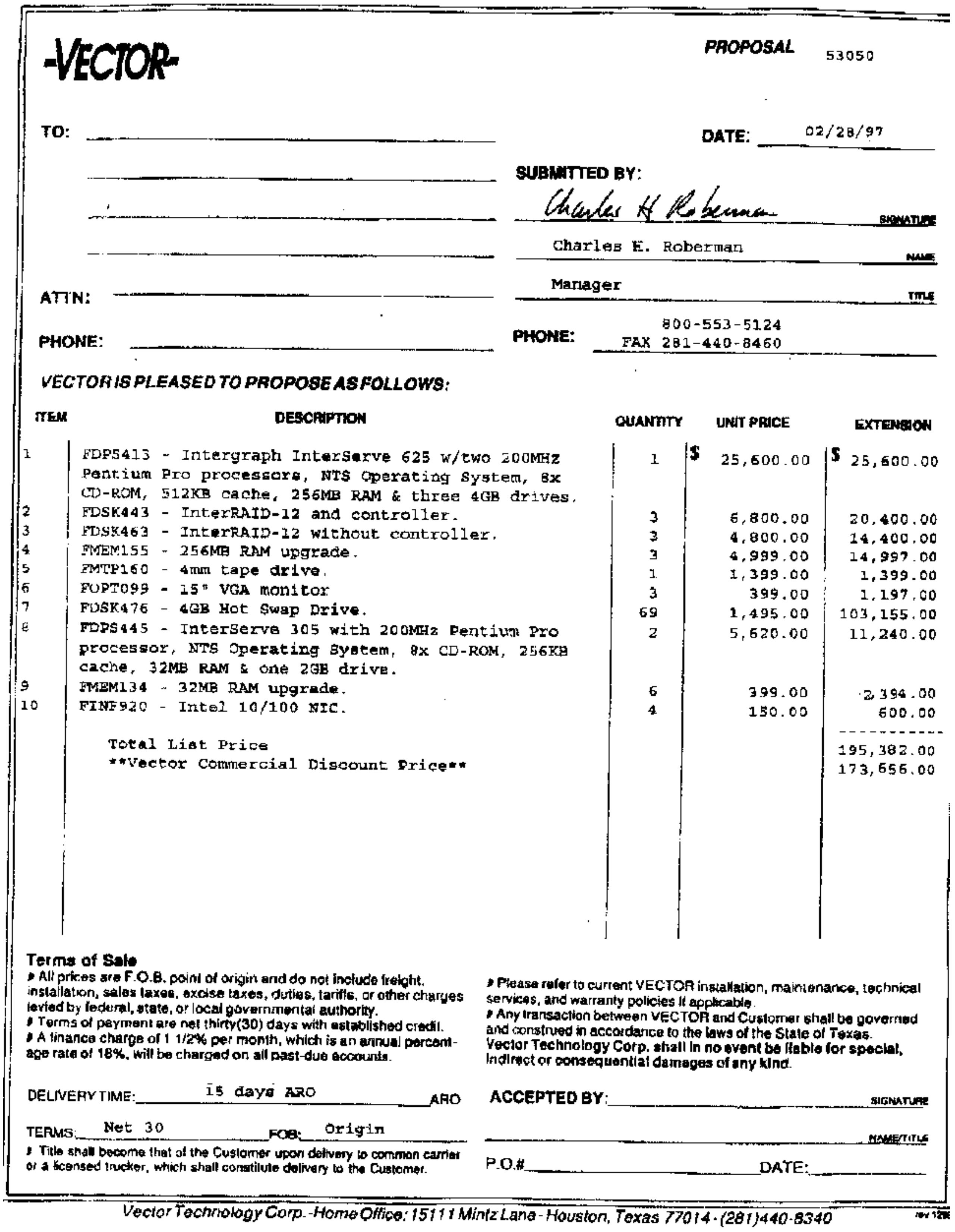
Dynamic space	6,256,932	Sum of Data for Order, Order_line and History	
Static space	19,174,825	Sum of all data and index (including the rootdbs) + 5% - Dynamic space	
Free space	38,024,499	Total space allocated to DBMS - Dynamic and static spaces	
Daily growth	1,201,634	(Dynamic space / (W*62.5))* tpmC	
Daily spread	36,222,047	Free Space - 1.5*Daily growth (zero if negative)	p.s. Since MS SQL Server can be configured to eleminate daily spread, zero is assumed in here
180 day space	235,469,001	Static space + 180 * (Daily growth + Daily Spread)	
180 day (GB)	**224.56**		

		after	before	diff	log/no in KB
log per new order	5.39	2222.234	0.253952	2221.98047	5.3851914
8 hrs log space	10,238,757				

