

TPC Benchmark™ H Full Disclosure Report

Sun Microsystems Sun Fire™ V490 Server Using Sybase IQ 12.6 Single Application Server

Submitted for Review
Report Date: Jan 5, 2006

TPC Benchmark H Full Disclosure Report

First Printing

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**Sun Fire™ V490 Server
with Sybase IQ Multiplex 12.6**

TPC-H Rev. 2.3.0

Report Date: Jan 5, 2006

Total System Cost

Composite Query per Hour Metric

Price/Performance

\$136,120.70

4367.5
QphH@1000GB

\$31.17
per QphH@1000GB

Database Size

Database Manager

Operating System

Other Software

Availability Date

1000GB

**Sybase IQ 12.6
Single Application
Server**

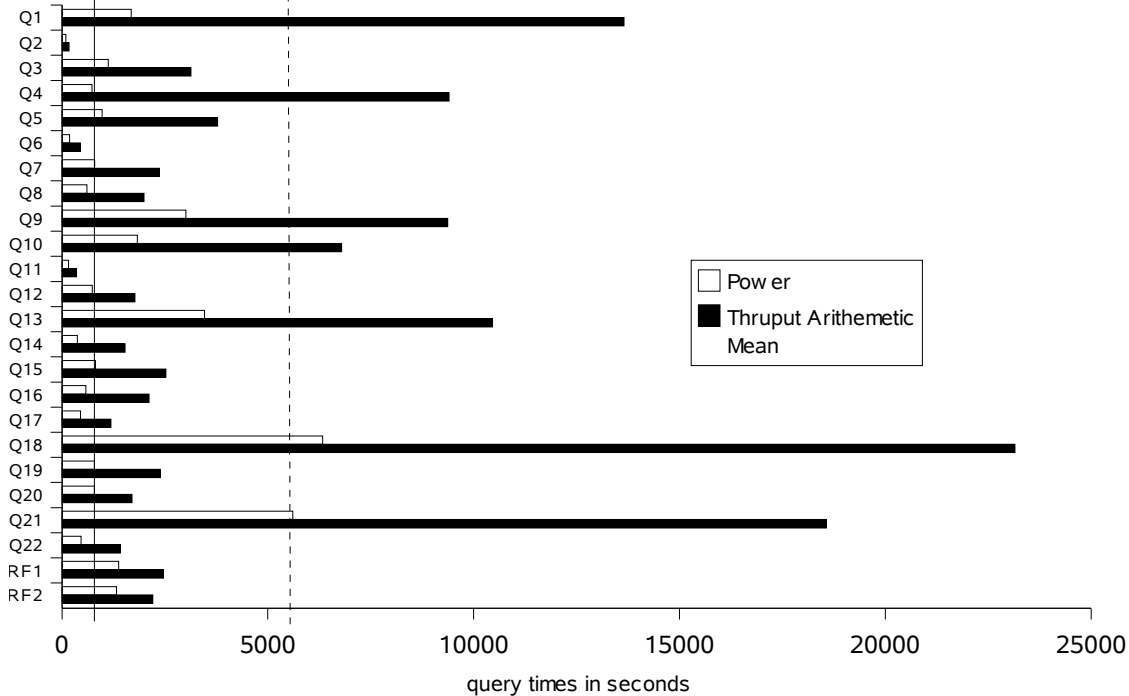
Solaris 10

**Solaris Volume
Manager**

Jan 5, 2006

870.6 = power geometric mean

5375.9 = throughput arithmetic mean



Database Load Time = 17hrs 31mins Load Includes Backup: N Total Storage/Database Size=2.72

RAID (Base tables): RAID 1 RAID (Base tables and auxiliary data structures): RAID 1 RAID (All): N

System Configuration:

- SunFire V490 Server with
- 4 UltraSPARC IV 1500 MHz processors (each processor is 1 chip, 2 cores, 2 threads)
- 32 GB memory
- 2 x 146GB (10K RPM) internal disks
- 3 x SE3310 SCSI JBOD disk array, each with 12 x 73GB (10K RPM) disks

Total Storage: 2719 GB

(in this calculation 1 GB is defined as 1024 * 1024 * 1024)



**Sun Fire™ V490 Server
with Sybase IQ 12.6 Single
Application Server**

TPC-H Rev. 2.3.0

Report Date: Jan 5, 2006

Description	Part Number	Source	Unit Price	Qty	Ext. Price	3 Yr. maint.
Server Hardware						
SunFire V490 4x1.5GHz CPUs, 32G memory, 2x146GB disk drives	A52-CLH4C232GTB		1 80,995.00	1	80,995.00	
3 Year Gold Warranty Upgrade – V880 Server (includes HBAs and Internal disks)	W9D-A52PLS-3G		1 10,332.00	1		10,332.00
Sun Discount			1		-16,199.00	-3,616.20
<i>Server Hardware Subtotal</i>					64,796.00	6,715.80
Storage						
SE3310 JBOD Disk Array(12X73GB 10,000 RPM disks)	XTA3310R01A0R876		2 10,995.00	3	32,985.00	
3 Year Gold Warranty Upgrade – SE3310 (includes all disks)	W9D-SE3310-3G		2 4,356.00	3		13,068.00
SCSI cable	X1138A		1 95.00	6	570.00	
Ultra320 SCSI HBA	XG-XPCI2SCSILM320		1 510.00	3	1,530.00	
Sun Discount			1		-10,525.50	-4,573.80
<i>Storage Subtotal</i>					24,559.50	8,494.20
Server Software						
Sybase IQ-M Single App Svr, per cpu core	12841		3 2,595.00	8	20,760.00	
Sybase IQ 3 Years Extended Support 24 x 7	98480		3 1,557.00	8		12,456.00
Sybase Discount			3		-1,660.80	
<i>Server Software Subtotal</i>					19,099.20	12,456.00
Total					108,454.70	27,666.00
3 Yr. Cost					136,120.70	
QphH@ 1000GB					4,367.50	
\$/QphH@ 100GB					\$31.17	

Service for all Sun products is from Sun Microsystems, Inc.

Service for Sybase products is from Sybase Inc.

Notes (Source):

1. Sun Microsystems Inc.
2. Continental Resources Inc
3. Sybase Inc.

PriceQuotes provided in Appendix G

Audited by: Brad Askins, InfoSizing, Inc. (www.sizing.com)

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



**Sun Fire™ V490 Server
with Sybase IQ 12.6 Single
Application Server**

TPC-H Rev. 2.3.0

Report Date: Jan 5, 2006

Numerical Quantities

Measurement Results:

Database Scale Factor	= 1000GB
Total Data Storage / Database Size	=2.72
Start of database load time	= 2005-11-02 09:56:55
End of database load time	= 2005-11-03 03:27:30
Database Load Time	= 17hrs 31mins
Query Streams for Throughput Test	= 7
TPC-H Power	= 4135.2
TPC-H Throughput	= 4612.9
TPC-H Composite Query-per-Hour Rating (QphH@1000GB)	= 4367.5
Total System Price Over 3 Years	= \$136,120.70
TPC-H Price/Performance Metric (\$/QphH@1000GB)	= \$31.17

Measurement Intervals:

Measurement Interval in Throughput Test (Ts)	= 120,184 seconds
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Duration of Stream Execution:

Stream ID	Seed	Start Date	Start Time	End Date	End Time	Duration
Stream 0	1103032730	2005-11-04	22:09:18	2005-11-05	07:40:26	9hrs:31mins:8secs
Stream 1	1103032731	2005-11-05	07:40:38	2005-11-06	16:39:16	1day:8hrs:58mins:38secs
Stream 2	1103032732	2005-11-05	07:40:38	2005-11-06	17:03:42	1day:9hrs:23mins:4secs
Stream 3	1103032733	2005-11-05	07:40:38	2005-11-06	15:34:05	1day:7hrs:53mins:27secs
Stream 4	1103032734	2005-11-05	07:40:38	2005-11-06	16:40:20	1day:8hrs:59mins:42secs
Stream 0	1103032735	2005-11-05	07:40:38	2005-11-06	16:51:13	1day:9hrs:10mins:35secs
Stream 6	1103032736	2005-11-05	07:40:38	2005-11-06	16:42:10	1day:9hrs:1min:32secs
Stream 7	1103032737	2005-11-05	07:40:38	2005-11-06	16:12:06	1day:8hrs:31mins:28secs



**Sun Fire™ V490 Server
with Sybase IQ 12.6 Single
Application Server**

TPC-H Rev. 2.3.0

Report Date: Jan 5, 2006

TPC-H Timing Intervals (in seconds)

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Stream 00	1679.5	95.4	1123.2	730.9	975.2	182.6	793.7	605.7	3008.7	1825.7	159.1	736.9
Stream 01	20059.3	200.7	2186.3	7788.5	2651.4	291.7	1715.8	896.6	8505.7	6042.9	414.5	1655.6
Stream 02	11732.1	188.3	4076.1	10697.2	3957.4	768.4	3247.6	2361.2	5878	5984.5	434.9	1813.2
Stream 03	13011.3	127	4436.9	10168.8	4367.6	313.2	1339.1	3996.4	8030.9	4793.5	297	1435.8
Stream 04	13929	195.5	1410.3	7438.4	6400.9	414.9	2913.7	1941.4	9045	4935.5	400.9	1834.6
Stream 05	12693.8	164.7	3439.3	13528.1	2507.5	378.3	2542.7	1533.8	7145.7	7713.3	305.2	1768.5
Stream 06	16660	156.5	3845	6541.7	3804.1	226.6	2246.3	1212.1	15420.9	10962.6	297.9	2740.6
Stream 07	7494.3	139.9	2525.5	9661.2	2750.8	695.8	2565.8	2015.3	11576.2	7130.6	305.1	1161.7
Minimum	7494.3	127.0	1410.3	6541.7	2507.5	226.6	1339.1	896.6	5878.0	4793.5	297.0	1161.7
Average	13654.3	167.5	3131.3	9403.4	3777.1	441.3	2367.3	1993.8	9371.8	6794.7	350.8	1772.9
Maximum	20059.3	200.7	4436.9	13528.1	6400.9	768.4	3247.6	3996.4	15420.9	10962.6	434.9	2740.6

	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
Stream 00	3462.4	369.7	812.4	575.3	450.8	6333.2	783.8	787.6	5609.8	459.3	1377.3	1323.8
Stream 01	8761.7	1237	2310.4	1757.4	1192.4	22945.6	2261	2114.3	22073.2	1654	3534.8	2404.9
Stream 02	8329.9	2381.6	2454	2629.5	2389.3	30184.3	3354.7	1425.1	13808.4	2085.3	2306.7	2356.4
Stream 03	12433.1	1396.8	3899.1	2780.2	831.3	19441.3	2021.7	980.8	16743.3	1956.9	2195.5	2095
Stream 04	14276.1	2103.1	3378.4	1716.8	1149.3	20769.9	3262.8	606.9	19627.4	1029.2	2078.6	2149.4
Stream 05	11505.9	761.6	1737.1	1864.8	927.8	22258.8	1735.5	2003.5	22076.2	841.7	2720.6	1971.4
Stream 06	7187.9	847.2	1590.2	2062.3	1075.2	19281.6	1720.6	1705	18146.6	1157.6	2199.1	2074.1
Stream 07	10725.3	2016.6	2296.2	1998.6	738.3	27170.3	2358.6	3050.2	17524.2	1185.2	2216.3	2383.3
Minimum	7187.9	761.6	1590.2	1716.8	738.3	19281.6	1720.6	606.9	13808.4	841.7	2078.6	1971.4
Average	10460.0	1534.8	2523.6	2115.7	1186.2	23150.3	2387.8	1698.0	18571.3	1415.7	2464.5	2204.9
Maximum	14276.1	2381.6	3899.1	2780.2	2389.3	30184.3	3354.7	3050.2	22076.2	2085.3	3534.8	2404.9

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December 6, 2005

Benchmark Sponsors:

Brad Carlile Director, Enterprise Benchmarking Sun Microsystems, Inc. 8305 S. W. Creekside Place Beaverton, OR 97008	Paul Kreneta Chief Technologist, Sybase IQ Sybase, Inc. 1 Sybase Drive Dublin, CA 94568
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I verified the TPC Benchmark™ H performance of the following configuration:

Platform: **Sun Fire V490 Server**
 Database Manager: **Sybase IQ 12.6 Single Application Server**
 Operating System: **Solaris 10**

The results were:

CPU (Speed)	Memory	Disks	QphH@1000GB
One (1) Sun Fire 490			
4 x UltraSPARC IV (1500 MHz) (2 cores/processor)	32 GB Main	36 x 73 GB 2 x 146 GB	4367.5

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

- The database records were defined with the proper layout and size
- The database population was generated using DBGEN
- The database was properly scaled to 1000GB and populated accordingly
- The compliance of the database auxiliary data structures was verified
- The database load time was correctly measured and reported
- The required ACID properties were verified and met
- The query input variables were generated by QGEN

- The query text was produced using minor modifications
- The execution of the queries against the SF1 database produced compliant answers
- A compliant implementation specific layer was used to drive the tests
- The throughput tests involved 7 query streams
- The ratio between the longest and the shortest query was such that no query timing was adjusted
- The execution times for queries and refresh functions were correctly measured and reported
- The repeatability of the measured results was verified
- The required amount of database log was configured
- The system pricing was verified for major components and maintenance
- The major pages from the FDR were verified for accuracy

Additional Audit Notes:

None.

Respectfully Yours,



François Raab, President



Bradley J. Askins, Auditor

TPC Benchmark H Overview

The TPC Benchmark™ H (TPC-H) is a Decision Support benchmark. It is a suite of business-oriented ad-hoc queries and concurrent modifications. 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
- 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

1. General Items

1.1 Benchmark Sponsor

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

Sun Microsystems, Inc. and Sybase Inc. are the sponsors of this TPC-H benchmark.

1.2 Parameter Settings

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

- *Database Tuning Options*
- *Optimizer/Query execution options*
- *Query processing tool/language configuration parameters*
- *Recovery/commit options*
- *Consistency/locking options*
- *Operating system and configuration parameters*
- *Configuration parameters and options for any other software component incorporated into the pricing structure*
- *Compiler optimization options*

Appendix A contains the Solaris and Sybase IQ parameters used in this benchmark.

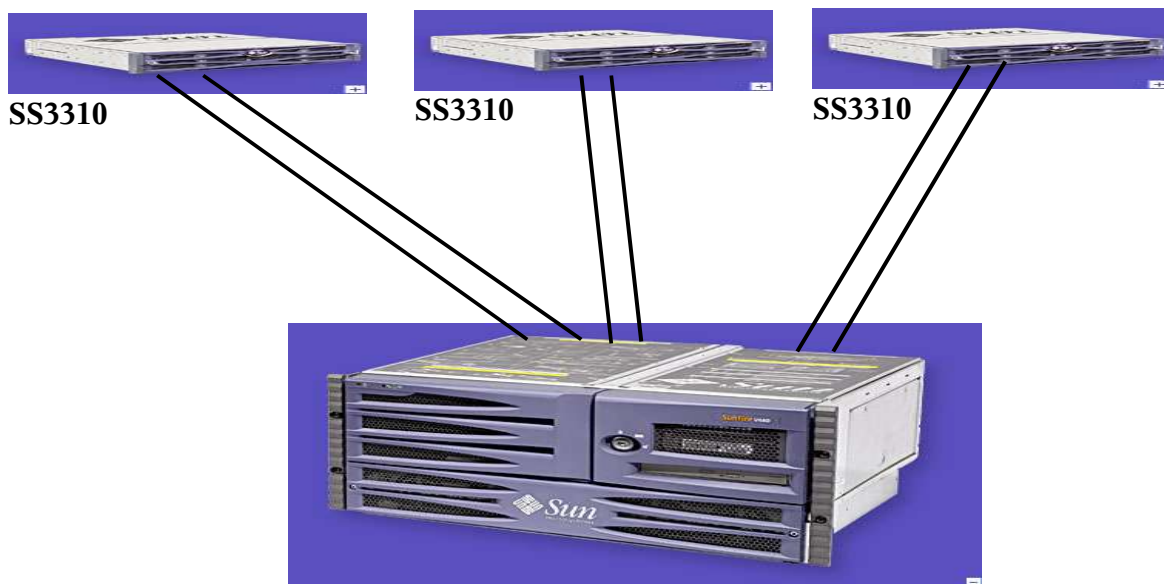
1.3 Configuration Diagram

Provide diagrams of both the measured and priced configurations, accompanied by a description of the differences.

The priced and measure configurations are as follow:

Priced Configuration

3 x SE3310 SCSI Arrays (each with 12 x 73GB Disks)



SUN Fire V490 Server

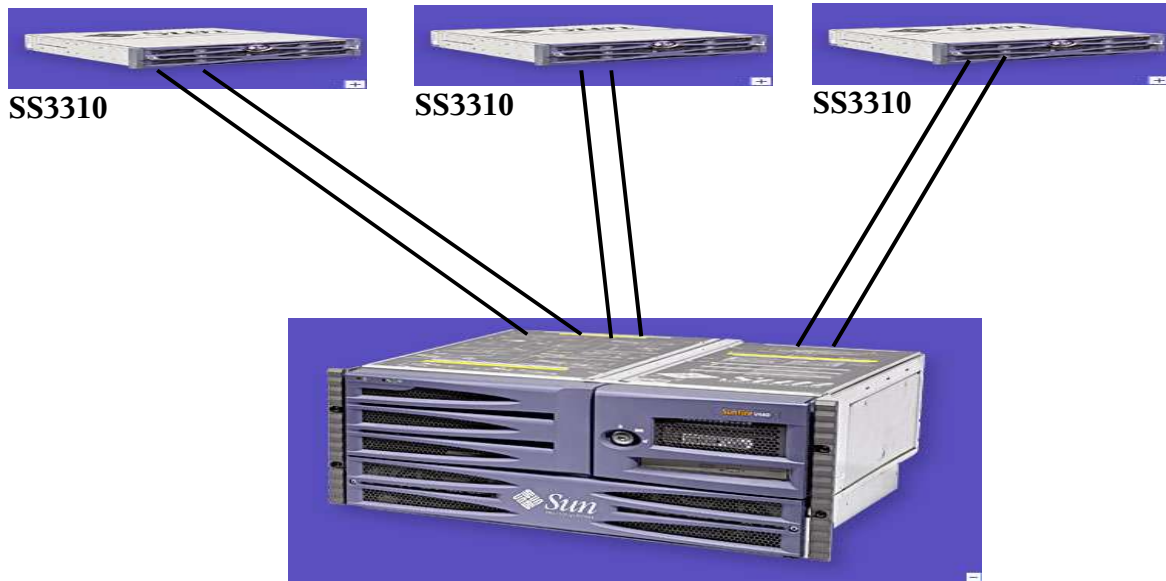
4 X 1500 MHz US IV processors

32 GB Memory

2 X 146 GB internal disks

Measured Configuration

3 x SE3310 SCSI Arrays (each with 12 x 73GB Disks)



SUN Fire V490 Server

4 X 1500 MHz US IV processors

32 GB Memory

2 X 73 GB internal disks

2. Clause 1 Logical Database Design

2.1 Database Definition Statements

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

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

2.2 Physical 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.

No record clustering or index clustering was used. Column ordering was changed for some tables. Refer to the table create statements in Appendix B for further details.

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 not used for any of the tables.

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. Clause 2 Queries and Refresh Functions

3.1 Query Language

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

SQL was the query language used to implement all queries.

3.2 Verifying Method for Random Number Generation

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

TPC supplied versions 1.3.0 of DBGEN and QGEN were used for this TPC-H benchmark.

3.3 Generating Values for Substitution Parameters

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

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

3.4 Query Text and Output Data from Qualification Database

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

Appendix C contains the query text and query output. The standard queries were used throughout with the following modifications:

- In Q1, Q4, Q5, Q6, Q10, Q12, Q14, Q15 and Q20, the "dateadd" function is used to perform date arithmetic.
- In Q7, Q8 and Q9, the "datepart" function is used to extract part of a date (e.g., "year").
- In Q2, Q3, Q10, Q18 and Q21, the "top" function is used to restrict the number of output rows.
- The semicolon (;) is used as a command delimiter.

3.5 Query Substitution Parameters and Seeds Used

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

Appendix D contains the seed and query substitution parameters.

3.6 Query Isolation Level

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

The queries and transactions were run with isolation level 3 (repeatable read).

3.7 Source Code of Refresh Functions

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

Appendix B contains the source code for the refresh functions.

4. Clause 3 Database System Properties

4.1 ACID Properties

The ACID (Atomicity, Consistency, Isolation and Durability) properties of transaction processing systems must be supported by the system under test during the timed portion of this benchmark. Since TPC-H is not a transaction processing benchmark, the ACID properties must be evaluated outside the timed portion of the test.

