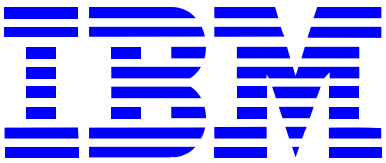

TPC Benchmark™ H Full Disclosure Report

IBM @server pSeries 690

Using

IBM DB2 Universal Database 8.1

Second Edition

February 26, 2003

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First Edition December 5, 2002

Second Edition February 26, 2003

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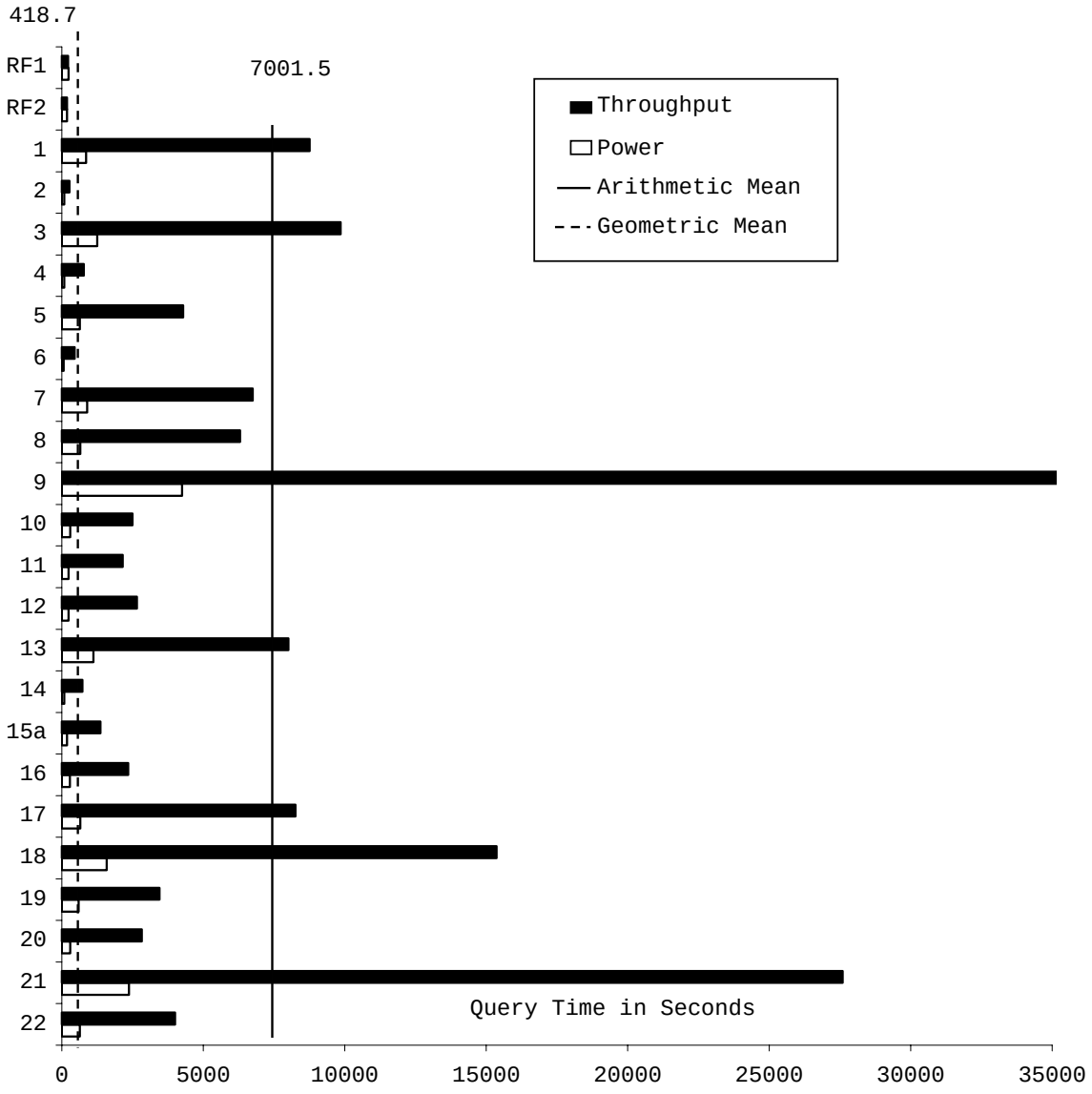
IBM @server p690 with DB2 UDB 8.1

TPC-H Rev. 2.0.0

Report Date: Dec. 5, 2002
Updated: Feb. 26, 2003

Total System Cost	Composite Query per Hour Rating	Price/Performance
$15,112,757	62,214.7 QphH@10000GB	243 $/QphH@10000GB

Database Size	Database Manager	Operating System	Other Software	Availability Date
10000GB	DB2 UDB 8.1	AIX 5L V5.2	none	May 15, 2003



Database Load Time: 10:06:33	Load included backup: N	Total Data Storage/Database Size: 8.99
RAID (base tables): N	RAID (Base Tables and Auxiliary Data Structures): N	RAID (All): Y

System Configuration

5 IBM @server p690 servers, each server with

Processors	32 x 1300MHz POWER4 with 4x 128MB L3 Cache
Memory	256GB
Disk Controllers	64 Advanced Serial RAID Plus adapters - 1 Integrated SCSI-2
Disk Drives	512 x 36.4GB 10K RPM SSA disks -- 6 x 36.4GB 10K RPM Ultra-160
Network	8 Gigabit Ethernet Adapters - 1 Integrated 10/100 Ethernet
Total Disk Storage	89,908.6GB (GB is defined as 1024 * 1024 * 1024 bytes)

IBM @server p690 with DB2 UDB 8.1

TPC-H Rev. 2.0.0

Report Date: Dec. 5, 2002
Updated: Feb. 26, 2003

Part Number	Description	Source	Unit Price	Qty	Ext Price	3 Yr Maint.
Server Hardware						
7040-681	IBM eserver pSeries 690	1	17,789	5	88,945	103,800
2624	32x/40x CDROM w / 16bit Connector	1	375	5	1,875	0
3155	Disk Drive Cable	1	150	5	750	0
3255	Operator panel Attachment cable	1	100	5	500	0
3627	P76 Color Monitor	1	995	1	995	0
4139	128MB (4x32) L3 Cache, 433MHz	1	25,000	20	500,000	0
4188	32 GB H-Memory (inw ard facing)	1	120,500	20	2,410,000	0
4189	32 GB H-Memory (outw ard facing)	1	120,500	20	2,410,000	0
5244	8-w POWER4 Turbo Processor (first)	1	275,000	5	1,375,000	504,000
5251	Programmable Clock Card	1	350	5	1750	0
5254	8-w POWER4 Turbo Processor option	1	275,000	15	4,125,000	1,512,000
6161	Cable groyp, pw r cntlr to CEC and Fans	1	400	5	2000	0
6162	Interface cable, Svc proc to pw r subsystem	1	200	5	1,000	0
6170	Standard CEC DC/DC Converter Assembly	1	4,700	10	47,000	0
6181	Pw r cable grp to 1st processor group	1	270	5	1,350	0
6182	Pw r cable grp to 2nd processor group option	1	150	5	750	0
6183	Pw r cable grp to 3rd processor group option	1	150	5	750	0
6184	Pw r cable grp to 4th processor group option	1	150	5	750	0
6189	Additional DC/DC Converter Assembly, (DCA)	1	4,200	15	63,000	0
6198	Capacitor book (for 2 MCMs)	1	1,800	10	18,000	0
6404	Service Processor + Dual Rio Loop (GX)	1	7,000	5	35,000	0
6410	Remote I/O Loop Adapter	1	8,000	10	80,000	0
6565	Backplane, CEC	1	50,000	5	250,000	0
7316	Hardw are Management Console	1	4,325	1	4,325	0
8692	Media Drw r, Operator panel, Diskette	1	1,700	5	8,500	0
7040-61D	I/O Draw er	1	3,980	40	159,200	163,200
2122	SCSI cable - B&C to Media Draw er	1	275	5	1,375	0
5700	Gigabit Adapter (Fiber)	1	1,700	40	68,000	0
3145	Remote I/O Cable, 500MHz, 0.5m (RIO)	1	310	40	12,400	0
3149	Remote I/O Cable, 500MHz, 2m (RIO)	1	350	80	28,000	0
3158	36.4 GB Ultra3 10K RPM 1" U3 Module	1	2,000	30	60,000	0
6121	Cable Grp, 4xUPIC/2xRIO, BPM(IO#1) to B&C(pos 4609)	1	400	5	2,000	0
6122	Cable Grp, 4xUPIC/2xRIO, BPM(IO#2) to B&C(pos 4605)	1	400	5	2,000	0
6123	Cable Grp, 4xUPIC/2xRIO, BPM(IO#3) to B&C(pos 4601)	1	400	5	2,000	0
6124	Cable Grp, 4xUPIC/2xRIO, BPM(IO#4) to B&C(pos 4613)	1	400	5	2,000	0
6125	Cable Grp, 4xUPIC/2xRIO, BPM(IO#4) to B&C(pos 4613)	1	400	5	2,000	0
6126	Cable Grp, 4xUPIC/2xRIO, BPM(IO#4) to B&C(pos 4613)	1	400	5	2,000	0
6128	Cable Grp, 4xUPIC/2xRIO, BPM(IO#4) to B&C(pos 4613)	1	400	5	2,000	0
6129	Cable Grp, 4xUPIC/2xRIO, BPM(IO#4) to B&C(pos 4613)	1	400	5	2,000	0
6172	I/O Drw r DC/DC Converter assembly, (DCA)	1	4,000	80	320,000	0
6179	Pow er Cable, B&C to Media Draw er	1	300	5	1,500	0
6206	Ultra SCSI PCI-BusAdapter	1	395	5	1,975	0
6230	Advanced Serial RAID Plus adapters	1	3,000	320	960,000	0
6235	32 MB Fast_Write Cache option card	1	575	320	184,000	0
6563	I/O drw PCI plner, 2 Int. Ultr3 SCSI ports	1	8,000	80	640,000	0
6564	Ultra3 SCSI 4-Pack	1	500	160	80,000	0
7040-61R	System Rack	1	5,500	5	27,500	19,800
6070	Front Door, 24W, 2M, IBM Black/Copper	1	3,000	5	15,000	0
6071	Front Door, Secondary rack	1	550	5	2,750	
6074	Rear Door, Slimline	1	750	10	7,500	0

IBM @server p690 with DB2 UDB 8.1

TPC-H Rev. 2.0.0

Report Date: Dec. 5, 2002
Updated: Feb. 26, 2003

	6186	Bulk Power Regulator (BPR)	1	4,000	30	120,000	0
	6187	Bulk Power Controller (BPC), 4 Fans + 3 DCAs	1	1,900	10	19,000	0
	6188	Bulk Power Distribution (BPD), 10 DCAs	1	3,500	20	70,000	0
	6200	Integrated Battery Backup, primary	1	4,500	15	67,500	0
	6201	Integrated Battery Backup, redundant	1	4,500	15	67,500	0
	6240	Cable Integrated Battery Backup, t	1	100	20	2,000	0
	6241	Cable Integrated Battery Backup, Exp. rack	1	135	10	1,350	0
	8678	Line Cord, 60A, 14', IEC309 Plug, Chargeable	1	1,000	10	10,000	0
	8690	Regatta-H Bulk Power Module (2x BPA, EPO PNL)	1	5,000	5	25,000	0
	8691	Expansion Rack 24", 42 EIA	1	8,000	5	40,000	0
		Server Subtotal				**14,434,790**	**2,302,800**
Storage							
7014-T42		System Rack Model T42 (6089,6098)	1	5,000	20	100,000	17,760
	6171	Additional Power Distribution Unit	1	1,000	60	60,000	0
7133-D40		SSA Disk Subsystem	1	12,750	160	2,040,000	706,560
	8022	50/60 Hz AC, 300 VDC Power Supply	1	2,000	160	320,000	0
	8031	Raven Black Drawer Cover	1	250	160	40,000	0
	8536	10K/36.4 GB Advanced Disk Drive Module	1	5,900	2,560	15,104,000	0
	8801	SSA Cables (8801)	1	60	160	9,600	0
		DASD Storage Subtotal				**17,513,600**	**724,320**
		RACK Hardware Subtotal				**160,000**	
Software							
		AIX 5.2 (Media only)	1	50	5	250	0
D5A1ELL, E1A1FLL		AIX C Compiler	1	559	1	559	104
	D5BISLL	DB2 FOR EBUSINESS Lic/1 yr Maint (500 user Lic)	1	221,000	1	221,000	
	E1BIQLL	DB2 FOR EBUSINESS Maint Renew (year)	1	49,500	2	0	99,000
		Software Subtotal		**Subtotal**		**221,809**	**99,104**
Third Party Hardware							
WS-C3508G-XL-EN		Catalyst 3508G XL Enterprise Edition		4,995	10	49,950	0
		Third Party Hardware Subtotal				**49,950**	**0**
		Subtotal				**32,380,149**	**3,126,224**
		Total					**35,506,373**
Discounts		All IBM hardware & AIX one time volume Discount			60%	(19,182,768)	
		Storage Service Discount			40%	(289,728)	
		Server Service Discount			40%	(921,120)	
Total						**(20,393,616)**	**15,112,757**

Notes (Source):	3 Year Cost of Ownership	$ **15,112,757**
1. IBM	QphH @ 10000 GB	**62,214**
	$/QphH @ 10000 GB	$ **242.92**

For assistance with any of these prices or their applicability to any customer's requirements, please contact one of the following individuals:
William R. Casey, eServer pSeries Offering Manager, email: wrcasey@us.ibm.com, phone 1-512-838-1422
Paul Rivot, Director Database Servers and Business Intelligence Software, email: privot@us.ibm.com, phone 1-914-766-1325

Audited by: Francois Raab & Brad Askins of Infosizing (www.infosizing.com)

Note: Hardware immediately available. All software will be available May 15, 2003

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 base on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details see the pricing sections of the TPC benchmark specifications. If you find the stated prices are not available according to these terms, please notify the TPC at pricing@tpc.org. Thank You.

Numerical Quantities Summary

Measurement Results:

Database Scaling (SF/Size)	=	10000
Total Data Storage/Database Size	=	8.99
Start of Database Load	=	11/19/2002 18:58:31
End of Database Load	=	11/20/2002 05:05:04
Database Load Time	=	10:06:33
Query Streams for Throughput Test	=	9
TPC-H Power Metric (QppH@10000GB)	=	85,972.5
TPC-H Throughput Metric (QthH@10000GB)	=	45,022.2
Composite Query-per-Hour Rating (QphH@10000GB)	=	62,214.7
Total System Price over 3 years	=	$15,112,757
TPC-H Price/Performance Metric ($/QphH@10000GB)	=	243

Measurement Intervals

Measurement Interval in Throughput Test (Ts) = 158,322.1 seconds

Duration of Stream Execution

Stream Id	Seed Used	Start Date & Time		End Date & Time		Duration
Stream 00	1120050504	11/22/2002	18:16:29	11/22/2002	23:13:07	4:56:38
Stream 01	1120050505	11/22/2002	23:13:45	11/24/2002	18:11:23	42:57:38
Stream 02	1120050506	11/22/2002	23:13:45	11/24/2002	18:11:37	42:57:52
Stream 03	1120050507	11/22/2002	23:13:45	11/24/2002	17:49:47	42:36:02
Stream 04	1120050508	11/22/2002	23:13:45	11/24/2002	17:52:13	42:38:28
Stream 05	1120050509	11/22/2002	23:13:45	11/24/2002	17:52:48	42:39:03
Stream 06	1120050510	11/22/2002	23:13:45	11/24/2002	17:58:00	42:44:15
Stream 07	1120050511	11/22/2002	23:13:45	11/24/2002	18:08:40	42:54:55
Stream 08	1120050512	11/22/2002	23:13:45	11/24/2002	17:55:57	42:42:12
Stream 09	1120050513	11/22/2002	23:13:45	11/24/2002	18:08:27	42:54:42
Refresh		11/24/2002	18:11:37	11/24/2002	19:12:28	1:00:51

Timing Intervals (in Seconds)

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Stream 0	859.9	85.0	1247.1	82.4	630.8	63.9	896.4	651.8	4248.2	301.8	239.2	243.5
Stream 01	6053.6	774.7	9843.9	99.0	4676.6	422.4	6781.3	6191.8	38497.5	2267.1	1829.1	2872.9
Stream 02	8756.1	179.0	9697.9	909.2	4328.9	554.8	6650.7	6560.6	37624.7	2105.5	2109.8	2761.4
Stream 03	8874.1	201.1	9657.5	831.9	4079.0	380.1	6946.3	7092.4	34043.3	2366.7	2476.8	3314.0
Stream 04	9233.4	206.3	10595.4	704.6	4823.7	394.0	6458.7	5998.6	33800.0	2997.1	2335.6	2761.8
Stream 05	9731.9	163.8	10291.4	903.5	4055.9	410.7	6612.7	5930.8	33400.8	2558.3	2494.5	2645.0
Stream 06	8940.3	224.2	9934.1	849.7	4221.8	358.1	6584.6	6147.8	34535.1	2539.4	2181.2	2823.2
Stream 07	9087.8	248.6	9842.1	1068.5	4485.7	627.3	7433.6	5981.9	35327.6	2516.4	2045.3	943.4
Stream 08	9370.0	185.9	9317.3	772.5	4222.3	440.3	6642.5	5751.6	34421.7	2151.6	1695.2	2912.6
Stream 09	8828.1	221.2	9522.2	841.3	3685.3	449.9	6661.9	7050.7	36302.4	2978.4	2248.8	2889.0
Minimum	6053.6	163.8	9317.3	99.0	3685.3	358.1	6458.7	5751.6	33400.8	2105.5	1695.2	943.4
Average	8763.9	267.2	9855.8	775.6	4286.6	448.6	6752.5	6300.7	35328.1	2497.8	2157.4	2658.1
Maximum	9731.9	774.7	10595.4	1068.5	4823.7	627.3	7433.6	7092.4	38497.5	2997.1	2494.5	3314.0

Stream ID	Q13	Q14	Q15a	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
Stream 0	1116.6	87.3	185.3	293.2	652.5	1589.4	597.9	294.7	2374.5	634.1	237.3	184.9
Stream 01	7970.4	663.4	1432.9	2556.3	8687.0	13513.5	3499.4	3081.1	28792.6	4151.6	219.9	185.9
Stream 02	8084.3	727.1	1359.5	2452.5	8801.7	15833.8	3424.8	2737.4	25173.3	3838.9	227.6	188.9
Stream 03	8292.6	777.5	1386.4	2753.9	8170.7	14879.8	3215.5	2765.8	26682.2	4173.5	217.3	173.5
Stream 04	7452.4	726.6	1313.7	2536.4	7822.4	14719.9	3378.2	2524.1	28585.7	4138.1	226.8	181.3
Stream 05	8348.8	738.2	1407.8	2513.1	7391.9	15068.7	3428.8	2980.3	28500.5	3964.7	229.8	180.1
Stream 06	8002.5	764.3	1355.2	2291.8	8118.6	15265.0	3314.5	2878.2	28455.6	4068.9	222.7	189.9
Stream 07	7805.4	676.7	1114.3	2388.2	8859.9	16168.0	3486.1	2957.4	27405.0	4024.0	227.9	177.5
Stream 08	7901.3	765.4	1463.2	2606.9	7899.7	16925.5	3902.4	2775.1	27827.9	3779.1	220.9	181.3
Stream 09	8190.2	724.9	1457.5	1032.5	8582.7	15944.4	3388.3	2717.1	26938.3	3824.3	225.2	173.6
Minimum	7452.4	663.4	1114.3	1032.5	7391.9	13513.5	3215.5	2524.1	25173.3	3779.1	217.3	173.5
Average	8005.3	729.3	1365.6	2348.0	8259.4	15368.7	3448.7	2824.1	27595.7	3995.9	224.2	181.3
Maximum	8348.8	777.5	1463.2	2753.9	8859.9	16925.5	3902.4	3081.1	28792.6	4173.5	229.8	189.9

Abstract

This report documents the full disclosure information required by the TPC Benchmark™ H Standard Specification Revision 2.0.0 dated July 15, 2002 for measurements on the IBM eServer p690.

The software used includes AIX 5L V5.2 operating system with DB2 Universal Database 8.1.

Preface

TPC Benchmark™ H Standard Specification was developed by the Transaction Processing Performance Council (TPC). It was released on February 26, 1999, and most recently revised (Revision 2.0.0) on July 15, 2002. This is the full disclosure report for benchmark testing of the IBM eServer p690 according to the TPC Benchmark™ H Standard Specification.

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

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

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

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

The TPC-H operations are modeled as follows:

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

The minimum database required to run the benchmark holds business data from 10,000 suppliers. It contains almost ten million rows representing a raw storage capacity of about 1 gigabyte. Compliant benchmark implementations may also use one of the larger permissible database populations (e.g., 100 gigabytes), as defined in Clause 4.1.3.

The performance metric reported by TPC-H is called the TPC-H Composite Query-per-Hour Performance Metric (QphH@Size), and reflects multiple aspects of the capability of the system to process queries. These aspects include the selected database size against which the queries are executed, the query processing power when queries are submitted by a single stream, and the query throughput when queries are submitted by multiple concurrent users. The TPC-H Price/Performance metric is expressed as $/QphH@Size. To be compliant with the TPC-H standard, all references to TPC-H results for a given configuration must include all required reporting components (see Clause 5.4.6). The TPC believes that comparisons of TPC-H results measured against different database sizes are misleading and discourages such comparisons.

The TPC-H database must be implemented using a commercially available database management system (DBMS) and the queries executed via an interface using dynamic SQL. The specification provides for variants of SQL, as implementers are not required to have implemented a specific SQL standard in full.

TPC-H uses terminology and metrics that are similar to other benchmarks, originated by the TPC and others. Such similarity in terminology does not in any way imply that TPC-H results are comparable to other benchmarks. The only benchmark results comparable to TPC-H are other TPC-H results compliant with the same revision.

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

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

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

1.0 General Items

1.1. Benchmark Sponsor

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

This benchmark was sponsored by International Business Machines Corporation.

1.2. Parameter Settings

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

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

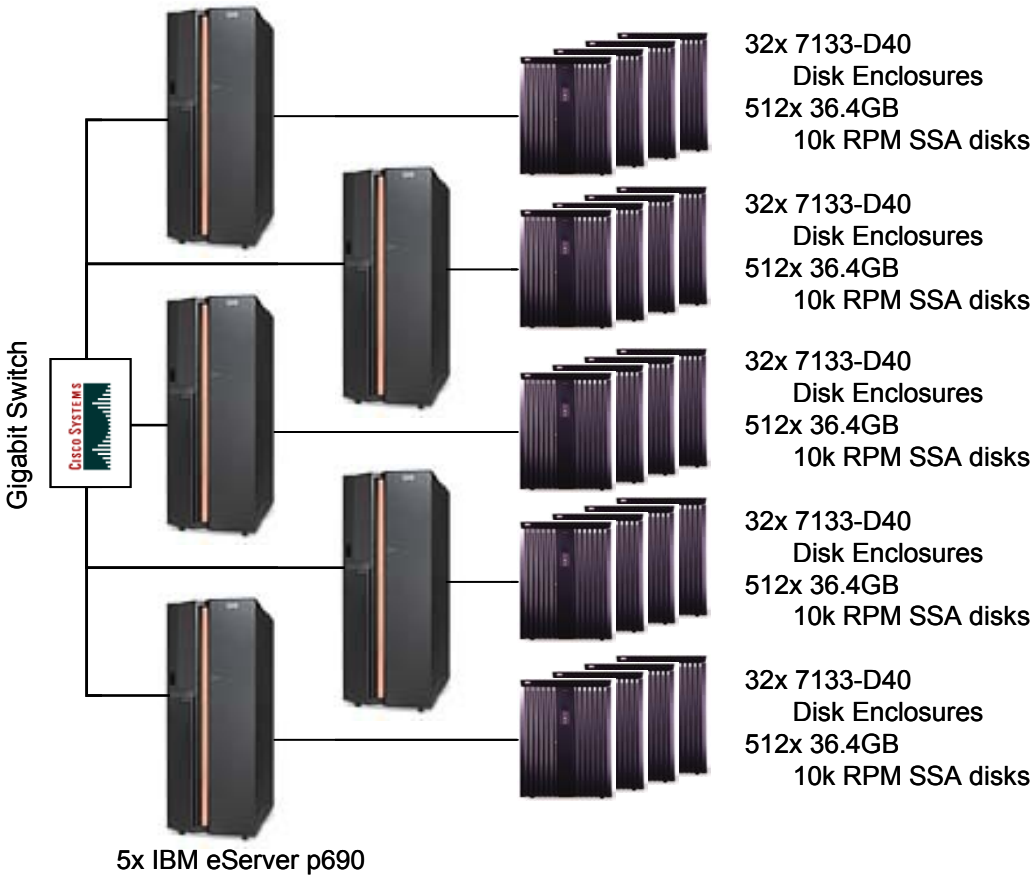
Appendix A "Tunable Parameters" contains a list of all DB2 parameters and operating system parameters. Session initialization parameters can be set during or immediately after establishing the connection to the database within the tpcdbatch program documented in Appendix D "Driver Source Code" . This result uses the default session initialization parameters established during preprocessing/binding of the tpcdbatch program.

1.3. Configuration Diagrams

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

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

IBM eServer p690 Benchmark Configuration



The system was a 5 node cluster of IBM eServer p690 systems each with

- 32 x POWER4 1300MHz processors with 4 MCMs each with 128MB L3 cache
- 256 GB of memory
- 64 x IBM SSA Advanced RAID Adapters
- 6 x 36.4GB Internal disk drives
- 512 x 36.4GB 10k RPM external disk drives
- 32x 7133-D40 disk enclosures
- 8 x Gigabit Ethernet adapters

For full details of the priced configuration see the pricing spreadsheet in the Executive Summary.

2.0 Clause 1: Logical Database Design Related Items

Appendix B "Database Build Scripts" contains the programs and input files used to load the test database. The test and qualification databases use the same table definitions, indices and partitioning methods. Thus, the buildtpcd script documented in Appendix B.1 was used for both the qualification and test databases except that different input files were used to define the tablespace devices and sizes.

2.1. Table Definitions

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

Appendix B "Database Build Scripts" contains the table definitions and the programs to load the database.

2.2. Database Organization

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

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

2.3. Horizontal Partitioning

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

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

2.4. Replication

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

No replication was used.

3.0 Clause 2: Queries and Refresh Functions

3.1. Query Language

The query language used to implement the queries must be identified (e.g.,"RALF/SQL-Plus").

SQL was the query language used.

3.2. Verification for the Random Number Generator

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

The supplied QGEN version 1.3.0 was used. DBGEN 1.3.0 was modified to allow for scale factor of 10000.

3.3. Substitution Parameters

3.3.1. Method of Generation

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

The supplied QGEN version 1.3.0 was used to generate the substitution parameters.

3.4. Query Text

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

Appendix C.1 "Qualification Query Output" contains the output for each of the queries. The functional query definitions and variants used in this disclosure use the following minor query modifications.

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

3.5. Query Substitution Parameters and Seeds

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

Appendix C3, "Query Substitution Parameters" contains the query substitution parameters used in the performance tests.

3.6. Isolation Level

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

The isolation level used to run the queries was **repeatable read**.

3.7. Refresh Functions

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

The refresh functions are part of the implementation specific layer/driver code included in Appendix D "Driver Source Code".

4.0 Clause 3: Database System Properties

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

All ACID tests were conducted according to specification. The Atomicity, Isolation, Consistency and Durability tests were performed on the eServer p690. Appendix E. "Acid Transaction Source Code" contains the source code for the ACID transaction and query.

4.1. Atomicity Requirements

The system under test must guarantee that 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.

4.1.1. Atomicity of Completed Transaction

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

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

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

4.1.2. Atomicity of Aborted Transactions

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

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

1. The total price from the ORDER table and the extended price from the LINEITEM table were retrieved for a random Orderkey. The number of records in the HISTORY table was also retrieved.
2. The ACID transaction was executed for the Orderkey used in step 1.
3. The transaction was rolled back.
4. The total price and the extended price were retrieved for the same orderkey used in step 1 and step 2. It was verified that the extended price and the total price were the same as in step 1.

4.2. Consistency Requirements

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

4.2.1. Consistency Condition

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

O_TOTALPRICE = SUM(L_EXTENDEDPRICE(1-L_DISCOUNT)*(1+L_TAX)*

for each ORDER and LINEITEM defined by (O_ORDERKEY=L_ORDERKEY)

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

```
SELECT DECIMAL(SUM(DECIMAL(INTEGER(INTEGER(DECIMAL
(INTEGER(100*DECIMAL(L_EXTENDEDPRICE,20,3)),20,3)*
(1-L_DISCOUNT)) * (1+L_TAX)),20,3)/100.0),20,3)
FROM TPCD.LINEITEM   WHERE L_ORDERKEY = okey
SELECT DECIMAL(SUM(O_TOTALPRICE, 20, 3)) from TPCD.ORDERS WHERE
O_ORDERKEY = okey
```

4.2.2. Consistency Tests

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

The queries defined in 4.2.1 , "Consistency Condition" were run after initial database build and prior to executing the ACID transaction. The queries showed that the database is in a consistent state.

After executing 10 streams of 100 ACID transactions each, the queries defined in 4.2.1 , "Consistency Condition" were run again. The queries showed that the database was still in a consistent state.

4.3. Isolation Requirements

4.3.1. Isolation Test 1

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

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

1. 1st session: Start an ACID transaction with a randomly selected O_KEY,L_KEY and DELTA. The transaction is delayed for 60 seconds just prior to the Commit.
2. 2nd session: Start an ACID query for the same O_KEY as in the ACID transaction.
3. 2nd session: The ACID query attempts to read the file but is locked out by the ACID transaction waiting to complete.

4. 1st session: The ACID transaction is released and the Commit is executed releasing the record. With the LINEITEM record now released, the ACID query can now complete.
5. 2nd session: Verify that the ACID query delays for approximately 60 seconds and that the results displayed for the ACID query match the input for the ACID transaction.

4.3.2. Isolation Test 2

This test demonstrates isolation for the read-write conflict of read-write transaction and read-only transaction when the read-write transaction is rolled back.

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

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

4.3.3. Isolation Test 3

This test demonstrates isolation for the write-write conflict of two refresh transactions when the first transaction is committed.

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

1. 1st session: Start an ACID transaction T1 for a randomly selected O_KEY, L_KEY and DELTA. The transaction is delayed for 60 seconds just prior to the COMMIT.
2. 2nd session: Start a second ACID transaction T2 for the same O_KEY, L_KEY, and for a randomly selected DELTA2. This transaction is forced to wait while the 1st session holds a lock on the LINEITEM record requested by the second session.
3. 1st session: The ACID transaction T1 is released and the Commit is executed, releasing the record. With the LINEITEM record now released, the ACID transaction T2 can now complete.
4. Verify that:

   T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE +
   (DELTA*(T1.L_EXTENDEDPRICE)/T1.L_QUANTITY)

4.3.4. Isolation Test 4

This test demonstrates isolation for write-write conflict of two ACID transactions when the first transaction is rolled back.

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

1. 1st session: Start an ACID transaction T1 for a randomly selected O_KEY, L_KEY, and DELTA. The transaction is delayed for 60 seconds just prior to the rollback.

2. 2nd session: Start a second ACID transaction T2 for the same O_KEY, L_KEY used by the 1st session. This transaction is forced to wait while the 1st session holds a lock on the LINEITEM record requested by the second session.
3. 1st session: Rollback the ACID transaction T1. With the LINEITEM record now released, the ACID transaction T2 completes.
4. Verify that T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE

4.3.5. Isolation Test 5

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

1. 1st session: Start an ACID transaction, T1, for a randomly selected O_KEY, L_KEY and DELTA. The ACID transaction was suspended prior to COMMIT.
2. 2nd session: Start a second ACID transaction, T2, which selects random values of PS_PARTKEY and PS_SUPPKEY and returns all columns of the PARTSUPP table for which PS_PARTKEY and PS_SUPPKEY are equal to the selected values.
3. T2 completed.
4. T1 was allowed to complete.
5. It was verified that the appropriate rows in the ORDERS, LINEITEM and HISTORY tables have been changed.

4.3.6. Isolation Test 6

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

1. 1st session: A transaction T1, which executes TPC-H query 1 with DELTA=0, was started.
2. 2nd session: Before T1 completed, an ACID transaction T2, with randomly selected values of O_KEY, L_KEY and DELTA, was started.
3. 3rd session: Before T1 completed, a transaction T3, which executes modified TPC-H query 1 with a randomly selected value of DELTA (not equal to 0), was started.
4. T1 completed.
5. T2 completed.
6. T3 completed.
7. It was verified that the appropriate rows in the ORDERS, LINEITEM and HISTORY tables were changed.

4.4. Durability Requirements

The SUT must guarantee durability: the ability to preserve the effects of committed transactions and ensure database consistency after recovery from any one of the failures listed in Clause 3.5.3.

4.4.1. Permanent Failure of Single Durable Medium and Loss of System Power

These tests were combined and conducted on the qualification database. The test database and the qualification database were fully mirrored. The following steps were performed:

Failure of Durable Medium Containing Recovery Log Data, and Loss of System Power/Memory

1. The consistency test described in section 4.2.1 was verified.
2. The current count of the total number of records in the HISTORY table was determined giving hist1.
3. A test to run 200 ACID transactions on each of 10 execution streams was started such that each stream executes a different set of transactions.
4. One of the disks containing the DB2 transaction log recovery data, database table data, database index and temporary space was powered off after at least 80 ACID transactions had completed from each of the execution streams.
5. Because the disk were in RAID 1 configuration the applications continued running the ACID transactions.
6. The system was shutdown by switching off circuit breakers on the power rail connected to all system component cabinets, after at least a total of 100 transactions had completed for each stream.
7. The system was powered back on and rebooted.
8. All volumes were re-established and mirrored volumes were synchronized.
9. Step 2 was performed giving hist2. It was verified that hist2 - hist1 was greater than or equal to the number of records in the success file.
10. Consistency condition described in 4.2.1 was verified.

4.4.2. Loss of Switch Power

This test was conducted on the qualification database. The following steps were performed:

The consistency test described in section 4.2.1 was verified.

1. The current count of the total number of records in the HISTORY table was determined giving hist1.
2. A test to run 200 ACID transactions on each of 10 execution streams was started such that each stream executes a different set of transactions.
3. The Gigabit switch was disconnected from the system.
4. Database detected the network loss and terminated processing
5. Network connections were reestablished and the database was restarted
6. Step 2 was performed giving hist2. It was verified that hist2 - hist1 was greater than or equal to the number of records in the success file.

Consistency condition described in 4.2.1 was verified.

5.0 Clause 4: Scaling and Database Population Related Items

5.1. Cardinality of Tables

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

The following table contains the TPC Benchmark™ H defined tables and the number of rows for each table as they existed upon build completion:

Table	Rows
Lineitem	59,999,994,267
Orders	15,000,000,000
Customer	1,500,000,000
Supplier	100,000,000
Part	2,000,000,000
Partsupp	8,000,000,000
Nation	25
Region	5

5.2. Distribution of Tables and Logs

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

DB2 was configured on a five node IBM eServer p690 test system. Each node had:

- 64 IBM SSA Advanced RAID disk controllers
- 512 36.4GB external SSA and 6 36.4GB internal disk drives.

Each p690 had 256 RAID 1 volumes. These volumes were distributes across 64 SSA RAID adapters, so that there were 4 volumes on each controllers. All volumes had RAID fast write cache enabled.

For each node, all RAID volumes were used for the table data tablespaces(TABDATA), the index tablespaces (TABINDEXES), the temp space tablespaces (TEMPSPACE), database logs and staging data for RF functions.

The tablespace for NATION and REGION were stored on a single RAID volume on node 1.

The Operating System resided on an internal disk on each node. The benchmark executing programs resided on a shared home directory NFS mounted from node 1. The database software resided on an internal disk on each node.

5.3. Mapping of Database Partitions/Replications

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

The database was not replicated. The database was logically partitioned into 160 logical nodes, 32 nodes on each physical server.

5.4. Implementation of RAID

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

RAID level 1 was used across all database tables, indexes, temp space and recovery logs. Battery backed write cache was used on RAID volumes.

5.5. DBGEN Modifications

The version number, release number, modification number, and patch level of DBGEN must be disclosed. Any modifications to the DBGEN (see Clause 4.2.1) source code must be disclosed. In the event that a program other than DBGEN was used to populate the database, it must be disclosed in its entirety.

The standard distribution of DBGEN version 1.3.0 with the following two minor modifications for scale factor 10000 was used

- orderkey was changed to 64bit integer
- C_name was changed to use 10 digit custkey

5.6. Database Loading

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

The database load time was 10 hour 6 minutes 33 seconds.

5.7. Data Storage Ratio

The data storage ratio must be disclosed. It is computed by dividing the total data storage of the priced configuration (expressed in GB) by the size chosen for the test database as defined in clause 4.1.3.1. The ratio must be reported to the nearest 1/100th, rounded up.

The calculation of the data storage ratio is shown in the following table:

Disk Type	Number of Disks	Space per Disk	Sub-Total Disk Space	Database Size	Data Storage Ratio
ULTRA-160 36.4GB	30	35,546.875 MB	1,041.4GB		
SSA 36.4GB	2,560	35,546.875 MB	88,867.2GB		
Total			89,908.6 GB	10,000GB	8.99

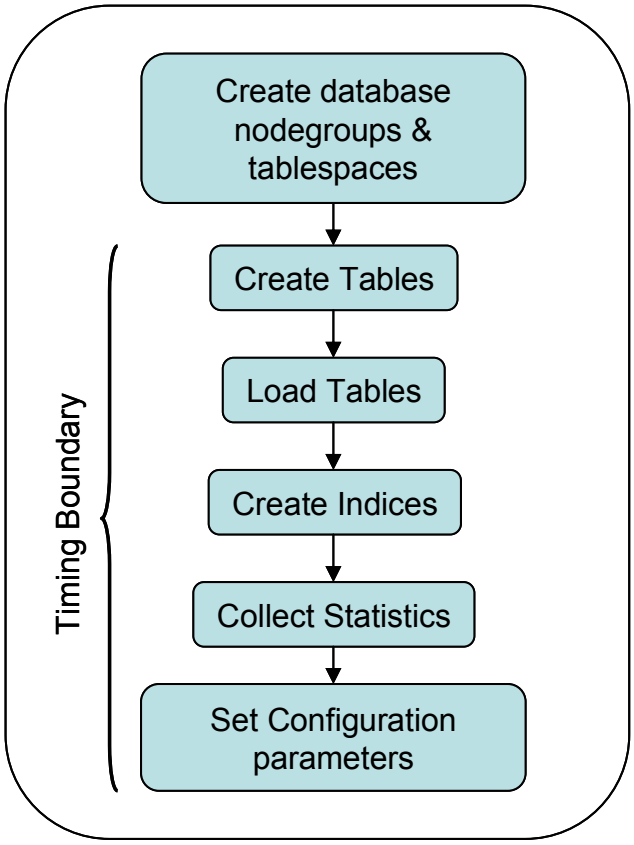
5.8. Details of Database Loading

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

Flat files for each of the tables were created using DBGEN.

The NATION and REGION tables were created on node 1 and then loaded from dbgen output. The other tables were loaded on all of the nodes.

Database Load Procedure:



6.0 Clause 5: Performance Metrics and Execution-Rules Related Items

6.1. System Activity Between Load and Performance Tests

Any system activity on the SUT that takes place between the conclusion of the load test and the beginning of the performance test must be fully disclosed

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

6.2. Steps in the Power Test

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

The following steps were used to implement the power test:

1. RF1 Refresh Transaction
2. Stream 00 Execution
3. RF2 Refresh Transaction

6.3. Timing Intervals for Each Query and Refresh Function

The timing intervals for each query of the measured set and for both update functions must be reported for the power test.

The timing intervals for the each query and both update functions are given in the Numerical Quantities Summary in the Executive Summary.

6.4. Number of Streams for the Throughput Test

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

Nine streams were used for the Throughput Test.

6.5. Start and End Date/Times for Each Query Stream

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

The throughput test start time and finish time for each stream are given in the Numerical Quantities Summary in the Executive Summary.

6.6. Total Elapsed Time for the Measurement Interval

The total elapsed time of the measurement interval (see Clause 5.3.6) must be reported for the throughput test.

The total elapsed time of the throughput test is given in the Numerical Quantities Summary in the Executive Summary.

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

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

The start and finish time for each update function in the update stream are given in the Numerical Quantities Summary in the Executive Summary.

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

The timing intervals (see Clause 5.3.7) for each query of each stream and for each refresh function must be reported for the throughput test.

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

6.9. Performance Metrics

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

The performance metrics, and the numbers on which they are based, are given in the Numerical Quantities Summary in the Executive Summary.

6.10. The Performance Metric and Numerical Quantities from Both Runs

The performance metric and numerical quantities from both runs must be disclosed.

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

	QppH@10000GB	QthH@10000GB	QphH@10000GB
Run 1	86,467.4	44,910.4	62,316.0
Run 2	85,972.5	45,022.2	62,214.7

6.11. System Activity Between Tests

Any activity on the SUT that takes place between the conclusion of Run1 and the beginning of Run2 must be disclosed.

The database server was restarted between runs.

7.0 Clause 6: SUT and Driver Implementation

7.1. Driver

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

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

The power test is invoked by calling tpcdbatch with the stream number 0 specified. The refresh function is initiated as a separate call to tpcdbatch with the SQL script for the refresh functions.

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

7.2. Implementation Specific Layer

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

The implementation specific layer is a single executable SQL application that uses embedded dynamic SQL to process the EQT generated by QGEN. The application is called tpcdbatch to indicate that it processes a batch of TPC-H queries, although it is completely capable of processing any arbitrary SQL statement (both DML and DDL).

A separate instance of tpcdbatch is invoked for each stream. Each instance establishes a distinct connection to the database server through which the EQT is transmitted to the database and the results are returned through the implementation specific layer to the driver. When an instance of tpcdbatch is invoked, it is provided with a context of whether it is running a power test, query stream or refresh stream, as well as an input file containing the 22 queries and/or refresh functions. tpcdbatch then connects to the database, performs any session initialization as well as preparing output files required by the auditor. Then it proceeds to read from the input file and processes each query or refresh function in turn.

For queries, each query is prepared, described, and a cursor is opened and used to fetch the required number of rows. After the last row has been retrieved a commit is issued. For the refresh functions, during the database build all data is first split for each node using the db2split utility. For RF1, the data for each node is further split into n equal portions for both the lineitem and orders tables taking care that the records for the same orderkey remain in the same set. For RF2, the data for each node is further split into m equal portions. During the run, when tpcdbatch encounters a call to execute RF1, it first calls a shell script which loads these n sets of data into staging tables. Then tpcdbatch forks off q children (where q * y = n), with each child to do y sets of insert with fullselect from the staging tables into the original lineitem and orders tables. When tpcdbatch encounters a call to execute RF2, it calls a shell script that loads these data into a single staging table. Then tpcdbatch forks off p children (where p * x =m) to do x sets of deletes from the orders and lineitem tables with a subselect from the staging table.

7.3. Profile-Directed Optimization

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

Profile-directed optimization was not used.

8.0 Clause 7: Pricing-Related Items

8.1. Hardware and Software Used

A detailed list of hardware and software used in the priced system must be reported. Each item must have a vendor part number, description, and release/revision level, and indicate General Availability (see Clause 7.2.2.1) either implicitly or explicitly(omitted Availability Dates default to the System Availability Date). If package pricing is used, contents of the package must be disclosed. Pricing source(s) and effective date(s) of price(s) must also be reported.

The detailed list of all hardware and software for the priced configuration is listed in the in the Executive Summary.

8.2. Three Year Cost of System Configuration

The total 3-year price of the entire configuration must be reported, including: hardware, software, hardware maintenance, and software support charges. Separate component pricing is required (see Clause 7.3.1. Pricing Spreadsheet.) Hardware maintenance and software support must be reported separately. The software support level must be disclosed separately from that of hardware, with separate pricing and discounts.

The price sheet for this disclosure is contained in the executive summary pages.

The pricing spreadsheet includes maintenance costs for 3 years. This service provides 7 days per week, 24 hours per day coverage.

All discounts are based on US list prices and for similar quantities and configurations

The prices listed for the IBM software products includes software support that provides the items identified in paragraph 7.1.5.6 of the TPC-H Benchmark Specification.

For assistance with any of these prices or their applicability to any customer's requirements, please contact one of the following individuals:

William R. Casey, eServer pSeries Offering Manager
email: wrcasey@us.ibm.com phone 1-512-838-1422

Paul Rivot, Director Database Servers and Business Intelligence Software
email: privot@us.ibm.com phone 1-914-766-1325

8.3. System Availability Date

The System Availability Date (see Clause 7.2.2.1) must be the single availability date reported on the first page of the executive summary. The full disclosure report must report Availability Dates individually for at least each of the categories for which a pricing subtotal must be provided (see Clause 7.3.1.4). All Availability Dates required to be reported must be disclosed to a precision of 1 day, but the precise format is left to the test sponsor.

All server hardware and storage is available immediately. All software will be available on May 15, 2003.

9.0 Clause 9: Audit Items

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

The auditor's attestation letter is included at the front of this report.