Total Space Usage	**(GB)**
180-day space	224.56 GB
Logs (mirrored)	19.53 GB
swap	1.00 GB
OS and MSSQL	0.13 GB
Total	**245.22 GB**

Currently using				
Size:	**4.04 GB**	**(After formatted)**		
Quantity:	**72**		**Total Storage:**	290.88 GB

Appendix E: Third Party Letters and Price Quotations



-VECTOR-

PROPOSAL 53050

TO:

DATE: 02/28/97

SUBMITTED BY:

[illegible] SIGNATURE

Charles E. Roberman NAME

Manager TITLE

ATTN:

PHONE:

PHONE: 800-553-5124
FAX 281-440-8460

VECTOR IS PLEASED TO PROPOSE AS FOLLOWS:

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENSION
1	FDP5413 - Intergraph InterServe 625 w/two 200MHz Pentium Pro processors, NTS Operating System, 8x CD-ROM, 512KB cache, 256MB RAM & three 4GB drives.	1	$ 25,600.00	$ 25,600.00
2	FDSK443 - InterRAID-12 and controller.	3	6,800.00	20,400.00
3	FDSK463 - InterRAID-12 without controller.	3	4,800.00	14,400.00
4	FMEM155 - 256MB RAM upgrade.	3	4,999.00	14,997.00
5	FMTP160 - 4mm tape drive.	1	1,399.00	1,399.00
6	FOPT099 - 15" VGA monitor	3	399.00	1,197.00
7	FDSK476 - 4GB Hot Swap Drive.	69	1,495.00	103,155.00
8	FDPS445 - InterServe 305 with 200MHz Pentium Pro processor, NTS Operating System, 8x CD-ROM, 256KB cache, 32MB RAM & one 2GB drive.	2	5,620.00	11,240.00
9	FMEM134 - 32MB RAM upgrade.	6	399.00	2,394.00
10	FINF920 - Intel 10/100 NIC.	4	150.00	600.00
	Total List Price			195,382.00
	Vector Commercial Discount Price			173,656.00

Terms of Sale

- All prices are F.O.B. point of origin and do not include freight, installation, sales taxes, excise taxes, duties, tariffs, or other charges levied by federal, state, or local governmental authority.
- Terms of payment are net thirty(30) days with established credit.
- A finance charge of 1 1/2% per month, which is an annual percentage rate of 18%, will be charged on all past-due accounts.
- Please refer to current VECTOR installation, maintenance, technical services, and warranty policies if applicable.
- Any transaction between VECTOR and Customer shall be governed and construed in accordance to the laws of the State of Texas. Vector Technology Corp. shall in no event be liable for special, indirect or consequential damages of any kind.

