



TPC Benchmark D™
Full Disclosure Report

Compaq AlphaServer GS140 6/575
Four Node Cluster
Using
Informix Dynamic Server
AD/XP 8.21UD2™,
and
Digital UNIX V4.0E™

| Company Name | System Name | Database Software | Operating System |
|-----------------------------|-----------------------------------|-------------------------------|--------------------|
| Compaq Computer Corporation | Compaq AlphaServer GS140 6/575 | Informix Dynamic Server AD/XP | Digital UNIX V4.0E |
| Informix Software | 4 Node Cluster | 8.21UD2 | |

Availability Date: March 15, 1999

| Total System Cost | TPC-D Power | TPC-D Throughput | Price/Performance |
|------------------------|-----------------------|-----------------------|------------------------|
| \$5,366,527 | 8,273.1 QppD@300GB | 3,487.8 QthD@300GB | \$999 \$/QphD@300GB |
| DATABASE SIZE 300GB | | | |

First Printing October 1998

Compaq Computer Corporation believes that the information in this document is accurate as of its publication date; such information is subject to change without notice. Compaq Computer Corporation is not responsible for any inadvertent errors.

Compaq conducts its business in a manner that conserves the environment and protects the safety and health of its employees, customers, and the community.

The pricing information in this document is believed to accurately reflect prices in effect on the indicated dates. However, Compaq Computer Corporation provides no warranty on the pricing information in this document.

The performance information in this document is for guidance only. System performance is highly dependent on many factors, including system hardware, system and user software, and user application characteristics. Customer applications must be carefully evaluated before estimating performance. Compaq Computer Corporation does not warrant or represent that a user can or will achieve similar performance expressed in QppD or QthD or normalized price/performance (\$/QphD). No warranty on system performance or price/performance is expressed or implied in this document.

Copyright ©1998 Compaq Computer Corporation

All Rights Reserved.

Printed in U.S.A.


Permission is hereby granted to reproduce this document in whole or in part provided the copyright notice printed above is set forth in full text on the title page of each item reproduced.

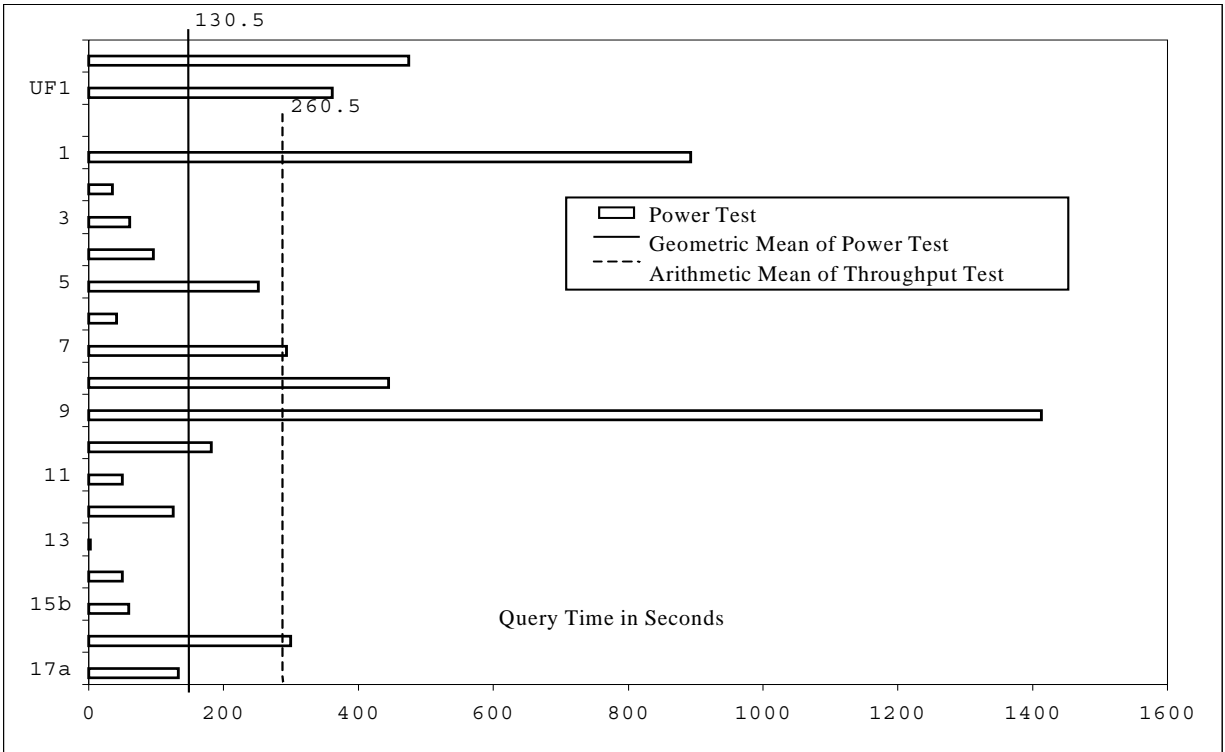
AlphaServer, Digital and the Compaq logo are trademarks of Compaq Computer Corporation.

TPC Benchmark D, is a registered trademark of the Transaction Processing Performance Council.

Informix Dynamic Server AD/XP 8.21UD2 and the Informix logo are trademarks of Informix.

UNIX is a registered trademark in the United States and other countries, exclusively licensed through X/Open Company Ltd.

| | | | | | | | |
|---|--|---|-----------------------|---|--|-------------------------------|--|
|  | | Compaq AlphaServer GS140 6/575 | | TPC-D™ 1.3.1 | | | |
| | | 4 Node Cluster Using Informix Dynamic Server AD/XP 8.21UD2 | | REPORT DATE: October 22, 1998 | | | |
| TOTAL SYSTEM COST | | TPC-D POWER | | TPC-D THROUGHPUT | | PRICE/PERFORMANCE | |
| \$5,366,527 | | 8,273.1 QppD@300GB | | 3,487.8 QthD@300GB | | \$999 \$/QphD@300GB | |
| DATABASE SIZE | DATABASE MANAGER | OPERATING SYSTEM | OTHER SOFTWARE | AVAILABILITY DATE | | | |
| 300GB | Informix IDS/AD/XP 8.21.UD2 | Digital UNIX V4.0E | TruCluster 1.6 | March 15, 1999 | | | |



| | | |
|--|-------------------------------|---------|
| DATABASE LOAD TIME = 8 HOURS, 58 MINUTES, 33 SECONDS | DISK SIZE/DATABASE SIZE =7.34 | Raid: Y |
|--|-------------------------------|---------|

Four node cluster, each node configured with:

- 10 Alpha 21264 575MHz CPUs with 4MB L2 Cache
- 8GB of memory
- 26 PCI/SCSI Disk Controllers
- 1 HSZ70 RAID controller
- 128 4.3GB disks
- 1 Ethernet controller
- 1 Memory Channel controller

Total Disk Storage 2201.6 GB



**Compaq AlphaServer
GS140 6/575
4 Node Cluster Using Informix
Dynamic Server AD/XP 8.21UD2**

TPC-D™ 1.3.1

REPORT DATE:
October 22, 1998

| Description | Part Number | Unit Price | Qty | Extended Price | 5 yr. Maint. Price |
|---|-------------|---------------|------------|--------------------|-------------------------|
| Server Hardware | | | | | |
| | | Source | | | |
| Compaq AlphaServer GS140 Model 6/525 | DA-393GG-BA | 1 | 399,400 | 4 | 1,597,600 |
| PCI PIU for 8400 System Cab | DWLPB-AA | 1 | 9,000 | 4 | 36,000 |
| 2 nd 12 Slot PCI for DWLPB-AA | DWLPB-BA | 1 | 9,000 | 8 | 72,000 |
| Sys I/O Module w/4 I/O Channels | KFTHA-AA | 1 | 8,200 | 4 | 32,800 |
| COAXIAL Assy 9.5L 100 Conn | 17-03085-01 | 1 | 291 | 4 | 1,164 |
| Dual CPU 6/525 SMP Add-on/in Module | 762P2-AX | 1 | (\$65,000) | 4 | (\$260,000) |
| Dual CPU 6/575 SMP Add-on/in Module | 2T-762T8-AX | 1 | 93,000 | 20 | 1,860,000 |
| 4 GB AlphaServer 8xxx Memory | MS7CC-GA | 1 | 65,600 | 4 | 262,400 |
| PCI Ethernet Card(TW,TP,AUI) | SN-DE450-CA | 1 | 110 | 4 | 440 |
| MEMORY CHANNEL ADAPTER | CCMAB-BA | 1 | 4,193 | 4 | 16,772 |
| PCI-RM LINK CABLE | BC12N-10 | 1 | 250 | 4 | 1,000 |
| MEMORY CHANNEL HUB | CCMHB-AA | 1 | 9,793 | 1 | 9,793 |
| White, North American, No Key | VT510-AA | 1 | 376 | 4 | 1,504 |
| US/CANADA W95 KYBD WHIT | PCXLA-NA | 1 | 25 | 4 | 100 |
| Subtotal | | | | 3,631,573 | 787,488 |
| Storage: | | | | | |
| Cab w/fan tray/7200RPM device | SW800-FA | 1 | 7,019 | 6 | 42,114 |
| SCSI Signal Convt 16-bit SBB | DWZZB-VW | 1 | 660 | 96 | 63,360 |
| 7Dev Rackm pwr no I/O Module | BA356-JC | 1 | 1,214 | 96 | 116,544 |
| ESA High BW Building Blk 60Hz | DS-SWXES-BA | 1 | 88,307 | 2 | 176,614 |
| PCI to SCSI UWD Adapter | KZPBA-CB | 1 | 825 | 4 | 3,300 |
| 4.3GB 7200RPM UltraSCSI HDD** | DS-RZ1CB-VW | 1 | 899 | 564 | 507,036 |
| 10 M Cable, SCSI-3 "P" 1S/1R | BN21K-10 | 1 | 212 | 96 | 20,352 |
| PCI-HOST BUS ADAPTER (FWD) | KZPSA-BB | 1 | 1,095 | 96 | 105,120 |
| Subtotal | | | | 1,034,440 | 217,958 |
| Software | | | | | |
| HS70 SW U/A Lic/MCD/No Doc. | QB-5SBAB-SB | 1 | 750 | 8 | 6,000 |
| 5YR;AS8400 DUAL UNIX BRZ24X7 | FM-D84US-60 | 1 | 38,448 | 4 | 153,792 |
| TruCI PSvr U/A LIC/DOC Qtier | QB-3RLAQ-KA | 1 | 35,180 | 4 | 140,720 |
| Digital UNIX Alpha CDRM | QA-MT4AA-H8 | 1 | 395 | 4 | 1,580 |
| Informix License | Informix | 2 | 589,600 | 1 | 589,600 |
| 5YR Informix Service | Informix | 2 | 604,400 | 1 | 604,400 |
| Subtotal | | | | 737,900 | 758,192 |
| Notes:** 10% Spares | | | | | |
| ICS Discount: 35% on Server Hardware/Software based on volume. | | | | (\$1,685,172) | |
| ICS Discount: 10% on FM and FR numbers based on volume. | | | | | (\$115,852) |
| Subtotal | | | | \$3,718,741 | \$1,647,786 |
| Five-Year Cost of Ownership: | | | | | \$5,366,527 |
| 1=IC System Solutions, 2=Informix | | | | | QphD 5,371.7 |
| | | | | | \$ / QphD: \$999 |

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.

Audited by: Francois Raab, Information Paradigm, Inc.



**Compaq AlphaServer
 GS140 6/575
 4 Node Cluster Using Informix
 Dynamic Server AD/XP 8.21UD2**

TPC-D™ 1.3.1

REPORT DATE:
October 22, 1998

Numerical Quantities Summary

Measurement Results:

| | | |
|--|---|---------------------------------|
| Database Scaling (SF/Size) | = | 300GB |
| Total Data Storage/Database Size | = | 7.34 |
| Database Load Time | = | 8 Hours, 58 Minutes, 33 Seconds |
| Query Streams for Throughput Test (S) | = | 0 |
| TPC-D Power Metric (QppD@300GB) | = | 8,273.1 |
| TPC-D Throughput Metric (QthD@300GB) | = | 3,487.8 |
| Composite (QphD@300GB) | = | 5,371.7 |
| Total System Price Over five years | = | \$5,366,527 |
| TPC-D Price/Performance Metric (\$/QphD@300GB) | = | \$999 |

Measurement Intervals:

| | |
|---|---------------|
| Measurement interval in Performance Test (TS) | 5,264 seconds |
|---|---------------|

Duration of Stream Execution:

| Stream ID | Seed | Start Date | Start Time | End Date | End Time | Total Time |
|-----------|------------|------------|------------|----------|----------|------------|
| Stream 00 | 1021075513 | 10/21/98 | 09:39:21 | 10/21/98 | 11:07:05 | 01:27:44 |
| UF1 | | 10/21/98 | 09:39:21 | 10/21/98 | 09:45:22 | 00:06:01 |
| UF2 | | 10/21/98 | 10:59:11 | 10/21/98 | 11:07:05 | 00:07:54 |

TPC-D Timing Intervals (in seconds):

| Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 |
|-------|------|------|------|-------|------|-------|-------|--------|
| 893.1 | 35.1 | 60.7 | 95.6 | 251.3 | 41.1 | 292.7 | 445.1 | 1413.6 |

| Q10 | Q11 | Q12 | Q13 | Q14 | Q15b | Q16 | Q17a | UF1 | UF2 |
|-------|------|-------|-----|------|------|-------|-------|-------|-------|
| 181.5 | 50.1 | 125.5 | 2 | 49.5 | 59.5 | 299.9 | 132.7 | 360.6 | 474.1 |



Test Sponsors: Tony Petrossian
Manager, Product Development
Informix Software, Inc.
921 SW Washington Street
Portland, OR 97205

Dave Stanley
Manager, HPS Bench. Perf. Engineering
Compaq Computer Corporation
110 Spit Brook Road
Nashua NH, 03062

October 22, 1998

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

Platform: Compaq AlphaServer GS140 6/575, four node cluster
DataBase Manager: INFORMIX IDS/AD/XP Version 8.21.UD2
Operating System: Digital UNIX V4.0E
Other software: TruCluster Version 1.5

The results were:

Table with 5 columns: CPU's Speed, Memory, Disks, QppD@300GB, QthD@300GB. Row 1: Each node with 10 x Alpha 21264 (575 MHz), Each node with 4 MB L2/cpu 8 GB Main, 512 x 4.3 GB, 7,734.4, 3,055.4

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

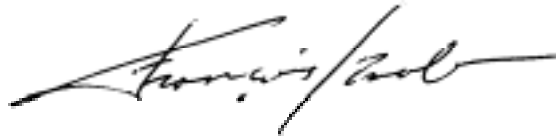
- The TIME table was not used
The input variables were generated by QGEN
The database was populated using DBGEN
The database was maintained by the "Evolve" method
The throughput metric was computed using the results from the power test
The ratio between the longest and the shortest query was such that no adjustment was necessary
A compliant implementation specific layer was used
The query text was produced using compliant variants and minor modifications
The database records were defined with the proper layout and size

- The database was properly scaled to 300GB and populated accordingly
- The database load time was correctly measured and reported
- The ACID Properties were verified and met
- The reported execution times were correctly measured and reported
- Measurement repeatability was verified
- At least 8 hours 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,

A handwritten signature in black ink, appearing to read "François Raab", with a long horizontal flourish extending to the right.

François Raab
President

Table Of Contents

| | |
|--|-------------|
| TABLE OF CONTENTS | VIII |
| 1. GENERAL ITEMS..... | 10 |
| 1.1 TEST SPONSOR | 10 |
| 1.2 PARAMETER SETTINGS | 10 |
| 1.3 CONFIGURATION ITEMS | 10 |
| 2. CLAUSE 1: LOGICAL DATABASE DESIGN RELATED ITEMS..... | 13 |
| 2.1 TABLE DEFINITIONS..... | 13 |
| 2.2 PHYSICAL ORGANIZATION OF DATABASE | 13 |
| 2.3 HORIZONTAL PARTITIONING | 13 |
| 2.4 REPLICATION | 13 |
| 3. CLAUSE 2: QUERIES AND UPDATE FUNCTIONS RELATED ITEMS..... | 14 |
| 3.1 QUERY LANGUAGE..... | 14 |
| 3.2 RANDOM NUMBER GENERATION | 14 |
| 3.3 SUBSTITUTION PARAMETERS GENERATION | 14 |
| 3.4 QUERY TEXT AND OUTPUT DATA FROM DATABASE..... | 14 |
| 3.5 QUERY SUBSTITUTION PARAMETERS AND SEEDS USED | 15 |
| 3.6 ISOLATION LEVEL..... | 15 |
| 3.7 UPDATE FUNCTION SOURCE CODE | 15 |
| 3.8 DATABASE MAINTENANCE OPTION | 15 |
| 4. CLAUSE 3: DATABASE SYSTEM PROPERTIES RELATED ITEMS..... | 16 |
| 4.1 ATOMICITY | 16 |
| 4.1.1 Completed Transaction..... | 16 |
| 4.1.2 Aborted Transaction..... | 16 |
| 4.2 CONSISTENCY..... | 16 |
| 4.2.1 Consistency Test | 16 |
| 4.3 ISOLATION..... | 17 |
| 4.3.1 Read-Write Conflict with Commit..... | 17 |
| 4.3.2 Read-Write Conflict with Rollback | 17 |
| 4.3.3 Write-Write Conflict with Commit | 17 |
| 4.3.4 Write-Write Conflict with Rollback..... | 18 |
| 4.3.5 Isolation Test 5 | 18 |
| 4.3.6 Isolation Test 6 | 18 |
| 4.4 DURABILITY | 19 |
| 4.4.1 Failure of a Durable Medium..... | 19 |
| 4.4.2 System Crash | 19 |
| 4.4.3 Memory Failure | 19 |
| 5. CLAUSE 4: SCALING AND DATA-BASE POPULATION RELATED ITEMS | 20 |
| 5.1 INITIAL CARDINALITY OF TABLES..... | 20 |
| 5.2 DISTRIBUTION OF TABLES AND LOGS ACROSS MEDIA | 20 |
| 5.3 DATABASE PARTITION/REPLICATION MAPPING | 20 |
| 5.4 RAID FEATURE..... | 20 |
| 5.5 DBGEN VERSION AND MODIFICATIONS | 21 |
| 5.6 DATABASE CONTENT OF THE FIRST TEN ROWS | 21 |
| 5.7 DATABASE LOAD TIME | 21 |
| 5.8 DATA STORAGE RATIO | 21 |
| 5.9 DATABASE LOAD MECHANISM DETAILS AND ILLUSTRATION | 21 |

| | | |
|-----------|--|-----------|
| 6. | CLAUSE 5: PERFORMANCE METRICS AND EXECUTION RULES RELATED ITEMS | 22 |
| 6.1 | STEPS IN THE POWER TEST | 22 |
| 6.2 | TIMING INTERVALS..... | 22 |
| 6.3 | NUMBER OF STREAMS FOR THE THROUGHPUT TEST | 22 |
| 6.4 | START/FINISH TIME OF EACH QUERY STREAM | 22 |
| 6.5 | TOTAL ELAPSED TIME | 22 |
| 6.6 | START/FINISH TIME FOR UPDATE FUNCTION | 23 |
| 6.7 | TIMING INTERVALS FOR EACH QUERY AND EACH UPDATE | 23 |
| 6.8 | PERFORMANCE METRICS | 23 |
| 6.9 | REPRODUCIBILITY METHOD..... | 23 |
| 7. | CLAUSE 6: SUT AND DRIVER IMPLEMENTATION RELATED ITEMS | 24 |
| 7.1 | DRIVER..... | 24 |
| 7.2 | IMPLEMENTATION SPECIFIC LAYER (ISL)..... | 24 |
| 7.3 | UPDATE FUNCTION | 24 |
| 8. | CLAUSE 7: PRICING RELATED ITEMS..... | 25 |
| 8.1 | HARDWARE AND SOFTWARE USED IN THE PRICED SYSTEM..... | 25 |
| 8.2 | TOTAL FIVE YEAR PRICE | 25 |
| 8.3 | AVAILABILITY DATE..... | 25 |
| 9. | CLAUSE 9: AUDIT RELATED ITEMS | 25 |
| 9.1 | AUDITOR'S REPORT | 25 |
| | APPENDIX A: PARAMETER SETTINGS | 26 |
| | APPENDIX B: TABLE DEFINITIONS | 29 |
| | APPENDIX C: QUERY TEXT AND OUTPUT | 54 |
| | APPENDIX D: SEED AND QUERY SUBSTITUTION PARAMETERS..... | 67 |
| | APPENDIX E: IMPLEMENTATION SPECIFIC LAYER/DRIVER CODE | 68 |
| | APPENDIX F: FIRST 10 RECORDS..... | 70 |
| | APPENDIX G: THIRD PARTY PRICE | 74 |

1. General Items

1.1 Test Sponsor

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

Compaq Computer Corporation and Informix Software, Inc. were joint sponsors of this TPC Benchmark D.