Appendix - A Tunable Parameters

A.1 DB2 Database Configuration

Database Configuration for Database tpcd

```
 Database configuration release level            = 0x0a00
 Database release level                          = 0x0a00

 Database territory                              = US
 Database code page                              = 819
 Database code set                               = ISO8859-1
 Database country/region code                    = 1

 Dynamic SQL Query management         (DYN_QUERY_MGMT) =
DISABLE

 Discovery support for this database       (DISCOVER_DB) = ENABLE

 Default query optimization class        (DFT_QUERYOPT) = 7
 Degree of parallelism                   (DFT_DEGREE) = 1
 Continue upon arithmetic exceptions   (DFT_SQLMATHWARN) = NO
 Default refresh age                (DFT_REFRESH_AGE) = 0
 Number of frequent values retained     (NUM_FREQVALUES) = 0
 Number of quantiles retained           (NUM_QUANTILES) = 600

 Backup pending                                  = NO

 Database is consistent                          = YES
 Rollforward pending                             = NO
 Restore pending                                 = NO

 Multi-page file allocation enabled              = NO

 Log retain for recovery status                  = NO
 User exit for logging status                    = NO

 Data Links Token Expiry Interval (sec)      (DL_EXPINT) = 60
 Data Links Write Token Init Expiry Intvl(DL_WT_IEXPINT) = 60
 Data Links Number of Copies            (DL_NUM_COPIES) = 1
 Data Links Time after Drop (days)       (DL_TIME_DROP) = 1
 Data Links Token in Uppercase             (DL_UPPER) = NO
 Data Links Token Algorithm                (DL_TOKEN) = MAC0

 Database heap (4KB)                        (DBHEAP) = 15000
 Size of database shared memory (4KB)  (DATABASE_MEMORY) =
AUTOMATIC
 Catalog cache size (4KB)            (CATALOGCACHE_SZ) =
(MAXAPPLS*4)
 Log buffer size (4KB)                   (LOGBUFSZ) = 128
 Utilities heap size (4KB)               (UTIL_HEAP_SZ) = 10000
 Buffer pool size (pages)                (BUFFPAGE) = 1000
 Extended storage segments size (4KB)    (ESTORE_SEG_SZ) =
16000
 Number of extended storage segments   (NUM_ESTORE_SEGS) = 0
 Max storage for lock list (4KB)            (LOCKLIST) = 16392

 Max size of appl. group mem set (4KB) (APPGROUP_MEM_SZ) =
40000
 Percent of mem for appl. group heap   (GROUPHEAP_RATIO) = 70
 Max appl. control heap size (4KB)     (APP_CTL_HEAP_SZ) = 512

 Sort heap thres for shared sorts (4KB) (SHEAPTHRES_SHR) = 250
 Sort list heap (4KB)                    (SORTHEAP) = 41000
 SQL statement heap (4KB)                (STMTHEAP) = 20000
 Default application heap (4KB)          (APPLHEAPSZ) = 156
 Package cache size (4KB)                (PCKCACHESZ) =
(MAXAPPLS*8)
 Statistics heap size (4KB)              (STAT_HEAP_SZ) = 4384

 Interval for checking deadlock (ms)        (DLCHKTIME) = 10000
 Percent. of lock lists per application       (MAXLOCKS) = 13
 Lock timeout (sec)                      (LOCKTIMEOUT) = -1

 Changed pages threshold               (CHNGPGS_THRESH) = 15
 Number of asynchronous page cleaners   (NUM_IOCLEANERS) = 1
 Number of I/O servers                  (NUM_IOSERVERS) = 16
 Index sort flag                        (INDEXSORT) = YES
 Sequential detect flag                 (SEQDETECT) = YES
 Default prefetch size (pages)        (DFT_PREFETCH_SZ) = 32

 Track modified pages                      (TRACKMOD) = OFF

 Default number of containers                    = 1
 Default tablespace extentsize (pages)   (DFT_EXTENT_SZ) = 32

 Max number of active applications          (MAXAPPLS) = 365
 Average number of active applications       (AVG_APPLS) = 1
 Max DB files open per application          (MAXFILOP) = 1024

 Log file size (4KB)                     (LOGFILSIZ) = 8192
 Number of primary log files               (LOGPRIMARY) = 25
 Number of secondary log files             (LOGSECOND) = 10
 Changed path to log files               (NEWLOGPATH) =
 Path to log files                               = /db/tpcd/NODE0001/
 Overflow log path                  (OVERFLOWLOGPATH) =
 Mirror log path                    (MIRRORLOGPATH) =
 First active log file                           =
 Block log on disk full             (BLK_LOG_DSK_FUL) = NO
 Percent of max active log space by transaction(MAX_LOG) = 0
 Num. of active log files for 1 active UOW(NUM_LOG_SPAN) = 0

 Group commit count                        (MINCOMMIT) = 1
 Percent log file reclaimed before soft chckpt (SOFTMAX) = 300
 Log retain for recovery enabled           (LOGRETAIN) = OFF
 User exit for logging enabled             (USEREXIT) = OFF

 Auto restart enabled                    (AUTORESTART) = ON
 Index re-creation time                    (INDEXREC) = SYSTEM
(RESTART)
 Default number of loadrec sessions     (DFT_LOADREC_SES) = 1
 Number of database backups to retain    (NUM_DB_BACKUPS) = 12
 Recovery history retention (days)      (REC_HIS_RETENTN) = 366

 TSM management class                    (TSM_MGMTCLASS) =
 TSM node name                          (TSM_NODENAME) =
 TSM owner                              (TSM_OWNER) =
 TSM password                           (TSM_PASSWORD) =
```

A.2 DB2 Database Manager Configuration

Database Manager Configuration

Node type = Enterprise Server Edition with local and remote clients

```
 Database manager configuration release level            = 0x0a00

 CPU speed (millisec/instruction)             (CPUSPEED) = 5.235149e-
07
 Communications bandwidth (MB/sec)      (COMM_BANDWIDTH) =
1.000000e+01

 Max number of concurrently active databases     (NUMDB) = 1
 Data Links support                         (DATALINKS) = NO
 Federated Database System Support          (FEDERATED) = NO
 Transaction processor monitor name        (TP_MON_NAME) =
```

```
 Default charge-back account          (DFT_ACCOUNT_STR) =

 Java Development Kit installation path       (JDK_PATH) =
/usr/java13_64

 Diagnostic error capture level            (DIAGLEVEL) = 3
 Notify Level                         (NOTIFYLEVEL) = 3
 Diagnostic data directory path            (DIAGPATH) =
/install/db2dump

 Default database monitor switches
   Buffer pool                    (DFT_MON_BUFPOOL) = OFF
   Lock                           (DFT_MON_LOCK) = OFF
   Sort                           (DFT_MON_SORT) = OFF
   Statement                      (DFT_MON_STMT) = OFF
   Table                          (DFT_MON_TABLE) = OFF
   Timestamp                      (DFT_MON_TIMESTAMP) = ON
   Unit of work                   (DFT_MON_UOW) = OFF
 Monitor health of instance and databases   (HEALTH_MON) = OFF

 SYSADM group name                    (SYSADM_GROUP) =
 SYSCTRL group name                   (SYSCTRL_GROUP) =
 SYSMAINT group name                  (SYSMAINT_GROUP) =

 Database manager authentication        (AUTHENTICATION) =
SERVER
 Cataloging allowed without authority   (CATALOG_NOAUTH) = NO
 Trust all clients                 (TRUST_ALLCLNTS) = YES
 Trusted client authentication          (TRUST_CLNTAUTH) = CLIENT
 Use SNA authentication                 (USE_SNA_AUTH) = NO
 Bypass federated authentication          (FED_NOAUTH) = NO

 Default database path                  (DFTDBPATH) = /tpc/tpcd

 Database monitor heap size (4KB)         (MON_HEAP_SZ) = 90
 Java Virtual Machine heap size (4KB)     (JAVA_HEAP_SZ) = 1024
 Audit buffer size (4KB)                (AUDIT_BUF_SZ) = 0
 Size of instance shared memory (4KB)  (INSTANCE_MEMORY) =
AUTOMATIC
 Backup buffer default size (4KB)         (BACKBUFSZ) = 1024
 Restore buffer default size (4KB)        (RESTBUFSZ) = 1024

 Sort heap threshold (4KB)              (SHEAPTHRES) = 2800000

 Directory cache support                (DIR_CACHE) = YES

 Application support layer heap size (4KB)   (ASLHEAPSZ) = 15
 Max requester I/O block size (bytes)        (RQRIOBLK) = 32767
 Query heap size (4KB)                (QUERY_HEAP_SZ) = 1000
 DRDA services heap size (4KB)          (DRDA_HEAP_SZ) = 128

 Priority of agents                     (AGENTPRI) = SYSTEM
 Max number of existing agents            (MAXAGENTS) = 400
 Agent pool size                   (NUM_POOLAGENTS) =
200(calculated)
 Initial number of agents in pool       (NUM_INITAGENTS) = 170
 Max number of coordinating agents     (MAX_COORDAGENTS) =
(MAXAGENTS - NUM_INITAGENTS)
 Max no. of concurrent coordinating agents  (MAXCAGENTS) =
MAX_COORDAGENTS
 Max number of client connections      (MAX_CONNECTIONS) =
MAX_COORDAGENTS

 Keep fenced process                    (KEEPFENCED) = YES
 Number of pooled fenced processes        (FENCED_POOL) =
MAX_COORDAGENTS
 Initialize fenced process with JVM     (INITFENCED_JVM) = NO
 Initial number of fenced processes     (NUM_INITFENCED) = 0

 Index re-creation time                   (INDEXREC) = RESTART

 Transaction manager database name        (TM_DATABASE) =
1ST_CONN
 Transaction resync interval (sec)     (RESYNC_INTERVAL) = 180

 SPM name                               (SPM_NAME) =
 SPM log size                      (SPM_LOG_FILE_SZ) = 256
 SPM resync agent limit              (SPM_MAX_RESYNC) = 20
 SPM log path                        (SPM_LOG_PATH) =

 TCP/IP Service name                     (SVCENAME) =
 Discovery mode                       (DISCOVER) = SEARCH
 Discovery communication protocols       (DISCOVER_COMM) =
 Discover server instance             (DISCOVER_INST) = ENABLE

 Maximum query degree of parallelism   (MAX_QUERYDEGREE) =
ANY
 Enable intra-partition parallelism     (INTRA_PARALLEL) = NO

 No. of int. communication buffers(4KB)(FCM_NUM_BUFFERS) =
262144
Node connection elapse time (sec)        (CONN_ELAPSE) = 10
 Max number of node connection retries (MAX_CONNRETRIES) = 5
 Max time difference between nodes (min) (MAX_TIME_DIFF) = 60
 db2start/db2stop timeout (min)        (START_STOP_TIME) = 10
```

A.3 DB2 Registry Settings

```
DB2OPTIONS="-t -v +c"
DB2_EXTENDED_OPTIMIZATION=Y
DB2_ANTIJOIN=ON
DB2_STRIPED_CONTAINERS=ON
DB2_FORCE_FCM_BP=ON
DB2MEMMAXFREE=8000000
DB2MEMDISCLAIM=ON
DB2BPVARS=/tpc/tpcd/tpcd/custom/bpvars.cfg
DB2_PARALLEL_IO="*"
DB2BQTRY=120

/tpc/tpcd/tpcd/custom/bpvars.cfg Content
NUMPREFETCHQUEUES=4
PREFETCHQUEUESIZE=200
```

A.4 AIX Parameters

```
vmo -p -o minperm%=20
vmo -p -o maxperm%=40
vmo -p -o maxclient%=10
vmo -p -o memory_affinity=1
ioo -p -o lvm_bufcnt=16
ioo -p -o maxpgahead=64
chdev -l sys0 -a maxuproc=8192
/usr/sbin/rsetcntl -d /etc/rsets
```

A.5 /etc/rset

```
DB2/MLN1:
   owner    = tpcd
   group    = system
   perm     = rwr-r-
   resources =
sys/cpu.00000,sys/cpu.00001,sys/cpu.00002,sys/cpu.00003

DB2/MLN2:
   owner    = tpcd
   group    = system
   perm     = rwr-r-
```

```
   resources =
sys/cpu.00004,sys/cpu.00005,sys/cpu.00006,sys/cpu.00007

DB2/MLN3:
   owner     = tpcd
   group     = system
   perm      = rwr-r-
   resources =
sys/cpu.00008,sys/cpu.00009,sys/cpu.00010,sys/cpu.00011

DB2/MLN4:
   owner     = tpcd
   group     = system
   perm      = rwr-r-
   resources =
sys/cpu.00012,sys/cpu.00013,sys/cpu.00014,sys/cpu.00015

DB2/MLN5:
   owner     = tpcd
   group     = system
   perm      = rwr-r-
   resources =
sys/cpu.00016,sys/cpu.00017,sys/cpu.00018,sys/cpu.00019

DB2/MLN6:
   owner     = tpcd
   group     = system
   perm      = rwr-r-
   resources =
sys/cpu.00020,sys/cpu.00021,sys/cpu.00022,sys/cpu.00023

DB2/MLN7:
   owner     = tpcd
   group     = system
   perm      = rwr-r-
   resources =
sys/cpu.00024,sys/cpu.00025,sys/cpu.00026,sys/cpu.00027

DB2/MLN8:
   owner     = tpcd
   group     = system
   perm      = rwr-r-
   resources =
sys/cpu.00028,sys/cpu.00029,sys/cpu.00030,sys/cpu.00031
```

Appendix - B Database Build Scripts

B.1 buildtpcd

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

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

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


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

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

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

# verify that necessary environment variables for building the database
# are present.  Default those that aren't necessary
require "version";
$instance=$ENV{"DB2INSTANCE"};
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
$platform=$ENV{"TPCD_PLATFORM"};
if ( $platform eq "nt" )
{
   $sep="&";
}
else
{
   $sep=";";
}
if ((length($ENV{"TPCD_BUILD_STAGE"}) <= 0) ||
($ENV{"TPCD_BUILD_STAGE"}) eq "NULL" )
{
   $ENV{"TPCD_BUILD_STAGE"} = "ALL";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
   die "Must set TPCD_PRODUCT env't var.\n";
}
if ( length($ENV{"TPCD_DBNAME"}) <= 0 )
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_MODE"}) <= 0)
{
  die "TPCD_MODE environment variable not set - uni/smp/mln \n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_DBPATH"}) <= 1)
{
   # if no db pathname specified, build the db in the home directory
   if ( $platform eq "aix" || $platform eq "sun" || $platform eq "ptx" ||
$platform eq "hp")
   {
      $ENV{"TPCD_DBPATH"} = $ENV{"HOME"};
   }
   elsif ( $platform eq "nt" )
   {
      $ENV{"TPCD_DBPATH"} = $ENV{"HOMEDRIVE"};
   }
   else
   {
      die "platform $platform not supported yet\n";
   }
}
if (length($ENV{"TPCD_DDLPATH"}) <= 0)
{
   # if no db pathname specified, use default
  $ENV{"TPCD_DBPATH"} =
"/afs/tor/groups/dbp/perf/benchmark/tpcd/ddl/vanilla";
}
if (length($ENV{"TPCD_GENERATE_SEED_FILE"}) <= 0)
{
   # if no db pathname specified, use default
  $ENV{"TPCD_GENERATE_SEED_FILE"} = "no";
}
if (length($ENV{"TPCD_DDL"}) <= 0)
{
   $ENV{"TPCD_DDL"} = "dss.ddl";
}
if (length($ENV{"TPCD_STAGING_TABLE_DDL"}) <= 0)
{
   $ENV{"TPCD_STAGING_TABLE_DDL"} = "NULL";
}
if (length($ENV{"TPCD_PRELOAD_STAGING_TABLE_SCRIPT"}) <=
0)
{
   $ENV{"TPCD_PRELOAD_STAGING_TABLE_DDL"} = "NULL";
}
if (length($ENV{"TPCD_DELETE_STAGING_TABLE_SQL"}) <= 0)
{
   $ENV{"TPCD_DELETE_STAGING_TABLE_DDL"} = "NULL";
}
if (length($ENV{"TPCD_TBSP_DDL"}) <= 0)
{
   $ENV{"TPCD_TBSP_DDL"} = "dss.tbsp.ddl";
}
if (length($ENV{"TPCD_INDEXDDL"}) <= 0)
{
   $ENV{"TPCD_INDEXDDL"} = "dss.index";
}
if (length($ENV{"TPCD_RUNSTATS"}) <= 0)
{
   $ENV{"TPCD_RUNSTATS"} = "dss.runstats";
}
if (length($ENV{"TPCD_RUNSTATSHORT"}) <= 0)
{
   $ENV{"TPCD_RUNSTATSHORT"} = "NULL";
}
if (length($ENV{"TPCD_ADD_RI"}) <= 0)
{
```

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

#set up local variables
```

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

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

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

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

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

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

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

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

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

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

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



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

print "Sleeping for 15 seconds to give you a chance to reconsider...\n";
sleep 15;

# don't need separate calls for mln/mpp vs uni since the $all_ln will be
# defined appropriately
if ( $platform eq "nt" )
{
   if (($mode eq "uni") || ($mode eq "smp"))
   {
     #spaces required for NT
     $rc=&dodb_noconn("db2set DB2OPTIONS=\"   -t -v +c\"",$all_ln);
   }
   else
   {
     $rc=&dodb_noconn("db2set DB2OPTIONS=\\\"   -t -v
+c\\\"",$all_ln);
   }
}
else
{
   if (($mode eq "uni") || ($mode eq "smp"))
   {
     $rc=&dodb_noconn("db2set DB2OPTIONS=\"-t -v +c\"",$once);
   }
   else
```

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

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

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

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

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

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

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

    # reset the db and dbm configuration before we start
    &dodb_conn($dbname,"db2 grant connect on database to public
$sep       \
       db2 commit",$once);
    &dodb_noconn("db2 reset database manager configuration",$once);

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

    # setup the load configuration
    &outtime("*** Setting LOAD configuration.");
    if (($loadconfigfile eq "") || ($loadconfigfile eq "NULL"))
    {
      &dodb_noconn("db2 update db cfg for $dbname using buffpage
$buffpage $sep \
          db2 update db cfg for $dbname using sortheap $sortheap $sep
\
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```
          db2 update db cfg for $dbname using num_iocleaners $ioclnrs
$sep \
          db2 update db cfg for $dbname using num_ioservers
$ioservers $sep \
          db2 update db cfg for $dbname using util_heap_sz
$util_heap_sz $sep \
          db2 update db cfg for $dbname using chngpgs_thresh
$chngpgs",
          $all_ln);
      &dodb_noconn("db2 update dbm cfg using sheapthres
$sheapthres",$once);
   }
   else
   {
      &dodb2file_noconn("$ddlpath${delim}$loadconfigfile",$all_ln);
      &dodb2file_noconn("$ddlpath${delim}$loadDBMconfig",$once);
   }
   system(" db2_all \"||\\\" db2 get db cfg for tpcd >
/install/db2dump/dbcfg_load.## \" ");
   &dodb_noconn("db2 terminate",$once);
   $rc=system("db2stop");
   if ( $rc != 0 )
   {
      die "failure during db2stop after resetting for load config rc = $rc
\n";
   }
   $rc=system("db2start");
   if ( $rc != 0 )
   {
      die "failure during db2start rc = $rc \n";
   }
}  # end of "CREATE DATABASE" phase
if (( $buildStage eq "ALL" ) || ( $buildStage eq "CRTTBSP" ) ||
   ( $buildStage eq "LOAD" ) ||
   (( $buildStage eq "INDEX" ) && ( $earlyindex eq "yes" )) )
{
   # create the nodegroups is there is a file specified
   if ( $nodegroupdef ne "NULL" )
   {
      #run the create bufferpool ddl
      &outtime("*** Creating the nodegroups");
      &dodb2file($dbname,"$ddlpath${delim}$nodegroupdef",$once);

   }
   # create the explain tables - these should go into userspace1 since
no
   # other tablespaces exist
   if ( $explainDDL ne "NULL" )
   {
      $explnPathFile="$ddlpath${delim}$explainDDL";
   }
   else
   {
      if ( $platform eq "ptx" )
      {
         $home=$ENV{"HOME"};
         $sqlpath="$home${delim}sqllib";
      }
      if ( $platform ne "nt" )
      {
         $sqlpath="~${delim}sqllib";
      }
      else
      {
         $sqlpath=$ENV{"DB2PATH"};
      }
      $explnPathFile="$sqlpath${delim}misc${delim}EXPLAIN.DDL";
   }

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

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

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

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

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

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

    if ( $mode eq "mpp" )
    {
       #need parallel specific
       print "need to figure parallel specific creation of tmp\n";
    }
    mkdir("${delim}tmp${delim}$instance",0777);
}  # end of "CREATE TABLESPACE and TABLES" phase
if (( $buildStage eq "ALL" ) || ( $buildStage eq "CRTTBSP" ) ||
    ( $buildStage eq "LOAD" ) ||
    (( $buildStage eq "INDEX" ) && ( $earlyindex eq "yes" )) )
{
    # do the load stage of the build, or if early index is on do
    # the index creation also
    # setup the load configuration
    if ( $buildStage ne "ALL")
    { # we're restarting a build so reapply the load config
      &outtime("*** Setting LOAD configuration.");
      if (($loadconfigfile eq "") || ($loadconfigfile eq "NULL"))
      {
       &dodb_noconn("db2 update db cfg for $dbname using buffpage
$buffpage $sep \
            db2 update db cfg for $dbname using sortheap $sortheap $sep
\
            db2 update db cfg for $dbname using num_iocleaners $ioclnrs
$sep \
            db2 update db cfg for $dbname using num_ioservers
$ioservers $sep \
            db2 update db cfg for $dbname using util_heap_sz
$util_heap_sz $sep \
            db2 update db cfg for $dbname using chngpgs_thresh
$chngpgs",
            $all_ln);
       &dodb_noconn("db2 update dbm cfg using sheapthres
$sheapthres",$once);
      }
      else
      {
        &dodb2file_noconn("$ddlpath${delim}$loadconfigfile",$all_ln);
        &dodb2file_noconn("$ddlpath${delim}$loadDBMconfig",$once);
      }
      &dodb_noconn("db2 terminate",$once);
      $rc=system("db2stop");
      if ( $rc != 0 )
      {
        die "failure during db2stop after resetting for load config rc = $rc
\n";
      }
      $rc=system("db2start");
      if ( $rc != 0 )
      {
        die "failure during db2start rc = $rc \n";
      }
    }

    # if earlyindex requested, create indexes
    if ( $earlyindex eq "yes" )
    {
       &outtime("*** Starting to create indexes");
       &dodb2file($dbname,"$ddlpath${delim}$indexddl",$once);

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


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

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

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

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

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


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

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

if (( $buildStage eq "ALL" ) || ( $buildStage eq "CRTTBSP" ) ||
    ( $buildStage eq "LOAD" ) ||
```

```
   ( $buildStage eq "INDEX" ))
{
   if ( $buildStage eq "INDEX")
   { # we're restarting a build so reapply the load config
     &outtime("*** Setting LOAD configuration.");
     if (($loadconfigfile eq "") || ($loadconfigfile eq "NULL"))
     {
      &dodb_noconn("db2 update db cfg for $dbname using buffpage
$buffpage $sep \
          db2 update db cfg for $dbname using sortheap $sortheap $sep
\
          db2 update db cfg for $dbname using num_iocleaners $ioclnrs
$sep \
          db2 update db cfg for $dbname using num_ioservers
$ioservers $sep \
          db2 update db cfg for $dbname using util_heap_sz
$util_heap_sz $sep \
          db2 update db cfg for $dbname using chngpgs_thresh
$chngpgs",
          $all_ln);
       &dodb_noconn("db2 update dbm cfg using sheapthres
$sheapthres",$once);
     }
     else
     {
       &dodb2file_noconn("$ddlpath${delim}$loadconfigfile",$all_ln);
       &dodb2file_noconn("$ddlpath${delim}$loadDBMconfig",$once);
     }
     &dodb_noconn("db2 terminate",$once);
     $rc=system("db2stop");
     if ( $rc != 0 )
     {
       die "failure during db2stop after resetting for load config rc = $rc
\n";
     }
     $rc=system("db2start");
     if ( $rc != 0 )
     {
       die "failure during db2start rc = $rc \n";
     }
   }
   # if indexes haven't been created, do so now
   if ( $earlyindex ne "yes" )
   {
      &outtime("*** Create index started");
      &dodb2file($dbname,"$ddlpath${delim}$indexddl",$once);

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

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

if (( $buildStage eq "ALL" ) ||  ( $buildStage eq "CRTTBSP" ) ||
   ( $buildStage eq "LOAD" ) ||
   ( $buildStage eq "INDEX" ) || ( $buildStage eq "RUNSTATS" ))
{
   if ( $buildStage eq "RUNSTATS")
   { # we're restarting a build so reapply the load config
     &outtime("*** Setting LOAD configuration.");
     if (($loadconfigfile eq "") || ($loadconfigfile eq "NULL"))
     {
      &dodb_noconn("db2 update db cfg for $dbname using buffpage
$buffpage $sep \
          db2 update db cfg for $dbname using sortheap $sortheap $sep
\
          db2 update db cfg for $dbname using num_iocleaners $ioclnrs
$sep \
          db2 update db cfg for $dbname using num_ioservers
$ioservers $sep \
          db2 update db cfg for $dbname using util_heap_sz
$util_heap_sz $sep \
          db2 update db cfg for $dbname using chngpgs_thresh
$chngpgs",
          $all_ln);
       &dodb_noconn("db2 update dbm cfg using sheapthres
$sheapthres",$once);
     }
     else
     {
       &dodb2file_noconn("$ddlpath${delim}$loadconfigfile",$all_ln);
       &dodb2file_noconn("$ddlpath${delim}$loadDBMconfig",$once);
     }
     &dodb_noconn("db2 terminate",$once);
     $rc=system("db2stop");
     if ( $rc != 0 )
     {
       die "failure during db2stop after resetting for load config rc = $rc
\n";
     }
     $rc=system("db2start");
     if ( $rc != 0 )
     {
       die "failure during db2start rc = $rc \n";
     }
   }
   # if statistics not gathered on the load, run runstats  (we have to run
the
   # stats at the same time as the index creation whether it be both
during load,
   # or after load)
   # We need to run the runstats as well if we have specifed an extra
index file
   # for "after load" indexes
   if (( $loadstats eq "no" ) || ( $earlyindex eq "no" ) || ( $extraindex ne
"no" ))
   {
      # if loadstats not gathered, then index stats not gathered either.
      &outtime("*** Runstats started");

      if ( $runstatShort ne "NULL" )
      {
         # we've specified a second runstats file...This runstats file
should do
         # runstats for all table except lineitem. The lineitem runstats
command
         # should be left in the main runstats file.
         if ( $platform eq "aix" || $platform eq "sun" || $platform eq "ptx" )
         {
            print "runstats from $ddlpath${delim}$runstatShort running
now\n";
            $rc = system("db2 -tvf \"$ddlpath${delim}$runstatShort\" >
\"$auditDir${delim}tools${delim}runstatShort.out\"  & ");
            print "rc from runstatshort=$rc\n";
         }
         elsif ( $platform eq "nt" )
         {
            system("start db2 -tvf $ddlpath${delim}$runstatShort");
         }
         else
         {
            print "Don't know how to start in background on $platform
platform\n";
            print "therefore running runstats serially\n";
```

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

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

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

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

# set the configuration
&outtime("*** Set Configuration started");
&dodb2file_noconn("${ddlpath}${delim}$configfile",$all_ln);
&dodb2file_noconn("${ddlpath}${delim}$dbmconfig",$once);
system(" db2_all \"||\\\" db2 get db cfg for tpcd >
/install/db2dump/dbcfg_run.## \" ");

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

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

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

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

# stop and restart the database to get config parms recognized
```

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

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

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

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

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

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

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

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

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

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

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

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

1;
```

B.2 create_nodegroups.ddl

```
CREATE NODEGROUP ng_all ON NODES (1 to 160);
CREATE NODEGROUP ng_node1 ON NODE (1);
COMMIT WORK;
```

B.3 create_bpools.ddl

```
-----------------------------------------------------------
-- Create Bufferpools
-----------------------------------------------------------
ALTER BUFFERPOOL IBMDEFAULTBP SIZE 200;
COMMIT WORK;
CREATE BUFFERPOOL BPTEMP ALL NODES SIZE 64000
PAGESIZE 8K;
COMMIT WORK;
CREATE BUFFERPOOL BP32K ALL NODES SIZE 96000
NUMBLOCKPAGES 57600 BLOCKSIZE 16 PAGESIZE 32K;
COMMIT WORK;
```

B.4 create_tbspace.ddl

```
-----------------------------------------------------------------
-- Create Tablespaces
-----------------------------------------------------------------
CREATE regular TABLESPACE TABDATA
  in nodegroup ng_all
  PAGESIZE 32K MANAGED BY DATABASE
USING (
device '/dev/rdata1p $N' 458752,
device '/dev/rdata2p $N' 458752,
device '/dev/rdata3p $N' 458752,
device '/dev/rdata4p $N' 458752,
device '/dev/rdata5p $N' 458752,
device '/dev/rdata6p $N' 458752,
device '/dev/rdata7p $N' 458752,
```

```
device '/dev/rdata8p $N' 458752
)
BUFFERPOOL BP32K
extentsize 16
prefetchsize 384
overhead 9.62
transferrate 1.74;

CREATE regular TABLESPACE TABINDEXES
  in nodegroup ng_all
  PAGESIZE 32K MANAGED BY DATABASE
USING (
device '/dev/ridx1p $N' 98304,
device '/dev/ridx2p $N' 98304,
device '/dev/ridx3p $N' 98304,
device '/dev/ridx4p $N' 98304,
device '/dev/ridx5p $N' 98304,
device '/dev/ridx6p $N' 98304,
device '/dev/ridx7p $N' 98304,
device '/dev/ridx8p $N' 98304
)
BUFFERPOOL BP32K
extentsize 16
prefetchsize 384
overhead 9.62
transferrate 1.74;

CREATE TEMPORARY TABLESPACE TEMPSPACE
  PAGESIZE 8K MANAGED BY DATABASE
USING (
device '/dev/rtm1p $N'  2007040,
device '/dev/rtm2p $N'  2007040,
device '/dev/rtm3p $N'  2007040,
device '/dev/rtm4p $N'  2007040,
device '/dev/rtm5p $N'  2007040,
device '/dev/rtm6p $N'  2007040,
device '/dev/rtm7p $N'  2007040,
device '/dev/rtm8p $N'  2007040
)
BUFFERPOOL BPTEMP
extentsize 16
prefetchsize 384
overhead 9.62
transferrate 0.87;

CREATE REGULAR TABLESPACE SMALL
  in nodegroup ng_node1
  pagesize 4K
  managed by system
  using ('/db/small')
  bufferpool IBMDEFAULTBP;

COMMIT WORK;
```

B.5 create_tables.ddl

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

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

CREATE TABLE TPCD.PART  ( P_PARTKEY     INTEGER NOT
NULL,
                    P_NAME        VARCHAR(55) NOT NULL,
                    P_MFGR        CHAR(25) NOT NULL,
                    P_BRAND       CHAR(10) NOT NULL,
                    P_TYPE        VARCHAR(25) NOT NULL,
                    P_SIZE        INTEGER NOT NULL,
                    P_CONTAINER   CHAR(10) NOT NULL,
                    P_RETAILPRICE FLOAT NOT NULL,
                    P_COMMENT     VARCHAR(23) NOT NULL )
     IN TABDATA
     INDEX IN TABINDEXES;

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

CREATE TABLE TPCD.PARTSUPP ( PS_PARTKEY     INTEGER
NOT NULL,
                    PS_SUPPKEY     INTEGER NOT NULL,
                    PS_AVAILQTY    INTEGER NOT NULL,
                    PS_SUPPLYCOST  FLOAT   NOT NULL,
                    PS_COMMENT     VARCHAR(199) NOT NULL )
     IN TABDATA
     INDEX IN TABINDEXES;

CREATE TABLE TPCD.CUSTOMER ( C_CUSTKEY     INTEGER
NOT NULL,
                    C_NAME        VARCHAR(25) NOT NULL,
                    C_ADDRESS     VARCHAR(40) NOT NULL,
                    C_NATIONKEY   INTEGER NOT NULL,
                    C_PHONE       CHAR(15) NOT NULL,
                    C_ACCTBAL     FLOAT    NOT NULL,
                    C_MKTSEGMENT  CHAR(10) NOT NULL,
                    C_COMMENT     VARCHAR(117) NOT NULL)
     IN TABDATA
     INDEX IN TABINDEXES;

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

CREATE TABLE TPCD.LINEITEM ( L_ORDERKEY    BIGINT NOT
NULL,
                    L_PARTKEY     INTEGER NOT NULL,
                    L_SUPPKEY     INTEGER NOT NULL,
                    L_LINENUMBER  INTEGER NOT NULL,
                    L_QUANTITY    FLOAT NOT NULL,
                    L_EXTENDEDPRICE  FLOAT NOT NULL,
                    L_DISCOUNT    FLOAT NOT NULL,
                    L_TAX         FLOAT NOT NULL,
```

```
                L_RETURNFLAG  CHAR(1) NOT NULL,
                L_LINESTATUS  CHAR(1) NOT NULL,
                L_SHIPDATE    DATE NOT NULL,
                L_COMMITDATE  DATE NOT NULL,
                L_RECEIPTDATE DATE NOT NULL,
                L_SHIPINSTRUCT CHAR(25) NOT NULL,
                L_SHIPMODE     CHAR(10) NOT NULL,
                L_COMMENT      VARCHAR(44) NOT NULL)
ORGANIZE BY (L_SHIPDATE)
     IN TABDATA
     INDEX IN TABINDEXES;

COMMIT WORK;
```

B.6 load.sh

```
#!/bin/ksh
messages=${TPCD_TMP_DIR}
rawdata=${TPCD_INPUT}
custom=${TPCD_DDLPATH}

rah "rm -f ${messages}/lineitem.*.msg"
rah "rm -f ${messages}/orders.*.msg"
rah "rm -f ${messages}/customer.*.msg"
rah "rm -f ${messages}/supplier.*.msg"
rah "rm -f ${messages}/partsupp.*.msg"
rah "rm -f ${messages}/part.*.msg"
rah "rm -f ${messages}/nation*msg"
rah "rm -f ${messages}/region*msg"

echo "Load Summary Time: " > ${messages}/loadstatus.out

# Nation and Region are loaded into the current node

db2 connect to tpcd;

echo "Loading Nation at "`date` >> ${messages}/loadstatus.out
db2 "load from ${rawdata}00001/nation.tbl of del modified by coldel|
fastparse noheader messages ${messages}/nation.msg replace into
TPCD.NATION nonrecoverable"

echo "Loading Region at "`date` >> ${messages}/loadstatus.out
db2 "load from ${rawdata}00001/region.tbl of del modified by coldel|
fastparse noheader messages ${messages}/region.msg replace into
TPCD.REGION nonrecoverable"


echo "Loading Lineitem at "`date` >> ${messages}/loadstatus.out
 db2 -tvf ${custom}/load_lineitem.ddl
#
echo "Loading Orders at "`date` >> ${messages}/loadstatus.out
 db2 -tvf ${custom}/load_orders.ddl
#
echo "Loading Partsupp at "`date` >> ${messages}/loadstatus.out
 db2 -tvf ${custom}/load_partsupp.ddl
#
echo "Loading Customer at "`date` >> ${messages}/loadstatus.out
 db2 -tvf ${custom}/load_customer.ddl
#
echo "Loading Part at "`date` >> ${messages}/loadstatus.out
 db2 -tvf ${custom}/load_part.ddl
#
echo "Loading Supplier at "`date` >> ${messages}/loadstatus.out
 db2 -tvf ${custom}/load_supplier.ddl
#

db2 commit;
db2 terminate;

echo "Finished Loading  at "`date` >> ${messages}/loadstatus.out
echo "-----------------------------------------" >> ${messages}/loadstatus.out

#echo "Starting Sanity Chequing at  "`date` >>
${messages}/loadstatus.out
#db2 connect to tpcd;
#db2 "select count_big(*) as lineitem from tpcd.lineitem" >>
${messages}/loadstatus.out
#db2 "select count_big(*) as orders from tpcd.orders" >>
${messages}/loadstatus.out
#db2 "select count_big(*) as partsupp from tpcd.partsupp" >>
${messages}/loadstatus.out
#db2 "select count_big(*) as customer from tpcd.customer" >>
${messages}/loadstatus.out
#db2 "select count_big(*) as part from tpcd.part" >>
${messages}/loadstatus.out
#db2 "select count_big(*) as supplier from tpcd.supplier" >>
${messages}/loadstatus.out
#db2 "select count(*) as nation from tpcd.nation" >>
${messages}/loadstatus.out
#db2 "select count(*) as region from tpcd.region" >>
${messages}/loadstatus.out
#db2 terminate;
#echo "Finish Sanity Chequing at  "`date` >>
${messages}/loadstatus.out
```

B.7 dbcfg_load

```
update database configuration for tpcd using
dft_queryopt 7 num_freqvalues 0 num_quantiles 600
stat_heap_sz 40000 dbheap 3000 newlogpath /db/tpcd
logbufsz 128 util_heap_sz 131072 locklist 8192
app_ctl_heap_sz 512 sortheap 60000 stmtheap 20000
applheapsz 156 maxlocks 13 chngpgs_thresh 90
num_iocleaners 1 num_ioservers 16 maxappls 365
maxfilop 1024 logfilsiz 8192 logprimary 25
SHEAPTHRES_SHR 250 logsecond 10;
```

B.8 dbmcfg_load

```
update database manager configuration using
comm_bandwidth 10 numdb 1 diagpath /install/db2dump
cpuspeed 5.235149e-07 sheapthres 2800000
max_querydegree -1 FCM_NUM_BUFFERS 16384
intra_parallel no;
```

B.9 load_lineitem.ddl

```
load from
      lineitem.1,   lineitem.2,   lineitem.3,   lineitem.4,
      lineitem.5,   lineitem.6,   lineitem.7,   lineitem.8,
      lineitem.9,   lineitem.10,   lineitem.11,   lineitem.12,
      lineitem.13,   lineitem.14,   lineitem.15,   lineitem.16,
      lineitem.17,   lineitem.18,   lineitem.19,   lineitem.20,
      lineitem.21,   lineitem.22,   lineitem.23,   lineitem.24,
      lineitem.25,   lineitem.26,   lineitem.27,   lineitem.28,
      lineitem.29,   lineitem.30,   lineitem.31,   lineitem.32
   of del modified by coldel|
    fastparse
    messages /dev/null
    replace into TPCD.lineitem nonrecoverable
    partitioned db config mode load_only
    part_file_location /rawdata/links;
```

B.10 load_orders.ddl

```
load from
```

```
    orders.1,    orders.2,    orders.3,    orders.4,
    orders.5,    orders.6,    orders.7,    orders.8,
    orders.9,    orders.10,    orders.11,    orders.12,
    orders.13,    orders.14,    orders.15,    orders.16,
    orders.17,    orders.18,    orders.19,    orders.20,
    orders.21,    orders.22,    orders.23,    orders.24,
    orders.25,    orders.26,   orders.27,    orders.28,
    orders.29,    orders.30,    orders.31,    orders.32
    of del modified by coldel|
     fastparse
     messages /dev/null
     replace into TPCD.orders nonrecoverable
     partitioned db config mode load_only
     part_file_location /rawdata/links;
```

B.11 load_partsupp.ddl

```
load from
    partsupp.1,    partsupp.2,    partsupp.3,    partsupp.4,
    partsupp.5,    partsupp.6,    partsupp.7,    partsupp.8,
    partsupp.9,    partsupp.10,    partsupp.11,    partsupp.12,
    partsupp.13,    partsupp.14,    partsupp.15,    partsupp.16,
    partsupp.17,    partsupp.18,    partsupp.19,    partsupp.20,
    partsupp.21,    partsupp.22,    partsupp.23,    partsupp.24,
    partsupp.25,    partsupp.26,    partsupp.27,    partsupp.28,
    partsupp.29,    partsupp.30,    partsupp.31,    partsupp.32
    of del modified by coldel|
     fastparse
     messages /dev/null
     replace into TPCD.partsupp nonrecoverable
     partitioned db config mode load_only
     part_file_location /rawdata/links;
```

B.12 load_part.ddl

```
load from
    part.1,    part.2,    part.3,    part.4,
    part.5,    part.6,    part.7,    part.8,
    part.9,    part.10,    part.11,    part.12,
    part.13,    part.14,    part.15,    part.16,
    part.17,    part.18,    part.19,    part.20,
    part.21,    part.22,    part.23,    part.24,
    part.25,    part.26,    part.27,    part.28,
    part.29,    part.30,    part.31,    part.32
    of del modified by coldel|
     fastparse
     messages /dev/null
     replace into TPCD.part nonrecoverable
     partitioned db config mode load_only
     part_file_location /rawdata/links;
```

B.13 load_customer.ddl

```
load from
    customer.1,    customer.2,    customer.3,    customer.4,
    customer.5,    customer.6,    customer.7,    customer.8,
    customer.9,    customer.10,    customer.11,    customer.12,
    customer.13,    customer.14,    customer.15,    customer.16,
    customer.17,    customer.18,    customer.19,    customer.20,
    customer.21,    customer.22,    customer.23,    customer.24,
    customer.25,    customer.26,    customer.27,    customer.28,
    customer.29,    customer.30,    customer.31,    customer.32
    of del modified by coldel|
     fastparse
     messages /dev/null
     replace into TPCD.customer nonrecoverable
     partitioned db config mode load_only
     part_file_location /rawdata/links;
```

B.14 load_supplier.ddl

```
load from
    supplier.1,    supplier.2,    supplier.3,    supplier.4,
    supplier.5,    supplier.6,    supplier.7,    supplier.8,
    supplier.9,    supplier.10,    supplier.11,    supplier.12,
    supplier.13,    supplier.14,    supplier.15,    supplier.16,
    supplier.17,    supplier.18,    supplier.19,    supplier.20,
    supplier.21,    supplier.22,    supplier.23,    supplier.24,
    supplier.25,    supplier.26,    supplier.27,    supplier.28,
    supplier.29,    supplier.30,    supplier.31,    supplier.32
    of del modified by coldel|
     fastparse
     messages /dev/null
     replace into TPCD.supplier nonrecoverable
     partitioned db config mode load_only
     part_file_location /rawdata/links;
```

B.15 create_index.ddl

```
-------------------------------------------------------
-- Create Indexes
-------------------------------------------------------
values(current timestamp);
CREATE UNIQUE INDEX TPCD.R_RK ON TPCD.REGION
        (R_REGIONKEY ASC) PCTFREE 0;
commit work;
alter table tpcd.region add primary key (r_regionkey);
commit work;

values(current timestamp);
CREATE UNIQUE INDEX TPCD.N_NK ON TPCD.NATION
        (N_NATIONKEY ASC) PCTFREE 0 ;
commit work;
alter table tpcd.nation add primary key (n_nationkey);
commit work;

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

values(current timestamp);
CREATE UNIQUE INDEX TPCD.S_SK ON TPCD.SUPPLIER
        (S_SUPPKEY ASC) PCTFREE 0 ;
commit work;
alter table tpcd.supplier add primary key (s_suppkey);
commit work;

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

values(current timestamp);
CREATE UNIQUE INDEX TPCD.PS_PKSK ON TPCD.PARTSUPP
        (PS_PARTKEY ASC, PS_SUPPKEY ASC) PCTFREE 0 ;
commit work;
alter table tpcd.partsupp add primary key (ps_partkey, ps_suppkey);
commit work;

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

values(current timestamp);
CREATE UNIQUE INDEX TPCD.PS_SKPK ON TPCD.PARTSUPP
        (PS_SUPPKEY ASC, PS_PARTKEY ASC) PCTFREE 0 ;
```

```
commit work;

values(current timestamp);
CREATE INDEX TPCD.PS_SK ON TPCD.PARTSUPP
            (PS_SUPPKEY ASC) PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE UNIQUE INDEX TPCD.P_PK ON TPCD.PART
            (P_PARTKEY ASC) PCTFREE 0 ;
commit work;
alter table tpcd.part add primary key (p_partkey);
commit work;

values(current timestamp);
CREATE UNIQUE INDEX TPCD.C_CK ON TPCD.CUSTOMER
            (C_CUSTKEY ASC) PCTFREE 0 ;
commit work;
alter table tpcd.customer add primary key (c_custkey);
commit work;

values(current timestamp);
CREATE INDEX TPCD.C_NK ON TPCD.CUSTOMER
           (C_NATIONKEY ASC) PCTFREE 0 ;
commit work;

values(current timestamp);
CREATE UNIQUE INDEX TPCD.O_OK ON TPCD.ORDERS
            (O_ORDERKEY ASC) PCTFREE 3 ;
commit work;
alter table tpcd.orders add primary key (o_orderkey);
commit work;

values(current timestamp);
CREATE INDEX TPCD.O_CK ON TPCD.ORDERS
            (O_CUSTKEY ASC) PCTFREE 3 ;
commit work;

values(current timestamp);

CREATE UNIQUE INDEX TPCD.L_OKLN ON TPCD.LINEITEM
            (L_ORDERKEY ASC, L_LINENUMBER ASC) PCTFREE 3 ;
commit work;
alter table tpcd.lineitem add primary key (l_orderkey, l_linenumber);
commit work;

values(current timestamp);

select substr(tbname,1,10),substr(name,1,18),create_time from
sysibm.sysindexes where tbcreator='TPCD' order by 3;
select substr(tbname,1,10),
substr(name,1,18),indextype,substr(colnames,1,40) from
sysibm.sysindexes where name like 'SQL%' and tbcreator ='TPCD'
order by 1,2;
```

B.16 deleteuftables.ddl

```
import from /dev/null of del replace into TPCDTEMP.ORDERS_NEW;
import from /dev/null of del replace into TPCDTEMP.LINEITEM_NEW;
import from /dev/null of del replace into TPCDTEMP.ORDERS_DEL;
```

B.17 runstats.ddl

```
values (current timestamp, 'TS*** runstats nation START like ');
RUNSTATS ON TABLE TPCD.NATION    WITH DISTRIBUTION on all
columns
  and columns (
    n_name like statistics,
    n_comment like statistics )
  AND  INDEXES ALL;
commit;
values (current timestamp, 'TS*** runstats done nation ');
RUNSTATS ON TABLE TPCD.REGION    WITH DISTRIBUTION on all
columns
  and columns (
    r_name like statistics,
    r_comment like statistics )
  AND  INDEXES ALL;
commit;
RUNSTATS ON TABLE TPCD.SUPPLIER  WITH DISTRIBUTION on
all columns
  and columns (
    s_name like statistics,
    s_address like statistics,
    s_phone like statistics,
    s_comment like statistics)
  AND  INDEXES ALL;
commit;
values (current timestamp, 'TS*** runstats done part ');
RUNSTATS ON TABLE TPCD.PART      WITH DISTRIBUTION on all
columns
  and columns (
    p_name like statistics,
    p_mfgr like statistics,
    p_brand like statistics,
    p_type like statistics,
    p_container like statistics,
    p_comment like statistics)
  AND  INDEXES ALL;
commit;
values (current timestamp, 'TS*** runstats done partsupp ');
RUNSTATS ON TABLE TPCD.PARTSUPP  WITH DISTRIBUTION on
all columns
  and columns (
    ps_comment like statistics)
  AND  INDEXES ALL;
commit;
values (current timestamp, 'TS*** runstats done customer ');
RUNSTATS ON TABLE TPCD.CUSTOMER  WITH DISTRIBUTION on
all columns
  and columns (
    c_name like statistics,
    c_address like statistics,
    c_phone like statistics,
    c_mktsegment like statistics,
    c_comment like statistics)
  AND  INDEXES ALL;
commit;
values (current timestamp, 'TS*** runstats done orders ');
RUNSTATS ON TABLE TPCD.ORDERS    WITH DISTRIBUTION on
all columns
  and columns (
    o_orderstatus like statistics,
    o_orderpriority like statistics,
    o_clerk like statistics,
    o_comment like statistics)
  AND  INDEXES ALL;
commit;
values (current timestamp, 'TS*** runstats done lineitem ');
RUNSTATS ON TABLE TPCD.LINEITEM  WITH DISTRIBUTION on
all columns
  and columns (
    l_returnflag like statistics,
    l_linestatus like statistics,
    l_shipinstruct like statistics,
    l_shipmode like statistics,
    l_comment like statistics)
  AND  INDEXES ALL;
COMMIT WORK;
values (current timestamp, 'TS*** runstats END like');
```

B.18 db2nodes.cfg