DELIVERY TIME: 15 days ARO ARO

TERMS: Net 30 FOB: Origin

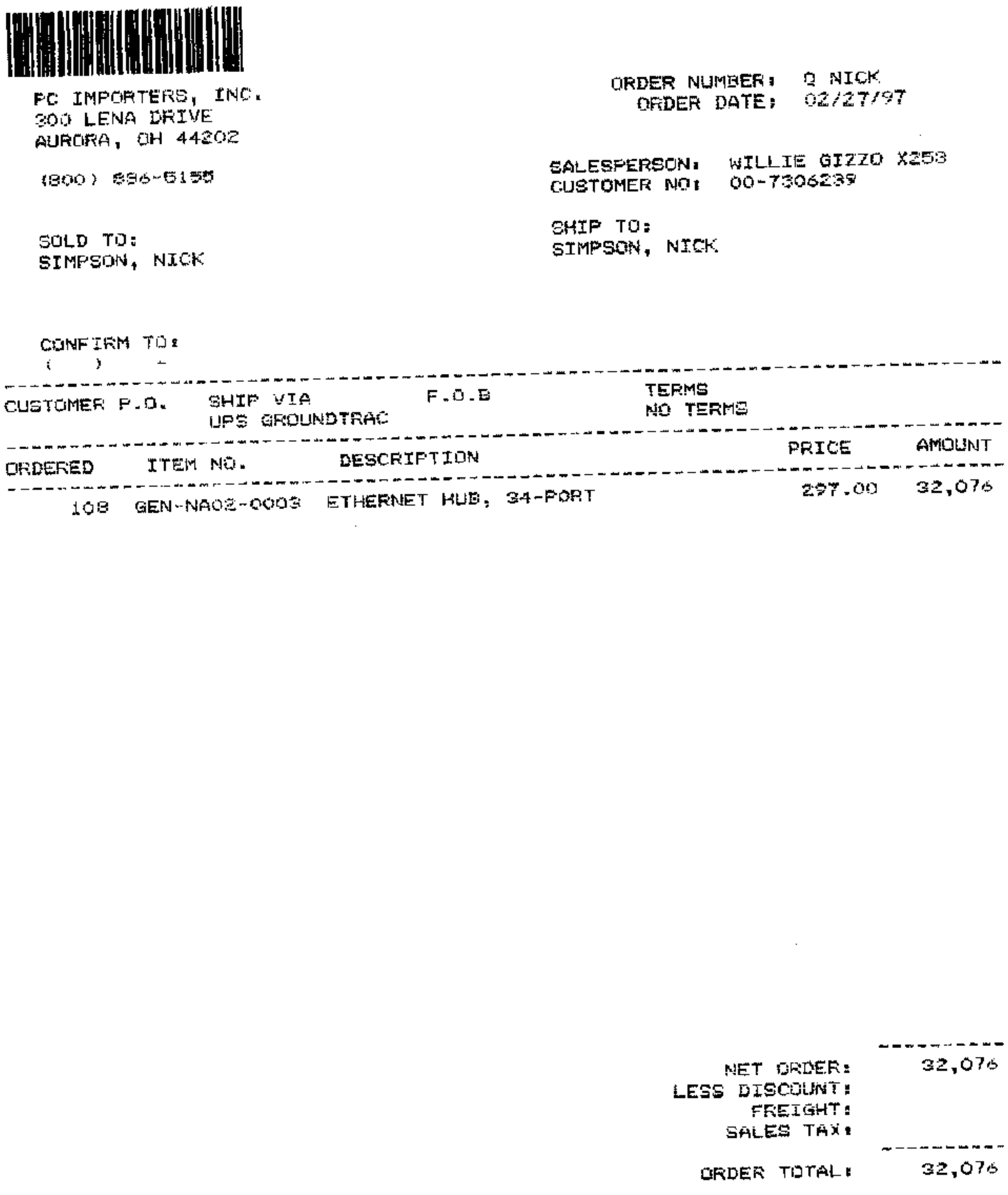
- Title shall become that of the Customer upon delivery to common carrier or a licensed trucker, which shall constitute delivery to the Customer.

ACCEPTED BY: ________ SIGNATURE

________ NAME/TITLE

P.O.# ________ DATE: ________

Vector Technology Corp.-Home Office: 15111 Mintz Lane - Houston, Texas 77014 - (281)440-8340 rev 12/96