1.2 Parameter Settings

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

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

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

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

1.3 Configuration Items

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

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

The tested system was a four node cluster of Compaq AlphaServer GS140 6/575 each with the following configuration:

- 10 Alpha 21264 575MHz CPUs with 4MB L2 Cache
- 8 GB memory
- 116 direct connect 4.3GB SCSI disks
- 1 HSZ70 RAID Storage subsystem with 12 4.3GB disks
- 1 Ethernet adapter
- 26 SCSI adapters
- 1 Memory Channel adapter
- Total number of disk 128

Tested and priced configurations are identical.

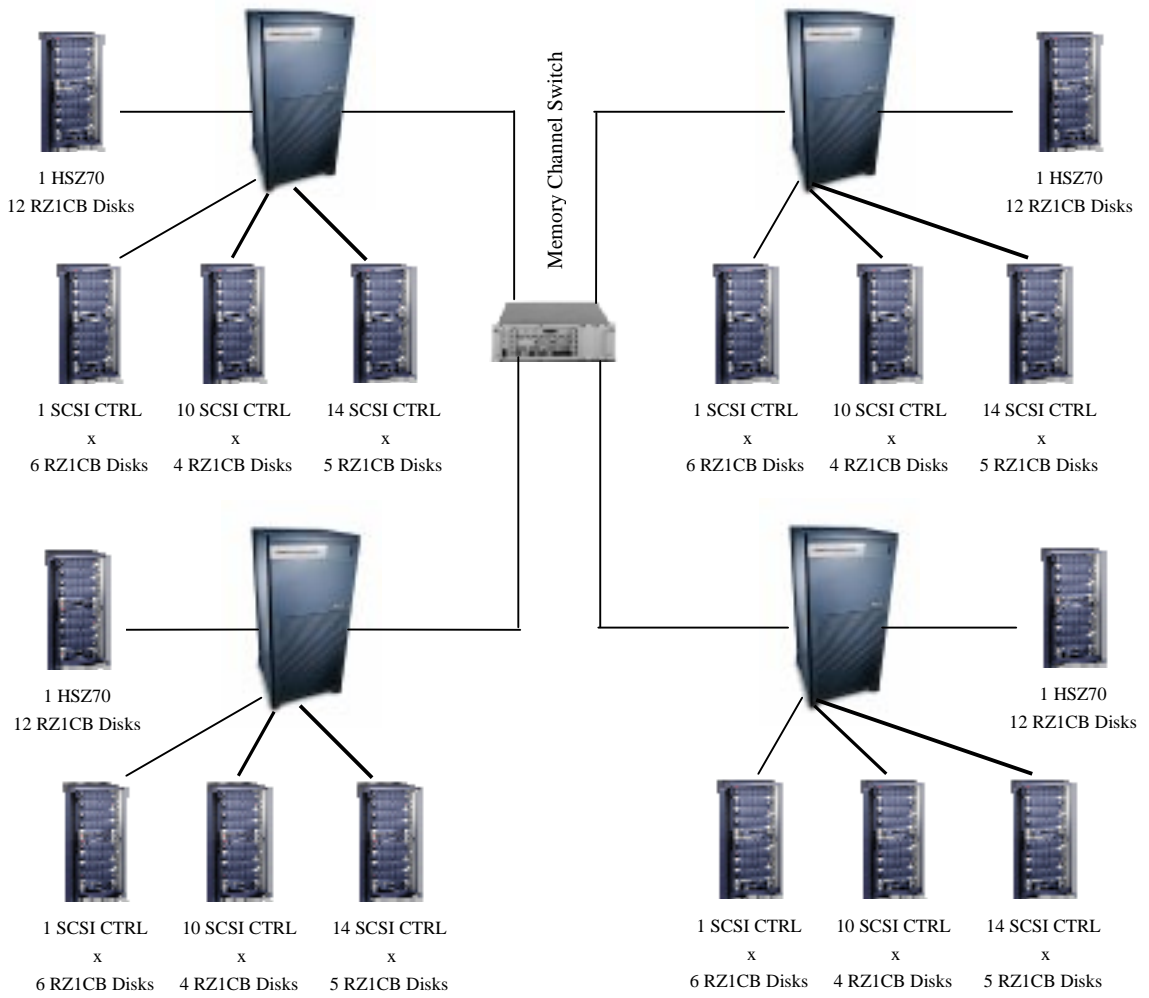


Figure 1.1 Benchmarked and Priced Configuration

2. Clause 1: Logical Database Design Related Items

2.1 Table Definitions

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

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

2.2 Physical Organization of Database

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

No record clustering or index clustering was used. Default column ordering was used.

2.3 Horizontal Partitioning

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

Horizontal partitioning was used for all base and index tables except NATION and REGION. The details of this partitioning can be understood by examining the syntax of table and index definition statements in Appendix B. Similar partitioning was used in the qualification database, scaled appropriately for its size.

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 Update Functions Related Items

3.1 Query Language

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

SQL was the query language used to implement all queries.

3.2 Random Number Generation

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

The 1.3 version of DBGEN and version 1.3 of QGEN were used to generate the random numbers for this TPC-D benchmark.

3.3 Substitution Parameters Generation

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

The 1.3 version of QGEN was used to generate the substitution parameters.

3.4 Query Text and Output Data from Database

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

- Appendix C contains the actual query text and query output. The following minor modifications were applied:
- In Q2, Q3, and Q10, following *Clause 2.1.2.8*, the INFORMIX SELECT ... FIRST *N* mechanism was used for return of the correct number of rows.
- In accordance with *Clause 2.2.3.3(c)*, all date expressions were adapted to appropriate INFORMIX-supported syntax with equivalent semantics.
- In Q7, Q8, Q9, and Q13, which use a nested table expression solely for the purpose of grouping on an expression, in accordance with *Clause 2.2.3.3(d)* table names were used in the FROM clause instead of the form using a nested table-expression. The GROUP BY and/or ORDER BY clauses were modified to use an ordinal.
- In Q8 in the outermost select, in accordance with *Clause 2.2.3.3(f)*, ROUND(...,2) is used for intermediate arithmetic result precision.

3.5 Query Substitution Parameters and Seeds Used

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

Appendix D contains the seed and query substitution parameters.

3.6 Isolation Level

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

The queries and transactions were run with the isolation level set to “Level 2” (repeatable read).

3.7 Update Function Source Code

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

The update functions are part of the implementation-specific driver code included in Appendix E.

3.8 Database Maintenance Option

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

This implementation used the evolve option.

4. Clause 3: Database System Properties Related Items

4.1 Atomicity

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

4.1.1 Completed Transaction

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

1. The total price from the ORDER table and the extended price from the LINEITEM table were retrieved for a randomly selected order key.
2. The ACID Transaction was performed using the order key from step 1.
3. The ACID Transaction committed.
4. The total price from the ORDER 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.

4.1.2 Aborted Transaction

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

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

4.2 Consistency

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

4.2.1 Consistency Test

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

1. The consistency of the ORDER and LINEITEM tables was verified based on a sample of O_ORDERKEY's.

2. 100 ACID Transactions were submitted from each of 2 execution streams.
3. The consistency of the ORDER and LINEITEM tables was verified again.

4.3 Isolation

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

4.3.1 Read-Write Conflict with Commit

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

1. An ACID Transaction was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID Transaction was suspended prior to COMMIT.
2. An ACID Query was started for the same O_KEY used in step 1. The ACID Query blocked and did not return any uncommitted changes made by the ACID Transaction.
3. The ACID Transaction was resumed, and COMMITTED.
4. The ACID Query completed. It returned the data as committed by the ACID Transaction.

4.3.2 Read-Write Conflict with Rollback

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

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

4.3.3 Write-Write Conflict with Commit

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

1. An ACID Transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID Transaction was suspended prior to COMMIT.
2. Another ACID Transaction, T2, was started using the same O_KEY and L_KEY and a randomly selected DELTA.
3. T2 waited.
4. T1 was allowed to COMMIT and T2 completed.
5. It was verified the $T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE + (DELTA1 * (T1.L_EXTENDEDPRICE / T1.L_QUANTITY))$

4.3.4 Write-Write Conflict with Rollback

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

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

4.3.5 Isolation Test 5

This test demonstrates 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. The ACID Transaction was suspended prior to ROLLBACK.
2. Another ACID Transaction was started using random values for PS_PARTKEY and PS_SUPPKEY.
3. ACID Transaction T2 completed.
4. ACID Transaction 1 completes and the appropriate rows in the ORDER, LINEITEM, and HISTORY tables have been changed.

4.3.6 Isolation Test 6

This test demonstrates that the continuous submission of arbitrary (read-only) queries against one or more tables of the database does not indefinitely delay 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. Transaction T1 completed Q1.
3. A second transaction, T3, executing Q1 was started using a DELTA random but different for T1's.
4. An ACID Transaction, T2, was started for a randomly selected O_KEY, L_KEY and DELTA.
5. T2 completed and the appropriate rows in the ORDER, LINEITEM, and HISTORY tables had been changed.
6. T3 completed.

4.4 Durability

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

4.4.1 Failure of a Durable Medium

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

The disks containing TPC-D tables and log files were mirrored. During the durability test one side of a data file mirror and one side of a log file mirror was disabled. The test continued uninterrupted, using the remaining side of the mirror.

4.4.2 System Crash

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

The system crash and memory failure tests were combined. Power to the server was turned off during the durability test. When power was restored, the system rebooted and the database was restarted. The durability success file and the HISTORY table were compared and the counts matched.

4.4.3 Memory Failure

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

See the previous section.

5. Clause 4: Scaling and Data-base Population Related Items

5.1 Initial Cardinality of Tables

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

Table 5. 1: Initial number of Rows

| Table | Occurrences |
|----------|---------------|
| Order | 450,000,000 |
| Lineitem | 1,799,989,091 |
| Customer | 45,000,000 |
| Part | 60,000,000 |
| Supplier | 3,000,000 |
| Partsupp | 240,000,000 |
| Nation | 25 |
| Region | 5 |

5.2 Distribution of Tables and Logs Across Media

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

The database tables and indexes were distributed across 192 disks that were mirrored on another set of 192 disks. All database logs were contained on 24 drives that were mirrored on another set of 24 drives. Eight disks were used for Informix root and its mirror. 40 disks were used for database temp space.

5.3 Database Partition/Replication Mapping

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

The database was not replicated.

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 used must be disclosed for each device.

RAID level 1 (mirroring) was implemented in software (LSM) for all database tables and indices. A Compaq HSZ70 Raid array was used to implement RAID level 1 (mirroring) for all database log disks. Temporary database storage was not mirrored.

5.5 DBGEN Version and Modifications

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

No modifications were made to the DBGEN 1.3 program.

5.6 Database Content of the First Ten Rows

The content of the first ten rows of each table in the test database must be disclosed.

Appendix F contains the first ten rows of each table in the test database.

5.7 Database Load time

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

The database load time was 8 hours 58 minutes 33 seconds.

5.8 Data Storage Ratio

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

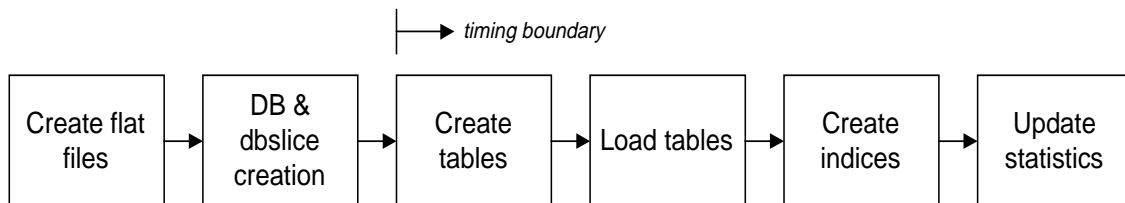
The data storage ratio is computed as follows:

| Disk Type | # of disks | Space per disk | Sub-Total Disk Space | Total SF/Size | Data Storage Ratio |
|-----------|------------|----------------|-------------------------|---------------|-----------------------|
| RZ1CB | 512 | 4.3GB | 2201.6GB | | |
| Total | | | 2201.6GB | 300 GB | 7.34 |

5.9 Database Load Mechanism Details and Illustration

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

The database was loaded using Informix Pload. The LINEITEM, ORDER, PART, CUSTOMER, SUPPLIER and PARTSUPP flat files were split into 60 files. The NATION and REGION table were loaded from a single flat file.



6. Clause 5: Performance Metrics and Execution rules Related Items

6.1 Steps in the Power Test

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

The following steps were used to implement the power test:

1. Database Restart
2. UF1 Update Transaction
3. Stream 00 Execution
4. UF2 Update Transaction

6.2 Timing Intervals

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

The power test timing intervals are presented in the Numerical Quantities Summary in the Executive Summary.

6.3 Number of Streams for The Throughput Test

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

A single query stream throughput metric was calculated using the timings from the power test, as indicated in Clause 5.3.1.4. A separate throughput test was not run.

6.4 Start/Finish Time of Each Query Stream

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

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

6.5 Total Elapsed Time

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

The total elapsed time of the throughput test is given in the Numerical Quantities Summary in the Executive Summary (as “Measurement interval in Performance Test (TS)”).

6.6 Start/Finish Time for Update Function

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

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

6.7 Timing Intervals for Each Query and Each Update

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

The timing intervals for each query and each update function for the throughput test are contained in the Numerical Quantities Summary in the Executive Summary. The values for the power test are used for the throughput test.

6.8 Performance Metrics

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

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

6.9 Reproducibility Method

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

Performance results from the first two executions of the TPC-D benchmark indicated the following percent differences for the metrics:

| Run ID | QppD@300 GB | QthD@300 GB | QphD@300 GB |
|---------------|--------------------|--------------------|--------------------|
| Run 1 | 8,502.8 | 3,545.5 | 5,490.6 |
| Run 2 | 8,273.1 | 3,488.0 | 5,371.9 |
| Difference | 2.8% | 1.6% | 2.2% |

7. Clause 6: SUT and Driver Implementation Related Items

7.1 Driver

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

The Power Test is performed by a single script. QGEN is used to produce the executable query text.

For each Power test execution:

- The SQL for UF1 is submitted to the database
- The queries as generated by QGEN are submitted in the order defined by Clause 5.3.4.4
- The SQL for UF2 is submitted to the database

In all cases, inserts, deletes, and queries are executed by submitting the appropriate SQL to the utility DB-Access, as described under the Implementation Specific Layer description.

The time (using `gettimeofday()`) is recorded in seconds to a resolution of 0.01 seconds at the beginning of each run and after each query or update function. The difference is computed and directed to a file to record performance.

7.2 Implementation Specific Layer (ISL)

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

DB-Access is an Informix database utility that facilitates access and manipulation of data in an Informix database. DB-Access is invoked from the command-line mode on the SUT, specifying access to the TPC-D database. It runs an input file containing either the QGEN-generated SQL for the queries or SQL for the update functions.

The environment variables `INFORMIXDIR` and `INFORMIXSERVER` were set appropriately for execution of DB-Access.

7.3 Update Function

UF1 is implemented using the Informix Pload functionality. UF2 uses the delete SQL syntax. Logical consistency of the database is ensured by using a single transaction to do all the inserts (or deletes) in both tables.

8. Clause 7: Pricing Related Items

8.1 Hardware and Software Used in the Priced System

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

A detailed list of the hardware and software used in the priced system is included in the pricing sheet in the Executive Summary.

8.2 Total Five year Price

The total 5-year price of the entire configuration must be reported including: hardware, software, and maintenance charges. Separate component pricing is recommended. The basis of all discounts used must be disclosed.

The total 5-year price of the configuration is \$5,366,527.

A detailed price sheet of all the hardware and software used in this configuration and the 5-year maintenance cost is included in the Executive Summary at the beginning 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 availability date reported on the executive summary must be the date by which all components are committed to being available. The full disclosure report must report availability dates individually for at least each of the categories for which a pricing subtotal must be provided..

Storage hardware is available immediately. All other hardware will be available as of November 30, 1998. Software components will be available as of March 15, 1999.

9. Clause 9: Audit Related Items

9.1 Auditor's Report

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

The auditor's letter of attestation is included in this full disclosure report following the Executive Summary. This implementation of the TPC Benchmark D was audited by François Raab of Information Paradigm, Inc.

Appendix A: Parameter Settings

onconfig.load

```

*****
#
#                               INFORMIX SOFTWARE, INC.
#
# Title: onconfig.chida
# Description: INFORMIX-OnLine XPS Configuration Parameters
#
*****

# Root Dbspace Configuration

ROOTSLICE rootdbs          # Root dbspace name
ROOTOFFSET 20              # Offset of root dbspace
                           # into device (kbytes)
ROOTSIZE 1200000          # Size of root dbspace
                           # (kbytes)

# Disk Mirroring Configuration Parameters

MIRROR 0                   # Mirroring flag (Yes = 1,
                           # No = 0)
MIRRORPATH
MIRROROFFSET 0            # Offset into mirrored
                           # device (kbytes)

# Physical Log Configuration

PHYSSLICE rootdbs        # physical log dbspace
PHYSSFILE 200000         # Physical log file size (kbytes)
#PHYSSLICE physlice      # physical log dbspace
#PHYSSFILE 1900000       # Physical log file size (kbytes)

# Logical Log Configuration

LOGFILES 3                # Number of logical log files
LOGSIZE 20000             # Logical log size
                           # (kbytes)

# Diagnostics

MSGPATH /Informix/tpcd/online.log # System message log
                           # file path
CONSOLE /Informix/tpcd/online.log # System console
                           # message path
# ALARMPROGRAM            # Alarm program path

# System Archive Tape Device

TAPEDEV /dev/null         # Tape device path
TAPEBLK 16                # Tape block size (kbytes)
TAPEISZ 10240             # Maximum amount of data to put on
                           # tape (kbytes)

LOG_BACKUP_MODE NONE

# Optical
# STAGEBLOB                # INFORMIX-OnLine/Optical
                           # staging area

# System Configuration

SERVERNUM 50              # Unique id corresponding to a
                           # OnLine instance
DBSERVERNAME dec         # Name of default database
                           # server
DBSERVERALIASES          # List of alternate
                           # dbservernames
NETTYPE ipcshm           # Override
                           # sqlhosts nettype parameters
DEADLOCK_TIMEOUT 60      # Max time to wait of lock in
                           # distributed env.
RESIDENT 0               # Forced residency flag (Yes = 1, No
                           # = 0)

MULTIPROCESSOR 1         # 0 for single-processor, 1 for
                           # multi-processor
NUMCPUVPS 10            # Number of user (cpu) vps
SINGLE_CPU_VP 0          # If non-zero, limit number of cpu
                           # vps to one

NOAGE 0                  # Process aging
AFF_SPROC 0             # Affinity start processor
AFF_NPROCS 0            # Affinity number of
                           # processors

# Shared Memory Parameters

LOCKS 1000000            # Maximum number of locks
BUFFERS 50000           # Changed
                           # 3/19/98
NUMAIOVPS 2             # Number of IO vps modified on sep 9
NUMFIOVPS                # Number of IO vps
PHYSBUFF 128            # Logical log buffer size
LOGBUFF 128             # (kbytes)
LOGSMAX 50              # Maximum number of
                           # Logical log files
CLEANERS 20             # Number of buffer cleaner processes