```
1 c325f1g01 0 c325f1g01
2 c325f1g01 1 c325f1g01
3 c325f1g01 2 c325f1g01
4 c325f1g01 3 c325f1g01
5 c325f1g01 4 c325f1g02
6 c325f1g01 5 c325f1g02
7 c325f1g01 6 c325f1g02
8 c325f1g01 7 c325f1g02
9 c325f1g01 8 c325f1g03
10 c325f1g01 9 c325f1g03
11 c325f1g01 10 c325f1g03
12 c325f1g01 11 c325f1g03
13 c325f1g01 12 c325f1g04
14 c325f1g01 13 c325f1g04
15 c325f1g01 14 c325f1g04
16 c325f1g01 15 c325f1g04
17 c325f1g01 16 c325f1g05
18 c325f1g01 17 c325f1g05
19 c325f1g01 18 c325f1g05
20 c325f1g01 19 c325f1g05
21 c325f1g01 20 c325f1g06
22 c325f1g01 21 c325f1g06
23 c325f1g01 22 c325f1g06
24 c325f1g01 23 c325f1g06
25 c325f1g01 24 c325f1g07
26 c325f1g01 25 c325f1g07
27 c325f1g01 26 c325f1g07
28 c325f1g01 27 c325f1g07
29 c325f1g01 28 c325f1g08
30 c325f1g01 29 c325f1g08
31 c325f1g01 30 c325f1g08
32 c325f1g01 31 c325f1g08
33 c325f2g01 0 c325f2g01
34 c325f2g01 1 c325f2g01
35 c325f2g01 2 c325f2g01
36 c325f2g01 3 c325f2g01
37 c325f2g01 4 c325f2g02
38 c325f2g01 5 c325f2g02
39 c325f2g01 6 c325f2g02
40 c325f2g01 7 c325f2g02
41 c325f2g01 8 c325f2g03
42 c325f2g01 9 c325f2g03
43 c325f2g01 10 c325f2g03
44 c325f2g01 11 c325f2g03
45 c325f2g01 12 c325f2g04
46 c325f2g01 13 c325f2g04
47 c325f2g01 14 c325f2g04
48 c325f2g01 15 c325f2g04
49 c325f2g01 16 c325f2g05
50 c325f2g01 17 c325f2g05
51 c325f2g01 18 c325f2g05
52 c325f2g01 19 c325f2g05
53 c325f2g01 20 c325f2g06
54 c325f2g01 21 c325f2g06
55 c325f2g01 22 c325f2g06
56 c325f2g01 23 c325f2g06
57 c325f2g01 24 c325f2g07
58 c325f2g01 25 c325f2g07
59 c325f2g01 26 c325f2g07
60 c325f2g01 27 c325f2g07
61 c325f2g01 28 c325f2g08
62 c325f2g01 29 c325f2g08
63 c325f2g01 30 c325f2g08
64 c325f2g01 31 c325f2g08
65 c325f3g01 0 c325f3g01
66 c325f3g01 1 c325f3g01
67 c325f3g01 2 c325f3g01
68 c325f3g01 3 c325f3g01
69 c325f3g01 4 c325f3g02
70 c325f3g01 5 c325f3g02
71 c325f3g01 6 c325f3g02
72 c325f3g01 7 c325f3g02
73 c325f3g01 8 c325f3g03
74 c325f3g01 9 c325f3g03
75 c325f3g01 10 c325f3g03
76 c325f3g01 11 c325f3g03
77 c325f3g01 12 c325f3g04
78 c325f3g01 13 c325f3g04
79 c325f3g01 14 c325f3g04
80 c325f3g01 15 c325f3g04
81 c325f3g01 16 c325f3g05
82 c325f3g01 17 c325f3g05
83 c325f3g01 18 c325f3g05
84 c325f3g01 19 c325f3g05
85 c325f3g01 20 c325f3g06
86 c325f3g01 21 c325f3g06
87 c325f3g01 22 c325f3g06
88 c325f3g01 23 c325f3g06
89 c325f3g01 24 c325f3g07
90 c325f3g01 25 c325f3g07
91 c325f3g01 26 c325f3g07
92 c325f3g01 27 c325f3g07
93 c325f3g01 28 c325f3g08
94 c325f3g01 29 c325f3g08
95 c325f3g01 30 c325f3g08
96 c325f3g01 31 c325f3g08
97 c325f4g01 0 c325f4g01
98 c325f4g01 1 c325f4g01
99 c325f4g01 2 c325f4g01
100 c325f4g01 3 c325f4g01
101 c325f4g01 4 c325f4g02
102 c325f4g01 5 c325f4g02
103 c325f4g01 6 c325f4g02
104 c325f4g01 7 c325f4g02
105 c325f4g01 8 c325f4g03
106 c325f4g01 9 c325f4g03
107 c325f4g01 10 c325f4g03
108 c325f4g01 11 c325f4g03
109 c325f4g01 12 c325f4g04
110 c325f4g01 13 c325f4g04
111 c325f4g01 14 c325f4g04
112 c325f4g01 15 c325f4g04
113 c325f4g01 16 c325f4g05
114 c325f4g01 17 c325f4g05
115 c325f4g01 18 c325f4g05
116 c325f4g01 19 c325f4g05
117 c325f4g01 20 c325f4g06
118 c325f4g01 21 c325f4g06
119 c325f4g01 22 c325f4g06
120 c325f4g01 23 c325f4g06
121 c325f4g01 24 c325f4g07
122 c325f4g01 25 c325f4g07
123 c325f4g01 26 c325f4g07
124 c325f4g01 27 c325f4g07
125 c325f4g01 28 c325f4g08
126 c325f4g01 29 c325f4g08
127 c325f4g01 30 c325f4g08
128 c325f4g01 31 c325f4g08
129 c325f5g01 0 c325f5g01
130 c325f5g01 1 c325f5g01
131 c325f5g01 2 c325f5g01
132 c325f5g01 3 c325f5g01
133 c325f5g01 4 c325f5g02
134 c325f5g01 5 c325f5g02
135 c325f5g01 6 c325f5g02
136 c325f5g01 7 c325f5g02
137 c325f5g01 8 c325f5g03
```

```
138 c325f5g01 9 c325f5g03
139 c325f5g01 10 c325f5g03
140 c325f5g01 11 c325f5g03
141 c325f5g01 12 c325f5g04
142 c325f5g01 13 c325f5g04
143 c325f5g01 14 c325f5g04
144 c325f5g01 15 c325f5g04
145 c325f5g01 16 c325f5g05
146 c325f5g01 17 c325f5g05
147 c325f5g01 18 c325f5g05
148 c325f5g01 19 c325f5g05
149 c325f5g01 20 c325f5g06
150 c325f5g01 21 c325f5g06
151 c325f5g01 22 c325f5g06
152 c325f5g01 23 c325f5g06
153 c325f5g01 24 c325f5g07
154 c325f5g01 25 c325f5g07
155 c325f5g01 26 c325f5g07
156 c325f5g01 27 c325f5g07
157 c325f5g01 28 c325f5g08
158 c325f5g01 29 c325f5g08
159 c325f5g01 30 c325f5g08
160 c325f5g01 31 c325f5g08
```

B.19 dbcfg_run

```
update database configuration for tpcd using
dft_queryopt 7 num_freqvalues 0 num_quantiles 600
stat_heap_sz 4384 dbheap 15000 logbufsz 128
util_heap_sz 10000 locklist 16392  softmax 300
app_ctl_heap_sz 512 sortheap 41000 stmtheap 20000
applheapsz 156 maxlocks 13 chngpgs_thresh 15
num_iocleaners 1 num_ioservers 16 maxappls 365
maxfilop 1024 logfilsiz 8192 logprimary 25
SHEAPTHRES_SHR 250 logsecond 10;
```

B.20 dbmcfg_run

```
update database manager configuration using
comm_bandwidth 10 numdb 1 diagpath /install/db2dump
diaglevel 3 cpuspeed 5.235149e-07 sheapthres 2800000
num_initagents 170 num_poolagents -1 max_querydegree -1
FCM_NUM_BUFFERS 262144 intra_parallel no;
```

B.21 db2set_run.sh

```
#!/bin/ksh
db2set DB2OPTIONS="-t -v +c"
db2set DB2_EXTENDED_OPTIMIZATION=Y
db2set DB2_ANTIJOIN=ON
db2set DB2_STRIPED_CONTAINERS=ON
db2set DB2_FORCE_FCM_BP=ON
db2set DB2MEMMAXFREE=8000000
db2set DB2MEMDISCLAIM=ON
db2set DB2BPVARS=/tpc/tpcd/tpcd/custom/bpvars.cfg
db2set DB2_PARALLEL_IO="*"
db2set DB2BQTRY=120
```

B.22 db2sets_load.sh

```
#!/bin/ksh
db2set DB2OPTIONS="-t -v +c"
db2set DB2_EXTENDED_OPTIMIZATION=Y
db2set DB2_ANTIJOIN=ON
db2set DB2_STRIPED_CONTAINERS=ON
db2set DB2_FORCE_FCM_BP=ON
db2set DB2MEMMAXFREE=8000000
db2set DB2MEMDISCLAIM=ON
db2set DB2BPVARS=/tpc/tpcd/tpcd/custom/bpvars.cfg
db2set DB2BQTRY=120
```

B.23 /tpc/tpcd/tpcd/custom/bpvar.cfg

```
PREFETCHQUEUESIZE=200
NUMPREFETCHQUEUES=4
```

B.24 createUFtbls.ddl

```
-----------------------------------------------------------------
-- Create Update Function Tables
-----------------------------------------------------------------
CREATE TABLE TPCDTEMP.ORDERS_NEW ( APP_ID INTEGER
NOT NULL,
                O_ORDERKEY      BIGINT NOT NULL,
                O_CUSTKEY       INTEGER NOT NULL,
                O_ORDERSTATUS    CHAR(1) NOT NULL,
                O_TOTALPRICE     FLOAT NOT NULL,
                O_ORDERDATE      DATE NOT NULL,
                O_ORDERPRIORITY  CHAR(15) NOT NULL,
                O_CLERK          CHAR(15) NOT NULL,
                O_SHIPPRIORITY   INTEGER NOT NULL,
                O_COMMENT       VARCHAR(79) NOT NULL WITH
DEFAULT)
     PARTITIONING KEY (O_ORDERKEY)
     IN TABDATA;

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

CREATE TABLE TPCDTEMP.LINEITEM_NEW ( APP_ID INTEGER
NOT NULL,
                 L_ORDERKEY    BIGINT NOT NULL,
                 L_PARTKEY     INTEGER NOT NULL,
                 L_SUPPKEY     INTEGER NOT NULL,
                 L_LINENUMBER  INTEGER NOT NULL,
                 L_QUANTITY    FLOAT NOT NULL,
                 L_EXTENDEDPRICE  FLOAT NOT NULL,
                 L_DISCOUNT    FLOAT NOT NULL,
                 L_TAX         FLOAT NOT NULL,
                 L_RETURNFLAG  CHAR(1) NOT NULL,
                 L_LINESTATUS  CHAR(1) NOT NULL,
                 L_SHIPDATE    DATE NOT NULL,
                 L_COMMITDATE  DATE NOT NULL,
                 L_RECEIPTDATE DATE NOT NULL,
                 L_SHIPINSTRUCT CHAR(25) NOT NULL,
                 L_SHIPMODE     CHAR(10) NOT NULL,
                 L_COMMENT      VARCHAR(44) NOT NULL WITH
DEFAULT)
     PARTITIONING KEY (L_ORDERKEY)
     IN TABDATA;

CREATE INDEX TPCDTEMP.I_ORDERS_NEW ON
TPCDTEMP.ORDERS_NEW
( APP_ID,
 O_ORDERKEY,
 O_CUSTKEY,
 O_ORDERSTATUS,
 O_TOTALPRICE,
 O_ORDERDATE,
 O_ORDERPRIORITY,
 O_CLERK,
 O_SHIPPRIORITY,
 O_COMMENT);

CREATE INDEX TPCDTEMP.I_LINEITEM_NEW ON
TPCDTEMP.LINEITEM_NEW (APP_ID);
```

```
CREATE UNIQUE INDEX TPCDTEMP.I_ORDERS_DEL ON
TPCDTEMP.ORDERS_DEL
(APP_ID, O_ORDERKEY);

COMMIT WORK;

ALTER TABLE TPCDTEMP.ORDERS_NEW LOCKSIZE TABLE;
ALTER TABLE TPCDTEMP.ORDERS_DEL LOCKSIZE TABLE;
ALTER TABLE TPCDTEMP.LINEITEM_NEW LOCKSIZE TABLE;

COMMIT WORK;
```

B.25 tpcd.setup

```
# NOTE: ALL variable defitions must have a comment at the end -
haven't got
#       the getvars script recognizing the uncommented line yet
TPCD_VERSION=2                  # 1 or 2 (Version of tpcd). Default 1
TPCD_PLATFORM=aix               # aix, nt, sun ....
TPCD_DBNAME=TPCD                # name to create database
under
TPCD_WORKLOAD=H                 # TPC version (R for TPCR, H
for TPCH)
TPCD_AUDIT_DIR=/tpc/tpcd/tpcd   # top level directory of tar file
for
                        # all the tpcd scripts
TPCD_PRODUCT=v5                 # v5 or pe
                        # Use pe if you really are using pe v1.2!
                        # but I won't guarantee that it will work!
TPCD_MODE=mln                   # uni/smp/mln/mpp
TPCD_PHYS_NODE=5                # number of physical nodes
TPCD_LN_PER_PN=32               # number of logical nodes per
physical node
TPCD_SF=10000                   # size of the database (1=1GB,...) to
                        # get test size databases use:
                        #     0.012 = 12MB
                        #     0.1   = 100MB
TPCD_BUILD_STAGE=ALL            # where to start the build -
currently the
                        # following is possible:
                        #  ALL - do everything (create,load,
                        #        index,stats,config) (Default)
                        #  CRTTBSP - start after create db and
                        #      config setting.  Start righ at
                        #      create tbsp
                        #  LOAD - start from the load of the tables
                        #  INDEX - start from the index creation
                        #       (NOTE if earlyindex is specified,
                        #        then this will do the create index
                        #        followed by the load...)
                        #  RUNSTATS - start from the runstats
                        #       (NOTE Do not use this option if
                        #        distribution stats are gathered
                        #        as part of the load, this will
                        #        start after the load and indices
                        #        have been created.
                        #  CONFIG - start from the setting up of
                        #        the benchmark runs config setup
                        #
TPCD_DBPATH=/db                 # path for database (defaults to
home)
TPCD_DDLPATH=/tpc/tpcd/tpcd/custom     # path for all ddl files and
customized
                        # scripts (load script), config files,etc
TPCD_BUFFERPOOL_DEF=create_bpools.ddl  # name of file with
bufferpool definitions
                        # and sizes
TPCD_NODEGROUP_DEF=create_nodegroups.ddl # name of file in
ddlpath with nodegroup
                        # definitions
TPCD_EXPLAIN_DDL=explain.ddl        #  file with DDL for explains
statments
                        # if this is NULL then uses the default
                        # and puts it in USERSPACE1 across all
                        # nodes...nt 1TB found it was faster if
                        # just in a single node nodegroup
TPCD_TBSP_DDL=create_tbspaces.ddl      # ddl file for tablespaces
TPCD_DDL=create_tables.ddl          # ddl file for tables
TPCD_QUAL_TBSP_DDL=NULL             # ddl file for tablespaces for
qual
TPCD_QUAL_DDL=NULL                  # ddl file for qualification
database
                        # tablespaces and tables should be identical
                        # to regular ddl except container names
TPCD_INDEXDDL=create_indexes.ddl       # ddl file for indexes
TPCD_EXTRAINDEX=no                  # no = no extra indexes
                        # filename = If you want to create some
                        # indices before
                        # the load, and some indices after, then
                        # use this additional file to specify the
TPCD_ADD_RI=NULL                    # file name that contains any RI
                        # constraints to add after index creation
                        # set to NULL (default) if unused
                        # indices to create after the load.
TPCD_AST=ast.ddl                    # file name that contains complete
AST
                        # definition including connection to
                        # the database, summary table creation,
                        # population, indexing and runstats.
TPCD_RUNSTATS=runstats.ddl          # ddl file for runstats.  If you
have
                        # created indices before the load (ie
                        # TPCD_EARLYINDEX=yes), have specified
to
                        # gather stats on the load command (either
                        # through your own load script or by using
                        # TPCD_LOADSTATS=yes, AND you have
                        # specified a file for TPCD_EXTRAINDEX
                        # then this runstats file should include
                        # the runstats commands specifically for
                        # the extra indices.
TPCD_RUNSTATSHORT=                  # NOTE!! THIS IS BUGGY....I
can't get it to
                        # work on UNI successfully
                        # ddl file for short runstats that are
                        # run in the background while the
                        # TPCD_RUNSTATS are run in the
foreground
                        # of the build.  If this is used, then
                        # TPCD_RUNSTATS should have the runstats
                        # command for lineitem and
                        # TPCD_RUNSTATSHORT should have
runstats
                        # commands for all other tables.
TPCD_DBGEN=/tpc/tpcd/tpcd/appendix.v2/dbgen    # path name to
data generation code
                        # Parameters used to specify source of
                        # data for load scripts
TPCD_INPUT=/rawdata                 # NULL - use dbgen generated
data  OR
                        # path name -  to the pre-generated
                        #           flat files
                        # /gwl/dss/12MB - path for pregenerated
12MB
                        # /gwl/dss/100MB - path for pregen'd 100MB
                        #
```

```
TPCD_QUAL_INPUT=NULL                # NULL - use dbgen
generated data  OR
                        # path name -  to the pre-generated
                        #           flat files
TPCD_TAILOR_DIR=/tmp/tpcd           # path name for the directory
used to
                        # generate split specific config files
                        # only used for partitioned environment
TPCD_EARLYINDEX=no                  # create indexes before the load
                        # LOAD specific parameters follow:
TPCD_LOAD_DB2SET_SCRIPT=db2set_load.sh # Script that
contains the db2set commands
                        # for the load process Use NULL if not
                        # specified
TPCD_LOAD_CONFIGFILE=dbcfg_load     # config file with specific
database config
                        # parms for the load/index/runstats part
                        # of the build.
                        # set to NULL if use defaults
TPCD_LOAD_DBM_CONFIGFILE=dbmcfg_load  # config file with
specific
                        # database manager config parts for the
                        # load/index/runstats part of the build.
                        # set to NULL if use defaults
TPCD_LOAD_QUALCONFIGFILE=NULL       # config file with
specific database config
                        # parms for the load/index/runstats part
                        # of the build for qualification db.
                        # set to NULL if use defaults
TPCD_LOAD_DBM_QUALCONFIGFILE=NULL   # config file with
specific
                        # database manager config parts for the
                        # load/index/runstats part of the build.
                        # set to NULL if use defaults
TPCD_LOADSTATS=no                   # gather statistics during load
                        # ignored if EARLYINDEX is not set
                        # due to runstats limitation
TPCD_TEMP=                          # path for LOAD temp files
                        # defaults to /u/<instance>/sqllib/tmp
                        # used in load script only
TPCD_SORTBUF=                       # sortbuf size for LOAD
                        # used in load script only
TPCD_LOAD_PARALLELISM=0             # degree of parallelism to
use on load
                        # 0 = use the "intelligent default" that
                        # the load will chose at run time
                        # used in load script only
TPCD_COPY_DIR=NULL                  # directory where copy image is
created
                        # on load command CURRENTLY UNUSED
                        # used in load script only
TPCD_FASTPARSE=yes                  # use fastparse on load
                        # used in load script only
                        # Backup and logfile specific parameters
follow:
TPCD_BACKUP_DIR=                    # directory where backup files
are placed
TPCD_LOGPRIMARY=NULL                # NULL/value = how many
primary log files
                        # to configure.  If NULL is specified then
                        # the default is not changed.
TPCD_LOGFILSIZ=NULL                 # NULL/value = how 4KB pages
to use for
                        # logfilsiz db cfg parameter.  If NULL is
                        # specified then the default is not changed
TPCD_LOGSECOND=NULL                 # NULL/value = how many
secondary log files
                        # to configure.  If NULL is specified then
                        # the default is not changed.
TPCD_LOG_DIR=NULL                   # directory where log files
stored..
                        # NULL leaves them in the dbpath
TPCD_LOG_QUAL_DIR=NULL              # directory where qual log
files stored
                        # NULL leaves them in the dbpath
TPCD_LOG=no                         # yes/no - whether to turn
LOG_RETAIN on
                        # i.e. are backups needed to be taken

                        # CONFIG specific parameters
TPCD_DB2SET_SCRIPT=db2set_run.sh    # Script that contains the
db2set commands
                        # for the benchmark run.  Use NULL if not
                        # specified
TPCD_CONFIGFILE=dbcfg_run           # name of configuration file in
ddl path
                        # that will be used for the benchmark run
TPCD_DBM_CONFIG=dbmcfg_run          # name of config file for
database manager
                        # cfg parms
TPCD_QUALCONFIGFILE=NULL            # name of database cfg file
in ddl path
                        # for qualification database
TPCD_DBM_QUALCONFIG=NULL            # name of database
managers cfg file
                        # for qualification database
TPCD_MACHINE=big                    # set to NULL if using load config
file
                        # big/medium/small  size of machine used to
                        # determine buffpage, sortheap,sheapthres
                        # and ioservers parms for load, create
                        # index and runstats
                        # NOTE that this parameter is ignored if
                        # a TPCD_LOAD_CONFIGFILE
TPCD_SMPDEGREE=1                    # 1...# of degrees of parallelism
to run
                        # with
TPCD_AGENTPRI=NULL                  # set agentpri to this value
(default
                        # is SYSTEM)
TPCD_ACTIVATE=no                    # activate the database upon build
                        # completion

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

TPCD_SHARED_TEMP_FULL_PATHNAME=/tpc/tpcd/tpcd/tmp    #
just added
TPCD_QUERY_TEMPLATE_DIR=standard.V2    # subdirectory in
AUDIT_DIR/queries
                        # to use as the source of the query
                        # templates.  Currently there are
                        # v2 ones and pe ones.  You can make
                        # your own directory following the same
                        # form as in the v2 directory using
                        # any variant you wish
TPCD_QUAL_DBNAME=NULL               # name of qualification
database
TPCD_NUMSTREAM=9                    # number of streams for the
throughput test
```

```
TPCD_FLATFILES=/db/ufdata                    # where to generate
flat files
                    # for update functions
TPCD_STAGING_TABLE_DDL=createUfTables.ddl # script that
contains the ddl for creating
                    # the staging tables if they are used for
                    # the update functions
TPCD_PRELOAD_STAGING_TABLE_SCRIPT=loadSampleUf.sh  #
file that contains the sql for preloading
                    # and gathering stats on sample UF data
                    # Note that the data used is sample data
                    # and is not data from any of the applied
                    # update pairs
TPCD_DELETE_STAGING_TABLE_SQL=deleteUfTables.ddl # file
that contains the sql for deleting
                    # the preloaded data from the staging
                    # tables
TPCD_UPDATE_IMPORT=false          # true = use import for the
staging tables
                    #   for UNI/SMP mode only (code change in
                    #   tpcdbatch) (if not uni mode then must
                    #   change load_update)
                    # false = use load for staging tables
                    # The default is false if not set.
                    # NOTE that this parm is only for UNI/SMP
                    # it is not for multi node invocation

TPCD_SPLIT_UPDATES=32          # number of chunks to split the
update
                    # function into.
TPCD_CONCURRENT_INSERTS=32          # number of insert
chunks that are run
                    # concurrently.  TPCD_SPLIT_UPDATES
                    # should be evenly divisible by this number
TPCD_CONCURRENT_INSERTS_LOAD=1      # number of insert
chunks that are loaded
                    # concurrently.  TPCD_SPLIT_UPDATES
should
                    # be evenly divisible by this number.
                    # this controls the load portion of the
                    # insert routine for partitioned databases
TPCD_SPLIT_DELETES=32          # number of portions to split
the delete
                    # function into.
                    # this variable is only valid in UNI/SMP
                    # mode.
TPCD_CONCURRENT_DELETES=32          # number of delete
chunks that are run
                    # concurrently.  This number should be
                    # evently divisible by TPCD_SPLIT_DELETES
TPCD_GEN_UPDATEPAIRS=24          # number of pairs of update
function data
                    # to generate
                    # if 0 the update data generation and
                    # setup will not be done.  use this if
                    # you don't want to run the update
                    # functions   (Update functions not
                    # fully tested in new env't yet)
TPCD_GENERATE_SEED_FILE=yes          # yes/no  These are the
seed files for
                    # generating the query substitution values
                    # yes - generate a seed file base on
                    #      year/month/day (for audited runs)
                    # no  - use qgen's default seeds
TPCD_RUN_ON_MULTIPLE_NODES=NULL      # pe V1.2 only - will
we be running each
                    # query stream of throughput starting at
                    # different nodes or from same node
TPCD_STATS_INTERVAL=5          # timing interval for
vmstats/iostats
TPCD_STATS_THRU_INT=30          # timing interval for
vmstats/iostats for
                    # throughput run
TPCD_GATHER_STATS=on          # on/off   - only implement for
AIX yet
                    # on = gather statistics around power
                    #      test run  (vmstat,iostat,netstat)
                    # off = no stats gathered during power run

TPCD_UFTEMP=data          # base name of tablespace(s)
where the
##TPCD_UFTEMP=UFTEMP          # base name of
tablespace(s) where the
                    # staging tables for the update functions
                    # are created
                    # this name will be used as the
                    # basename for the tablespaces...eg
                    # UFTEMP1 UFTEMP2 ....
TPCD_HAVECOMPILER=yes          # rebuild tpcdbatch
executable
                    # yes/no
TPCD_SLEEP=5          # ?
TPCD_INLISTMAX=default          # max num of keys to delete at a
time
                    # for UF2, use "default" for default.
TPCD_LOAD_SCRIPT=load.sh          # script to run for loading
tables
                    # in TPCD_DDLPATH directory under
mln/mpp
                    # leave as NULL if using default genloaduni
TPCD_LOAD_SCRIPT_QUAL=NULL          # script to run for loading
tables in
                    # TPCD_DDLPATH directory under mln/mpp
                    # for QUAL db
TPCD_ROOTPRIV=yes          # do you have root privileges to
be able
                    # get values of things like schedtune
                    # and vmtune (currently on AIX only)
                    #  acid test specific information
TPCD_DB2LOG=/install/db2dump          # directory wehre the
db2diag.log can
                    # be found for the durability tests
TPCD_APPEND_ON=no          # set to no if the cluster indexes
are used
```

Appendix - C Query Text and Output

C.1 Qualification Query Output

Query 1

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

Tag: Q1 Stream: -1 Sequence number: 17

```
select
l_returnflag,
l_linestatus,
sum(l_quantity) as sum_qty,
sum(l_extendedprice) as sum_base_price,
sum(l_extendedprice * (1 - l_discount)) as sum_disc_price,
sum(l_extendedprice * (1 - l_discount) * (1 + l_tax)) as sum_charge,
avg(l_quantity) as avg_qty,
avg(l_extendedprice) as avg_price,
avg(l_discount) as avg_disc,
count_big(*) as count_order
from
tpcd.lineitem
where
l_shipdate <= date ('1998-12-01') - 90 day
group by
l_returnflag,
l_linestatus
order by
l_returnflag,
l_linestatus
```

```
L_RETURNFLAG  L_LINESTATUS  SUM_QTY
SUM_BASE_PRICE       SUM_DISC_PRICE       SUM_CHARGE
AVG_QTY              AVG_PRICE            AVG_DISC
COUNT_ORDER
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
------------------------
A            F                37734107.000      56586554400.729
53758257134.869      55909065222.828              25.522
38273.130            0.050                     1478493.
N            F                  991417.000      1487504710.380
1413082168.054       1469649223.194               25.516
38284.468            0.050                       38854.
N            O                74476040.000      111701729697.743
106118230307.606     110367043872.499             25.502
38249.118            0.050                     2920374.
R            F                37719753.000      56568041380.899
53741292684.604      55889619119.832              25.506
38250.855            0.050                     1478870.


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

Query 2

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

Tag: Q2 Stream: -1 Sequence number: 2

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

```
S_ACCTBAL            S_NAME                    N_NAME
P_PARTKEY    P_MFGR                    S_ADDRESS
S_PHONE          S_COMMENT
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------
         9938.530  Supplier#000005359         UNITED KINGDOM
185358  Manufacturer#4             QKuHYh,vZGiwu2FWEJoLDx04
33-429-790-6131  blithely silent pinto beans are furiously. slyly final
deposits acros
         9937.840  Supplier#000005969         ROMANIA
108438  Manufacturer#1
ANDENSOSmk,miq23Xfb5RWt6dvUcvt6Qa          29-520-692-3537
carefully slow deposits use furiously. slyly ironic platelets above the
ironic
         9936.220  Supplier#000005250         UNITED KINGDOM
249  Manufacturer#4             B3rqp0xbSEim4Mpy2RH J
33-320-228-2957  blithely special packages are. stealthily express
deposits across the closely final instructi
         9923.770  Supplier#000002324         GERMANY
29821  Manufacturer#4             y3OD9UywSTOk                    17-
779-299-1839  quickly express packages breach quiet pinto beans.
requ
         9871.220  Supplier#000006373         GERMANY
43868  Manufacturer#5             J8fcXWsTqM                      17-
813-485-8637  never silent deposits integrate furiously blit
         9870.780  Supplier#000001286         GERMANY
81285  Manufacturer#2
YKA,E2fjiVd7eUrzp2Ef8j1QxGo2DFnosaTEH       17-516-924-4574
final theodolites cajole slyly special,
```

```
        9870.780  Supplier#000001286         GERMANY
181285  Manufacturer#4
YKA,E2fjiVd7eUrzp2Ef8j1QxGo2DFnosaTEH     17-516-924-4574
final theodolites cajole slyly special,
        9852.520  Supplier#000008973         RUSSIA
18972  Manufacturer#2             t5L67YdBYYH6o,Vz24jpDyQ9
32-188-594-7038  quickly regular instructions wake-- carefully unusual
braids into the expres
        9847.830  Supplier#000008097         RUSSIA
130557  Manufacturer#2             xMe97bpE69NzdwLoX
32-375-640-3593  slyly regular dependencies sleep slyly furiously
express dep
        9847.570  Supplier#000006345         FRANCE
86344  Manufacturer#1
VSt3rzk3qG698u6ld8HhOByvrTcSTSvQlDQDag    16-886-766-7945
silent pinto beans should have to snooze carefully along the final
reques
[[ ROWS DELETED FROM OUTPUT]]
        7843.520  Supplier#000006683         FRANCE
11680  Manufacturer#4             2Z0JGkiv01Y00oCFwUGfviIbhzCdy
16-464-517-8943  carefully bold accounts doub


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

Query 3

```
-- Query 03 - Var_0 Rev_01 - Shipping Priority Query

Tag: Q3     Stream: -1   Sequence number: 11

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

L_ORDERKEY          REVENUE             O_ORDERDATE
O_SHIPPRIORITY
--------------------------------------------------------------------------
          2456423          406181.011  1995-03-05              0
          3459808          405838.699  1995-03-04              0
           492164          390324.061  1995-02-19              0
          1188320          384537.936  1995-03-09              0
          2435712          378673.056  1995-02-26              0
          4878020          378376.795  1995-03-12              0
          5521732          375153.922  1995-03-13              0
          2628192          373133.309  1995-02-22              0
           993600          371407.459  1995-03-05              0
          2300070          367371.145  1995-03-13              0

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

Query 4

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

Tag: Q4     Stream: -1   Sequence number: 14

select
o_orderpriority,
count(*) as order_count
from
tpcd.orders
where
o_orderdate >= date ('1993-07-01')
and o_orderdate < date ('1993-07-01') + 3 month
and exists (
select
*
from
tpcd.lineitem
where
l_orderkey = o_orderkey
and l_commitdate < l_receiptdate
)
group by
o_orderpriority
order by
o_orderpriority

O_ORDERPRIORITY  ORDER_COUNT
-------------------------------
1-URGENT              10594
2-HIGH                10476
3-MEDIUM              10410
4-NOT SPECIFIED       10556
5-LOW                 10487


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

Query 5

```
-- Query 05 - Var_0 Rev_02 Local Supplier Volume Query

Tag: Q5     Stream: -1   Sequence number: 20

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

```
n_name
order by
revenue desc
```

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


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

Query 6

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

Tag: Q6 Stream: -1 Sequence number: 5

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

```
REVENUE
----------------------
      123141078.228


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

Query 7

-- Query 07 - Var_0 Rev_01 - Volume Shipping Query

Tag: Q7 Stream: -1 Sequence number: 21

```
select
supp_nation,
cust_nation,
l_year,
sum(volume) as revenue
from
(
select
n1.n_name as supp_nation,
n2.n_name as cust_nation,
year (l_shipdate) as l_year,
l_extendedprice * (1 - l_discount) as volume
from
tpcd.supplier,
tpcd.lineitem,
tpcd.orders,
tpcd.customer,
tpcd.nation n1,
tpcd.nation n2
where
s_suppkey = l_suppkey
and o_orderkey = l_orderkey
and c_custkey = o_custkey
and s_nationkey = n1.n_nationkey
and c_nationkey = n2.n_nationkey
and (
(n1.n_name = 'FRANCE' and n2.n_name = 'GERMANY')
or (n1.n_name = 'GERMANY' and n2.n_name = 'FRANCE')
)
and l_shipdate between date('1995-01-01') and date('1996-12-31')
) as shipping
group by
supp_nation,
cust_nation,
l_year
order by
supp_nation,
cust_nation,
l_year
```

```
SUPP_NATION               CUST_NATION               L_YEAR
REVENUE
-------------------------------------------------------------------------------------------
FRANCE                    GERMANY                   1995
54639732.734
FRANCE                    GERMANY                   1996
54633083.308
GERMANY                   FRANCE                    1995
52531746.670
GERMANY                   FRANCE                    1996
52520549.022


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

Query 8

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

Tag: Q8 Stream: -1 Sequence number: 8

```
select
o_year,
sum(case
when nation = 'BRAZIL' then volume
else 0
end) / sum(volume) as mkt_share
from
(
select
year(o_orderdate) as o_year,
l_extendedprice * (1 - l_discount) as volume,
n2.n_name as nation
from
tpcd.part,
tpcd.supplier,
tpcd.lineitem,
tpcd.orders,
tpcd.customer,
tpcd.nation n1,
tpcd.nation n2,
tpcd.region
where
p_partkey = l_partkey
and s_suppkey = l_suppkey
and l_orderkey = o_orderkey
and o_custkey = c_custkey
and c_nationkey = n1.n_nationkey
and n1.n_regionkey = r_regionkey
and r_name = 'AMERICA'
and s_nationkey = n2.n_nationkey
and o_orderdate between date('1995-01-01') and date ('1996-12-31')
and p_type = 'ECONOMY ANODIZED STEEL'
) as all_nations
```

```
group by
o_year
order by
o_year
```

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

Number of rows retrieved is: 2

Query 9

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

Tag: Q9 Stream: -1 Sequence number: 3

```
select
nation,
o_year,
sum(amount) as sum_profit
from
(
select
n_name as nation,
year(o_orderdate) as o_year,
l_extendedprice * (1 - l_discount) - ps_supplycost * l_quantity as
amount
from
tpcd.part,
tpcd.supplier,
tpcd.lineitem,
tpcd.partsupp,
tpcd.orders,
tpcd.nation
where
s_suppkey = l_suppkey
and ps_suppkey = l_suppkey
and ps_partkey = l_partkey
and p_partkey = l_partkey
and o_orderkey = l_orderkey
and s_nationkey = n_nationkey
and p_name like '%green%'
) as profit
group by
nation,
o_year
order by
nation,
o_year desc
```

```
NATION                    O_YEAR      SUM_PROFIT
----------------------------------------------------------------
ALGERIA                     1998       31342867.235
ALGERIA                     1997       57138193.023
ALGERIA                     1996       56140140.133
ALGERIA                     1995       53051469.653
ALGERIA                     1994       53867582.129
ALGERIA                     1993       54942718.132
ALGERIA                     1992       54628034.713
ARGENTINA                     1998       30211185.708
ARGENTINA                     1997       50805741.752
ARGENTINA                     1996       51923746.575
[[SOME ROWS DELETED]]
VIETNAM                     1992       49613838.315
```

Number of rows retrieved is: 175

Query 10

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

Tag: Q10 Stream: -1 Sequence number: 18

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

```
C_CUSTKEY   C_NAME                  REVENUE
C_ACCTBAL          N_NAME                    C_ADDRESS
C_PHONE         C_COMMENT
----------------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------------------
----
     57040  Customer#000057040                734235.245
632.870  JAPAN                     Eioyzjf4pp                              22-895-
641-3466  requests sleep blithely about the furiously i
    143347  Customer#000143347                721002.695
2557.470  EGYPT                     1aReFYv,Kw4                             14-
742-935-3718  fluffily bold excuses haggle finally after the u
     60838  Customer#000060838                679127.308
2454.770  BRAZIL                    64EaJ5vMAHWJlBOxJklpNc2RJiWE
12-913-494-9813  furiously even pinto beans integrate under the
ruthless foxes; ironic, even dolphins across the slyl
    101998  Customer#000101998                637029.567
3790.890  UNITED KINGDOM            01c9CILnNtfOQYmZj
33-593-865-6378  accounts doze blithely! enticing, final deposits sleep
blithely special accounts. slyly express accounts pla
    125341  Customer#000125341                633508.086
4983.510  GERMANY                   S29ODD6bceU8QSuuEJznkNaK
17-582-695-5962  quickly express requests wake quickly blithely
     25501  Customer#000025501                620269.785
7725.040  ETHIOPIA
W556MXuoiaYCCZamJI,Rn0B4ACUGdkQ8DZ        15-874-808-6793
```

```
quickly special requests sleep evenly among the special deposits.
special deposi
    115831  Customer#000115831              596423.867
5098.100  FRANCE                  rFeBbEEyk dl
ne7zV5fDrmiq1oK09wV7pxqCgIc  16-715-386-3788  carefully bold
excuses sleep alongside of the thinly idle
     84223  Customer#000084223              594998.024
528.650  UNITED KINGDOM          nAVZCs6BaWap rrM27N
2qBnzc5WBauxbA       33-442-824-8191  pending, final ideas haggle
final requests. unusual, regular asymptotes affix according to the even
foxes.
     54289  Customer#000054289              585603.392
5583.020  IRAN                    vXCxoCsU0Bad5JQI ,oobkZ
20-834-292-4707  express requests sublate blithely regular requests.
regular, even ideas solve.
     39922  Customer#000039922              584878.113
7321.110  GERMANY
Zgy4s50l2GKN4pLDPBU8m342gIw6R            17-147-757-8036  even
pinto beans haggle. slyly bold accounts inte
[[SOME  ROWS DELETED]]
     23431  Customer#000023431              554269.536
3381.860  ROMANIA                 HgiV0phqhaIa9aydNoIlb
29-915-458-2654  instructions nag quickly. furiously bold accounts
cajol


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

Query 11

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

Tag: Q11    Stream: -1   Sequence number: 15

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

PS_PARTKEY   VALUE
-----------------------------------
    129760        17538456.860
    166726        16503353.920
    191287        16474801.970
    161758        16101755.540
     34452        15983844.720
    139035        15907078.340
      9403        15451755.620
    154358        15212937.880
     38823        15064802.860
     85606        15053957.150
[[SOME ROWS DELETED]]
      5182         7874521.730


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

Query 12

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

Tag: Q12    Stream: -1   Sequence number: 22

select
l_shipmode,
sum(case
when o_orderpriority = '1-URGENT'
or o_orderpriority = '2-HIGH'
then 1
else 0
end) as high_line_count,
sum(case
when o_orderpriority <> '1-URGENT'
and o_orderpriority <> '2-HIGH'
then 1
else 0
end) as low_line_count
from
tpcd.orders,
tpcd.lineitem
where
o_orderkey = l_orderkey
and l_shipmode in ('MAIL', 'SHIP')
and l_commitdate < l_receiptdate
and l_shipdate < l_commitdate
and l_receiptdate >= date ('1994-01-01')
and l_receiptdate < date ('1994-01-01') + 1 year
group by
l_shipmode
order by
l_shipmode

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


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

Query 13

```
-- Query 13 - Var_0 Rev_01 - Customer Distribution Query

Tag: Q13    Stream: -1   Sequence number: 10

select
c_count,
count(*) as custdist
from
(
select
c_custkey,
count(o_orderkey)
from
```

```
tpcd.customer left outer join tpcd.orders on
c_custkey = o_custkey
and o_comment not like '%special%requests%'
group by
c_custkey
) as c_orders (c_custkey, c_count)
group by
c_count
order by
custdist desc,
c_count desc
```

```
C_COUNT      CUSTDIST
-----------------------
          0     50004
          9      6641
         10      6566
         11      6058
          8      5949
         12      5553
         13      4989
         19      4748
          7      4707
         18      4625
         15      4552
         17      4530
         14      4484
         20      4461
         16      4323
         21      4217
         22      3730
          6      3334
         23      3129
         24      2622
         25      2079
          5      1972
         26      1593
         27      1185
          4      1033
         28       869
         29       559
          3       398
         30       373
         31       235
          2       144
         32       128
         33        71
         34        48
         35        33
          1        23
         36        17
         37         7
         40         4
         38         4
         39         2
         41         1

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

Query 14

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

-- Query 14 - Var_0 Rev_01 - Promotion Effect Query

Tag: Q14    Stream: -1   Sequence number: 1

select
100.00 * sum(case
when p_type like 'PROMO%'
then l_extendedprice * (1 - l_discount)
else 0
end) / sum(l_extendedprice * (1 - l_discount)) as promo_revenue
from
tpcd.lineitem,
tpcd.part
where
l_partkey = p_partkey
and l_shipdate >= date ('1995-09-01')
and l_shipdate < date ('1995-09-01') + 1 month

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


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

Query 15

```
-- Query 15 - Var_a Rev_01 - Top Supplier Query

Tag: Q15a   Stream: -1   Sequence number: 16

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

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


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

Query 16

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

Tag: Q16    Stream: -1   Sequence number: 13

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

P_BRAND    P_TYPE                    P_SIZE      SUPPLIER_CNT
-------------------------------------------------------------
Brand#41   MEDIUM BRUSHED TIN          3           28
Brand#54   STANDARD BRUSHED COPPER     14          27
Brand#11   STANDARD BRUSHED TIN        23          24
Brand#11   STANDARD BURNISHED BRASS    36          24
Brand#15   MEDIUM ANODIZED NICKEL      3           24
Brand#15   SMALL ANODIZED BRASS        45          24
Brand#15   SMALL BURNISHED NICKEL      19          24
Brand#21   MEDIUM ANODIZED COPPER      3           24
Brand#22   SMALL BRUSHED NICKEL       3           24
Brand#22   SMALL BURNISHED BRASS       19          24
[[SOME ROWS DELETED]]
Brand#55   STANDARD PLATED TIN         49          3


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

Query 17

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

Tag: Q17    Stream: -1   Sequence number: 6

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

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


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

Query 18

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

Tag: Q18    Stream: -1   Sequence number: 7

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

C_NAME                 C_CUSTKEY    O_ORDERKEY
O_ORDERDATE  O_TOTALPRICE         6
-------------------------------------------------------------------------------------------------------------
--------------------
Customer#000128120          128120          4722021  1994-04-07
544089.090          323.000
Customer#000144617          144617          3043270  1997-02-12
530604.440          317.000
Customer#000013940          13940           2232932  1997-04-13
522720.610          304.000
Customer#000066790          66790           2199712  1996-09-30
515531.820          327.000
```

```
Customer#000046435          46435          4745607  1997-07-03
508047.990          309.000
Customer#000015272          15272          3883783  1993-07-28
500241.330          302.000
Customer#000146608          146608          3342468  1994-06-12
499794.580          303.000
Customer#000096103          96103          5984582  1992-03-16
494398.790          312.000
Customer#000024341          24341          1474818  1992-11-15
491348.260          302.000
Customer#000137446          137446          5489475  1997-05-23
487763.250          311.000
Customer#000107590          107590          4267751  1994-11-04
485141.380          301.000
Customer#000050008          50008          2366755  1996-12-09
483891.260          302.000
Customer#000015619          15619          3767271  1996-08-07
480083.960          318.000
Customer#000077260          77260          1436544  1992-09-12
479499.430          307.000
Customer#000109379          109379          5746311  1996-10-10
478064.110          302.000
Customer#000054602          54602          5832321  1997-02-09
471220.080          307.000
Customer#000105995          105995          2096705  1994-07-03
469692.580          307.000
Customer#000148885          148885          2942469  1992-05-31
469630.440          313.000
Customer#000114586          114586          551136  1993-05-19
469605.590          308.000
Customer#000105260          105260          5296167  1996-09-06
469360.570          303.000
Customer#000147197          147197          1263015  1997-02-02
467149.670          320.000
Customer#000064483          64483          2745894  1996-07-04
466991.350          304.000
Customer#000136573          136573          2761378  1996-05-31
461282.730          301.000
Customer#000016384          16384          502886  1994-04-12
458378.920          312.000
Customer#000117919          117919          2869152  1996-06-20
456815.920          317.000
Customer#000012251          12251          735366  1993-11-24
455107.260          309.000
Customer#000120098          120098          1971680  1995-06-14
453451.230          308.000
Customer#000066098          66098          5007490  1992-08-07
453436.160          304.000
Customer#000117076          117076          4290656  1997-02-05
449545.850          301.000
Customer#000129379          129379          4720454  1997-06-07
448665.790          303.000
Customer#000126865          126865          4702759  1994-11-07
447606.650          320.000
Customer#000088876          88876          983201  1993-12-30
446717.460          304.000
Customer#000036619          36619          4806726  1995-01-17
446704.090          328.000
Customer#000141823          141823          2806245  1996-12-29
446269.120          310.000
Customer#000053029          53029          2662214  1993-08-13
446144.490          302.000
Customer#000018188          18188          3037414  1995-01-25
443807.220          308.000
Customer#000066533          66533          29158  1995-10-21
443576.500          305.000
Customer#000037729          37729          4134341  1995-06-29
441082.970          309.000
Customer#000003566          3566          2329187  1998-01-04
439803.360          304.000
Customer#000045538          45538          4527553  1994-05-22
436275.310          305.000
Customer#000081581          81581          4739650  1995-11-04
435405.900          305.000
Customer#000119989          119989          1544643  1997-09-20
434568.250          320.000
Customer#000003680          3680          3861123  1998-07-03
433525.970          301.000
Customer#000113131          113131          967334  1995-12-15
432957.750          301.000
Customer#000141098          141098          565574  1995-09-24
430986.690          301.000
Customer#000093392          93392          5200102  1997-01-22
425487.510          304.000
Customer#000015631          15631          1845057  1994-05-12
419879.590          302.000
Customer#000112987          112987          4439686  1996-09-17
418161.490          305.000
Customer#000012599          12599          4259524  1998-02-12
415200.610          304.000
Customer#000105410          105410          4478371  1996-03-05
412754.510          302.000
Customer#000149842          149842          5156581  1994-05-30
411329.350          302.000
Customer#000010129          10129          5849444  1994-03-21
409129.850          309.000
Customer#000069904          69904          1742403  1996-10-19
408513.000          305.000
Customer#000017746          17746          6882  1997-04-09
408446.930          303.000
Customer#000013072          13072          1481925  1998-03-15
399195.470          301.000
Customer#000082441          82441          857959  1994-02-07
382579.740          305.000
Customer#000088703          88703          2995076  1994-01-30
363812.120          302.000