PC IMPORTERS, INC.
300 LENA DRIVE
AURORA, OH 44202

(800) 896-6150

ORDER NUMBER: Q NICK
ORDER DATE: 02/27/97

SALESPERSON: WILLIE GIZZO X253
CUSTOMER NO: 00-7306239

SOLD TO:
SIMPSON, NICK

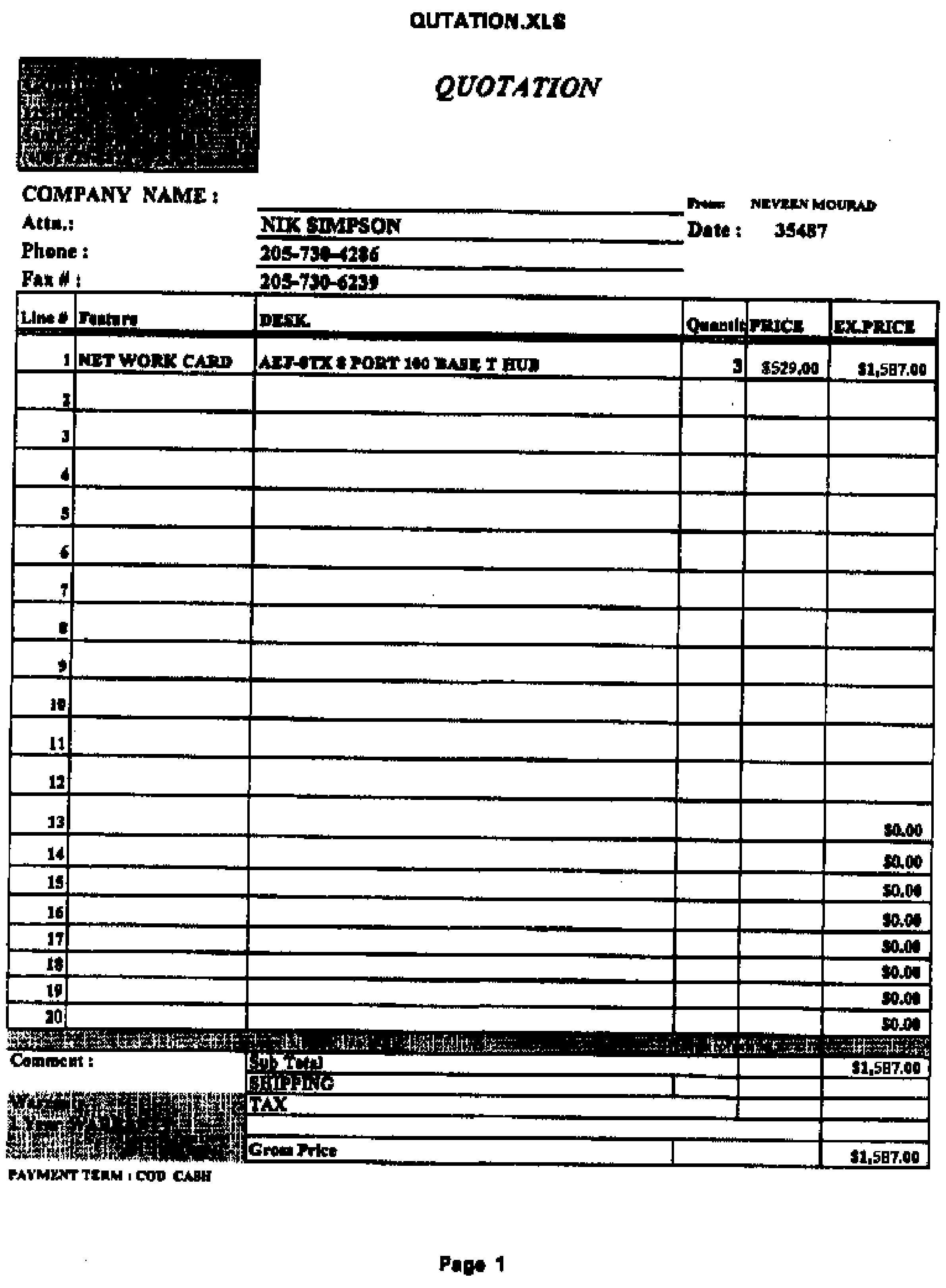
SHIP TO:
SIMPSON, NICK

CONFIRM TO:
( ) -

CUSTOMER P.O.	SHIP VIA	F.O.B	TERMS
	UPS GROUNDTRAC		NO TERMS

ORDERED	ITEM NO.	DESCRIPTION	PRICE	AMOUNT
108	GEN-NA02-0003	ETHERNET HUB, 34-PORT	297.00	32,076

NET ORDER:	32,076
LESS DISCOUNT:	
FREIGHT:	
SALES TAX:	
ORDER TOTAL:	32,076



QUTATION.XLS

QUOTATION

COMPANY NAME :

Attn.:	NIK SIMPSON	From:	NEVEEN MOURAD
Phone :	205-730-4286	Date :	35487
Fax # :	205-730-6239		