```

```

memory base address (Low)
SHMBASE 0x200000000L     # Shared memory (Changed
                           # 4/27/98)
SHMVIRTSIZE 2097150     # modified on aug 27th
SHMADD 16384             # Size of new shared memory
                           # segments (kbytes)
Size of new shared memory segments (kbytes)
SHMTOTAL 0              # Total shared memory (kbytes).
0=>unlimited
CKPTINTVL 9999999       # Check point interval (in
                           # sec)
LRUS 20                  # Number of LRU queues
LRU_MAX_DIRTY 48         # LRU percent dirty begin
                           # Cleaning limit
LRU_MIN_DIRTY 30        # LRU percent dirty end
                           # Cleaning limit
LTXHWM 80                # Long transaction high
                           # water mark percentage
LTXEHWM 90               # Long transaction high
                           # water mark (exclusive)
TXTIMEOUT 300           # Transaction timeout (in sec)
STACKSIZE 64            # Stack size (kbytes)

during fast recovery or an offline restore.
RAL_PAGES 64            # Number of pages to attempt to read
                           # ahead
RA_THRESHOLD 32         # Number of pages left
                           # before next group

# DBSPACETEMP:
# OnLine equivalent of DBTEMP for SE. This is the list of dbspaces
# that the OnLine SQL Engine will use to create temp tables etc.
# The list can be specified using various preset "sets" that are
# ALL - all dbspaces can be used for temp files
# TEMP - use only temporary dbspaces for temp files
# NOTCRITICAL - use only non-critical dbspaces for temp files
# Critical dbspaces are the rootdbspaces and
# dbspaces containing
# log files.
# The list can also be specified as an explicit list of
# dbspaces/dbspaces
# that exist when the OnLine system is brought online. If not
# specified,
# or if all dbspaces specified are invalid, various ad hoc queries
# will create
# temporary files in /tmp instead. If a dbspaces in this list is
# added to the system at a later point in time, it is
# automatically added
# to the list of dbspaces that can be used for temp purposes.

DBSPACETEMP TEMP

# CONFIGSIZE:
# Specifies relative amount of space in rootdbs to preallocate for
# storage
# of CfgMgr data (only applies to CM Coservers).
# Legal values are SMALL, STANDARD, and LARGE. If CONFIGSIZE is
# not
# given an explicit value, it defaults to STANDARD.

CONFIGSIZE LARGE

# DUMP*:
# The following parameters control the type of diagnostics
# information which
# is preserved when an unanticipated error condition (assertion
# failure) occurs
# during OnLine operations.
# For DUMPSHMEM, DUMPGCORE and DUMPCORE 1 means Yes, 0 means No.

DUMPPDIR /tmp           # Preserve diagnostics in
                           # this directory
DUMPSHMEM 0             # Dump a copy of shared memory
DUMPGCORE 0             # Dump a core image using 'gcore'
DUMPCORE 1              # Dump a core image (warning:this
                           # aborts OnLine)
DUMPCNT 1               # Number of shared memory
                           # or gcore dumps for
                           # a single user's session

# ADT*:
# The following parameters control the type and level of secure
# auditing
# present in the OnLine system. By default, ADTMODE is 0 and
# auditing
# is disabled

ADTMODE 0               # Auditing mode
ADTPATH /tmp            # Directory where audit trails will
                           # be written by OnLine
ADTSIZE 50000          # Maximum size of any single audit
                           # trail file
ADTERR 0                # 0 ==> retry failed audit writes; 1
                           # ==> log failure

FILLFACTOR 90           # Fill factor for building
                           # indexes

# method for OnLine to use when determining current time
USEOSTIME 0             # 0: use internal time(fast), 1: get time from
                           # OS(slow)

# Parallel Database Queries (pdq)
PDQPRIORITY 100        # Degree of parallelism: 0 => OFF, 1
                           # => LOW,
MAX_PDQPRIORITY 100    # Maximum allowed pdqpriority
DS_MAX_QUERIES 100     # Maximum number of decision support
                           # queries
DS_TOTAL_MEMORY 6194304
DS_MAX_SCANS 1000000   # Maximum number of decision support
                           # scans
DS_HASHSIZE 251
DS_POOLSIZ 500
DATASIP                # List of dbspaces to skip

```

```

ASYNCRQT 100
SENDEPDS 1

COSERVER 1
ROOTPATH /Informix/dbspace/coserver.1/rootdbs.1
NODE ifmx1
SADDR node1:7610,1,0
LADDR node1:7620,1,0
HADDR node1:7625,1,0
SADDR node1:7710,1,1
LADDR node1:7720,1,1
HADDR node1:7725,1,1
SADDR node1:7730,1,2
LADDR node1:7740,1,2
HADDR node1:7745,1,2
SADDR node1:7750,1,3
LADDR node1:7760,1,3
HADDR node1:7765,1,3
SADDR node1:7770,1,4
LADDR node1:7780,1,4
HADDR node1:7785,1,4
SADDR node1:7790,1,5
LADDR node1:7800,1,5
HADDR node1:7805,1,5
SADDR node1:7810,1,6
LADDR node1:7820,1,6
HADDR node1:7825,1,6
SADDR node1:7830,1,7
LADDR node1:7840,1,7
HADDR node1:7845,1,7
SADDR node1:6850,1,8
LADDR node1:6860,1,8
HADDR node1:6865,1,8
SADDR node1:6870,1,9
LADDR node1:6880,1,9
HADDR node1:6885,1,9
END

COSERVER 2
ROOTPATH /Informix/dbspace/coserver.2/rootdbs.2
NODE ifmx2
SADDR node2:8610,1,0
LADDR node2:8620,1,0
HADDR node2:8625,1,0
SADDR node2:8710,1,1
LADDR node2:8720,1,1
HADDR node2:8725,1,1
SADDR node2:8730,1,2
LADDR node2:8740,1,2
HADDR node2:8745,1,2
SADDR node2:8750,1,3
LADDR node2:8760,1,3
HADDR node2:8765,1,3
SADDR node2:8770,1,4
LADDR node2:8780,1,4
HADDR node2:8785,1,4
SADDR node2:8790,1,5
LADDR node2:8800,1,5
HADDR node2:8805,1,5
SADDR node2:8810,1,6
LADDR node2:8820,1,6
HADDR node2:8825,1,6
SADDR node2:8830,1,7
LADDR node2:8840,1,7
HADDR node2:8845,1,7
SADDR node2:6850,1,8
LADDR node2:6860,1,8
HADDR node2:6865,1,8
SADDR node2:6870,1,9
LADDR node2:6880,1,9
HADDR node2:6885,1,9
END

COSERVER 3
ROOTPATH /Informix/dbspace/coserver.3/rootdbs.3
NODE ifmx3
SADDR node3:9610,1,0
LADDR node3:9620,1,0
HADDR node3:9625,1,0
SADDR node3:9710,1,1
LADDR node3:9720,1,1
HADDR node3:9725,1,1
SADDR node3:9730,1,2
LADDR node3:9740,1,2
HADDR node3:9745,1,2
SADDR node3:9750,1,3
LADDR node3:9760,1,3
HADDR node3:9765,1,3
SADDR node3:9770,1,4
LADDR node3:9780,1,4
HADDR node3:9785,1,4
SADDR node3:9790,1,5
LADDR node3:9800,1,5
HADDR node3:9805,1,5
SADDR node3:9810,1,6
LADDR node3:9820,1,6
HADDR node3:9825,1,6
SADDR node3:9830,1,7
LADDR node3:9840,1,7
HADDR node3:9845,1,7
SADDR node3:6850,1,8
LADDR node3:6860,1,8
HADDR node3:6865,1,8
SADDR node3:6870,1,9
LADDR node3:6880,1,9
HADDR node3:6885,1,9
END

COSERVER 4
ROOTPATH /Informix/dbspace/coserver.4/rootdbs.4
NODE ifmx4
SADDR node4:6610,1,0
LADDR node4:6620,1,0

```

```

HADDR node4:6625,1,0
SADDR node4:6710,1,1
LADDR node4:6720,1,1
HADDR node4:6725,1,1
SADDR node4:6730,1,2
LADDR node4:6740,1,2
HADDR node4:6745,1,2
SADDR node4:6750,1,3
LADDR node4:6760,1,3
HADDR node4:6765,1,3
SADDR node4:6770,1,4
LADDR node4:6780,1,4
HADDR node4:6785,1,4
SADDR node4:6790,1,5
LADDR node4:6800,1,5
HADDR node4:6805,1,5
SADDR node4:6810,1,6
LADDR node4:6820,1,6
HADDR node4:6825,1,6
SADDR node4:6830,1,7
LADDR node4:6840,1,7
HADDR node4:6845,1,7
SADDR node4:6850,1,8
LADDR node4:6860,1,8
HADDR node4:6865,1,8
SADDR node4:6870,1,9
LADDR node4:6880,1,9
HADDR node4:6885,1,9
END

```

Informix onconfig.load and onconfig.run diff

```

25_28c25_28
< PHYSSLICE rootdbs # physical log dbspace
< PHYSFILE 200000 # Physical log file size (Kbytes)
---
> PHYSSLICE physlice # physical log dbspace
> PHYSFILE 1900000 # Physical log file size (Kbytes)
79_80c79_80
< LOCKS 1000000 # Maximum number of locks
< BUFFERS 50000 # Changed 4/27/98
---
> LOCKS 900000 # Maximum number of locks
> BUFFERS 600000 # Changed 4/27/98
82c82
< NUMAIOVPS 2 # Number of IO vps
modified on sep 9
---
> NUMAIOVPS 4 # Number of IO vps
modified on sep 9
88c88
< CLEANERS 48 # Number of buffer cleaner
processes
---
> CLEANERS 50 # Number of buffer cleaner
processes
92c92_93
< SHMADD 16384 # Size of new shared memory
segments (Kbytes)
---
> SHMADD 2097152 # Size of new shared memory
segments (Kbytes)
96_100c97_101
< LRU 32 # Number of LRU queues
< LRU_MAX_DIRTY 48 # LRU percent dirty begin
cleaning limit
< LRU_MIN_DIRTY 30 # LRU percent dirty end
cleaning limit
< LTXHWM 80 # Long transaction high
water mark percentage
< LTXEHWM 90 # Long transaction high
water mark (exclusive)
---
> LRU 50 # Number of LRU queues
> LRU_MAX_DIRTY 8 # LRU percent dirty begin
cleaning limit
> LRU_MIN_DIRTY 6 # LRU percent dirty end
cleaning limit
> LTXHWM 50 # Long transaction high
water mark percentage
> LTXEHWM 50 # Long transaction high
water mark (exclusive)
203c204
< DS_TOTAL_MEMORY 6194304
---
> DS_TOTAL_MEMORY 4194304

```

Informix-related environment variables

```

TOP=/Informix/tpcd/SF300
INFORMIXDIR=/Informix/informix/sqlldist
INFORMIXSERVER=dec
ONCONFIG=onconfig.tpcd
INFORMIXSQLHOSTS=/Informix/informix/sqlldist/etc/sqlhosts.tpcd
DBDATE=Y4MD-
TERMCAP=/Informix/informix/sqlldist/etc/termcap
DEBUG=MAXSCAN:48
DFM_DBG_FLCPEND=4500
XMF_DBG_EXPFLIST=1
XMF_DBG_FLIST_ATHRESH=30
XMF_DBG_SBF_ALLOCNUM=2000
XMF_DBG_LBF_ALLOCNUM=2000
DBGEN=/Informix/tpcd/SF300/drive/dbgen.v1.3.1/appendix/dbgen/dbgen
DSS_CONFIG=/Informix/tpcd/SF300/drive/dbgen.v1.3.1/appendix/dbgen
DSS_PATH=/Tools/ufdata
DSS_SEED=/Informix/tpcd/SF300/drive/dbgen.v1.3.1/appendix/dbgen/60
STEP_300G_SEED
DFM_DBG_FLCCRED=125
DFM_DBG_FLCCLEN=10

```

Digital UNIX kernel configuration

```
rm:
    rm-no-inheritance = 1

generic:
    msgbuf_size = 32768

cma_dd:

rt:
    aio-max-percent = 3
    aio-max-retry = 10
    aio-max-num = 16384
    aio-task-max-num = 8192

io:
    dma-sg-map-unload-zero = 0

ipc:
    ssm-threshold = 0
    sem-ume = 500
    sem-opm = 500
    sem-msl = 1000
    sem-mni = 500
    msg-tql = 1024
    msg-mni = 128
    shm-seg = 8192
    shm-mni = 2048
    shm-max = 2147483647

vm:
    gh-chunks = 1900
    vm-mapentries = 32768
    new-wire-method = 0
    vm-maxvas = 124179869184
    vm-heappercnt = 60
    private-text = 1
    private-cache-percent = 50

#
proc:
    max-proc-per-user = 27990
    max-threads-per-user = 27990
    per-proc-stack-size = 33554432
    max-per-proc-stack-size = 67108864
    per-proc-data-size = 100089934592
    max-per-proc-data-size = 1244877906944
    max-per-proc-address-space = 121179869184
    per-proc-address-space = 121179869184
    maxusers = 1024
    task-max = 28000
    thread-max = 28000
    num-wait-queues = 1024
    num-timeout-hash-queues = 1024

socket:
    somaxconn = 65000
    sominconn = 65000

inet:
    tcbhashsize = 32768

lsm:
    max-vo1 = 4093

mcs:
    mcs_num_events = 4096
    mcs_mcm_eps = 4096
    mcs_mcm_rts = 4096
    mcs_ignore_tags = 1

#ipr:
#
# Module_Config_Name = ipr
# Module_Type = Dynamic
# Module_Path = /subsys/ipr.mod
# Device_Char_Major = ANY
# Device_Char_Minor = 0
# Device_Char_Files = ipr
# Device_User = root
# Device_Group = 0
# Device_Mode = 666
# Device_Major_Req = Same

rdg:
    max_bufs = 256

tmon:
    Subsystem_Description = TurboLaser Perf Monitor
    Module_Type = Dynamic
    Module_Path = /subsys/tmon.mod
    Module_Config_name = tmon
    Device_Dir = /dev
    Device_Major_Req = None
    Device_Char_Major = ANY
    Device_Char_Minor = 0
    Device_Char_Files = tmon

#mchan:
#
# mchan_debug=1

pcount:
    Subsystem_Description = pcount device driver
    Module_Config_Name = pcount
    Module_Type = Dynamic
#
# Device_Major_Req = Same
# Device_Char_Major = ANY
# Device_Char_Minor = 0
# Device_Char_Files = pcount0
```

Create LSM Volumes

```
#!/bin/sh -x
```

```
# creating lsm volumes

num=1
while [ $num -le 48 ]
do
    volmake plex pli-$num sd=sdli-$num
    volmake vol vli-$num usetype=gen plex=pli-$num
    volume start vli-$num &
    volmake plex pi-$num sd=sdi-$num
    volmake vol vi-$num usetype=gen plex=pi-$num
    volume start vi-$num &
    volmake plex po-$num sd=sdo-$num
    volmake vol vo-$num usetype=gen plex=po-$num
    volume start vo-$num &
    num=`expr $num + 1`
done

num=1
mir=48
while [ $num -le 24 ]
do
    volmake plex pmirli-$mir sd=mirli-$mir
    volplex att vli-$num pmirli-$mir &
    volmake plex pmiri-$mir sd=miri-$mir
    volplex att vi-$num pmiri-$mir &
    volmake plex pmiro-$mir sd=miro-$mir
    volplex att vo-$num pmiro-$mir &
    num=`expr $num + 1`
    mir=`expr $mir - 1`
done

wait

while [ $num -le 48 ]
do
    volmake plex pmirli-$mir sd=mirli-$mir
    volplex att vli-$num pmirli-$mir &
    volmake plex pmiri-$mir sd=miri-$mir
    volplex att vi-$num pmiri-$mir &
    volmake plex pmiro-$mir sd=miro-$mir
    volplex att vo-$num pmiro-$mir &
    num=`expr $num + 1`
    mir=`expr $mir - 1`
done

# creating lsm sub-disks
#!/bin/sh -x
PART=c
part=a
dsk=1
for DISK in `cat DIS1.lis`
do
    /sbin/disklabel -z /dev/rrz$DISK$PART
    /sbin/disklabel -rw /dev/rrz$DISK$PART ./disk.line
    voldisk init rz$DISK$PART type=nopriv
    voldg adddisk rz$DISK$PART
done
for DISK in `cat DIS2.lis`
do
    /sbin/disklabel -z /dev/rrz$DISK$PART
    /sbin/disklabel -rw /dev/rrz$DISK$PART ./disk.line
    voldisk init rz$DISK$PART type=nopriv
    voldg adddisk rz$DISK$PART
done

num=1
for DISK in `cat DIS1.lis`
do
    /sbin/volmake sd sdli-${num} rz$DISK$PART,10240,4194304
    /sbin/volmake sd sdi-${num} rz$DISK$PART,4204544,2307000
    /sbin/volmake sd sdo-${num} rz$DISK$PART,6511544,1868536
    num=`expr $num + 1`
done

num=1
for DISK in `cat DIS2.lis`
do
    /sbin/volmake sd mirli-${num} rz$DISK$PART,10240,4194304
    /sbin/volmake sd miri-${num} rz$DISK$PART,4204544,2307000
    /sbin/volmake sd miro-${num} rz$DISK$PART,6511544,1868536
    num=`expr $num + 1`
done
```

Appendix B: Table Definitions

build_database

```
#!/bin/ksh
echo Init xps at `date`
cp $INFORMIXDIR/etc/onconfig.tpcd.load
$INFORMIXDIR/etc/onconfig.tpcd
ixxps
echo Done with init xps at `date`
echo Begin create database and load at `date`
./create_and_load tpcd
echo Done create and load at `date`
echo Start creating Index at `date`
./create_index
echo Done creating Index at `date`
xctl onmode -c
bringdn_xps
cp $INFORMIXDIR/etc/onconfig.tpcd.upd
$INFORMIXDIR/etc/onconfig.tpcd
bringup_xps_upd
echo alter table lock mode page at `date`
./alter_table
echo done at `date`
echo Start update stats at `date`
./update_stats
echo Done update stats at `date`
cp $INFORMIXDIR/etc/onconfig.tpcd.run
$INFORMIXDIR/etc/onconfig.tpcd
echo End of timing, ready for runs `date`
```

create_and_load

```
#!/bin/ksh
if (( $# != 1 )); then
    echo "Usage: $0 DBNAME"
    exit
fi
export DBDATE=y4md-
export DBNAME=$1
#
# then create it
#
dbaccess -e - - <<EOF
create database $DBNAME with log ;
grant dba to "public";
EOF
echo "move logs"
./move_logs.sh
echo Slice config before slice creation
xctl onstat -d
echo "Create all slices"
cd slices
./create_slices
cd ..
echo Slice config after slice creation
xctl onstat -d
#
# now load data for each of the tables
#
echo begin load at `date`
echo "Start timing"
echo "Start table creation at `date`"
for i in nation region supplier part customer partsupp order
lineitem
do
    echo begin create and load of table $i at `date`
    dbaccess -e - - < $i.ld
    echo done load of table $i at `date`
done
echo done loading all at `date`
exit 0
```

move_logs

```
echo moving logs to another disk
onutil<<EOF
create dbslice log_slice1 from
```

```
cogroup cogroup_all chunk
"/Informix/dspace/coserver.%c/logslice1" size 2097100 ;
create dbslice log_slice2 from
cogroup cogroup_all chunk
"/Informix/dspace/coserver.%c/logslice2" size 2097100 ;
create dbslice log_slice3 from
cogroup cogroup_all chunk
"/Informix/dspace/coserver.%c/logslice3" size 2097100 ;
EOF
sleep 60
xctl onmode -sy
sleep 60
onutil<<EOF
create logical logslice logslice1 in dbslice log_slice1
size 2000000;
create logical logslice logslice2 in dbslice log_slice2
size 2000000;
create logical logslice logslice3 in dbslice log_slice3
size 2000000;
EOF
sleep 60
onutil<<EOF
alter cogroup cogroup_all reset backup;
EOF
#
xctl onmode -l
xctl onmode -l
xctl onmode -l
xctl onmode -c
onutil <<EOF
drop logical log 1 coserver 1;
drop logical log 2 coserver 1;
drop logical log 3 coserver 1;
drop logical log 1 coserver 2;
drop logical log 2 coserver 2;
drop logical log 3 coserver 2;
drop logical log 1 coserver 3;
drop logical log 2 coserver 3;
drop logical log 3 coserver 3;
drop logical log 1 coserver 4;
drop logical log 2 coserver 4;
drop logical log 3 coserver 4;
EOF
sleep 60
xctl onmode -m
sleep 60
```