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

Query 19

```
-- Query 19 - Var_0 Rev_01 - Discounted Revenue Query

Tag: Q19    Stream: -1   Sequence number: 19

select
sum(l_extendedprice* (1 - l_discount)) as revenue
from
tpcd.lineitem,
tpcd.part
where
(
p_partkey = l_partkey
and p_brand = 'Brand#12'
and p_container in ('SM CASE', 'SM BOX', 'SM PACK', 'SM PKG')
and l_quantity >= 1 and l_quantity <= 1 + 10
and p_size between 1 and 5
and l_shipmode in ('AIR', 'AIR REG')
and l_shipinstruct = 'DELIVER IN PERSON'
)
or
(
p_partkey = l_partkey
and p_brand = 'Brand#23'
and p_container in ('MED BAG', 'MED BOX', 'MED PKG', 'MED PACK')
and l_quantity >= 10 and l_quantity <= 10 + 10
and p_size between 1 and 10
and l_shipmode in ('AIR', 'AIR REG')
```

```
and l_shipinstruct = 'DELIVER IN PERSON'
)
or
(
p_partkey = l_partkey
and p_brand = 'Brand#34'
and p_container in ('LG CASE', 'LG BOX', 'LG PACK', 'LG PKG')
and l_quantity >= 20 and l_quantity <= 20 + 10
and p_size between 1 and 15
and l_shipmode in ('AIR', 'AIR REG')
and l_shipinstruct = 'DELIVER IN PERSON'
)
```

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


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

Query 20

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

Tag: Q20 Stream: -1 Sequence number: 4

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

```
S_NAME                    S_ADDRESS
-----------------------------------------------------------------------
Supplier#000000020        iybAE,RmTymrZVYaFZva2SH,j
Supplier#000000091
YV45D7TkfdQanOOZ7q9QxkyGUapU1oOWU6q3
Supplier#000000197        YC2Acon6kjY3zj3Fbxs2k4Vdf7X0cd2F
Supplier#000000226        83qOdU2EYRdPQAQhEtn GRZEd
Supplier#000000285        Br7e1nnt1yxrw6ImgpJ7YdhFDjuBf
Supplier#000000378        FfbhyCxWvcPrO8ltp9
Supplier#000000402        i9Sw4DoyMhzhKXCH9By,AYSgmD
Supplier#000000530        0qwCMwobKY OcmLyfRXlagA8ukENJv,
Supplier#000000688        D fw5ocppmZpYBBIPI718hCihLDZ5KhKX
Supplier#000000710        f19YPvOyb QoYwjKC,oPycpGfieBAcwKJo
[[SOME ROWS DELETED]]
Supplier#000009974        7wJ,J5DKcxSU4Kp1cQLpbcAvB5AsvKT


Number of rows retrieved is:    204
-----------------------------------------------
```

Query 21

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

Tag: Q21 Stream: -1 Sequence number: 9

```
select
s_name,
count(*) as numwait
from
tpcd.supplier,
tpcd.lineitem l1,
tpcd.orders,
tpcd.nation
where
s_suppkey = l1.l_suppkey
and o_orderkey = l1.l_orderkey
and o_orderstatus = 'F'
and l1.l_receiptdate > l1.l_commitdate
and exists (
select
*
from
tpcd.lineitem l2
where
l2.l_orderkey = l1.l_orderkey
and l2.l_suppkey <> l1.l_suppkey
)
and not exists (
select
*
from
tpcd.lineitem l3
where
l3.l_orderkey = l1.l_orderkey
and l3.l_suppkey <> l1.l_suppkey
and l3.l_receiptdate > l3.l_commitdate
)
and s_nationkey = n_nationkey
and n_name = 'SAUDI ARABIA'
group by
s_name
order by
numwait desc,
s_name
fetch first 100 rows only
```

```
S_NAME                    NUMWAIT
-----------------------------------------
Supplier#000002829                  20
Supplier#000005808                  18
Supplier#000000262                  17
Supplier#000000496                  17
Supplier#000002160                  17
Supplier#000002301                  17
```

```
Supplier#000002540              17
Supplier#000003063              17
Supplier#000005178              17
Supplier#000008331              17
[[SOME ROWS DELETED]]
Supplier#000002483              12


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

Query 22

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

Tag: Q22    Stream: -1   Sequence number: 12

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

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


Number of rows retrieved is:      7
-------------------------------------------------
```

C.2 First 10 rows of Test Database Tables

```
SELECT * FROM TPCD.REGION FETCH FIRST 10 ROWS ONLY

R_REGIONKEY R_NAME                 R_COMMENT
----------- ------------------------- ------------------------------------------------------------
------------------------------------------------------------------------------------------------
          0 AFRICA                  special Tiresias about the furiously even
dolphins are furi
          1 AMERICA                  even, ironic theodolites according to the
bold platelets wa
          2 ASIA                    silent, bold requests sleep slyly across the
quickly sly dependencies. furiously silent instructions alongside
          3 EUROPE                  special, bold deposits haggle foxes.
platelet
          4 MIDDLE EAST             furiously unusual packages use
carefully above the unusual, exp

  5 record(s) selected.


SELECT * FROM TPCD.NATION FETCH FIRST 10 ROWS ONLY

N_NATIONKEY N_NAME                 N_REGIONKEY N_COMMENT
----------- ------------------------- ----------- ------------------------------------------------
------------------------------------------------------------------------------------------------
------------
          0 ALGERIA                           0 final accounts wake quickly.
special reques
          5 ETHIOPIA                          0 fluffily ruthless requests integrate
fluffily. pending ideas wake blithely acco
         14 KENYA                             0 ironic requests boost. quickly
pending pinto beans cajole slyly slyly even deposits. ironic packages
         15 MOROCCO                           0 ideas according to the fluffily
final pinto beans sleep furiously
         16 MOZAMBIQUE                        0 ironic courts wake fluffily
even, bold deposi
          1 ARGENTINA                         1 idly final instructions cajole
stealthily. regular instructions wake carefully blithely express accounts.
fluffi
          2 BRAZIL                            1 always pending pinto beans sleep
sil
          3 CANADA                            1 foxes among the bold requests
         17 PERU                              1 final, final accounts sleep slyly
across the requests.
         24 UNITED STATES                     1 blithely regular deposits
serve furiously blithely regular warthogs! slyly fi

  10 record(s) selected.


SELECT * FROM TPCD.PART FETCH FIRST 10 ROWS ONLY

P_PARTKEY   P_NAME                                        P_MFGR
P_BRAND    P_TYPE                P_SIZE      P_CONTAINER
P_RETAILPRICE          P_COMMENT
----------- ---------------------------------------------- ------------------------- -
--------- ------------------------- ----------- ----------- ------------------------ ----------
------------
         43 medium khaki chocolate rosy blush
Manufacturer#4           Brand#44   PROMO POLISHED STEEL
5 WRAP CASE     +9.43040000000000E+002 carefully iro
        242 magenta deep lawn linen navy
Manufacturer#3           Brand#35   SMALL POLISHED STEEL
42 LG BAG       +1.14224000000000E+003 final pearls wake b
```

```
      244 midnight brown magenta maroon tan
Manufacturer#5          Brand#51   ECONOMY BURNISHED BRASS
48 LG BOX       +1.14424000000000E+003 careful
      578 black dim lace almond bisque
Manufacturer#4          Brand#41   MEDIUM ANODIZED NICKEL
9 WRAP DRUM     +1.47857000000000E+003 carefully regula
      621 almond coral dim frosted midnight
Manufacturer#5          Brand#53   PROMO PLATED TIN
47 JUMBO DRUM   +1.52162000000000E+003 blithely
      691 burnished deep black cream blanched
Manufacturer#3          Brand#35   PROMO BURNISHED BRASS
3 SM JAR        +1.59169000000000E+003 unusual
      949 thistle burlywood frosted yellow midnight
Manufacturer#5          Brand#51   LARGE BURNISHED TIN
47 LG PKG       +1.84994000000000E+003 carefully ironic foxes
      997 powder lavender purple dim saddle
Manufacturer#5          Brand#51   STANDARD ANODIZED BRASS
22 JUMBO BAG    +1.89799000000000E+003 platel
     1201 aquamarine lace pink medium khaki
Manufacturer#5          Brand#54   LARGE POLISHED COPPER
21 JUMBO DRUM   +1.10222000000000E+003 quickly s
     1737 violet beige misty midnight green
Manufacturer#3          Brand#32   ECONOMY POLISHED BRASS
29 WRAP PKG     +1.63873000000000E+003 ironic

  10 record(s) selected.


SELECT * FROM TPCD.SUPPLIER FETCH FIRST 10 ROWS ONLY

S_SUPPKEY   S_NAME                 S_ADDRESS
S_NATIONKEY S_PHONE         S_ACCTBAL               S_COMMENT
----------- ------------------------ ---------------------------------------- ---------- -----
---------- ------------------- ---------------------------------------------------------------
----------------------------------------
      2072 Supplier#000002072       XBBFJ0OV0RxLBgG ,dNl
0 10-983-966-7774   +7.180160000000000E+003 even dinos among
the furiously
      6040 Supplier#000006040       y,nMWLIFjz6qhR1Rqnlji,8Uf
0 10-953-490-2366   +3.482050000000000E+003 regular, final frets are
blithely along the blithely ironic deposits. carefully special
      9418 Supplier#000009418
chJOHEWwW2Iec5roXAeLiyhe8fKYus                  0 10-160-293-8608
+5.105250000000000E+003 slyly final deposits doubt bli
     17198 Supplier#000017198       huYUWFRkZMQNs
0 10-905-342-1346   +3.712400000000000E+003 quickly final packages
against the
     21791 Supplier#000021791
AY1IGVlhuZeKfs,61SDijJX7Djbvr,7Bdobkchq          0 10-674-966-
6118   +8.934850000000000E+003 ironic, bold theodolites are blithely
above the special pinto beans. ironic foxes acros
     24109 Supplier#000024109       B9nJgbUm1,pN
0 10-222-659-1814   +1.805490000000000E+003 furiously brave
packages might integrate above the furiously regular accounts.
requests
     37529 Supplier#000037529       kN0fkq8rnNA4VlA m55sXV
0WloMvkz                0 10-182-345-9824
+9.285160000000000E+003 special, even deposits boost quickl
     40816 Supplier#000040816       HxhcDZT
eKo,GUsDKefMOfVDmW17ohk                 0 10-433-830-5982
+2.815720000000000E+003 slyly regular platelets above the unus
     41390 Supplier#000041390
8fhciVvp2kSq6R1IuOfBj31o0LH4XylN0RdV1v          0 10-388-363-
6591   +8.339320000000000E+003 even, special theodolites above the
blithely silent accounts
     49869 Supplier#000049869       w9oqgTgAWZEsLRgZJIHr0e6uW
0 10-684-457-6177   +8.280310000000000E+003 special ideas unwind.
stealthy instructions sublate against the fluffily r

  10 record(s) selected.


SELECT * FROM TPCD.PARTSUPP FETCH FIRST 10 ROWS ONLY

PS_PARTKEY  PS_SUPPKEY  PS_AVAILQTY PS_SUPPLYCOST
PS_COMMENT
----------- ----------- ----------- ------------------------ ---------------------------------
---------------------------------------------------------------------------------------------
---------------------------------------------------------------
      43          44          3211   +8.057800000000000E+002 final, express
dependencies sleep according to the express requests. bold, regular
accounts detect outside the slyly
      43    25000044          6770   +4.931900000000000E+002 furiously
special pinto beans cajole. ironic decoys across the
      43    50000044          9506   +4.936500000000000E+002 carefully
fluffy accounts across the blithely final accounts hang slyly according to
the furiously special platelets. sil
      43    75000044          3232   +3.071200000000000E+002 bold
packages wake blithely above the furiously bold
     242         243          6454   +5.365000000000000E+002 slyly ironic
accounts haggle furiously along the blithely ironic d
     242    25000243           394   +9.724000000000000E+001 silent
accounts snooze according to the regular depths. final, specia
     242    50000243          2514   +2.083900000000000E+002 furiously
even dependencies of the blithely final asymptotes need to s
     242    75000243          6902   +1.473900000000000E+002 furiously
ironic deposits according to the final requests will
     244         245          5942   +1.488400000000000E+002 excuses
sublate slyly sly accounts. furiously special packages about the
carefully regular packages boost furiously stealthy packages.
     244    25000245          4940   +2.936200000000000E+002 final,
ironic somas are blithely express foxes. furiously regular excuses
according to the pending, unusual pinto beans doze across the
furiously special

  10 record(s) selected.


SELECT * FROM TPCD.CUSTOMER FETCH FIRST 10 ROWS ONLY

C_CUSTKEY   C_NAME                 C_ADDRESS
C_NATIONKEY C_PHONE         C_ACCTBAL
C_MKTSEGMENT C_COMMENT
----------- ------------------------ ---------------------------------------- ---------- -----
---------- ------------------- ------------ ----------
---------------------------------------------------------------------------
      118 Customer#0000000118       OVnFuHygK9wx3xpg8
18 28-639-943-7051   +3.582370000000000E+003 AUTOMOBILE
foxes are slyly. ironic deposits haggle. theodolites haggle furiously
quickly silent pinto beans. pending,
      690 Customer#0000000690       xH61m,Si5X4REvi
3 13-489-760-5455   +1.034500000000000E+002 HOUSEHOLD
requests nag quickly according to the requests. c
      718 Customer#0000000718       w,GXCSSI4NEHAFPKG
20 30-605-635-8197   +8.438400000000000E+003 HOUSEHOLD
slyly regular foxes hang. slyly even theodolites haggle carefully after
the furiously final requests. ironic f
      760 Customer#0000000760       jp8DYJ7GPQSDQC
2 12-176-116-3113   +2.883240000000000E+003 BUILDING     blithely
regular accounts haggle around the unusual requests. sly brai
      904 Customer#0000000904       YdJEbNygDU6DrgWXQY6orasq
5 15-940-929-4572   +9.562820000000000E+003 BUILDING
instructions would are quickly according to the furiously even accounts.
even Tiresia
      921 Customer#0000000921       XYBVDdDifSYrW
gUeDPhITqMjpjtbnc               8 18-765-936-2316
+3.651090000000000E+003 HOUSEHOLD    slyly express foxes across
the slyly express accounts cajo
     1020 Customer#0000001020
DHom,LSHKfYSwLSZv39AooYQHlvbaeztefjwR           3 13-692-286-
```

```
8158   +6.91487000000000E+003 MACHINERY    accounts about the
carefully ironic instructions haggle q
      1636 Customer#0000001636
t1VhiA5gssjGA4,o5b2e8WJHsaBAmCfm4G               20 30-559-573-
5410   +3.22888000000000E+003 FURNITURE    carefully ironic
asymptotes above the daring, regular tithes haggle even ins
      1715 Customer#0000001715       TNwfsu3dIIti
12 22-283-174-5611   +2.58736000000000E+003 BUILDING
furiously bold pinto beans cajole slyly accounts. blith
      2021 Customer#0000002021       1ZLujitHdPv
23 33-814-768-2072   +2.19346000000000E+003 AUTOMOBILE
requests are slyly. furiously regular packages cajole slyly final ac

  10 record(s) selected.


SELECT * FROM TPCD.ORDERS FETCH FIRST 10 ROWS ONLY

O_ORDERKEY           O_CUSTKEY   O_ORDERSTATUS
O_TOTALPRICE            O_ORDERDATE O_ORDERPRIORITY
O_CLERK         O_SHIPPRIORITY O_COMMENT
-------------------- ----------- ------------ ---------------------- ----------- ------------
--- --------------- -------------- ---------------------------------------------------------
-------------------
          6778912   478245220 F              +3.22040910000000E+005
01/01/1992  5-LOW          Clerk#008371476              0 slyly slow
accounts cajole carefully at
          7031047   143106347 F              +2.40468360000000E+005
01/01/1992  2-HIGH         Clerk#002654843              0 regular
requests sleep. slyly ironic theodolites across the
          7211205  1376933353 F              +2.96240010000000E+005
01/01/1992  4-NOT SPECIFIED Clerk#000093879              0 gifts are
along the furiously bold requests. slyly ironic id
          8638209   682954945 F              +2.24417000000000E+005
01/01/1992  5-LOW          Clerk#003600234              0 dependencies
are quickly regular, special dolphins
          9737542   108430388 F              +1.89791440000000E+005
01/01/1992  5-LOW          Clerk#000223874              0 pinto beans
sleep slyl
         10293349   788094167 F              +2.06394700000000E+005
01/01/1992  3-MEDIUM       Clerk#000381776              0 even, silent
requests are ruthless frays. ironic re
         11174723   953829496 F              +2.29809620000000E+005
01/01/1992  4-NOT SPECIFIED Clerk#005394312              0 blithely
final platelets aft
         13459781   805866632 F              +1.17318440000000E+005
01/01/1992  5-LOW          Clerk#005320354              0 dependencies
thrash pending deposits. quickly fina
         13609669   455668936 F              +3.05727520000000E+005
01/01/1992  4-NOT SPECIFIED Clerk#007399046              0 final,
unusual dependencies among the pending, regu
         15114274   546705230 F              +2.32719670000000E+005
01/01/1992  4-NOT SPECIFIED Clerk#002558383              0
theodolites integrate. blithely ironic somas dazzle silently. ironic
account

  10 record(s) selected.


SELECT * FROM TPCD.LINEITEM FETCH FIRST 10 ROWS ONLY

L_ORDERKEY           L_PARTKEY   L_SUPPKEY   L_LINENUMBER
L_QUANTITY              L_EXTENDEDPRICE         L_DISCOUNT
L_TAX                L_RETURNFLAG L_LINESTATUS L_SHIPDATE
L_COMMITDATE L_RECEIPTDATE L_SHIPINSTRUCT
L_SHIPMODE L_COMMENT
-------------------- ----------- ----------- ------------ ---------------------- ------------
---------- ---------- ---------------------- ---------------------- ------------ ------------ --------
-- ------------ ------------ ---------------------- ---------- ----------------------------
----------
          6928030402   887199327    37199344           7
+3.30000000000000E+001   +4.56050100000000E+004
+1.00000000000000E-001   +2.00000000000000E-002 A           F
01/02/1992 02/26/1992   01/18/1992    NONE                 AIR
blithely final dep
          6968286083   173690692    23690695           4
+3.50000000000000E+001   +5.85903500000000E+004
+3.00000000000000E-002   +0.00000000000000E+000 R           F
01/02/1992 03/05/1992   01/07/1992    TAKE BACK RETURN
FOB        express depo
          7021258818   580339524     5339530           6
+2.20000000000000E+001   +3.37592200000000E+004
+8.00000000000000E-002   +7.00000000000000E-002 R           F
01/02/1992 02/07/1992   01/24/1992    TAKE BACK RETURN
FOB        special, unusual req
          7033394309   690977794    15977801           1
+3.60000000000000E+001   +6.61410000000000E+004
+8.00000000000000E-002   +7.00000000000000E-002 A           F
01/02/1992 03/20/1992   01/19/1992    NONE                 RAIL
blithely even instruc
          7088244964   323743110    23743111           4
+1.00000000000000E+001   +1.13693000000000E+004
+0.00000000000000E+000   +5.00000000000000E-002 A           F
01/02/1992 03/02/1992   01/05/1992    DELIVER IN PERSON
REG AIR    dogged, even dep
          7126528356  1991591603    16591623           2
+4.00000000000000E+000   +6.38012000000000E+003
+1.00000000000000E-001   +8.00000000000000E-002 A           F
01/02/1992 03/08/1992   01/13/1992    DELIVER IN PERSON
MAIL       bold, bold instructions engage
          7145826055   380763717    55763727           3
+4.80000000000000E+001   +8.45606400000000E+004
+0.00000000000000E+000   +0.00000000000000E+000 R           F
01/02/1992 02/26/1992   01/16/1992    COLLECT COD          RAIL
final, regular
          7182519524   113780156    63780159           4
+6.00000000000000E+000   +7.38282000000000E+003
+5.00000000000000E-002   +0.00000000000000E+000 R           F
01/02/1992 03/26/1992   01/26/1992    TAKE BACK RETURN
FOB        carefully even
          7344925350  1097439200    22439211           5
+4.30000000000000E+001   +5.52266200000000E+004
+8.00000000000000E-002   +7.00000000000000E-002 R           F
01/02/1992 03/04/1992   01/16/1992    TAKE BACK RETURN
RAIL       furiously silent accounts en
          7352500358   440979043    15979056           2
+1.20000000000000E+001   +1.32000000000000E+004
+0.00000000000000E+000   +6.00000000000000E-002 R           F
01/02/1992 02/19/1992   01/22/1992    DELIVER IN PERSON
FOB        furiously ironic

  10 record(s) selected.
```

C.3 Query Substitution Parameters

```
Power stream    Seed = 1120050504

-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050504 as a seed to the RNG
Q1  DELTA       115
Q2  SIZE        48
   TYPE        STEEL
   REGION      EUROPE
Q3  SEGMENT     FURNITURE
   DATE        1995-03-25
Q4  DATE        1996-11-01
Q5  REGION      AFRICA
   DATE        1993-01-01
```

```
Q6  DATE        1993-01-01
   DISCOUNT    0.04
   QUANTITY    25
Q7  NATION1     FRANCE
   NATION2     CHINA
Q8  NATION      CHINA
   REGION      ASIA
   TYPE        SMALL ANODIZED BRASS
Q9  COLOR       coral
Q10 DATE        1993-06-01
Q11 NATION      INDIA
   FRACTION    0.0000000100
Q12 SHIPMODE1   FOB
   SHIPMODE2   AIR
   DATE        1995-01-01
Q13 WORD1       express
   WORD2       requests
Q14 DATE        1994-06-01
Q15 DATE        1995-07-01
Q16 BRAND       Brand#52
   TYPE        PROMO BURNISHED
   SIZE1       27
   SIZE2       35
   SIZE3       30
   SIZE4       34
   SIZE5       44
   SIZE6       24
   SIZE7       46
   SIZE8       11
Q17 BRAND       Brand#25
   CONTAINER   WRAP CASE
Q18 QUANTITY    315
Q19 BRAND1      Brand#51
   BRAND2      Brand#44
   BRAND3      Brand#51
   QUANTITY1   10
   QUANTITY2   12
   QUANTITY3   23
Q20 COLOUR      blush
   DATE        1996-01-01
   NATION      MOZAMBIQUE
Q21 NATION      MOROCCO
Q22 I1          13
   I2          31
   I3          24
   I4          10
   I5          16
   I6          17
   I7          29

Throughput Stream = 1    Seed = 1120050505
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050505 as a seed to the RNG
Q1  DELTA       62
Q2  SIZE        36
   TYPE        NICKEL
   REGION      AMERICA
Q3  SEGMENT     MACHINERY
   DATE        1995-03-10
Q4  DATE        1994-08-01
Q5  REGION      AMERICA
   DATE        1993-01-01
Q6  DATE        1993-01-01
   DISCOUNT    0.09
   QUANTITY    24
Q7  NATION1     UNITED KINGDOM
   NATION2     IRAN
Q8  NATION      IRAN
   REGION      MIDDLE EAST
   TYPE        STANDARD POLISHED BRASS
Q9  COLOR       brown
Q10 DATE        1994-03-01
Q11 NATION      SAUDI ARABIA
   FRACTION    0.0000000100
Q12 SHIPMODE1   TRUCK

   SHIPMODE2   FOB
   DATE        1994-01-01
Q13 WORD1       express
   WORD2       requests
Q14 DATE        1994-09-01
Q15 DATE        1993-04-01
Q16 BRAND       Brand#32
   TYPE        SMALL PLATED
   SIZE1       45
   SIZE2       6
   SIZE3       43
   SIZE4       19
   SIZE5       4
   SIZE6       27
   SIZE7       7
   SIZE8       20
Q17 BRAND       Brand#22
   CONTAINER   WRAP JAR
Q18 QUANTITY    313
Q19 BRAND1      Brand#53
   BRAND2      Brand#22
   BRAND3      Brand#41
   QUANTITY1   5
   QUANTITY2   13
   QUANTITY3   30
Q20 COLOUR      maroon
   DATE        1994-01-01
   NATION      FRANCE
Q21 NATION      GERMANY
Q22 I1          12
   I2          29
   I3          17
   I4          26
   I5          18
   I6          33
   I7          25

Throughput Stream = 2    Seed = 1120050506
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050506 as a seed to the RNG
Q1  DELTA       70
Q2  SIZE        24
   TYPE        TIN
   REGION      MIDDLE EAST
Q3  SEGMENT     BUILDING
   DATE        1995-03-27
Q4  DATE        1997-02-01
Q5  REGION      ASIA
   DATE        1993-01-01
Q6  DATE        1993-01-01
   DISCOUNT    0.07

   QUANTITY    24
Q7  NATION1     MOROCCO
   NATION2     BRAZIL
Q8  NATION      BRAZIL
   REGION      AMERICA
   TYPE        STANDARD BURNISHED BRASS
Q9  COLOR       beige
Q10 DATE        1994-12-01
Q11 NATION      INDIA
   FRACTION    0.0000000100
Q12 SHIPMODE1   RAIL
   SHIPMODE2   SHIP
```

```
   DATE        1994-01-01
Q13 WORD1       express
   WORD2       requests
Q14 DATE        1994-12-01
Q15 DATE        1995-11-01
Q16 BRAND       Brand#22
   TYPE        LARGE BRUSHED
   SIZE1       21
   SIZE2       34
   SIZE3       50
   SIZE4       24
   SIZE5       37
   SIZE6       11
   SIZE7       36
   SIZE8       22
Q17 BRAND       Brand#24
   CONTAINER    WRAP CAN
Q18 QUANTITY    314
Q19 BRAND1      Brand#55
   BRAND2      Brand#55
   BRAND3      Brand#45
   QUANTITY1    10
   QUANTITY2    14
   QUANTITY3    26
Q20 COLOUR      tomato
   DATE        1997-01-01
   NATION      VIETNAM
Q21 NATION      UNITED STATES
Q22 I1          27
   I2          21
   I3          17
   I4          26
   I5          12
   I6          25
   I7          29

Throughput Stream = 3    Seed = 1120050507
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050507 as a seed to the RNG
Q1  DELTA       78
Q2  SIZE        11
   TYPE        COPPER
   REGION      AMERICA
Q3  SEGMENT     HOUSEHOLD
   DATE        1995-03-12
Q4  DATE        1994-11-01
Q5  REGION      EUROPE
   DATE        1994-01-01
Q6  DATE        1994-01-01
   DISCOUNT    0.04
   QUANTITY    25
Q7  NATION1     GERMANY
   NATION2     ROMANIA
Q8  NATION      ROMANIA
   REGION      EUROPE
   TYPE        PROMO BRUSHED STEEL
Q9  COLOR       white
Q10 DATE        1993-09-01
Q11 NATION      VIETNAM
   FRACTION    0.0000000100
Q12 SHIPMODE1   AIR
   SHIPMODE2   SHIP
   DATE        1995-01-01
Q13 WORD1       express
   WORD2       requests
Q14 DATE        1995-04-01
Q15 DATE        1993-07-01
Q16 BRAND       Brand#52
   TYPE        STANDARD ANODIZED
   SIZE1       2
   SIZE2       16
   SIZE3       35
   SIZE4       22
   SIZE5       33
   SIZE6       37
   SIZE7       17
   SIZE8       26
Q17 BRAND       Brand#21
   CONTAINER    SM CASE
Q18 QUANTITY    312
Q19 BRAND1      Brand#12
   BRAND2      Brand#43
   BRAND3      Brand#44
   QUANTITY1    5
   QUANTITY2    15
   QUANTITY3    22
Q20 COLOUR      goldenrod
   DATE        1996-01-01
   NATION      IRAQ
Q21 NATION      MOZAMBIQUE
Q22 I1          14
   I2          31
   I3          28
   I4          10
   I5          13
   I6          19
   I7          32

Throughput Stream = 4    Seed = 1120050508
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050508 as a seed to the RNG
Q1  DELTA       86
Q2  SIZE        49
   TYPE        STEEL
   REGION      MIDDLE EAST
Q3  SEGMENT     BUILDING
   DATE        1995-03-29
Q4  DATE        1997-06-01
Q5  REGION      MIDDLE EAST
   DATE        1994-01-01
Q6  DATE        1994-01-01
   DISCOUNT    0.09
   QUANTITY    24
Q7  NATION1     UNITED STATES
   NATION2     IRAN
Q8  NATION      IRAN
   REGION      MIDDLE EAST
   TYPE        PROMO PLATED STEEL
Q9  COLOR       tan
Q10 DATE        1994-07-01
Q11 NATION      INDONESIA
   FRACTION    0.0000000100
Q12 SHIPMODE1   REG AIR
   SHIPMODE2   SHIP
   DATE        1995-01-01
Q13 WORD1       express
   WORD2       requests
Q14 DATE        1995-07-01
Q15 DATE        1996-02-01
Q16 BRAND       Brand#32
   TYPE        MEDIUM PLATED
   SIZE1       10
   SIZE2       4
   SIZE3       19
   SIZE4       39
   SIZE5       33
   SIZE6       20
   SIZE7       6
   SIZE8       13
Q17 BRAND       Brand#23
```

```
   CONTAINER    SM JAR
Q18 QUANTITY    313
Q19 BRAND1      Brand#14
   BRAND2       Brand#21
   BRAND3       Brand#33
   QUANTITY1    1
   QUANTITY2    16
   QUANTITY3    30
Q20 COLOUR      rosy
   DATE         1994-01-01
   NATION       ALGERIA
Q21 NATION      INDIA
Q22 I1          30
   I2           18
   I3           26
   I4           33
   I5           25
   I6           29
   I7           34

Throughput Stream = 5    Seed = 1120050509
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050509 as a seed to the RNG
Q1  DELTA       94
Q2  SIZE        37
   TYPE         BRASS
   REGION       ASIA
Q3  SEGMENT     HOUSEHOLD
   DATE         1995-03-14
Q4  DATE        1995-03-01
Q5  REGION      AFRICA
   DATE         1994-01-01
Q6  DATE        1994-01-01
   DISCOUNT     0.07
   QUANTITY     24
Q7  NATION1     MOZAMBIQUE
   NATION2      BRAZIL
Q8  NATION      BRAZIL

   REGION       AMERICA
   TYPE         PROMO ANODIZED STEEL
Q9  COLOR       sky
Q10 DATE        1993-04-01
Q11 NATION      RUSSIA
   FRACTION     0.0000000100
Q12 SHIPMODE1   SHIP
   SHIPMODE2    TRUCK
   DATE         1993-01-01
Q13 WORD1       express
   WORD2        accounts
Q14 DATE        1995-10-01
Q15 DATE        1993-11-01
Q16 BRAND       Brand#22
   TYPE         ECONOMY POLISHED
   SIZE1        8
   SIZE2        40
   SIZE3        17
   SIZE4        43
   SIZE5        18
   SIZE6        4
   SIZE7        19
   SIZE8        14
Q17 BRAND       Brand#24
   CONTAINER    SM CAN
Q18 QUANTITY    315
Q19 BRAND1      Brand#11
   BRAND2       Brand#14
   BRAND3       Brand#33
   QUANTITY1    6
   QUANTITY2    17
   QUANTITY3    26
Q20 COLOUR      cornflower
   DATE         1993-01-01
   NATION       MOROCCO
Q21 NATION      ARGENTINA
Q22 I1          25
   I2           18
   I3           14
   I4           12
   I5           33
   I6           17
   I7           32

Throughput Stream = 6    Seed = 1120050510
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050510 as a seed to the RNG
Q1  DELTA       102
Q2  SIZE        25
   TYPE         TIN
   REGION       MIDDLE EAST
Q3  SEGMENT     AUTOMOBILE
   DATE         1995-03-31
Q4  DATE        1997-10-01
Q5  REGION      AMERICA
   DATE         1994-01-01
Q6  DATE        1994-01-01
   DISCOUNT     0.04
   QUANTITY     25
Q7  NATION1     INDIA
   NATION2      ROMANIA
Q8  NATION      ROMANIA
   REGION       EUROPE
   TYPE         ECONOMY POLISHED STEEL
Q9  COLOR       royal
Q10 DATE        1994-01-01
Q11 NATION      IRAN
   FRACTION     0.0000000100
Q12 SHIPMODE1   MAIL
   SHIPMODE2    REG AIR
   DATE         1995-01-01
Q13 WORD1       special
   WORD2        accounts
Q14 DATE        1996-01-01
Q15 DATE        1996-06-01
Q16 BRAND       Brand#52
   TYPE         SMALL ANODIZED
   SIZE1        12
   SIZE2        33
   SIZE3        26
   SIZE4        6
   SIZE5        20
   SIZE6        13
   SIZE7        11
   SIZE8        17
Q17 BRAND       Brand#21
   CONTAINER    LG CASE
Q18 QUANTITY    312
Q19 BRAND1      Brand#24
   BRAND2       Brand#42
   BRAND3       Brand#32
   QUANTITY1    1
   QUANTITY2    18
   QUANTITY3    22
Q20 COLOUR      navy
   DATE         1996-01-01
   NATION       ETHIOPIA
Q21 NATION      CHINA
Q22 I1          15
   I2           19
   I3           26
```

```
   I4         34
   I5         31
   I6         22
   I7         17

Throughput Stream = 7    Seed = 1120050511
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050511 as a seed to the RNG
Q1  DELTA       110
Q2  SIZE        12
   TYPE        COPPER
   REGION      ASIA
Q3  SEGMENT     HOUSEHOLD
   DATE        1995-03-16
Q4  DATE        1995-07-01
Q5  REGION      ASIA
   DATE        1995-01-01
Q6  DATE        1995-01-01
   DISCOUNT    0.02
   QUANTITY    24
Q7  NATION1     ALGERIA
   NATION2     IRAQ
Q8  NATION      IRAQ
   REGION      MIDDLE EAST
   TYPE        ECONOMY BURNISHED STEEL
Q9  COLOR       powder
Q10 DATE        1994-10-01
Q11 NATION      UNITED KINGDOM
   FRACTION    0.0000000100
Q12 SHIPMODE1   TRUCK
   SHIPMODE2   REG AIR
   DATE        1996-01-01
Q13 WORD1       special
   WORD2       accounts
Q14 DATE        1996-05-01
Q15 DATE        1994-02-01
Q16 BRAND       Brand#32
   TYPE        LARGE BURNISHED
   SIZE1       41
   SIZE2       2
   SIZE3       3
   SIZE4       4
   SIZE5       20
   SIZE6       6
   SIZE7       30
   SIZE8       23
Q17 BRAND       Brand#23
   CONTAINER   LG JAR
Q18 QUANTITY    314
Q19 BRAND1      Brand#21
   BRAND2      Brand#34
   BRAND3      Brand#21
   QUANTITY1   6
   QUANTITY2   19
   QUANTITY3   29
Q20 COLOUR      aquamarine
   DATE        1995-01-01
   NATION      ROMANIA
Q21 NATION      IRAN
Q22 I1          29
   I2          28
   I3          20
   I4          10
   I5          23
   I6          16
   I7          13

Throughput Stream = 8    Seed = 1120050512
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050512 as a seed to the RNG
Q1  DELTA       118
Q2  SIZE        50
   TYPE        STEEL
   REGION      AFRICA
Q3  SEGMENT     AUTOMOBILE
   DATE        1995-03-02
Q4  DATE        1993-04-01
Q5  REGION      EUROPE
   DATE        1995-01-01
Q6  DATE        1995-01-01
   DISCOUNT    0.07
   QUANTITY    24
Q7  NATION1     PERU
   NATION2     CANADA
Q8  NATION      CANADA
   REGION      AMERICA
   TYPE        LARGE BRUSHED COPPER
Q9  COLOR       pale
Q10 DATE        1993-07-01
Q11 NATION      IRAQ
   FRACTION    0.0000000100
Q12 SHIPMODE1   RAIL
   SHIPMODE2   REG AIR
   DATE        1996-01-01
Q13 WORD1       special
   WORD2       accounts
Q14 DATE        1996-08-01
Q15 DATE        1996-09-01
Q16 BRAND       Brand#23
   TYPE        PROMO POLISHED
   SIZE1       11
   SIZE2       17
   SIZE3       6
   SIZE4       41
   SIZE5       24
   SIZE6       48
   SIZE7       2
   SIZE8       49
Q17 BRAND       Brand#35
   CONTAINER   LG CAN
Q18 QUANTITY    315
Q19 BRAND1      Brand#23
   BRAND2      Brand#12
   BRAND3      Brand#25
   QUANTITY1   2
   QUANTITY2   20
   QUANTITY3   25
Q20 COLOUR      lace
   DATE        1993-01-01
   NATION      INDONESIA
Q21 NATION      BRAZIL
Q22 I1          15
   I2          26
   I3          33
   I4          29
   I5          22
   I6          30
   I7          18

Throughput Stream = 9    Seed = 1120050513
-- TPC TPC-H Parameter Substitution (Version 1.3.0)
-- using 1120050513 as a seed to the RNG
Q1  DELTA       65
Q2  SIZE        38
   TYPE        BRASS
   REGION      ASIA
Q3  SEGMENT     FURNITURE
   DATE        1995-03-18
Q4  DATE        1995-11-01
Q5  REGION      MIDDLE EAST
```

```
   DATE        1995-01-01
Q6  DATE       1995-01-01
   DISCOUNT    0.05
   QUANTITY    25
Q7  NATION1    INDONESIA
   NATION2     SAUDI ARABIA
Q8  NATION     SAUDI ARABIA
   REGION      MIDDLE EAST
   TYPE        LARGE PLATED COPPER
Q9  COLOR      moccasin
Q10 DATE       1994-05-01
Q11 NATION     UNITED STATES
   FRACTION    0.0000000100
Q12 SHIPMODE1  AIR
   SHIPMODE2   REG AIR
   DATE        1996-01-01
Q13 WORD1      special
   WORD2       deposits
Q14 DATE       1996-11-01
Q15 DATE       1994-06-01
Q16 BRAND      Brand#53
   TYPE        SMALL BRUSHED
   SIZE1       11
   SIZE2       16
   SIZE3       9
   SIZE4       43
   SIZE5       12
   SIZE6       3
   SIZE7       41
   SIZE8       17
Q17 BRAND      Brand#32
   CONTAINER   MED CASE
Q18 QUANTITY   313
Q19 BRAND1     Brand#35
   BRAND2      Brand#45
   BRAND3      Brand#24
   QUANTITY1   7
   QUANTITY2   10
   QUANTITY3   22
Q20 COLOUR     slate
   DATE        1996-01-01
   NATION      UNITED STATES
Q21 NATION     ROMANIA
Q22 I1         10
   I2          13
   I3          29
   I4          12
   I5          20
   I6          15
   I7          14
```

Appendix - D
Driver Source Code

D.1 tpcdbatch.h

```
/*****************************************************************************

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

/** Necessary header files **/

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

#include <time.h>
#include <ctype.h>

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


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

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


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

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

#define TPCDBATCH_MAX_COLS    100                       /*
@d30369 tjg */

#define TPCDBATCH_CHAR char

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

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

#define PARALLEL_UPDATES 1

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


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

```
#endif
/* jen TIME_ACC start */


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

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



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

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

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

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

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

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

D.2 tpcdbatch.sqc

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

#include "tpcdbatch.h"

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


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

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

};


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

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


/*****************************************************************************/
/* Structure used to hold precision for decimal numbers               */
/*****************************************************************************/
```

```
struct declen
{/* kmw */
  unsigned char m;       /* # of digits left of decimal */
  unsigned char n;       /* # of digits right of decimal */
};



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


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

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

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

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

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

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

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

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

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


EXEC SQL INCLUDE SQLCA;

/*********************************************************************/
/* Declare the SQL host variables.                                   */
/*********************************************************************/
EXEC SQL BEGIN DECLARE SECTION;

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

EXEC SQL END DECLARE SECTION;


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

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

/* Other globals */
FILE            *instream, *outstream;  /* File pointers             */
int             verbose = 0;            /* Verbose option flag       */
int             semcontrol = 1;         /* allows/disallows smaphores usage
*/
int             updatePairStart;        /* update pair to start at    */
int             currentUpdatePair;      /* update pair running        */
int             updatePairStop;         /* update pair to stop before */
char            newtime[50]="\0";       /* Des - moved from
get_time_stamp */
char            outstreamfilename[256]; /* store filename of outstream
                                        wlc 081397 */
```

```
int             inlistmax = 400;        /* define # of keys to delete at a time
                                        wlc 081897 */
int             sqlda_allocated = 0;    /* fixing free() problem in NT
                                        wlc 090597 */
int             iImportStagingTbl=0;    /* IMPORT use import or load
(default) */
char              temp_time_stamp[50];    /* holds end timestamp to be
copied into start_time_stamp of next query bbeaton */
Timer_struct      temp_time_struct;       /* holds end time value to be
copied into start_time of next query bbeaton */

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

/*********************************************************************/
/* Start main program processing.                                    */
/*********************************************************************/
int main(int argc, char *argv[])
{

  struct comm_line_opt c_l_opt = { "\0","\0", 0, 1, 0, 0, 0 };
  /* command line options         */
  Timer_struct         start_time;         /* start point for elapsed time */


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

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

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

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


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


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

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

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

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

  strcpy(temp_time_stamp, "0");
  /*****************************************************************************
   *                                                                           *
   *   This is the transition from the "driver" to the "SUT"                   *
   *                                                                           *

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

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

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

    c_flags.eo_block = 0;

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

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

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

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

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

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

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

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

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


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


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


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

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


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

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

 return(0);

}  /* end of main  */

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

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

/*********************************************************************/
/* Get environment variables.  (sks May 25 98)                       */
/*********************************************************************/
int get_env_vars(void) {
  if (strcpy(env_tpcd_dbname, getenv("TPCD_DBNAME")) == NULL) {
     fprintf(stderr, "\n The environment variable $TPCD_DBNAME is not
setup correctly.\n");
     return -1;
   }
   if (strcpy(env_user, getenv("USER")) == NULL) {
     fprintf(stderr, "\n The environment variable $USER is not setup
correctly.\n");
     return -1;
   }
   if (strcpy(env_tpcd_audit_dir, getenv("TPCD_AUDIT_DIR")) ==
NULL) {
     fprintf(stderr, "\n The environment variable $TPCD_AUDIT_DIR is
not setup correctly.\n");
     return -1;
   }
   if (strcpy(env_tpcd_tmp_dir, getenv("TPCD_TMP_DIR")) == NULL) {
     fprintf(stderr, "\n The environment variable $TPCD_TMP_DIR is not
setup correctly.\n");
     return -1;
   }
#if 0
   if (strcpy(env_tpcd_path_delim, getenv("TPCD_PATH_DELIM")) ==
NULL ||
       (strcmp(env_tpcd_path_delim, "/") &&
strcmp(env_tpcd_path_delim, "\\"))){
     fprintf(stderr, "\n The environment variable $TPCD_PATH_DELIM is
not setup correctly , env_tpcd_path_delim'%s'.\n",
env_tpcd_path_delim);

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

   return 0;
}

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

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

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

   int good_sql = 0;             /* good-sql stmt flag   @d23684 tjg */
   int stmt_num_flag = 1;          /* first line of SQL stmt flag     */
```

```
  int eostmt = 0;               /* flag to signal end of statement  */


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

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

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

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

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

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

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

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

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

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

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

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

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

      eostmt=0;
    }

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

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


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

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

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

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

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

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

  }  while (!eostmt);
```

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

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

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

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

  else                                          /* @d23684 tjg */
    return TPCDBATCH_NONSQL;

} /*  Get_SQL_stmt */



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

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

  for (loopvar=0; loopvar<sqlda->sqld; loopvar++)
  {
    switch (sqlda->sqlvar[loopvar].sqltype)
    {
     case SQL_TYP_INTEGER:                      /* INTEGER */
     case SQL_TYP_NINTEGER:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)malloc(sizeof(sqlint32))) ==
NULL)
        mem_error("allocating INTEGER");
      break;
     case SQL_TYP_BIGINT:                       /* BIGINT */
/*kmwBIGINT*/
     case SQL_TYP_NBIGINT:
/*#ifdef SQLWINT */
/*       if ((sqlda->sqlvar[loopvar].sqldata= */
/*             (TPCDBATCH_CHAR *)malloc(sizeof(__int64))) ==
NULL)*/
/* #else */
       if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)malloc(sizeof(sqlint64))) ==
NULL)
/* #endif*/
        mem_error("allocating BIGINT");
      break;
     case SQL_TYP_CHAR:                         /* CHAR */
     case SQL_TYP_NCHAR:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(256,sizeof(char))) ==
NULL)
        mem_error("allocating CHAR/VARCHAR");
      break;
     case SQL_TYP_VARCHAR:                      /* VARCHAR */
     case SQL_TYP_NVARCHAR:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(4002,sizeof(char))) ==
NULL)
        mem_error("allocating CHAR/VARCHAR");
      break;
     case SQL_TYP_LONG:                         /* LONG VARCHAR */
     case SQL_TYP_NLONG:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(32702,sizeof(char))) ==
NULL)
        mem_error("allocating VARCHAR/LONG VARCHAR");
      break;
     case SQL_TYP_FLOAT:                        /* FLOAT */
     case SQL_TYP_NFLOAT:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)malloc(sizeof(double))) == NULL)
        mem_error("allocating FLOAT");
      break;
     case SQL_TYP_SMALL:                        /* SMALLINT */
     case SQL_TYP_NSMALL:
      if ((sqlda->sqlvar[loopvar].sqldata=
             (TPCDBATCH_CHAR *)malloc(sizeof(short))) == NULL)
        mem_error("allocating SMALLINT");
      break;
     case SQL_TYP_DECIMAL:                      /* DECIMAL */
     case SQL_TYP_NDECIMAL:
      if ((sqlda->sqlvar[loopvar].sqldata=
             (TPCDBATCH_CHAR *)malloc(20)) == NULL)
        mem_error("allocating DECIMAL");
      break;
     case SQL_TYP_CSTR:                     /* VARCHAR (null
terminated) */
     case SQL_TYP_NCSTR:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(4001,sizeof(char))) ==
NULL)
        mem_error("allocating CHAR/VARCHAR");
      break;
     case SQL_TYP_DATE:                         /* DATE */
     case SQL_TYP_NDATE:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(13,sizeof(char))) == NULL)
        mem_error("allocating DATE");
      break;
     case SQL_TYP_TIME:                         /* TIME */
     case SQL_TYP_NTIME:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(11,sizeof(char))) == NULL)
        mem_error("allocating TIME");
      break;
     case SQL_TYP_STAMP:                        /* TIMESTAMP */
     case SQL_TYP_NSTAMP:
      if ((sqlda->sqlvar[loopvar].sqldata=
            (TPCDBATCH_CHAR *)calloc(29,sizeof(char))) == NULL)
        mem_error("allocating TIMESTAMP");
      break;
    }
    if ((sqlda->sqlvar[loopvar].sqlind=
          (short *)calloc(1,sizeof(short))) == NULL)
      mem_error("allocating indicator");

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

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


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

  int    col_type;                   /* Type of column            */

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

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


  for (col=0; col<sqlda->sqld; col++)   /* Loop through column count  */
  {
    col_type=sqlda->sqlvar[col].sqltype;                 /* @d22817 tjg */

    if (*(sqlda->sqlvar[col].sqlind))                    /* @d30369 tjg */
      fprintf(outstream, "%* n/a  ",(col_lengths[col]-3));
    else
      switch (col_type)
      {
       case SQL_TYP_INTEGER:
       case SQL_TYP_NINTEGER:

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

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

       case SQL_TYP_CHAR:
       case SQL_TYP_NCHAR:

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

       case SQL_TYP_SMALL:
       case SQL_TYP_NSMALL:

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

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

           temp_ptr = temp_string;

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


           else
             strcpy(decimal_string, " ");

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

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

         break;

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

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

  fprintf(outstream, "\n");

  return;
}
```