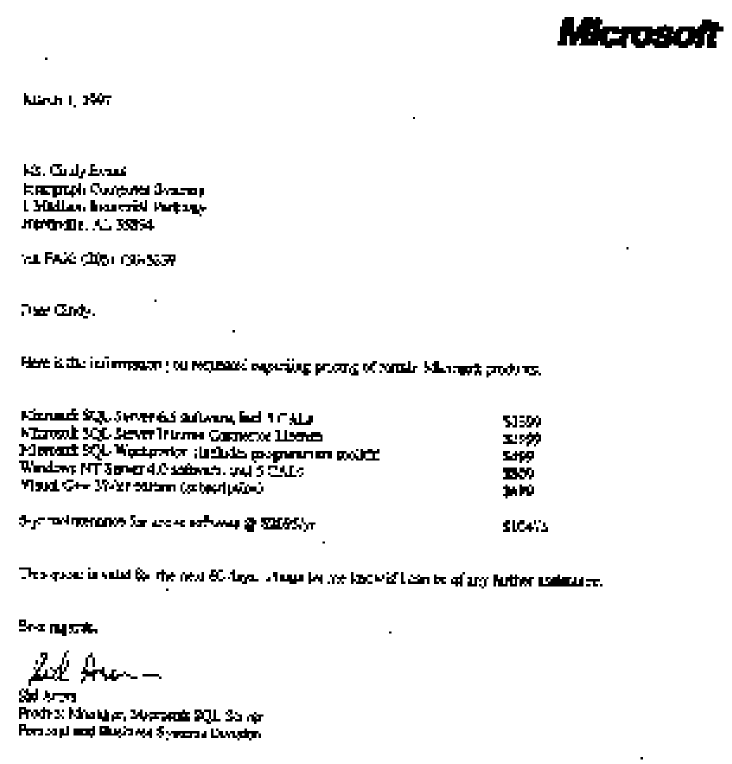
Line #	Feature	DESK.	Quantity	PRICE	EX.PRICE
1	NET WORK CARD	AEJ-8TX 8 PORT 100 BASE T HUB	3	$529.00	$1,587.00
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					$0.00
14					$0.00
15					$0.00
16					$0.00
17					$0.00
18					$0.00
19					$0.00
20					$0.00

Comment :

Sub Total	$1,587.00
SHIPPING	
TAX	
Gross Price	$1,587.00

PAYMENT TERM : COD CASH

Page 1



Microsoft

March 1, 1997

Ms. Cindy Evans
Intergraph Computer Systems
1 Madison Industrial Parkway
Huntsville, AL 35894

via FAX (205) [illegible]

Dear Cindy,

Here is the information you requested regarding pricing of certain Microsoft products.

Microsoft SQL Server 6.5 software, incl 5 CALs	$1399
Microsoft SQL Server Internet Connector License	$2999
Microsoft SQL Workstation (includes programmers toolkit)	$499
Windows NT Server 4.0 software, incl 5 CALs	$809
Visual C++ 32-bit edition (subscription)	$499
5-yr maintenance for above software @ $2095/yr	$10475

This quote is valid for the next 60 days. Please let me know if I can be of any further assistance.

Best regards,

[illegible]
Sid Arora
Product Manager, Microsoft SQL Server
Personal and Business Systems Division

From: Sid Arora
Sent: Thursday, February 27, 1997 9:21 PM
To: Evans, Cindy (Cynthia H)
Cc: Damien Lindauer
Subject: RE: SQL Server Pricing for TPC-C

Hi Cindy,

Here is the information you requested regarding pricing of certain Microsoft products:

Microsoft SQL Server 6.5 software, incl 5 CALs	$1399
Microsoft SQL Server Internet Connector License	$2999
Microsoft SQL Workstation (includes programmers toolkit)	$499
Windows NT Server 4.0 software, incl 5 CALs	$809
Visual C++ 32-bit edition (subscription)	$499
5-yr maintenance for above software @ $2095/yr	$10475

This quote is valid for the next 60 days. Please let me know if I can be of any further assistance.

Thanks
-Sid (sidarora\microsoft.com)
http://www.microsoft.com/sql/