Source code for the ACID test is included in Appendix B.

4.2 Atomicity

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.

4.2.1 Completed Transaction

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

1. The total price from the ORDERS table and the extended price from the LINEITEM table were retrieved for a randomly selected order key.
2. The ACID Transaction was performed using the order key from step 1.
3. The ACID Transaction committed.
4. The total price from the ORDERS table and the extended price from the LINEITEM table were retrieved for the same order key. It was verified that the appropriate rows had been changed.

4.2.2 Aborted Transaction

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

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

4.3 Consistency

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

4.3.1 Consistency Test

Verify that ORDERS and LINEITEM tables are initially consistent, submit the prescribed number of ACID Transactions with randomly selected input parameters, and re-verify the consistency of the ORDERS and LINEITEM.

1. The consistency of the ORDERS and LINEITEM tables was verified based on a sample of order keys.
2. 100 ACID Transactions were submitted by each of six execution streams.
3. The consistency of the ORDERS and LINEITEM tables was re-verified.

4.4 Isolation

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

4.4.1 Read-Write Conflict with Commit

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

1. An ACID Transaction was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID Transaction was suspended prior to COMMIT.
2. An ACID Query was started for the same O_KEY used in step 1.
3. The ACID Transaction was resumed and COMMITTED.
4. The ACID Query completed. It returned the data as committed by the ACID Transaction.

4.4.2 Read-Write Conflict with Rollback

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

1. An ACID Transaction was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID Transaction was suspended prior to ROLLBACK.
2. An ACID Query was started for the same O_KEY used in step 1. The ACID Query did not see the uncommitted changes made by the ACID Transaction.
3. The ACID Transaction was ROLLED BACK.
4. The ACID Query completed.

4.4.3 Write-Write Conflict with Commit

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

1. An ACID Transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. T1 was suspended prior to COMMIT.
2. Another ACID Transaction, T2, was started using the same O_KEY and L_KEY and a randomly selected DELTA.
3. T2 waited.
4. T1 was allowed to COMMIT and T2 completed.

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

4.4.4 Write-Write Conflict with Rollback

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

1. An ACID Transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. T1 was suspended prior to ROLLBACK.
2. Another ACID Transaction, T2, was started using the same O_KEY and L_KEY and a randomly selected DELTA.
3. T2 waited.
4. T1 was allowed to ROLLBACK and T2 completed.
5. It was verified that $T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE$.

4.4.5 Concurrent Progress of Read and Write Transactions

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

1. An ACID Transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. T1 was suspended prior to ROLLBACK.
2. Another Transaction, T2, was started which did the following:

For random values of PS_PARTKEY and PS_SUPPKEY, all columns of the PARTSUPP table for which PS_PARTKEY and PS_SUPPKEY are equal, are returned.
3. T2 completed.
4. T1 was allowed to COMMIT.
5. It was verified that appropriate rows in ORDERS, LINEITEM and HISTORY tables were changed.

4.4.6 Read-Only Query Conflict with Update Transaction

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

1. A Transaction, T1, executing Q1 against the qualification database, was started using a randomly selected DELTA.
2. An ACID Transaction T2, was started for a randomly selected O_KEY, L_KEY and DELTA.
3. T2 completed and appropriate rows in the ORDERS, LINEITEM and HISTORY tables had been changed.
4. Transaction T1 completed executing Q1.

4.5 Durability

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

4.5.1 Failure of a Durable Medium

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

All disks containing TPC-H tables, TPC-H indexes, the Sybase IQ utility db file and the Sybase IQ log file are housed on RAID1 volumes. A permanent irrecoverable failure of one of these disks was simulated by removing it from its array. After this was done processing continued without interruption, since the disk was a member of a RAID1 volume. After an additional span of about 60 seconds, a disk containing the IQ recover log was removed from the system. Again the system continued processing transactions as if nothing had happened. Finally, after another interval of 60 seconds, power to the server was cut off. The outcome is described in section 4.5.2.

4.5.2 System Crash

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

A system crash was produced by cutting off power to the V490 server. When power was restored, the system automatically rebooted and the database was restarted. The durability success file and the HISTORY table were compared successfully.

4.5.3 Memory Failure

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

A memory failure was simulated by cutting off power to the V490 server. The outcome is described in section 4.5.2.

5. Clause 4 Scaling and Database Population

5.1 Ending Cardinality of Tables

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

Table	Rows
<i>Lineitem</i>	6000016166
<i>orders</i>	1,500,000,000
<i>Partsupp</i>	800,000,000
<i>Part</i>	200,000,000
<i>Customer</i>	150,000,000
<i>Supplier</i>	10,000,000
<i>Nation</i>	25
<i>Region</i>	5

5.2 Distribution of Tables and Logs Across Media

The distribution of tables and logs across all media must be explicitly described.

- All tables and indexes were stored on 16 RAID 1 volumes. Each volume was constructed from two raw partitions using the Solaris Volume Manager.
- The Temp database for Sybase IQ was configured using six raw partitions, two on each of two internal disks, and four on four of the external disks. The Temp databases were not mirrored.

The following table shows all the disk slices used for all the non-RAID1 devices.

Partition	Use	Size (in GB)
c1t0d0s0	root partition	8
c1t1d0s3	swap	66.34
c16t12d0s6	tempdb [via symbolic link /sybase2/T01]	62.49
c16t13d0s6	tempdb [via symbolic link /sybase2/T02]	62.44
c17t12d0s6	tempdb [via symbolic link /sybase2/T03]	62
c17t13d0s6	tempdb [via symbolic link /sybase2/T04]	62
c1t0d0s6	SVM state replica	0.5
c1t1d0s6	SVM state replica	0.5

The next table shows the disk slices used for the SVM RAID1 devices. The /sybase2 file system is used to store the IQ catalog file and IQ log file.

SVM Device Details:

Raw Partition Name	SVM Device Name	SVM Contained Device	Symbolic Link	Database Usage	Database Device Size GB	RAID
c1t0d0s1	d1	d2	none	/sybase2	1.5	RAID 1
c1t1d0s1	d1	d3	none	/sybase2	1.5	RAID 1
c12t8d0s6	d15	d10	/sybase2/M01	IQ Main	68.35	RAID 1
c14t8d0s6	d15	d11	/sybase2/M01	IQ Main	68.35	RAID 1
c12t9d0s6	d25	d20	/sybase2/M02	IQ Main	68.35	RAID 1
c14t9d0s6	d25	d21	/sybase2/M02	IQ Main	68.35	RAID 1
c12t10d0s6	d35	d30	/sybase2/M03	IQ Main	68.35	RAID 1
c14t10d0s6	d35	d31	/sybase2/M03	IQ Main	68.35	RAID 1
c12t11d0s6	d45	d40	/sybase2/M04	IQ Main	68.35	RAID 1
c14t11d0s6	d45	d41	/sybase2/M04	IQ Main	68.35	RAID 1
c12t12d0s6	d55	d50	/sybase2/M05	IQ Main	68.35	RAID 1
c14t12d0s6	d55	d51	/sybase2/M05	IQ Main	68.35	RAID 1
c12t13d0s6	d65	d60	/sybase2/M06	IQ Main	68.35	RAID 1
c14t13d0s6	d65	d61	/sybase2/M06	IQ Main	68.35	RAID 1
c13t8d0s6	d75	d70	/sybase2/M07	IQ Main	68.35	RAID 1
c15t8d0s6	d75	d71	/sybase2/M07	IQ Main	68.35	RAID 1
c13t9d0s6	d85	d80	/sybase2/M08	IQ Main	68.35	RAID 1
c15t9d0s6	d85	d81	/sybase2/M08	IQ Main	68.35	RAID 1
c13t10d0s6	d95	d90	/sybase2/M09	IQ Main	68.35	RAID 1
c15t10d0s6	d95	d91	/sybase2/M09	IQ Main	68.35	RAID 1
c13t11d0s6	d105	d100	/sybase2/M10	IQ Main	68.35	RAID 1
c15t11d0s6	d105	d101	/sybase2/M10	IQ Main	68.35	RAID 1
c13t12d0s6	d115	d110	/sybase2/M11	IQ Main	68.35	RAID 1
c15t12d0s6	d115	d111	/sybase2/M11	IQ Main	68.35	RAID 1
c13t13d0s6	d125	d120	/sybase2/M12	IQ Main	68.35	RAID 1
c15t13d0s6	d125	d121	/sybase2/M12	IQ Main	68.35	RAID 1
c16t8d0s6	d135	d130	/sybase2/M13	IQ Main	68.35	RAID 1
c17t8d0s6	d135	d131	/sybase2/M13	IQ Main	68.35	RAID 1
c16t9d0s6	d145	d140	/sybase2/M14	IQ Main	68.35	RAID 1
c17t9d0s6	d145	d141	/sybase2/M14	IQ Main	68.35	RAID 1
c16t10d0s6	d155	d150	/sybase2/M15	IQ Main	68.35	RAID 1
c17t10d0s6	d155	d151	/sybase2/M15	IQ Main	68.35	RAID 1
c16t11d0s6	d165	d160	/sybase2/M16	IQ Main	68.35	RAID 1
c17t11d0s6	d165	d161	/sybase2/M16	IQ Main	68.35	RAID 1

Additional details can be found in the disk configuration section in Appendix B.

5.3 Database partition/replication mapping

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

Database partitioning/replication was not used.

5.4 RAID Feature

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 must be disclosed for each device.

RAID 1 was used for all base tables and auxiliary data structures. In addition, the Sybase IQ utility db file and log file also resided on a RAID 1 devices.

5.5 Modifications to the DBGEN

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 supplied DBGEN version 1.3.0 was used to generate the database population for this benchmark.

5.6 Database Load Time

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

The database load time was =17hrs 31mins

5.7 Data Storage Ratio

The data storage ratio must be disclosed. It is computed as the ratio between the total amount of priced disk space, and the chosen test database size as defined in Clause 4.1.3.

The data storage ratio is computed from the following information:

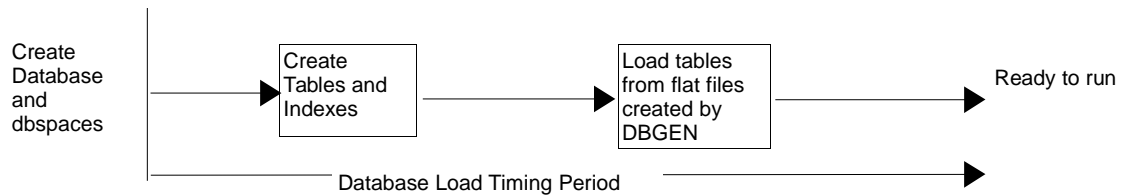
Disk Type	# of Disks	GB* per disk	Total Disk Space in GB**
Internal	2	146	271.95
External	36	73	2447.52
		Total Space	2719.46
		Data Storage Ratio	2.72

* Disk manufacturer definition of one GB is 10^9 bytes

**In this calculation one GB is defined as 2^{30} bytes

5.8 Database Load Mechanism Details and Illustration

The details of the database load must be described, including a block diagram illustrating the overall process.



The test database was loaded using flat files. All load scripts are included in Appendix B.

5.9 Qualification Database Configuration

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

The qualification database used identical scripts to create and load the data with only the necessary adjustments for size differences.

6. Clause 5 Performance Metrics and Execution Rules

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.

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

All scripts and queries used are included in Appendix F

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 Functions

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

The timing intervals for each query and both update functions are reported on the page titled “Numerical Quantities”, contained in the beginning of this document and replicated in the Executive Summary document.

6.4 Number of Streams for the Throughput Test

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

Seven 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 stream must be reported for the throughput test.

The start times and finish times for each query stream in the throughput test are reported on the page titled “Numerical Quantities”, contained in the beginning of this document and replicated in the Executive Summary document.

6.6 Total Elapsed Time of the Measurement Interval

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

The total elapsed time of the throughput test is reported on the page titled “Numerical Quantities”, contained in the beginning of this document and replicated in the Executive Summary document.

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 times for each refresh function:

Stream ID	Refresh Function	Start Date	Start Time	End Date	End Time
stream01	RF1	2005-11-05	07:40:38	2005-11-05	08:39:33
stream01	RF2	2005-11-05	08:39:33	2005-11-05	09:19:38
stream02	RF1	2005-11-05	10:04:39	2005-11-05	10:43:06
stream02	RF2	2005-11-05	14:58:13	2005-11-05	15:37:29
stream03	RF1	2005-11-05	15:37:29	2005-11-05	16:14:05
stream03	RF2	2005-11-05	16:39:05	2005-11-05	17:14:00
stream04	RF1	2005-11-05	20:49:07	2005-11-05	21:23:45
stream04	RF2	2005-11-05	22:33:48	2005-11-05	23:09:37
stream05	RF1	2005-11-06	03:09:44	2005-11-06	03:55:05
stream05	RF2	2005-11-06	05:25:07	2005-11-06	05:57:59
stream06	RF1	2005-11-06	08:33:02	2005-11-06	09:09:41
stream06	RF2	2005-11-06	09:09:41	2005-11-06	09:44:15
stream07	RF1	2005-11-06	13:14:23	2005-11-06	13:51:19

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

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

The timing intervals for each query and each refresh function for the throughput test are reported on the page titled “Numerical Quantities”, contained in the beginning of this document and replicated in the Executive Summary document.

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 reported on the page titled “Numerical Quantities”, contained in the beginning of this document and replicated in the Executive Summary document.

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 three metrics:

Run ID	QppH@1000GB	QthH@1000GB	QphH@1000GB
Run 1	4179.1	4653.0	4409.7
Run 2	4135.2	4612.9	4367.5
% Difference	-1.06%	-0.87%	-0.97%

6.11 System Activity Between Performance Tests

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

No activity occurred between Run 1 and Run 2. Moreover Sybase IQ was not restarted after the database load or between the two runs.

7. Clause 6 SUT and Driver Implementation

7.1 Driver

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

The entire test is run by executing the ntest shellscrip.

The text of ntest is reproduced in Appendix E and the texts of the subscripts invoked by ntest are reproduced in Appendix B.

The scripts that perform the query streams within the power and throughput tests are generated by the gen_streams_new .ksh script (which in turn invokes QGEN to generate the actual query stream files).

The Power Test is performed when ntest executes update_power.sql, which in turn runs the refresh functions and the power stream queries.

The Throughput Test is performed when ntest concurrently executes the 7 query stream scripts, stream[1-7].sql, together with the script update_throughput7.sql. The latter executes the refresh functions in parallel with the query streams according to the rules set out in the TPC-H specification document.

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.

All database configuration was done through scripts disclosed in Appendix B.

The performance tests are performed using dbisqlc. dbisqlc is a Sybase-provided utility that allows SQL statements to be executed against an Sybase IQ database. The dbisqlc utility is invoked from the command-line on the SUT. It reads input from files containing SQL statements and sends results to stdout. dbisqlc uses information in the .odbc.ini file to connect to the database. The performance test scripts utilizing dbisqlc can be found in Appendix E.

The ACID tests are performed using dbtest. dbtest is a Sybase-provided utility, similar to dbisqlc, but providing additional scripting capabilities. It is invoked from the command-line on the SUT and uses information in the .odbc.ini file to connect to the database. All the ACID test scripts are reproduced in Appendix B.

7.3 Profile-Directed Optimization

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

Profile-directed optimization was not used.

8. Clause 7 Pricing

8.1 Hardware and Software Used

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

Refer to the Executive Summary for the pricing spreadsheet and Appendix G for the actual price quotes used to create the spreadsheet.

8.2 Total Three Year Price

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

The total 3-year price of the configuration is \$136,120.70. For details of pricing, see the second page of the Executive Summary.

Discounts were taken from actual price quotes, available to any buyer with like conditions, provided by Sun Microsystems Inc., Continental Resources Inc. and Sybase Inc. The respective price quotes are included in Appendix G of this document.

8.3 Availability Date

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

All hardware and software components used in the measured configuration are generally available as of Jan 5, 2006.

9. Auditor's Information and Attestation Letter

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 follows the table of contents.

Appendix A. Solaris 10 and Sybase IQ 12.5 Parameters

This Appendix contains Solaris kernel parameters and environment variables and Sybase IQ system parameters.

Sybase IQ Server Configuration Parameters

utility.cfg

```
#
# these are the default suggested startup parameters
for the asiq
#
# note that you will still need to provide the
# server with the server name on startup "-n", and
# possibly a different system port number
#
-n tpch490
-c 32m
-gd all
-gl all
-gm 15
-gp 4096
-ti 4400
-tl 300
-iqtc 128
-iqmc 128
```

tpch.cfg

```
# note the port number here must matche the one in
# .odbc.ini
-c 12m
-gd all
-gl all
-gm 10
-gp 4096
-ti 4400
-tl 300

-iqmc 21000
-iqtc 9500

-iqmt 800

-iqgovern 12
-iqpartition 2

-x tcpip{port=3002}
-n tpch_wgs109-167
```

Sybase IQ Database Options

(altered from default)

options.sql

```
SET OPTION PUBLIC.Allow_Nulls_By_Default='Off';
SET OPTION PUBLIC.Flatten_Subqueries = 'On';
SET OPTION PUBLIC.Force_No_Scroll_Cursors='On';
SET OPTION PUBLIC.Load_Memory_Mb=0;
SET OPTION PUBLIC.Minimize_Storage='On';
SET OPTION PUBLIC.Notify_Modulus=10000000;
SET OPTION PUBLIC.Query_Temp_Space_Limit=0;
SET OPTION PUBLIC.Row_Counts='On';
SET OPTION PUBLIC.Query_Plan='off';
```

```
SET OPTION PUBLIC.Hash_Thrashing_Percent=100;
SET OPTION PUBLIC.Main_Reserved_DBSpace_MB=300;
SET OPTION
PUBLIC.SignificantDigitsForDoubleEquality=15;
SET OPTION PUBLIC.Sort_Phase1_Helpers=3;
```

```
SET OPTION PUBLIC.Max_IQ_Threads_Per_Connection=100;
SET OPTION PUBLIC.Append_Load='On';
SET OPTION PUBLIC.Default_Having_Selectivity = 1;
SET OPTION PUBLIC.Default_Like_Range_Selectivity = 1;
SET OPTION PUBLIC.Garray_Fill_Factor_Percent=3;
```

```
SET OPTION PUBLIC.Max_Hash_Rows = 25000000;
SET OPTION PUBLIC.Prefetch_Threads_Percent=18;
SET OPTION PUBLIC.Sweeper_Threads_Percent=12 ;
SET OPTION PUBLIC.Wash_Area_Buffers_Percent = '18';
```

Sybase IQ Environment Variables

```
SYBASE="/export/home/sybase"
export SYBASE
SYBASE_OCS="OCS-12_5"
export SYBASE_OCS
ASDIR="${SYBASE}/ASIQ-12_6"
export ASDIR
PATH="${ASDIR}/bin:${SYBASE}/${SYBASE_OCS}/bin:
${PATH}:/etc:."
export PATH
IQLIB="${ASDIR}/usr/lib:${ASDIR}/lib:${SYBASE}/
${SYBASE_OCS}/lib"
LD_LIBRARY_PATH_64="${IQLIB}:${LD_LIBRARY_PATH_64}"
export LD_LIBRARY_PATH_64
LD_LIBRARY_PATH="${IQLIB}:${LD_LIBRARY_PATH}"
export LD_LIBRARY_PATH
unset IQLIB
```

.odbc.ini

```
[ODBC Data Sources]
tpch=ASIQ Driver
utility_db=ASIQ Driver

[tpch]
Driver=/export/home/sybase/asiq12/lib/dbodbc7_r.so.1
EngineName=tpch_wgs109-167
CommLinks=tcpip{host=129.148.109.167;Port=3002}
DatabaseName=tpch
UserID=DBA
Password=SQL
DBG=yes
LOG=/tmp/tpch_odbc.log

[utility_db]
Driver=/export/home/sybase/asiq12/lib/dbodbc7_r.so.1
EngineName=tpch490
CommLinks=tcpip{host=129.148.109.167;Port=2638}
DatabaseName=utility_db
UserID=DBA
Password=SQL
DBG=yes
LOG=/tmp/utility_db_odbc.log
```

Solaris Parameters

(altered from default)

/etc/system

```
set tune_t_fsflushr=600
set autoup=36000000
set lotsfree = 16096
set bufhwm = 50000
```