create_slices

```
#!/usr/bin/ksh
# script to create all the table and index slices.
echo "Creating dbslices for Lineitem table"
onutil -i ldbs
echo "Creating dbslices for Order table"
onutil -i odbs
echo "Creating dbslices for Partsupplier table"
onutil -i psdbs
echo "Creating dbslices for Part table"
onutil -i pdbs
echo "Creating dbslices for Customer table"
onutil -i cdbs
echo "Creating dbslices for Supplier table"
onutil -i sdbs
echo "Creating dbslices for l1 index"
onutil -i llind
echo "Creating dbslices for l2 index"
onutil -i l2ind
echo "Creating dbslices for o1 index"
onutil -i olind
echo "Creating dbslices for o2 index"
onutil -i o2ind
echo "Creating dbslices for ps1 index"
onutil -i ps1ind
echo "Creating dbslices for ps2 index"
onutil -i ps2ind
echo "Creating dbslices for p1 index"
onutil -i p1ind
echo "Creating dbslices for physlog"
onutil -i physdbs
echo "Creating the tempdbslice"
onutil -i tdbs
onutil -i ldbs
```

ldbs

```
create dbslice ldbs1 from
cogroup cogroup_all chunk "/Informix/dspace/coserver.%c/li_dbs1"
offset 0 size 226596 kbytes,
cogroup cogroup_all chunk "/Informix/dspace/coserver.%c/li_dbs2"
offset 0 size 226596 kbytes,
```



```
alter table customer type (raw);
```

```
create external table cust_ext
sameas customer using (
format "delimited",
datafiles (
"disk:1:/ff1/customer.tb1.1",
"disk:1:/ff1/customer.tb1.2",
"disk:1:/ff1/customer.tb1.3",
"disk:1:/ff1/customer.tb1.4",
"disk:1:/ff1/customer.tb1.5",
"disk:1:/ff1/customer.tb1.6",
"disk:1:/ff1/customer.tb1.7",
"disk:1:/ff2/customer.tb1.8",
"disk:1:/ff2/customer.tb1.9",
"disk:1:/ff2/customer.tb1.10",
"disk:1:/ff2/customer.tb1.11",
"disk:1:/ff2/customer.tb1.12",
"disk:1:/ff2/customer.tb1.13",
"disk:1:/ff2/customer.tb1.14",
"disk:1:/ff2/customer.tb1.15",
"disk:2:/ff1/customer.tb1.16",
"disk:2:/ff1/customer.tb1.17",
"disk:2:/ff1/customer.tb1.18",
"disk:2:/ff1/customer.tb1.19",
"disk:2:/ff1/customer.tb1.20",
"disk:2:/ff1/customer.tb1.21",
"disk:2:/ff1/customer.tb1.22",
"disk:2:/ff2/customer.tb1.23",
"disk:2:/ff2/customer.tb1.24",
"disk:2:/ff2/customer.tb1.25",
"disk:2:/ff2/customer.tb1.26",
"disk:2:/ff2/customer.tb1.27",
"disk:2:/ff2/customer.tb1.28",
"disk:2:/ff2/customer.tb1.29",
"disk:2:/ff2/customer.tb1.30",
"disk:3:/ff1/customer.tb1.31",
"disk:3:/ff1/customer.tb1.32",
"disk:3:/ff1/customer.tb1.33",
"disk:3:/ff1/customer.tb1.34",
"disk:3:/ff1/customer.tb1.35",
"disk:3:/ff1/customer.tb1.36",
"disk:3:/ff1/customer.tb1.37",
"disk:3:/ff2/customer.tb1.38",
"disk:3:/ff2/customer.tb1.39",
"disk:3:/ff2/customer.tb1.40",
"disk:3:/ff2/customer.tb1.41",
"disk:3:/ff2/customer.tb1.42",
"disk:3:/ff2/customer.tb1.43",
"disk:3:/ff2/customer.tb1.44",
"disk:3:/ff2/customer.tb1.45",
"disk:4:/ff1/customer.tb1.46",
"disk:4:/ff1/customer.tb1.47",
"disk:4:/ff1/customer.tb1.48",
"disk:4:/ff1/customer.tb1.49",
"disk:4:/ff1/customer.tb1.50",
"disk:4:/ff1/customer.tb1.51",
"disk:4:/ff1/customer.tb1.52",
"disk:4:/ff2/customer.tb1.53",
"disk:4:/ff2/customer.tb1.54",
"disk:4:/ff2/customer.tb1.55",
"disk:4:/ff2/customer.tb1.56",
"disk:4:/ff2/customer.tb1.57",
"disk:4:/ff2/customer.tb1.58",
"disk:4:/ff2/customer.tb1.59",
"disk:4:/ff2/customer.tb1.60"),
rejectfile "/tmp/customer.%c",
express
);
```

```
insert into customer select * from cust_ext;
```

```
drop table cust_ext;
```

```
alter table customer type (operational);
```

```
close database;
```

lineitem.ld

```
database tpcd;
set pdqpriority 100;
```

```
create table lineitem
```

```
(
l_orderkey integer,
l_partkey integer,
l_suppkey integer,
l_linenum integer,
l_quantity decimal(12,2) not null,
l_extendedprice decimal(12,2) not null,
l_discount decimal(12,2) not null,
l_tax decimal(12,2),
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)
) fragment by hybrid (l_orderkey) expression
```

```
l_shipdate < '1992-02-01' in lds1,
l_shipdate >= '1992-02-01' and l_shipdate < '1992-03-01' in
lds2,
l_shipdate >= '1992-03-01' and l_shipdate < '1992-04-01' in
lds3,
l_shipdate >= '1992-04-01' and l_shipdate < '1992-05-01' in
lds4,
l_shipdate >= '1992-05-01' and l_shipdate < '1992-06-01' in
lds5,
```

```
l_shipdate >= '1992-06-01' and l_shipdate < '1992-07-01' in
lds6,
l_shipdate >= '1992-07-01' and l_shipdate < '1992-08-01' in
lds7,
l_shipdate >= '1992-08-01' and l_shipdate < '1992-09-01' in
lds8,
l_shipdate >= '1992-09-01' and l_shipdate < '1992-10-01' in
lds9,
l_shipdate >= '1992-10-01' and l_shipdate < '1992-11-01' in
lds10,
l_shipdate >= '1992-11-01' and l_shipdate < '1992-12-01' in
lds11,
l_shipdate >= '1992-12-01' and l_shipdate < '1993-01-01' in
lds12,
l_shipdate >= '1993-01-01' and l_shipdate < '1993-02-01' in
lds13,
l_shipdate >= '1993-02-01' and l_shipdate < '1993-03-01' in
lds14,
l_shipdate >= '1993-03-01' and l_shipdate < '1993-04-01' in
lds15,
l_shipdate >= '1993-04-01' and l_shipdate < '1993-05-01' in
lds16,
l_shipdate >= '1993-05-01' and l_shipdate < '1993-06-01' in
lds17,
l_shipdate >= '1993-06-01' and l_shipdate < '1993-07-01' in
lds18,
l_shipdate >= '1993-07-01' and l_shipdate < '1993-08-01' in
lds19,
l_shipdate >= '1993-08-01' and l_shipdate < '1993-09-01' in
lds20,
l_shipdate >= '1993-09-01' and l_shipdate < '1993-10-01' in
lds21,
l_shipdate >= '1993-10-01' and l_shipdate < '1993-11-01' in
lds22,
l_shipdate >= '1993-11-01' and l_shipdate < '1993-12-01' in
lds23,
l_shipdate >= '1993-12-01' and l_shipdate < '1994-01-01' in
lds24,
l_shipdate >= '1994-01-01' and l_shipdate < '1994-02-01' in
lds25,
l_shipdate >= '1994-02-01' and l_shipdate < '1994-03-01' in
lds26,
l_shipdate >= '1994-03-01' and l_shipdate < '1994-04-01' in
lds27,
l_shipdate >= '1994-04-01' and l_shipdate < '1994-05-01' in
lds28,
l_shipdate >= '1994-05-01' and l_shipdate < '1994-06-01' in
lds29,
l_shipdate >= '1994-06-01' and l_shipdate < '1994-07-01' in
lds30,
l_shipdate >= '1994-07-01' and l_shipdate < '1994-08-01' in
lds31,
l_shipdate >= '1994-08-01' and l_shipdate < '1994-09-01' in
lds32,
l_shipdate >= '1994-09-01' and l_shipdate < '1994-10-01' in
lds33,
l_shipdate >= '1994-10-01' and l_shipdate < '1994-11-01' in
lds34,
l_shipdate >= '1994-11-01' and l_shipdate < '1994-12-01' in
lds35,
l_shipdate >= '1994-12-01' and l_shipdate < '1995-01-01' in
lds36,
l_shipdate >= '1995-01-01' and l_shipdate < '1995-02-01' in
lds37,
l_shipdate >= '1995-02-01' and l_shipdate < '1995-03-01' in
lds38,
l_shipdate >= '1995-03-01' and l_shipdate < '1995-04-01' in
lds39,
l_shipdate >= '1995-04-01' and l_shipdate < '1995-05-01' in
lds40,
l_shipdate >= '1995-05-01' and l_shipdate < '1995-06-01' in
lds41,
l_shipdate >= '1995-06-01' and l_shipdate < '1995-07-01' in
lds42,
l_shipdate >= '1995-07-01' and l_shipdate < '1995-08-01' in
lds43,
l_shipdate >= '1995-08-01' and l_shipdate < '1995-09-01' in
lds44,
l_shipdate >= '1995-09-01' and l_shipdate < '1995-10-01' in
lds45,
l_shipdate >= '1995-10-01' and l_shipdate < '1995-11-01' in
lds46,
l_shipdate >= '1995-11-01' and l_shipdate < '1995-12-01' in
lds47,
l_shipdate >= '1995-12-01' and l_shipdate < '1996-01-01' in
lds48,
l_shipdate >= '1996-01-01' and l_shipdate < '1996-02-01' in
lds49,
l_shipdate >= '1996-02-01' and l_shipdate < '1996-03-01' in
lds50,
l_shipdate >= '1996-03-01' and l_shipdate < '1996-04-01' in
lds51,
l_shipdate >= '1996-04-01' and l_shipdate < '1996-05-01' in
lds52,
l_shipdate >= '1996-05-01' and l_shipdate < '1996-06-01' in
lds53,
l_shipdate >= '1996-06-01' and l_shipdate < '1996-07-01' in
lds54,
l_shipdate >= '1996-07-01' and l_shipdate < '1996-08-01' in
lds55,
l_shipdate >= '1996-08-01' and l_shipdate < '1996-09-01' in
lds56,
l_shipdate >= '1996-09-01' and l_shipdate < '1996-10-01' in
lds57,
l_shipdate >= '1996-10-01' and l_shipdate < '1996-11-01' in
lds58,
l_shipdate >= '1996-11-01' and l_shipdate < '1996-12-01' in
lds59,
l_shipdate >= '1996-12-01' and l_shipdate < '1997-01-01' in
lds60,
```

```

l_shipdate >= '1997-01-01' and l_shipdate < '1997-02-01' in
ldbs61,
l_shipdate >= '1997-02-01' and l_shipdate < '1997-03-01' in
ldbs62,
l_shipdate >= '1997-03-01' and l_shipdate < '1997-04-01' in
ldbs63,
l_shipdate >= '1997-04-01' and l_shipdate < '1997-05-01' in
ldbs64,
l_shipdate >= '1997-05-01' and l_shipdate < '1997-06-01' in
ldbs65,
l_shipdate >= '1997-06-01' and l_shipdate < '1997-07-01' in
ldbs66,
l_shipdate >= '1997-07-01' and l_shipdate < '1997-08-01' in
ldbs67,
l_shipdate >= '1997-08-01' and l_shipdate < '1997-09-01' in
ldbs68,
l_shipdate >= '1997-09-01' and l_shipdate < '1997-10-01' in
ldbs69,
l_shipdate >= '1997-10-01' and l_shipdate < '1997-11-01' in
ldbs70,
l_shipdate >= '1997-11-01' and l_shipdate < '1997-12-01' in
ldbs71,
l_shipdate >= '1997-12-01' and l_shipdate < '1998-01-01' in
ldbs72,
l_shipdate >= '1998-01-01' and l_shipdate < '1998-02-01' in
ldbs73,
l_shipdate >= '1998-02-01' and l_shipdate < '1998-03-01' in
ldbs74,
l_shipdate >= '1998-03-01' and l_shipdate < '1998-04-01' in
ldbs75,
l_shipdate >= '1998-04-01' and l_shipdate < '1998-05-01' in
ldbs76,
l_shipdate >= '1998-05-01' and l_shipdate < '1998-06-01' in
ldbs77,
l_shipdate >= '1998-06-01' and l_shipdate < '1998-07-01' in
ldbs78,
l_shipdate >= '1998-07-01' and l_shipdate < '1998-08-01' in
ldbs79,
l_shipdate >= '1998-08-01' and l_shipdate < '1998-09-01' in
ldbs80,
l_shipdate >= '1998-09-01' and l_shipdate < '1998-10-01' in
ldbs81,
l_shipdate >= '1998-10-01' and l_shipdate < '1998-11-01' in
ldbs82,
l_shipdate >= '1998-11-01' and l_shipdate < '1998-12-01' in
ldbs83,
l_shipdate >= '1998-12-01' in ldbs84
extent size 380000 next size 500
lock mode table;

alter table lineitem type (raw);

create external table lineitem_ext
sameas lineitem using (
format "delimited",
datafiles (
"disk:1://f1/lineitem.tbl.1",
"disk:1://f1/lineitem.tbl.2",
"disk:1://f1/lineitem.tbl.3",
"disk:1://f1/lineitem.tbl.4",
"disk:1://f1/lineitem.tbl.5",
"disk:1://f1/lineitem.tbl.6",
"disk:1://f1/lineitem.tbl.7",
"disk:1://f2/lineitem.tbl.8",
"disk:1://f2/lineitem.tbl.9",
"disk:1://f2/lineitem.tbl.10",
"disk:1://f2/lineitem.tbl.11",
"disk:1://f2/lineitem.tbl.12",
"disk:1://f2/lineitem.tbl.13",
"disk:1://f2/lineitem.tbl.14",
"disk:1://f2/lineitem.tbl.15",
"disk:2://f1/lineitem.tbl.16",
"disk:2://f1/lineitem.tbl.17",
"disk:2://f1/lineitem.tbl.18",
"disk:2://f1/lineitem.tbl.19",
"disk:2://f1/lineitem.tbl.20",
"disk:2://f1/lineitem.tbl.21",
"disk:2://f1/lineitem.tbl.22",
"disk:2://f2/lineitem.tbl.23",
"disk:2://f2/lineitem.tbl.24",
"disk:2://f2/lineitem.tbl.25",
"disk:2://f2/lineitem.tbl.26",
"disk:2://f2/lineitem.tbl.27",
"disk:2://f2/lineitem.tbl.28",
"disk:2://f2/lineitem.tbl.29",
"disk:2://f2/lineitem.tbl.30",
"disk:3://f1/lineitem.tbl.31",
"disk:3://f1/lineitem.tbl.32",
"disk:3://f1/lineitem.tbl.33",
"disk:3://f1/lineitem.tbl.34",
"disk:3://f1/lineitem.tbl.35",
"disk:3://f1/lineitem.tbl.36",
"disk:3://f1/lineitem.tbl.37",
"disk:3://f2/lineitem.tbl.38",
"disk:3://f2/lineitem.tbl.39",
"disk:3://f2/lineitem.tbl.40",
"disk:3://f2/lineitem.tbl.41",
"disk:3://f2/lineitem.tbl.42",
"disk:3://f2/lineitem.tbl.43",
"disk:3://f2/lineitem.tbl.44",
"disk:3://f2/lineitem.tbl.45",
"disk:4://f1/lineitem.tbl.46",
"disk:4://f1/lineitem.tbl.47",
"disk:4://f1/lineitem.tbl.48",
"disk:4://f1/lineitem.tbl.49",
"disk:4://f1/lineitem.tbl.50",
"disk:4://f1/lineitem.tbl.51",
"disk:4://f1/lineitem.tbl.52",
"disk:4://f2/lineitem.tbl.53",
"disk:4://f2/lineitem.tbl.54",
"disk:4://f2/lineitem.tbl.55",
"disk:4://f2/lineitem.tbl.56",
"disk:4://f2/lineitem.tbl.57",
"disk:4://f2/lineitem.tbl.58",

```

```

"disk:4://f2/lineitem.tbl.59",
"disk:4://f2/lineitem.tbl.60",
rejectfile "/tmp/liner.%"",
express
);
insert into lineitem select * from lineitem_ext;
drop table lineitem_ext;
alter table lineitem type(operational);
close database;

nation.ld
database tpcd;
set pdqpriority 100;
create table nation
(
n_nationkey integer,
n_name char(25),
n_regionkey integer,
n_comment varchar(152)
) in rootdbs.1 lock mode table;
alter table nation type (raw);

create external table nation_ext
sameas nation using (
format "delimited",
datafiles ("disk:1:/Informix/tpcd/pipe/nation.tbl")
);
insert into nation select * from nation_ext;
drop table nation_ext;
alter table nation type (operational);
close database;

order.ld
database tpcd;
set pdqpriority 100;
create table order
(
o_orderkey integer,
o_custkey integer,
o_orderstatus char(1),
o_totalprice decimal(12,2),
o_orderdate date,
o_orderpriority char(15),
o_clerk char(15),
o_shippriority integer,
o_comment varchar(79)
) fragment by hybrid(o_orderkey) expression
o_orderdate < '1992-02-01' in odb1,
o_orderdate >= '1992-02-01' and o_orderdate < '1992-03-01' in
odbs2,
o_orderdate >= '1992-03-01' and o_orderdate < '1992-04-01' in
odbs3,
o_orderdate >= '1992-04-01' and o_orderdate < '1992-05-01' in
odbs4,
o_orderdate >= '1992-05-01' and o_orderdate < '1992-06-01' in
odbs5,
o_orderdate >= '1992-06-01' and o_orderdate < '1992-07-01' in
odbs6,
o_orderdate >= '1992-07-01' and o_orderdate < '1992-08-01' in
odbs7,
o_orderdate >= '1992-08-01' and o_orderdate < '1992-09-01' in
odbs8,
o_orderdate >= '1992-09-01' and o_orderdate < '1992-10-01' in
odbs9,
o_orderdate >= '1992-10-01' and o_orderdate < '1992-11-01' in
odbs10,
o_orderdate >= '1992-11-01' and o_orderdate < '1992-12-01' in
odbs11,
o_orderdate >= '1992-12-01' and o_orderdate < '1993-01-01' in
odbs12,
o_orderdate >= '1993-01-01' and o_orderdate < '1993-02-01' in
odbs13,
o_orderdate >= '1993-02-01' and o_orderdate < '1993-03-01' in
odbs14,
o_orderdate >= '1993-03-01' and o_orderdate < '1993-04-01' in
odbs15,
o_orderdate >= '1993-04-01' and o_orderdate < '1993-05-01' in
odbs16,
o_orderdate >= '1993-05-01' and o_orderdate < '1993-06-01' in
odbs17,
o_orderdate >= '1993-06-01' and o_orderdate < '1993-07-01' in
odbs18,
o_orderdate >= '1993-07-01' and o_orderdate < '1993-08-01' in
odbs19,