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

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

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

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



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


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

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

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

  }

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


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

  for (i = 0; i < 6; i++)
  {
  fprintf(outstream,"SQLERRD[%d]: %d\n", i, ca->sqlerrd[i] );
  }
  fprintf(outstream,"SQLWARN   : %.11s\n", ca->sqlwarn);
  fprintf(outstream,"SQLSTATE  : %.5s\n", ca->sqlstate);
  fprintf(outstream,"*******************  END OF SQLCA DUMP
*****************\n");
  return;
}


/*****************************************************************************/
/* error_check                                                               */
/* This function prints the contents of the sqlca error information          */
/* structure.                                                                */
/*****************************************************************************/
long error_check(void)
{
  char          buffer[512]="\0";
  unsigned short i;
  struct sqlca   temp_sqlca;       /* temporary sqlca */     /* @d30369 tjg
*/

  temp_sqlca.sqlcode = 0;          /* initialize the temporary sqlca to
```

```
                        avoid any memory problems */

  if (sqlca.sqlcode != 0) {
    sqlaintp(buffer, sizeof(buffer), 80, &sqlca);
    fprintf(stderr, "\n%0.200s\n", buffer);
    fprintf(outstream, "\n%0.200s\n", buffer);

    /* Decode the SQLCA in more detail  KBS 98/09/28 */
    if ((sqlca.sqlerrml)   /*  there's one or more tokens   */
       && (sqlca.sqlerrml < sizeof(sqlca.sqlerrmc)) /* and field not full */
       )
    {
      char *tokptr;
      int  tokl;
      *(sqlca.sqlerrmc + sqlca.sqlerrml) = '\0';  /*  prevent strtok from
scanning beyond end */
      fprintf(stderr,"\n     SQLCA:   tokens:\n");
      fprintf(outstream,"\n     SQLCA:   tokens:\n");
      tokptr=strtok(sqlca.sqlerrmc, "\xff");
      while (  tokptr                          &&
             ( (tokl = (sizeof(sqlca.sqlerrmc) - (tokptr-sqlca.sqlerrmc))) >
0)
             )
      {
        fprintf(stderr, "%.*s\n", tokl, tokptr);
        fprintf(outstream, "%.*s\n", tokl, tokptr);
        tokptr=strtok(NULL, "\xff");
      }
    }
    fprintf(stderr, "\n     SQLCA:   errp= %.8s, errd 1-6= %d %d %d %d
%d %d\n",
            sqlca.sqlerrp, sqlca.sqlerrd[0], sqlca.sqlerrd[1],
sqlca.sqlerrd[2],
            sqlca.sqlerrd[3], sqlca.sqlerrd[4], sqlca.sqlerrd[5]);
    fprintf(outstream, "\n     SQLCA:   errp= %.8s, errd 1-6= %d %d %d
%d %d %d\n",
            sqlca.sqlerrp, sqlca.sqlerrd[0], sqlca.sqlerrd[1],
sqlca.sqlerrd[2],
            sqlca.sqlerrd[3], sqlca.sqlerrd[4], sqlca.sqlerrd[5]);

    temp_sqlca = sqlca; /* Make a copy of sqlca in case it gets
changed
                        in the next statement below */   /* @d30369 tjg */

    /** Determine if the error is critical or a connection can be made **/

    EXEC SQL CONNECT ;                                  /* @d28763 tjg */

    if (sqlca.sqlcode == SQLE_RC_NOSUDB ) { /* no connection
exists */

      /*Print out header for DUMP*/
      fprintf(outstream, "*************************************\n");
      fprintf(outstream, "*         CONTENTS OF SQLCA         *\n");
      fprintf(outstream, "*************************************\n\n");

      /*Print out contents of SQLCA variables*/
      fprintf(outstream, "SQLCABC  = %ld\n", temp_sqlca.sqlcabc);
      fprintf(outstream, "SQLCODE  = %ld\n", temp_sqlca.sqlcode);
      fprintf(outstream, "SQLERRMC = %0.70s\n",
temp_sqlca.sqlerrmc);
      fprintf(outstream, "SQLERRP  =  %0.8s\n", temp_sqlca.sqlerrp);

      for (i = 0; i < 6; i++)
      {
        fprintf(outstream, "sqlerrd[%d] = %lu \n", i,
temp_sqlca.sqlerrd[i]);
      }
      fprintf(outstream, "SQLWARN  = %0.11s\n",
temp_sqlca.sqlwarn);
      fprintf(outstream, "SQLSTATE = %0.5s\n", temp_sqlca.sqlstate);

      fprintf(stderr, "\nCritical SQLCODE.  Exiting TPCDBATCH\n");
      exit(-1);

    }
  }
  return (temp_sqlca.sqlcode);

}  /* error_check */



/*****************************************************/
/* Displays a help screen                            */
/*****************************************************/
void display_usage()
{
  printf("\ntpcdbatch  --  version %s",TPCDBATCH_VERSION);
  printf("\n\nSyntax is:\n");
  printf("tpcdbatch [-d dbname] [-f file_name] [-l file_name] [-r on/off]");
  printf("\n        [-v on/off] [-b on/off] [-u p/t/t1/t2]");
  printf("\n        [-s scale_factor] [-n stream_num] [-m inlistmax] [-h]\n");
  printf("\n  where: -d  Database name");
  printf("\n             Default - dbname set in $DB2DBDFT");
  printf("\n        -f  Input file containing SQL statements");
  printf("\n             Default - stdin ");
  printf("\n        -l  Input file containing list of statement numbers");
  printf("\n        -r  Create set of output files containing query results");
  printf("\n             Default - off");
  printf("\n        -v  Verbose.  Sends information to stderr during");
  printf("\n            query processing");
  printf("\n             Default - off");
  printf("\n        -b  Process groups of statements as blocks ");
  printf("\n            instead of individually.");
  printf("\n             Default - off");
  printf("\n        -u  Update streams: p    - for power test");
  printf("\n                            t    - for throughput test without");
  printf("\n                                   UFs (run this instead of t2)");
  printf("\n                            t1   - for throughput test step 1");
  printf("\n                                   only running queries");
  printf("\n                            t2   - for throughput test step 2");
  printf("\n                                   running update functions");
  printf("\n        -s  Scale factor");
  printf("\n             Default - 0.1");
  printf("\n        -n  Stream number");
  printf("\n                    Default - 0");
  printf("\n                Qualification - -1");
  printf("\n                      Power - 0");
  printf("\n                  Throughput - >= 1 (actual number depends on
the current query stream");
  printf("\n        -m  Maximum number of keys to delete at a time");
  printf("\n             Default - 400");
  printf("\n        -h  Display this help screen");
  printf("\n        -p  turns smeaphores on or off");
  printf("\n             Default - off");

  printf("\n\nControl statements specifying output and performance
details");
  printf("\ncan be included before SQL statements; they will apply for");
  printf("\nthat and subsequent statements until updated.");

  printf("\n\nSyntax:    --#SET <control option> <value>");
  printf("\n\n  option      value    default");
  printf("\nROWS_FETCH   -1 to n     -1  (all rows fetched from answer
set)");
  printf("\nROWS_OUT     -1 to n     -1  (all fetched rows sent to
output)");
```

```
   printf("\n\n--#TAG       tag             (user specified tag name for
sequence#)");
   printf("\n--#COMMENT   comment         (user specified comments for
output)");
   printf("\nNote:  All statements executed with ISOLATION LEVEL
RR");
   printf("\n       and must be terminated with semi-colons.\n");
   exit (1);
}


/*****************************************************/
/* Converts a string to upper case characters   */
/*****************************************************/
char *uppercase( char *string )
{
   char   *c;      /* temp char used to convert word to upper case */

   for ( c = string; *c != '\0'; c++)
      *c = (char) toupper( (int) *c );

   return (string);
}

/*****************************************************/
/* Converts a string to lower case characters   */
/*****************************************************/
char *lowercase( char *string )
{
   char   *c;      /* temp char used to convert word to lower case */

   for ( c = string; *c != '\0'; c++)
      *c = (char) tolower( (int) *c );

   return (string);
}


/*****************************************************/
/* Parses and processes command line options.      */
/*****************************************************/

void comm_line_parse(int argc, char *argv[], struct global_struct
*g_struct)
{
   char authent_info[40] = "\0";
   char *testptr;
   int loopvar = 0;

   int comm_opt = 0;
#ifdef PARALLEL_UPDATES
   int running_updates=0;
   int updatePair=-1;
   int updateStream=-1;
   int function;
   int copyOnOrOff;
   int deleteChunk=0;         /*DELjen */
#endif

   while ((loopvar < argc) && (argc != 1)) {

      if (*argv[loopvar] == '-') {

         switch(*(argv[loopvar]+1)) {

          case 'f' :                                  /* @d26350 tjg */
          case 'F' :
                    strcpy(g_struct->c_l_opt->infile,argv[++loopvar]);
                    break;

          case 'l' :                                  /* @d26350 tjg */
          case 'L' :    strcpy(g_struct->c_l_opt-
>str_file_name,argv[++loopvar]);
                    break;

          case 'r' :                                  /* @d26350 tjg */
          case 'R' :
            if (!strcmp(uppercase(argv[++loopvar]),"ON"))
              g_struct->c_l_opt->outfile=1;
            else
              g_struct->c_l_opt->outfile=0;
            break;

          case 'd' :                                  /* @d26350 tjg */
          case 'D' :
                    strcpy(dbname,argv[++loopvar]);
                    break;

          case 'v' :                                  /* @d26350 tjg */
          case 'V' :
            if (!strcmp(uppercase(argv[++loopvar]),"ON"))
              verbose=1;
            else
              verbose=0;
            break;

          case 'u' :                                  /* @d26350 tjg */
          case 'U' :
            g_struct->c_l_opt->update=-1; /* init to invalid number */
            if (!strcmp(uppercase(argv[++loopvar]),"P1"))
              g_struct->c_l_opt->update=1; /* power query stream*/
            if (!strcmp(uppercase(argv[loopvar]),"P2"))
                g_struct->c_l_opt->update=3; /* power update with
updates*/
            if (!strcmp(uppercase(argv[loopvar]),"P"))
              g_struct->c_l_opt->update=4; /* power update without
updates*/
            if (!strcmp(uppercase(argv[loopvar]),"T1"))
                g_struct->c_l_opt->update=0; /*throughput query stream */
            if (!strcmp(uppercase(argv[loopvar]),"T2"))
                g_struct->c_l_opt->update=2; /* throughput update with
updates */
            if (!strcmp(uppercase(argv[loopvar]),"T"))
                g_struct->c_l_opt->update=5; /* throughput update without
updates */

            break;

          case 'b' :                                  /* @d26350 tjg */
          case 'B' :
            if (!strcmp(uppercase(argv[++loopvar]),"ON"))
              g_struct->s_info_ptr->query_block=1;
            else
              g_struct->s_info_ptr->query_block=0;
            break;

          case 'n' :                                  /* @d26350 tjg */
          case 'N' :
            g_struct->c_l_opt->intStreamNum = atoi(argv[++loopvar]);
            break;

          case 's' :                                  /* @d26350 tjg */
          case 'S' :    g_struct->scale_factor=atof(argv[++loopvar]); break;

          case 'h':
          case 'H' :                                  /* @d26350 tjg */
            display_usage();
            break;

          case 'm' :
```

```
        case 'M' :
          inlistmax = atoi(argv[++loopvar]); /* wlc 081897 */
          break;

        case 'p' :
        case 'P' :
          if (!strcmp(uppercase(argv[++loopvar]),"ON")) /* bbe 072599 */
            semcontrol = 1;
          else
            semcontrol = 0;
          break;


#ifdef PARALLEL_UPDATES
        case 'i':
          updatePair = atoi (argv[++loopvar]);
#ifdef UF2DEBUG
          fprintf (stderr, "updatePair = %d\n",updatePair);
          fflush(stderr);
#endif
          break;

        case 'j':
          function = atoi (argv[++loopvar]);
#ifdef UF2DEBUG
          fprintf (stderr, "function = %d\n",function);
          fflush(stderr);
#endif
          break;

        case 'k':
          updateStream = atoi (argv [++loopvar]);
#ifdef UF2DEBUG
          fprintf (stderr, "updateStream = %d\n",updateStream);
          fflush(stderr);
#endif
          break;

        case 'x':                               /*DEL jen -x is chunk*/
          deleteChunk = atoi (argv[++loopvar]);       /* to delete for this */
#ifdef UF2DEBUG
          fprintf (stderr, "DelChunk = %d\n",deleteChunk);
          fflush(stderr);
#endif
          break;                                /* invocation */

        case 'z':
          running_updates = 1;
          break;
#endif
         default :
          fprintf(stderr,"An invalid option has been set\n");
          display_usage();
          break;

       }  /** end switch **/
     } /** end if **/

     loopvar ++;
   } /** end while **/

   /* checking if -u option is set */
   if (g_struct->c_l_opt->update == -1) {
     fprintf(stderr, "-u option is not set, exiting ...\n");
     exit(-1);
   }


#ifdef PARALLEL_UPDATES
   if (running_updates) {
     if (updatePair == -1) {
       fprintf (stderr, "The parameters to tpcdbatch have not been
passed correctly\n");
       exit (-1);
     }
     else {
       /* check to see if we are to use copy on for the load */
       if (( getenv("TPCD_LOG") != NULL ) &&
           (!strcmp(uppercase(getenv("TPCD_LOG")),"YES")))
       {
         /* okay, we have set LOG_RETAIN on so we need to use copy
directory */
         copyOnOrOff = TRUE;
       }
       else
       {
         /* log retain off don't use copy directory */
         copyOnOrOff = FALSE;
       }

       if (function == 1)
         /* runUF1_fn (updatePair, updateStream);  aph 981205 */
         runUF1_fn (updatePair, updateStream, dbname, userid,
passwd);
       else
         if (function == 2) {
           fprintf(stderr, "A-Calling runUF2_fn  %d   %d   %d ...\n",
                           updatePair, updateStream, deleteChunk);
           /* runUF2_fn (updatePair, updateStream, deleteChunk);   aph
981205 */
           runUF2_fn (updatePair, updateStream, deleteChunk, dbname,
userid, passwd);
         }
         else {
           fprintf (stderr, "Wrong function to tpcdbatch\n");
           exit (-1);
         }
         exit (0);
     }
   }
#endif /* PARALLEL_UPDATES */

   /* If no database name is given, then use the one specified in the
      environment variable DB2DBDFT, otherwise error */
   if (!strcmp(dbname,"\0")) {
     testptr = getenv("DB2DBDFT");
     if (testptr == NULL) {
       fprintf(stderr, "\nNo database name has been specified on
command ");
       fprintf(stderr, "line\nnor in environment variable DB2DBDFT.");
       display_usage();
     }
     else
       strcpy(dbname,testptr);

   }

   if (g_struct->c_l_opt->outfile &&
       !strcmp(g_struct->c_l_opt->str_file_name,"\0")) {
     fprintf(stderr, "\nMust specify input file for statement list.\n");
     display_usage();
   }

}



/*****************************************************/
/* Converts DECIMAL values to ASCII text             */
/*****************************************************/
```

```
int sqlrxd2a(                                   /*kmw*/
                                        /* C++ */char *decptr,
                                        /* C++ */char *asciiptr,
                                        short prec,
                                        short scal)
{/* */
  int allzero = TRUE;
  /* C++ */char *srcptr;
  unsigned char sign;
  /* C++ */char *targptr, decimal_point = '.';
  int rc = 0;                                   /*kmw*/
  int tmpint, src_nibble;
  int count, j, limit[3];

  targptr = &asciiptr[ prec + 1];
  *(1 + targptr) = '\0';
  srcptr = decptr + prec/2;


  /* Validity check sign nibble */
  if (((sign = sqlrx_get_right_nibble( *srcptr )) < 0x0a)
     || (prec > SQL_MAXDECIMAL) || (prec < scal ))
  {
    goto exit;
  }/** end end if invalid sign value **/


  limit[ 0 ] = scal; limit[ 1 ] = prec - scal; limit[ 2 ] = 0;
  src_nibble = LEFT;
  for( j = 0 ; j < 2 ; j++ )
  {
    for( count = limit[ j ] ; count > 0 ; count-- )
    {
      tmpint = ( (src_nibble == LEFT)?
              sqlrx_get_left_nibble( *srcptr-- ) :
              sqlrx_get_right_nibble( *srcptr ) );
      if( tmpint > 9 )
      {
        goto exit;
      }
      else
        *targptr-- = (/* C++ */char)tmpint + '0';
      src_nibble = ((src_nibble == LEFT) ? RIGHT : LEFT);
      if ( tmpint != 0 ) allzero = FALSE;
    } /** end for scal > 0 **/

    if( j == 0 )
      *targptr-- = decimal_point;
    else
      *targptr = (/* C++ */char)((allzero
                          || (sign == SQLRX_PREFERRED_PLUS)
                          || (sign == 0x0a)
                          || (sign == 0x0e)
                          || (sign == 0x0f)) ?
                         '+' : '-' );
  } /** end for limit[ j++ ] > 0 **/

  exit :
  if( rc < 0 )
  {
    printf ("The decimal conversion has failed\n");
    exit (-1);

  }

  return(rc);
} /** sqlrxd2a **/


/*********************************************************************/
```

```
/* Does some setup and initialization like parsing command line  */
/* and connecting to database.  Returns process id of agent.     */
/*****************************************************************/

void init_setup(int argc, char *argv[], struct global_struct *g_struct)
{
  int connect=0;
#ifndef SQLWINT
  char *pid;
#endif
  char temparray[256]="\0";
  int loopvar=0;
  FILE *updateFP;
  FILE *fpSeed;
  char file_name[256] = "\0";
  short seedEntry;
  long  lSeed;
  int i;

  /** Parse and process command line options **/
  comm_line_parse (argc,argv,g_struct);

/*********************************************************************/
/* Start the mainline report processing.                             */
/*********************************************************************/
  if (!strcmp(g_struct->c_l_opt->infile,"\0")) {
    instream=stdin;
  }
  else {
    instream=NULL;
    if ( (instream = fopen(g_struct->c_l_opt->infile, READMODE)) ==
NULL ) {
      fprintf(outstream, "The input file could not be opened.\n\n");
      fprintf(stdout,"Make sure that the filename is correct.\n");
      fprintf(stdout,"filename = %s\n",g_struct->c_l_opt->infile);
      exit(-1);

    }  /* open the input file if specified  */
  }

  /* IMPORT (begin) - determine whether we should use the IMPORT
api or */
  /* LOAD api for loading into the staging tables, default is load      */
  if (env_tpcd_update_import != NULL)
  {
    if (!strcmp(uppercase(env_tpcd_update_import),"TRUE"))
    {
      iImportStagingTbl = 1;   /* use import */
    }
    /* DJD */
    else if (!strcmp(uppercase(env_tpcd_update_import),"TF"))
    {
      iImportStagingTbl = 2;   /* Table Functions */
    }
  }



  /* IMPORT (end) */

  /* we want to print the seed in the output files to show what seed was
*/
  /* used to generate the queries.  */
  /* if intStreamNum is -1 then we are running a qualification database
*/
  /* and the default seed has been used so skip this section */
  if (g_struct->c_l_opt->intStreamNum >= 0)
  {
    /* check to make sure the TPCD_RUNNUMBER environment
variable is set. We */
```

```
    /* use this and the stream number to determine which seed was
used to    */
    /* generate the current set of queries */
    if (getenv("TPCD_RUNNUMBER") == NULL)
    {
      fprintf(stderr,"\nThe TPCD_RUNNUMBER environment variable
is not set");
      fprintf(stderr,"....exiting\n");
      exit(-1);
    }
    if (getenv("TPCD_NUMSTREAM") == NULL)
    {
      fprintf(stderr,"\nThe TPCD_NUMSTREAM environment variable
is not set");
      fprintf(stderr,"....exiting\n");
      exit(-1);
    }

    /*************************************************************************
     * SEED jen
     * we want to print the seed used in the output files.  For the seed
usage
     * we can now reuse the seeds from run to run, therefore all the
power runs
     * will use the 1st seed in the file, and the throughput streams will
use
     * the 2nd to #streams+1 seeds.
     * determine the seed to use...e.g. given 3 streams will have the
following:
     *                              Entry in seed file
     *     TEST       Stream Number     Run 1    Run 2
     *     power      0                 1        1
     *     throughput  1                2        2
     *                 2                3        3
     *                 3                4        4
     *************************************************************************/
    seedEntry = g_struct->c_l_opt->intStreamNum + 1;
    /* end SEED jen */
    /* open the generated seed file...if not there, try the default */

    sprintf(file_name, "%s%sauditruns%smseedme",
env_tpcd_audit_dir,
            env_tpcd_path_delim, env_tpcd_path_delim);

    if ((fpSeed = fopen(file_name,READMODE)) == NULL )
    {
      fprintf(stderr,"\nCannot open the seed file, please ensure that\n");
      fprintf(stderr,"the file exists.  filename = %s\n",file_name);
      exit(-1);
    }
    for (i = 1; i <= seedEntry; i++)
    {
      if (feof(fpSeed))
      {
        lSeed = -1;   /* seed not available for some reason */
      }
      fscanf(fpSeed,"%ld\n",&lSeed);
    }
    g_struct->lSeed = lSeed;
    fclose(fpSeed);
  }

  /* check to see if we are to use copy on for the load */
  if (( getenv("TPCD_LOG") != NULL ) &&
     (!strcmp(uppercase(getenv("TPCD_LOG")),"YES")))
  {
    /* okay, we have set LOG_RETAIN on so we need to use copy
directory */
    g_struct->copy_on_load = TRUE;
  }
  else
  {
    /* log retain off don't use copy directory */
    g_struct->copy_on_load = FALSE;
  }

/*********************************************************************/
/* Make sure that DB2 is started.                                    */
/* CONNECT now unless this is a UF stream for a Throughput test. */
/* (aph 98/12/22)                                                    */
/*********************************************************************/

  if (g_struct->c_l_opt->update > 1)
  {
    /* This is an update function stream in a throughput run. */
    /* Just make sure that DB2 is started.  Each UF child will
CONNECT itself. */
    if (verbose) fprintf(stderr,"\nStarting the DB2 Database Manager
Now\n");
/*      sqlestar ();  TMPkmw */
  }
  else
  {  /* In all other cases, CONNECT to the target database. */
    do
    {
      if (!strcmp(userid,"\0"))   /** No authentication provided **/
        EXEC SQL CONNECT TO :dbname;
      else EXEC SQL CONNECT TO :dbname USER :userid USING
:passwd;
      if (sqlca.sqlcode == SQLE_RC_NOSTARTG) {
        if (verbose)
          fprintf(stderr,"\nStarting the DB2 Database Manager Now\n");
        sqlestar ();
        connect=0;
      }
      else connect=1;
    } while (!connect);
    error_check();
  }


/*************************************************************************
 *  All session initialization is performed at connect time or immediately
*
 *  following and is complete before starting the stream.                *
 *************************************************************************/

  /** Get start timestamp for stream **/
  get_start_time(&(g_struct->stream_start_time));     /* TIME_ACC
jen*/
  strcpy(g_struct->file_time_stamp,
       get_time_stamp(T_STAMP_FORM_2,&(g_struct-
>stream_start_time))); /* TIME_ACC jen*/

  if (getenv("TPCD_RUN_DIR") != NULL)
    strcpy(g_struct->run_dir,getenv("TPCD_RUN_DIR"));
  else
    strcpy(g_struct->run_dir,".");

  /* if we are running a throughput test, then we must report the */
  /* stream count information...we will report one file per stream */
  /* and amalgamate them after all streams have completed */
  /* if the number of streams is greater than 0 then this is a throughput
test*/
  switch (g_struct->c_l_opt->update)
  {
      case (2):
      case (5):
            /* update throughput function stream */
            sprintf(file_name,"%s%sstrcntuf.%s",g_struct->run_dir,
```

```
                env_tpcd_path_delim, g_struct->file_time_stamp);
            break;
      case (3):
      case (4):
            /* update power function stream */
            sprintf(file_name,"%s%spstrcntuf.%s",g_struct->run_dir,
                env_tpcd_path_delim, g_struct->file_time_stamp);
            break;
      case (1):
            /* power query stream */
            sprintf(file_name, "%s%spstrcnt%d.%s",g_struct->run_dir,
env_tpcd_path_delim,
                g_struct->c_l_opt->intStreamNum,g_struct-
>file_time_stamp);
            break;
      case (0):
            /* throughput query stream */
            sprintf(file_name, "%s%sstrcnt%d.%s",g_struct->run_dir,
env_tpcd_path_delim,
                g_struct->c_l_opt->intStreamNum,g_struct-
>file_time_stamp);
            break;
  }

  if( (g_struct->stream_report_file = fopen(file_name, WRITEMODE))
== NULL )
  {
    fprintf(stderr,"\nThe output file for the stream count information\n");
    fprintf(stderr,"could not be opened, make sure the filename is
correct\n");
    fprintf(stderr,"filename = %s\n",file_name);
    exit(-1);
  }

  if (g_struct->c_l_opt->update > 1)
  {
    /* update function stream */
    fprintf(g_struct->stream_report_file,
          "Update function stream starting at %*.*s\n",
          T_STAMP_3LEN,T_STAMP_3LEN, /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_start_time))); /* TIME_ACC jen*/
  }
  else
  {
     /* query stream */
    fprintf(g_struct->stream_report_file,
          "Stream number %d starting at %*.*s\n",
          g_struct->c_l_opt->intStreamNum,
          T_STAMP_3LEN,T_STAMP_3LEN,          /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_start_time))); /* TIME_ACC jen*/
  }

#ifndef LINUX

  fclose(g_struct->stream_report_file);

#endif

  /* set up the update_num_file name so that if we do use
semaphores, */
  /* we will have a filename to generate the semkey */

  sprintf(g_struct->update_num_file, "%s%s%s.%s.update.pair.num",
env_tpcd_audit_dir,
        env_tpcd_path_delim, uppercase(env_tpcd_dbname),
lowercase(env_user));
  sprintf(g_struct->sem_file, "%s.%s.semfile", env_tpcd_dbname,
env_user);
  if (g_struct->c_l_opt->intStreamNum == 0)
  {
    sprintf(g_struct->sem_file2, "%s.%s.semfile2", env_tpcd_dbname,
env_user);
  }
  if (verbose) {   /* print out the update pair number file for debugging */
    fprintf(stderr,"\n init_setup: strem %d update pair numb file = %s\n",
          g_struct->c_l_opt->intStreamNum,g_struct->update_num_file);
  }

  /* update the
$TPCD_AUDIT_DIR/$TPCD_DBNAME.$USER.update.pair.num file */
  /* update pairs have been run */
  if (( g_struct->c_l_opt->update >= 1 ) && ( g_struct->c_l_opt->update
< 4 ))
       /* on or onl, but not  */ /* bbe or > 1 */
  {
    updateFP = fopen(g_struct->update_num_file,"r");
    if (updateFP != NULL )
    {
      fscanf(updateFP,"%d",&updatePairStart);
      fclose(updateFP);
      if (g_struct->c_l_opt->intStreamNum == 0)   /* on, 1 update pair */
        updatePairStop = updatePairStart + 1;
      else       /* only, multiple update pairs, stream number will be
total */
        updatePairStop = updatePairStart + g_struct->c_l_opt-
>intStreamNum;
      currentUpdatePair = updatePairStart;

      if (updatePairStart <= 0)
      {
        fprintf(stderr,"updatePairStart is bogus!");
        exit(-1);
      }
    }
    else
    {
      fprintf(stderr,"\n %s not set up, set this \n",g_struct-
>update_num_file);
      fprintf(stderr,"file to contain the number of the update pair to  \n");
      fprintf(stderr,"run and resubmit\n");
      exit(-1);
    }
  }

  return ;

}

/*****************************************************************/
/* A function to print out the column titles for a returned set      */
/*****************************************************************/
void print_headings (struct sqlda *sqlda, int *col_lengths)
{
  int col = 0;                    /* Column number           */
  int col_width = 0;              /* width of column         */
  int max_col_width = 0;          /* maximum column width    */
  int col_name_length = 0;        /* sizeof column name string */
  int col_type = 0;               /* column type             */

  int total_length = 0;           /* accumulator var. for
                                  length of column headings */
  int loopvar = 0;

  char col_name[256] = "\0";
  unsigned char m,n;              /* precision and accuracy
                                  for decimal conversion    */

  fprintf (outstream,"\n");
```

```
   /** loop through for each column in solution set
     and determine the maximum column width  **/

   for (col = 0; col < sqlda->sqld; col++) {
      col_name_length=sqlda->sqlvar[col].sqlname.length;
      col_type = sqlda->sqlvar[col].sqltype;
      col_width = sqlda->sqlvar[col].sqllen;
      strncpy(col_name,(char *)sqlda-
>sqlvar[col].sqlname.data,col_name_length) ;

      switch (col_type)
      {
       case SQL_TYP_SMALL:
       case SQL_TYP_NSMALL:                              /* @d30369 tjg */
         col_lengths[col] = TPCDBATCH_MAX (col_name_length,6);
         break;
       case SQL_TYP_INTEGER:
       case SQL_TYP_NINTEGER:
         col_lengths[col] = TPCDBATCH_MAX (col_name_length,11);
         break;
       case SQL_TYP_BIGINT:   /*kmwBIGINT*/
       case SQL_TYP_NBIGINT:
         col_lengths[col] = TPCDBATCH_MAX (col_name_length,19);
         break;
       case SQL_TYP_CSTR:
       case SQL_TYP_NCSTR:
       case SQL_TYP_DATE:
       case SQL_TYP_NDATE:
       case SQL_TYP_TIME:
       case SQL_TYP_NTIME:
       case SQL_TYP_STAMP:
       case SQL_TYP_NSTAMP:
       case SQL_TYP_CHAR:
       case SQL_TYP_NCHAR:
       case SQL_TYP_VARCHAR:
       case SQL_TYP_NVARCHAR:
       case SQL_TYP_LONG:
       case SQL_TYP_NLONG:
         col_lengths[col] = TPCDBATCH_MAX
(col_name_length,col_width);
         break;

       case SQL_TYP_FLOAT:
       case SQL_TYP_NFLOAT:
         /* kmw - note: TPCDBATCH_PRINT_FLOAT_WIDTH > max long
identifier */
         col_lengths[col] = TPCDBATCH_PRINT_FLOAT_WIDTH;
         break;

       case SQL_TYP_DECIMAL:
       case SQL_TYP_NDECIMAL:

         m=(*(struct declen *)&sqlda->sqlvar[col].sqllen).m;
         n=(*(struct declen *)&sqlda->sqlvar[col].sqllen).n;

         col_lengths[col] = TPCDBATCH_MAX ((int)(m+n),
col_name_length);
         /* Special handling for DECIMAL */    /* @d26350 tjg */
         break;

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

      fprintf(outstream,"%-*.*s
",col_lengths[col],col_name_length,col_name);
      total_length += (col_lengths[col] + 2);  /* 2 is from padding spaces
*/
    }

    fprintf(outstream,"\n");
    for (loopvar=0; loopvar < total_length; loopvar++)
      fprintf(outstream,"-");
    fprintf(outstream,"\n");

}


/*****************************************************************/
/* Gets the current system time and prints it out                */
/*****************************************************************/
char *get_time_stamp(int form, Timer_struct *time_pointer)
{
    Timer_struct temp_stamp;  /* TIME_ACC jen */

    struct tm *tp;
    size_t timeLength = 0;

    /* TIME_ACC jen start */
    if (time_pointer == (Timer_struct *)NULL)
      get_start_time(&temp_stamp);
    else
     temp_stamp = *time_pointer;

#if defined (SQLUNIX) || defined (SQLAIX)
    tp = localtime((time_t *)&(temp_stamp.tv_sec));
#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
    tp = localtime(&(temp_stamp.time));
#else
#error Unknown operating system
#endif
    /* TIME_ACC jen stop*/

    if ((form == T_STAMP_FORM_1) || (form == T_STAMP_FORM_3))
    {
    /* SUN fix bbe start */
#if (defined (SQLWINT) || defined (SQLWIN) || defined (SQLOS2) ||
defined(SQLDOS))
      timeLength = strftime(newtime,50,"%x %X",tp);
#elif (defined (SQLUNIX) || defined (SQLAIX))
      timeLength = strftime(newtime,50,"%D %T",tp);  /* SUN  ...test this
*/
#else
#error Unknown operating system
#endif
    /* SUN fix bbe stop */
      /* TIME_ACC jen start*/
      if (form == T_STAMP_FORM_3)
      {
        /* concatenate the microsecond/milliseconds  on the end of the */
        /*timestamp jen1006 */
#if defined (SQLUNIX) || defined (SQLAIX)
        sprintf(newtime+timeLength,".%0.6d",temp_stamp.tv_usec);
#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
        sprintf(newtime+timeLength,".%0.3d",temp_stamp.millitm);
#else
#error Unknown operating system
#endif
        /* TIME_ACC jen stop*/
      }
    }
    else
      if (form == T_STAMP_FORM_2)
        strftime(newtime,50,"%y%m%d-%H%M%S",tp);
```

```
  return (newtime);

}



/*****************************************************************/
/* Handle all the processing for the summary table               */
/*****************************************************************/

void summary_table (struct global_struct *g_struct)
{
  double arith_mean = 0;
  double geo_mean   = 0;
  int    num_stmt   = 0;
  int    num_stmt_for_geo_mean   = 0;

  double adjusted_a_mean = 0;
  double adjusted_g_mean = 0;
  double adjusted_g_mean_intern;
  double adjusted_max_time = 0;

  double Ts   = 0;                  /* different TPC-D metrics */
  double Ts1;
  double Ts2;
/* double QppD = 0;                    MARK
  double QthD = 0;

  double QphD = 0; */

  double db_size_frac_part = 0;       /* stores the fractional part of db
size */
  double db_size = 0;                 /* size in numbers */
  char db_size_qualifier[3] = "\0";   /* MB, GB or TB */

  struct stmt_info
    *s_info_ptr,
    *s_info_head_ptr,
    *max,
    *min;


  /* Determine the size of the database from the scale factor (1 SF =
1GB) */
  if (g_struct->scale_factor < 1.0) {
      db_size = g_struct->scale_factor * 1000;
      strcpy(db_size_qualifier, "MB");
  } else if (g_struct->scale_factor >= 1000.0) {
      db_size = g_struct->scale_factor / 1000;
      strcpy(db_size_qualifier, "TB");
  } else {
      db_size = g_struct->scale_factor;
      strcpy(db_size_qualifier, "GB");
  }


  /* computes the fractional part of db_size */
  db_size_frac_part = db_size - (int) db_size;

  s_info_ptr = g_struct->s_info_ptr;  /* Just use a local copy */
  s_info_head_ptr = s_info_ptr;

  max = s_info_head_ptr;

  /* ensure that we are not already setting max to the UF timings */
  while ( strstr(max->tag, "UF") != NULL )
    max = max->next;
  min = max;

  if (g_struct->c_l_opt->outfile)     /* create the appropriate output file */
    output_file(g_struct);

  /* write the seed used for this run unless it is a qualification run */
  /* (qualification runs use the default seed for their queries) or  */
  /* unless it is the update function stream (no seeds used for this) */
  /* (this is an update stream iff update is 2) */
  if ((g_struct->c_l_opt->intStreamNum >=0) &&
      (g_struct->c_l_opt->update != 2) )
  {
    if (g_struct->lSeed == -1)
    {
      fprintf( outstream,"\nUsing default qgen seed file");
    }
    else
      fprintf (outstream, "\nSeed used for current run = %ld",g_struct-
>lSeed);
    fprintf( outstream,"\n");
  }

  /* print out the stream number if we are in a throughput stream and if
*/
  /* this is not the update stream portion of the throughput test */
  if ( (g_struct->c_l_opt->intStreamNum > 0) &&
       (g_struct->c_l_opt->update != 2)  )
  {
    fprintf( outstream, "Stream number = %d\n",g_struct->c_l_opt-
>intStreamNum);
  }
  /* print the stream start timestamp to the inter file */
  fprintf (outstream, "Stream start time stamp %*.*s\n",
           T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
           get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_start_time))); /* TIME_ACC jen*/
  /* print the stream stop timestamp to the inter file */
  fprintf (outstream, "Stream stop time stamp %*.*s\n",
           T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
           get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_end_time)));  /* TIME_ACC jen*/

  fprintf (outstream, "\n\n\nSummary of
Results\n==================\n");
  fprintf (outstream,
           "\nSequence #     Elapsed Time   Adjusted Time Start
Timestamp   End Timestamp\n\n");

  /* Go through the linked list and determine which statement had the
     highest and lowest elapsed times */
  while ( (s_info_ptr != NULL) && (s_info_ptr != g_struct-
>s_info_stop_ptr) ) {

    /* check if we are in an update function...if so, we do not want to */
    /* consider the update function times as the min or max time */
    if ( strstr(s_info_ptr->tag,"UF") == NULL )
    {
      /* we are not in an update function */
      if (s_info_ptr->elapse_time > max->elapse_time)
        max = s_info_ptr;
      else
        if ((s_info_ptr->elapse_time < min->elapse_time)
           && (s_info_ptr->elapse_time > -1))
          min = s_info_ptr;
    }

    s_info_ptr = s_info_ptr->next;

  }

  s_info_ptr = s_info_head_ptr;
```

```
  /** Start from the first structure and go through until the stop
    pointer is reached **/
  while ( (s_info_ptr != NULL) && (s_info_ptr != g_struct-
>s_info_stop_ptr) ) {

    if (s_info_ptr->elapse_time != -1)  {
      s_info_ptr->adjusted_time = s_info_ptr->elapse_time;
      /* determine whether the elapsed times have to be adjusted or
not */
      /* if this is an update function, we do not adjust the elapsed time*/
      if ( strstr(s_info_ptr->tag,"UF") == NULL )
      {
        /* this is not an update function, adjust time if necessary */
        if (max->elapse_time/min->elapse_time > 1000)
        {
          /* jmc fix geo_mean calculation...round adjusted time properly
ROUNDING*/
          adjusted_max_time = max->elapse_time/1000;
          if (s_info_ptr->elapse_time < adjusted_max_time)
          {
            s_info_ptr->adjusted_time =
              (double)(((long)((adjusted_max_time + 0.05) * 10))/10.0);
            if (s_info_ptr->adjusted_time < 0.1)
              s_info_ptr->adjusted_time = 0.1;
          }
          /*jmc fix geo_mean calculation...round adjusted time properly
ROUNDING end*/
        }
      }

                                  /* a value was calculated */
      fprintf (outstream,
            "%-5d %-5.5s %15.1f %15.1f %*.*s %*.*s\n",
            s_info_ptr->stmt_num,s_info_ptr->tag,
            s_info_ptr->elapse_time,s_info_ptr->adjusted_time,
            T_STAMP_1LEN,T_STAMP_1LEN,s_info_ptr-
>start_stamp, /* TIME_ACC jen*/
            T_STAMP_1LEN,T_STAMP_1LEN,s_info_ptr-
>end_stamp); /* TIME_ACC jen*/

      /* Only update arithmetic mean for queries not update functions */
      if ( strstr(s_info_ptr->tag,"UF") == NULL )
      {
        arith_mean += s_info_ptr->elapse_time;
        adjusted_a_mean += s_info_ptr->adjusted_time;
      }

      if (s_info_ptr->elapse_time > 0) {  /* don't bother finding log of
                                    numbers < 0 */
        geo_mean += log(s_info_ptr->elapse_time);
        adjusted_g_mean += log(s_info_ptr->adjusted_time);
      }


      /* Only update num_stmt for queries not update functions */
      if ( strstr(s_info_ptr->tag,"UF") == NULL )
        num_stmt ++;
      num_stmt_for_geo_mean++;
    }

    else
      fprintf (outstream,"%-5d %-5.5s %-15s %-15s\n",
            s_info_ptr->stmt_num,
            s_info_ptr->tag,"Not Collected", "Not Collected");


    if (s_info_ptr != g_struct->s_info_stop_ptr)
      s_info_ptr=s_info_ptr->next;
  }
```

```
  fprintf(outstream, "\n\nNumber of statements: %d\n\n", s_info_ptr-
>stmt_num - 1);
  /* Calculate the arithmetic and geometric means */

  if (geo_mean != 0) {     /*Used to test if arith_mean != 0
                           Don't bother doing any of this if the
                            elapsed time mean is 0 */
    arith_mean = arith_mean / num_stmt;
    adjusted_a_mean = adjusted_a_mean / num_stmt;
    geo_mean = exp(geo_mean / num_stmt_for_geo_mean);
    adjusted_g_mean_intern = adjusted_g_mean; /*MARK*/
    adjusted_g_mean = exp(adjusted_g_mean /
num_stmt_for_geo_mean);

  }


  /* print out all the appropriate information including the
    different TPC-D metrics */
  /* do not bother with this if we are in an update only stream */
  fprintf (outstream, "\nGeom.  mean queries %7.3f %15.3f\n",\
          geo_mean,adjusted_g_mean);
  if (g_struct->c_l_opt->update < 2)
  {
    fprintf (outstream, "Arith. mean queries %7.3f %15.3f\n",\
          arith_mean,adjusted_a_mean);


    fprintf (outstream,
          "\n\nMax Qry %-3.3s %15.1f %15.1f %*.*s %*.*s\n",
          max->tag,max->elapse_time,max->adjusted_time,
          T_STAMP_1LEN,T_STAMP_1LEN,max->start_stamp,  /*
TIME_ACC jen*/
          T_STAMP_1LEN,T_STAMP_1LEN,max->end_stamp);  /*
TIME_ACC jen*/
    fprintf (outstream,
          "Min Qry %-3.3s %15.1f %15.1f %*.*s %*.*s\n",
          min->tag,min->elapse_time,min->adjusted_time,
          T_STAMP_1LEN,T_STAMP_1LEN,min->start_stamp,  /*
TIME_ACC jen*/
          T_STAMP_1LEN,T_STAMP_1LEN,min->end_stamp);  /*
TIME_ACC jen*/
  }

  if (g_struct->c_l_opt->intStreamNum == 0) {
    /* fprintf (outstream, "\n\nMetrics\n=======\n\n"); */

    /* Increase the Ts measurement by one second since the accuracy
of our */
    /* timestamps is only to 1 second and if the start was at 1.01
seconds, */
    /* and the end was at 5.99 seconds, we get a free second ... this
will */
    /* be made explicit in the upcoming revision of the spec (after 1.0.1)
*/
     /* TIME_ACC jen start*/
    /* NOTE this can probably be better coded by changing
get_elapsed_time */
    /* to just calculate the elapsed time give a start and an end time,
and */
    /* to also give a precision for the calculation (sec, 10ths....).  The */
    /* call then will grab a timestamp before calling. THen we can get
rid */
    /* of the if def...and just call get_elapsed_time (whcih can handle
the */
    /* os differences on its own */

#if defined (SQLUNIX) || defined (SQLAIX)
    Ts = g_struct->stream_end_time.tv_sec - g_struct-
>stream_start_time.tv_sec + 1;
```

```
    Ts1 = (double)g_struct->stream_start_time.tv_sec +
((double)g_struct->stream_start_time.tv_usec/1000000);
    Ts2 = (double)g_struct->stream_end_time.tv_sec +
((double)g_struct->stream_end_time.tv_usec/1000000);

#elif (defined (SQLOS2) || defined(SQLWINT) || defined (SQLWIN) ||
defined(SQLDOS))
    Ts = g_struct->stream_end_time.time - g_struct-
>stream_start_time.time + 1;
    Ts1 = (double)g_struct->stream_start_time.time +
((double)g_struct->stream_start_time.millitm/1000);
    Ts2 = (double)g_struct->stream_end_time.time + ((double)g_struct-
>stream_end_time.millitm/1000);

#else
#error Unknown operating system
#endif

    /* TIME_ACC jen stop*/

   /* MARK
    ##Now do in calcmetricsp.pl##
    QppD = (3600 * g_struct->scale_factor) / adjusted_g_mean;
    QthD = (num_stmt * 3600 * g_struct->scale_factor) / Ts;
    QphD = sqrt(QppD*QthD);
   */
    /* if the decimal part has some meaningful value then print the
database size
    with decimal part; otherwise just print the integer part */

        fprintf (outstream,
            "\nGeometric mean interim value  = %10.3f\n\nStream Ts
%11 = %10.0f\n\nStream start int representation %11 = %f\n\nStream
stop int representation  %11 = %f",
            adjusted_g_mean_intern,Ts,Ts1,Ts2);
  }

}


/*************************************************************/
/* free up all the elements of the sqlda after done processing */
/*************************************************************/
void free_sqlda (struct sqlda *sqlda, int select_status)    /* @d30369 tjg
*/
{
  int loopvar;

  if (select_status == TPCDBATCH_SELECT)
    for (loopvar=0; loopvar<sqlda->sqld; loopvar++) {
      free(sqlda->sqlvar[loopvar].sqldata);
      free(sqlda->sqlvar[loopvar].sqlind);
    }

  free(sqlda);
  sqlda_allocated = 0; /* fix free() problem on NT
                    wlc 090597 */
}


/************************************************/
/* processing to run the insert update function */
/************************************************/
void runUF1 ( struct global_struct *g_struct, int updatePair )
{

  char statement[3000];
  char sourcedir[256];
  int split_updates = 2;       /* no. of ways update records are split */
  int concurrent_inserts = 2;  /* jenCI no of concurrent updates to be */
                               /* jenCI run at once*/
  int loop_updates = 1;        /* jenCI no of updates to be run in one  */
                               /* jenCI "concurrent" invocation.  should*/
                               /* jenCI be split_updates / concurrent_inserts*/
  int i;
  int streamNum;
#ifdef SQLWINT
  /* PROCESS_INFORMATION childprocess[100]; */
  char commandline[256];
  HANDLE              su_hSem;
  char              UF1_semfile[256];
#else
  int childpid[100];
  int               su_semid; /* semaphore for controlling split updates*/
  key_t             su_semkey; /* key to generate semid */
#endif
  if (g_struct->c_l_opt->intStreamNum == 0)
     streamNum = 0;
  else
     streamNum = currentUpdatePair - updatePairStart + 1;

  fprintf( outstream,"UF1 for update pair %d, stream %d,
starting\n",updatePair, streamNum);