Appendix B. Programs and Scripts

check_query1.bash

```
#!/bin/bash
#
# First remove the rf1.lock so that the Query Stream
will start
#
rm -f /export/home/sybase/run/scripts/rf1.lock
#
# Sleep while the rf2.lock file exists
# when the query stream completes it will remove the
rf2.lock
#
while [ -f /export/home/sybase/run/scripts/rf2.lock ]
do
# Wait for the Query Steam to complete
# check every 10 seconds
# echo "Lock File Exists"
sleep 10
done
# Return Control to the RF stream
```

create_database.sql

```
CREATE DATABASE '/sybase2/tpch.db'
TRANSACTION LOG ON
COLLATION 'ISO_BINENG'
CASE RESPECT
PAGE SIZE 4096
BLANK PADDING ON
JAVA ON
JCONNECT ON
IQ PATH '/sybase2/M01'
IQ PAGE SIZE 524288
TEMPORARY PATH '/sybase2/T01'
```

create_dbspaces.sql

```
create dbspace main2 as '/sybase2/M02' iq store;
create dbspace main3 as '/sybase2/M03' iq store;
create dbspace main4 as '/sybase2/M04' iq store;
create dbspace main5 as '/sybase2/M05' iq store;
create dbspace main6 as '/sybase2/M06' iq store;
create dbspace main7 as '/sybase2/M07' iq store;
create dbspace main8 as '/sybase2/M08' iq store;
create dbspace main9 as '/sybase2/M09' iq store;
create dbspace main10 as '/sybase2/M10' iq store;
create dbspace main11 as '/sybase2/M11' iq store;
create dbspace main12 as '/sybase2/M12' iq store;
create dbspace main13 as '/sybase2/M13' iq store;
create dbspace main14 as '/sybase2/M14' iq store;
create dbspace main15 as '/sybase2/M15' iq store;
create dbspace main16 as '/sybase2/M16' iq store;

create dbspace iqtemp2 as '/sybase2/T02' iq
temporary store;
create dbspace iqtemp3 as '/sybase2/T03' iq
temporary store;
create dbspace iqtemp4 as '/sybase2/T04' iq
temporary store;
```

create_tables.sql

```
CREATE TABLE region
(
r_regionkey unsigned int,
r_name char(25),
r_comment varchar(152),
PRIMARY KEY (r_regionkey)
);

CREATE TABLE nation
(
n_nationkey unsigned int,
n_name char(25),
n_regionkey unsigned int,
n_comment varchar(152),
PRIMARY KEY (n_nationkey)
);
CREATE HG INDEX n_regionkey_hg ON nation
(n_regionkey) ;

CREATE TABLE supplier
(
s_suppkey unsigned int,
s_name char(25),
s_address varchar(40),
s_nationkey unsigned int,
s_phone char(15),
s_acctbal double precision,
s_comment varchar(101),
PRIMARY KEY (s_suppkey)
);
CREATE HG INDEX s_nationkey_hg ON supplier
(s_nationkey) ;

CREATE TABLE part
(
p_partkey unsigned int,
p_name varchar(55),
p_mfgr char(25),
p_brand char(10),
p_type varchar(25),
p_size int,
p_container char(10),
p_retailprice double precision,
p_comment varchar(23),
PRIMARY KEY(p_partkey)
);

CREATE TABLE partsupp
(
ps_partkey unsigned int,
ps_suppkey unsigned int,
ps_availqty integer,
ps_supplycost double precision,
ps_comment varchar(199),
PRIMARY KEY (ps_partkey, ps_suppkey)
);
CREATE HG INDEX ps_partkey_hg ON partsupp
(ps_partkey) ;
CREATE HG INDEX ps_suppkey_hg ON partsupp
(ps_suppkey) ;

CREATE TABLE customer
(
c_custkey unsigned int,
c_name varchar(25),
c_address varchar(40),
c_nationkey unsigned int,
c_phone char(15),
c_acctbal double precision,
c_mktsegment char(10),
c_comment varchar(117),
PRIMARY KEY(c_custkey)
);
```

```

CREATE HG INDEX c_nationkey_hg ON customer
(c_nationkey) ;

CREATE TABLE orders
(
    o_orderkey          unsigned bigint,
    o_custkey           unsigned int,
    o_orderstatus      char(1),
    o_totalprice       double precision,
    o_orderdate        date,
    o_orderpriority    char(15),
    o_clerk             char(15),
    o_shippriority     int,
    o_comment           varchar(79),
    PRIMARY KEY (o_orderkey)
);
CREATE HG INDEX o_custkey_hg ON orders(o_custkey) ;
CREATE DATE INDEX o_orderdate_date ON orders
(o_orderdate) ;

CREATE TABLE lineitem
(
    l_orderkey          unsigned bigint,
    l_partkey           unsigned int,
    l_suppkey           unsigned int,
    l_linenum          int,
    l_quantity         double precision,
    l_extendedprice    double precision,
    l_discount         double precision,
    l_tax              double precision,
    l_returnflag       char(1),
    l_linestatus       char(1),
    l_shipdate         date,
    l_commitdate       date,
    l_receiptdate      date,
    l_shipinstruct     char(25),
    l_shipmode         char(10),
    l_comment           varchar(44)
);

CREATE HG INDEX l_partsupp_hg ON lineitem
(l_partkey,l_suppkey) ;
CREATE HG INDEX l_orderkey_hg ON lineitem
(l_orderkey) ;
CREATE HG INDEX l_partkey_hg ON lineitem(l_partkey) ;
CREATE HG INDEX l_suppkey_hg ON lineitem(l_suppkey) ;
CREATE DATE INDEX l_shipdate_date ON lineitem
(l_shipdate) ;
CREATE DATE INDEX l_receiptdate_date ON lineitem
(l_receiptdate);

```

tpch_rf.sql

```

=====
create table refresh_control ( rf1_data_set int not
null, rf2_data_set int not null);
insert into refresh_control values (0,0);
commit;
CREATE PROCEDURE DBA.tpch_rf1 (IN c_directory varchar
(128),
                                IN c_stream varchar(3))
ON EXCEPTION RESUME
BEGIN
    DECLARE delim_ascii integer;
    DECLARE c_data_set varchar(3);
    DECLARE i_data_set integer;
    DECLARE c_cmd long varchar;
    DECLARE outfile_name varchar(128); -- Debug
    DECLARE outfile_name2 varchar(128); -- Debug
    DECLARE c_lf varchar(2);
    DECLARE t_qstart timestamp;
    DECLARE t_qstop timestamp;

```

```

    DECLARE n_seconds numeric(12,5);
    DECLARE c_sqlstate CHAR(5);
    SET t_qstart = now(*);
    SET c_lf=char(10);
    SELECT rf1_data_set INTO i_data_set FROM
refresh_control;
    SET c_data_set=CAST(i_data_set+1 AS varchar(3));
    SET c_cmd='load table orders ( '+c_lf;
    SET c_cmd=c_cmd+' o_orderkey '+char(39)+'|'+char(39)
+', '+c_lf;
    SET c_cmd=c_cmd+' o_custkey '+char(39)+'|'+char(39)
+', '+c_lf;
    SET c_cmd=c_cmd+' o_orderstatus '+char(39)+'|'+char
(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' o_totalprice '+char(39)+'|'+char
(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' o_orderdate date('+char(39)+'YYYY-
MM-DD'+char(39)+'), filler(1), '+c_lf;
    SET c_cmd=c_cmd+' o_orderpriority '+char(39)+'
|'+char(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' o_clerk '+char(39)+'|'+char(39)+'',
'+c_lf;
    SET c_cmd=c_cmd+' o_shippriority '+char(39)+'|'+char
(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' o_comment '+char(39)+'|'+char(39)
+' ) '+c_lf;
    SET c_cmd=c_cmd+'from '+char(39)
+c_directory+'orders.tbl.u'+c_data_set+char(39)+c_lf;
    SET c_cmd=c_cmd+'row delimited by '+char(39)
+'\\x0a'+char(39)+' quotes off escapes off preview
on;';
    EXECUTE IMMEDIATE c_cmd;
    SELECT SQLSTATE INTO c_sqlstate;
    IF c_sqlstate != '00000' THEN
        ROLLBACK;
        RAISERROR 23002 'RF1 failed at Step 1 with
SQLSTATE: ', c_sqlstate;
        RETURN(1);
    END IF;
    SET c_cmd='load table lineitem ( '+c_lf;
    SET c_cmd=c_cmd+' l_orderkey '+char(39)+'|'+char(39)
+', '+c_lf;
    SET c_cmd=c_cmd+' l_partkey '+char(39)+'|'+char(39)
+', '+c_lf;
    SET c_cmd=c_cmd+' l_suppkey '+char(39)+'|'+char(39)
+', '+c_lf;
    SET c_cmd=c_cmd+' l_linenum '+char(39)+'|'+char
(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' l_quantity '+char(39)+'|'+char(39)
+', '+c_lf;
    SET c_cmd=c_cmd+' l_extendedprice '+char(39)+'
|'+char(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' l_discount '+char(39)+'|'+char(39)
+', '+c_lf;
    SET c_cmd=c_cmd+' l_tax '+char(39)+'|'+char(39)+'',
'+c_lf;
    SET c_cmd=c_cmd+' l_returnflag '+char(39)+'|'+char
(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' l_linestatus '+char(39)+'|'+char
(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' l_shipdate date('+char(39)+'YYYY-
MM-DD'+char(39)+'), filler(1), '+c_lf;
    SET c_cmd=c_cmd+' l_commitdate date('+char(39)
+'YYYY-MM-DD'+char(39)+'), filler(1), '+c_lf;
    SET c_cmd=c_cmd+' l_receiptdate date('+char(39)
+'YYYY-MM-DD'+char(39)+'), filler(1), '+c_lf;
    SET c_cmd=c_cmd+' l_shipinstruct '+char(39)+'|'+char
(39)+'', '+c_lf;
    SET c_cmd=c_cmd+' l_shipmode '+char(39)+'|'+char(39)
+', '+c_lf;
    SET c_cmd=c_cmd+' l_comment '+char(39)+'|'+char(39)
+' ) '+c_lf;
    SET c_cmd=c_cmd+'from '+char(39)
+c_directory+'lineitem.tbl.u'+c_data_set+char(39)
+c_lf;
    SET c_cmd=c_cmd+'row delimited by '+char(39)
+'\\x0a'+char(39)+c_lf+'quotes off escapes off preview
on;';

```

```

EXECUTE IMMEDIATE c_cmd;
SELECT SQLSTATE INTO c_sqlstate;
IF c_sqlstate != '00000' THEN
    rollback;
    RAISERROR 23002 'RF1 failed at Step 2 with
SQLSTATE: ', c_sqlstate;
    RETURN(1);
END IF;
UPDATE refresh_control SET rf1_data_set=cast
(c_data_set AS integer);
COMMIT;
SET t_qstop = now(*);
SET n_seconds=cast(datediff
(millisecond,t_qstart,t_qstop) AS numeric(12,5))/1000;
SET c_cmd='Stream updates Update
update_'+c_stream+'_RF1 LENGTH -- '+cast(n_seconds AS
varchar(20))+ ' seconds' ;
SELECT c_cmd;
RETURN(0);
END;
CREATE PROCEDURE DBA.tpch_rf2 (in c_directory varchar
(128),
                                in c_stream varchar(3))
ON exception resume
BEGIN
    DECLARE delim_ascii integer;
    DECLARE c_data_set varchar(3);
    DECLARE i_data_set integer;
    DECLARE c_cmd long varchar;
    DECLARE outfile_name varchar(128); -- Debug
    DECLARE c_lf varchar(2);
    DECLARE t_qstart timestamp;
    DECLARE t_qstop timestamp;
    DECLARE n_seconds numeric(12,5);
    DECLARE c_sqlstate CHAR(5);
    SET t_qstart = now(*);
    SET c_lf=char(10);
    SELECT rf2_data_set INTO i_data_set FROM
refresh_control;
    SET c_data_set=CAST(i_data_set+1 AS varchar(3));
    CREATE TABLE #delete_table ( d_orderkey UNSIGNED
INT, PRIMARY KEY (d_orderkey) );
    SET c_cmd='load table #delete_table (d_orderkey
'+char(39)+'\x0a'+char(39)+' ')+c_lf;
    SET c_cmd=c_cmd+'from '+char(39)
+c_directory+'delete.'+c_data_set+char(39)+c_lf;
    SET c_cmd=c_cmd+'quotes off '+c_lf;
    SET c_cmd=c_cmd+'escapes off; '+c_lf;
    EXECUTE IMMEDIATE c_cmd;
    SELECT SQLSTATE INTO c_sqlstate;
    IF c_sqlstate != '00000' THEN
        ROLLBACK;
        SET c_cmd='RF2 failed at Step 1 with SQLSTATE:
'+c_sqlstate;
        RAISERROR 23002 c_cmd;
        RETURN(1);
    END IF;
    DELETE lineitem FROM lineitem, #delete_table WHERE
l_orderkey = d_orderkey;
    SELECT SQLSTATE INTO c_sqlstate;
    IF c_sqlstate != '00000' THEN
        ROLLBACK;
        SET c_cmd='RF2 failed at Step 2 with SQLSTATE:
'+c_sqlstate;
        RAISERROR 23002 c_cmd;
        RETURN(1);
    END IF;
    DELETE orders FROM orders, #delete_table WHERE
o_orderkey = d_orderkey;
    SELECT SQLSTATE INTO c_sqlstate;
    IF c_sqlstate != '00000' THEN
        ROLLBACK;
        SET c_cmd='RF2 failed at Step 3 with SQLSTATE:
'+c_sqlstate;
        RAISERROR 23002 c_cmd;
        RETURN(1);
    END IF;
    UPDATE refresh_control SET rf2_data_set=CAST

```

```

(c_data_set AS integer);
COMMIT;
DROP TABLE #delete_table;
SET t_qstop = now(*);
SET n_seconds=cast(datediff
(millisecond,t_qstart,t_qstop) as numeric(12,5))/1000;
SET c_cmd='Stream updates Update
update_'+c_stream+'_RF2 LENGTH -- '+cast(n_seconds as
varchar(20))+ ' seconds' ;
SELECT c_cmd;
RETURN(0);
END;
=====

```

load_region.sql

```

=====
LOAD TABLE REGION (
R_REGIONKEY
R_NAME
R_COMMENT
)
FROM '/sybase_stage/region.tbl'
escapes off
quotes off
row delimited by '\x0a'
WITH CHECKPOINT ON;
commit;
=====

```

load_nation.sql

```

=====
LOAD TABLE NATION (
N_NATIONKEY
N_NAME
N_REGIONKEY
N_COMMENT
)
FROM '/sybase_stage/nation.tbl'
escapes off
quotes off
row delimited by '\x0a'
WITH CHECKPOINT ON;
commit;
=====

```

load_customer.sql

```

=====
LOAD TABLE CUSTOMER (
C_CUSTKEY
C_NAME
C_ADDRESS
C_NATIONKEY
C_PHONE
C_ACCTBAL
C_MKTSEGMENT
C_COMMENT
)
FROM '/sybase_stage/customer.tbl'
escapes off
quotes off
row delimited by '\x0a'
WITH CHECKPOINT ON;
commit;
=====

```

load_part.sql

```

=====
LOAD TABLE PART (
P_PARTKEY
P_NAME
P_MFGR

```

```

P_BRAND          | '|',
P_TYPE           | '|',
P_SIZE          | '|',
P_CONTAINER     | '|',
P_RETAILPRICE   | '|',
P_COMMENT       | '|',
)

```

```

FROM '/sybase_stage/part.tbl'
escapes off
quotes off
row delimited by '\x0a'
WITH CHECKPOINT ON;
commit;

```

load_supplier.sql

```

LOAD TABLE SUPPLIER (
S_SUPPKEY       | '|',
S_NAME          | '|',
S_ADDRESS       | '|',
S_NATIONKEY     | '|',
S_PHONE         | '|',
S_ACCTBAL       | '|',
S_COMMENT       | '|',
)

```

```

FROM '/sybase_stage/supplier.tbl'
escapes off
quotes off
row delimited by '\x0a'
WITH CHECKPOINT ON;
commit;

```

load_partsupp.sql

```

LOAD TABLE PARTSUPP (
PS_PARTKEY      | '|',
PS_SUPPKEY      | '|',
PS_AVAILQTY     | '|',
PS_SUPPLYCOST   | '|',
PS_COMMENT       | '|',
)

```

```

FROM '/sybase_stage/partsupp.tbl'
escapes off
quotes off
row delimited by '\x0a'
WITH CHECKPOINT ON;
commit;

```

load_orders.sql

```

LOAD TABLE ORDERS (
O_ORDERKEY      | '|',
O_CUSTKEY       | '|',
O_ORDERSTATUS   | '|',
O_TOTALPRICE    | '|',
O_ORDERDATE     | '|',
O_ORDERPRIORITY | '|',
O_CLERK         | '|',
O_SHIPPRIORITY  | '|',
O_COMMENT       | '|',
)

```

```

FROM
'/sybase_stage/orders.tbl.1',
'/sybase_stage/orders.tbl.2',
'/sybase_stage/orders.tbl.3',
'/sybase_stage/orders.tbl.4',
'/sybase_stage/orders.tbl.5',
'/sybase_stage/orders.tbl.6',
'/sybase_stage/orders.tbl.7',
'/sybase_stage/orders.tbl.8'

```

```

escapes off
quotes off
row delimited by '\x0a'
WITH CHECKPOINT ON;
commit;

```

load_lineitem.sql

```

LOAD TABLE LINEITEM (
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       | '|',
)

```

```

FROM
'/sybase_stage/lineitem.tbl.1',
'/sybase_stage/lineitem.tbl.2',
'/sybase_stage/lineitem.tbl.3',
'/sybase_stage/lineitem.tbl.4',
'/sybase_stage/lineitem.tbl.5',
'/sybase_stage/lineitem.tbl.6',
'/sybase_stage/lineitem.tbl.7',
'/sybase_stage/lineitem.tbl.8'

```

```

escapes off
quotes off
row delimited by '\x0a'
WITH CHECKPOINT ON;
commit;
checkpoint;
commit;

```

update_power.sql

```

create variable qstart timestamp;
create variable qstop timestamp;
create variable c_sqlstate CHAR(5);
create variable c_path varchar(128);
set c_path='/sybase_stage/';
set qstart=now(*);
select 'Stream 0 RF1 START -- ', qstart ;
call tpch_rf1 (c_path,'0');
set qstop=now(*);
select 'Stream 0 Update RF1 LENGTH -- ',cast(datediff
(millisecond,qstart,qstop) as numeric)/1000, '
seconds';
select 'Stream 0 RF1 FINISH -- ', qstop ;
-- Sleep Until the query stream completes
set qstart = now(*);
select 'Stream 0 RF WAITING -- ', qstart;
xp_cmdshell
('/export/home/sybase/run/scripts/check_query1.bash');
set qstart = now(*);
select 'Stream 0 RF CONTINUING -- ', qstart;
set qstart = now(*);
select 'Stream 0 RF2 START -- ', qstart ;
call tpch_rf2 (c_path,'0');
set qstop=now(*);
select 'Stream 0 Update RF2 LENGTH -- ',cast(datediff
(millisecond,qstart,qstop) as numeric)/1000, '
seconds';
select 'Stream 0 RF2 FINISH -- ', qstop ;

```

update_throughput7.sql

```
create variable qstart timestamp;
create variable qstop timestamp;
create variable c_sqlstate CHAR(5);
create variable c_path varchar(128);
set qstart = now(*);
set c_path='dbgen_files/';
select 'Stream updates START -- ', qstart ;
select @@servername, db_name();
call tpch_rf1 (c_path,'1');
commit;
tpch_wait;
call tpch_rf2 (c_path,'1');
commit;
tpch_wait;
call tpch_rf1 (c_path,'2');
commit;
tpch_wait;
call tpch_rf2 (c_path,'2');
commit;
tpch_wait;
call tpch_rf1 (c_path,'3');
commit;
tpch_wait;
call tpch_rf2 (c_path,'3');
commit;
tpch_wait;
call tpch_rf1 (c_path,'4');
commit;
tpch_wait;
call tpch_rf2 (c_path,'4');
commit;
tpch_wait;
call tpch_rf1 (c_path,'5');
commit;
tpch_wait;
call tpch_rf2 (c_path,'5');
commit;
tpch_wait;
call tpch_rf1 (c_path,'6');
commit;
tpch_wait;
call tpch_rf2 (c_path,'6');
commit;
tpch_wait;
call tpch_rf1 (c_path,'7');
commit;
tpch_wait;
call tpch_rf2 (c_path,'7');
commit;
set qstop = now(*);
select 'Stream updates STOP -- ', qstop ;
```

gen_streams_new.ksh

```
#!/bin/ksh
```

```
if (( $# < 3 ))
then
    echo "usage: $0 seed scale_factor
num_streams"
    exit
fi
```

```
PATH=/export/home/sybase/ASIQ-
12_5/bin:/export/home/sybase/OCS-
12_5/bin:/usr/openwin/bin:/bin:./usr/dist/pkgs/forte_
dev/SUNWspro/bin:/usr/ccs/bin:/usr/dt/bin:/usr/dist/pk
gs/devpro,v4.0/5.x-
```

```
sparc/bin:/usr/dist/local/exe:/usr/dist/exe:/usr/ucb:/
usr/sbin:/net/josie/export/home18/rgostan/bin:/export/
home/sybase/run/scripts:/etc:./export/home/sybase/run
/tpch/appendix/dbgen
export PATH
export DSS_PATH=/export/home/sybase/run/scripts;
export
DSS_CONFIG=/export/home/sybase/run/tpch/appendix/dbgen
;
export DSS_DIST=dists.dss;
export
DSS_QUERY=/export/home/sybase/run/tpch/appendix/templa
tes/queries;
#export
DSS_QUERY=/export/home/sybase/run/tpch/appendix/templa
tes/queries.debug;
```

```
seed=$1
sf=$2
ns=$3
```

```
i=0
```

```
while ((i<=ns))
do
```

```
    qgen -c -p 0 -l qparm${i}.txt -i
    $DSS_QUERY/init.sql -t $DSS_QUERY/complete.sql -r
    $seed -s $sf \
    1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
    21 22 > stream${i}.sql
    ((seed=seed+1))
    ((i=i+1))0
done
```

```
echo $seed
```