```

```

o_orderdate >= '1993-08-01' and o_orderdate < '1993-09-01' in
odbs20,
o_orderdate >= '1993-09-01' and o_orderdate < '1993-10-01' in
odbs21,
o_orderdate >= '1993-10-01' and o_orderdate < '1993-11-01' in
odbs22,
o_orderdate >= '1993-11-01' and o_orderdate < '1993-12-01' in
odbs23,
o_orderdate >= '1993-12-01' and o_orderdate < '1994-01-01' in
odbs24,
o_orderdate >= '1994-01-01' and o_orderdate < '1994-02-01' in
odbs25,
o_orderdate >= '1994-02-01' and o_orderdate < '1994-03-01' in
odbs26,
o_orderdate >= '1994-03-01' and o_orderdate < '1994-04-01' in
odbs27,
o_orderdate >= '1994-04-01' and o_orderdate < '1994-05-01' in
odbs28,
o_orderdate >= '1994-05-01' and o_orderdate < '1994-06-01' in
odbs29,
o_orderdate >= '1994-06-01' and o_orderdate < '1994-07-01' in
odbs30,
o_orderdate >= '1994-07-01' and o_orderdate < '1994-08-01' in
odbs31,
o_orderdate >= '1994-08-01' and o_orderdate < '1994-09-01' in
odbs32,
o_orderdate >= '1994-09-01' and o_orderdate < '1994-10-01' in
odbs33,
o_orderdate >= '1994-10-01' and o_orderdate < '1994-11-01' in
odbs34,
o_orderdate >= '1994-11-01' and o_orderdate < '1994-12-01' in
odbs35,
o_orderdate >= '1994-12-01' and o_orderdate < '1995-01-01' in
odbs36,
o_orderdate >= '1995-01-01' and o_orderdate < '1995-02-01' in
odbs37,
o_orderdate >= '1995-02-01' and o_orderdate < '1995-03-01' in
odbs38,
o_orderdate >= '1995-03-01' and o_orderdate < '1995-04-01' in
odbs39,
o_orderdate >= '1995-04-01' and o_orderdate < '1995-05-01' in
odbs40,
o_orderdate >= '1995-05-01' and o_orderdate < '1995-06-01' in
odbs41,
o_orderdate >= '1995-06-01' and o_orderdate < '1995-07-01' in
odbs42,
o_orderdate >= '1995-07-01' and o_orderdate < '1995-08-01' in
odbs43,
o_orderdate >= '1995-08-01' and o_orderdate < '1995-09-01' in
odbs44,
o_orderdate >= '1995-09-01' and o_orderdate < '1995-10-01' in
odbs45,
o_orderdate >= '1995-10-01' and o_orderdate < '1995-11-01' in
odbs46,
o_orderdate >= '1995-11-01' and o_orderdate < '1995-12-01' in
odbs47,
o_orderdate >= '1995-12-01' and o_orderdate < '1996-01-01' in
odbs48,
o_orderdate >= '1996-01-01' and o_orderdate < '1996-02-01' in
odbs49,
o_orderdate >= '1996-02-01' and o_orderdate < '1996-03-01' in
odbs50,
o_orderdate >= '1996-03-01' and o_orderdate < '1996-04-01' in
odbs51,
o_orderdate >= '1996-04-01' and o_orderdate < '1996-05-01' in
odbs52,
o_orderdate >= '1996-05-01' and o_orderdate < '1996-06-01' in
odbs53,
o_orderdate >= '1996-06-01' and o_orderdate < '1996-07-01' in
odbs54,
o_orderdate >= '1996-07-01' and o_orderdate < '1996-08-01' in
odbs55,
o_orderdate >= '1996-08-01' and o_orderdate < '1996-09-01' in
odbs56,
o_orderdate >= '1996-09-01' and o_orderdate < '1996-10-01' in
odbs57,
o_orderdate >= '1996-10-01' and o_orderdate < '1996-11-01' in
odbs58,
o_orderdate >= '1996-11-01' and o_orderdate < '1996-12-01' in
odbs59,
o_orderdate >= '1996-12-01' and o_orderdate < '1997-01-01' in
odbs60,
o_orderdate >= '1997-01-01' and o_orderdate < '1997-02-01' in
odbs61,
o_orderdate >= '1997-02-01' and o_orderdate < '1997-03-01' in
odbs62,
o_orderdate >= '1997-03-01' and o_orderdate < '1997-04-01' in
odbs63,
o_orderdate >= '1997-04-01' and o_orderdate < '1997-05-01' in
odbs64,
o_orderdate >= '1997-05-01' and o_orderdate < '1997-06-01' in
odbs65,
o_orderdate >= '1997-06-01' and o_orderdate < '1997-07-01' in
odbs66,
o_orderdate >= '1997-07-01' and o_orderdate < '1997-08-01' in
odbs67,
o_orderdate >= '1997-08-01' and o_orderdate < '1997-09-01' in
odbs68,
o_orderdate >= '1997-09-01' and o_orderdate < '1997-10-01' in
odbs69,
o_orderdate >= '1997-10-01' and o_orderdate < '1997-11-01' in
odbs70,
o_orderdate >= '1997-11-01' and o_orderdate < '1997-12-01' in
odbs71,
o_orderdate >= '1997-12-01' and o_orderdate < '1998-01-01' in
odbs72,
o_orderdate >= '1998-01-01' and o_orderdate < '1998-02-01' in
odbs73,
o_orderdate >= '1998-02-01' and o_orderdate < '1998-03-01' in
odbs74,
o_orderdate >= '1998-03-01' and o_orderdate < '1998-04-01' in
odbs75,
o_orderdate >= '1998-04-01' and o_orderdate < '1998-05-01' in
odbs76,
o_orderdate >= '1998-05-01' and o_orderdate < '1998-06-01' in
odbs77,
o_orderdate >= '1998-06-01' and o_orderdate < '1998-07-01' in
odbs78,
o_orderdate >= '1998-07-01' and o_orderdate < '1998-08-01' in
odbs79,
o_orderdate >= '1998-08-01' and o_orderdate < '1998-09-01' in
odbs80,
o_orderdate >= '1998-09-01' and o_orderdate < '1998-10-01' in
odbs81,
o_orderdate >= '1998-10-01' and o_orderdate < '1998-11-01' in
odbs82,
o_orderdate >= '1998-11-01' and o_orderdate < '1998-12-01' in
odbs83,
o_orderdate >= '1998-12-01' in odbs84
extent size 90000 next size 500
lock mode table;
alter table order type (raw);
create external table order_ext
sameas order using (
format "delimited",
datafiles (
"disk:1:/ff1/order.tbl.1",
"disk:1:/ff1/order.tbl.2",
"disk:1:/ff1/order.tbl.3",
"disk:1:/ff1/order.tbl.4",
"disk:1:/ff1/order.tbl.5",
"disk:1:/ff1/order.tbl.6",
"disk:1:/ff1/order.tbl.7",
"disk:1:/ff2/order.tbl.8",
"disk:1:/ff2/order.tbl.9",
"disk:1:/ff2/order.tbl.10",
"disk:1:/ff2/order.tbl.11",
"disk:1:/ff2/order.tbl.12",
"disk:1:/ff2/order.tbl.13",
"disk:1:/ff2/order.tbl.14",
"disk:1:/ff2/order.tbl.15",
"disk:2:/ff1/order.tbl.16",
"disk:2:/ff1/order.tbl.17",
"disk:2:/ff1/order.tbl.18",
"disk:2:/ff1/order.tbl.19",
"disk:2:/ff1/order.tbl.20",
"disk:2:/ff1/order.tbl.21",
"disk:2:/ff1/order.tbl.22",
"disk:2:/ff2/order.tbl.23",
"disk:2:/ff2/order.tbl.24",
"disk:2:/ff2/order.tbl.25",
"disk:2:/ff2/order.tbl.26",
"disk:2:/ff2/order.tbl.27",
"disk:2:/ff2/order.tbl.28",
"disk:2:/ff2/order.tbl.29",
"disk:2:/ff2/order.tbl.30",
"disk:3:/ff1/order.tbl.31",
"disk:3:/ff1/order.tbl.32",
"disk:3:/ff1/order.tbl.33",
"disk:3:/ff1/order.tbl.34",
"disk:3:/ff1/order.tbl.35",
"disk:3:/ff1/order.tbl.36",
"disk:3:/ff1/order.tbl.37",
"disk:3:/ff2/order.tbl.38",
"disk:3:/ff2/order.tbl.39",
"disk:3:/ff2/order.tbl.40",
"disk:3:/ff2/order.tbl.41",
"disk:3:/ff2/order.tbl.42",
"disk:3:/ff2/order.tbl.43",
"disk:3:/ff2/order.tbl.44",
"disk:3:/ff2/order.tbl.45",
"disk:4:/ff1/order.tbl.46",
"disk:4:/ff1/order.tbl.47",
"disk:4:/ff1/order.tbl.48",
"disk:4:/ff1/order.tbl.49",
"disk:4:/ff1/order.tbl.50",
"disk:4:/ff1/order.tbl.51",
"disk:4:/ff2/order.tbl.52",
"disk:4:/ff2/order.tbl.53",
"disk:4:/ff2/order.tbl.54",
"disk:4:/ff2/order.tbl.55",
"disk:4:/ff2/order.tbl.56",
"disk:4:/ff2/order.tbl.57",
"disk:4:/ff2/order.tbl.58",
"disk:4:/ff2/order.tbl.59",
"disk:4:/ff2/order.tbl.60"),
rejectfile "/tmp/oderrr.%"",
express
);
insert into order select * from order_ext;
drop table order_ext;
alter table order type (operational);
close database;

```

part.ld

```

database tpcd;
set pdqpriority 100;
create table part
(
p_partkey integer,
p_name varchar(55),
p_mfg char(25),
p_brand char(10),
p_type varchar(25),
p_size integer,
p_container char(10),
p_retailprice decimal(12,2),

```

```

    p_comment          varchar(23)
) fragment by hash(p_partkey) in pddb
lock mode table;

alter table part type (raw);

create external table part_ext
sameas part using (
    format "delimited",
    datafiles (
        "disk:1://f1/part.tbl.1",
        "disk:1://f1/part.tbl.2",
        "disk:1://f1/part.tbl.3",
        "disk:1://f1/part.tbl.4",
        "disk:1://f1/part.tbl.5",
        "disk:1://f1/part.tbl.6",
        "disk:1://f1/part.tbl.7",
        "disk:1://f2/part.tbl.8",
        "disk:1://f2/part.tbl.9",
        "disk:1://f2/part.tbl.10",
        "disk:1://f2/part.tbl.11",
        "disk:1://f2/part.tbl.12",
        "disk:1://f2/part.tbl.13",
        "disk:1://f2/part.tbl.14",
        "disk:1://f2/part.tbl.15",
        "disk:2://f1/part.tbl.16",
        "disk:2://f1/part.tbl.17",
        "disk:2://f1/part.tbl.18",
        "disk:2://f1/part.tbl.19",
        "disk:2://f1/part.tbl.20",
        "disk:2://f1/part.tbl.21",
        "disk:2://f1/part.tbl.22",
        "disk:2://f2/part.tbl.23",
        "disk:2://f2/part.tbl.24",
        "disk:2://f2/part.tbl.25",
        "disk:2://f2/part.tbl.26",
        "disk:2://f2/part.tbl.27",
        "disk:2://f2/part.tbl.28",
        "disk:2://f2/part.tbl.29",
        "disk:2://f2/part.tbl.30",
        "disk:3://f1/part.tbl.31",
        "disk:3://f1/part.tbl.32",
        "disk:3://f1/part.tbl.33",
        "disk:3://f1/part.tbl.34",
        "disk:3://f1/part.tbl.35",
        "disk:3://f1/part.tbl.36",
        "disk:3://f1/part.tbl.37",
        "disk:3://f2/part.tbl.38",
        "disk:3://f2/part.tbl.39",
        "disk:3://f2/part.tbl.40",
        "disk:3://f2/part.tbl.41",
        "disk:3://f2/part.tbl.42",
        "disk:3://f2/part.tbl.43",
        "disk:3://f2/part.tbl.44",
        "disk:3://f2/part.tbl.45",
        "disk:4://f1/part.tbl.46",
        "disk:4://f1/part.tbl.47",
        "disk:4://f1/part.tbl.48",
        "disk:4://f1/part.tbl.49",
        "disk:4://f1/part.tbl.50",
        "disk:4://f1/part.tbl.51",
        "disk:4://f1/part.tbl.52",
        "disk:4://f2/part.tbl.53",
        "disk:4://f2/part.tbl.54",
        "disk:4://f2/part.tbl.55",
        "disk:4://f2/part.tbl.56",
        "disk:4://f2/part.tbl.57",
        "disk:4://f2/part.tbl.58",
        "disk:4://f2/part.tbl.59",
        "disk:4://f2/part.tbl.60"),
    rejectfile "/tmp/parts.%c",
    express
);

```

```

insert into part select * from part_ext;

drop table part_ext;

alter table part type (operational);

close database;

```

partsupp.ld

```

database tpcd;
set pdqpriority 100;

create table partsupp
(
    ps_partkey          integer ,
    ps_suppkey          integer ,
    ps_availqty        integer ,
    ps_supplycost      decimal(12,2),
    ps_comment         varchar(199)
) fragment by hash(ps_partkey) in psddb
lock mode table ;

alter table partsupp type (raw);

create external table partsupp_ext
sameas partsupp using (
    format "delimited",
    datafiles (
        "disk:1://f1/partsupp.tbl.1",
        "disk:1://f1/partsupp.tbl.2",
        "disk:1://f1/partsupp.tbl.3",
        "disk:1://f1/partsupp.tbl.4",
        "disk:1://f1/partsupp.tbl.5",
        "disk:1://f1/partsupp.tbl.6",
        "disk:1://f1/partsupp.tbl.7",

```

```

        "disk:1://f2/partsupp.tbl.8",
        "disk:1://f2/partsupp.tbl.9",
        "disk:1://f2/partsupp.tbl.10",
        "disk:1://f2/partsupp.tbl.11",
        "disk:1://f2/partsupp.tbl.12",
        "disk:1://f2/partsupp.tbl.13",
        "disk:1://f2/partsupp.tbl.14",
        "disk:1://f2/partsupp.tbl.15",
        "disk:2://f1/partsupp.tbl.16",
        "disk:2://f1/partsupp.tbl.17",
        "disk:2://f1/partsupp.tbl.18",
        "disk:2://f1/partsupp.tbl.19",
        "disk:2://f1/partsupp.tbl.20",
        "disk:2://f1/partsupp.tbl.21",
        "disk:2://f1/partsupp.tbl.22",
        "disk:2://f2/partsupp.tbl.23",
        "disk:2://f2/partsupp.tbl.24",
        "disk:2://f2/partsupp.tbl.25",
        "disk:2://f2/partsupp.tbl.26",
        "disk:2://f2/partsupp.tbl.27",
        "disk:2://f2/partsupp.tbl.28",
        "disk:2://f2/partsupp.tbl.29",
        "disk:2://f2/partsupp.tbl.30",
        "disk:3://f1/partsupp.tbl.31",
        "disk:3://f1/partsupp.tbl.32",
        "disk:3://f1/partsupp.tbl.33",
        "disk:3://f1/partsupp.tbl.34",
        "disk:3://f1/partsupp.tbl.35",
        "disk:3://f1/partsupp.tbl.36",
        "disk:3://f1/partsupp.tbl.37",
        "disk:3://f2/partsupp.tbl.38",
        "disk:3://f2/partsupp.tbl.39",
        "disk:3://f2/partsupp.tbl.40",
        "disk:3://f2/partsupp.tbl.41",
        "disk:3://f2/partsupp.tbl.42",
        "disk:3://f2/partsupp.tbl.43",
        "disk:3://f2/partsupp.tbl.44",
        "disk:3://f2/partsupp.tbl.45",
        "disk:4://f1/partsupp.tbl.46",
        "disk:4://f1/partsupp.tbl.47",
        "disk:4://f1/partsupp.tbl.48",
        "disk:4://f1/partsupp.tbl.49",
        "disk:4://f1/partsupp.tbl.50",
        "disk:4://f1/partsupp.tbl.51",
        "disk:4://f1/partsupp.tbl.52",
        "disk:4://f2/partsupp.tbl.53",
        "disk:4://f2/partsupp.tbl.54",
        "disk:4://f2/partsupp.tbl.55",
        "disk:4://f2/partsupp.tbl.56",
        "disk:4://f2/partsupp.tbl.57",
        "disk:4://f2/partsupp.tbl.58",
        "disk:4://f2/partsupp.tbl.59",
        "disk:4://f2/partsupp.tbl.60"),
    rejectfile "/tmp/partsuppr.%c",
    express
);

insert into partsupp select * from partsupp_ext;

drop table partsupp_ext;

alter table partsupp type (operational);

close database;

```

supplier.ld

```

database tpcd;
set pdqpriority 100;

create table supplier
(
    s_suppkey          integer not null,
    s_name             char(25),
    s_address          varchar(40),
    s_nationkey        integer,
    s_phone            char(15),
    s_acctbal          decimal(12,2),
    s_comment          varchar(101)
) fragment by hash(s_suppkey) in sddb
lock mode table;

alter table supplier type (raw);

```

```

create external table supplier_ext
sameas supplier using (
    format "delimited",
    datafiles (
        "disk:1/ff1/supplier.tbl.1",
        "disk:1/ff1/supplier.tbl.2",
        "disk:1/ff1/supplier.tbl.3",
        "disk:1/ff1/supplier.tbl.4",
        "disk:1/ff1/supplier.tbl.5",
        "disk:1/ff1/supplier.tbl.6",
        "disk:1/ff1/supplier.tbl.7",
        "disk:1/ff2/supplier.tbl.8",
        "disk:1/ff2/supplier.tbl.9",
        "disk:1/ff2/supplier.tbl.10",
        "disk:1/ff2/supplier.tbl.11",
        "disk:1/ff2/supplier.tbl.12",
        "disk:1/ff2/supplier.tbl.13",
        "disk:1/ff2/supplier.tbl.14",
        "disk:1/ff2/supplier.tbl.15",
        "disk:2/ff1/supplier.tbl.16",
        "disk:2/ff1/supplier.tbl.17",
        "disk:2/ff1/supplier.tbl.18",
        "disk:2/ff1/supplier.tbl.19",
        "disk:2/ff1/supplier.tbl.20",
        "disk:2/ff1/supplier.tbl.21",
        "disk:2/ff1/supplier.tbl.22",
        "disk:2/ff2/supplier.tbl.23",
        "disk:2/ff2/supplier.tbl.24",
        "disk:2/ff2/supplier.tbl.25",
        "disk:2/ff2/supplier.tbl.26",
        "disk:2/ff2/supplier.tbl.27",
        "disk:2/ff2/supplier.tbl.28",
        "disk:2/ff2/supplier.tbl.29",
        "disk:2/ff2/supplier.tbl.30",
        "disk:3/ff1/supplier.tbl.31",
        "disk:3/ff1/supplier.tbl.32",
        "disk:3/ff1/supplier.tbl.33",
        "disk:3/ff1/supplier.tbl.34",
        "disk:3/ff1/supplier.tbl.35",
        "disk:3/ff1/supplier.tbl.36",
        "disk:3/ff1/supplier.tbl.37",
        "disk:3/ff2/supplier.tbl.38",
        "disk:3/ff2/supplier.tbl.39",
        "disk:3/ff2/supplier.tbl.40",
        "disk:3/ff2/supplier.tbl.41",
        "disk:3/ff2/supplier.tbl.42",
        "disk:3/ff2/supplier.tbl.43",
        "disk:3/ff2/supplier.tbl.44",
        "disk:3/ff2/supplier.tbl.45",
        "disk:4/ff1/supplier.tbl.46",
        "disk:4/ff1/supplier.tbl.47",
        "disk:4/ff1/supplier.tbl.48",
        "disk:4/ff1/supplier.tbl.49",
        "disk:4/ff1/supplier.tbl.50",
        "disk:4/ff1/supplier.tbl.51",
        "disk:4/ff1/supplier.tbl.52",
        "disk:4/ff2/supplier.tbl.53",
        "disk:4/ff2/supplier.tbl.54",
        "disk:4/ff2/supplier.tbl.55",
        "disk:4/ff2/supplier.tbl.56",
        "disk:4/ff2/supplier.tbl.57",
        "disk:4/ff2/supplier.tbl.58",
        "disk:4/ff2/supplier.tbl.59",
        "disk:4/ff2/supplier.tbl.60"),
    rejectfile "/tmp/supplier.%"",
    express
);

insert into supplier select * from supplier_ext;

drop table supplier_ext;

alter table supplier type(operational);

close database;

create_index
export DBNAME=tpcd
[]
[]
echo start creating l_x1_ored at `date`
[]
dbaccess -e $DBNAME <<EOF
set pdqpriority 100;
create index l_x1_ored on lineitem (
    l_orderkey,
    l_returnflag,
    l_extendedprice,
    l_discount)
    fragment by hash(l_orderkey) in l1ind ;
EOF
echo end creating l_x1_ored at `date`

echo start creating l_x2_pqe at `date`
dbaccess -e $DBNAME <<EOF
set pdqpriority 100;
create index l_x2_pqe on lineitem (
    l_partkey,
    l_quantity,
    l_extendedprice)
    fragment by hybrid(l_orderkey) expression
    l_partkey < 1250000 in l2ind1,
    l_partkey >= 1250000 and l_partkey < 2500000 in l2ind2,
    l_partkey >= 2500000 and l_partkey < 3750000 in l2ind3,
    l_partkey >= 3750000 and l_partkey < 5000000 in l2ind4,
    l_partkey >= 5000000 and l_partkey < 6250000 in l2ind5,
    l_partkey >= 6250000 and l_partkey < 7500000 in l2ind6,
    l_partkey >= 7500000 and l_partkey < 8750000 in l2ind7,
    l_partkey >= 8750000 and l_partkey < 10000000 in l2ind8,