  /* Start by loading the data into the staging table at each node */
  /* The orderkeys were split earlier by the split_updates program */
  if (env_tpcd_audit_dir != NULL)
    strcpy(sourcedir,env_tpcd_audit_dir);
  else
    strcpy(sourcedir,".");

  /* Load the orderkeys into the staging table */
  /* In SMP environments one could use a load command but by using
a */
  /* script we can keep the code common */
#ifdef SQLWINT
  sprintf (statement, "perl %s\\tools\\ploaduf1 %d\n", sourcedir,
updatePair);
#else
  sprintf (statement, "perl %s/tools/ploaduf1 %d 1", sourcedir,
updatePair);
#endif
  if (system(statement))
  {
     fprintf (stderr, "ploaduf1 failed for UF1, examine UF1.log for cause.
Exiting.\n");
     if (verbose)
       fprintf (stderr,
           "ploaduf1 failed for UF1, examine UF1.log for cause.
Exiting.\n");
     exit (-1);
  }

  fprintf (outstream, "load_update finished for UF1.\n");

  if (getenv ("TPCD_SPLIT_UPDATES") != NULL)
    split_updates = atoi (getenv ("TPCD_SPLIT_UPDATES"));
  if (getenv ("TPCD_CONCURRENT_INSERTS") != NULL)
/*jenCI*/
    concurrent_inserts = atoi (getenv
("TPCD_CONCURRENT_INSERTS"));  /*jenCI*/
  loop_updates = split_updates / concurrent_inserts;
/*jenCI*/

#ifndef SQLWINT
  /*    we will use the tpcd.setup file to generate the semaphore key */
  if (getenv("TPCD_AUDIT_DIR") != NULL)               /*begin SEMA */
  {
```

```
    /* this is assuming that you will be running this from 0th node */
    sprintf(sourcefile, "%s%ctools%ctpcd.setup",
          getenv("TPCD_AUDIT_DIR"), PATH_DELIM,PATH_DELIM);
  }
  else
  {
    fprintf (stderr, "runUF1 Can't open UF1 semaphore
file,TPCD_AUDIT_DIR is not defined.\n");
    exit (-1);
  }
  /*end SEMA */
  su_semkey = ftok (sourcefile, 'J');
  if ( (su_semid = semget (su_semkey, 1,
IPC_CREAT|S_IRUSR|S_IWUSR)) < 0)
  {
    fprintf (stderr, "Cannot get semaphore! semget failed: errno =
%d\n",errno);
    exit (-1);
  }
#else  /* SQLWINT */
  sprintf (UF1_semfile, "%s.%s.UF1.semfile", env_tpcd_dbname,
env_user);
  su_hSem = CreateSemaphore(NULL, 0,
                        concurrent_inserts,                    /*jenCI*/
                        (LPCTSTR)(UF1_semfile));
  if (su_hSem == NULL)
  {
    fprintf(stderr,
          "CreateSemaphore (ready semaphore) failed, GetLastError:
%d, quitting\n",
          GetLastError());
    exit(-1);
  }
#endif /* SQLWINT */
  if (verbose) fprintf(stderr,"Semaphore created successfully!\n");

  fclose(outstream); /* to prevent multiple header caused by forking
                    wlc 081397 */

  for (i=0; i < concurrent_inserts; i++)                       /*jenCI*/
  {
#ifndef SQLWINT
    if ((childpid[i] = fork()) == 0)
    {
      /* runUF1_fn (updatePair, i);   aph 981205 */
      runUF1_fn (updatePair, i, dbname, userid, passwd);
    }
    else
    {
      /* This is the parent */
      if (verbose)
        fprintf (stderr, "stream #%d started with pid %d\n", i, childpid[i]);
    }
#else  /* SQLWINT */
    sprintf (commandline,
          "start /b %s\\auditruns\\tpcdbatch.exe -z -d %s -i %d -j 1 -k
%d",
          env_tpcd_audit_dir, dbname, updatePair, i ); /* aph 082797 */

    system (commandline);
#endif /* SQLWINT */
    sleep (UF1_SLEEP);
  }

  /* All children have been created, now wait for them to finish */
#ifndef SQLWINT
  if (sem_op (su_semid, 0, concurrent_inserts * -1) != 0)
/*jenCI*/
  {                                                    /*jenSEM*/
    fprintf(stderr,
          "Failure to wait on insert semaphone with %d of children\n",
          concurrent_inserts);
    exit(1);
  }                                                    /*jenSEM*/
  semctl (su_semid, 0, IPC_RMID, 0);
#else
  for (i = 0; i < concurrent_inserts; i++)                     /*jenCI*/
  {
    if (verbose)
    {
      fprintf(stderr,"About to wait again ...Sets to wait for %d\n",
            concurrent_inserts - i);                         /*jenCI*/
    }
    if (WaitForSingleObject(su_hSem, INFINITE) == WAIT_FAILED)
    {
      fprintf(stderr,
            "WaitForSingleObject (su _hSem) failed in runUF1 on set
%d, error: %d, quitting\n",
            i, GetLastError());
      exit(-1);
    }
  }
  if (! CloseHandle(su_hSem))
  {
    fprintf(stderr,
          "RunUF1 Close Sem failed - Last Error: %d\n",
GetLastError());
    /* no exit here */
  }
#endif

  if( (outstream = fopen(outstreamfilename, APPENDMODE)) == NULL
)
  {
    fprintf(stderr,"\nThe output file could not be opened.  ");
    fprintf(stderr,"Make sure that the filename is correct.\n");
    fprintf(stderr,"filename = %s\n",outstreamfilename);
    exit(-1);
  }

  fprintf( outstream,"UF1 for update pair %d complete\n",updatePair);
}


/* runUF1_fn() moved to another SQC file                    aph 981205 */


/************************************************/
/* processing to run the delete update function */
/************************************************/
void runUF2 ( struct global_struct *g_struct, int updatePair )
{
  char statement[3000];
  char sourcedir[256];

  int split_deletes = 1;    /*   no. of ways update records are split
@dxxxxxhar */
  int concurrent_deletes  = 1;    /* number of database partitions
DELjen */
  int chunks_per_concurrent_delete = 1;

  int i;
  int streamNum;
#ifdef SQLWINT
  char commandline[256];
  HANDLE              su_hSem;
  char              UF2_semfile[256];
#else
  int childpid[100];
  char sourcefile[256];
```

```
  int                su_semid; /* semaphore for controlling split updates*/
  key_t              su_semkey; /* key to generate semid */
#endif
   if (g_struct->c_l_opt->intStreamNum == 0)
      streamNum = 0;
  else
      streamNum = currentUpdatePair - updatePairStart + 1;

  fprintf( outstream,"UF2 for update pair %d, stream %d,
starting\n",updatePair, streamNum);

  /* We need to know both how many chunks there are and how many
chunks*/
  /* are to be executed by each concurrent UF2 process.   More
chunks means */
  /* both smaller transactions (less deadlock) and more potential
concurrency */

  /* How many "chunks" have the orderkeys been divided into? */
  if (getenv ("TPCD_SPLIT_DELETES") != NULL)
    split_deletes = atoi (getenv ("TPCD_SPLIT_DELETES"));
  /* How many deletes should run concurrently */
  if (getenv ("TPCD_CONCURRENT_DELETES") != NULL)
    concurrent_deletes = atoi (getenv
("TPCD_CONCURRENT_DELETES"));
  /* How many chunks in each concurrently running delete process */
  chunks_per_concurrent_delete = split_deletes / concurrent_deletes;


  /* Start by loading the data into the staging table at each node */
  /* The orderkeys were split earlier by the split_updates program */
  if (env_tpcd_audit_dir != NULL)
    strcpy(sourcedir,env_tpcd_audit_dir);
  else
    strcpy(sourcedir,".");

  /* Load the orderkeys into the staging table */
  /* In SMP environments one could use a load command but by using
a */
  /* script we can keep the code common */


#ifdef SQLWINT
  sprintf (statement, "perl %s\\tools\\ploaduf2 %d\n", sourcedir,
updatePair);
#else
  sprintf (statement, "perl %s/tools/ploaduf2 %d 2", sourcedir,
updatePair);
#endif
  if (system(statement))
  {
    fprintf (stderr, "ploaduf2 failed for UF2, examine UF2.log for cause.
Exiting.\n");
    exit (-1);
  }
  fprintf (outstream, "ploaduf2 finished for UF2.\n");

  fclose(outstream); /* to prevent multiple header caused by forking
                wlc 081397 */

  /* Next we need to get ready to launch a bunch of concurrent
processes */
#ifndef SQLWINT
  /*    we will use the tpcd.setup file to generate the semaphore key
begin SEMA */
  if (getenv("TPCD_AUDIT_DIR") != NULL)
  {
    sprintf(sourcefile, "%s%ctools%ctpcd.setup",
          getenv("TPCD_AUDIT_DIR"), PATH_DELIM, PATH_DELIM);
  }
  else
  {
    fprintf (stderr, "runUF2 Can't open UF2 semaphore file,
TPCD_AUDIT_DIR is not defined.\n");
    exit (-1);
  }

  su_semkey = ftok (sourcefile, 'D');   /* use D for deletes    */
  /* end SEMA */
  if ( (su_semid = semget (su_semkey, 1,
IPC_CREAT|S_IRUSR|S_IWUSR)) < 0)
  {
    fprintf (stderr, "UF2 Can't get semaphore! semget failed: errno =
%d\n",
          errno);
    exit (-1);
  }
#else
  sprintf (UF2_semfile, "%s.%s.UF2.semfile", env_tpcd_dbname,
env_user);
  fprintf(stderr,"UF2 semfile = %s\n",UF2_semfile);
  su_hSem = CreateSemaphore(NULL, 0,
                    concurrent_deletes,
                    (LPCTSTR)(UF2_semfile));
  if (su_hSem == NULL)
  {
    fprintf(stderr,
        "CreateSemaphore (ready semaphore) failed, GetLastError:
%d, quitting\n",
          GetLastError());
    exit(-1);
  }
  fprintf(stderr,"Semaphore created successfully!\n");
#endif

  for (i=0; i < concurrent_deletes; i++)
  {
#ifndef SQLWINT
    if ((childpid[i] = fork()) == 0)
    {
      fprintf(stderr, "B-Calling runUF2_fn  %d   %d   %d ...\n",
                    updatePair, i,chunks_per_concurrent_delete);
      /* runUF2_fn (updatePair, i, chunks_per_concurrent_delete);
aph 981205 */
      runUF2_fn (updatePair, i, chunks_per_concurrent_delete,
dbname, userid, passwd);
    }
    else
    {
      /* This is the parent */
      if (verbose)
        fprintf (stderr, "stream #%d started with pid %d\n", i, childpid[i]);
    }
#else
    {
      /*  SECURITY_ATTRIBUTES sec_process;
          SECURITY_ATTRIBUTES sec_thread; */
      /* NEED TO FIX THIS UP - KBS 98/10/20 */

      sprintf (commandline,
          "start /b %s\\auditruns\\tpcdbatch.exe -z -d %s -i %d -j 2 -k %d
-x %d",
          env_tpcd_audit_dir, dbname, updatePair, i,
chunks_per_concurrent_delete  ); /* aph */
      /* the -x parm should be passed at 0...not 100% sure of this jen */
      fprintf(stderr, "commandline= %s\n", commandline);
      system (commandline);
      sleep (UF2_SLEEP);
    }
#endif
```

```
  }

  /* All children have been created, now wait for them to finish */
#ifndef SQLWINT
  fprintf(stderr, "About to wait on the semaphore...\n");
  if (sem_op (su_semid, 0, concurrent_deletes * -1) != 0)
/*jenSEM*/
  {                                                 /*jenSEM*/
    fprintf(stderr,
          "Failure to update wait on delete semaphone with %d
children\n",
          concurrent_deletes);
    exit(1);
  }                                                 /*jenSEM*/
  semctl (su_semid, 0, IPC_RMID, 0);
#else
// for (i = 0; i < split_deletes; i++)   //DJD Waits forever.....
  for (i = 0; i < concurrent_deletes; i++)
  {
    if (verbose)
    {
//       fprintf(stderr,"About to wait again ...Sets to wait for %d\n",
//               split_deletes - i);
      fprintf(stderr,"About to wait again ...Sets to wait for %d\n",
              concurrent_deletes - i);
    }
    if (WaitForSingleObject(su_hSem, INFINITE) == WAIT_FAILED)
    {
      fprintf(stderr,
              "WaitForSingleObject (su_hSem) failed on set %d, error:
%d, quitting\n",
              i, GetLastError());
      exit(-1);
    }
  }
  if (! CloseHandle(su_hSem))
  {
    fprintf(stderr, "Close Sem failed - Last Error: %d\n", GetLastError());
    /* no exit here */
  }
#endif

  if( (outstream = fopen(outstreamfilename, APPENDMODE)) == NULL
)
  {
    fprintf(stderr,"\nThe output file could not be opened.  ");
    fprintf(stderr,"Make sure that the filename is correct.\n");
    fprintf(stderr,"filename = %s\n",outstreamfilename);
    exit(-1);
  }

  fprintf( outstream,"UF2 for update pair %d complete\n",updatePair);

}


/* runUF2_fn() moved to another SQC file                    aph 981205 */


/*---------------------------------------------------------------*/
/*        General semaphore function.                            */
/*---------------------------------------------------------------*/
#ifndef SQLWINT
int sem_op (int semid, int semnum, int value)
{
  struct sembuf sembuf;    /* = {semnum ,value,0}; */
  sembuf.sem_num = semnum;
  sembuf.sem_op  = value;
  sembuf.sem_flg = 0;
  if (semop(semid,&sembuf,1) < 0)
  {
    fprintf(stderr,"ERROR*** sem_op errorno = %d\n", errno);
    return(-1);
    /*  exit(1); */
  }
  return (0);       /* successful return  jenSEM */
}
#endif

/*****************************************************************/
/* Determines the proper name for the output file to
   be generated for a particular TPC-D query, update function, or
   interval summary                                              */
/*****************************************************************/
void output_file(struct global_struct *g_struct)
{
  char file_name[256] = "\0";
  char run_dir[150]   = "\0";
  char time_stamp[50] = "\0";
  char delim[2]       = "\0";
  int qnum;


  strcpy(run_dir,g_struct->run_dir);
  sprintf(delim,"%s",env_tpcd_path_delim);
  strcpy(time_stamp,g_struct->file_time_stamp);

  if (g_struct->stream_list == NULL)
    if ((g_struct->stream_list =
              fopen(g_struct->c_l_opt->str_file_name, READMODE))
== NULL)
    {
      fprintf(stderr,"\nThe stream list file could not be opened.");
      fprintf(stderr,"Make sure that the filename is correct.\n");
      exit(-1);
    }

  fscanf(g_struct->stream_list,"%d",&qnum);

  switch (g_struct->c_l_opt->intStreamNum)
  {
   case -1: /* qualifiying */
     sprintf(file_name,
"%s%sqryqual%02d.%s",run_dir,delim,qnum,time_stamp);
     break;
   case 0: /* power tests */
     if (qnum < 0) /* update functions */
       sprintf(file_name,
"%s%smps00uf%d.%02d.%s",run_dir,delim,abs(qnum), \
             currentUpdatePair,time_stamp);
    else
       sprintf(file_name,
"%s%smpqry%02d.%s",run_dir,delim,qnum,time_stamp);
     break;

   default:
     /*     if (qnum < 0)  - replaced by berni 96/03/26 */
     if (g_struct->c_l_opt->update == 2 ||
        g_struct->c_l_opt->update == 5)
       sprintf(file_name, "%s%smts%02duf%d.%02d.%s",run_dir,delim,
\
             currentUpdatePair - updatePairStart + 1,abs(qnum),
currentUpdatePair,time_stamp);
     else
       sprintf(file_name, "%s%smts%dqry%02d.%s",run_dir,delim, \
             g_struct->c_l_opt->intStreamNum,qnum,time_stamp);
     break;

  }
```

```
  if (g_struct->c_flags->eo_infile)
    if (g_struct->c_l_opt->update == 2 ||
       g_struct->c_l_opt->update == 5)
      sprintf(file_name,
"%s%smtufinter.%s",run_dir,delim,time_stamp);
    else
      switch (g_struct->c_l_opt->intStreamNum) {
       case -1:
         sprintf(file_name,
"%s%sqryqualinter.%s",run_dir,delim,time_stamp);
         break;
       case 0:
         /*sprintf(file_name,
"%s%smpinter.%s",run_dir,delim,time_stamp);*/
         if (g_struct->c_l_opt->update == 1)
           sprintf(file_name,
"%s%smpqinter.%s",run_dir,delim,time_stamp);
         else
           sprintf(file_name,
"%s%smpufinter.%s",run_dir,delim,time_stamp);
         break;
       default:
         if (g_struct->c_l_opt->intStreamNum > 0)
           sprintf(file_name,
                 "%s%smts%dinter.%s",
                 run_dir,delim,g_struct->c_l_opt-
>intStreamNum,time_stamp);
         else
           fprintf(stderr,"Invalid stream number specified\n");
         break;
      }

  strcpy(outstreamfilename, file_name); /* wlc 081397 */

  if (!feof(instream) || g_struct->c_flags->eo_infile)
    /* Only create an output file if there are input
       statements left to process, or if we're all done
       and want to print out the summary table file */
    if( (outstream = fopen(file_name, WRITEMODE)) == NULL ) {
      fprintf(stderr,"\nThe output file could not be opened.  ");
      fprintf(stderr,"Make sure that the filename is correct.\n");
      fprintf(stderr,"filename = %s\n",file_name);
      exit(-1);
    }

  return;
}


/*********************************************************************/
/* Determine whether or not we should break out of the block loop
  because of an end of file, end of block, or update function.
  Also handle some semaphore stuff for update functions          */
/*********************************************************************/
int PreSQLprocess(struct global_struct *g_struct, Timer_struct
*start_time)
{
  int              rc = 1;
  FILE               *updateFP;
#ifndef SQLWINT
  int              semid;             /* semaphore for controlling UFs*/
  key_t              semkey;            /* key to generate semid */
#else
  int              SemTimeout = 600000;    /* Des time out period of 1
minute */
#endif


  switch (g_struct->c_flags->select_status)
  {
   case TPCDBATCH_NONSQL:
     g_struct->s_info_stop_ptr = g_struct->s_info_ptr;
     /* if we're at the end of the input file, set the stop
        pointer to this structure */
     rc = FALSE;
     break;
   case TPCDBATCH_EOBLOCK:
     rc = FALSE;
     break;
   case TPCDBATCH_INSERT:
     /* we have to check whether or not this is a throughput */
     /* test, and if it is, we have to set up a semaphore to */
     /* control when the update functions are run.  We want  */
     /* them to be run after all the query streams have finished. */
     /* What we do is set up the semaphore here, decrement it */
     /* in the query streams, and wait for it to get cleared */
     /* before we allow the UFs to run.                      */
     /* Note: we only set up the semaphore if:               */
     /*       1. we are running the throughput test (num of */
     /*          streams > 0)                               */
     /*       2. we are at the first UF1 (i.e. this is the  */
     /*          case where currentUpdatePair = updatePairStart */
     /* we also want to check the sem_on element in the global */
     /* structure to see if we want to use semaphores or let */
     /* the calling script do the synchronization of the update */
     /* stream                                               */
     if ( semcontrol == 1 )
     {
       /* yes we are to be using semaphores */
       /* is this the 1st time into update function 1 (uf1)? */
       if (currentUpdatePair == updatePairStart )
       {
            /* create the semaphores */
            create_semaphores(g_struct);
            if (g_struct->c_l_opt->intStreamNum != 0)
            /* wait period for runthroughput updates */
                 throughput_wait(g_struct);
       }
       /* otherwise continue to run*/
     }
     if ((g_struct->c_l_opt->update == 3) || (g_struct->c_l_opt->update
== 4))
     {
       get_start_time(start_time);
       strcpy(g_struct->s_info_ptr->start_stamp,
            get_time_stamp(T_STAMP_FORM_3,start_time ));  /*
TIME_ACC jen*/
       /* write the start timestamp to the file...if this is not a qualification
*/
       /* run, then write the seed used as well */
       fprintf( outstream,"Start timestamp %*.*s \n",
              T_STAMP_3LEN,T_STAMP_3LEN,                 /*
TIME_ACC jen*/
              g_struct->s_info_ptr->start_stamp);
       if (g_struct->c_l_opt->intStreamNum >= 0)
       {
         if (g_struct->lSeed == -1)
         {
           fprintf( outstream,"Using default qgen seed file");
         }
         else
           fprintf( outstream,"Seed used = %ld",g_struct->lSeed);
         fprintf( outstream,"\n");
       }
     }
     if (g_struct->c_l_opt->update < 4){
     /* run only if updates are enabled */
       runUF1(g_struct, currentUpdatePair);
     }
```

```
    rc = FALSE;
    if ((g_struct->c_l_opt->intStreamNum == 0) && (semcontrol == 1))
    /* RUNPOWER: release first semaphore so the queries can run */
      release_semaphore(g_struct, INSERT_POWER_SEM);
    break;
   case TPCDBATCH_DELETE:
    if ((g_struct->c_l_opt->intStreamNum == 0) && (semcontrol == 1))
    {
    /* RUNPOWER: wait for queries to finish */
    /* waiting on QUERY_POWER_SEM semaphore */
      runpower_wait(g_struct, QUERY_POWER_SEM);
    }
    if ((g_struct->c_l_opt->update == 3) || (g_struct->c_l_opt->update
== 4))
    {
      get_start_time(start_time);
      strcpy(g_struct->s_info_ptr->start_stamp,
            get_time_stamp(T_STAMP_FORM_3,start_time ));  /*
TIME_ACC jen*/
      /* write the start timestamp to the file...if this is not a qualification
*/
      /* run, then write the seed used as well */
      fprintf( outstream,"Start timestamp %*.*s \n",
            T_STAMP_3LEN,T_STAMP_3LEN,                /*
TIME_ACC jen*/
            g_struct->s_info_ptr->start_stamp);
      if (g_struct->c_l_opt->intStreamNum >= 0)
      {
        if (g_struct->lSeed == -1)
        {
          fprintf( outstream,"Using default qgen seed file");
        }
        else
          fprintf( outstream,"Seed used = %ld",g_struct->lSeed);
        fprintf( outstream,"\n");
      }
    }
    if (g_struct->c_l_opt->update < 4){
    /* run only if updates are enabled */
      runUF2(g_struct, currentUpdatePair);
      if (g_struct->c_l_opt->intStreamNum == 0)
      {/* RUNPOWER */
        fprintf(stderr, "UF2 completed\n");
      }
    }
    currentUpdatePair += 1;
    /* update the update.pair.num file to reflect the successfully
completed */
    /* update pair */
    if (g_struct->c_l_opt->update < 4)
    {    /*jen*/
#ifndef NO_INCREMENT
      /* don't update the pair, only for my testing - Haider */
      updateFP = fopen(g_struct->update_num_file,"w");
      fprintf(updateFP,"%d\n",currentUpdatePair);
      fclose(updateFP);
#endif
    }  /*jen*/
    rc = FALSE;
    break;

  }
  return(rc);
}


/*****************************************************************/
/* Handles actual processing of SQL statement.  Initializes the SQLDA
   for returned rows, does PREPARE, DECLARE, and OPEN
statements and
   executed multiple FETCHes as needed.  If not a SELECT statement,
   goes into EXECUTE IMMEDIATE section                          */
/*****************************************************************/
void SQLprocess(struct global_struct *g_struct)
{
  int rc = 0;                          /* 912RETRY */
  int rows_fetch = 0;
  long sqlcode = SQL_RC_E911;             /* Temporary sqlcode to test
                                       for deadlocks */
  int max_wait = 1;                       /* Maximum number of retries
                                       for deadlock scenario */

  int col_lengths[TPCDBATCH_MAX_COLS];     /* array containing
widths of
                                       columns in returned set  */
  struct stmt_info *s_info_ptr;

  s_info_ptr = g_struct->s_info_ptr;
/*****************************************************************/
/* grab storage for the SQLDA                                    */
/*****************************************************************/
  if ((sqlda=(struct sqlda *)malloc(SQLDASIZE(100))) == NULL)
    mem_error("allocating sqlda");

  sqlda->sqln = TPCDBATCH_MAX_COLS;                    /* @d30369
tjg */


  /* Error-recovery code for errors resulting from multi-stream errors */

  while (((sqlcode == SQL_RC_E911) ||
         (sqlcode == SQL_RC_E912) ||
         (sqlcode == SQL_RC_E901)) &&
        (max_wait < MAXWAIT) &&
        (rc==0) )
  {

    sqlcode = 0;          /* Re-initialize sqlcode to avoid infinite-loop */
    if (g_struct->c_flags->select_status == TPCDBATCH_SELECT)
    {
      /* Enter this loop if SQL stmt is a SELECT   */
      EXEC SQL PREPARE STMT1 INTO :*sqlda FROM :stmt_str;

      sqlcode = error_check();
      if (sqlcode < 0)
      {
        fprintf (stderr,"\nPrepare failed. Stopping this query.\n");
        rc = -1;
      }
      else  /* print out the column headings for the answer set */
      {
        print_headings(sqlda,col_lengths);              /* @d22817 tjg */

        allocate_sqlda(sqlda);      /* This is where we set storage for the
*/
                              /* SQLDA based on the column types in   */
                              /* the answer set table.               */

        EXEC SQL DECLARE DYNCUR CURSOR FOR STMT1;

        EXEC SQL OPEN DYNCUR;
        sqlcode = error_check();

        if (sqlcode < 0)       /* we ran into an error of some kind KBS
98/09/28 */
        {
          max_wait ++;
```

```
            fprintf (stderr, "\nAn error has been detected on
open...Retrying...\n");
            SleepSome(10);
          }
          else
          {

/*********************************************************************/
            /* Fetch appropriate number of rows and determine whether
or not to   */
            /* send them to file.                                    */

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

            rows_fetch = 0;

            do
            {
              /* Keep fetching as long as we haven't finished reading
              all the rows and we haven't gone past the limits set
              in the control string */


              EXEC SQL FETCH DYNCUR USING DESCRIPTOR
:*sqlda;
              if (sqlca.sqlcode == 100)
              {
                sqlcode = sqlca.sqlcode;
              }
              else
              {
                sqlcode = error_check();
              }
              if (sqlcode == 0)
              {
                rows_fetch++;
                if ( (rows_fetch <= s_info_ptr->max_rows_out) ||
                     (s_info_ptr->max_rows_out == -1) )
                  echo_sqlda(sqlda,col_lengths);
              }
              else if (sqlcode < 0)
              {
                max_wait++;
                fprintf (stderr, "\nAn error has been detected on
fetch...Retrying...\n");
                SleepSome(10);
              }
            }  while ( (sqlcode == 0) && \
                     ( (s_info_ptr->max_rows_fetch == -1) || \
                       (rows_fetch < s_info_ptr->max_rows_fetch) ) );
        } /* end of successful open */
      } /* end of successful prepare */
    } /** End of block for handling SELECT statements **/

    else
    {         /** SQL statement is not a SELECT **/
      EXEC SQL EXECUTE IMMEDIATE :stmt_str;
      sqlcode = error_check();

      if (sqlcode < 0 && sqlcode != -1415 )  /* TMPkmw */
      {
        max_wait ++;
        fprintf (stderr, "\nAn error has been detected on execute
immediate...Retrying...\n");
        SleepSome(10);
      }
    } /* end of block for handling NON-select statements */

    if ( (sqlcode >= 0 ) &&
       (g_struct->c_flags->select_status == TPCDBATCH_SELECT))
      {
        /* we opened a cursor before */
        EXEC SQL CLOSE DYNCUR;
        sqlcode = error_check();

        if ((s_info_ptr->max_rows_fetch == -1) ||
           (rows_fetch < s_info_ptr->max_rows_fetch))
#ifndef SQLPTX
        fprintf (outstream, "\n\nNumber of rows retrieved is: %6d",
              rows_fetch);
        else
          fprintf (outstream, "\n\nNumber of rows retrieved is: %6d",
                s_info_ptr->max_rows_fetch);
#else
        fprintf (outstream, "\n\nNumber of rows retrieved is: %6d",
              rows_fetch);
        else
          fprintf (outstream, "\n\nNumber of rows retrieved is: %6d",
                s_info_ptr->max_rows_fetch);
#endif
      }                                          /* @d28763 tjg */

      if (s_info_ptr->query_block == FALSE)  /* if block is off don't loop */
        g_struct->c_flags->eo_block = TRUE;

    } /* end of while loop to retry if needed */

} /* end of SQLprocess */

/*********************************************************************/
/* performs some operations after a statement has been processed,
   including doing a COMMIT if necessary, and calculating the
   elapsed time.  Also initializes a new stmt_info structure
   for the next block of statements                          */
/*********************************************************************/
int PostSQLprocess(struct global_struct *g_struct, Timer_struct
*start_time)
{
   struct stmt_info *s_info_ptr;
   Timer_struct        end_t;         /* end point for elapsed time */

#if DEBUG
   fprintf (outstream, "In PostSQLprocess\n");
#endif

   s_info_ptr = g_struct->s_info_ptr;


   if (g_struct->c_flags->select_status == TPCDBATCH_NONSQL)
     return FALSE;  /* get out if we've reached the end of input file */

   if (g_struct->c_l_opt->update > 1)
   {
     /* This is an update function stream.  There is no need to COMMIT.
*/
     /* Each UF child will COMMIT its own transactions. */
     ;
   }
   else
   {  /* For non-UF cases, COMMIT now. */
     if (g_struct->c_l_opt->a_commit) {
       EXEC SQL COMMIT WORK;
       error_check();                              /* @d22275 tjg */
     }
   }

   fflush(outstream);

   s_info_ptr->elapse_time = get_elapsed_time(start_time);
```

```
  if (g_struct->c_flags->time_stamp == TRUE)              /* @d25594 tjg
*/
    get_start_time(&end_t); /* Get the end time */
    strcpy(s_info_ptr->end_stamp,
    get_time_stamp(T_STAMP_FORM_3,&end_t) );
    /*get_time_stamp(T_STAMP_FORM_3,(time_t)NULL) );*/

  /* BBE: Pass on time stamp values for the next query */
  temp_time_struct = end_t;
  strcpy(temp_time_stamp, s_info_ptr->end_stamp);

  /* write the start timestamp to the file */
  fprintf( outstream,"\n\nStop timestamp %*.*s \n",
        T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
        s_info_ptr->end_stamp);

  /* DJD print elapsed time in seconds  */
  fprintf( outstream,"Query Time = %15.1f secs\n", s_info_ptr-
>elapse_time);


  /** Allocate space for a new stmt_info structure **/    /* @d24993 tjg
*/
  s_info_ptr->next =
    (struct stmt_info *) malloc(sizeof(struct stmt_info));
  if (s_info_ptr->next != NULL)  {
    memset(s_info_ptr->next, '\0', sizeof(struct stmt_info));
    /** Transfer details from one structure to another for
      to apply for the next statement **/
    s_info_ptr->next->stmt_num = s_info_ptr->stmt_num + 1;
    s_info_ptr->next->max_rows_fetch = s_info_ptr->max_rows_fetch;
    s_info_ptr->next->max_rows_out = s_info_ptr->max_rows_out;

    s_info_ptr->next->query_block = s_info_ptr->query_block;
    s_info_ptr->next->elapse_time = -1;

    s_info_ptr = s_info_ptr->next;

  }
  else {
    mem_error("allocating next stmt structure. Exiting\n");
    exit(-1);
  }

  /** Set the stop and travelling pointer to the current info structure **/
  g_struct->s_info_stop_ptr = g_struct->s_info_ptr = s_info_ptr;

  if (sqlda_allocated)
    free_sqlda(sqlda,g_struct->c_flags->select_status);
    /* fix free() problem on NT
      wlc 090597 */

  if (g_struct->c_l_opt->outfile != 0)
    fclose(outstream);

  return (TRUE);
}

/*****************************************************************************/
/* Does some cleaning up once all the statements are processed.
Disconnects
  from the database, cleans up some semaphore stuff from the update
functions,
  prints out the summary table, and closes all file handles.              */
/*****************************************************************************/
int cleanup(struct global_struct *g_struct)
{
#ifndef SQLWINT
  int             semid;          /* semaphore for controlling UFs*/
  key_t           semkey;         /* key to generate semid */
#endif
  char file_name[256] = "\0";

  /** End timestamp for stream **/
  /*g_struct->stream_end_time = time(NULL);*/
  get_start_time(&(g_struct->stream_end_time));  /* TIME_ACC jen */

  switch (g_struct->c_l_opt->update)
  {
      case (2):
      case (5):
            /* update throughput function stream */
            sprintf(file_name,"%s%sstrcntuf.%s",g_struct->run_dir,
                  env_tpcd_path_delim, g_struct->file_time_stamp);
            break;
      case (3):
      case (4):
            /* update power function stream */
            sprintf(file_name,"%s%spstrcntuf.%s",g_struct->run_dir,
                  env_tpcd_path_delim, g_struct->file_time_stamp);
            break;
      case (1):
            /* power query stream */
            sprintf(file_name, "%s%spstrcnt%d.%s",g_struct->run_dir,
env_tpcd_path_delim,
                  g_struct->c_l_opt->intStreamNum,g_struct-
>file_time_stamp);
            break;
      case (0):
            /* throughput query stream */
            sprintf(file_name, "%s%sstrcnt%d.%s",g_struct->run_dir,
env_tpcd_path_delim,
                  g_struct->c_l_opt->intStreamNum,g_struct-
>file_time_stamp);
            break;
  }

#ifndef LINUX

  if( (g_struct->stream_report_file = fopen(file_name, APPENDMODE))
== NULL )
  {
    fprintf(stderr,"\nThe output file for the stream count information\n");
    fprintf(stderr,"could not be opened, make sure the filename is
correct\n");
    fprintf(stderr,"filename = %s\n",file_name);
    exit(-1);
  }

#endif

  /* print out the stream stop time in the stream count information file*/
  if (g_struct->c_l_opt->update > 1)
  {
    /* update function stream */
    fprintf(g_struct->stream_report_file,
          "Update function stream stopping at %*.*s\n",
          T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_end_time)));  /* TIME_ACC jen*/
  }
  else
  {
    /* query stream(s) */
    fprintf(g_struct->stream_report_file,
          "Stream number %d stopping at %*.*s\n",
          g_struct->c_l_opt->intStreamNum,
          T_STAMP_3LEN,T_STAMP_3LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_3,&(g_struct-
>stream_end_time)));  /* TIME_ACC jen*/
```

```
  }
  fclose(g_struct->stream_report_file);



  /* No need to check for errors here.
     Also, the UF stream in a Throughput run
     has no connection in tpcdbatch.sqc.            aph 98/12/26
  error_check();
  */

  /* if we are in a query stream AND this is a throughput test, then
need */
  /* do to some semaphore stuff   (0 implies update functions are off) */
  /* AND we are supposed to be using semaphores */

  if ( ( semcontrol == 1 ) &&
       ( g_struct->c_l_opt->update < 2))
     /* only queries need to release the semaphore at this point */
  {
     if (g_struct->c_l_opt->intStreamNum == 0)
       release_semaphore(g_struct, QUERY_POWER_SEM); /* power
stream */
     else
       release_semaphore(g_struct, THROUGHPUT_SEM); /*
throughput stream */


  EXEC SQL CONNECT RESET;
#ifndef SQLWINT
     if (verbose)
     {
       fprintf(stderr,
            "cleanup: semkey = %ld, semid = %d, file = %s, stream =
%d\n",
            semkey,semid,g_struct->update_num_file,
            g_struct->c_l_opt->intStreamNum);
     }
#endif
  }


  /** Summary table processing **/                    /* @d24993 tjg */
  summary_table(g_struct);

  fprintf (outstream, "\n\n");

  fclose(outstream);          /* Close the output data stream.     */
  fclose(instream);           /* Close the SQL input stream.       */

  return (TRUE);
}

void create_semaphores(struct global_struct *g_struct)
{

#ifndef SQLWINT
  int               semid;             /* semaphore for controlling UFs*/
  key_t             semkey;            /* key to generate semid */
#else
  HANDLE            hSem;
  HANDLE            hSem2;
  int               SemTimeout = 600000;    /* Des time out period of 1
minute */
#endif
      fprintf(stderr,"numstreams = %d\n",g_struct->c_l_opt-
>intStreamNum);
      fprintf(stderr,"Update stream creating semaphore(s) for update
and query sequencing\n");
#ifdef SQLWINT
      fprintf(stderr,"semfile = %s\n",g_struct->sem_file);
      if (g_struct->c_l_opt->intStreamNum == 0)
      /*RUNPOWER*/
      {
            fprintf(stderr,"semfile2 = %s\n",g_struct->sem_file2);
            hSem = CreateSemaphore(NULL, 0,1,(LPCTSTR)(g_struct-
>sem_file));
            hSem2 = CreateSemaphore(NULL, 0,1,(LPCTSTR)(g_struct-
>sem_file2));
            if ((hSem == NULL) || (hSem2 == NULL))
            {
              fprintf(stderr,
                    "CreateSemaphores (ready semaphore) failed,
GetLastError: %d, quitting\n",
                    GetLastError());
              exit(-1);
            }
            fprintf(stderr,"Semaphores created successfully!\n");
      }
      else
      {
      /* RUNTHROUGHPUT creates semaphores based on the number
of query streams while the number of streams for runpower is constant
*/
            hSem = CreateSemaphore(NULL, 0,
                        g_struct->c_l_opt->intStreamNum,
                        (LPCTSTR)(g_struct->sem_file));

            if (hSem == NULL)
            {
                 fprintf(stderr,
                      "CreateSemaphore (ready semaphore) failed,
GetLastError: %d, quitting\n",
                       GetLastError());
                 exit(-1);
            }
            fprintf(stderr,"Semaphore created successfully!\n");

      }
#else               /* AIX, SUN, etc. */
      /* create a semaphore key...use the name of a file that */
      /* you know exists */
      fprintf(stderr,"semfile = %s\n", g_struct->update_num_file);
      semkey = ftok(g_struct->update_num_file,'J');
      if (g_struct->c_l_opt->intStreamNum == 0)
      /* RUNPOWER */
      {

            if ( (semid =
semget(semkey,2,IPC_CREAT|S_IRUSR|S_IWUSR)) < 0)
            {
                  fprintf(stderr,
                       "Throughput can't get initial semaphore! semget
failed errno = %d\n",
                        errno);
                  exit(1);
            }
      }
      else
      /* THROUGHPUT */
      {

            if ( (semid =
semget(semkey,1,IPC_CREAT|S_IRUSR|S_IWUSR)) < 0)
            {
                  fprintf(stderr,
                       "Throughput can't get initial semaphore! semget
failed errno = %d\n",
                        errno);
```

```
                exit(1);
        }
        if (verbose)
        {
                fprintf(stderr,
                        "insert: semkey = %ld, semid = %d, file = %s,
value = %d\n",
                        semkey,semid,g_struct->update_num_file,
                        (g_struct->c_l_opt->intStreamNum * -1));
        }
    }


#endif
}

/*throughput update */
void throughput_wait(struct global_struct *g_struct)
{
#ifndef SQLWINT
  int           semid;          /* semaphore for controlling UFs*/
  key_t          semkey;          /* key to generate semid */
#else
  HANDLE          hSem;
  int           j;
  int           SemTimeout = 600000;    /* Des time out period of 1
minute */
#endif

#ifdef SQLWINT
    hSem = open_semaphore(g_struct, THROUGHPUT_SEM);
    for (j = 0; j < g_struct->c_l_opt->intStreamNum; j++)
    {
        if (verbose)
          fprintf(stderr,"About to wait again ...\n");
        if (WaitForSingleObject(hSem, INFINITE) == WAIT_FAILED)
        {
            fprintf(stderr,
                "WaitForSingleObject (hSem) failed on stream %d,
error: %d, quitting\n",
                j, GetLastError());
            exit(-1);
        }
        if (verbose)
            fprintf(stderr,"Streams to wait for  %d\n", j);
    }
    fprintf(stderr,"finished waiting on stream semaphore! Ready to run
updates!\n");
    /* close the semaphore handle */
    if (! CloseHandle(hSem)) {
      fprintf(stderr, "Close Sem failed - Last Error: %d\n",
GetLastError());
       /* no exit here */
    }
#else
    semid = open_semaphore(g_struct);
    /* call the sem_op routine to decrement the semaphore by */
    /* however many streams .... by calling this function with*/
    /* a negative number, this stream is forced to wait until */
    /* the semaphore gets back to 0 */
    if (sem_op(semid, 0, (g_struct->c_l_opt->intStreamNum * -1)) !=
0)
    {                                       /*jenSEM*/
        fprintf(stderr,
            "Failure to wait on throughput semaphone for %d
streams\n",
            g_struct->c_l_opt->intStreamNum);
        exit(1);
    }                                       /*jenSEM*/
    fprintf(stderr,"finished waiting on stream semaphore! Ready to run
updates!\n");
    semctl(semid,0,IPC_RMID,0);  /* we've finished waiting, now */
                        /* remove the semaphore */
#endif
}

void runpower_wait(struct global_struct *g_struct, int sem_num)
{
   char semfile[150];
#ifdef SQLWINT
   HANDLE hSem;


   if (sem_num == 1)
      strcpy (semfile, g_struct->sem_file);
   else
      strcpy (semfile, g_struct->sem_file2);


#else    /* AIX */
   int           semid;          /* semaphore for controlling UFs*/
   key_t          semkey;          /* key to generate semid */

   strcpy (semfile, g_struct->update_num_file);

#endif

  if (g_struct->c_l_opt->update == 1)
    fprintf(stderr,"querystream waiting for update stream (UF1) to signal
semaphore based on %s\n", semfile);
  else
    fprintf(stderr,"updatestream (UF2) waiting on querystream
semaphore to signal semaphore based on %s\n", semfile);

#ifdef SQLWINT

   hSem = open_semaphore(g_struct, sem_num);
   if (verbose)
     fprintf(stderr,"Runpower queries about to wait ...\n");
   if (WaitForSingleObject(hSem, INFINITE) == WAIT_FAILED)
   {
     fprintf(stderr,
       "WaitForSingleObject (hSem) failed on stream 0, error: %d,
quitting\n",
       GetLastError());
       exit(-1);
   }
   if (! CloseHandle(hSem))
   {
        fprintf(stderr, "Close Sem failed - Last Error: %d\n",
GetLastError());
        /* no exit here */
   }

#else

   semid = open_semaphore(g_struct);

   /* call the sem_op routine to decrement the semaphore by */
   /* however many streams .... by calling this function with*/
   /* a negative number, this stream is forced to wait until */
   /* the semaphore gets back to 0 */
   /* aix semaphores start at 0, not 1, so sem_num -1 is used */
   if (sem_op(semid, sem_num - 1, -1) != 0)
   {                                        /*jenSEM*/
      fprintf(stderr,
          "Failure to wait on runpower semaphone for %d streams\n",
          g_struct->c_l_opt->intStreamNum);
      exit(1);
```

```
   }                                        /*jenSEM*/
#endif
   if (g_struct->c_l_opt->update == 1)
    fprintf(stderr,"querystream finished waiting on updatestream
semaphore\n");
   else
    fprintf(stderr,"updatestream finished waiting on querystream
semaphore\n");
}

void release_semaphore(struct global_struct *g_struct, int sem_num)
{
#ifndef SQLWINT
  int              semid;          /* semaphore for controlling UFs*/
  key_t            semkey;         /* key to generate semid */
#else
  HANDLE           hSem;
  int              SemTimeout = 600000;    /* Des time out period of 1
minute */
#endif

#ifdef SQLWINT
      hSem = open_semaphore(g_struct, sem_num); /* query */
      if (! ReleaseSemaphore(hSem,
                        1,
                        (LPLONG)(NULL)))
      {
          fprintf(stderr, "ReleaseSemaphore failed, Sem#: %d LastError:
%d, quit\n",
                sem_num, GetLastError());
          exit(-1);
      }
#else
      semid = open_semaphore(g_struct); /* query */
      /* aix semaphores start at 0, not 1, so sem_num -1 is used */
      if (sem_op(semid, sem_num - 1, 1) != 0)
/*jenSEM*/
       {                                        /*jenSEM*/
            fprintf(stderr,
                "Failed to increment semaphore %d for throughput
stream %d\n",
                sem_num, g_struct->c_l_opt->intStreamNum);
            fprintf(stderr,
                "file for generation of semaphore is: %s\n",
                g_struct->update_num_file);
            exit(1);
       }

#endif
      if (g_struct->c_l_opt->intStreamNum == 0)
      {  /* RUNPOWER */
        if (sem_num == 1)
        {
          fprintf(stderr, "UF1 completed.\n");
        }
        else
        {
          fprintf(stderr, "query stream completed.\n");
        }
      }
}

#ifdef SQLWINT /* Compile only in NT */
HANDLE open_semaphore(struct global_struct *g_struct, int num)
{
      HANDLE  hSem;
      LPCTSTR semfile;

      if (num == 1)
            semfile = (LPCTSTR)g_struct->sem_file;
      else
            semfile = (LPCTSTR)g_struct->sem_file2;

      while ((hSem = OpenSemaphore(SEMAPHORE_ALL_ACCESS |
                              SEMAPHORE_MODIFY_STATE |
                              SYNCHRONIZE,
                             TRUE,
                             semfile))
                  == (HANDLE)(NULL))
      {
         /*
         ** if cannot open the semaphore, wait for 0.1 second
         */
         fprintf(stderr,"Retry Open semaphore %s\n",semfile);

         Sleep(1000);
      }
      return hSem;
}

#else  /* Compile only in non-NT (i.e. AIX) */
int open_semaphore(struct global_struct *g_struct)
{
      int              semid;          /* semaphore for controlling UFs*/
      key_t            semkey;         /* key to generate semid */
      int num;

      if (g_struct->c_l_opt->intStreamNum == 0)
            num = 2;
      else
            num = 1;

      semkey = ftok(g_struct->update_num_file,'J');
      while ((semid = semget(semkey,num,0)) < 0)
      {
            if (errno == ENOENT)
            {
                  sleep(2);
                  fprintf(stderr,"cleanUp: looping for access to semaphore
stream %d  ",
                        g_struct->c_l_opt->intStreamNum);
                  fprintf(stderr,"semkey=%ld semid = %d
file=%s\n",semkey,semid,
                        g_struct->update_num_file);
            }
            else
            {
                  fprintf(stderr,"query stream %d semget failed errno =
%d\n",
                        g_struct->c_l_opt->intStreamNum,errno);
                  exit(1);
            }
      }
      return semid;
}
#endif
```

D.3 tpcdUF.sqc