ACID Test Execution Code

atomicity test

```
dbtest acid_atomic_main.tst > acid_atomic_main.out
```

consistency test

```
dbtest acid_consistency_main.tst >
acid_consistency_main.out
```

isolation tests

```
dbtest acid_isolation_main1.tst >
acid_isolation_main1.out
dbtest acid_isolation_main2.tst >
acid_isolation_main2.out
dbtest acid_isolation_main3.tst >
acid_isolation_main3.out
dbtest acid_isolation_main4.tst >
acid_isolation_main4.out
dbtest acid_isolation_main5.tst >
acid_isolation_main5.out
dbtest acid_isolation_main6.tst >
acid_isolation_main6.out
```

durability test

```
dbtest acid_durability_main.tst >
```

acid_durability_main.out

ACID Test Source Code

acid_atomic_main.tst

```
stringconnect "dsn=tpch;"

execute {select now(*)} into times
print 'Atomicity test start = ', times
print ' '

include 'acid_functions.tst'
commit

%
% Atomicity test with rollback
%
print ' '
print 'Starting atomicity test with rollback'
print ' '

run test 'acid_atomic_setup.tst'

stringconnect "dsn=tpch;"
let counter=0

LOOP {
open cur2 {select ordr, line, delta from aa_whattodo
where seqnum=^}
    substitute counter
print 'counter = ',counter
fetch cur2 into ordr, line, delta
if ROWSTATUS != FOUND then { BREAK LOOP } endif
print 'Acid transaction for: o_key-',ordr,' l_key-',
line,' delta-',delta

execute {select o_totalprice, l_quantity,
l_extendedprice
    from orders, lineitem
    where o_orderkey = l_orderkey and o_orderkey
=^ and l_linenumber = ^}
    substitute ordr, line
    into o_total, l_quan, l_price
print 'o_totalprice = ',o_total,' l_quantity =
',l_quan,
    l_extendedprice = ',l_price

execute {call acid_transaction(^, ^, ^, rprice,
quantity,
                                tax, disc, extprice,
ototal)
    } substitute ordr, line, delta
close cur2
let counter = counter+1

rollback
execute {select now(*)} into times
print 'rollback : ', times

execute {select o_totalprice, l_quantity,
l_extendedprice
    from orders, lineitem
    where o_orderkey = l_orderkey and o_orderkey
=^ and l_linenumber = ^}
    substitute ordr, line
    into o_total, l_quan, l_price
print 'o_totalprice = ',o_total,' l_quantity =
',l_quan,
    l_extendedprice = ',l_price
print ' '
} ENDFEED
```

```
commit

%
% Atomicity test with commit
%
stringconnect "dsn=tpch;"
print ' '
print 'Starting atomicity test with commit '
print ' '
run test 'acid_atomic_setup.tst'

stringconnect "dsn=tpch;"

open curl {select ordr, line, delta from aa_whattodo}
LOOP {
fetch curl into ordr, line, delta
if ROWSTATUS != FOUND then { BREAK LOOP } endif
print 'Acid transaction for: o_key-',ordr,' l_key-',
line,' delta-',delta
execute {select o_totalprice, l_quantity,
l_extendedprice
    from orders, lineitem
    where o_orderkey = l_orderkey and o_orderkey
=^ and l_linenumber = ^}
    substitute ordr, line
    into o_total, l_quan, l_price
print 'o_totalprice = ',o_total,' l_quantity =
',l_quan,
    l_extendedprice = ',l_price

execute {call acid_transaction(^, ^, ^, rprice,
quantity,
                                tax, disc, extprice,
ototal)
    } substitute ordr, line, delta
commit
execute {select now(*)} into times
print 'commit : ', times

execute {select o_totalprice, l_quantity,
l_extendedprice
    from orders, lineitem
    where o_orderkey = l_orderkey and o_orderkey
=^ and l_linenumber = ^}
    substitute ordr, line
    into o_total, l_quan, l_price
print 'o_totalprice = ',o_total,' l_quantity =
',l_quan,
    l_extendedprice = ',l_price
print ' '
} ENDFEED

close curl
commit

execute {select now(*)} into times
print 'Atomicity test end = ', times

End Test
```

acid_atomic_setup.tst

```
stringconnect "dsn=tpch;"

allow error -141
execute { commit }
execute { drop table aa_whattodo }
allow no error

execute {
create table aa_whattodo (
    seqnum int not null,
```

```

        ordr      int      not null,
        line      int      null,
        delta     int      null)
}

print 'aa_whattodo CREATED!!'
execute {select now(*)} into times
print 'time = ', times

fetch {select count(*) from aa_whattodo } into ROWS
assert ROWS = 0

print 'Number of rows before load: ',ROWS

LOOP ({let counter = 0}; {counter < 5}; {let counter =
counter + 1})
{
    execute {call generate_acid_values()}
        into orderkey, linenumber,delta
    execute {insert into aa_whattodo values ( ^ ,
^ , ^ , ^ ) }
        substitute counter, orderkey,
linenumber, delta
    print counter, ' ',orderkey, ' ',linenumber,' ',
delta
}
ENDLOOP

commit

fetch {select count(*) from aa_whattodo } into ROWS
assert ROWS = 5

print 'Number of rows after load: ',ROWS

disconnect

End Test

```

acid_consistency_main.tst

```

stringconnect "dsn=tpch;"

execute {select now(*)} into times
print 'Consistency test start = ', times
print ' '

include 'acid_functions.tst'

run test 'acid_consistency_setup.tst'

execute {select now(*)} into times
print 'Consistency test time = ', times
print ' '

run test '-o' 'acid_consistency_q1.ot'
'acid_consistency_query.tst'
disconnect

start test '-o' 'acid_consist_user1.ot' 'stream=1'
'acid_consistency_txn.tst'
sleep 1000
start test '-o' 'acid_consist_user2.ot' 'stream=2'
'acid_consistency_txn.tst'
sleep 1000
start test '-o' 'acid_consist_user3.ot' 'stream=3'
'acid_consistency_txn.tst'
sleep 1000
start test '-o' 'acid_consist_user4.ot' 'stream=4'
'acid_consistency_txn.tst'
sleep 1000
start test '-o' 'acid_consist_user5.ot' 'stream=5'
'acid_consistency_txn.tst'
sleep 1000

```

```

start test '-o' 'acid_consist_user6.ot' 'stream=6'
'acid_consistency_txn.tst'
sleep 1000
start test '-o' 'acid_consist_user7.ot' 'stream=7'
'acid_consistency_txn.tst'
sleep 1000
start test '-o' 'acid_consist_user8.ot' 'stream=8'
'acid_consistency_txn.tst'
sleep 1000
start test '-o' 'acid_consist_user9.ot' 'stream=9'
'acid_consistency_txn.tst'

% let the log flush...
sleep 1500000

stringconnect "dsn=tpch;"
run test '-o' 'acid_consistency_q2.ot'
'acid_consistency_query.tst'

execute {select now(*)} into times
print 'Consistency test end = ', times
print ' '

End Test

```

acid_consistency_query.tst

```

stringconnect "dsn=tpch;"

open curl {select stream, seqnum, ordr, line, delta
from acid_table
        where seqnum > 10 order by seqnum}

print ' '

let n=1
LOOP {
    fetch curl into str, seq, ord, lin, delta

    fetch {select round(cast(o_totalprice as numeric
(26,16)),2)
        from orders where o_orderkey=^ }
        substitute ord into o_price

    if ROWSTATUS != FOUND then { BREAK LOOP } endif
    if n > 25 then { BREAK LOOP } endif

    fetch { call acid_single_query (^) } substitute ord
into l_total

    fetch {select cast(^ as numeric(12,2)) } substitute
o_price into o_price
    fetch {select cast(^ as numeric(12,2)) } substitute
l_total into l_total

    print 'orderid = ', ord, '          o_totalprice =
', o_price,
        '          acid query = ' , l_total

    ASSERT (o_price = l_total)
        then { print 'Did not compare correctly' }
ENDASSERT
    let n=n+1
} ENDLOOP

disconnect

END Test

```

acid_consistency_setup.tst

```

stringconnect "dsn=tpch;"

```



```

execute { set option public.isolation_level=3 }
execute {set option public.query_plan='off'}
execute {set temporary option chained='on'}
execute {set option public.auto_commit=off}

% Drop Table if found
allow error -141
execute { drop table acid_table }
execute {drop table latest}
allow no error

execute {
create table acid_table (
        stream int      null,
        seqnum  int      null,
        ordr    int      null,
        line    int      null,
        delta   int      null)
on SYSTEM
}

execute {checkpoint}

fetch {select count(*) from acid_table } into ROWS
assert ROWS = 0
print 'Number of rows before load: ',ROWS
commit

print 'acid_table created'

execute {create table latest(stream int ,last int
null) on SYSTEM }
LOOP ({let j = 1}; {j <= 9}; {let j = j + 1})
{
    execute { insert into latest(stream,last)
values (^,0) }
        substitute j
    } endloop
commit

print 'latest created'

LOOP ({let i = 1}; {i <= 9}; { let i = i + 1})
{
    LOOP ({let j = 1}; {j <= 100}; {let j = j + 1})
    {
        execute { call generate_acid_values() } into
ordr, line, delta
        execute { insert into acid_table values
(^,^,^,^,^) }
            substitute i,j,ordr,line,delta
    } endloop
    print (j-1)*i
} endloop

commit

fetch {select count(*) from acid_table } into ROWS
assert ROWS = 900
print 'Number of rows after load: ',ROWS

End Test

```

acid_consistency_txn.tst

```

=====
stringconnect "dsn=tpch;"

execute {set temporary option chained='on'}

execute {select now(*)} into times
print 'Consistency test start = ', times
print ' '

commit

```

```

LOOP ({let i = 1}; {i <= 100}; { let i = i + 1})
{
    fetch {select ordr, line, delta from acid_table
        where stream=^ and seqnum=^ }
        substitute stream, i
    commit
    if ROWSTATUS != FOUND then { print 'not enough rows'
        BREAK LOOP }
    endif

    print 'User=',stream,' Acid Txn=',i,
        ' o_key=', ord , ' l_key=', line , '
delta=' ,delta

    execute {call acid_transaction( ^, ^, ^, rprice,
quantity,
                                tax, disc, extprice,
ototal)
        } substitute ordr, line, delta

    commit
    execute { update latest set last=^ where stream=^ }
    substitute i,stream
    commit
    execute { set temporary option isolation_level=1 }
    execute { select max(last) from latest } into biggest
    execute { select min(last) from latest } into
smallest
    commit
    execute { set temporary option isolation_level=3 }

    let num=1200*(i-smallest)
    if i+4>=biggest
    then {let num=num+8000}
    endif
    sleep 14000
}
ENDLOOP

disconnect

End Test

```

acid_durability_main.tst

```

=====
stringconnect "dsn=tpch;"

execute {select now(*)} into times
print 'Durability test start = ', times
print ' '

include 'acid_functions.tst'
run test 'acid_durability_setup.tst'

execute {select now(*)} into times
print 'Durability test time = ', times
print ' '

run test '-o' 'acid_durability_q1.ot'
'acid_durability_query.tst'

start test '-o' 'acid_dura_user1.ot' 'stream=1'
'acid_durability_txn.tst'
sleep 1000
start test '-o' 'acid_dura_user2.ot' 'stream=2'
'acid_durability_txn.tst'
sleep 1000
start test '-o' 'acid_dura_user3.ot' 'stream=3'
'acid_durability_txn.tst'
sleep 1000
start test '-o' 'acid_dura_user4.ot' 'stream=4'
'acid_durability_txn.tst'
sleep 1000
start test '-o' 'acid_dura_user5.ot' 'stream=5'

```

```
'acid_durability_txn.tst'
sleep 1000
start test '-o' 'acid_dura_user6.ot' 'stream=6'
'acid_durability_txn.tst'
sleep 1000
start test '-o' 'acid_dura_user7.ot' 'stream=7'
'acid_durability_txn.tst'
sleep 1000
start test '-o' 'acid_dura_user8.ot' 'stream=8'
'acid_durability_txn.tst'
sleep 1000
start test '-o' 'acid_dura_user9.ot' 'stream=9'
'acid_durability_txn.tst'
```

```
synchronize 10
```

```
execute {select now(*)} into times
print 'Durability test time = ', times
print ' '
```

```
run test '-o' 'acid_durability_q2.ot'
'acid_durability_query.tst'
```

```
execute {select now(*)} into times
print 'Durability test end = ', times
print ' '
```

```
End Test
```

```
=====
acid_durability_query.tst
=====
```

```
Test 'tpcd_acid_query'
Description 'perform the acid query.'
```

```
stringconnect "dsn=tpch;"
```

```
open curl {select stream, seqnum, ord, line, delta
from acid_table
where seqnum > 5 order by seqnum}
print ' '
```

```
let n=1
LOOP {
  fetch curl into str, seq, ord, lin, delta
  fetch {select round(cast(o_totalprice as numeric
(26,16)),2)
from orders where o_orderkey=^ }
substitute ord into o_price
```

```
if ROWSTATUS != FOUND then { BREAK LOOP } endif
if n > 50 then { BREAK LOOP } endif
fetch { call acid_single_query (^) } substitute ord
into l_total
```

```
fetch {select cast(^ as numeric(12,2)) } substitute
o_price into o_price
fetch {select cast(^ as numeric(12,2)) } substitute
l_total into l_total
```

```
print 'orderkey = ', ord, ' o_totalprice =
', o_price,
' acid query = ', l_total
```

```
ASSERT (o_price = l_total)
then { print 'Did not compare correctly' }
ENDASSERT
let n=n+1
```

```
} ENDLLOOP
```

```
disconnect
```

```
END Test
```

```
=====
acid_durability_setup.tst
=====
```

```
stringconnect "dsn=tpch;"
```

```
% Drop Table if found
allow error -141
execute { drop table acid_table }
allow no error
```

```
execute {
create table acid_table (
stream int not null,
seqnum int not null,
ord int not null,
line int null,
delta int null)
}
```

```
execute {checkpoint}
```

```
print 'acid_table CREATED!!'
```

```
fetch {select count(*) from acid_table } into ROWS
assert ROWS = 0
print 'Number of rows before load: ',ROWS
commit
```

```
LOOP ({let i = 1}; {i <= 9}; { let i = i + 1})
{
  LOOP ({let j = 1}; {j <= 200}; { let j = j + 1})
  {
    execute { call generate_acid_values()} into
ordr, line, delta
execute { insert into acid_table values
(^,^,^,^,^ ) substitute i,j,ordr,line,delta
} endloop
print (j-1)*i
} endloop
```

```
commit
execute {checkpoint}
```

```
fetch {select count(*) from acid_table } into ROWS
print 'Number of rows after load: ',ROWS
```

```
End Test
```

```
=====
acid_durability_txn.tst
=====
```

```
stringconnect "dsn=tpch;"
```

```
execute {select now(*)} into times
print 'Durability test start = ', times
print ' '
print 'stream trans. o_key l_key p_key s_key
delta date_t '
```

```
LOOP ({let i = 1}; {i <= 200}; { let i = i + 1})
{
  fetch {select ord, line, delta from acid_table
where stream=^ and seqnum=^ }
substitute stream, i
```

```
if ROWSTATUS != FOUND then { print 'not enough rows'
BREAK LOOP }
endif
```

```
execute {select l_partkey, l_suppkey from lineitem
```

```

        where l_orderkey=^ and l_linenumber=^}
        substitute ordr, line
        into p_key, s_key

execute {call acid_transaction( ^, ^, ^)
        } substitute ordr, line, delta
        into rprice, quantity, tax, disc, extprice,
ototal

assert SQLCODE=0 then { DIE } endassert
commit

execute {select now(*)} into times
print stream, ' ', ' ',
      'txn ', i, ' ', ' ',
      ordr, ' ', ' ', ' ',
      line, ' ', ' ', ' ',
      p_key, ' ', ' ', ' ',
      s_key, ' ', ' ', ' ',
      delta, ' ', ' ', ' ',
      times, ' ', ' ', ' '

sleep 1000
}
ENDLOOP

synchronize 10

End Test

```

acid_functions.tst

```

=====
print 'creating the sleep procedure'

allow error -265
execute { DROP PROCEDURE dbo.sleep}
allow no error

execute{ create procedure dbo.sleep(in sleep_time
integer default null)
begin
  declare command varchar(255);
  select 'xp_cmdshell ''sleep '+str(sleep_time)+'''
into command;
  execute immediate command
end;
}

print 'creating the Acid Transaction'

allow error -265
execute { DROP PROCEDURE acid_transaction }
allow no error

execute{ CREATE PROCEDURE acid_transaction(
      IN o_key      INT,
      IN l_key      INT,
      IN delta      INT,
      OUT rprice    Numeric(18,8),
      OUT quantity  INT,
      OUT tax       Numeric(18,8),
      OUT disc      Numeric(18,8),
      OUT extprice  Numeric(18,8),
      OUT ototal    Numeric(18,8)
      )
ON EXCEPTION RESUME
BEGIN
  DECLARE pkey      INT ;
  DECLARE skey      INT ;
  DECLARE cost      NUMERIC(18,8) ;
  DECLARE new_extprice NUMERIC(18,8) ;
  DECLARE new_ototal NUMERIC(18,8) ;
  DECLARE new_quantity INT ;
  DECLARE c_sqlstate char(5);

```

```

LOOP1: LOOP
COMMIT;
SELECT o_totalprice
      INTO ototal
      FROM orders
      WHERE o_orderkey = o_key ;
SELECT l_quantity,
      l_extendedprice,
      l_partkey,
      l_suppkey,
      l_tax,
      l_discount
      INTO quantity,
      extprice,
      pkey,
      skey,
      tax,
      disc
      FROM lineitem
      WHERE l_orderkey = o_key
      AND l_linenumber = l_key;
-- CLEAN UP IMPRECICE NUMBERS
SET ototal = ototal -
"TRUNCATE"("truncate"(extprice*(1-disc),2)*(1+tax),2);
SET rprice = "TRUNCATE"((extprice / quantity),2);
SET cost = "TRUNCATE"((rprice * delta),2);
SET new_extprice = extprice + cost;
SET new_ototal = "TRUNCATE"(new_extprice * (1.0 -
disc),2);
SET new_ototal = "TRUNCATE"(new_ototal * (1.0 +
tax),2);
SET new_ototal = ototal + new_ototal ;
SET new_quantity = quantity + delta ;
--
-- Update LineItem
--
UPDATE lineitem
  SET l_quantity      = new_quantity,
      l_extendedprice = new_extprice
  WHERE l_orderkey=o_key
      AND l_linenumber=l_key;
SELECT SQLSTATE INTO c_sqlstate;
IF c_sqlstate = '00000' THEN
  --
  -- Update Orders
  --
  UPDATE orders
    SET o_totalprice = new_ototal
    WHERE o_orderkey = o_key;
  SELECT SQLSTATE INTO c_sqlstate;
  IF c_sqlstate = '00000' THEN
    INSERT INTO history VALUES ( pkey, skey,
o_key, l_key, delta, now(*) ) ;
    SELECT SQLSTATE INTO c_sqlstate;
    IF c_sqlstate = '00000' THEN
      LEAVE LOOP1;
    END IF;
  END IF;
  END IF;
  END LOOP LOOP1;
RETURN(0);
END;
}

print 'Acid transaction created'
print ' '

print 'Creating Acid query'

allow error -265
execute { DROP PROCEDURE acid_single_query }
allow no error

execute{
CREATE PROCEDURE acid_single_query( IN o_key INT, OUT
o_total NUMERIC(26,16) )
BEGIN
  SELECT o_total =