```

```

    l_partkey >= 10000000 and l_partkey < 11250000 in l2ind9,
    l_partkey >= 11250000 and l_partkey < 12500000 in l2ind10,
    l_partkey >= 12500000 and l_partkey < 13750000 in l2ind11,
    l_partkey >= 13750000 and l_partkey < 15000000 in l2ind12,
    l_partkey >= 15000000 and l_partkey < 16250000 in l2ind13,
    l_partkey >= 16250000 and l_partkey < 17500000 in l2ind14,
    l_partkey >= 17500000 and l_partkey < 18750000 in l2ind15,
    l_partkey >= 18750000 and l_partkey < 20000000 in l2ind16,
    l_partkey >= 20000000 and l_partkey < 21250000 in l2ind17,
    l_partkey >= 21250000 and l_partkey < 22500000 in l2ind18,
    l_partkey >= 22500000 and l_partkey < 23750000 in l2ind19,
    l_partkey >= 23750000 and l_partkey < 25000000 in l2ind20,
    l_partkey >= 25000000 and l_partkey < 26250000 in l2ind21,
    l_partkey >= 26250000 and l_partkey < 27500000 in l2ind22,
    l_partkey >= 27500000 and l_partkey < 30000000 in l2ind23,
    l_partkey >= 28750000 and l_partkey < 30000000 in l2ind24,
    l_partkey >= 30000000 and l_partkey < 31250000 in l2ind25,
    l_partkey >= 31250000 and l_partkey < 32500000 in l2ind26,
    l_partkey >= 32500000 and l_partkey < 33750000 in l2ind27,
    l_partkey >= 33750000 and l_partkey < 35000000 in l2ind28,
    l_partkey >= 35000000 and l_partkey < 36250000 in l2ind29,
    l_partkey >= 36250000 and l_partkey < 37500000 in l2ind30,
    l_partkey >= 37500000 and l_partkey < 38750000 in l2ind31,
    l_partkey >= 38750000 and l_partkey < 40000000 in l2ind32,
    l_partkey >= 40000000 and l_partkey < 41250000 in l2ind33,
    l_partkey >= 41250000 and l_partkey < 42500000 in l2ind34,
    l_partkey >= 42500000 and l_partkey < 43750000 in l2ind35,
    l_partkey >= 43750000 and l_partkey < 45000000 in l2ind36,
    l_partkey >= 45000000 and l_partkey < 46250000 in l2ind37,
    l_partkey >= 46250000 and l_partkey < 47500000 in l2ind38,
    l_partkey >= 47500000 and l_partkey < 48750000 in l2ind39,
    l_partkey >= 48750000 and l_partkey < 50000000 in l2ind40,
    l_partkey >= 50000000 and l_partkey < 51250000 in l2ind41,
    l_partkey >= 51250000 and l_partkey < 52500000 in l2ind42,
    l_partkey >= 52500000 and l_partkey < 53750000 in l2ind43,
    l_partkey >= 53750000 and l_partkey < 55000000 in l2ind44,
    l_partkey >= 55000000 and l_partkey < 56250000 in l2ind45,
    l_partkey >= 56250000 and l_partkey < 57500000 in l2ind46,
    l_partkey >= 57500000 and l_partkey < 58750000 in l2ind47,
    l_partkey >= 58750000 in l2ind48;
EOF
echo end creating l_x2_pqe at `date`

echo start creating o_x2_ckd at `date`
dbaccess -e $DBNAME <<EOF
set pdqpriority 100;
create index o_x2_ckd on order
    (o_clerk,
    o_orderkey,
    o_orderdate)
    fragment by hybrid(o_orderkey) expression
    o_clerk < 'Clerk#000025001' in o2ind1,
    o_clerk >= 'Clerk#000025001' and o_clerk < 'Clerk#000050002' in
o2ind2,
    o_clerk >= 'Clerk#000050002' and o_clerk < 'Clerk#000075003' in
o2ind3,
    o_clerk >= 'Clerk#000075003' and o_clerk < 'Clerk#000100004' in
o2ind4,
    o_clerk >= 'Clerk#000100004' and o_clerk < 'Clerk#000125005' in
o2ind5,
    o_clerk >= 'Clerk#000125005' and o_clerk < 'Clerk#000150006' in
o2ind6,
    o_clerk >= 'Clerk#000150006' and o_clerk < 'Clerk#000175007' in
o2ind7,
    o_clerk >= 'Clerk#000175007' and o_clerk < 'Clerk#000200008' in
o2ind8,
    o_clerk >= 'Clerk#000200008' and o_clerk < 'Clerk#000225009' in
o2ind9,
    o_clerk >= 'Clerk#000225009' and o_clerk < 'Clerk#000250010' in
o2ind10,
    o_clerk >= 'Clerk#000250010' and o_clerk < 'Clerk#000275011' in
o2ind11,
    o_clerk >= 'Clerk#000275011' in o2ind12;
EOF
echo end creating o_x2_ckd at `date`

echo start creating o_x1_k at `date`
dbaccess -e $DBNAME <<EOF
set pdqpriority 100;
create index o_x1_k on order (o_orderkey)
    fragment by hash(o_orderkey) in o1ind ;
EOF
echo end creating o_x1_k at `date`

echo start creating ps_x1 at `date`
dbaccess -e $DBNAME <<EOF
set pdqpriority 100;
create unique index ps_x1 on partsupp (ps_partkey,
    ps_supplykey,
    ps_supplycost)
    fragment by hybrid(ps_partkey) expression
    ps_partkey < 1250000 in ps1ind1,
    ps_partkey >= 1250000 and ps_partkey < 2500000 in ps1ind2,
    ps_partkey >= 2500000 and ps_partkey < 3750000 in ps1ind3,
    ps_partkey >= 3750000 and ps_partkey < 5000000 in ps1ind4,
    ps_partkey >= 5000000 and ps_partkey < 6250000 in ps1ind5,
    ps_partkey >= 6250000 and ps_partkey < 7500000 in ps1ind6,
    ps_partkey >= 7500000 and ps_partkey < 8750000 in ps1ind7,
    ps_partkey >= 8750000 and ps_partkey < 10000000 in ps1ind8,
    ps_partkey >= 10000000 and ps_partkey < 11250000 in ps1ind9,
    ps_partkey >= 11250000 and ps_partkey < 12500000 in ps1ind10,
    ps_partkey >= 12500000 and ps_partkey < 13750000 in ps1ind11,
    ps_partkey >= 13750000 and ps_partkey < 15000000 in ps1ind12,
    ps_partkey >= 15000000 and ps_partkey < 16250000 in ps1ind13,
    ps_partkey >= 16250000 and ps_partkey < 17500000 in ps1ind14,
    ps_partkey >= 17500000 and ps_partkey < 18750000 in ps1ind15,
    ps_partkey >= 18750000 and ps_partkey < 20000000 in ps1ind16,
    ps_partkey >= 20000000 and ps_partkey < 21250000 in ps1ind17,
    ps_partkey >= 21250000 and ps_partkey < 22500000 in ps1ind18,
    ps_partkey >= 22500000 and ps_partkey < 23750000 in ps1ind19,
    ps_partkey >= 23750000 and ps_partkey < 25000000 in ps1ind20,
    ps_partkey >= 25000000 and ps_partkey < 26250000 in ps1ind21,
    ps_partkey >= 26250000 and ps_partkey < 27500000 in ps1ind22,
    ps_partkey >= 27500000 and ps_partkey < 28750000 in ps1ind23,
    ps_partkey >= 28750000 and ps_partkey < 30000000 in ps1ind24,

```

```

ps_partkey >= 30000000 and ps_partkey < 31250000 in ps1ind25,
ps_partkey >= 31250000 and ps_partkey < 32500000 in ps1ind26,
ps_partkey >= 32500000 and ps_partkey < 33750000 in ps1ind27,
ps_partkey >= 33750000 and ps_partkey < 35000000 in ps1ind28,
ps_partkey >= 35000000 and ps_partkey < 36250000 in ps1ind29,
ps_partkey >= 36250000 and ps_partkey < 37500000 in ps1ind30,
ps_partkey >= 37500000 and ps_partkey < 38750000 in ps1ind31,
ps_partkey >= 38750000 and ps_partkey < 40000000 in ps1ind32,
ps_partkey >= 40000000 and ps_partkey < 41250000 in ps1ind33,
ps_partkey >= 41250000 and ps_partkey < 42500000 in ps1ind34,
ps_partkey >= 42500000 and ps_partkey < 43750000 in ps1ind35,
ps_partkey >= 43750000 and ps_partkey < 45000000 in ps1ind36,
ps_partkey >= 45000000 and ps_partkey < 46250000 in ps1ind37,
ps_partkey >= 46250000 and ps_partkey < 47500000 in ps1ind38,
ps_partkey >= 47500000 and ps_partkey < 48750000 in ps1ind39,
ps_partkey >= 48750000 and ps_partkey < 50000000 in ps1ind40,
ps_partkey >= 50000000 and ps_partkey < 51250000 in ps1ind41,
ps_partkey >= 51250000 and ps_partkey < 52500000 in ps1ind42,
ps_partkey >= 52500000 and ps_partkey < 53750000 in ps1ind43,
ps_partkey >= 53750000 and ps_partkey < 55000000 in ps1ind44,
ps_partkey >= 55000000 and ps_partkey < 56250000 in ps1ind45,
ps_partkey >= 56250000 and ps_partkey < 57500000 in ps1ind46,
ps_partkey >= 57500000 and ps_partkey < 58750000 in ps1ind47,
ps_partkey >= 58750000 in ps1ind48;

```

```

EOF
echo done creating ps_x1 at `date`

```

```

echo start creating ps_x2 at `date`

```

```

dbaccess -e $DBNAME <<EOF

```

```

set pdqpriority 100;

```

```

create index ps_x2 on partsupp (ps_suppkey,

```

```

ps_partkey,
ps_supplycost,
ps_availqty)

```

```

fragment by hybrid (ps_partkey) expression

```

```

ps_suppkey < 62500 in ps2ind1,
ps_suppkey >= 62500 and ps_suppkey < 125000 in ps2ind2,
ps_suppkey >= 125000 and ps_suppkey < 187500 in ps2ind3,
ps_suppkey >= 187500 and ps_suppkey < 250000 in ps2ind4,
ps_suppkey >= 250000 and ps_suppkey < 312500 in ps2ind5,
ps_suppkey >= 312500 and ps_suppkey < 375000 in ps2ind6,
ps_suppkey >= 375000 and ps_suppkey < 437500 in ps2ind7,
ps_suppkey >= 437500 and ps_suppkey < 500000 in ps2ind8,
ps_suppkey >= 500000 and ps_suppkey < 562500 in ps2ind9,
ps_suppkey >= 562500 and ps_suppkey < 625000 in ps2ind10,
ps_suppkey >= 625000 and ps_suppkey < 687500 in ps2ind11,
ps_suppkey >= 687500 and ps_suppkey < 750000 in ps2ind12,
ps_suppkey >= 750000 and ps_suppkey < 812500 in ps2ind13,
ps_suppkey >= 812500 and ps_suppkey < 875000 in ps2ind14,
ps_suppkey >= 875000 and ps_suppkey < 937500 in ps2ind15,
ps_suppkey >= 937500 and ps_suppkey < 1000000 in ps2ind16,
ps_suppkey >= 1000000 and ps_suppkey < 1062500 in ps2ind17,
ps_suppkey >= 1062500 and ps_suppkey < 1125000 in ps2ind18,
ps_suppkey >= 1125000 and ps_suppkey < 1187500 in ps2ind19,
ps_suppkey >= 1187500 and ps_suppkey < 1250000 in ps2ind20,
ps_suppkey >= 1250000 and ps_suppkey < 1312500 in ps2ind21,
ps_suppkey >= 1312500 and ps_suppkey < 1375000 in ps2ind22,
ps_suppkey >= 1375000 and ps_suppkey < 1437500 in ps2ind23,
ps_suppkey >= 1437500 and ps_suppkey < 1500000 in ps2ind24,
ps_suppkey >= 1500000 and ps_suppkey < 1562500 in ps2ind25,
ps_suppkey >= 1562500 and ps_suppkey < 1625000 in ps2ind26,
ps_suppkey >= 1625000 and ps_suppkey < 1687500 in ps2ind27,
ps_suppkey >= 1687500 and ps_suppkey < 1750000 in ps2ind28,
ps_suppkey >= 1750000 and ps_suppkey < 1812500 in ps2ind29,
ps_suppkey >= 1812500 and ps_suppkey < 1875000 in ps2ind30,
ps_suppkey >= 1875000 and ps_suppkey < 1937500 in ps2ind31,
ps_suppkey >= 1937500 and ps_suppkey < 2000000 in ps2ind32,
ps_suppkey >= 2000000 and ps_suppkey < 2062500 in ps2ind33,
ps_suppkey >= 2062500 and ps_suppkey < 2125000 in ps2ind34,
ps_suppkey >= 2125000 and ps_suppkey < 2187500 in ps2ind35,
ps_suppkey >= 2187500 and ps_suppkey < 2250000 in ps2ind36,
ps_suppkey >= 2250000 and ps_suppkey < 2312500 in ps2ind37,
ps_suppkey >= 2312500 and ps_suppkey < 2375000 in ps2ind38,
ps_suppkey >= 2375000 and ps_suppkey < 2437500 in ps2ind39,
ps_suppkey >= 2437500 and ps_suppkey < 2500000 in ps2ind40,
ps_suppkey >= 2500000 and ps_suppkey < 2562500 in ps2ind41,
ps_suppkey >= 2562500 and ps_suppkey < 2625000 in ps2ind42,
ps_suppkey >= 2625000 and ps_suppkey < 2687500 in ps2ind43,
ps_suppkey >= 2687500 and ps_suppkey < 2750000 in ps2ind44,
ps_suppkey >= 2750000 and ps_suppkey < 2812500 in ps2ind45,
ps_suppkey >= 2812500 and ps_suppkey < 2875000 in ps2ind46,
ps_suppkey >= 2875000 and ps_suppkey < 2937500 in ps2ind47,
ps_suppkey >= 2937500 in ps2ind48;

```

```

EOF
echo end creating ps_x2 at `date`

```

```

echo start creating p_x1 at `date`

```

```

dbaccess -e $DBNAME <<EOF

```

```

set pdqpriority 100;

```

```

create index p_x1 on part (p_container, p_brand, p_partkey)

```

```

fragment by hash(p_partkey) in plind;

```

```

EOF
echo end creating p_x1 at `date`

```

alter_table

```

#!/bin/ksh

```

```

[]

```

```

dbaccess -e tpcd <<EOF

```

```

alter table region lock mode(page);

```

```

alter table nation lock mode(page);

```

```

alter table customer lock mode(page);

```

```

alter table supplier lock mode(page);

```

```

alter table partsupp lock mode(page);

```

```

alter table order lock mode(page);

```

```

alter table lineitem lock mode(page);

```

```

alter table part lock mode(page);

```

```

EOF

```

update_stats

```

#!/bin/ksh

```

```

[]
export DBNAME=tpcd

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

[]

```

```

done

```

```

xctl onmode -a 1957888
sleep 3
xctl onmode -a 1957888
sleep 3
xctl onmode -a 1421312

echo Sysmaster is built and the database is up

bringup_xps
#!/bin/ksh

if ( [[ "${ONCONFIG}" = "x" ]] || [[ "${INFORMIXDIR}" = "x" ]] )
&& [[ $# -ne 1 ]] ; then
    print 'INFORMIXDIR and ONCONFIG must be set or'
    print 'number of coservers must be specified'
    exit 1
fi

COSERVERS=$(nawk '$1 == "COSERVER" { cs++ }; END { print cs }' <
${INFORMIXDIR}/etc/${ONCONFIG})

STARTUP_TIMEOUT=1200
GREP_ONLINE="On-Line"

xctl -C oninit -y

interval=10 # seconds
elapsed=0
servercount=0
serverUp=0

while [ $serverUp = 0 -a $elapsed -lt $STARTUP_TIMEOUT ]; do
    sleep $interval
    (( elapsed += interval ))
    servercount=`xctl onstat - | fgrep -c "$GREP_ONLINE"`
    if [ $servercount -ge $COSERVERS ]; then
        serverUp=1;
    fi
done
if [ $serverUp != 1 ]; then
    print "$0: server startup failed, check timeout"
    exit 1
fi

sleep 60
xctl onmode -a 1957888
sleep 3
xctl onmode -a 1908736
sleep 20

```

bringdn_xps

```

#!/bin/ksh

#
# Stop Informix Dynamic Server
#
if ( [[ "${ONCONFIG}" = "x" ]] || [[ "${INFORMIXDIR}" = "x" ]] )
&& [[ $# -ne 1 ]] ; then
    print 'INFORMIXDIR and ONCONFIG must be set or'
    print 'number of coservers must be specified'
    exit 1
fi

COSERVERS=$(nawk '$1 == "COSERVER" { cs++ }; END { print cs }' <
${INFORMIXDIR}/etc/${ONCONFIG})

STARTUP_TIMEOUT=1200
GREP_OFFLINE="not initialized"

xctl -P onmode -yuk

interval=10 # seconds
elapsed=0
servercount=0
serverDN=0

while [ $serverDN = 0 -a $elapsed -lt $STARTUP_TIMEOUT ]; do
    sleep $interval
    elapsed=`expr $elapsed + $interval`
    servercount=`xctl onstat - | fgrep -c "$GREP_OFFLINE"`
    if [ $servercount -ge $COSERVERS ]; then
        serverDN=1
    fi
done
if [ $serverDN != 1 ]; then
    print "$0: server shutdown failed, check timeout"
    exit 1
fi

exit 0