```
/*****************************************************************************
*
*  TPCDUF.SQC
*****************************************************************************/

#define UF1DEBUG
#define UF2DEBUG

#if (defined(SQLPTX) && defined(SQLSUN))
#define exit(rc) _exit(rc)
```

```
#else
#define exit(rc) exit(rc)
#endif /* SQLPTX & SQLSUN*/


#include "tpcdbatch.h"
/** EXEC SQL INCLUDE SQLCA; **/

#include "sqlca.h"
extern struct sqlca sqlca;

/*****************************************************************************/
/* Function Prototypes                                                       */
/*****************************************************************************/
extern int SleepSome( int amount );
extern long error_check(void);                                  /* @d28763 tjg
*/
extern void dumpCa(struct sqlca*);       /*kmw*/
extern int sem_op (int semid, int semnum, int value);
extern char *get_time_stamp(int form, Timer_struct *timer_pointer);
/* TIME_ACC jen */

/*****************************************************************************/
/* Declare the SQL host variables.                                           */
/*****************************************************************************/
EXEC SQL BEGIN DECLARE SECTION;
  char UF_dbname[9] = "\0";
  char UF_userid[9] = "\0";
  char UF_passwd[9] = "\0";
  sqlint32 UF_chunk = 0;
  short month = 0;
EXEC SQL END DECLARE SECTION;

/*****************************************************************************/
/* Declare the global variables.                                             */
/*****************************************************************************/
extern char env_tpcd_tmp_dir[150];
extern FILE *instream, *outstream;  /* File pointers */
extern char sourcefile[256];    /* Used for semaphores and table
functions?*/
extern struct {                         /* jen LONG */
              short len;
              char data[32700];
            } stmt_str;                 /* jen LONG */


/*****************************************************************************/
/* UF1 child                                                                 */
/* (i is the application number.)                                            */
/*****************************************************************************/
void runUF1_fn ( int updatePair, int i, char *dbname, char *userid, char
*passwd )
{
  int rc = 0;
  int split_updates = 2;       /* no. of ways update records are split */
  int concurrent_inserts = 2;  /* jenCI no of concurrent updates to be */
                          /* jenCI run at once*/
  int loop_updates = 1;        /* jenCI no of updates to be run in one  */
                          /* jenCI "concurrent" invocation.  should*/
                          /* jenCI be split_updates / concurrent_inserts*/
  int startChunk = 0;          /* jenCI number of first chunk to insert for */
                          /* jenCI this child */
  int stopChunk = 0;           /* jenCI number of last chunk to insert for */
                          /* jenCI this child */
  long insertedLineitem = 0;  /*kmw*/
  long insertedOrders = 0;    /*kmw*/
  long saveInsertedOrders = 0; /*kbs*/

  long sqlcode;
  int maxwait;

#ifndef SQLWINT
  int               su_semid;
  key_t              su_semkey;
#else
  HANDLE              su_hSem;
  char               UF1_semfile[256];
#endif

  char myoutstreamfile[256];
  FILE *myoutstream;

  strcpy(UF_dbname, dbname);
  strcpy(UF_userid, userid);
  strcpy(UF_passwd, passwd);

  /* Get ready to start logging diagnostic output */
  sprintf (myoutstreamfile, UF1OUTSTREAMPATTERN,
env_tpcd_tmp_dir, PATH_DELIM,
          updatePair, i);
  if ( (myoutstream = fopen (myoutstreamfile, WRITEMODE)) ==
NULL)
  {
    fprintf (stderr, "\nThe output file '%s' for update pair %d set %d
could not be opened. runUF1_fn\n",
             myoutstreamfile,updatePair,i);
    rc=-1;
    goto UF1_exit;
  }
  outstream=myoutstream;    /* initialize outstream for error_check
dxxxxhar*/

  fprintf( myoutstream,"\nUF1 for update pair %d set %d starting at
%*.*s\n",
          updatePair, i,
          T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));
/* TIME_ACC jen*/


  if (getenv ("TPCD_SPLIT_UPDATES") != NULL)
    split_updates = atoi (getenv ("TPCD_SPLIT_UPDATES"));
  if (getenv ("TPCD_CONCURRENT_INSERTS") != NULL)
/*jenCI*/
    concurrent_inserts = atoi (getenv
("TPCD_CONCURRENT_INSERTS"));  /*jenCI*/
  loop_updates = split_updates / concurrent_inserts;
/*jenCI*/

  /* determine the starting and stopping point of the chunks that this
jenCI*/
  /* invocation will apply. i is starting chunk number with range 0
jenCI*/
  /* through (concurrent_inserts -1)                                jenCI*/
  startChunk = i * loop_updates;                                 /*jenCI*/
  stopChunk = startChunk + (loop_updates - 1);
/*jenCI*/


  /* Establish a connection to the database */
  if (!strcmp(userid,"\0"))   /** No authentication provided **/
    EXEC SQL CONNECT TO :UF_dbname;
  else
    EXEC SQL CONNECT TO :UF_dbname USER :UF_userid USING
:UF_passwd;
  error_check();
  if (sqlca.sqlcode < 0)
  {
    rc=-1;
    goto UF1_exit;
```

```
  }

  /* Start processing each chunk in my range */
#ifdef UF1DEBUG
  fprintf (myoutstream,"Before loop_a startChunk = %d, stopChunk =
%d\n", startChunk, stopChunk);
  fflush(myoutstream);
#endif
  for ( UF_chunk = startChunk; UF_chunk <= stopChunk; UF_chunk++
)          /*jenCI*/
  {                                                    /*jenCI*/
    /* wlc  062797 */
    sqlcode = SQL_RC_E911;
    month = (short)UF_chunk;  /* Cast 'short' added bbe */
    maxwait = 1;
    rc = 0;

#ifdef UF1DEBUG
  fprintf (myoutstream, "Before While_a Chunk= %d \n",UF_chunk);
  fflush(myoutstream);
#endif
    /* Loop to handle any deadlocks */
    while (sqlcode == SQL_RC_E911 && maxwait <= MAXWAIT &&
rc==0)
    {

      sqlcode = 0;
#ifdef UF1DEBUG
  fprintf (myoutstream, "in loop before orders exec sql\n");
  fflush(myoutstream);
#endif
      EXEC SQL INSERT INTO TPCD.ORDERS
            SELECT
O_ORDERKEY,O_CUSTKEY,O_ORDERSTATUS,O_TOTALPRICE,

O_ORDERDATE,O_ORDERPRIORITY,O_CLERK,O_SHIPPRIORITY,
O_COMMENT
            FROM TPCDTEMP.ORDERS_NEW
            WHERE APP_ID = :UF_chunk;
            /*AND 12*(YEAR(O_ORDERDATE)-
1992)+MONTH(O_ORDERDATE)-01 = :month;*/

      if (sqlca.sqlcode < 0)
        sqlcode = error_check();

      if (sqlcode == SQL_RC_E911)
      {       /* we've hit a deadlock */
        fprintf (myoutstream,
              "\nDeadlock detected inserting from tpcdtemp.orders_new
for chunk %d for pair %d..Retrying...\n",UF_chunk,updatePair);
        SleepSome(UF_DEADLOCK_SLEEP);
        maxwait++;                          /* jen DEADLOCK */
      }
      else if (sqlcode < 0)
      {
        fprintf(myoutstream,
            "Insert into orders pair %d chunk %d failed
sqlcode=%d\n",
            updatePair,UF_chunk,sqlcode);
        dumpCa(&sqlca);
        rc = -1;
      }
      else
      {
        /* Everything worked with ORDERS, proceed with LINEITEM */
        saveInsertedOrders = sqlca.sqlerrd[2];

        sqlcode = 0;
#ifdef UF1DEBUG
        fprintf (myoutstream, "in lineitem for update pair number %d set
%d chunk %d\n",
              updatePair, i,UF_chunk);
        fflush(myoutstream);
#endif

        EXEC SQL INSERT INTO TPCD.LINEITEM
          SELECT
L_ORDERKEY,L_PARTKEY,L_SUPPKEY,L_LINENUMBER,L_QUAN
TITY,
          L_EXTENDEDPRICE,L_DISCOUNT,L_TAX,

L_RETURNFLAG,L_LINESTATUS,L_SHIPDATE,L_COMMITDATE,L_
RECEIPTDATE,
          L_SHIPINSTRUCT,L_SHIPMODE,L_COMMENT
          FROM TPCDTEMP.LINEITEM_NEW WHERE APP_ID =
:UF_chunk;
          /*(AND L_ORDERKEY IN
            (SELECT O_ORDERKEY FROM TPCD.ORDERS
              WHERE 12*(YEAR(O_ORDERDATE)-
1992)+MONTH(O_ORDERDATE)-01 = :month);*/

        if (sqlca.sqlcode < 0)
          sqlcode = error_check();

        if (sqlcode == SQL_RC_E911)
        {       /* we've hit a deadlock */
          fprintf (myoutstream,
                "\nA deadlock has been detected inserting from
tpcdtemp.lineitem%d_%d...Retrying...\n",
                updatePair, UF_chunk);
          SleepSome(UF_DEADLOCK_SLEEP);
          maxwait++;                          /* jen DEADLOCK */
        }
        else if (sqlcode < 0)
        {
          fprintf(myoutstream,
              "Insert into lineitem pair %d chunk %d failed
sqlcode=%d\n",
              updatePair,UF_chunk,sqlcode);
          dumpCa(&sqlca);
          rc = -1;
        }
        else
        {
#ifdef UF1DEBUG
          fprintf (myoutstream, "lineitem insert succeeded\n");
          fflush(myoutstream);
#endif
          /* accumulate the number of row inserted */
          /* Order count ONLY updated if both orders and lineitem */
          /* go through */
          insertedOrders += saveInsertedOrders;          /* kbs */
          insertedLineitem += sqlca.sqlerrd[2];
          rc=0;
          EXEC SQL COMMIT WORK;
          error_check();

#ifdef UF1DEBUG
          /* report the number of row inserted */
          fprintf(myoutstream, "    interim %ld rows for chunk %d into
TPCD.ORDERS at %*.*s\n",

insertedOrders,UF_chunk,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
              get_time_stamp(T_STAMP_FORM_1,(Timer_struct
*)NULL));  /* TIME_ACC jen*/
          /* report the number of row deleted *s inserted */
          fprintf(myoutstream,
```

```
                "    interim %ld rows for chunk %d into TPCD.LINEITEM
at %*.*s\n",
                insertedLineitem,UF_chunk,
                T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
                get_time_stamp(T_STAMP_FORM_1,
                        (Timer_struct *)NULL));  /* TIME_ACC jen*/

          fprintf( myoutstream,
                "    inserts for update pair %d chunk %d complete at
%*.*s\n\n",
                updatePair, UF_chunk,
                T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
                get_time_stamp(T_STAMP_FORM_1,
                        (Timer_struct *)NULL));  /* TIME_ACC jen*/

#endif
        }
      } /* process lineitem INSERTs */
    } /* while loop for deadlocks */
  } /* while processing chunks */

  /* report the number of row deleted */
  fprintf(myoutstream, "%ld rows inserted into TPCD.ORDERS at
%*.*s\n",
        insertedOrders,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
        get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));
/* TIME_ACC jen*/
  fprintf(myoutstream, "%ld rows inserted into TPCD.LINEITEM at
%*.*s\n",
        insertedLineitem,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
        get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));
/* TIME_ACC jen*/

  if (sqlcode < 0)
  {
    if (sqlcode == SQL_RC_E911)
    {
      fprintf (myoutstream,"# of deadlocks exceeds %i\n", MAXWAIT);
    }
    rc=-1;
    EXEC SQL ROLLBACK WORK;
    error_check();                /* @d22275 tjg */

    goto UF1_exit;
  }

/* UF1_conn_reset:  */
  EXEC SQL CONNECT RESET;
  error_check();                /* @d22275 tjg */


UF1_exit:
  fclose (myoutstream);
  /* exiting, increment the semaphore */

  /* we used the first flat file to generate the semaphore key */

#ifndef SQLWINT
  /*    we will use the tpcd.setup file to generate the semaphore key
begin SEMA */
  if (getenv("TPCD_AUDIT_DIR") != NULL)
  {
    /* this is assuming that you will be running this from 0th node */
    sprintf(sourcefile, "%s%ctools%ctpcd.setup",
          getenv("TPCD_AUDIT_DIR"), PATH_DELIM,PATH_DELIM);
  }
  else
  {
    fprintf (stderr, "Can't open UF1 semaphore file TPCD_AUDIT_DIR
is not defined.\n");
    exit (-1);
  }
  /* end SEMA */

  su_semkey = ftok (sourcefile, 'J');
  while ( (su_semid = semget (su_semkey, 1, 0)) < 0)
  {
    if (errno == ENOENT) {
      sleep(2);
    }
    else {
      fprintf(stderr,"update set %d: semget failed errno = %d\n",
            i, errno);
      exit(1);
    }
  }
  if (sem_op (su_semid, 0, 1) != 0)                    /*jen SEM*/
  {
    fprintf(stderr,"Failure to increment semaphore UF1 set %d\n",i);
    fprintf(stderr,"  semaphore sourcefile = %s  su_semid =
su_semid\n",sourcefile);
    exit(1);
  }                                                    /*jenSEM*/

#else  /* SQLWINT */
  sprintf (UF1_semfile, "%s.%s.UF1.semfile",
        getenv("TPCD_DBNAME"), getenv("USER"));
  fprintf(stderr,"UF1 semfile = %s\n",UF1_semfile);
  while ((su_hSem = OpenSemaphore(SEMAPHORE_ALL_ACCESS |
                SEMAPHORE_MODIFY_STATE |
                SYNCHRONIZE,
                TRUE,
                UF1_semfile))
      == (HANDLE)(NULL))
  {
    /*
    ** if cannot open the semaphore, wait for 0.1 second
    */
    fprintf(stderr,"Retry Open semaphore %s\n", UF1_semfile);

    sleep(1);
  }

  if (! ReleaseSemaphore(su_hSem,
                1,
                (LPLONG)(NULL)))
  {
    fprintf(stderr, "ReleaseSemaphore failed, LastError: %d, quit\n",
          GetLastError());
    exit(-1);
  }
#endif /* SQLWINT */
  exit(rc);                /* child exiting after finishing up */
}



/*****************************************************************/
/* UF2 child                                                     */
/*****************************************************************/
void runUF2_fn ( int updatePair, int thisConcurrentDelete, int
numChunks, char *dbname, char *userid, char *passwd )
{
  int rc = 0;
  long sqlcode;
  int maxwait;
  int startChunk = thisConcurrentDelete*numChunks; /* where do we
start? */
```

```
  long deletedLineitems = 0; /*kmw*/
  long deletedOrders = 0;    /*kmw*/
  long savedDeletedLineitems = 0; /*kbs*/

#ifndef SQLWINT
  int               su_semid; /* semaphore for controlling split updates*/
  key_t             su_semkey; /* key to generate semid */
#else
  HANDLE            su_hSem;
  char              UF2_semfile[256];
#endif

  char myoutstreamfile[256];
  FILE *myoutstream, *src_fh=NULL;

  strcpy(UF_dbname, dbname);
  strcpy(UF_userid, userid);
  strcpy(UF_passwd, passwd);


  /* Generate the unique filename for this concurrent delete process */
  sprintf (myoutstreamfile, UF2OUTSTREAMPATTERN,
env_tpcd_tmp_dir, PATH_DELIM,
        updatePair, thisConcurrentDelete);
  if ( (myoutstream = fopen (myoutstreamfile, WRITEMODE)) ==
NULL)
  {
    fprintf (stderr,
          "\nThe output file '%s' for update pair %d set %d could not be
opened runUF2_fn.\n",
          myoutstreamfile,updatePair,thisConcurrentDelete);
    rc=-1;
    goto UF2_exit;
  }

  outstream=myoutstream;    /* initialize outstream for error_check
dxxxxhar*/

#ifdef UF2DEBUG
  fprintf (myoutstream, "RunUF2 Called %d   %d   %d\n",
                  updatePair, thisConcurrentDelete, numChunks );
  fflush(myoutstream);
#endif
  fprintf( myoutstream,
        "\nUF2 for update pair %d set %d starting at %*.*s\n",
        updatePair, thisConcurrentDelete,
T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
        get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));
/* TIME_ACC jen*/

#ifdef UF2DEBUG
  fprintf (myoutstream, "before connect\n");
  fflush(myoutstream);
#endif

  if (!strcmp(userid,"\0"))   /** No authentication provided **/
    EXEC SQL CONNECT TO :UF_dbname;
  else
    EXEC SQL CONNECT TO :UF_dbname USER :UF_userid USING
:UF_passwd;
  error_check();


#ifdef UF2DEBUG
  fprintf (myoutstream, "after connect  startchunk= %d, EndChunk =
%d\n",
                        startChunk, startChunk+numChunks);
  fflush(myoutstream);
#endif

  /* Start processing each chunk in my range */
  for ( UF_chunk = startChunk; UF_chunk < startChunk+numChunks;
UF_chunk++ )
  {

    /* Set things up for the loop which will retry if there is a deadlock */
    sqlcode = SQL_RC_E911;
    month = (short)UF_chunk;
    maxwait = 1;
    rc = 0;

#ifdef UF2DEBUG
  fprintf (myoutstream, "Chunk = %d\n", UF_chunk);
  fflush(myoutstream);
#endif
    while (sqlcode == SQL_RC_E911 && maxwait <= MAXWAIT && rc
== 0)
    {

#ifdef UF2DEBUG
  fprintf (myoutstream, "in loop before orders exec sql\n");
  fflush(myoutstream);
#endif
      sqlcode = 0;

      EXEC SQL DELETE FROM TPCD.LINEITEM
            WHERE L_ORDERKEY IN
              (SELECT O_ORDERKEY FROM
TPCDTEMP.ORDERS_DEL
               WHERE APP_ID = :UF_chunk);
               /*AND O_ORDERKEY IN
                (SELECT O_ORDERKEY FROM TPCD.ORDERS
                 WHERE 12*(YEAR(O_ORDERDATE)-
1992)+MONTH(O_ORDERDATE)-01 = :month));*/
      if (sqlca.sqlcode < 0)
        sqlcode = error_check();

      if (sqlcode == SQL_RC_E911)
      {       /* we've hit a deadlock */
        fprintf (myoutstream,
          "\nA deadlock detected while deleting from LINEITEM: update
pair %d set %d chunk %d.  Retrying.\n",
          updatePair, thisConcurrentDelete, UF_chunk);
        dumpCa(&sqlca);
        SleepSome(UF_DEADLOCK_SLEEP);
        maxwait++;      /* jen DEADLOCK */
      }
      else if (sqlcode < 0)
      {
        fprintf (myoutstream,"\n%s\n", stmt_str.data);
        fprintf (myoutstream,"\nsqlcode %d occurred deleting from
TPCD.LINEITEM\n", sqlca.sqlcode);
        dumpCa(&sqlca);
        fprintf (myoutstream,
              "for update pair number %d set %d chunk %d..Exiting\n",
              updatePair, thisConcurrentDelete,UF_chunk);
        rc=-1;
      }
      else
      {
        /* accumulate the number of row deleted */
        savedDeletedLineitems = sqlca.sqlerrd[2];   /*kbs*/

#ifdef UF2DEBUG
        fprintf (myoutstream, "in loop for update pair number %d set %d
chunk %d\n",
              updatePair, thisConcurrentDelete,UF_chunk);
        fflush(myoutstream);
#endif
```

```
        /* delete the orders now */

        EXEC SQL DELETE FROM TPCD.ORDERS
        WHERE O_ORDERKEY IN
          (SELECT O_ORDERKEY FROM TPCDTEMP.ORDERS_DEL
WHERE APP_ID = :UF_chunk);
           /*AND 12*(YEAR(O_ORDERDATE)-
1992)+MONTH(O_ORDERDATE)-01 = :month;*/

        if (sqlca.sqlcode < 0)
          sqlcode = error_check();

        if (sqlcode == SQL_RC_E911)
        {       /* we've hit a deadlock */
#ifdef UF2DEBUG
  fprintf (myoutstream, "orders deadlocked\n");
  fflush(myoutstream);
#endif
          fprintf (myoutstream,
          "\nA deadlock detected while deleting from ORDERS: update
pair %d set %d chunk %d.  Retrying.\n",
          updatePair, thisConcurrentDelete, UF_chunk);
          dumpCa(&sqlca);
          SleepSome(UF_DEADLOCK_SLEEP);
          maxwait++;      /* jen DEADLOCK */
        }
        else if (sqlcode < 0)
        {
#ifdef UF2DEBUG
  fprintf (myoutstream, "orders failed\n");
  fflush(myoutstream);
#endif
          fprintf (myoutstream,"\nAn error %d occurred deleting from
TPCD.ORDERS\n",sqlca.sqlcode);
          dumpCa(&sqlca);
          fprintf (myoutstream,"for update pair number %d set %d
chunk %d..Exiting\n",
                updatePair, thisConcurrentDelete,UF_chunk);
          rc=-1;
        }
        else
        {
#ifdef UF2DEBUG
  fprintf (myoutstream, "orders succeeded\n");
  fflush(myoutstream);
#endif
          /* accumulate the number of row deleted */
          /* Order count ONLY updated if both orders and lineitem */
          /* go through */
          deletedLineitems += savedDeletedLineitems;   /* kbs */
          deletedOrders += sqlca.sqlerrd[2];
          rc=0;
          EXEC SQL COMMIT WORK;
          error_check();
#ifdef UF2DEBUG
          /* report the number of rows deleted */
          fprintf(myoutstream, "    interim %ld rows for chunk %d from
TPCD.ORDERS at %*.*s\n",

deletedOrders,UF_chunk,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
                get_time_stamp(T_STAMP_FORM_1,(Timer_struct
*)NULL));  /* TIME_ACC jen*/
          fprintf(myoutstream, "    interim %ld rows for chunk %d from
TPCD.LINEITEM at %*.*s\n",

deletedLineitems,UF_chunk,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
                get_time_stamp(T_STAMP_FORM_1,(Timer_struct
*)NULL));  /* TIME_ACC jen*/
          fprintf( myoutstream,
                "    deletes for update pair %d chunk %d complete at
%*.*s\n\n",
                updatePair, UF_chunk,
                T_STAMP_1LEN,T_STAMP_1LEN,  /* TIME_ACC jen*/
                get_time_stamp(T_STAMP_FORM_1,
                        (Timer_struct *)NULL));  /* TIME_ACC jen*/
#endif
          }
        } /* process orders  deletes */
      } /* while trying to delete one chunk loop */
    } /* while there are more chunks */

#ifdef UF2DEBUG
    fprintf (myoutstream, "after loop\n");
    fflush(myoutstream);
#endif
    /* report the number of row deleted */
    fprintf(myoutstream, "%ld rows deleted from TPCD.ORDERS at
%*.*s\n",
          deletedOrders,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));
/* TIME_ACC jen*/
    fprintf(myoutstream, "%ld rows deleted from TPCD.LINEITEM at
%*.*s\n",
          deletedLineitems,T_STAMP_1LEN,T_STAMP_1LEN,  /*
TIME_ACC jen*/
          get_time_stamp(T_STAMP_FORM_1,(Timer_struct *)NULL));
/* TIME_ACC jen*/

    if (sqlca.sqlcode < 0)
    {
      fprintf (myoutstream,"# of deadlocks %d exceeds %i\n",
maxwait,MAXWAIT);
      rc=-1;
      EXEC SQL ROLLBACK WORK;
      error_check();                /* @d22275 tjg */
    }

/* UF2_conn_reset:  */                  /*971101jen*/
    EXEC SQL CONNECT RESET;
    error_check();                /* @d22275 tjg */


UF2_exit:
    fclose (myoutstream);

    /* exiting, increment the semaphore */
#ifndef SQLWINT
    /* we used the tpcd.setup file to generate the semaphore key
begin SEMA */
    if (getenv("TPCD_AUDIT_DIR") != NULL)
    {
      sprintf(sourcefile, "%s%ctools%ctpcd.setup",
            getenv("TPCD_AUDIT_DIR"), PATH_DELIM, PATH_DELIM);
    }
    else
    {
      fprintf (stderr, "Can't open UF2 semaphore file TPCD_AUDIT_DIR
is not defined.\n");
      exit (-1);
    }

    su_semkey = ftok (sourcefile, 'D');   /* use D for deletes */
    /* end SEMA */
    while ((su_semid = semget(su_semkey,1,0)) < 0)
    {
      if (errno == ENOENT)
        sleep(2);
```

```
    else {
      fprintf(stderr,"UF2 update stream %d: semget failed errno =
%d\n",
              updatePair, errno);
      exit(1);
    }
  }
  if (sem_op (su_semid, 0, 1) != 0 )     /*jenSEM*/
  {                                      /*jenSEM*/
    fprintf(stderr,"Failure to increment semaphone UF2 set %d\n",
thisConcurrentDelete);
    exit(1);
  }                                                  /*jenSEM*/

#else
  sprintf (UF2_semfile, "%s.%s.UF2.semfile",
        getenv("TPCD_DBNAME"), getenv("USER"));
  fprintf(stderr,"UF2 semfile = %s\n",UF2_semfile);
  while ((su_hSem = OpenSemaphore(SEMAPHORE_ALL_ACCESS |
                          SEMAPHORE_MODIFY_STATE |
                          SYNCHRONIZE,
                          TRUE,
                          UF2_semfile))
      == (HANDLE)(NULL)) {
    /*
    ** if cannot open the semaphore, wait for 0.1 second
    */
    fprintf(stderr,"Retry Open semaphore %s\n", UF2_semfile);

    SleepSome(1);
  }

  if (! ReleaseSemaphore(su_hSem,
                  1,
                  (LPLONG)(NULL)))
  {
    fprintf(stderr, "ReleaseSemaphore failed, LastError: %d, quit\n",
          GetLastError());
    exit(-1);
  }
#endif

  exit(rc);                  /* child exiting after finishing up */

}
```

D.4 Makefile

```
#############################################################
#############

# MAKEFILE for tpcdbatch program
# Enter the Following:
#
#     make tpcdbatch     -- makes tpcdbatch
#
#     make cleanup       -- removes builds from tpcdbatch program
#
#############################################################
#############

DB=tpcd

BASE=$(HOME)/sqllib
##COMPILE_FLAGS= -c -DSQLAIX -I$(BASE)/include -g -
qmaxmem=-1 -q64
COMPILE_FLAGS= -c -DSQLAIX -I$(BASE)/include -O2 -qmaxmem=-
1 -q64
#COMPILE_FLAGS= -c -DSQLAIX -I$(BASE)/include -g

# if using an installed db2 image use the 2nd link_flags value
LINK_FLAGS= -o $@ -L$(BASE)/lib -ldb2 -q64 -lm
#LINK_FLAGS= -o $@ -L/usr/lpp/db2_05_00/lib -ldb2
COMPILER=xlc
LIB_LINKER=ld
LIB_LINK_FLAGS= -o $@ -H512 -T512 -bE:$@.exp -L$(BASE)/lib -
ldb2 -lc

cleanup :
        rm -f tpcdbatch tpcdbatch.bnd tpcdbatch.o tpcdbatch.c
tpcdbatch.u tpcdUF.bnd tpcdUF.o tpcdUF.c tpcdUF.u 2>/dev/null

all : tpcdbatch


tpcdbatch.c : tpcdbatch.sqc
        @echo 'connect to $(DB) \n prep tpcdbatch.sqc BINDFILE
PACKAGE ISOLATION RR BLOCKING ALL OPTLEVEL 1 DATETIME
ISO \n connect reset \n terminate \n' | db2 -c +p -v +t

tpcdUF.c : tpcdUF.sqc
        @echo 'connect to $(DB) \n prep tpcdUF.sqc BINDFILE
PACKAGE ISOLATION RR BLOCKING ALL OPTLEVEL 1 DEGREE 1
DATETIME ISO \n connect reset \n terminate \n' | db2 -c +p -v +t

tpcdbatch : tpcdUF.c tpcdbatch.c
            $(COMPILER) $(COMPILE_FLAGS) tpcdUF.c
            $(COMPILER) $(COMPILE_FLAGS) tpcdbatch.c
            $(COMPILER) $(LINK_FLAGS) tpcdUF.o tpcdbatch.o
```

D.5 Runpower

```
:   # -*-Perl-*-

eval 'exec perl5 -S $0 ${1+"$@"}' # Horrible kludge to convert this
    if 0;                  # into a "portable" perl script

# usage  runpower [UF]
# where UF is the optional parameter that says to run the power test
# with the update functions.  By default, the update functions are not
# run

push(@INC, split(':', $ENV{'PATH'}));

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

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

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

if (@ARGV > 0)
{
   $runUF=$ARGV[0];
}
else
{
   $runUF="no";
}


if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
```

```
{
  die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_RUN_DIR"}) <= 0)
{
  die "TPCD_RUN_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_DBNAME"}) <= 0)
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_RUNNUMBER"}) <= 0)
{
  die "TPCD_RUNNUMBER environment variable not set\n";
}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
if (length($ENV{"TPCD_PATH_DELIM"}) <= 0)
{
  die "TPCD_PATH_DELIM environment variable not set\n";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
  die "TPCD_PRODUCT environment variable not set\n";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
    die "Must set TPCD_AUDIT env't var.  Real audit timing sequence
run if yes\n";
}
if (length($ENV{"TPCD_PHYS_NODE"}) <= 0)
{
    die "TPCD_PHYS_NODE env't var not set\n";
}
if (length($ENV{"TPCD_LOG_DIR"}) <= 0)
{
    $ENV{"TPCD_LOG_DIR"} = "NULL";
}
if (length($ENV{"TPCD_MODE"}) <= 0)
{
  die "TPCD_MODE environment variable not set - uni/smp/mln \n";
}
if (length($ENV{"TPCD_ROOTPRIV"}) <= 0)
{
  die "TPCD_ROOTPRIV environment variable not set - yes/no \n";
}

#set up local variables
$runNum=$ENV{"TPCD_RUNNUMBER"};
$runDir=$ENV{"TPCD_RUN_DIR"};
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$dbname=$ENV{"TPCD_DBNAME"};
$sf=$ENV{"TPCD_SF"};
$platform=$ENV{"TPCD_PLATFORM"};
$delim=$ENV{"TPCD_PATH_DELIM"};
$gatherstats=$ENV{"TPCD_GATHER_STATS"};
$product=$ENV{"TPCD_PRODUCT"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$inlistmax=$ENV{"TPCD_INLISTMAX"};
$pn=$ENV{"TPCD_PHYS_NODE"};
$logDir=$ENV{"TPCD_LOG_DIR"};
$rootPriv=$ENV{"TPCD_ROOTPRIV"};
$mode=$ENV{"TPCD_MODE"};
if (( $mode eq "uni" ) || ( $mode eq "smp" ))
{
  $all_ln="once";
  $all_pn="once";
  $once="once";
}
else
{
  $all_ln="all_ln";
  $all_pn="all_pn";
  $once="once";
}


if ($inlistmax eq "default")
{
  $inlistmax = 400;
}

# the auditruns directory is where we have already generate the sql
files for the
# updates and the power tests

# append isolation level information about tpcdbatch to the miso file
# the miso file is created here but appended to for power and
throughput
#information

$misofile="$runDir${delim}miso$runNum";
if ( -e $misofile )
{
    &rm("$misofile");
}
# if we are in real audit mode then we must start the db manager now
since
# there must be no activity on the database between the time the build
script
# has finished and the time the power test is started
if ( $RealAudit eq "yes" )
{
    $rc=system("db2start");
    if ( $rc != 0 )
    {
        die "failure during db2start rc = $rc \n";
    }
    $rc=system("db2 activate database $dbname");
    if ( $rc != 0 )
    {
        die "failure during db2 activate rc = $rc \n";
    }
}

# do not activate the database
#if ( $RealAudit ne "yes" )
#{
#    system("db2 activate database $dbname");
#}



#Report current log info to the run# directory in a file called
startLog.Info
print "getLogInfo.pl\n";
#system("perl getLogInfo.pl startLog");

open(MISO, ">$misofile") || die "Can't open $misofile: $!\n";
$curTs = `perl gettimestamp "long"`;
print MISO "Timestamp and isolation level of tpcdbatch before power
run at : $curTs\n";
close(MISO);
if ( $product eq "pe" )
```

```
{
   system("db2 \"connect to $dbname\"; db2 \"select
name,creator,valid,unique_id,isolation from sysibm.sysplan where
name like 'TPCD%'\"; db2 connect reset; db2 terminate  >>
$runDir${delim}miso$runNum ");
}
else
{
   &verifyTPCDbatch("$misofile","$dbname");
}

print "finished sub\n";
if ($platform eq "aix")
{

  # Create the sysunused file.  This reports what disks are attached,
and which
  # ones are being used.  Its use spans both the runpower and
runthroughtput tests
  system("echo \"The following disks are assigned to the indicated
volume groups\" > $runDir/sysunused$runNum") && die "cannot create
$runDir/sysunused$runNum";

  system("lspv >> $runDir/sysunused$runNum");
  system("echo \"The following volume groups are currently online\" >>
$runDir/sysunused$runNum");
  $curTs = `perl gettimestamp "long"`;
  system("echo \"$curTs\" >> $runDir/sysunused$runNum");
  system("lsvg -o >> $runDir/sysunused$runNum");
  # show the disks that are used/unused
  system("getdisks \"Before the start of the Power Test\"");

}
else
{
  # for all other platforms
  system("echo Assume that all portions of the system are used >>
$runDir${delim}sysunused$runNum");
}

&getConfig("p");
if ( $rootPriv eq "yes" )
{
   # get the o/s tuning parameters...currently AIX only and only if your
   # user has root privileges to run this
   &getOSTune("p");
}
if ($gatherstats eq "on")
{
   # gather vm io and net stats
   if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx" ||
      $platform eq "hp")
   {
     # gather vmstats and iostats (and net stats if in mpp mode)
     system("perl getstats p &");
   }
   else
   {
      print "Stats gather not set up for current platform $platform\n";
   }
}

# print to screen what type of run is running and set variables to run
# the query and update streams in parallel
if ($runUF ne "UF")
{
   $semcontrol = "off";
   print "Beginning power stream....no update functions\n";

   $streamEx = "";
   $streamExNT = "";
}
else
{
   $semcontrol = "on";
   print "Beginning power stream....with update functions\n";
   if ( $platform eq "nt" )
   {
     $streamExNT = "start /b";
     $streamEx = "";
   }
   else
   {
     $streamExNT = "";
     $streamEx = "&";
   }
}

# bbe This new line (below) runs queries for power test
# AZ COMMENTED OUT THIS SO IT DOES NOT RUN THE 22
QUERIES
$ret=system("$streamExNT
$auditDir${delim}auditruns${delim}tpcdbatch -d $dbname -f
$runDir${delim}qtextpow.sql -r on -b on -s $sf -u p1 -m $inlistmax -n 0 -
l $auditDir${delim}auditruns${delim}querytext${delim}streampow.list -p
$semcontrol $streamEx");


if ( $runUF eq "UF" )
{
  $ret2 = system("$auditDir${delim}auditruns${delim}tpcdbatch -d
$dbname -f $runDir${delim}qtextquf.sql -r on -b on -s $sf -u p2 -m
$inlistmax -n 0 -l
$auditDir${delim}auditruns${delim}querytext${delim}streampuf.list");
}
else
{
   $ret2 = 0; # If UFs were not running, then the stream cannot fail
}


if (($ret2 == 0) && ($ret == 0))
{
   print "Power stream completed succesfully.\n";
}
else
{
   print "Power stream failed. ret=$ret\n";
}

if ($platform eq "aix")
{
   # show that the same disks are still used or unused
   system("getdisks \"After completion of the Power Test\"");

   #clean up
}
if ($gatherstats eq "on")
{
   # gather vm io and net stats
   if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx")
   {
     # kill the stats that were being gathered
      if ($platform eq "ptx")
      {
         $rc= `perl5 zap "-f" "sar"`;
         $rc= `perl5 zap "-f" "sadc"`;
      }
      else
      {
```

```
        $rc= `perl5 zap "-f" "vmstat"`;
##        system("rsh 9.114.26.3 -n '~/tpcd/tools/zap -f vmstat'");
##        system("rsh 9.114.26.5 -n '~/tpcd/tools/zap -f vmstat'");
        $rc= `perl5 zap "-f" "iostat"`;
      }
      if ( $pn > 1 )
      {
        $rc= `perl5 zap "-f" "netstat"`;
      }
      $rc= `perl5 zap "-f" "getstats"`;
           $rc= `perl5 zap "-f" "dfstat"`;
           $rc= `perl5 zap "-f" "entstatt"`;
           $rc= `perl5 zap "-f" "alstat"`;
  }
}

open(MISO, ">>$misofile") || die "Can't open $misofile: $!\n";
$curTs = `perl gettimestamp "long"`;
print MISO "Timestamp and isolation level of tpcdbatch after power run
at : $curTs\n";
close(MISO);

if ( $product eq "pe" )
{
   system("db2 \"connect to $dbname\"; db2 \"select
name,creator,valid,unique_id,isolation from sysibm.sysplan where
name like 'TPCD%'\";db2 connect reset;db2 terminate  >>
$runDir${delim}miso$runNum");
}
else
{
   &verifyTPCDbatch("$misofile","$dbname");
}
if ( $RealAudit ne "yes" )
{
   $curTs = `perl gettimestamp "short"`;
   # grab the db and dbm snapshot before we deactivate
   system("db2 get snapshot for all on $dbname >
$runDir${delim}dbrun$runNum.snap.$curTs");
   system("db2 get snapshot for database manager >>
$runDir${delim}dbrun$runNum.snap.$curTs");
}

######################

# now copy the reports from the count of streams files into one final file
&cat("$runDir${delim}pstrcnt*","$runDir${delim}mpstrcnt$runNum");
#(NOTE: there is a dependancy that this mpstrcnt file exist before the
# calcmetrics.pl script is called, both because it is used as input for
# calcmetrics.pl, and because the output from calcmetrics is used as
# the trigger for watchstreams to complete, and watchstreams cats its
# output at the end of the mstrcnt file.

# generate the mpinter?.metrics file in the run directory
#require 'calcmetricsp.pl';
if ( $runUF eq "UF")
{
  system("perl calcmetricsp.pl UF");
}
else
{
  system("perl calcmetricsp.pl");
}

# concatenate all the throughput inter files that were used to
# generate these results into the calcmetrics output file
(mpinterX.metrics)
#cd $TPCD_RUN_DIR
&cat("$runDir${delim}mpqinter*","$runDir${delim}mpinter$runNum.metr
ics");

if ($runUF eq "UF") {

&cat("$runDir${delim}mpufinter*","$runDir${delim}mpinter$runNum.met
rics");
}

#if ($runUF eq "no") {
#  &rm("$runDir${delim}mpuf*");
#}

######################

# no longer activate/deactivate the database
#if ( $RealAudit ne "yes" )
#{
#   # deactivate the database
#   system("db2 deactivate database $dbname");
#}

# do not stop the database after the power test
#if ( $RealAudit ne "yes" )
#{
#   system("db2stop");
#}

1;

sub getConfig
{
  $testtype=$_[0];
  print "Getting database configuration.\n";
  $dbtunefile="$runDir${delim}m${testtype}dbtune${runNum}";
  open(DBTUNE, ">$dbtunefile") || die "Can't open $dbtunefile: $!\n";
  $timestamp=`perl gettimestamp "long"`;
  print DBTUNE "Database and Database manager configuration taken
at : $timestamp";
  # get library info for tsumami
  print DBTUNE "\nLIBRARYS\n--------\n";
  close(DBTUNE);
  system("ls -l /install/libs/*.current >> $dbtunefile");
  system("ls -lL /install/libs/*.current >> $dbtunefile");

  system("ls -l ~/tpcd/custom/bpvars.cfg >> $dbtunefile");
  system("cat ~/tpcd/custom/bpvars.cfg >> $dbtunefile");

  system("db2level >> $dbtunefile");
  system("db2 get database configuration for $dbname >>
$dbtunefile");
  system("db2 get database manager configuration >> $dbtunefile");
  system("db2set >> $dbtunefile");
  if (( $mode eq "mln" ) || ( $mode eq "mpp"))
  {
     $cfgfile="$runDir${delim}dbtune${runNum}.";
     #removed by Alex due to hang
     #system("db2_all '||\" typeset -i ln=##; db2 get db cfg for $dbname >
$cfgfile\${ln} ; db2 get dbm cfg >> $cfgfile\${ln}; db2set >>
$cfgfile\${ln}; db2 terminate '");
  }

}

sub getOSTune
{
  $testtype=$_[0];
  if ( $platform eq "aix" )
  {
     print "Getting OS and VMdatabase configuration.\n";
     $ostunefile="$runDir${delim}m${testtype}ostune${runNum}";
```

```
    #open(OSTUNE, ">$ostunefile") || die "Can't open $ostunefile:
$!\n";
    #$timestamp=`perl gettimestamp "long"`;
    #print OSTUNE "Operating System and Virtual Memory
configuration taken at : $timestamp";
    #close(OSTUNE);

#system("${delim}usr${delim}samples${delim}kernel${delim}schedtune
>> $ostunefile");
    #system("rah
'${delim}usr${delim}samples${delim}kernel${delim}vmtune >>
$ostunefile'");
    system("rah
'${delim}usr${delim}samples${delim}kernel${delim}vmtune >>
$ostunefile");
  }
  else
  {
    print "OS parameters retrieval not supported for $platform \n";
  }

}

sub verifyTPCDbatch
{
  $logfile=$_[0];
  $dbname=$_[1];
  $file="verifytpcdbatch.clp";
  open(VERTBL, ">$file") || die "Can't open $file: $!\n";
  print VERTBL "connect to $dbname;\n";
  print VERTBL "select name,creator,valid,last_bind_time,isolation from
sysibm.sysplan where name like 'TPCD%';\n";
  print VERTBL "connect reset;\n";
  print VERTBL "terminate;\n";
  close(VERTBL);
  system("db2 -vtf $file >> $logfile");
}
```

D.6 Runthroughput

```
:   # -*-Perl-*-

eval 'exec perl5 -S $0 ${1+"$@"}' # Horrible kludge to convert this
    if 0;                         # into a "portable" perl script

# usage  runthroughput [UF]
# where UF is the optional parameter that says to run the throughput
test
# with the update functions.  By default, the update functions are not
# run
# If UF is not supplied and a number is supplied, then that number is
taken
# as the number of concurrent throughput streams to run.  This is also
optional

push(@INC, split(':', $ENV{'PATH'}));

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

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

$runUF="no";
if (@ARGV > 0)
{
  if ($ARGV[0] eq "UF")
  {
    $runUF=$ARGV[0];
  }
}

if (length($ENV{"TPCD_AUDIT_DIR"}) <= 0)
{
  die "TPCD_AUDIT_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_RUN_DIR"}) <= 0)
{
  die "TPCD_RUN_DIR environment variable not set\n";
}
if (length($ENV{"TPCD_DBNAME"}) <= 0)
{
  die "TPCD_DBNAME environment variable not set\n";
}
if (length($ENV{"TPCD_RUNNUMBER"}) <= 0)
{
  die "TPCD_RUNNUMBER environment variable not set\n";
}
if (length($ENV{"TPCD_NUMSTREAM"}) <= 0)
{
  die "TPCD_NUMSTREAM environment variable not set\n";
}
if (length($ENV{"TPCD_RUN_ON_MULTIPLE_NODES"}) <= 0)
{
  die "TPCD_RUN_ON_MULTIPLE_NODES environment variable not
set\n";

}
if (length($ENV{"TPCD_SF"}) <= 0)
{
  die "TPCD_SF environment variable not set\n";
}
if (length($ENV{"TPCD_PRODUCT"}) <= 0)
{
  die "TPCD_PRODUCT environment variable not set\n";
}
if (length($ENV{"TPCD_PLATFORM"}) <= 0)
{
  die "TPCD_PLATFORM environment variable not set\n";
}
if (length($ENV{"TPCD_AUDIT"}) <= 0)
{
    die "Must set TPCD_AUDIT env't var.  Real audit timing sequence
run if yes\n";
}
if (length($ENV{"TPCD_LOG_DIR"}) <= 0)
{
   $ENV{"TPCD_LOG_DIR"} = "NULL";
}
if (length($ENV{"TPCD_MODE"}) <= 0)
{
  die "TPCD_MODE environment variable not set - uni/smp/mln \n";
}
if (length($ENV{"TPCD_ROOTPRIV"}) <= 0)
{
  die "TPCD_ROOTPRIV environment variable not set - yes/no \n";
}

#set up local variables
$runNum=$ENV{"TPCD_RUNNUMBER"};
$numStream=$ENV{"TPCD_NUMSTREAM"};
$runDir=$ENV{"TPCD_RUN_DIR"};
$auditDir=$ENV{"TPCD_AUDIT_DIR"};
$dbname=$ENV{"TPCD_DBNAME"};
$sf=$ENV{"TPCD_SF"};
```

```
$product=$ENV{"TPCD_PRODUCT"};
$multinode=$ENV{"TPCD_RUN_ON_MULTIPLE_NODES"};
$platform=$ENV{"TPCD_PLATFORM"};
$delim=$ENV{"TPCD_PATH_DELIM"};
$RealAudit=$ENV{"TPCD_AUDIT"};
$inlistmax=$ENV{"TPCD_INLISTMAX"};
$gatherstats=$ENV{"TPCD_GATHER_STATS"};
$logDir=$ENV{"TPCD_LOG_DIR"};
$rootPriv=$ENV{"TPCD_ROOTPRIV"};
$mode=$ENV{"TPCD_MODE"};

$path="$auditDir${delim}auditruns";

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

# return 1 if the given pattern(parameter $_[0]) matches any file
sub existfile {
  if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx")
  {
    `ls $_[0] 2> /dev/null | wc -l` + 0 != 0;
  }
  else
  {
    `dir /b $_[0] 2> NUL | wc -l` + 0 != 0;
  }
}

if ($inlistmax eq "default")
{
   $inlistmax = 400;
}

# no longer stop and start the dbm between runs when not in realaudit
mode
#if ( $RealAudit ne "yes" )
#{
#    # if we are not in real audit mode then we must start the db
manager now
#    system("db2start");
#    # activate the database
#    system("db2 activate database $dbname");
#}

$misofile="$runDir${delim}miso$runNum";
# append isolation level information about tpcdbatch to the miso file
open(MISO, ">>$misofile") || die "Can't open $misofile: $!\n";
$curTs = `perl gettimestamp "long"`;
print MISO "Timestamp and isolation level of tpcdbatch before
throughput run at : $curTs\n";
close(MISO);

if ( $product eq "pe" )
{
   system("db2 \"connect to $dbname\"; db2 \"select
name,creator,valid,unique_id,isolation from sysibm.sysplan where
name like 'TPCD%'\" >> $runDir${delim}miso$runNum ");
}
else
{
   &verifyTPCDbatch("$misofile","$dbname");
}

# kick off the script that will monitor for the database applications
during
# the running of the throughput tests.  This will quit when the
mtinterX.metrics
# (where X=runnumber) file has been created.