```

```

sum ("truncate" ("truncate"(
round(cast(l_extendedprice as
numeric(26,16)),2) *
(1 - round(cast(l_discount as
numeric(26,16)),2)),2)
* (1 + round(cast(l_tax as numeric
(26,16)),2)) , 2))
FROM lineitem WHERE l_orderkey = o_key;
END
}

print 'Acid query created'
print ' '

print 'Creating Generate_acid_values function'

allow error -265
execute { DROP PROCEDURE generate_acid_values }
allow no error

execute{
create procedure generate_acid_values(
out orderkey int,
out linenumbr int,
out delta int)
BEGIN

declare seed bigint;
declare rand_dbl double precision;
declare rand_int int;
declare out_key int;

declare times cursor for select datediff
(millisecond,convert(char(10),getdate(), 116),now(*));
declare randoml cursor for select rand(seed);
declare random cursor for select rand();
declare get_order cursor for
select o_orderkey from orders where o_orderkey
= rand_int;
declare get_linenumbr cursor for
select max(l_linenumbr) from lineitem
where l_orderkey = orderkey;

open times;
fetch next times into seed;
open randoml;
fetch next randoml into rand_dbl;

set out_key = 0;
loop1:
while out_key = 0 LOOP
open random;
open get_order;

fetch next random into rand_dbl;
set rand_int = rand_dbl * 6001215 +1;
fetch next get_order into out_key;

close random;
close get_order;
end loop loop1;

set orderkey = out_key;

open get_linenumbr;
fetch next get_linenumbr into linenumbr;
close get_linenumbr;

open random;
fetch next random into rand_dbl;
set delta = rand_dbl * 100 + 1;
close random;

END
}
commit
execute {checkpoint}

```

```

print 'Generate_acid_values function created'
print ' '

print 'Creating Generate_Ps_Values function'

allow error -265
execute { DROP PROCEDURE generate_ps_values }
allow no error

execute{
create procedure generate_ps_values(
out partkey int,
out suppkey int)
BEGIN

declare seed bigint;
declare rand_dbl double precision;
declare rand_int int;
declare out_key int;
declare counter int;

declare times cursor for select datediff
(millisecond,convert(char(10),getdate(), 116),now(*));
declare randoml cursor for select rand(seed);
declare random cursor for select rand();
declare get_supp cursor for
select ps_suppkey from partsupp
where ps_suppkey = rand_int;
declare get_part cursor for
select ps_partkey from partsupp
where ps_suppkey = suppkey;

open times;
fetch next times into seed;
open randoml;
fetch next randoml into rand_dbl;
close randoml;

set out_key = 0;
while out_key = 0 LOOP
open random;
open get_supp ;

fetch next random into rand_dbl;
set rand_int = rand_dbl * 10000 +1;
fetch next get_supp into out_key;

close random;
close get_supp ;
end loop;
set suppkey = out_key;

set out_key = 0;
set counter = 0;
open random;
open get_part;
fetch next random into rand_dbl;
set rand_int = rand_dbl * 10 +1;

loop1:
while counter < rand_int LOOP
set counter = counter+1;
fetch next get_part into out_key;
end loop loop1;

set partkey = out_key;
close random;
close get_part;

END
}
commit
execute {checkpoint}
print 'Generate_Ps_Values function created'
print ' '

print 'Creating history table'

```

```

allow error -141
execute { drop table history }
allow no error

```

```

execute {
create table history (
  h_p_key  unsigned INT NOT NULL ,
  h_s_key  unsigned INT NOT NULL ,
  h_o_key  unsigned INT NOT NULL ,
  h_l_key  INT NOT NULL,
  h_delta  INT NOT NULL,
  h_date_t  TIMESTAMP NOT NULL)
}

```

```

commit
execute {checkpoint}
print 'history table created'
print ' '

```

```

=====
acid_isolation_main1.tst
=====

```

```

stringconnect "dsn=tpch;"

execute {select now(*)} into times
print ' '
print ' '
print 'Isolation test 1'
print 'start = ', times
print ' '

```

```

include 'acid_functions.tst'
include 'acid_isolation_setup.tst'

```

```

start test 'acid_isolation_test1.tst'
start test 'acid_isolation_test1_query.tst'

```

```

End Test

```

```

=====
acid_isolation_main2.tst
=====

```

```

stringconnect "dsn=tpch;"

execute {select now(*)} into times
print ' '
print ' '
print 'Isolation test 2'
print 'start = ', times
print ' '

```

```

include 'acid_functions.tst'
include 'acid_isolation_setup.tst'

```

```

start test 'acid_isolation_test2.tst'
start test 'acid_isolation_test2_query.tst'

```

```

End Test

```

```

=====
acid_isolation_main3.tst
=====

```

```

stringconnect "dsn=tpch;"

execute {select now(*)} into times
print ' '
print ' '
print 'Isolation test 3'
print 'start = ', times
print ' '

```

```

print 'Isolation test start = ', times

```

```

include "acid_functions.tst"
include 'acid_isolation_setup.tst'

```

```

start test 'acid_isolation_test3_transaction1.tst'
start test 'acid_isolation_test3_transaction2.tst'

```

```

End Test

```

```

=====
acid_isolation_main4.tst
=====

```

```

stringconnect "dsn=tpch;"

```

```

execute {select now(*)} into times
print ' '
print ' '
print 'Isolation test 4'
print 'start = ', times
print ' '
print 'Isolation test start = ', times

```

```

include 'acid_functions.tst'
include 'acid_isolation_setup.tst'

```

```

start test 'acid_isolation_test4_transaction1.tst'
start test 'acid_isolation_test4_transaction2.tst'

```

```

End Test

```

```

=====
acid_isolation_main5.tst
=====

```

```

stringconnect "dsn=tpch;"

```

```

execute {select now(*)} into times
print ' '
print ' '
print 'Isolation test 5'
print 'start = ', times
print ' '

```

```

include 'acid_functions.tst'
include 'acid_isolation_setup.tst'

```

```

start test 'acid_isolation_test5_transaction1.tst'
start test 'acid_isolation_test5_query.tst'

```

```

End Test

```

```

=====
acid_isolation_main6.tst
=====

```

```

stringconnect "dsn=tpch;"

```

```

execute {select now(*)} into times
print ' '
print ' '
print 'Isolation test 6'
print 'start = ', times
print ' '

```

```

include 'acid_functions.tst'
include 'acid_isolation_setup.tst'

```

```

start test '-u' 'acid_isolation_test6_query.tst'
start test 'acid_isolation_test6_transaction1.tst'

```

```

End Test

```

acid_isolation_setup.tst

```
=====
stringconnect "dsn=tpch;"

% Drop Table if found

allow error -141
execute { commit }
execute { drop table acid_isolation_table }
allow no error

execute {
create table acid_isolation_table (
            ordr      int      not null,
            line      int      null,
            delta     int      null)
}

execute {checkpoint}

print 'acid_isolation_table CREATED!!'
execute {select now(*)} into times
print 'time = ', times

fetch {select count(*) from acid_isolation_table }
into ROWS
assert ROWS = 0

print 'Number of rows before load: ',ROWS

execute {call generate_acid_values()} into orderkey,
linenumber,delta
execute {insert into acid_isolation_table values ( ^ ,
^ , ^ ) }
            substitute orderkey, linenumber, delta
print orderkey, ' ',linenumber,' ', delta

commit

fetch {select count(*) from acid_isolation_table }
into ROWS
assert ROWS = 1

print 'Number of rows after load: ',ROWS

disconnect

End Test
```

acid_isolation_test1.tst

```
=====
stringconnect "dsn=tpch;"

execute {select ordr, line, delta from
acid_isolation_table}
            into ordr, line, delta

print 'The following are the data input values for
the ACID Transaction.'
print '(user 1) o_key-',ordr, ' l_key-', line, '
delta-',delta

execute {call acid_transaction( ^, ^, ^,
rprice, quantity, tax, disc, extprice, ototal)
} substitute ordr, line, delta

execute {select now(*)} into times
print 'User 1 waiting to commit = ', times
print ' '
synchronize 2
sleep 10000
execute {select now(*)} into times
print 'User 1 about to commit = ', times
commit
```

```
execute { select round(cast(o_totalprice as numeric
(18,2)),2)
            from orders where o_orderkey = ^}
            substitute ordr into o_total
print 'User 1 new values: '
print 'user 1 ordr= ', ordr
print 'user 1 o_total= ', o_total
print ' '

End Test
```

acid_isolation_test1_query.tst

```
=====
stringconnect "dsn=tpch;"

synchronize 2
print ' '
execute {select now(*)} into times
print 'User 2 start query = ', times

execute {select ordr from acid_isolation_table}
into ordr

print 'user 2 ordr = ', ordr
fetch { call acid_single_query (^) } substitute ordr
into o_total
print 'user 2 o_total=' , o_total
print ' '

execute {select now(*)} into times
print 'User 2 completed query = ', times

disconnect

END Test
```

acid_isolation_test2.tst

```
=====
stringconnect "dsn=tpch;"

execute {select ordr, line, delta from
acid_isolation_table}
            into ordr, line, delta

print 'The following are the data input values for
the ACID Transaction.'
print '(user 1) o_key-',ordr, ' l_key-', line, '
delta-',delta

execute {call acid_transaction( ^, ^, ^,
rprice, quantity, tax, disc, extprice, ototal)
} substitute ordr, line, delta

execute {select now(*)} into times
print 'User 1 waiting to roll back = ', times
print ' '
synchronize 2
sleep 10000
execute {select now(*)} into times
print 'User 1 about to roll back = ', times
rollback

execute { select round(cast(o_totalprice as numeric
(18,2)),2)
            from orders where o_orderkey = ^}
            substitute ordr into o_total
print 'User 1 new values: '
print 'user 1 ordr= ', ordr
print 'user 1 o_total= ', o_total
print ' '

End Test
```

acid_isolation_test2_query.tst

```
=====
stringconnect "dsn=tpch;"

synchronize 2
print ' '
execute {select now(*)} into times
print 'User 2 start query = ', times

execute {select ordr from acid_isolation_table}
into ordr

print 'user 2 ordr = ', ordr
fetch { call acid_single_query (^) } substitute ordr
into o_total
print 'user 2 o_total=' , o_total
print ' '

execute {select now(*)} into times
print 'User 2 completed query = ', times

disconnect

END Test
```

acid_isolation_test3_transaction1.tst

```
=====
stringconnect "dsn=tpch;"

execute {select now(*)} into times
print 'Isolation test 3 test start = ', times
print ' '

execute {select ordr, line, delta from
acid_isolation_table}
into ordr, line, delta

print 'User 1 -- The input data values for User 1
Acid Transaction.'
print 'User 1 -- o_key = ',ordr
print 'User 1 -- l_key = ',line
print 'User 1 -- delta1 = ',delta

print ' '
execute {select now(*)} into times
print 'User 1 -- Starting the Acid Transaction: ',
times

execute {call acid_transaction( ^, ^, ^ )}
substitute ordr, line, delta
into rprice, quantity, tax, disc, extprice,
ototal

print ' '
execute {select now(*)} into times
print 'User 1 -- Acid Transaction complete: ', times
print '30 second timer started'
SYNCHRONIZE 2
sleep 30000

print ' '
execute {select now(*)} into times
print 'User 1 -- starting commit: ', times

commit
print ' '
execute {select now(*)} into times
print 'User 1 -- transaction commit complete: ',
times

print ' '
print 'USER 1 -- original extendedprice = ', extprice
```

```
print 'USER 1 -- original quantity = ', quantity

fetch { select cast(^ as numeric(18,6))
+ (cast(^ as numeric(18,6))*(cast (^ as
numeric(18,6))
/cast (^ as numeric(18,6)))) }
substitute extprice, delta, extprice, quantity
into result1
% make it format nicely...
execute { select cast(^ as numeric(18,2)) }
substitute result1 into result2

print ' '
print 'User 1 -- result1 = '
print ' txnl_extendedprice + (delta *
(txnl_extendedprice/txnl_quantity))'
print 'User 1 -- result1= ', result2
print ' '

disconnect
End Test
```

acid_isolation_test3_transaction2.tst

```
=====
stringconnect "dsn=tpch;"

execute {select ordr, line, delta from
acid_isolation_table}
into ordr, line, delta
% generate a new set of values; we only use delta2
execute { call generate_acid_values()} into ordr2,
line2, delta2

print ' '
print 'User 2 - The input data values for the Acid
Transaction.'
print 'User 2 -- o_key = ',ordr
print 'User 2 -- l_key= ',line
print 'User 2 -- delta2 = ',delta2

SYNCHRONIZE 2
sleep 5000

print ' '
execute {select now(*)} into times
print 'User 2 -- Starting the Acid Transaction: ',
times

execute {call acid_transaction( ^, ^, ^ ) }
substitute ordr, line, delta2
into rprice, quantity, tax, disc, extprice,
ototal
execute {select round(cast(^ as numeric(20,6)),2) }
substitute extprice into extprice2

sleep 5000
print ' '
execute {select now(*)} into times
print 'User 2 -- About to commit: ', times
commit

execute {select now(*)} into times
print 'User 2 -- transaction commit complete: ', times

print ' '

print 'USER 2 -- original extendedprice = ', extprice2
print 'USER 2 -- original quantity = ', quantity
print ' '

End Test
```

acid_isolation_test4_transaction1.tst

```

stringconnect "dsn=tpch;"

execute {select now(*)} into times
print 'Isolation test 3 test start = ', times
print ' '

execute {select ordr, line, delta from
acid_isolation_table}
into ordr, line, delta

print 'User 1 -- The input data values for User 1
Acid Transaction.'
print 'User 1 -- o_key = ',ordr
print 'User 1 -- l_key = ',line
print 'User 1 -- delta = ',delta

print ' '
execute {select now(*)} into times
print 'User 1 -- Starting the Acid Transaction: ',
times

execute {call acid_transaction( ^, ^, ^ )}
substitute ordr, line, delta
into rprice, quantity, tax, disc, extprice,
ototal

print ' '
execute {select now(*)} into times
print 'User 1 -- Acid Transaction complete: ', times
print '30 second timer started'
SYNCHRONIZE 2
sleep 30000

print ' '
execute {select now(*)} into times
print 'User 1 -- starting rollback: ', times

rollback
print ' '
execute {select now(*)} into times
print 'User 1 -- transaction rollback complete: ',
times

execute {select round(cast(^ as numeric(20,6)),2) }
substitute extprice into extprice2
print ' '
print 'USER 1 -- original extendedprice = ',
extprice2
print 'USER 1 -- original quantity = ', quantity
print ' '

disconnect
End Test

```

```

=====
acid_isolation_test4_transaction2.tst
=====

```

```

stringconnect "dsn=tpch;"

execute {select ordr, line, delta from
acid_isolation_table}
into ordr, line, delta
% generate a new set of values; we only use delta2
execute { call generate_acid_values()} into ordr2,
line2, delta2

print ' '
print 'User 2 - The input data values for the Acid
Transaction.'
print 'User 2 -- o_key = ',ordr
print 'User 2 -- l_key= ',line
print 'User 2 -- delta2 = ',delta2

SYNCHRONIZE 2
sleep 5000

```

```

print ' '
execute {select now(*)} into times
print 'User 2 -- Starting the Acid Transaction: ',
times

execute {call acid_transaction( ^, ^, ^ ) }
substitute ordr, line, delta2
into rprice, quantity, tax, disc, extprice,
ototal
execute {select round(cast(^ as numeric(20,6)),2) }
substitute extprice into extprice2

sleep 5000
print ' '
execute {select now(*)} into times
print 'User 2 -- About to commit: ', times
commit

execute {select now(*)} into times
print 'User 2 -- transaction commit complete: ', times
print ' '
print 'USER 2 -- original extendedprice = ', extprice2
print 'USER 2 -- original quantity = ', quantity
print ' '

End Test

```

```

=====
acid_isolation_test5_query.tst
=====

```

```

stringconnect "dsn=tpch;"

synchronize 2

execute { call generate_ps_values() } into ps_ptky,
ps_spky
print ' '
print 'user 2 ps_partkey = ', ps_ptky
print 'user 2 ps_suppkey = ', ps_spky
print ' '

execute {select now(*)} into times
print 'User 2 beginning query = ', times
execute {select * from partsupp where ps_partkey=^ and
ps_suppkey=^}
substitute ps_ptky, ps_spky
into ps_ptky, ps_spky, ps_aly, ps_spct, ps_ct

print ' '
print 'User2 gets all columns of the PARTSUPP table '
print ' for selected ps_partkey and ps_suppkey doing a
query.'
print ' '
print 'ps_partkey = ', ps_ptky, ' ps_suppkey = ',
ps_spky
print 'ps_availqty = ', ps_aly, ' ps_supplycost =
',ps_spct
print 'ps_comment = ', ps_ct
execute {select now(*)} into times
print 'User 2 query complete = ', times
print ' '

execute {select now(*)} into times
print 'User 2 about to commit = ', times
commit
execute {select now(*)} into times
print 'User 2 transaction commit complete = ', times

print ' '

End Test

```

```

=====
acid_isolation_test5_transaction1.tst
=====

```



```

stringconnect "dsn=tpch;"

execute {select ordr, line, delta from
acid_isolation_table}
      into ordr, line, delta

print ' '
print 'The following are the input values for the
users1 ACID Transaction.'
print 'o_key = ',ordr,'      l_key = ',line,'
delta = ',delta
print ' '
execute {select now(*)} into times
print 'User 1 isolation test time = ', times
print ' '
execute {select o_totalprice from orders where
o_orderkey=^ }
      substitute ordr into o_tprice
execute {select l_extendedprice, l_quantity,l_partkey,
l_suppkey
      from lineitem
      where l_orderkey=^ and l_linenum=^}
      substitute ordr, line
      into l_price, l_quant, l_ptky, l_spky
print 'User 1 o_totalprice = ', o_tprice
print 'User 1 l_extendedprice = ', l_price,'
l_quantity = ', l_quant
print 'User 1 l_partkey      = ', l_ptky,' l_suppkey
= ', l_spky
print ' '

execute {select now(*)} into times
print 'User 1 starting acid transaction = ', times

execute {call acid_transaction( ^, ^, ^, rprice,
quantity, tax, disc,
      extprice, ototal) } substitute ordr, line,
delta

execute {select now(*)} into times
print 'User 1 waiting to commit = ', times
print ' '
synchronize 2
sleep 10000
execute {select now(*)} into times
print 'User 1 about to commit = ', times
commit
execute {select now(*)} into times
print 'User 1 transaction commit complete = ', times

execute {select o_totalprice from orders where
o_orderkey=^ }
      substitute ordr into o_tprice
execute {select l_extendedprice, l_quantity
      from lineitem where l_orderkey=^ and
l_linenum=^}
      substitute ordr, line
      into l_price, l_quant
print 'User 1 o_totalprice = ', o_tprice
print 'User 1 l_extendedprice = ', l_price,'
l_quantity = ', l_quant
print 'User 1 l_partkey      = ', l_ptky,' l_suppkey
= ', l_spky

print ' '
execute {select * from history where h_o_key=^
and h_date_t=(select max(h_date_t) from
history where h_o_key=^)}
      substitute ordr, ordr
      into hpk, hsk, hok, hlk, hda, hdt

print 'User 1 history entry:'
print ' h_p_key = ', hpk
print ' h_s_key = ', hsk
print ' h_o_key = ', hok
print ' h_l_key = ', hlk

```

```

print ' h_delta = ', hda
print ' h_date_t = ', hdt

```

```

execute {select now(*)} into times
print 'User 1 isolation test time = ', times
print ' '

```

End Test

acid_isolation_test6_query.tst

```

stringconnect "dsn=tpch;"

```

```

print 'User1 Query: '
print ' '
print 'User1 starts its query (Q1) here.'
execute {select now(*)} into qstart
print 'Start time for User1 Q1 =', qstart
print ' '
compare fetchall {select
      l_returnflag,
      l_linestatus,
      sum(l_quantity) as sum_qty,
      sum(l_extendedprice) as sum_base_price,
      sum(l_extendedprice * (1 - l_discount)) as
sum_disc_price,
      sum(l_extendedprice * (1 - l_discount) * (1 +
l_tax)) as sum_charge,
      avg(l_quantity) as avg_qty,
      avg(l_extendedprice) as avg_price,
      avg(l_discount) as avg_disc,
      count(*) as count_order
      from lineitem
      where l_shipdate <= dateadd(day, -1, '1998-12-01')
      group by l_returnflag,l_linestatus
      order by l_returnflag,l_linestatus
      } in 'queryresult'

```

```

execute {select now(*)} into qstop
print 'Stop time for User1 Q1 =', qstop
print ' '

```

End Test

acid_isolation_test6_transaction1.tst

```

stringconnect "dsn=tpch;"

```

```

execute {select ordr, line, delta from
acid_isolation_table}
      into ordr, line, delta

execute {select now(*)} into qstart2
print 'User2 acid Transaction = ', qstart2
print 'o_key = ',ordr,'      l_key = ',line,'
delta = ',delta
print ' '
execute {select o_totalprice from orders where
o_orderkey=^ }
      substitute ordr into o_tprice
execute {select l_extendedprice, l_quantity,l_partkey,
l_suppkey
      from lineitem where l_orderkey=^ and
l_linenum=^}
      substitute ordr, line
      into l_price, l_quant, l_ptky, l_spky
print 'User 2 o_totalprice = ', o_tprice
print 'User 2 l_extendedprice = ', l_price,'
l_quantity = ', l_quant
print 'User 2 l_partkey      = ', l_ptky,'
l_suppkey = ', l_spky
print ' '

```

```

execute {select now(*)} into qstart2
print 'Start Time for User2 Transaction = ', qstart2
print ' '
execute {call acid_transaction( ^, ^, ^, rprice,
quantity,
tax, disc, extprice,
ototal) }
substitute ordr, line, delta

execute {select now(*)} into qstop2
print 'User 2 about to commit = ', qstop2
commit
execute {select now(*)} into qstop2
print 'User 2 transaction commit complete = ', qstop2
print ' '

execute {select o_totalprice from orders where
o_orderkey=^ }
substitute ordr
into o_tprice
execute {select l_extendedprice, l_quantity
from lineitem where l_orderkey=^ and
l_linenum=^}
substitute ordr, line
into l_price, l_quant
print 'User 2 o_totalprice = ', o_tprice
print 'User 2 l_extendedprice = ', l_price,
l_quantity = ', l_quant
print 'User 2 l_partkey = ', l_ptky,
l_suppkey = ', l_spky
print ' '

print ' '
execute {select * from history
where h_o_key=^
and h_date_t=(select max(h_date_t) from
history where h_o_key=^)}
substitute ordr, ordr
into hpk, hsk, hok, hlk, hda, hdt

print 'User 2 history entry:'
print ' h_p_key = ', hpk
print ' h_s_key = ', hsk
print ' h_o_key = ', hok
print ' h_l_key = ', hlk
print ' h_delta = ', hda
print ' h_date_t = ', hdt

print ' '
execute {select now(*)} into times
print 'User 2 completed = ', times

```

End Test

Disk Configuration Details

Solaris Volume Manager Setup

Note: The instructions below pertain to the controller number and targets generated by the configuration used in the benchmark. Even for identically configured systems, the controller numbers and SCSI targets will rarely match the numbers used here.