```

Appendix C: Query Text and Output

Part 1: ACID Test Code

```
/*
 * Sccsid:  @(#)acid.ec 9.1.2.5 8/16/95 20:56:46
 * ACID test implementation for TPC-D
 *
 *
 * this routine acutally does twice the required number of
 * transactions,
 * one set to alter the data and another to unroll the changes
 * after things
 * have completed. It relies on semop() for synchronization.
 */

#define DECLARER
/*#define _XOPEN_SOURCE*/
#include "config.h"
#include <stdio.h>
#include <signal.h>
#include <sys/wait.h>
#include <time.h>
#include <sys/sem.h>
#include <sys/types.h>
#include <sys/ipc.h>
#include <unistd.h>
#include "dss.h"
#include "acid.h"

/*
 * synchronization scheme:
 * sem[0] -- number of children ready to go
 * sem[1] -- number of children allowed to go
 * CHILDSYNC() -- this child registers as ready, then waits for
 * permission,
 * to continue
 * ALLREADY() -- parent will wait here until all children are
 * ready
 * ALLGO() -- parent allows all children to proceed
 * ONEGO() -- parent allows *a* child to proceed
 */
union semun {
    int val;
    struct semid_ds *buf;
    ushort *array;
} semun1;

#define MAKESEMS \
    if ((semid = semget(IPC_PRIVATE, 2, 0600+IPC_CREAT)) == -1) \
        fprintf(stderr, "semget FAILS\n");
    if (semctl(semid, 0, SETVAL, semun1)) fprintf(stderr, "set 0
failed\n");
    if (semctl(semid, 1, SETVAL, semun1)) fprintf(stderr, "set 1
failed\n")

#define DROPSEMS (semctl(semid, 0, IPC_RMID, semun1))
#define CHILDSYNC do_semop(0,1); do_semop(1,-1)
#define ALLREADY do_semop(0,-nprocs)
#define ALLGO do_semop(1,nprocs)
#define ONEGO do_semop(1,1)

int semid; /* timing control semaphores */
int nprocs; /* number of active children */
pid_t pids[MAX_CHILDREN];
FILE *sfp = NULL;

/*
 * status file macros:
 * SET_FILE(tgt) -- redirect status messages to tgt, unless
 * overridden
 * on the command line
 * TIMESTAMP -- generate a timestamped status message
 * DEC_DBL -- convert a dec_t to a dbl; -1 == error
 * NEW_SUCCESS -- force the start of a new success file
 */
#include <sys/time.h>
struct timeval tp;
double secs;

#define TIMESTAMP(note) \
{ \
    gettimeofday(&tp, 0); \
    secs = tp.tv_sec + (double)tp.tv_usec / 1000000; \
    fprintf(ofp, "%-40s TIME: %.2f\n", note, secs); \
    fflush(ofp); \
}

#define NEW_SUCCESS sfp = NULL
#define SET_FILE(str) \
    if ((flags & FL_DEBUG) == 0) \
    { \
        if (ofp != NULL) fclose(ofp); \
        if ((ofp = fopen(str, "a")) == NULL) \
            fprintf(stderr, "open failed for %s\n", str); \
        \
        exit(1); \
    } \
    else ofp=stdout
#define DEC_DBL(src, tgt) \
    if (dectodbl(&src, &tgt)) \
        tgt = -1

/*
 * general defines
 */
```

```
*/
#define ORDER_PER_SF 1500000L

#include sqlca;
#include sqlda;
#include decimal;
#include datetime;

$ typedef struct TRAN_T {
    long o;
    int l;
    int d;
    dec_t rprice;
    dec_t qty;
    dec_t tax;
    dec_t disc;
    dec_t eprice;
    dec_t tprice;
} tran_t;

int c_cnt, t_cnt;
char keyfile[80] = "";
char logfile[80] = "";
$ char dbname[80];
FILE *ofp = NULL;
int phase2 = 0;
double flt_scale;
time_t t_tmpt;
int flags = 0;
$ tran_t work[1000];
long seed;
extern long Seed[];

static void process_options(int ac, char **av);
void c_check();
void pick_keys(void);
void parallel_tran(int, int*, int);
void usage(char *);
void post_proc(int);
void do_testa(void);
void do_testc(void);
void do_testi(void);
void do_testd(void);
void do_semop(int, int);
void build_tran(int);
void init(int);
void wrapup(void);
void do_tran(int, int);
void prt_history(int); /* print the history records */
void dump_row(int, char *); /* print the named rows for o/l */
long uniInt PROTO(long, long, long);

main(int ac, char **av)
{
    process_options(ac, av);

    MAKESEMS;

    if (flags & FL_TESTC)
        do_testc();
    if (flags & FL_TESTI)
        do_testi();
    if (flags & FL_TESTA)
        do_testa();
    if (flags & FL_TESTD)
        do_testd();

    ALLGO; /* to clear anyone who's left */
    DROPSEMS;

    exit(0);
}

void
c_check(int tnum)
{
    double t1, t2;
    $int okey;
    int i = 0;
    $decimal otot,
    res;

    $begin work;
    $ whenever not found continue;
    $ whenever error call do_error;
    okey = work[tnum].o;
    $execute o_stmt into $otot using $okey;
    if (SQLCODE == SQLNOTFOUND)
        fprintf(ofp, "%ld is not a valid orderkey\n", okey);
        return;
    $execute l_stmt into $res using $okey;
    if (SQLCODE == SQLNOTFOUND)
        fprintf(ofp, "%ld has no lines!\n", okey);
        return;
    dectodbl(&otot, &t1);
    dectodbl(&res, &t2);
    fprintf(ofp, "%s orderkey %ld: wanted %8.2f, got %8.2f\n",
        (deccmp(&otot, &res))?"ERROR: Bad":"success for", okey,
    t1, t2);

    $commit work;
    return;
}

static void
process_options(int cnt, char **vector)
{
    extern int optind, opterr;
    extern char *optarg;
    int flg,
```

```

i;
flags |= FL_TESTALL;
seed = Seed[0];
while ((flg = getopt(cnt, vector, "C:uDb:hk:l:n:r:s:t:T:") !=
-1)
{
switch (flg)
{
case 'd':
strcpy(dbname, optarg);
flags |= FL_DBNAME;
break;
case 'D':
flags |= FL_DEBUG;
break;
case 'C':
children = atoi(optarg);
flags |= FL_STREAMS;
break;
case 'h':
usage(vector[0]);
exit(0);
break;
case 'k':
if (strlen(optarg) > 79)
{
printf("pathname '%s' exceeds 80 character
limit\n", optarg);
exit(1);
}
strcpy(keyfile, optarg);
flags |= FL_KEY;
break;
case 'l':
if (strlen(optarg) > 79)
{
printf("pathname '%s' exceeds 80 character
limit\n", optarg);
exit(1);
}
strcpy(logfile, optarg);
flags |= FL_LOG;
break;
case 'n':
c_cnt = atoi(optarg);
flags |= FL_COUNT;
break;
case 'r':
seed = atol(optarg);
flags |= FL_SEED;
break;
case 's':
flt_scale = atof(optarg);
flags |= FL_SCALE;
break;
case 't':
t_cnt = atoi(optarg);
if (t_cnt >= 1000)
{
printf("-t upper bound is 1000\n");
t_cnt = 999;
}
flags |= FL_TRANS;
break;
case 'T':
flags &= ~FL_TESTALL;
if (*optarg == 'A' || *optarg == 'a')
flags |= FL_TESTA;
if (*optarg == 'C' || *optarg == 'c')
flags |= FL_TESTC;
if (*optarg == 'I' || *optarg == 'i')
flags |= FL_TESTI;
if (*optarg == 'D' || *optarg == 'd')
flags |= FL_TESTD;
break;
}
}
if ((flags & FL_SCALE) == 0)
flt_scale = 0.1;
if ((flags & FL_COUNT) == 0)
c_cnt = 10;
if ((flags & FL_TRANS) == 0)
t_cnt = 100;
if ((flags & FL_STREAMS) == 0)
children = 1;
if ((flags & FL_DBNAME) == 0)
if (flt_scale < 0) sprintf(dbname, "dssf");
else sprintf(dbname, "dssf%3.0F", flt_scale);
if ((flags & FL_SEED) == 0)
for (i=0; i < DSS_PROC; i++)
UnifInt(1L, 100L, 0);
return;
}
void
pick_keys(void)
{
int *res, i, j;
FILE *kfp;
if (strlen(keyfile) != 0)
{
if ((kfp = fopen(keyfile, "r")) == (FILE *)NULL)
{
printf("unable to open key file '%s'\n", keyfile);
exit(1);
}
fscanf(kfp, "%d\n", &c_cnt);
for (i=0; i < c_cnt; i++)
fscanf(kfp, "%d\n", work[i].o);
fclose(kfp);
}
else
{

```

```

res = (int *)malloc(sizeof(int) * (c_cnt + 1));
MALLOC_CHECK(res);
for (i=0; i < c_cnt; i++)
work[i].o = MK_SPARSE(UnifInt(1L, (long)(ORDER_PER_SF *
flt_scale), 0L), 0);
}
return;
}
void
usage(char *prog)
{
printf("USAGE: %s [options]\n\n\toptions\n\t=====\n", prog);
printf("\t-d <name>\t-- run against database <name>\n");
printf("\t-h\t\t-- generate this usage message\n");
printf("\t-C <procs>\t-- run <procs> transaction streams\n");
printf("\t-k <file>\t-- read keys from <file>\n");
printf("\t-l <file>\t-- use <file> as the OnLine log file\n");
printf("\t-n <keycount>\t-- use <keycount> random keys for
verification\n");
printf("\t-s <SF>\t\t-- assume scale factor SF\n");
printf("\t-t <trans>\t-- issues <trans> transactions per
stream\n");
printf("\t-D\t\t-- output results to stdout\n");
return;
}
void
post_proc(c)
$parameter int c;
{
char n[80];
int i;
$int pkey, skey, okey, lkey, delta, child;
$time_t d_time;
sprintf(n, "Transactions from stream #d\n", c);
TIMESTAMP(n);
fprintf(ofp, "%-10s|%-2s|%-3s|%-8s|%-6s|\n",
"order", "l", "dl", "part", "supp", "time");
begin_tran();
$open h_crsr using :c;
$fetch h_crsr
into :pkey, :skey, :okey, :lkey, :delta, :d_time,
:child;
while (!SQLCODE)
{
dttoasc(&d_time, n);
fprintf(ofp, "%-10d|%-2d|%-3d|%-8d|%-6d|\n",
okey, lkey, delta, pkey, skey, n);
$fetch h_crsr
into :pkey, :skey, :okey, :lkey, :delta, :d_time,
:child;
}
}
$close h_crsr;
$commit work;
fflush(ofp);
return;
}
void
do_testa(void)
{
int i;
init(0);
$delete from history;
SET_FILE("stdout");
fprintf(ofp, "ATOMICITY TEST ONE\n");
dump_row(0, "Initial State:");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(0);
begin_tran();
do_tran(0, 0);
commit_tran(0, 0, "asuccess");
dump_row(0, "Final State:");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(0);
NEW_SUCCESS;
$delete from history;
fprintf(ofp, "ATOMICITY TEST TWO\n");
dump_row(1, "Initial State:");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(1);
begin_tran();
do_tran(1, 1);
fprintf(ofp, "\n");
TIMESTAMP("Requesting Rollback");
$rollback work;
TIMESTAMP("Rollback Complete");
fprintf(ofp, "\n");
dump_row(1, "Final State:");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(1);
wrapup();
return;
}
void
do_testc(void)
{
int *p, i, c_pid, j, status;
tran_t *damage;
char cmd[80];
nprocs = children;
for (i = 0; i < children; i++)

```

```

{
switch (c_pid = SPAWN())
{
case -1:
fprintf(ofp, "Fork failed for child #%d\n",
i);
for (j=0; j < i; j++)
kill(pids[j], SIGKILL);
exit(1);
break;
case 0: /* CHILD */
SET_FILE("");
init(0);
NEW_SUCCESS;
$set isolation to repeatable read;
CHILDSYNC;
for (j=0; j < t_cnt; j++)
if ((j + 1) % children == i)
{
begin_tran();
$set Lock mode to wait;
do_tran(j, i);
commit_tran(j, i, "csuccess");
}
CHILDSYNC;
SET_FILE("consrte");
post_proc(i);
CHILDSYNC;
exit(0);
break;
default: /* PARENT */
pids[i] = c_pid;
break;
}
}
init(0);
if (children != 0)
$delete from history;
SET_FILE("consb");
$set isolation to repeatable read;
TIMESTAMP("Initial State");
for (i=0; i < c_cnt; i++) {
c_check(i);
}
if (children == 0)
exit(0);
SET_FILE("conस्कpt");
TIMESTAMP("Allow Transactions");
ALLREADY; /* everyone is ready */
ALLGO;
sleep(CKPT_WAIT);
system("INFORMIXSERVER=qtpcd.1 xctl onmode -c ;
INFORMIXSERVER=qtpcd.1 onstat -m >> conस्कpt");
ALLREADY; /* everyone is done */
SET_FILE("consa");
TIMESTAMP("Final State");
for (i=0; i < c_cnt; i++)
c_check(i);
for (i=0; i < children; i++)
{
ONEGO; /* allow them to post process in turn */
sleep(5);
}
ALLGO; /* allow them to terminate */
sleep(5);
wrapup();
/* system("mv success.0 csuccess.0; mv success.1
csuccess.1"); */
return;
}
void
do_testi(void)
{
double cost;
int delta1, delta2, hold;
pid_t child;
$char comment[199];
$char stmt_buf1[1000];
$char stmt_buf2[1000];
$decimal supplycost;
$int availqty;
$long max_partkey, max_suppkey, partkey, suppkey;
char buf[1024];
nprocs = 1; /* these are all 1 parent / 1 child tests */
hold = c_cnt;
c_cnt = 1;
child = SPAWN();
switch(child)
{
case -1:
TIMESTAMP("Process creation failed!");
exit(1);
break;
case 0: /* CHILD */
init(0);
$delete from history;
/* iso1: read-only isolation in the face of a commit */
SET_FILE("iso1");
fprintf(ofp, "ISOLATION TEST ONE\n");
$set isolation to repeatable read;

```

```

dump_row(0, "Initial State");
TIMESTAMP("History table Contents");
prt_history(2);
work[0].o, work[0].l);
TIMESTAMP(buf);
begin_tran();
do_tran(0, 2);
TIMESTAMP("T1: Suspending");
fprintf(ofp, "\n");
CHILDSYNC;
sleep(10); /* sleep to be *sure* there is overlap */
TIMESTAMP("T1: Requesting Commit");
commit_tran(0, 1, "isuccess");
TIMESTAMP("T1: Commit Done");
fprintf(ofp, "\n");
sleep(20); /* sleep to be *sure* trace file is
obvious */
dump_row(0, "Final State");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(2);
CHILDSYNC;
fflush(ofp);
/* iso2: read-only isolation in the face of a
*/
$delete from history;
NEW_SUCCESS;
SET_FILE("iso2");
fprintf(ofp, "ISOLATION TEST TWO\n");
$set isolation to repeatable read;
dump_row(1, "Initial State");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(3);
sprintf(buf, "T1: Initiate Update (%d,%d)",
work[1].o, work[1].l);
TIMESTAMP(buf);
begin_tran();
do_tran(1, 3);
TIMESTAMP("T1: Suspending");
CHILDSYNC;
sleep(10); /* sleep to be *sure* there is overlap */
TIMESTAMP("T1: Requesting Rollback");
$rollback work;
TIMESTAMP("T1: Rollback Complete");
sleep(10); /* sleep to be *sure* trace file is
obvious */
dump_row(1, "Final State");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(3);
CHILDSYNC;
fflush(ofp);
/* iso3: update isolation in the face of a commit
*/
$delete from history;
NEW_SUCCESS;
SET_FILE("iso3");
fprintf(ofp, "ISOLATION TEST THREE\n");
$set isolation to repeatable read;
dump_row(2, "Initial State");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(4);
sprintf(buf, "T1: Initiate Update (%d,%d)",
work[2].o, work[2].l);
TIMESTAMP(buf);
begin_tran();
do_tran(2, 4);
TIMESTAMP("T1: Suspending");
CHILDSYNC;
sleep(10); /* sleep to be *sure* there is overlap */
TIMESTAMP("T1: Requesting Commit");
commit_tran(2, 3, "isuccess");
TIMESTAMP("T1: Commit Complete");
fprintf(ofp, "\n");
/* sleep(10); sleep to be *sure* trace file is
obvious */
dump_row(2, "T1: Final State");
TIMESTAMP("T1: Committed Transaction (History
Table)");
prt_history(4);
CHILDSYNC;
fflush(ofp);
/* iso4: update isolation in the face of a rollback
*/
$delete from history;
NEW_SUCCESS;
SET_FILE("iso4");
fprintf(ofp, "ISOLATION TEST FOUR\n");
$set isolation to repeatable read;
dump_row(3, "Initial State");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(5);
sprintf(buf, "T1: Initiate Update (%d,%d)",
work[3].o, work[3].l);
TIMESTAMP(buf);
begin_tran();
do_tran(3, 5);
TIMESTAMP("T1: Suspending");
CHILDSYNC;
sleep(10); /* sleep to be *sure* there is overlap */
TIMESTAMP("T1: Requesting Rollback");
$rollback work;
TIMESTAMP("T1: Rollback Complete");
/* sleep(10); sleep to be *sure* trace file is
obvious */
dump_row(3, "T1: Final State");

```

```

Table");
    TIMESTAMP("T1: Committed Transaction (History
    prt_history(5);
    fflush(ofp);
    CHILDSYNC;

    /*
    * iso5: concurrent read/write transactions against
    * different tables
    */
    $delete from history;
    NEW_SUCCESS;
    SET_FILE("iso5");
    fprintf(ofp, "ISOLATION TEST FIVE\n");
    $set isolation to repeatable read;
    dump_row(6, "Initial State");
    TIMESTAMP("Committed Transaction (History Table)");
    prt_history(8);
    sprintf(buf, "T1: Initiate Update (%d,%d)",
work[6].o, work[6].l);
    TIMESTAMP(buf);
    begin_tran();
    do_tran(6,8);
    TIMESTAMP("T1: waiting to commit");
    CHILDSYNC;
    TIMESTAMP("T1: Requesting Commit");
    commit_tran(6, 5, "isuccess");
    TIMESTAMP("T1: Commit Complete");
    dump_row(6, "Final State");
    TIMESTAMP("Committed Transaction (History Table)");
    prt_history(8);
    fflush(ofp);
    CHILDSYNC;

    /*
    * iso6: test to see that update transactions are
    * not delayed indefinitely when run
    * with arbitrary read-only queries
    */
    NEW_SUCCESS;
    SET_FILE("iso6");
    fprintf(ofp, "ISOLATION TEST SIX\n");
    fflush(ofp);
    $set isolation to repeatable read;
    dump_row(7, "Initial State");
    TIMESTAMP("Committed Transaction (History Table)");
    prt_history(9);
    sleep(3);
work[7].o, work[7].l);
    sprintf(buf, "T2: Initiate Update (%d,%d)",
    TIMESTAMP(buf);
    begin_tran();
    do_tran(7,9);
    CHILDSYNC;
    sleep(3);
    TIMESTAMP("T2: Requesting Commit");
    commit_tran(7, 6, "isuccess");
    TIMESTAMP("T2: Commit Complete");
    /*dump_row(7, "Final State");
    TIMESTAMP("Committed Transaction (History Table)");
    prt_history(9);*/
    CHILDSYNC;
    fflush(ofp);

    exit(0);
    break;

default: /* PARENT */
    init(0);

    /*
    * iso1: read-only isolation in the face of a commit
    */
    SET_FILE("iso1");
    $set isolation to committed read;
    ALLREADY; /* process one is waiting to commit */
    ALLGO;
    sleep(5);
    TIMESTAMP("T2: Initiate Read Query");
    dump_row(0, "T2: Query Complete");

    /*
    * iso2: read-only isolation in the face of a
    */
    ALLREADY; /* make sure child is ready for test
2 */
    ALLGO; /* let him set up */
    SET_FILE("iso2");
    $set isolation to committed read;
    ALLREADY; /* process one is waiting to commit */
    ALLGO;
    sleep(5);
    TIMESTAMP("T2: Initiate Read Query");
    dump_row(1, "T2: Query Complete");

    /*
    * iso3: update isolation in the face of a commit
    */
    ALLREADY; /* process 1 is ready for the test
*/
    ALLGO; /* let him set up */
    work[4].o = work[2].o;
    work[4].l = work[2].l;
    SET_FILE("iso3");
    $set isolation to repeatable read;
    ALLREADY; /* process 1 is ready to commit */
    ALLGO;
    fprintf(ofp, "\n");
    sprintf(buf, "T2: Initiate Update (%d,%d)",
work[4].o, work[4].l);
    TIMESTAMP(buf);
    fprintf(ofp, "\n");
    begin_tran();

    do_tran(4, 6);
    TIMESTAMP("T2: Requesting Commit");
    commit_tran(4, 3, "isuccess");
    TIMESTAMP("T2: Commit Complete");
    dump_row(4, "T2: Final State");
    TIMESTAMP("T2: Committed Transaction (History
Table)");
    prt_history(6);
    fflush(ofp);

    /*
    * iso4: update isolation in the face of a rollback
    */
    ALLREADY; /* process 1 is ready for the test
*/
    ALLGO; /* let him set up */
    work[5].o = work[3].o;
    work[5].l = work[3].l;
    SET_FILE("iso4");
    $set isolation to repeatable read;
    sleep(5);
    ALLREADY; /* process 1 is ready to commit */
    ALLGO;
    fprintf(ofp, "\n");
    sprintf(buf, "T2: Initiate Update (%d,%d)",
work[5].o, work[5].l);
    TIMESTAMP(buf);
    fprintf(ofp, "\n");
    begin_tran();
    do_tran(5, 7);
    TIMESTAMP("T2: Requesting Commit");
    commit_tran(5, 4, "isuccess");
    TIMESTAMP("T2: Commit Complete");
    dump_row(5, "T2: Final State");
    TIMESTAMP("T2: Committed Transaction (History
Table)");
    prt_history(7);
    fflush(ofp);

    /*
    * concurrent read/write transactions against
    * different tables
    */
    ALLREADY;
    ALLGO;
    SET_FILE("iso5");
    $set isolation to repeatable read;
    sleep(2);
    TIMESTAMP("T2: Initiate Query");

    begin_tran();
    $select max(ps_partkey) into :max_partkey
    from partsupp where 1 = 1;
    $select max(ps_suppkey) into :max_suppkey
    from partsupp where 1 = 1;
    partkey = UnifInt(1L, max_partkey, 1L);
    suppkey = UnifInt(1L, max_suppkey, 1L);
    $open ps_crsr using :partkey, :suppkey;
    $fetch ps_crsr into
    :partkey, :suppkey, :availqty, :supplycost,
:comment;
    while (SQLCODE)
    {
    $close ps_crsr;
    partkey = UnifInt(1L, max_partkey, 1L);
    suppkey = UnifInt(1L, max_suppkey, 1L);
    $open ps_crsr using :partkey, :suppkey;
    $fetch ps_crsr into
    :partkey, :suppkey, :availqty, :supplycost,
:comment;
    }
    $close ps_crsr;

    if (dectodbl(&supplycost, &cost))
    cost = -999.99;
    TIMESTAMP("T2: Query Results");
    fprintf(ofp, "\n%8s |%8s |%5s |%8s |%s\n",
"p_key", "s_key", "avqty", "cost",
"comment");
    fprintf(ofp, "%8d |%8d |%5d |%8.2f |%s\n",
partkey, suppkey, availqty, cost,
comment);
    $commit work;
    fflush(ofp);

    ALLREADY; /* process 1 is ready to commit */
    ALLGO;
    ALLREADY; /* process 1 is complete */
    ALLGO;

    /*
    * iso6: test to see that update transactions are
    * not delayed indefinitely when run
    * with arbitrary read-only queries
    */
    SET_FILE("iso6");

    $set isolation to repeatable read;
    sleep(3);

    delta1 = UnifInt((long) 0, (long) 2159, (long) 0);
    sprintf(stmt_buf1, "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 <= date('1998-12-01') - interval (%d) day (4) to
day \
group by 1, 2 \
order by 1, 2 into temp temp%d;", delta1, delta1);

TIMESTAMP("T1: Initiating Q1");
begin_tran();
$execute immediate :stmt_buf1;
$commit work;
TIMESTAMP("T1: Q1 Complete");

ALLREADY;
ALLGO;

delta2 = UnifInt((long) 0, (long) 2159, (long) 0);
while (delta1 == delta2)
delta2 = UnifInt((long) 0, (long) 2159, (long) 0);

sprintf(stmt_buf2,"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 <= date('1998-12-01') - interval (%d) day (4) to
day \
group by 1, 2 \
order by 1, 2 into temp temp%d;", delta2, delta2);

TIMESTAMP("T1: Initiating Q1");
begin_tran();
$execute immediate :stmt_buf2;
$commit work;
TIMESTAMP("T1: Q1 Complete");
dump_row(7, "Final State:");
TIMESTAMP("Committed Transaction (History Table)");
prt_history(9);

ALLREADY;
ALLGO; /* allow him to cleanup */
sleep(10);

wrapup();
break;
}

c_cnt = hold;
return;
}

void
do_testd(void)
{
int c_pid, pids[MAX_CHILDREN], o, l, d;
int i, count = 0;

nprocs = children;
for (i=0; i < children; i++)
switch(c_pid = SPAWN())
{
case -1:
perror("fork error: durability");
exit(1);
break;
case 0:
sleep(i);
init(i);
SET_FILE("durrate");
CHILDSYNC;
while(1)
{
TIMESTAMP("Begin Transaction");
begin_tran();
do_tran(count % t_cnt, i);
commit_tran(count % t_cnt, i, "success");
TIMESTAMP("End Transaction");
if (++count % 100 == 0)
{
char msg[60];
sprintf(msg, "Stream %d:
Batch of 100 transactions complete", i);
TIMESTAMP(msg);
}
if (count % t_cnt == 0)
{
char msg[60];
sprintf(msg, "Stream %d:
%d transactions complete",
i, t_cnt);
TIMESTAMP(msg);
build_tran(t_cnt);
}
}
break;
default:
break;
}
}

init(0);
$delete from history;
ALLREADY;
ALLGO;
exit(0);
}

void
do_semop(int s, int v)
{
struct sembuf sop;