# set variables to run streams in parallel
if ( $platform eq "nt" )
{
  $streamExNT = "start /b";
  $streamEx = "";
}
else

{
  $streamExNT = "";
  $streamEx = "&";
}
if ( $platform eq "aix"  || $platform eq "sun" || $platform eq "nt" ||
$platform eq "hp")
{
   system("$streamExNT perl watchstreams $streamEx");
}
else
{
   die "platform not supported, can't start watchstreams in
background";
}

# show the disks that are used/unused
if ($platform eq "aix")
{
   system("getdisks \"Before the start of the Throughput Test\"");
}

  &getConfig("t");
  if ( $rootPriv eq "yes" )
  {
     # get the o/s tuning parameters...currently AIX only and only if your
     # user has root privileges to run this
     &getOSTune("t");
  }

if ($gatherstats eq "on")
{
   # gather vm io and net stats
   if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx" ||
$platform eq "hp")
   {
      # gather vmstats and iostats (and net stats if in mpp mode)
      system("perl getstats t &");
   }
   else
   {
      print "Stats gather not set up for current platform $platform\n";
   }
}

if ( $multinode ne "yes" )
{
  # we are running the query streams and update stream from the same
node or
  # from a serial db....use semaphores for control of the update stream

  # the auditruns directory is where we have already generated the sql
files
  # for the updates and the power tests
```

```
  $loopStream=1;

  for ( $loopStream = 1; $loopStream <= $numStream; $loopStream++)
  {
    print "starting stream $loopStream\n";
    system("echo Executing stream $loopStream out of $numStream.");
    # run the queries
    if ( $platform eq "aix" || $platform eq "sun" || $platform eq "nt" ||
$platform eq "ptx" ||
        $platform eq "hp" )
    {
       system("$streamExNT $path${delim}tpcdbatch -d $dbname -f
$runDir${delim}qtextt$loopStream.sql -r on -b on -s $sf -u t1 -m
$inlistmax -n $loopStream -l
$path${delim}querytext${delim}stream$loopStream.list $streamEx");
    }
    else
    {
       die "platform $platform not supported yet";
    }
  }

  # run the update function stream....this will wait until the queries have
  # completed to kick off the updates
    print "starting update stream\n";

  if ($runUF eq "no") {
    $ret=system("$auditDir${delim}auditruns${delim}tpcdbatch -d
$dbname -f $runDir${delim}quft.sql -r on -b on -s $sf -u t -m $inlistmax
-n $numStream -l $runDir${delim}streamuf.list");
  }
  else {
    $ret=system("$auditDir${delim}auditruns${delim}tpcdbatch -d
$dbname -f $runDir${delim}quft.sql -r on -b on -s $sf -u t2 -m $inlistmax
-n $numStream -l $runDir${delim}streamuf.list");
  }
  print "update stream done\n";

}
else
{
  # we are running the query streams and update stream from different
nodes, use
  # files and rksh to control the update stream
  system("runthru.pe");
}

if ($platform eq "aix")
{
    # show the disks that are used/unused
    system("getdisks \"After the completion of the Throughput Test\"");
}
if ($gatherstats eq "on")
{
    # gather vm io and net stats
    if ($platform eq "aix" || $platform eq "sun" || $platform eq "ptx")
    {
      # kill the stats that were being gathered
       if ($platform eq "ptx")
       {
          $rc= `perl5 zap "-f" "sar"`;
          $rc= `perl5 zap "-f" "sadc"`;
       }
       else
       {
          $rc= `perl5 zap "-f" "vmstat"`;
#           system("rsh 9.114.26.3 -n '~/tpcd/tools/zap -f vmstat'");
#           system("rsh 9.114.26.5 -n '~/tpcd/tools/zap -f vmstat'");
          $rc= `perl5 zap "-f" "iostat"`;
       }
       if ( $pn > 1 )
       {
          $rc= `perl5 zap "-f" "netstat"`;
       }
       $rc= `perl5 zap "-f" "getstats"`;
       $rc= `perl5 zap "-f" "dfstat"`;
             $rc= `perl5 zap "-f" "entstatt"`;
             $rc= `perl5 zap "-f" "alstat"`;
    }
}

open(MISO, ">>$misofile") || die "Can't open $misofile: $!\n";
$curTs = `perl gettimestamp "long"`;
print MISO "Timestamp and isolation level of tpcdbatch after
throughput run at : $curTs\n";
close(MISO);

if ( $product eq "pe" )
{
    system("db2 \"connect to $dbname\"; db2 \"select
name,creator,valid,unique_id,isolation from sysibm.sysplan where
name like 'TPCD%'\" >> $runDir${delim}miso$runNum");
}
else
{
   &verifyTPCDbatch("$misofile","$dbname");
}

if ( $RealAudit ne "yes" )
{
    $curTs = `perl gettimestamp "short"`;
    # grab the db and dbm snapshot before we deactivate
    system("db2 get snapshot for all on $dbname >
$runDir${delim}dbTrun$runNum.snap.$curTs");
    system("db2 get snapshot for database manager >>
$runDir${delim}dbTrun$runNum.snap.$curTs");
}

# now copy the reports from the count of streams files into one final file
&cat("$runDir${delim}strcnt*","$runDir${delim}mstrcnt$runNum");
#(NOTE: there is a dependancy that this mstrcnt file exist before the
# calcmetrics.pl script is called, both because it is used as input for
# calcmetrics.pl, and because the output from calcmetrics is used as
# the trigger for watchstreams to complete, and watchstreams cats its
# output at the end of the mstrcnt file.

# generate the mtinter?.metrics file in the run directory
#require 'calcmetrics.pl';

if ( $runUF ne "no")
{
  system("perl calcmetrics.pl $numStream UF");
}
else
{
  system("perl calcmetrics.pl $numStream");
}

# concatenate all the throughput inter files that were used to
# generate these results into the calcmetrics output file
(mtinterX.metrics)
#cd $TPCD_RUN_DIR
&cat("$runDir${delim}mts*inter*","$runDir${delim}mtinter$runNum.metri
cs");

if ($runUF ne "no") {

&cat("$runDir${delim}mtufinter*","$runDir${delim}mtinter$runNum.metri
cs");
```

```
}

if (&existfile("$runDir${delim}mp*")) {
  # generate the mplot stuff
  system("gen_mplot");

  # generate the mlog information file
#  require 'buildmlog';
}

#if ($runUF eq "no") {
#  &rm("$runDir${delim}mtuf*");
#}

# deactivate the database  this needs to remain at the end of run
throughput so
# asynchronous writing of the log files completes.
system("db2 deactivate database $dbname");
$rc=&dodb_noconn("db2 get db cfg for $dbname | grep -i log >>
$runDir${delim}endLog.Info",$all_ln);
if ( $logDir ne "NULL" )
{
    $rc=&dodb_noconn("$dircmd $logDir >>
$runDir${delim}endLog.Info",$all_ln);
}

#system("db2_all \"]}db2 get db cfg for tpcd | grep -i log >>
$runDir${delim}endLog.Info ; db2 terminate\' ");
#system("ls -ltra /node??vg.log/NODE00* >>
$runDir${delim}endLog.Info");

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


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

#Report current log info to the run# directory in a file called endLog.Info
system("perl getLogInfo.pl endLog");

# if we are in audit mode we must do a db2stop at the end of the
power/throughput run
if ( $RealAudit eq "yes" )
{
    system("db2stop");
}

1;

sub getConfig
{
  $testtype=$_[0];
  print "Getting database configuration.\n";
  $dbtunefile="$runDir${delim}m${testtype}dbtune${runNum}";
  open(DBTUNE, ">$dbtunefile") || die "Can't open $dbtunefile: $!\n";
  $timestamp=`perl gettimestamp "long"`;
  print DBTUNE "Database and Database manager configuration taken
at : $timestamp";

  # get library info for tsumami
  print DBTUNE "\nLIBRARYS\n--------\n";
  close(DBTUNE);
  system("ls -l /install/libs/*.current >> $dbtunefile");
  system("ls -lL /install/libs/*.current >> $dbtunefile");

  system("ls -l ~/tpcd/custom/bpvars.cfg >> $dbtunefile");
  system("cat ~/tpcd/custom/bpvars.cfg >> $dbtunefile");
  system("db2level >> $dbtunefile");
  system("db2 get database configuration for $dbname >>
$dbtunefile");
  system("db2 get database manager configuration >> $dbtunefile");
  system("db2set >> $dbtunefile");

}

sub getOSTune
{
  $testtype=$_[0];
  if ( $platform eq "aix" )
  {
      print "Getting OS and VMdatabase configuration.\n";
      $ostunefile="$runDir${delim}m${testtype}ostune${runNum}";
      #open(OSTUNE, ">$ostunefile") || die "Can't open $ostunefile:
$!\n";
      #$timestamp=`perl gettimestamp "long"`;
      #print OSTUNE "Operating System and Virtual Memory
configuration taken at : $timestamp";
      #close(OSTUNE);

#system("${delim}usr${delim}samples${delim}kernel${delim}schedtune
>> $ostunefile");
      #system("rah
'${delim}usr${delim}samples${delim}kernel${delim}vmtune >>
$ostunefile'");
      system("rah
'${delim}usr${delim}samples${delim}kernel${delim}vmtune >>
$ostunefile");
  }
  else
  {
      print "OS parameters retrieval not supported for $platform \n";
  }

}

sub verifyTPCDbatch
{
  $logfile=$_[0];
  $dbname=$_[1];
  $file="verifytpcdbatch.clp";
  open(VERTBL, ">$file") || die "Can't open $file: $!\n";
  print VERTBL "connect to $dbname;\n";
  print VERTBL "select name,creator,valid,last_bind_time,isolation from
sysibm.sysplan where name like 'TPCD%';\n";
  print VERTBL "connect reset;\n";
  print VERTBL "terminate;\n";
  close(VERTBL);
  system("db2 -vtf $file >> $logfile");

}
```

D.7 ploaduf1

```
#!/bin/ksh


RFpair=$1;
db2 connect to tpcd
db2 "load from orders.tbl.u$RFpair.new of del modified by coldel|
fastparse  messages /dev/null replace into TPCDTEMP.ORDERS_new
nonrecoverable partitioned db config mode load_only part_file_location
/db/ufdata/links; "
db2 commit;
db2 "load from lineitem.tbl.u$RFpair.new of del modified by coldel|
fastparse messages /dev/null replace into TPCDTEMP.LINEITEM_new
```

```
nonrecoverable partitioned db config mode load_only part_file_location
/db/ufdata/links; "
db2 commit;
db2 connect reset
db2 terminate
```

D.8 ploaduf2

```
#!/bin/ksh


RFpair=$1;

db2 connect to tpcd

db2 "load from delete.$RFpair.new of del modified by coldel| fastparse
messages /dev/null replace into TPCDTEMP.ORDERS_del
nonrecoverable partitioned db config mode load_only
part_file_location /db/ufdata/links; "

db2 connect reset
db2 terminate
```

Appendix - E ACID Transaction Source Code

E.1 acid.sqc

```
/*************************************************************************/

/*      File: acid.sqc                                                   */
/*************************************************************************/

/*   changes:
 *
 *  961109  jel    add EXEC SQL CLOSE for each cursor in acidT
 *                 to avoid bug in db2pe v1r2
 *  980225  gav    port to NT
 *  981103  kal    added ast_acidQ  for isolation test 7
 *  981103  kal    changed ast query to be the same as that used in
 *                 consistency tests.  Fixed so the long lEprice is
 *                 cast to a double.  Changed so uses 3 decimal points of
 *                 precision.
 *
 */

#include "acid.h"

#if (defined(SQLPTX) || defined(SQLWINT) || defined(SQLSUN) ||
defined(Linux))
double nearest(double);
#endif /* SQLPTX */


#define DEADLOCK -911

/*
#define TRUNC2(d) ((floor((d)*100.0))/100.0)
*/
/*
#define TRUNC2(d) ((floor(nearest((d)*100.0)))*0.01)
*/
/*
#define TRUNC2(d)  ((floor(nearest((d)*1000.0)/10.0)/100.0))
*/
#define TRUNC2(d)  ((floor(nearest((d)*100000.0)/1000.0)/100.0))

void sqlerror(char * , struct sqlca *);

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char dbname[8];   /* = "tpcd"; */
EXEC SQL END DECLARE SECTION;

#ifdef SQLWINT

 /*
 ** redefine gettimeofday so I don't have to
 ** change too much aix-specific code
 */
/*#typedef struct timeval { unsigned tv_sec; unsigned tv_usec; }; */
typedef struct timezone { int dummy; };
struct timeb timer;

 void gettimeofday( struct timeval *tv, struct timezone *tz)
 {
   ftime(&timer);
   tv->tv_sec = timer.time;
   tv->tv_usec = timer.millitm  * 1000;
   tz->dummy = 0;
 }
#endif

/*--------------------------------------------------------------*/
/*       acidQ                                                  */
/*--------------------------------------------------------------*/
int acidQ (struct acidQ_struct *acid)
{
   time_t timeT;
   FILE *out;
   char out_fn[50];
   struct timeval tv;
   struct timezone tz;
   int mypid;
   int rc = 0;


   EXEC SQL BEGIN DECLARE SECTION;
   sqlint32    okey;
   sqlint32    lEprice;
   double  eprice;
   EXEC SQL END DECLARE SECTION;

   okey = acid->o_key;

   /* mypid = getpid(); */
   mypid = acid->tag;

   sprintf(out_fn,
"%s%cacidQ.out.%d",getenv("TPCD_TMP_DIR"),del(),mypid);
   out=fopen(out_fn,"a");
   if (out == NULL)
   {
     fprintf(stderr, "ERROR input file %s could not be appended
to!!\n",out_fn);
    }

   gettimeofday(&tv, &tz);
   time(&timeT);
   fprintf(out,"\n---------- START of acidQ tag: %d ----------\n\n",mypid);
   fprintf(out, "acidQ tag: %d, begin transaction time: (%us %06uu) %s",
         mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
   fprintf(out, "okey: %d\n", okey);

   gettimeofday(&tv, &tz);
   time(&timeT);
   fprintf(out,"acidQ tag: %d, before read of LINEITEM: (%us %06uu)
%s",
         mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));

   /*
   ** use the same sql code as used in the consistsql.pl to
   ** run the consistency acid queries.  Note we assign an long int
   ** to lEprice (we make it 10s of pennies by * 1000).  Then divide
   ** by 1000.0 and cast it to a double (eprice) for printing
   */

   EXEC SQL
     SELECT

INTEGER(DECIMAL(SUM(DECIMAL(INTEGER(INTEGER(DECIMAL
        (INTEGER(100*DECIMAL(L_EXTENDEDPRICE,20,3)), 20,3) *
        (1-L_DISCOUNT)) * (1+L_TAX)),20,3)/100.0),20,3) * 1000)
      into :lEprice
     FROM
       TPCD.LINEITEM
     WHERE
       L_ORDERKEY = :okey;

   if (sqlca.sqlcode != 0) {
```

```
    rc = sqlca.sqlcode;
    fprintf(out,"acidQ **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    sqlerror("acidQ: select sum(l_extendedprice)", &sqlca);
    goto Qerror;
  }
  eprice = (double)lEprice / 1000.0;  /* translate to double for printout*/

  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"ACID tag: %d, after read of LINEITEM: (%us %06uu) %s",
        mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  fprintf(out, "okey: %d \t sum(l_extendedprice): %0.3f\n",
        okey, eprice);

  EXEC SQL COMMIT;
  if (sqlca.sqlcode != 0) {
    rc = sqlca.sqlcode;
    fprintf(out,"acidQ **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    sqlerror("acidQ: COMMIT", &sqlca);
    goto Qerror;
  }
  acid->l_extendedprice = eprice;

  rc = 0;
  goto Qexit;

 Qerror:
  EXEC SQL rollback work;
  if (sqlca.sqlcode != 0) sqlerror("acidQ: ROLLBACK FAILED", &sqlca);

 Qexit:
  fprintf(out,"\n---------- END of acidQ tag: %d ----------\n\n",mypid);
  fflush(out);fclose(out);
  return(rc);
}

/*---------------------------------------------------------------------*/
/*       ast_acidQ                                                     */
/*---------------------------------------------------------------------*/
int ast_acidQ (struct acidQ_struct *acid)
{
  time_t timeT;
  FILE *out;
  char out_fn[50];
  struct timeval tv;
  struct timezone tz;
  int mypid;
  int rc = 0;


  EXEC SQL BEGIN DECLARE SECTION;
  double    ast_lEprice;
  double    ast_eprice;
  EXEC SQL END DECLARE SECTION;


  /* mypid = getpid(); */
  mypid = acid->tag;

  sprintf(out_fn,
"%s%cast_acidQ.out.%d",getenv("TPCD_TMP_DIR"),del(),mypid);
  out=fopen(out_fn,"a");
  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"\n---------- START of ast_acidQ tag: %d ----------
\n\n",mypid);
  fprintf(out, "ast_acidQ tag: %d, begin transaction time: (%us %06uu)
%s",
        mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));

  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"ast_acidQ tag: %d, before read of LINEITEM: (%us
%06uu) %s",
        mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));

  /*
  ** use the same query acidQ except don't select for specfic okey.
  ** this ensures that the ast will be used instead of the base table
  ** Have to use ast_lEprice as double since this sum is so big
  */
  EXEC SQL
    SELECT
      SUM ( L_EXTENDEDPRICE*(1-L_DISCOUNT)*(1 + L_TAX))
      into :ast_lEprice
    FROM
      TPCD.LINEITEM;

  if (sqlca.sqlcode != 0) {
    rc = sqlca.sqlcode;
    fprintf(out,"ast_acidQ **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    sqlerror("ast_acidQ: select sum(l_extendedprice)", &sqlca);
    goto Qerror;
  }
  ast_eprice = ast_lEprice;  /* use ast_eprice  for printout to be
consistent*/

  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"AST_ACID tag: %d, after read of LINEITEM: (%us
%06uu) %s",
        mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  fprintf(out, "sum(l_extendedprice): %0.3f\n",
        ast_eprice);

  EXEC SQL COMMIT;
  if (sqlca.sqlcode != 0) {
    rc = sqlca.sqlcode;
    fprintf(out,"ast_acidQ **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    sqlerror("ast_acidQ: COMMIT", &sqlca);
    goto Qerror;
  }
  acid->l_extendedprice = ast_eprice;

  rc = 0;
  goto Qexit;

 Qerror:
  EXEC SQL rollback work;
  if (sqlca.sqlcode != 0) sqlerror("ast_acidQ: ROLLBACK FAILED",
&sqlca);

 Qexit:
  fprintf(out,"\n---------- END of ast_acidQ tag: %d ----------\n\n",mypid);
  fflush(out);fclose(out);
  return(rc);
}
/*---------------------------------------------------------------------*/
/*       acidT                                                         */
/*---------------------------------------------------------------------*/
int acidT (struct acidT_struct *acid)
{

  time_t timeT;
  FILE *out;
  char out_fn[50];
  struct timeval tv;
  struct timezone tz;
  int mypid;
  int rc = 0;
```

```
  EXEC SQL BEGIN DECLARE SECTION;
  sqlint32      o_key, l_key, delta;
  sqlint32      l_partkey, l_suppkey;
  double    l_quantity, l_tax, l_discount, l_extendedprice;
  double    o_totalprice;
  double    new_quantity, rprice, cost, new_extprice, new_ototal, ototal;
  EXEC SQL END DECLARE SECTION;

  EXEC SQL DECLARE l_cursor CURSOR FOR
    SELECT l_partkey, l_suppkey, l_quantity,
    l_tax, l_discount,
    l_extendedprice
      FROM tpcd.lineitem
      WHERE l_orderkey = :o_key
      AND l_linenumber = :l_key
      FOR UPDATE OF l_extendedprice, l_quantity;

  EXEC SQL DECLARE o_cursor CURSOR FOR
    SELECT o_totalprice
      FROM tpcd.orders
      WHERE o_orderkey = :o_key
      FOR UPDATE OF o_totalprice;

  if (acid->termination < 0 || acid->termination > 3) acid->termination =
0;
  o_key = acid->o_key;
  l_key = acid->l_key;
  delta = acid->delta;

  if (acid->logging) {
    /* mypid = getpid(); */
    mypid = acid->tag;
    sprintf(out_fn,
"%s%cacidT.out.%d",getenv("TPCD_TMP_DIR"),del(),mypid);
    out=fopen(out_fn,"a");
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"\n---------- START of acidT tag: %d ----------\n\n",mypid);
    fprintf(out, "acidT tag: %d, begin transaction time: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "o_key: %d\tl_key: %d\tdelta: %d\n", o_key, l_key,
delta);
  }
#ifdef DEBUG
  printf("o_key: %d\tl_key: %d\tdelta: %d\n", o_key, l_key, delta);
#endif

 retry_tran:

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, before read of LINEITEM: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  EXEC SQL OPEN l_cursor;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: OPEN l_cursor", &sqlca);
    goto Terror;
  }

  EXEC SQL FETCH l_cursor INTO
    :l_partkey, :l_suppkey, :l_quantity, :l_tax,
    :l_discount, :l_extendedprice;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: FETCH l_cursor", &sqlca);
    goto Terror;
  }

#ifdef DEBUG
  printf("l_quantity = %0.3f\n",l_quantity);
  printf("l_tax = %0.3f  \n",l_tax);
  printf("l_discount = %0.3f \n",l_discount);
  printf("l_extendedprice = %0.3f \n", l_extendedprice);
#endif

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after read of LINEITEM: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "l_partkey: %d  l_suppkey: %d  l_quantity: %0.3f\nl_tax:
%0.3f  l_discount: %0.3f  l_extendedprice: %0.3f\n",
            l_partkey, l_suppkey, l_quantity, l_tax, l_discount,
l_extendedprice);
  }

  rprice = TRUNC2( l_extendedprice/l_quantity );
  cost = TRUNC2( rprice * delta );
  new_extprice = l_extendedprice + cost;
  new_quantity = l_quantity + delta;

#ifdef DEBUG
  printf("rprice = %0.3f\n", rprice );
  printf("cost = %0.3f\n", cost );
  printf("new_extprice = %0.3f\n", new_extprice );
  printf("new_quantity = %0.3f\n", new_quantity );
#endif

  EXEC SQL UPDATE tpcd.lineitem
    SET l_extendedprice = :new_extprice,
        l_quantity = :new_quantity
    WHERE CURRENT OF l_cursor;

  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: UPDATE l_cursor", &sqlca);
    goto Terror;

  }

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
```

```
    fprintf(out,"acidT tag: %d, after update of LINEITEM: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "updated l_extendedprice: %0.3f\n", new_extprice );
    fprintf(out, "updated l_quantity: %0.3f\n", new_quantity );
  }

/* if (acid->termination == 0) {
    EXEC SQL CLOSE L_CURSOR;
    EXEC SQL CLOSE O_CURSOR;
    EXEC SQL COMMIT;
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      }
      sqlerror("acidT: COMMIT", &sqlca);
      goto Terror;
    }
  } */

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, before read of ORDER: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  EXEC SQL OPEN o_cursor;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: OPEN o_cursor", &sqlca);
    goto Terror;
  }

  EXEC SQL FETCH o_cursor INTO :o_totalprice;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging)
    {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    }
    else
    {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    }
    sqlerror("acidT: FETCH o_cursor", &sqlca);
    goto Terror;
  }

#ifdef DEBUG
  printf("o_totalprice = %0.3f\n",o_totalprice);
#endif

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after read of ORDER: (%us %06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "o_totalprice: %0.3f\n", o_totalprice);
  }

#ifdef DEBUG
  {
   double zeroone= l_extendedprice * (1.0- l_discount);
   double zeroonetimes= (l_extendedprice * (1.0- l_discount))*100.0;
   double firstone = TRUNC2(l_extendedprice * (1.0-l_discount));
   double notone= TRUNC2 ( l_extendedprice * (1.0-l_discount)) *
(1.0+l_tax);
   double secondone= TRUNC2( TRUNC2( l_extendedprice * (1.0-
l_discount) ) * (1.0+l_tax) );
   printf("firstone=   %f\n", firstone);
   printf("zeroone=   %f\n", zeroone);
   printf("zeroonetimes=   %f\n", zeroonetimes);
   printf("notone=   %f\n", notone);
   printf("secondone=   %f\n", secondone);
  }
#endif
  ototal = o_totalprice -
           TRUNC2( TRUNC2( l_extendedprice * (1-l_discount) ) *
(1+l_tax) );
  new_ototal = TRUNC2( new_extprice * (1.0-l_discount) );
  new_ototal = TRUNC2( new_ototal * (1.0+l_tax) );
  new_ototal = ototal + new_ototal;

#ifdef DEBUG
  printf("o_totalprince= %f\n",o_totalprice);
  printf("ototal= %0.3f\n",ototal);
  printf("ototal= %f\n",ototal);
  printf("new_ototal= %0.3f\n",new_ototal);
#endif

  EXEC SQL UPDATE tpcd.orders
    SET o_totalprice = :new_ototal
    WHERE CURRENT OF o_cursor;
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: UPDATE o_cursor", &sqlca);
    goto Terror;
  }

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after update of ORDER: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    fprintf(out, "updated o_totalprice: %0.3f\n", new_ototal) ;
  }

/*
** why is this code in here? we don't want to
** commit until the history table has been updated as well
  if (acid->termination == 0) {
    EXEC SQL CLOSE L_CURSOR;
    EXEC SQL CLOSE O_CURSOR;
    EXEC SQL COMMIT;
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
```

```
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      }
      sqlerror("acidT: COMMIT", &sqlca);
      goto Terror;
    }
  }
*/

  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, before insert into HISTORY: (%us
%06uu) %s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  EXEC SQL INSERT INTO tpcd.history values
    (:l_partkey, :l_suppkey, :o_key, :l_key, :delta, CURRENT
TIMESTAMP);
  if (sqlca.sqlcode != 0) {
    if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
    rc = sqlca.sqlcode;
    if (acid->logging) {
      fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } else {
      fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
    } /* endif */
    sqlerror("acidT: INSERT INTO history", &sqlca);
    goto Terror;
  }


  if (acid->logging) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"acidT tag: %d, after insert into HISTORY: (%us %06uu)
%s",
          mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  /* sleep for 1 second for 80% of the transactions */
#ifdef SQLWINT
  if ( ((rand() % (100)) + 1) < 80 ) sleep(1);
#else
  if ( ((random() % (100)) + 1) < 80 ) sleep(1);
#endif

  switch (acid->termination) {
   case 1:
    {
      if (acid->logging)
      {
        gettimeofday(&tv, &tz);
        time(&timeT);
        fprintf(out,"acidT tag: %d, wait before COMMIT: (%us %06uu)
%s",
              mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
      }
    }
    sleep(60);
  case 0:
    /* gjc@011214 */
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, immediately before closing cursors:
(%us %06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    EXEC SQL CLOSE L_CURSOR;
    /* gjc@011214. */
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: Close L_CURSOR", &sqlca);
      goto Terror;
    }

    EXEC SQL CLOSE O_CURSOR;
    /* gjc@011214. */
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: Close O_CURSOR", &sqlca);
      goto Terror;
    }

    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, immediately before COMMIT: (%us
%06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    EXEC SQL COMMIT;
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: COMMIT", &sqlca);
      goto Terror;
    }
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, after COMMIT: (%us %06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    break;
  case 3:
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, wait before ROLLBACK: (%us %06uu)
%s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    sleep(60);
  case 2:
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, immediately before closing cursors:
(%us %06uu) %s",
            mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
```

```
    EXEC SQL CLOSE L_CURSOR;
    /* gjc@011214. */
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: Close L_CURSOR", &sqlca);
      goto Terror;
    }
    EXEC SQL CLOSE O_CURSOR;
    /* gjc@011214. */
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: Close O_CURSOR", &sqlca);
      goto Terror;
    }

    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, immediately before ROLLBACK: (%us
%06uu) %s",
              mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
    EXEC SQL rollback work;
    if (sqlca.sqlcode != 0) {
      if(sqlca.sqlcode == DEADLOCK) goto retry_tran;
      rc = sqlca.sqlcode;
      if (acid->logging) {
        fprintf(out,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } else {
        fprintf(stderr,"acidT **ERROR** sqlcode = %d\n",sqlca.sqlcode);
      } /* endif */
      sqlerror("acidT: ROLLBACK", &sqlca);
      goto Terror;
    }
    if (acid->logging) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"acidT tag: %d, after ROLLBACK: (%us %06uu) %s",
              mypid, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    }
      break;
  }

  acid->l_partkey = l_partkey;
  acid->l_suppkey = l_suppkey;
  acid->l_quantity = l_quantity;
  acid->l_tax = l_tax;
  acid->l_discount = l_discount;
  acid->l_extendedprice = l_extendedprice;
  acid->o_totalprice = o_totalprice;

  rc = 0;
  goto Texit;

Terror:
    EXEC SQL CLOSE L_CURSOR;
  if (sqlca.sqlcode != 0) sqlerror("acidT: Terror close L_CURSOR
failed", &sqlca);
    EXEC SQL CLOSE O_CURSOR;
  if (sqlca.sqlcode != 0) sqlerror("acidT: Terror close O_CURSOR
failed", &sqlca);
  EXEC SQL rollback work;
  if (sqlca.sqlcode != 0) sqlerror("acidT: ROLLBACK FAILED", &sqlca);

Texit:
  if (acid->logging) {
    fprintf(out,"\n---------- END of acidT tag: %d ----------\n\n",mypid);
    fflush(out);fclose(out);
  }
  return(rc);
}

/*-------------------------------------------------------------*/
/*      updateQ                                                */
/*-------------------------------------------------------------*/
int updateQ (struct update_struct *us)
{
  FILE *out;
  time_t timeT;
  struct timeval tv;
  struct timezone tz;
  int qnum;
  int rc = 0;
  int i;
  int secs2sleep;
  char buff[256];
  struct acidtype {int logging;} a, *acid;

  EXEC SQL BEGIN DECLARE SECTION;
  double    acctbal;
  double    discount;
  double    price;
  sqlint32      availqty;
  sqlint32      size;
  EXEC SQL END DECLARE SECTION;

  qnum = us->qnum;

  acid = &a;
  acid->logging= 1;

  sprintf(buff, "%s%cupdate.out",getenv("TPCD_TMP_DIR"),del());
  out=fopen(buff,"a");

  gettimeofday(&tv, &tz);
  time(&timeT);
  fprintf(out,"\n---------- START of update ----------\n\n");
  fprintf(out, "update query number: %d, begin transaction time: (%us
%06uu) %s",
          qnum, tv.tv_sec, tv.tv_usec, ctime(&timeT));

  sqlca.sqlcode = 0;
  discount = 0.25;
  price = 5000.50;
  acctbal = 1000.00;
  availqty = 10;
  size = 5;

  for (i=1; i <= 2; i++) {
    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"update query number: %d, pass %d, immediately before
UPDATE: (%us %06uu) %s",
            qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));

    switch (qnum)
    {
     case 1:
```

```
    {
      EXEC SQL

        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
        WHERE L_ORDERKEY IN (326,512,928,995);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 1", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 300;
      break;
    }
    case 2:
    {
      EXEC SQL
        UPDATE TPCD.SUPPLIER set S_ACCTBAL = S_ACCTBAL +
:acctbal
        WHERE S_NAME in
('Supplier#000000647','Supplier#000000070','Supplier#000000802');
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 2", &sqlca);
        goto Uerror;
      }
      acctbal = acctbal * (-1);
      secs2sleep = 90;
      break;
    }
    case 3:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
        WHERE L_ORDERKEY IN (260930, 402497, 457859, 509889,
58117,
                      538311, 588421, 416167, 97830, 90276);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 3", &sqlca);
        goto Uerror;
      }
      discount = discount * (-1);
      secs2sleep = 300;
      break;
    }
    case 4:
    {
      if ( i ==1 ) {
        EXEC SQL
          UPDATE TPCD.ORDERS set O_ORDERDATE =
O_ORDERDATE - 6 MONTHS
          WHERE O_ORDERKEY =  67461;
          /* WHERE O_ORDERKEY IN
(22400,28515,34338,46596,67461,92644,98307);*/
      } else {
        EXEC SQL
          UPDATE TPCD.ORDERS set O_ORDERDATE =
O_ORDERDATE + 6 MONTHS
          WHERE O_ORDERKEY =  67461;
      }
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        sqlerror("update query number 4", &sqlca);
        goto Uerror;
      }
      secs2sleep = 300;
      break;
    }
    case 5:
    {
      EXEC SQL
        UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
        WHERE L_ORDERKEY IN
(70976,566279,152897,84226,232483);
      if (sqlca.sqlcode != 0) {
        rc = sqlca.sqlcode;
        if (acid->logging)
        {
         fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
        else
        {
         fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                 qnum, i, sqlca.sqlcode);
        }
```

```
          sqlerror("update query number 5", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 6:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
          WHERE L_ORDERKEY in
(33,131,161,195,229,230,231,323,353,356);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 6", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 7:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
          WHERE L_ORDERKEY IN
(562917,410659,16550,398401,157634,429920,45411);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 7", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 8:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
          WHERE L_ORDERKEY IN
(129569,343591,270242,254983,98500,28963);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }

          sqlerror("update query number 8", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 9:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
          WHERE L_ORDERKEY IN
(113509,232997,246691,379233,448162,32134);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {

            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 9", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 10:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
          WHERE L_ORDERKEY IN
(516487,245411,265799,253025,6914,562020);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
```

```
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 10", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 300;
        break;
      }
      case 11:
      {
        EXEC SQL
          UPDATE TPCD.PARTSUPP set PS_AVAILQTY =
PS_AVAILQTY + :availqty
          WHERE PS_PARTKEY IN
(12098,5134,13334,17052,3452,12552,1084,5797);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 11", &sqlca);
          goto Uerror;
        }
        availqty = availqty * (-1);
        secs2sleep = 180;
        break;
      }
      case 12:
      {
        if ( i ==1 ) {
          EXEC SQL
            UPDATE TPCD.LINEITEM set L_RECEIPTDATE =
L_RECEIPTDATE - 3 YEARS
            WHERE L_ORDERKEY IN
(33,70,195,355,677,837,960,962,1028);
        } else {
          EXEC SQL
            UPDATE TPCD.LINEITEM set L_RECEIPTDATE =
L_RECEIPTDATE + 3 YEARS
            WHERE L_ORDERKEY IN
(33,70,195,355,677,837,960,962,1028);
        }
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 12", &sqlca);
          goto Uerror;
        }
        secs2sleep = 300;
        break;

      }
      case 13:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
          WHERE L_ORDERKEY IN
(263,9476,32355,34854,53445,56901);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          else
          {

            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 13", &sqlca);
          goto Uerror;
        }

        discount = discount * (-1);
        secs2sleep = 90;
        break;
      }
      case 14:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
          WHERE L_ORDERKEY IN (32,225,326,448,449,483,512);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 14", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 180;
        break;
      }
      case 15:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_DISCOUNT = L_DISCOUNT
+ :discount
          WHERE L_ORDERKEY IN (1,4,7,35,135,131300);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
```

```
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 15", &sqlca);
          goto Uerror;
        }
        discount = discount * (-1);
        secs2sleep = 180;
        break;
      }
      case 16:
      {
        EXEC SQL
          UPDATE TPCD.PART set P_SIZE = P_SIZE + :size
          WHERE P_PARTKEY IN (4,7,15,1313);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 16", &sqlca);
          goto Uerror;
        }
        size = size * (-1);
        secs2sleep = 180;
        break;
      }
      case 17:
      {
        EXEC SQL
          UPDATE TPCD.LINEITEM set L_EXTENDEDPRICE =
L_EXTENDEDPRICE + :price
          WHERE L_ORDERKEY IN
(4065,110372,165061,265702,87138);
        if (sqlca.sqlcode != 0) {
          rc = sqlca.sqlcode;
          if (acid->logging)
          {
            fprintf(out,"update query number: %d, pass %d, **ERROR**
sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          else
          {
            fprintf(stderr,"update query number: %d, pass %d,
**ERROR** sqlcode = %d\n",
                    qnum, i, sqlca.sqlcode);
          }
          sqlerror("update query number 17", &sqlca);
          goto Uerror;
        }
        price = price * (-1);
        secs2sleep = 90;
        break;
      }
      default:
      {
        fprintf(out,"ERROR: Invalid query number specified %d\n",
qnum);
        rc = 1;
        goto Uexit;
      }
    }

    gettimeofday(&tv, &tz);
    time(&timeT);

    if (acid->logging)
      fprintf(out,"update query number: %d, pass %d, after UPDATE:
(%us %06uu) %s",
              qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    else
      fprintf(stderr,"update query number: %d, pass %d, after
UPDATE: (%us %06uu) %s",
              qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));

    if ( i == 2 ) {
      gettimeofday(&tv, &tz);
      time(&timeT);
      fprintf(out,"update query number: %d, pass %d, sleeping for %d
seconds: (%us %06uu) %s",
              qnum, i, secs2sleep, tv.tv_sec, tv.tv_usec, ctime(&timeT));
      fflush(out);
      system("touch /tmp/tpcd/update.sync.sleep");

      sleep(secs2sleep);
    }

    gettimeofday(&tv, &tz);
    time(&timeT);
    fprintf(out,"update query number: %d, pass %d, immediately before
COMMIT: (%us %06uu) %s",
            qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));

    EXEC SQL COMMIT;
    if (sqlca.sqlcode != 0) {
      rc = sqlca.sqlcode;
      fprintf(out,"update pass %d, **ERROR** sqlcode = %d\n", i,
sqlca.sqlcode);
      sqlerror("update: COMMIT", &sqlca);
      goto Uerror;
    }
    gettimeofday(&tv, &tz);
    time(&timeT);
    if (acid->logging)
      fprintf(out,"update query number: %d, pass %d, after COMMIT:
(%us %06uu) %s",
              qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));
    else
      fprintf(stderr,"update query number: %d, pass %d, after
COMMIT: (%us %06uu) %s",
              qnum, i, tv.tv_sec, tv.tv_usec, ctime(&timeT));
  }

  rc = 0;
  goto Uexit;

Uerror:
  EXEC SQL rollback work;
  if (sqlca.sqlcode != 0) sqlerror("update: ROLLBACK FAILED",
&sqlca);
  system("touch /tmp/tpcd/update.sync.sleep");

Uexit:
```

```
  fprintf(out,"\n---------- END of update ----------\n\n");
  fflush(out);fclose(out);
  return(rc);
}

/*-------------------------------------------------------------------*/
/*       connect_to_TM                                               */
/*-------------------------------------------------------------------*/
void connect_to_TM( void )
{
  char *dbname_ptr;
  if ((dbname_ptr = getenv("TPCD_QUAL_DBNAME")) != NULL) {
    fprintf(stderr,"********** %s **********\n",dbname_ptr);
    strcpy (dbname, dbname_ptr);
  }

  EXEC SQL CONNECT TO :dbname IN SHARE MODE;
  if (sqlca.sqlcode <  0) {
    fprintf(stderr, "CONNECT TO %s failed SQLCODE = %d\n",
dbname, sqlca.sqlcode);
    exit(-1);
  }
  return;
}

/*-------------------------------------------------------------------*/
/*       disconnect_from_TM                                          */
/*-------------------------------------------------------------------*/
void disconnect_from_TM ( void )
{
  EXEC SQL CONNECT RESET;
  if (sqlca.sqlcode <  0) {
    fprintf(stderr, "DISCONNECT failed SQLCODE = %d\n",
sqlca.sqlcode);
    exit(-1);
  }
  return;
}

/*-------------------------------------------------------------------*/
/*       sqlerror                                                    */
/*-------------------------------------------------------------------*/
void sqlerror(char *msg, struct sqlca *psqlca)
{
  FILE *err_fp;


  char  err_fn[256];


  int j,k;

  sprintf(err_fn,
"%s%cacid.sqlerrors",getenv("TPCD_TMP_DIR"),del());
  err_fp=fopen(err_fn,"a");
  fprintf(err_fp,"acid: sqlcode: %4d %s\n", psqlca->sqlcode, msg);
  fprintf(stderr,"acid: sqlcode: %4d %s\n", psqlca->sqlcode, msg);
  fflush(stderr);
  if (psqlca->sqlerrmc[0] != ' ' || psqlca->sqlerrmc[1] != ' ') {
    fprintf(err_fp,"acid: slerrmc:  ");
    for(j = 0; j < 5; j++)
    {
      for(k = 0; k < 14; k++) fprintf(err_fp,"%x ", psqlca-
>sqlerrmc[j*10+k]);
      fprintf(err_fp,"    ");
      for(k = 0; k < 14; k++) fprintf(err_fp,"%c",  psqlca-
>sqlerrmc[j*10+k]);
      fprintf(err_fp,"\n");
      if (j < 4) fprintf(err_fp,"          ");
    }
  }

  fprintf(err_fp,"acid: sqlerrp:  ");
  for(j = 0; j < 8; j++)    fprintf(err_fp,"%c", psqlca->sqlerrp[j]);
  fprintf(err_fp,"\n");

  fprintf(err_fp,"acid: sqlerrd: ");
  for(j = 0; j < 6; j++)    fprintf(err_fp," %d", psqlca->sqlerrd[j]);
  fprintf(err_fp,"\n");

  if (psqlca->sqlwarn[0] != ' ') {
    fprintf(err_fp,"acid: sqlwarn: ");
    for(j = 0; j < 8; j++)    fprintf(err_fp,"%c ", psqlca->sqlwarn[j]);
    fprintf(err_fp,"\n");
  }

  fprintf(err_fp,"\n");
  fflush(err_fp);fclose(err_fp);
}

#ifdef SQLWINT
void sleep(int sec)
{
 Sleep(sec * 1000);
}
#endif


char del(void)
{
#ifdef SQLWINT
 return '\\';
#else
 return '/';
#endif
}

#if defined(SQLPTX) || defined(SQLWINT) || defined(SQLSUN) ||
defined(Linux)
/* added fot PTX as this one is not there in libm */
double nearest(double x)
{
      double y, z;

      y = x;
      if (x < 0)
            y = -x;
      z = y - (int)y;
      if (z == 0.5) {
            if ((int)floor(y) % 2) {
                  return((x < 0) ? -ceil(y) : ceil(y));
            } else {
                  return((x < 0) ? -floor(y) : floor(y));
            }
      } else  if (z < 0.5)
                  return((x < 0) ? -floor(y) : floor(y));

            else
                  return((x < 0) ? -ceil(y) : ceil(y));
}
#endif /* SQLPTX */
```

E.2 Acid.h

```
/**************************************************************************/

/*      File: acid.h                                                      */
/**************************************************************************/
```

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

#ifdef SQLWINT
  #include <windows.h>
  #include <sys\timeb.h>
  #include <sys\stat.h>
  #include <stdlib.h>
  #include <io.h>
#else
  #include <unistd.h>
  #include <sys/time.h>
  #include <sys/timeb.h>
#endif

#include <string.h>
#include <math.h>

#define acidtime(tvsec,tvusec) tvsec*1000+tvusec/1000
#define TSLEN 20

#if 0 /* needed on NT, not on AIX */
typedef struct timeval {
       long    tv_sec;         /* seconds */
       long    tv_usec;        /* and microseconds */
};
#endif

struct update_struct {
   int     qnum;
};

struct acidQ_struct {
   int     tag;
   long    o_key;
   double  l_extendedprice;
};

struct acidT_struct {
   int     termination;
   int     tag;
   int     logging;
   long    o_key;
   long    l_key;
   long    delta;
   long    l_partkey;
   long    l_suppkey;
   double  l_quantity;
   double  l_tax;
   double  l_discount;
   double  l_extendedprice;
   double  o_totalprice;
};

/*
** in acid.sqc
*/

int updateQ (struct update_struct *us);

char del(void);

#ifdef SQLWINT
void sleep (int sec);
#endif
```

E.3 Makefile

```
DBNAME =            $(TPCD_QUAL_DBNAME)


INCLUDE =           $(HOME)/sqllib/include

#CFLAGS             =           -I$(INCLUDE) -g -Dpascal= -
DLINT_ARGS \
#             -Dfar= -D_loadds= -DSQLA_NOLINES -qflag=i:i -
qlanglvl=ansi

#LFLAGS  =          -lm -lcurses -ls -ll -ly -liconv -lbsd
CFLAGS  =          -I$(INCLUDE) -g -Dpascal= -DLINT_ARGS  \
          -DSQLA_NOLINES -qflag=i:i -qlanglvl=ansi -q64
# .. sun       -DSQLA_NOLINES

LFLAGS  =          -lm -lbsd  -q64
# sun .... LFLAGS  =             -lm


LIB         =          -L$(HOME)/sqllib/lib -ldb2

CC          =          cc

HDR         =          acid.h
C     =     mainacid.c
SQC         =          acid.sqc
SRC         =          $(HDR)              $(C)                $(SQC)
OBJ         =          acid.o
EXEC        =          mainacid

TARGET  =          $(EXEC) tsec

.SUFFIXES: .o .c .sqc .bnd

.c.o:
           $(CC) -c $< $(CFLAGS)

all:       $(TARGET)

mainacid: $(SRC) $(OBJ) mainacid.o
           $(CC) -o $@ $(CFLAGS) $(OBJ) mainacid.o $(LIB)
$(LFLAGS)

acid.c: acid.sqc  $(HDR)
           - db2 connect to $(DBNAME); \
           db2 prep acid.sqc BINDFILE ISOLATION RR
NOLINEMACRO PACKAGE; \
           db2 bind acid.bnd GRANT PUBLIC; \
           db2 connect reset; \
           db2 terminate

acid.o: acid.c
           $(CC) $(CFLAGS) -c acid.c -o acid.o

tsec: tsec.c
           $(CC) $(CFLAGS) $(LFLAGS) -o tsec tsec.c

clean:
           rm -f *.o *.bnd $(EXEC) tsec
           rm -f acid.c
```

Appendix - F Third Party Pricing

F.1 Cisco Pricing

Cisco Systems, Inc.
12515 Research Blvd., Bldg. 2
Austin, TX 78746
mashaffe@cisco.com
Ph: 512 378-6055
Fax: 512 378-6099

Price Quotation

Date: 12/3/2002 **Quote Number:** 898-1V7H

To:

IBM
11400 Burnett Rd.
Austin, TX 78758

Ph:
Fax:

Product Number	Product Description	Qty	Unit List Price	Disc %	Extended Price
WS-C3508G-XL-EN	Catalyst 3508G XL Enterprise Edition	10	$4,995.00	0.000%	$49,950.00

Total Price: $49,950.00

FOB Point: Origin
Ship Date:
Quote Valid Until: 1/2/2003

Payment Terms: Net 30
Installation: Available on Request and Billable
Warranty: 90 Days

Signed: _____
Marc Shaffer

Notes:

This Price Quotation does not constitute an offer by Cisco to sell products, but is instead an invitation to issue a purchase order to Cisco until the Quotation Valid date specified in this Price Quotation. Such a purchase order will be subject to Cisco's standard procedures, terms, and conditions for the acceptance of purchase orders. This order may be subject to sales tax, VAT, duty and freight charges even if not noted on this quote.

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