Perform the following steps to create the RAID devices:

- 1) create the following 500MB slices
c1t0d0s6
c1t1d0s6

using the Solaris format command

- 2) create the SVM state replicas via
metadb -a -f -c 3 c1t0d0s6 c1t1d0s6
- 3) create 68.35 GB s0 slices on each of the following disks:

```

c12t8d0
c12t9d0
c12t10d0
c12t11d0
c12t12d0
c12t13d0
c13t8d0
c13t9d0
c13t10d0
c13t11d0
c13t12d0
c13t13d0
c14t8d0
c14t9d0
c14t10d0
c14t11d0
c14t12d0
c14t13d0
c15t8d0
c15t9d0
c15t10d0
c15t11d0
c15t12d0
c15t13d0
c16t8d0
c16t9d0
c16t10d0
c16t11d0
c16t12d0
c16t13d0
c17t8d0
c17t9d0
c17t10d0
c17t11d0
c17t12d0
c17t13d0

```

using the Solaris format command

- 4) create 16 mirrored devices via

```

metainit d10 1 1 c12t8d0s6
metainit d11 1 1 c14t8d0s6
metainit d15 -m d10 d11

metainit d20 1 1 c12t9d0s6
metainit d21 1 1 c14t9d0s6
metainit d25 -m d20 d21

metainit d30 1 1 c12t10d0s6
metainit d31 1 1 c14t10d0s6
metainit d35 -m d30 d31

metainit d40 1 1 c12t11d0s6
metainit d41 1 1 c14t11d0s6
metainit d45 -m d40 d41

metainit d50 1 1 c12t12d0s6
metainit d51 1 1 c14t12d0s6
metainit d55 -m d50 d51

metainit d60 1 1 c12t13d0s6
metainit d61 1 1 c14t13d0s6
metainit d65 -m d60 d61

metainit d70 1 1 c13t8d0s6
metainit d71 1 1 c15t8d0s6
metainit d75 -m d70 d71

metainit d80 1 1 c13t9d0s6
metainit d81 1 1 c15t9d0s6
metainit d85 -m d80 d81

```

```
metainit d90 1 1 c13t10d0s6
metainit d91 1 1 c15t10d0s6
metainit d95 -m d90 d91
```

```
metainit d100 1 1 c13t11d0s6
metainit d101 1 1 c15t11d0s6
metainit d105 -m d100 d101
```

```
metainit d110 1 1 c13t12d0s6
metainit d111 1 1 c15t12d0s6
metainit d115 -m d110 d111
```

```
metainit d120 1 1 c13t13d0s6
metainit d121 1 1 c15t13d0s6
metainit d125 -m d120 d121
```

```
metainit d130 1 1 c16t8d0s6
metainit d131 1 1 c17t8d0s6
metainit d135 -m d130 d131
```

```
metainit d140 1 1 c16t9d0s6
metainit d141 1 1 c17t9d0s6
metainit d145 -m d140 d141
```

```
metainit d150 1 1 c16t10d0s6
metainit d151 1 1 c17t10d0s6
metainit d155 -m d150 d151
```

```
metainit d160 1 1 c16t11d0s6
metainit d161 1 1 c17t11d0s6
metainit d165 -m d160 d161
```

5) create the followin 1.5 GB slices:
clt0d0s1
clt1d0s1
using the Solaris format command

6) create the mirrored volume d1 via the following:

```
metainit d2 1 1 clt0d0s1
metainit d3 1 1 clt1d0s1
metainit d1 -m d2 d3
```

File System Setup

7) create a filesystem on /dev/md/rdsk/d1

8) mount the filesystem on /sybase2

Database Device Links

Create the symbolic links for the mirrored
devices by running the following shellscript

```
cd /sybase2
ln -s /dev/md/rdsk/d15 M01
ln -s /dev/md/rdsk/d25 M02
ln -s /dev/md/rdsk/d35 M03
ln -s /dev/md/rdsk/d45 M04
ln -s /dev/md/rdsk/d55 M05
ln -s /dev/md/rdsk/d65 M06
ln -s /dev/md/rdsk/d75 M07
ln -s /dev/md/rdsk/d85 M08
ln -s /dev/md/rdsk/d95 M09
ln -s /dev/md/rdsk/d105 M10
ln -s /dev/md/rdsk/d115 M11
ln -s /dev/md/rdsk/d125 M12
ln -s /dev/md/rdsk/d135 M13
ln -s /dev/md/rdsk/d145 M14
```

```
ln -s /dev/md/rdsk/d155 M15
ln -s /dev/md/rdsk/d165 M16
```

Create symbolic links for the temp devices
by running the following shellscript

```
cd /sybase2
ln -s /dev/rdsk/c8t0d0s6 T01
ln -s /dev/rdsk/c8t1d0s1 T02
ln -s /dev/rdsk/c7t10d0s1 T03
ln -s /dev/rdsk/c7t11d0s1 T04
```

Appendix C. Query Text and Query Output

qualification query 1

```

=====
% select
% l_returnflag,
% l_linestatus,
% sum(l_quantity) as sum_qty,
% sum(l_extendedprice) as sum_base_price,
% sum(l_extendedprice * (1 - l_discount)) as
sum_disc_price,
% sum(l_extendedprice * (1 - l_discount) * (1 +
l_tax)) as sum_charge,
% avg(l_quantity) as avg_qty,
% avg(l_extendedprice) as avg_price,
% avg(l_discount) as avg_disc,
% count(*) as count_order
% from
% lineitem
% where
% l_shipdate <= dateadd(day,-90,'1998-12-01')
% group by
% l_returnflag,
% l_linestatus
% order by
% l_returnflag,
% l_linestatus;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.32000 seconds - current
time 16:40:13
'A','F',37734107,56586554400.7292032,53758257134.86945
63,55909065222.8284717,25.5220058532573342,38273.12973
46211374,.0499852958383577168,1478493
'N','F',991417,1487504710.38000107,1413082168.05409968
,1469649223.19436967,25.5164719205229819,38284.4677608
483374,.0500934266742134809,38854
'N','O',74476040,111701729697.737336,106118230307.6073
83,110367043872.495174,25.5022267695849895,38249.11798
8907361,.049996586053555131,2920374
'R','F',37719753,56568041380.8983326,53741292684.60453
75,55889619119.8339581,25.5057936126907617,38250.85462
60985255,.0500094058300870121,1478870
% total of 4 rows written
=====

```

qualification query 2

```

=====
% select top 100
% s_acctbal,
% s_name,
% n_name,
% p_partkey,
% p_mfgr,
% s_address,
% s_phone,
% s_comment
% from
% part,
% supplier,
% partsupp,
% nation,
% region
% where
% p_partkey = ps_partkey
% and s_suppkey = ps_suppkey
% and p_size = 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
% partsupp,
% supplier,
% nation,
% region
% where
% p_partkey = ps_partkey
% and s_suppkey = ps_suppkey
% and s_nationkey = n_nationkey
% and n_regionkey = r_regionkey
% and r_name = 'EUROPE'
% )
% order by
% s_acctbal desc,
% n_name,
% s_name,
% p_partkey;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.76000 seconds - current
time 16:40:25
9938.53,'Supplier#000005359','UNITED KINGDOM
',185358,'Manufacturer#4
','QKuHYh,vZGiwu2FWEJoLDx04','33-429-790-
6131','blithely silent pinto beans are furiously.
slyly final deposits across'
9937.84,'Supplier#000005969','ROMANIA
',108438,'Manufacturer#1
','ANDENSOSmk,miq23Xfb5Rwt6dvUcvt6Qa','29-520-692-
3537','carefully slow deposits use furiously. slyly
ironic platelets above the ironic'
9936.22,'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'
9923.77000000000119,'Supplier#000002324
','GERMANY','29821','Manufacturer#4
','y30D9UywSTok','17-779-299-1839','quickly express
packages breach quiet pinto beans. requ'
9871.22,'Supplier#000006373','GERMANY
',43868,'Manufacturer#5','J8fcXWsTqM','17-
813-485-8637','never silent deposits integrate
furiously blit'
9870.78,'Supplier#000001286','GERMANY
',81285,'Manufacturer#2
','YKA,E2fjiVd7eUrzp2Ef8j1QxGo2DFnosaTEH','17-516-924-
4574','final theodolites cajole slyly special,'
9870.78,'Supplier#000001286','GERMANY
',181285,'Manufacturer#4
','YKA,E2fjiVd7eUrzp2Ef8j1QxGo2DFnosaTEH','17-516-924-
4574','final theodolites cajole slyly special,'
9852.52000000000119,'Supplier#000008973
','RUSSIA','18972','Manufacturer#2
','t5L67YdBYH6o,Vz24jpDyQ9','32-188-594-
7038','quickly regular instructions wake-- carefully
unusual braids into the expres'
9847.83,'Supplier#000008097','RUSSIA
',130557,'Manufacturer#2
','xMe97bpE69NzdWLoX','32-375-640-3593','slyly regular
dependencies sleep slyly furiously express dep'
9847.57,'Supplier#000006345','FRANCE
',86344,'Manufacturer#1
','VSt3rzK3qG698u6ld8HhObYvvrTcSTsvQlDQDag','16-886-
766-7945','silent pinto beans should have to snooze
carefully along the final reques'
% total of 100 rows written

```

qualification query 3

```
=====
% select top 10
% l_orderkey,
% sum(l_extendedprice * (1 - l_discount)) as revenue,
% o_orderdate,
% o_shippriority
% from
% customer,
% orders,
% lineitem
% where
% c_mktsegment = 'BUILDING'
% and c_custkey = o_custkey
% and l_orderkey = o_orderkey
% and o_orderdate < '1995-03-15'
% and l_shipdate > '1995-03-15'
% group by
% l_orderkey,
% o_orderdate,
% o_shippriority
% order by
% revenue desc,
% o_orderdate;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.36000 seconds - current
time 16:40:27
2456423,406181.011100000024,'1995-03-05',0
3459808,405838.6988999999917,'1995-03-04',0
492164,390324.061,'1995-02-19',0
1188320,384537.9358999999976,'1995-03-09',0
2435712,378673.0557999999952,'1995-02-26',0
4878020,378376.7952000000048,'1995-03-12',0
5521732,375153.9215,'1995-03-13',0
2628192,373133.3093999999976,'1995-02-22',0
993600,371407.4594999999994,'1995-03-05',0
2300070,367371.1452000000107,'1995-03-13',0
% total of 10 rows written
=====
```

qualification query 4

```
=====
% select
% o_orderpriority,
% count(*) as order_count
% from
% orders
% where
% o_orderdate >= '1993-07-01'
% and o_orderdate < dateadd(month,3,'1993-07-01')
% and exists (
% select
% *
% from
% lineitem
% where
% l_orderkey = o_orderkey
% and l_commitdate < l_receiptdate
% )
% group by
% o_orderpriority
% order by
% o_orderpriority;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.25000 seconds - current
time 16:40:31
=====
```

```
'1-URGENT',10594
'2-HIGH',10476
'3-MEDIUM',10410
'4-NOT SPECIFIED',10556
'5-LOW',10487
% total of 5 rows written
=====
```

qualification query 5

```
=====
% select
% n_name,
% sum(l_extendedprice * (1 - l_discount)) as revenue
% from
% customer,
% orders,
% lineitem,
% supplier,
% nation,
% region
% where
% c_custkey = o_custkey
% and l_orderkey = o_orderkey
% and l_suppkey = s_suppkey
% and c_nationkey = s_nationkey
% and s_nationkey = n_nationkey
% and n_regionkey = r_regionkey
% and r_name = 'ASIA'
% and o_orderdate >= '1994-01-01'
% and o_orderdate < dateadd(year,1,'1994-01-01')
% group by
% n_name
% order by
% revenue desc;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.65000 seconds - current
time 16:40:36
'INDONESIA',55502041.1696999431
'VIETNAM',55295086.9966999531
'CHINA',53724494.2565999746
'INDIA',52035512.000200057
'JAPAN',45410175.6954000235
% total of 5 rows written
=====
```

qualification query 6

```
=====
% select
% sum(l_extendedprice * l_discount) as revenue
% from
% lineitem
% where
% l_shipdate >= '1994-01-01'
% and l_shipdate < dateadd(year,1,'1994-01-01')
% and l_discount between .06 - 0.01 and .06 + 0.01
% and l_quantity < 24;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.15000 seconds - current
time 16:40:41
123141078.228299007
% total of 1 rows written
=====
```

qualification query 7

```
=====
```

```

% select
% supp_nation,
% cust_nation,
% l_year,
% sum(volume) as revenue
% from
% (
% select
% n1.n_name as supp_nation,
% n2.n_name as cust_nation,
% datepart(year, l_shipdate) as l_year,
% l_extendedprice * (1 - l_discount) as volume
% from
% supplier,
% lineitem,
% orders,
% customer,
% nation n1,
% nation n2
% where
% s_suppkey = l_suppkey
% and o_orderkey = l_orderkey
% and c_custkey = o_custkey
% and s_nationkey = n1.n_nationkey
% and c_nationkey = n2.n_nationkey
% and (
% (n1.n_name = 'FRANCE' and n2.n_name = 'GERMANY')
% or (n1.n_name = 'GERMANY' and n2.n_name = 'FRANCE')
% )
% and l_shipdate between '1995-01-01' and '1996-12-31'
% ) as shipping
% group by
% supp_nation,
% cust_nation,
% l_year
% order by
% supp_nation,
% cust_nation,
% l_year;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.67000 seconds - current
time 16:40:43
'FRANCE', 'GERMANY
',1995,54639732.7335999489
'FRANCE', 'GERMANY
',1996,54633083.3075999737
'GERMANY', 'FRANCE
',1995,52531746.6696999669
'GERMANY', 'FRANCE
',1996,52520549.0223998487
% total of 4 rows written

```

qualification query 8

```

% select
% o_year,
% sum(case
% when nation = 'BRAZIL' then volume
% else 0
% end) / sum(volume) as mkt_share
% from
% (
% select
% datepart(year, o_orderdate) as o_year,
% l_extendedprice * (1 - l_discount) as volume,
% n2.n_name as nation
% from
% part,
% supplier,
% lineitem,
% orders,

```

```

% customer,
% nation n1,
% nation n2,
% region
% where
% p_partkey = l_partkey
% and s_suppkey = l_suppkey
% and l_orderkey = o_orderkey
% and o_custkey = c_custkey
% and c_nationkey = n1.n_nationkey
% and n1.n_regionkey = r_regionkey
% and r_name = 'AMERICA'
% and s_nationkey = n2.n_nationkey
% and o_orderdate between '1995-01-01' and '1996-12-
31'
% and p_type = 'ECONOMY ANODIZED STEEL'
% ) as all_nations
% group by
% o_year
% order by
% o_year;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.86000 seconds - current
time 16:40:47
1995,.0344358904066548347
1996,.041485521293530345
% total of 2 rows written

```

qualification query 9

```

% select
% nation,
% o_year,
% sum(amount) as sum_profit
% from
% (
% select
% n_name as nation,
% datepart(year, o_orderdate) as o_year,
% l_extendedprice * (1 - l_discount) - ps_supplycost *
l_quantity as
% amount
% from
% part,
% supplier,
% lineitem,
% partsupp,
% orders,
% nation
% where
% s_suppkey = l_suppkey
% and ps_suppkey = l_suppkey
% and ps_partkey = l_partkey
% and p_partkey = l_partkey
% and o_orderkey = l_orderkey
% and s_nationkey = n_nationkey
% and p_name like 'green'
% ) as profit
% group by
% nation,
% o_year
% order by
% nation,
% o_year desc;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.69000 seconds - current
time 16:40:48

```

```

'ALGERIA',1998,31342867.2345000029
'ALGERIA',1997,57138193.0233001232
'ALGERIA',1996,56140140.1330001235
'ALGERIA',1995,53051469.6533999741
'ALGERIA',1994,53867582.128600049
'ALGERIA',1993,54942718.132400012
'ALGERIA',1992,54628034.7126999021
'ARGENTINA',1998,30211185.708099997
'ARGENTINA',1997,50805741.75230003
'ARGENTINA',1996,51923746.5754999459
% total of 175 rows written

```

qualification query 10

```

% select top 20
% c_custkey,% c_name,
% sum(l_extendedprice * (1 - l_discount)) as revenue,
% c_acctbal,
% n_name,
% c_address,
% c_phone,
% c_comment
% from
% customer,
% orders,
% lineitem,
% nation
% where
% c_custkey = o_custkey
% and l_orderkey = o_orderkey
% and o_orderdate >= '1993-10-01'
% and o_orderdate < dateadd(month,3,'1993-10-01')
% and l_returnflag = 'R'
% and c_nationkey = n_nationkey
% group by
% c_custkey,
% c_name,
% c_acctbal,
% c_phone,
% n_name,
% c_address,
% c_comment
% order by
% revenue desc;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.50000 seconds - current
time 16:40:55
57040,'Customer#000057040',734235.2455,632.87,'JAPAN
','Eioyzzf4pp','22-895-641-3466','requests sleep
blithely about the furiously i'
143347,'Customer#000143347',721002.694799999952,2557.4
700000000003,'EGYPT
','laReFYv,Kw4','14-742-935-3718','fluffily bold
excuses haggle finally after the u'
60838,'Customer#000060838',679127.307700000048,2454.77
,'BRAZIL
','64EaJ5vMAHWJlB0xJklpNc2RjiWE','12-913-494-
9813','furiously even pinto beans integrate under the
ruthless foxes; ironic, even dolphins across the slyl'
101998,'Customer#000101998',637029.5666999999809,3790.8
9,'UNITED KINGDOM
','01c9CILnNtfoQYmZj','33-
593-865-6378','accounts doze blithely! enticing, final
deposits sleep blithely special accounts. slyly
express accounts pla'
125341,'Customer#000125341',633508.086,4983.5100000000
006,'GERMANY
','S29ODD6bceU8QSuEJznkNaK','17-582-695-
5962','quickly express requests wake quickly blithely'
25501,'Customer#000025501',620269.7848999999976,7725.04
,'ETHIOPIA
','
W556MXuoiaYCCZamJI,Rn0B4ACUGdkQ8DZ','15-874-808-

```

```

6793','quickly special requests sleep evenly among the
special deposits. special deposi'
115831,'Customer#000115831',596423.867200000167,5098.1
,'FRANCE
','rFeBbEEyk dl
ne7zv5fDrmiqloK09wV7pxqCgIc','16-715-386-
3788','carefully bold excuses sleep alongside of the
thinly idle'
84223,'Customer#000084223',594998.0238999999976,528.65,
'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',585603.3917999999952,5583.02
,'IRAN
','vXCxoCsU0Bad5JQI
,oobkZ','20-834-292-4707','express requests sublata
blithely regular requests. regular, even ideas solve.'
39922,'Customer#000039922',584878.1133999999976,7321.10
999999999881,'GERMANY
','Zgy4s5012GKN4pLDPBU8m342gIw6R','17-147-757-
8036','even pinto beans haggle. slyly bold accounts
inte'
6226,'Customer#000006226',576783.7605999999905,2230.09,
'UNITED KINGDOM
','8gPu8,NPGkfyQQ0hcIYUGPIBwc,ybP5g','33-657-701-
3391','quickly final requests against the regular
instructions wake blithely final instructions. pa'
922,'Customer#00000922',576767.5332999999833,3869.25,'
GERMANY
','Az9RFaut7NkPnc5zSD2PwHgVwr4jRzq','17-945-916-
9648','boldly final requests cajole blith'
147946,'Customer#000147946',576455.132,2030.1300000000
003,'ALGERIA
','iANyZHjghyy7AjahOpTrYyhJ','10-886-956-
3143','furiously even accounts are blithely above the
furiouslyl'
115640,'Customer#000115640',569341.1932999999952,6436.1
,'ARGENTINA
','Vtgfia9qI
7EpHgecU1X','11-411-543-4901','final instructions are
slyly according to the'
73606,'Customer#000073606',568656.8577999999952,1785.67
,'JAPAN
','xuR0Tro5yChDfOCrjkd2ol','22-437-653-
6966','furiously bold orbits about the furiously busy
requests wake across the furiously quiet theodolites.
d'
110246,'Customer#000110246',566842.9814999999881,7763.3
5,'VIETNAM
','7KzflgX MDOq7sOkI','31-
943-426-9837','dolphins sleep blithely among the slyly
final'
142549,'Customer#000142549',563537.2367999999952,5085.9
899999999994,'INDONESIA
','ChqEoK43OysjdHbtKcp6dKqjNyvvv9','19-955-562-
2398','regular, unusual dependencies boost slyly;
ironic attainments nag fluffily into the unusual
packages?'
146149,'Customer#000146149',557254.9865,1791.55,'ROMAN
IA
','s87fvzFQpU','29-744-164-
6487','silent, unusual requests detect quickly slyly
regul'
52528,'Customer#000052528',556397.3508999999976,551.79,
'ARGENTINA
','NFztyTOR10UOJ','11-208-
192-3205','unusual requests detect. slyly dogged
theodolites use slyly. deposit'
23431,'Customer#000023431',554269.536000000119,3381.86
,'ROMANIA
','HgiV0phqhaIa9aydNoIlb','29-915-458-
2654','instructions nag quickly. furiously bold
accounts cajol'
% total of 20 rows written

```

qualification query 11

```

% select
% ps_partkey,
% sum(ps_supplycost * ps_availqty) as value

```

```

% from
% partsupp,
% supplier,
% nation
% where
% ps_suppkey = s_suppkey
% and s_nationkey = n_nationkey
% and n_name = 'GERMANY'
% group by
% ps_partkey having
% sum(ps_supplycost * ps_availqty) > (
% select
% sum(ps_supplycost * ps_availqty) * 0.0001000000
% from
% partsupp,
% supplier,
% nation
% where
% ps_suppkey = s_suppkey
% and s_nationkey = n_nationkey
% and n_name = 'GERMANY'
% )
% order by
% value desc;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.49000 seconds - current
time 16:41:01
129760,17538456.85999999994
166726,16503353.9199999988
191287,16474801.9699999988
161758,16101755.5399999976
34452,15983844.7200000018
139035,15907078.3400000006
9403,15451755.6199999988
154358,15212937.8799999982
38823,15064802.8599999994
85606,15053957.150000003
% total of 1048 rows written

```

qualification query 12

```

% select
% l_shipmode,
% sum(case
% when o_orderpriority = '1-URGENT'
% or o_orderpriority = '2-HIGH'
% then 1
% else 0
% end) as high_line_count,
% sum(case
% when o_orderpriority <> '1-URGENT'
% and o_orderpriority <> '2-HIGH'
% then 1
% else 0
% end) as low_line_count
% from
% orders,
% lineitem
% where
% o_orderkey = l_orderkey
% and l_shipmode in ('MAIL', 'SHIP')
% and l_commitdate < l_receiptdate
% and l_shipdate < l_commitdate
% and l_receiptdate >= '1994-01-01'
% and l_receiptdate < dateadd(year,1,'1994-01-01')
% group by
% l_shipmode
% order by
% l_shipmode;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)

```

```

%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.26000 seconds - current
time 16:41:03
'MAIL      ',6202,9324
'SHIP      ',6200,9262
% total of 2 rows written

```

qualification query 13

```

% select
% c_count,
% count(*) as custdist
% from
% (
% select
% c_custkey,
% count(o_orderkey)
% from
% customer left outer join orders on
% c_custkey = o_custkey
% and o_comment not like 'specialrequests'
% group by
% c_custkey
% ) as c_orders (c_custkey, c_count)
% group by
% c_count
% order by
% custdist desc,
% c_count desc;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%

```

```

% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.17000 seconds - current
time 16:41:06
0,50004
9,6641
10,6566
11,6058
8,5949
12,5553
13,4989
19,4748
7,4707
18,4625
% total of 42 rows written

```

qualification query 14

```

% select
% 100.00 * sum(case
% when p_type like 'PROMO'
% then l_extendedprice * (1 - l_discount)
% else 0
% end) / sum(l_extendedprice * (1 - l_discount)) as
promo_revenue
% from
% lineitem,
% part
% where
% l_partkey = p_partkey
% and l_shipdate >= '1995-09-01'
% and l_shipdate < dateadd(month,1,'1995-09-01');
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.24000 seconds - current
time 16:41:19

```



```
16.3807786263955563
% total of 1 rows written
```

qualification query 15

```
Executing command:
% create view revenue0 (supplier_no, total_revenue) as
% select
% l_suppkey,
% sum(l_extendedprice * (1 - l_discount))
% from
% lineitem
% where
% l_shipdate >= '1996-01-01'
% and l_shipdate < dateadd(month,3,'1996-01-01')
% group by
% l_suppkey;
% execution time 0.81000 seconds - current time
16:41:21
```

```
Executing command:
%
% select
% s_suppkey,
% s_name,
% s_address,
% s_phone,
% total_revenue
% from
% supplier,
% revenue0
% where
% s_suppkey = supplier_no
% and total_revenue = (
% select
% max(total_revenue)
% from
% revenue0
% )
% order by
% s_suppkey;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.27000 seconds - current
time 16:41:21
8449,'Supplier#000008449
','Wp34zim9qYFbVctdW','20-469-856-
8873',1772627.208700000005
% total of 1 rows written
```

qualification query 16

```
% select
% p_brand,
% p_type,
% p_size,
% count(distinct ps_suppkey) as supplier_cnt
% from
% partsupp,
% part
% where
% p_partkey = ps_partkey
% and p_brand <> 'Brand#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
% supplier
```

```
% where
% s_comment like 'CustomerComplaints'
% )
% group by
% p_brand,
% p_type,
% p_size
% order by
% supplier_cnt desc,
% p_brand,
% p_type,
% p_size;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.27000 seconds - current
time 16:41:22
'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
```

```
% total of 18314 rows written
```

qualification query 17

```
% select
% sum(l_extendedprice) / 7.0 as avg_yearly
% from
% lineitem,
% 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
% lineitem
% where
% l_partkey = p_partkey
% );
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.22000 seconds - current
time 16:41:28
348406.054285713732
% total of 1 rows written
```

qualification query 18

```
% select top 100
% c_name,
% c_custkey,
% o_orderkey,
% o_orderdate,
% o_totalprice,
% sum(l_quantity)
% from
% customer,
% orders,
```

```

% lineitem
% where
% o_orderkey in (
% select
% l_orderkey
% from
% lineitem
% group by
% l_orderkey having
% sum(l_quantity) > 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;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.34000 seconds - current
time 16:41:29
'Customer#000128120',128120,4722021,'1994-04-
07',544089.089999999881,323
'Customer#000144617',144617,3043270,'1997-02-
12',530604.439999999994,317
'Customer#000013940',13940,2232932,'1997-04-
13',522720.61,304
'Customer#000066790',66790,2199712,'1996-09-
30',515531.82,327
'Customer#000046435',46435,4745607,'1997-07-
03',508047.99,309
'Customer#000015272',15272,3883783,'1993-07-
28',500241.33,302
'Customer#000146608',146608,3342468,'1994-06-
12',499794.58,303
'Customer#000096103',96103,5984582,'1992-03-
16',494398.789999999994,312
'Customer#000024341',24341,1474818,'1992-11-
15',491348.26,302
'Customer#000137446',137446,5489475,'1997-05-
23',487763.25,311
% total of 57 rows written

```

qualification query 19

```

% select
% sum(l_extendedprice* (1 - l_discount)) as revenue
% from
% lineitem,
% 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'
% );
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.35000 seconds - current
time 16:41:46
3083843.057800000031
% total of 1 rows written

```

qualification query 20

```

% select
% s_name,
% s_address
% from
% supplier,
% nation
% where
% s_suppkey in (
% select
% ps_suppkey
% from
% partsupp
% where
% ps_partkey in (
% select
% p_partkey
% from
% part
% where
% p_name like 'forest'
% )
% and ps_availqty > (
% select
% 0.5 * sum(l_quantity)
% from
% lineitem
% where
% l_partkey = ps_partkey
% and l_suppkey = ps_suppkey
% and l_shipdate >= '1994-01-01'
% and l_shipdate < dateadd(year,1,'1994-01-01')
% )
% )
% and s_nationkey = n_nationkey
% and n_name = 'CANADA'
% order by
% s_name;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.37000 seconds - current
time 16:41:51
'Supplier#000000020
','iybAE,RmTymrZVYafZva2SH,j'
'Supplier#000000091

```

```
' , 'YV45D7TkfdQanOOZ7q9QxkyGUapUloOWU6q3'
'Supplier#000000197
', 'YC2Acon6kjY3zj3Fbxs2k4Vdf7X0cd2F'
'Supplier#000000226      ', '83qOdU2EYRdPQAQhEtn
GRZEd'
'Supplier#000000285
', 'Br7einntlyxrw6ImgpJ7YdhFDjuBf'
'Supplier#000000378      ', 'FfbhyCxWvcPrO8ltp9'
'Supplier#000000402
', 'i9Sw4DoyMhzhKXCH9By,AYSgmD'
'Supplier#000000530      ', '0qwmwobKY
OcmLyfRXlagA8ukENJv,'
'Supplier#000000688      ', 'D
fw5ocppmZpYBBIPI718hCihLDZ5KhKX'
'Supplier#000000710      ', 'f19YPvOyb
QoYwjKC,oPycpGfieBAcwKJo'
% total of 204 rows written
```

qualification query 21

```
=====
% select top 100
% s_name,
% count(*) as numwait
% from
% supplier,
% lineitem l1,
% orders,
% nation
% where
% s_suppkey = l1.l_suppkey
% and o_orderkey = l1.l_orderkey
% and o_orderstatus = 'F'
% and l1.l_receiptdate > l1.l_commitdate
% and exists (
% select
% *
% from
% lineitem l2
% where
% l2.l_orderkey = l1.l_orderkey
% and l2.l_suppkey <> l1.l_suppkey
% )
% and not exists (
% select
% *
% from
% lineitem l3
% where
% l3.l_orderkey = l1.l_orderkey
% and l3.l_suppkey <> l1.l_suppkey
% and l3.l_receiptdate > l3.l_commitdate
% )
% and s_nationkey = n_nationkey
% and n_name = 'SAUDI ARABIA'
% group by
% s_name
% order by
% numwait desc,
% s_name;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.54000 seconds - current
time 16:41:53
'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
% total of 100 rows written
```

qualification query 22

```
=====
% select
% c_ntrycode,
% count(*) as numcust,
% sum(c_acctbal) as totacctbal
% from
% (
% select
% substring(c_phone,1,2) as c_ntrycode,
% c_acctbal
% from
% customer
% where
% substring(c_phone,1,2) in
% ('13', '31', '23', '29', '30', '18', '17')
% and c_acctbal > (
% select
% avg(c_acctbal)
% from
% customer
% where
% c_acctbal > 0.00
% and substring(c_phone,1,2) in
% ('13', '31', '23', '29', '30', '18', '17')
% )
% and not exists (
% select
% *
% from
% orders
% where
% o_custkey = c_custkey
% )
% ) as custsale
% group by
% c_ntrycode
% order by
% c_ntrycode;
% Estimated 1 rows in query (I/O estimate 1010)
% PLAN> vt_1 (seq)
%
%
% 1 record(s) selected -- actual I/O 0
% select time including I/O 0.18000 seconds - current
time 16:42:07
'13',888,6737713.98999999881
'17',861,6460573.72
'18',964,7236687.40000001431
'23',892,6701457.95000000954
'29',948,7158866.62999999642
'30',909,6808436.13000000119
'31',922,6806670.17999998569
% total of 7 rows written
Appendix D. Seed and Query Substitution Parameters

This Appendix contains Seed values and substitution parameters
for each stream

Seed Values

stream0 1103032730
stream1 1103032731
stream2 1103032732
stream3 1103032733
stream4 1103032734
stream5 1103032735
stream6 1103032736
stream7 1103032737
```

Query Parameters

stream0: 1103032730

```
14 1994-05-01
2 18 COPPER AMERICA
9 powder
20 chartreuse 1997-01-01 FRANCE
6 1995-01-01 0.09 24
17 Brand#25 JUMBO PKG
18 315
8 ALGERIA AFRICA ECONOMY BURNISHED STEEL
21 SAUDI ARABIA
13 pending requests
3 AUTOMOBILE 1995-03-11
22 16 13 20 24 15 22
12
16 Brand#22 PROMO BRUSHED 37 50
20 14 9 4 5 24
4 1994-09-01
11 RUSSIA 0.0000001000
15 1994-09-01
1 93
10 1994-01-01
19 Brand#41 Brand#52 Brand#52 1
15 22
5 AFRICA 1995-01-01
7 UNITED KINGDOM ALGERIA
12 AIR TRUCK 1994-01-01
```

stream1: 1103032731

```
21 JAPAN
3 FURNITURE 1995-03-27
18 313
5 AMERICA 1995-01-01
11 IRAN 0.0000001000
7 MOROCCO PERU
6 1995-01-01 0.07 25
20 midnight 1995-01-01 VIETNAM
17 Brand#22 JUMBO DRUM
12 REG AIR TRUCK 1994-01-01
16 Brand#12 MEDIUM ANODIZED 37
29 10 3 41 23 32 31
15 1997-04-01
13 pending requests
10 1994-11-01
2 5 STEEL MIDDLE EAST
8 PERU AMERICA LARGE BRUSHED STEEL
14 1994-08-01
19 Brand#43 Brand#35 Brand#51 6
16 29
9 pale
22 31 23 33 24 21 11
13
1 101
4 1997-04-01
```

stream2: 1103032732

```
6 1995-01-01 0.04 24
17 Brand#24 WRAP BAG
14 1994-11-01
16 Brand#42 ECONOMY PLATED 44 13
31 21 10 30 16 39
19 Brand#55 Brand#13 Brand#45 2
17 25
10 1993-08-01
```

```
9 moccasin
2 43 BRASS ASIA
15 1994-12-01
8 INDONESIA ASIA LARGE PLATED STEEL
5 ASIA 1995-01-01
22 19 33 16 15 20 10
13
12 SHIP TRUCK 1994-01-01
7 GERMANY INDONESIA
13 unusual requests
18 314
1 109
4 1995-01-01
20 wheat 1993-01-01 IRAQ
3 AUTOMOBILE 1995-03-13
11 UNITED KINGDOM 0.0000001000
21 EGYPT
```

stream3: 1103032733

```
8 ARGENTINA AMERICA LARGE ANODIZED
STEEL
5 EUROPE 1995-01-01
4 1997-08-01
6 1995-01-01 0.09 24
17 Brand#21 WRAP PKG
7 UNITED STATES ARGENTINA
1 117
18 312
22 11 26 33 17 29 25
21
14 1995-02-01
9 maroon
10 1994-05-01
15 1997-07-01
11 IRAQ 0.0000001000
20 hot 1997-01-01 ARGENTINA
2 31 TIN MIDDLE EAST
21 VIETNAM
19 Brand#52 Brand#51 Brand#45 7
18 21
13 unusual requests
16 Brand#22 STANDARD POLISHED 49
20 39 44 34 18 32 22
12 FOB TRUCK 1995-01-01
3 FURNITURE 1995-03-30
```

stream4: 1103032734

```
5 MIDDLE EAST 1996-01-01
21 JORDAN
14 1995-06-01
19 Brand#55 Brand#34 Brand#34 2
19 28
15 1995-04-01
17 Brand#23 WRAP DRUM
12 MAIL TRUCK 1995-01-01
6 1996-01-01 0.07 25
4 1995-05-01
9 lawn
8 CHINA ASIA MEDIUM POLISHED STEEL
16 Brand#12 LARGE ANODIZED 50 41
28 32 30 49 7 14
11 UNITED STATES 0.0000001000
2 19 COPPER ASIA
10 1993-02-01
18 314
1 64
13 unusual requests
7 MOZAMBIQUE CHINA
22 25 24 26 20 16 29
33
3 MACHINERY 1995-03-15
```

```

20 salmon 1995-01-01 MOROCCO
=====
stream5: 1103032735
=====
21 ETHIOPIA
15 1997-11-01
4 1993-02-01
6 1996-01-01 0.04 24
7 INDIA IRAN
16 Brand#42 PROMO BURNISHED 4
12 40 3 25 15 35 11
19 Brand#12 Brand#22 Brand#33 7
20 24
18 315
14 1995-09-01
22 15 23 26 17 13 21
33
11 JAPAN 0.0000001000
13 unusual accounts
3 FURNITURE 1995-03-01
1 72
2 7 STEEL AFRICA
5 AFRICA 1996-01-01
8 IRAN MIDDLE EAST MEDIUM BURNISHED COPPER
20 dark 1994-01-01 ETHIOPIA
12 RAIL MAIL 1995-01-01
17 Brand#25 SM BAG
10 1993-11-01
9 hot

```

```

11 JORDAN 0.0000001000
9 dodger
19 Brand#11 Brand#42 Brand#21 8
11 28
3 BUILDING 1995-03-03
13 unusual accounts
5 ASIA 1996-01-01
7 PERU ROMANIA
10 1993-06-01
16 Brand#13 LARGE BRUSHED 32 4
25 18 2 1 22 9
6 1996-01-01 0.07 25
14 1996-03-01
15 1993-04-01
12 REG AIR MAIL 1996-01-01

```

```

=====
stream6: 1103032736
=====
10 1994-09-01
3 MACHINERY 1995-03-17
15 1995-07-01
13 unusual accounts
6 1996-01-01 0.02 24
8 BRAZIL AMERICA SMALL BRUSHED COPPER
9 gainsboro
7 ALGERIA BRAZIL
4 1995-08-01
11 ALGERIA 0.0000001000
22 30 28 19 15 21 18
34
18 313
12 AIR MAIL 1995-01-01
1 80
5 AMERICA 1996-01-01
16 Brand#22 SMALL POLISHED 7 33
47 36 38 9 14 41
2 44 BRASS ASIA
14 1995-12-01
19 Brand#14 Brand#55 Brand#32 3
10 21
20 orchid 1997-01-01 SAUDI ARABIA
17 Brand#22 SM PKG
21 UNITED KINGDOM

```

```

=====
stream7: 1103032737
=====
18 314
8 ROMANIA EUROPE SMALL PLATED COPPER
20 black 1996-01-01 INDONESIA
21 MOROCCO
2 32 NICKEL AFRICA
4 1993-05-01
22 19 24 14 13 16 18
12
17 Brand#34 SM DRUM
1 88

```

Appendix E. Implementation-Specific Layer/Driver Code

```
=====
=====
nctest
=====

dbisqlc -c "DSN=tpch" -q load_lineitem.sql >
load_lineitem.out &
loadlpid=$!
sleep 2200
dbisqlc -c "DSN=tpch" -q load_region.sql
dbisqlc -c "DSN=tpch" -q load_nation.sql
dbisqlc -c "DSN=tpch" -q load_customer.sql
dbisqlc -c "DSN=tpch" -q load_part.sql
dbisqlc -c "DSN=tpch" -q load_supplier.sql
dbisqlc -c "DSN=tpch" -q load_partsupp.sql
dbisqlc -c "DSN=tpch" -q load_orders.sql
loadopid=$!
wait $loadopid
wait $loadlpid
end_load.out
echo " "
seed=`date '+%m%d%H%M%S'`;
echo $seed;
./gen_streams.ksh $seed 1000
dbisqlc -c "DSN=tpch" -q dbtables-syb.sql >
rdtablest.out
dbisqlc -c "DSN=tpch" -q dew_cat1.sql >
dew_cat1_start.out
dbisqlc -c "DSN=tpch" -q dew_cat2.sql >
dew_cat2_start.out
dbisqlc -c "DSN=tpch" -q dew_cat3.sql >
dew_cat3_start.out
dbisqlc -c "DSN=tpch" -q check_options.sql >
check_options_start.out

touch /export/home/sybase/run/scripts/rf1.lock
touch /export/home/sybase/run/scripts/rf2.lock
dbisqlc -c "DSN=tpch" -q update_power.sql >
update_power.out &
rfspid=$!
while [ -f /export/home/sybase/run/scripts/rf1.lock ]
do
    sleep 10
done

dbisqlc -c "DSN=tpch" -q stream0.sql > stream0.out

rm -f /export/home/sybase/run/scripts/rf2.lock
wait $rfspid

dbisqlc -c "DSN=tpch" -q stream1.sql > stream1.out &
dbisqlc -c "DSN=tpch" -q stream2.sql > stream2.out &
dbisqlc -c "DSN=tpch" -q stream3.sql > stream3.out &
dbisqlc -c "DSN=tpch" -q stream4.sql > stream4.out &
dbisqlc -c "DSN=tpch" -q stream5.sql > stream5.out &
dbisqlc -c "DSN=tpch" -q stream6.sql > stream6.out &
dbisqlc -c "DSN=tpch" -q stream7.sql > stream7.out &

dbisqlc -c "DSN=tpch" -q update_throughput20.sql >
update_throughput.out &
wait

mv stream0.out mls00q.out
mv update_power.out mls00rf.out
mv stream1.out mls01q.out
mv stream2.out mls02q.out
mv stream3.out mls03q.out
mv stream4.out mls04q.out
```

```
mv stream5.out mls05q.out
mv stream6.out mls06q.out
mv stream7.out mls07q.out

mv update_throughput.out mls01rf.out

touch /export/home/sybase/run/scripts/rf1.lock
touch /export/home/sybase/run/scripts/rf2.lock

dbisqlc -c "DSN=tpch" -q update_power.sql >
update_power.out &
rfspid=$!
while [ -f /export/home/sybase/run/scripts/rf1.lock ]
do
    sleep 10
done

dbisqlc -c "DSN=tpch" -q stream0.sql > stream0.out
rm -f /export/home/sybase/run/scripts/rf2.lock
wait $rfspid

dbisqlc -c "DSN=tpch" -q stream1.sql > stream1.out &
dbisqlc -c "DSN=tpch" -q stream2.sql > stream2.out &
dbisqlc -c "DSN=tpch" -q stream3.sql > stream3.out &
dbisqlc -c "DSN=tpch" -q stream4.sql > stream4.out &
dbisqlc -c "DSN=tpch" -q stream5.sql > stream5.out &
dbisqlc -c "DSN=tpch" -q stream6.sql > stream6.out &
dbisqlc -c "DSN=tpch" -q stream7.sql > stream7.out &

dbisqlc -c "DSN=tpch" -q update_throughput20.sql >
update_throughput.out &
wait

dbisqlc -q -c "DSN=tpch" -q dbtables-syb.sql >
rdtablest_end.out
dbisqlc -q -c "DSN=tpch" -q dew_cat1.sql >
dew_cat1_end.out
dbisqlc -q -c "DSN=tpch" -q dew_cat2.sql >
dew_cat2_end.out
dbisqlc -q -c "DSN=tpch" -q dew_cat3.sql >
dew_cat3_end.out
dbisqlc -q -c "DSN=tpch" check_options.sql >
check_options_end.out

mv stream0.out m2s00q.out
mv update_power.out m2s00rf.out
mv stream1.out m2s01q.out
mv stream2.out m2s02q.out
mv stream3.out m2s03q.out
mv stream4.out m2s04q.out
mv stream5.out m2s05q.out
mv stream6.out m2s06q.out
mv stream7.out m2s07q.out

mv update_throughput.out m2s01rf.out

exit
```

===== tpch_wait.sql =====

```
if exists (select 1
           from SYS.SYSPROCEDURE
           where proc_name = 'tpch_wait') then
    DROP procedure tpch_wait;
end if
;

-- Script to put a dealy between TPCH updates.
-- Normally we just want to sleep a bit to spread
updates out
-- through the entire throughput test. Sometimes we
run out of
```

```

-- space; if so, just wait some more...
create procedure tpch_wait()
begin

  declare local temporary table t_iq_spaceused(
    mainKB      unsigned bigint,
    mainKBUsed  unsigned bigint,
    tempKB      unsigned bigint,
    tempKBUsed  unsigned bigint,
  )
  in SYSTEM on commit preserve rows;

  declare maintotal unsigned bigint;
  declare mainused  unsigned bigint;
  declare temptotal unsigned bigint;
  declare tempused  unsigned bigint;
  declare mainfree  unsigned bigint;
  declare command  varchar(255);

  select 'xp_cmdshell 'sleep 120'' into command;

  waitloop:
  LOOP
    truncate table t_iq_spaceused;
    execute immediate
      'iq utilities main into t_iq_spaceused
command statistics 30000' ;

    select
      mainKB,
      mainKBUsed,
      tempKB,
      tempKBUsed
    into maintotal, mainused, temptotal,
tempused
    from t_iq_spaceused;

    message 'TPCH main total: ',maintotal,' main
used : ',mainused;
    message 'TPCH temp total: ',temptotal,' temp
used : ',tempused;
    set mainfree = maintotal-mainused;
    message 'TPCH main free : ',mainfree;

    if ( mainfree > 130000000 )
      then leave waitloop;
      end if;

    select 'xp_cmdshell 'sleep 300'' into
command;
    execute immediate command;

  END LOOP waitloop;

  drop table t_iq_spaceused;
  commit;
end
;

```

Appendix F. Misc database scripts

The dbtables-syb.sql script was run to validate the correctness of the database after the database load. Three other scripts were used to extract basic information about tables and indexes from the database dew_cat1.sql, dew_cat2.sql, dew_cat3.sql.

Auditor Scripts

dbtables-syb.sql

```
=====
-- FILENAME
-- DBTABLES.SQL
-- DESCRIPTION
-- CHECK ROW COUNT AND ROW STRUCTURE/CONTENT FOR
EACH TABLE
-- IN THE TPC-H DATABASE.
--
-- =====
--
-- GET TIMESTAMP
SELECT 'START TIME', CONVERT(CHAR(30), GETDATE(),
120);
go
--
-- TABLE: LINEITEM
--
SELECT COUNT(*) FROM LINEITEM;
go
SELECT * FROM LINEITEM
WHERE L_ORDERKEY IN
( 4, 26598, 148577, 387431, 56704, 517442,
600000)
AND L_LINENUMBER = 1
ORDER BY L_ORDERKEY;
go
--
-- TABLE: ORDERS
--
-- GET TIMESTAMP
SELECT 'TIME', CONVERT(CHAR(30), GETDATE(), 120);
go
SELECT COUNT(*) FROM ORDERS;
go
SELECT * FROM ORDERS
WHERE O_ORDERKEY IN ( 7, 44065, 287590, 411111,
483876, 599942 )
ORDER BY O_ORDERKEY;
go
--
-- TABLE: PART
--
-- GET TIMESTAMP
SELECT 'TIME', CONVERT(CHAR(30), GETDATE(), 120);
go
SELECT COUNT(*) FROM PART;
go
SELECT * FROM PART
WHERE P_PARTKEY IN (1,984,8743,9028,13876,17899,20000)
ORDER BY P_PARTKEY;
go
--
-- TABLE: PARTSUPP
--
-- GET TIMESTAMP
SELECT 'TIME', CONVERT(CHAR(30), GETDATE(), 120);
go
SELECT COUNT(*) FROM PARTSUPP;
go
SELECT* FROM PARTSUPP
```

```
WHERE PS_PARTKEY = 3398
AND PS_SUPPKY = (SELECT MIN(PS_SUPPKY)
FROM PARTSUPP WHERE PS_PARTKEY = 3398);
go
SELECT* FROM PARTSUPP
WHERE PS_PARTKEY =15873
AND PS_SUPPKY = (SELECT MIN(PS_SUPPKY)
FROM PARTSUPP WHERE PS_PARTKEY = 15873);
go
SELECT* FROM PARTSUPP
WHERE PS_PARTKEY = 11394
AND PS_SUPPKY = (SELECT MIN(PS_SUPPKY)
FROM PARTSUPP WHERE PS_PARTKEY = 11394);
go
SELECT* FROM PARTSUPP
WHERE PS_PARTKEY = 6743
AND PS_SUPPKY = (SELECT MIN(PS_SUPPKY)
FROM PARTSUPP WHERE PS_PARTKEY = 6743);
go
SELECT* FROM PARTSUPP
WHERE PS_PARTKEY = 19763
AND PS_SUPPKY = (SELECT MIN(PS_SUPPKY) FROM
PARTSUPP WHERE PS_PARTKEY =19763);
go
--
-- TABLE: SUPPLIER
--
-- GET TIMESTAMP
SELECT 'TIME', CONVERT(CHAR(30), GETDATE(), 120);
go
SELECT COUNT(*) FROM SUPPLIER;
go
SELECT * FROM SUPPLIER
WHERE S_SUPPKY IN (83,265,492,784,901,1000)
ORDER BY S_SUPPKY;
go
--
-- TABLE: CUSTOMER
--
-- GET TIMESTAMP
SELECT 'TIME', CONVERT(CHAR(30), GETDATE(), 120);
go
SELECT COUNT(*) FROM CUSTOMER;
go
SELECT * FROM CUSTOMER
WHERE C_CUSTKEY IN (832,2653,4924,7845,92016,108070)
ORDER BY C_CUSTKEY;
go
--
-- TABLE: NATION & REGION
--
-- GET TIMESTAMP
SELECT 'TIME', CONVERT(CHAR(30), GETDATE(), 120);
go
SELECT * FROM REGION;
go
SELECT COUNT(*) FROM NATION;
go
SELECT * FROM NATION
WHERE N_NATIONKEY IN (3,10,14,20)
ORDER BY N_NATIONKEY;
go
--
-- CHECK KEY VALUES
--
-- GET TIMESTAMP
SELECT 'TIME', CONVERT(CHAR(30), GETDATE(), 120);
go
if exists (select name from sysobjects where
name='MINMAX')
drop table MINMAX
go
CREATE TABLE MINMAX
(TNAME CHAR(15),
KEYMIN INTEGER,
KEYMAX INTEGER);
go
INSERT INTO MINMAX
```



```

SELECT 'LINEITEM_ORD',MIN(L_ORDERKEY),MAX(L_ORDERKEY)
FROM LINEITEM;
go
INSERT INTO MINMAX
SELECT 'LINEITEM_NBR',MIN(L_LINENUMBER),MAX
(L_LINENUMBER)
FROM LINEITEM;
go
INSERT INTO MINMAX
SELECT 'ORDERS',MIN(O_ORDERKEY),MAX(O_ORDERKEY)
FROM ORDERS;
go
INSERT INTO MINMAX
SELECT 'CUSTOMER',MIN(C_CUSTKEY),MAX(C_CUSTKEY)
FROM CUSTOMER;
go
INSERT INTO MINMAX
SELECT 'PART',MIN(P_PARTKEY),MAX(P_PARTKEY)
FROM PART;
go
INSERT INTO MINMAX
SELECT 'SUPPLIER',MIN(S_SUPPKEY),MAX(S_SUPPKEY)
FROM SUPPLIER;
go
INSERT INTO MINMAX
SELECT 'PARTSUPP_PART',MIN(PS_PARTKEY),MAX(PS_PARTKEY)
FROM PARTSUPP;
go
INSERT INTO MINMAX
SELECT 'PARTSUPP_SUPP',MIN(PS_SUPPKEY),MAX(PS_SUPPKEY)
FROM PARTSUPP;
go
INSERT INTO MINMAX
SELECT 'NATION',MIN(N_NATIONKEY),MAX(N_NATIONKEY)
FROM NATION;
go
INSERT INTO MINMAX
SELECT 'REGION',MIN(R_REGIONKEY),MAX(R_REGIONKEY)
FROM REGION;
go
SELECT * FROM MINMAX;
go
if exists (select name from sysobjects where
name='MINMAX')
drop table MINMAX
go
SELECT 'END TIME', CONVERT(CHAR(30), GETDATE(), 120);
go

```

```

=====
dew_cat1.sql
=====

```

```

SELECT st.table_name,
       st.table_type,
       su.user_name,
       st.server_type
  from SYS.SYSTABLE st, SYS.SYSUSERPERMS su
  where creator = user_id
order by 4,1,3;

```

```

=====
dew_cat2.sql
=====

```

```

select T.table_name      ,
       T.table_type      ,
       C.column_name     ,
       C.column_id
From   SYS.SYSTABLE T,
       SYS.SYSCOLUMN C,
       SYS.SYSDOMAIN D,
       SYS.SYSUSERPERMS SU
where  T.creator = SU.user_id
       and T.table_id = C.table_id
       and C.domain_id = D.domain_id
order by 1,2;

```

```

=====
dew_cat3.sql
=====

```

```

SELECT index_name,T.table_name  ,
       column_name  ,
       index_type
  from  SYS.SYSTABLE T,
       SYS.SYSCOLUMN C,
       SYS.SYSINDEX I,
       SYS.SYSUSERPERMS UP,
       SYS.SYSFILE F,
       SYS.SYSIXCOL IC
 where T.table_id = C.table_id
       and C.table_id = I.table_id
       and T.file_id = F.file_id
       and I.table_id = IC.table_id
       AND I.index_id = IC.index_id
       AND IC.column_id = C.column_id
       and T.creator = UP.user_id;

```

Appendix G. Pricing information

Price quotes from Sybase Inc and Sun Microsystems Inc are included below.

Company Sun Microsystems
Contact Richard Gostanian
Phone 781-442-3063
Fax
Address 1 Network Drive, Burlington MA 01803

Quotation for Software and Support

SYBASE Sales IHollie Nash
Phone: 972-687-6412
Fax: 972-687-6409

CBSS#

	Catalogue Number	Product Description	License Type	Machine	P/S	List Price Per Unit	Quantity	Discount	Extended Price	Extended Support Fees
										3 YEARS
1	12841	Sybase IQ Single App Svr, per cpu core	CP	Sun	P	2,595	8		20,760.00	
3	98480	3 yr support Single App Svr, per cpu core				1,557	8			12,456.00
4		Discount (5% if total license + support dollar value > 25000)						-1660.80		
5										
6										
7										
8										
9										
10										
11										
12										

Quote Date: 11/28/05
Valid thru:

Total 31,555.20

Licence + 3 year support

Payment terms : Net 30 Days

5400 LBJ Freeway, Suite 1500, Dallas, TX 75240



Sales Quotation

Quote Number: T-US-769888-A

Quote Date: 12/2/05

Customer : RICHARD GOSTANIAN
 SUN MICROSYSTEMS INC
 1 NETWORK DRIVE
 BURLINGTON MA 01803
 Tel / Fax : 7814423063 /

Sun : Holli Babb
 Sun Microsystems, Inc.
 1 Network Dr
 Burlington MA 01803
 Tel / Fax : 800-786-0404/781-442-0864

We are pleased to quote as follows:

Validity Period
42 Days

Credit Terms
NET 30 FRM INV DATE

Shipping Terms
Origin

Item	Product Number	Description	Qty	Unit List Price	Disc	Unit Net Price	Extended Net Price
SunFire V490 Server w/SE3310 Storage Arrays							
1	Config ID 4147126	Configuration: A52-CLH4C232GTB	1	\$139,480.00	N/A	\$104,565.50	\$104,565.50
1.1	A52-CLH4C232GTB	Sun Fire V490 Server, 4 * 1.5GHz UltraSPARC IV+ processors with 32MB cache each, 32GB memory (32 * 1GB DIMMs), 2 * 146GB 10Krpm FC-AL hard disks, DVD-ROM, 2 10/100/1000 Ethernet ports, 1 serial port, 2 USB ports, 6 * PCI slots, 2 (N+1 redundant) power supplies, Solaris 10 pre-installed and Java ES pre-loaded (Standard Configuration)	1	\$80,995.00	20.00%	\$64,796.00	\$64,796.00
1.2	SG-XPCI2SCSI-LM320	Sun StorEdge PCI dual channel Ultra320 differential SCSI host bus adapter	3	\$510.00	30.00%	\$357.00	\$1,071.00

YOU MUST READ THE FOLLOWING: THIS SUN QUOTATION AND ANY ORDER YOU SUBMIT FOR PRODUCTS OR SERVICES IS SUBJECT TO: (1) THE TERMS OF ANY EXISTING SALES AGREEMENT YOU HAVE WITH SUN GOVERNING THAT PRODUCT OR SERVICE, OR, IF NONE, BY SUN'S SALES TERMS FOUND AT <http://www.sun.com/sales/salesterms>, THE GENERAL TERMS OF WHICH ARE EITHER ATTACHED OR ON THE REVERSE SIDE HEREOF, AND (2) APPLICABLE SUN SERVICE LISTINGS AND STATEMENTS OF WORK FOUND AT <http://www.sun.com/service/servicelist> [(1) AND (2) COLLECTIVELY BEING CALLED "SUN SALES TERMS."]

ALL ORDERS MUST REFERENCE EITHER YOUR SALES AGREEMENT NUMBER OR THIS SALES QUOTATION AND BE IN CONFORMANCE WITH SUN SALES TERMS. ORDERS ARE SUBJECT TO ACCEPTANCE BY SUN EITHER THROUGH ISSUANCE OF AN ORDER ACKNOWLEDGEMENT OR DELIVERY OF THE PRODUCTS OR SERVICES. THIS QUOTATION REMAINS FIRM FOR THE PERIOD LISTED ABOVE, EXCEPT THAT SUN MAY MODIFY THIS SALES QUOTATION IF THERE IS A TYPOGRAPHICAL ERROR OR THE AVAILABILITY OF PRODUCTS, SERVICES, OR CREDIT CHANGE. SUN EQUIPMENT, OR PARTS OR COMPONENTS OF SUN EQUIPMENT, MAY BE NEW OR USED, REGARDLESS, SUN WARRANTY TERMS APPLY.





Sales Quotation

Quote Number: T-US-769888-A

Quote Date: 12/2/05

Item	Product Number	Description	Qty	Unit List Price	Disc	Unit Net Price	Extended Net Price
1.3	X320A	Power Cord Sun Fire 3800-4810 server, Sun Fire V490 server, Sun Fire V890 server, Direct to wall, N. American	2	N/C	N/A	N/C	N/C
1.4	XTA3310R01A0R876	Sun StorEdge 3310 SCSI Array Rack Ready, 876-GB (12 x 73-Gbyte 10K RPM disks) , Ultra160 SCSI-JBOD, and 2 AC power supplies.	3	\$10,995.00	30.00%	\$7,696.50	\$23,089.50
1.5	X311L	Localized Power Cord Kit North American/Asian	6	N/C	N/A	N/C	N/C
1.6	EBA9S-301-E9M9	ESM Base Applications, Media and Documentation; Includes: Sun Storage Automated Diagnostic Environment 2.4, Sun SAN Foundation Software 4.4.5, Storage Portlets	3	N/C	N/A	N/C	N/C
1.7	X1138A	Cable, SCSI, VHDCI/VHDCI, 2m	6	\$95.00	30.00%	\$66.50	\$399.00
1.8	W9D-SE3310-3G	SE3310 SCSI Array StorEdge Upgrade to 3 Years of Gold Support.	3	\$4,356.00	35.00%	\$2,831.40	\$8,494.20
1.9	W9D-A52PLS-3G	Sun Fire V490 with UltraSPARC IV Plus (1.5Ghz and higher) System Board Upgrade to 3 Years of Gold support.	1	\$10,332.00	35.00%	\$6,715.80	\$6,715.80

List Price Total:	\$139,480.00
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Total:	\$104,565.50
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