```

```

sop.sem_num = s;
sop.sem_op = v;
sop.sem_flg = 0;

if (semop(semid, &sop, 1) == -1)
{
perror("tpcd: semop");
exit(1);
}
return;
}

void
build_tran(int cnt)
{
int i, good_key;
static int init = 0;
$int lnum;

for (i = 0; i < cnt; i++)
{
good_key = 0;
if (i >= c_cnt)
work[i].o =
MK_SPARSE(UnifInt(1L, (long)(ORDER_PER_SF *
flt_scale), 0L), 0);
while (!good_key)
{
$execute get_lnum into :lnum using :work[i].o;
if (lnum >= 0)
good_key = 1;
else
work[i].o =
MK_SPARSE(UnifInt(1L, (long)(ORDER_PER_SF *
flt_scale), 0L), 0);
}
work[i].l = UnifInt(O_LCNT_MIN, (long)lnum, 0L);
work[i].d = UnifInt((long)1, (long)100, (long)0);
}
return;
}

void
wrapup(void)
{
$delete from history;

$close database;

$free get_lnum;
$free l_stmt;
$free o_stmt;
$free h_stmt;
$free h_crsr;
$free ps_stmt;
$free ps_crsr;

return;
}

void
init(childnum)
int childnum;
{
$database $dbname;
$set pdqpriority 0;
$whenever error call do_error;
$set lock mode to wait;
$set isolation to repeatable read;
$prepare get_lnum from
"select max(l_linenum) from lineitem where l_orderkey
= ?";
/*
* since the underlying calculation for DBGEN relies on integer
math and money
* expressed in pennies, while the schema requires a more standard
dollars and
* cents representation, it is necessary to apply the truncation
that integer
* math enforces, rather than the rounding that is informix's
default behavior
*/
$prepare l_stmt from
"select sum(\
trunc(\
trunc(l_extendedprice * (1 -
l_discount),2) \
* (1 + l_tax), 2)) \
from lineitem where l_orderkey = ?";
$prepare o_stmt from
"select o_totalprice from order where o_orderkey = ?";
$prepare h_stmt from
"select * from history where h_child = ? order by
h_date";

$declare h_crsr cursor for h_stmt;

$prepare ps_stmt from
"select * from partsupp where ps_partkey = ? and
ps_suppkey = ?";

$declare ps_crsr cursor for ps_stmt;

/* Seed[0] = seed; */
Seed[0] = seed + ( childnum * 201 );
pick_keys();
begin_tran();
build_tran(t_cnt);
$commit work;
return;
}

```

```

void
do_transaction(work_unit, c)
$tran_t *work_unit;
$int c;
{
    $decimal cost, disc, e, new_ototal, otot, ototal_delta, q,
    rprice, tax;
    $decimal num1, result1, result2, result3;
    $datetime year to fraction cur_dt;
    $int pkey, skey;

    $set isolation to repeatable read;
    /*$set explain on;*/

    $select o_totalprice into :otot from order
        where o_orderkey = :work_unit->o;

    $select l_quantity, l_extendedprice, l_partkey, l_suppkey,
    l_tax, l_discount
        into :q, :e, :pkey, :skey, :tax, :disc from lineitem
        where l_orderkey = :work_unit->o and l_linenumbr =
        :work_unit->l;

    decvint(1, &num1);

    /* 1 - disc */
    decsub(&num1, &disc, &result1);

    /* e times (1-disc) */
    decmul(&e, &result1, &result2);

    /* trunc (e times (1-disc)) */
    dectrunc(&result2, 2);

    /* 1 + tax */
    decadd(&num1, &tax, &result1);

    /* (e times (1-disc)) times (1+tax) */
    decmul(&result2, &result1, &result3);

    /* trunc (e times (1-disc)) times (1+tax) */
    dectrunc(&result3, 2);

    /* otot - ((e times (1-disc)) times (1+tax)) */
    decsub(&otot, &result3, &work_unit->tprice);

    /* e divided by q */
    decdiv(&e, &q, &work_unit->rprice);

    /* trunc (e divided by q) */
    dectrunc(&work_unit->rprice, 2);

    decvint(work_unit->d, &num1);

    /* d times rprice */
    decmul(&num1, &work_unit->rprice, &cost);

    /* trunc (d times rprice) */
    dectrunc(&cost, 2);

    $update lineitem
        set (l_extendedprice, l_quantity) =
        (:e + :cost, :q + :work_unit->d)
        where l_orderkey = :work_unit->o and l_linenumbr =
        :work_unit->l;

    $update order
        set o_totalprice =
        :work_unit->tprice + trunc(trunc((:e+:cost)*(1-
        :disc),2)*(1+:tax),2)
        where o_orderkey = :work_unit->o;

    $select o_totalprice into :new_ototal from order
        where o_orderkey = :work_unit->o;

    decsub(&new_ototal, &otot, &ototal_delta);

    dtcurrent(&cur_dt);
    if (work_unit->d > 0) {
        $insert into history values
        (:pkey, :skey, :work_unit->o, :work_unit->l, :work_unit->d,
        :cur_dt, :cost, :ototal_delta, :c);
    }
}

begin_tran()
{
    $begin work;
    $whenever not found continue;
    $whenever error call do_error;
}

commit_tran(n, child, filename)
int n;
$parameter int child;
char *filename;
{
    char name[20];
    double r, q, t, d, e, x;

    $commit work;

    /*
    * Print record of committed transaction to success file
    */
    if (sfp == NULL)
    {
        sprintf(name, "%s.%d", filename, child);
        sfp = fopen(name, "w");
    }
}

```

```

fprintf(sfp, "%-10s|%-2s|%-3s|%-10s|%-4s|%-4s|%-4s|%-
10s|%-10s\n",
    "order", "l", "dlt", "rprice", "qty", "tax",
    "dsc", "eprice", "tprice");
fflush(sfp);
}
DEC_DBL(work[n].rprice, r);
DEC_DBL(work[n].qty, q);
DEC_DBL(work[n].tax, t);
DEC_DBL(work[n].disc, d);
DEC_DBL(work[n].eprice, e);
DEC_DBL(work[n].tprice, x);

fprintf(sfp, "%10d|%21d|%31d|%10.2f|%4.0f|%4.2f|%4.2f|%10.2f|%10.2
f\n",
    work[n].o, work[n].l, work[n].d, r, q, t, d, e, x);

fflush(sfp);
}

/*
* transaction specifics:
* do_tran(n, mode, child) -- execute (mode == 0) or undo (mode
== 1) the
*
*
* n-th transaction
*/
void
do_tran(n, child)
int n;
$parameter int child;
{
    do_transaction(&work[n], child);
    sleep(1);

    return;
}

void
prt_history(h)
$parameter int h;
{
    $decimal cost, ototal_delta;
    $int p_key, s_key, o_key, l_key, delta, h_child;
    $datetime h_date;
    char dstr[40];

    $begin work;
    $open h_crsr using :h;
    $fetch h_crsr into
    $p_key, $s_key, $o_key, $l_key, $delta, $h_date,
    $h_child;

    if (!SQLCODE) {
        fprintf(ofp, "\n\t%8s |%8s |%9s |%2s |%3s |%s\n",
            "p_key", "s_key", "o_key", "l", "d", "date");
    } else {
        fprintf(ofp, "\n\tNo rows returned\n");
    }

    while (!SQLCODE)
    {
        if (dttoasc(&h_date, dstr))
            strcpy(dstr, "error");

        fprintf(ofp, "\t%8d |%8d |%9d |%2d |%3d | %s\n",
            p_key, s_key, o_key, l_key, delta, dstr);

        $fetch h_crsr into
        $p_key, $s_key, $o_key, $l_key, $delta, $h_date,
        $h_child;
    }

    $close h_crsr;
    $commit work;

    fprintf(ofp, "\n");
    fflush(ofp);

    return;
}

void
dump_row(tnum, which_tran)
int tnum;
char *which_tran;
{
    $int linenumbr, okey;
    $dec_t qty, eprice, otot;
    static int init = 0;
    double d;
    char msgbuf[40];

    if (init == 0)
    {
        $prepare d_stmt from
        "select l_quantity, l_extendedprice, l_linenumbr from
        lineitem where l_orderkey = ? order by l_linenumbr";
        $declare d_crsr cursor for d_stmt;
        init = 1;
    }

    okey = work[tnum].o;
    /*fprintf(ofp, "\n\trandomly selected order key = %d\n\n",
    okey);*/
    fprintf(ofp, "\n\n");
    $open d_crsr using $okey;
    $fetch d_crsr into $qty, $eprice, $linenumbr;

    TIMESTAMP(which_tran);

    fprintf(ofp, "\n\t%8s |%10s |%11s |%n", "line", "quantity",
    "ext price");
}

```

```

while (!ISQLCODE)
{
  if (dectodbl(&qty, &d))
    d = -1;

  if (work[tnum].l == linenumber) {
    fprintf(ofp, "\t*%7d |%10.2f |", linenumber,
d);
  } else {
    fprintf(ofp, "\t*%8d |%10.2f |", linenumber,
d);
  }
  if (dectodbl(&price, &d))
    d = -1;
  fprintf(ofp, "%11.2f |\n", d);
  $fetch_d_crsr into $qty, $price, $linenumber;
}
$execute o_stmt into $otot using $okey;
if (dectodbl(&otot, &d))
  d = -1;
fprintf(ofp, "\n\t*%8s %10.2f\n", "Total:", d);
fflush(ofp);

return;
}

```

Part 2: Queries and Output

Query 1

```

-- Start Query 1
-- using default substitutions
-- QUERY 1 PRICING SUMMARY REPORT QUERY

```

```

begin work;
Started transaction.

```

```

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 <= date('1998-12-01') - interval (90) day (3)
to day
group by l_returnflag, l_linestatus
order by l_returnflag, l_linestatus;

```

```

l_returnflag  A
l_linestatus  F
sum_qty       3773034.00
sum_base_price 5319329289.68
sum_disc_price 5053976845.7839
sum_charge    5256336547.67559
avg_qty       25.5095025928455
avg_price     35964.0131277086
avg_disc      0.04996403145219
count_order   147907

```

```

l_returnflag  N
l_linestatus  F
sum_qty       100245.00
sum_base_price 141459686.10
sum_disc_price 134380852.7691
sum_charge    139710306.872024
avg_qty       25.6250000000000
avg_price     36160.4514570552
avg_disc      0.05008946830265
count_order   3912

```

```

l_returnflag  N
l_linestatus  O
sum_qty       7464940.00
sum_base_price 10518546073.98
sum_disc_price 9992072944.4612
sum_charge    10392414192.0634
avg_qty       25.5419452409140
avg_price     35990.1255516625
avg_disc      0.05009676249392
count_order   292262

```

```

l_returnflag  R
l_linestatus  F
sum_qty       3779140.00
sum_base_price 5328886172.99
sum_disc_price 5062370635.9343
sum_charge    5265431221.82083
avg_qty       25.5485397512169
avg_price     36025.4608774337
avg_disc      0.05014223904813
count_order   147920

```

4 row(s) retrieved.

```

commit work;
Data committed.

```

Query 2

```

-- Start Query 2
-- using default substitutions
-- QUERY 2 MINIMUM COST SUPPLIER QUERY

```

```

begin work;
Started transaction.

```

```

select
FIRST 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;

```

```

s_acctbal  9828.21
s_name     Supplier#000000647
n_name     UNITED KINGDOM
p_partkey  13120
p_mfgr     Manufacturer#5
s_address  jB16PvPyB7B152jMjSPw3mS
s_phone    33-258-202-4782
s_comment  z1QhSiMj11Bm7Co1Lwh6Q10B1R2Mg4CLN
Lh1P0wimZy72h1kP715in2y6RS6N1301z
51nSRL5gog5S26hPCCQN2L

```

```

s_acctbal  9508.37
s_name     Supplier#000000070
n_name     FRANCE
p_partkey  3563
p_mfgr     Manufacturer#1
s_address  M5C616R5h5S1MR3zzmLkSw24j2
s_phone    16-821-608-1166
s_comment  m7z0CPSHmbkh1ChBAi3LkQ2CLw
mh16QP362RPS3044CB2y41yhohj1Bi n0CL7yhxmhS
4hBM07kQ1yyjOjz3C

```

```

s_acctbal  9508.37
s_name     Supplier#000000070
n_name     FRANCE
p_partkey  17268
p_mfgr     Manufacturer#4
s_address  M5C616R5h5S1MR3zzmLkSw24j2
s_phone    16-821-608-1166
s_comment  m7z0CPSHmbkh1ChBAi3LkQ2CLw
mh16QP362RPS3044CB2y41yhohj1Bi n0CL7yhxmhS
4hBM07kQ1yyjOjz3C

```

```

s_acctbal  9453.01
s_name     Supplier#000000802
n_name     ROMANIA
p_partkey  10021
p_mfgr     Manufacturer#5
s_address  5yARQNSLNRAl01bnkNQCik3So1yc1k7nmRhA2h0
s_phone    29-342-882-6463
s_comment  65y3RQ2i00P6nz7ms hc
PxxwLy7L1jQy60163x03iBCz52Rm1zm0MziCMLij2n6wky51
mB0wx Qh52iz QB1545Amxyj

```

```

s_acctbal  9453.01
s_name     Supplier#000000802
n_name     ROMANIA
p_partkey  13275
p_mfgr     Manufacturer#4
s_address  5yARQNSLNRAl01bnkNQCik3So1yc1k7nmRhA2h0
s_phone    29-342-882-6463
s_comment  65y3RQ2i00P6nz7ms hc
PxxwLy7L1jQy60163x03iBCz52Rm1zm0MziCMLij2n6wky51
mB0wx Qh52iz QB1545Amxyj

```

```

s_acctbal  9192.10
s_name     Supplier#000000115
n_name     UNITED KINGDOM
p_partkey  13325
p_mfgr     Manufacturer#1
s_address  h0m31z1SPMw2B0ny7LNyNckjRRn7iyM1LBLA
s_phone    33-597-248-1220
s_comment  10z0jhSyx
ixm21gz2Ry7075RL3MS5z36x56hxmR0wL N0LBxm164LZCmMALZOajnkz7
i4wj01CON11C51M7nCMX66SBRQA

```

```

s_acctbal 9032.15
s_name Supplier#000000959
n_name GERMANY
p_partkey 4958
p_mfgr Manufacturer#4
s_address 205LNCzMCn05gnz4n S3ynP6Mhnh
s_phone 17-108-642-3106
s_comment Px z7kox561jJz NwBBQhky yM7kLgXRQw5z6 426Bm551C6
OkQ7hQPLixjM7y47B
NP16CRi0kjk3541gxh

s_acctbal 8702.02
s_name Supplier#000000333
n_name RUSSIA
p_partkey 11810
p_mfgr Manufacturer#3
s_address 5iwkgN5n2BN150mQk2602h0N6NzxPyiPN51nj
s_phone 32-508-202-6136
s_comment SgimAjmn3wL7R1xmh3LcWOPnhjy1 7xxzxAN 4ACx43y65NwQ7P

s_acctbal 8615.50
s_name Supplier#000000812
n_name FRANCE
p_partkey 10551
p_mfgr Manufacturer#2
s_address h4i2M200 ky1g2m1Bomxjzj0hA2h6knsNhp
s_phone 16-585-724-6633
s_comment 57i0NAYR0RP2joh54C6B2201SL

s_acctbal 8615.50
s_name Supplier#000000812
n_name FRANCE
p_partkey 13811
p_mfgr Manufacturer#4
s_address h4i2M200 ky1g2m1Bomxjzj0hA2h6knsNhp
s_phone 16-585-724-6633
s_comment 57i0NAYR0RP2joh54C6B2201SL

s_acctbal 8488.53
s_name Supplier#000000367
n_name RUSSIA
p_partkey 6854
p_mfgr Manufacturer#4
s_address nkmQ2qzgh0wa 3x Sn2S7N5gmSOj xwC CoSn6
s_phone 32-458-198-9557
s_comment 35C2RR0P C Nlgi2N
SxAj0hQkn7kpSz4wSxSwgMxj6k4MRmh0S2Qm7R3z4jB 00QBm
1

s_acctbal 8430.52
s_name Supplier#000000646
n_name FRANCE
p_partkey 11384
p_mfgr Manufacturer#3
s_address 61SjP65 y B0 32111
s_phone 16-601-220-5489
s_comment kiw4NSNBxNy5kywzwyx0PMM21xiMOhXR423Akkm
Q7CNwrzQS23Nzz22 mnm6P377Q3M
j7n 56BLm61xw1lh ksmN

s_acctbal 8271.39
s_name Supplier#000000146
n_name RUSSIA
p_partkey 4637
p_mfgr Manufacturer#5
s_address wh yPSk6hNB1B4133iQ0wS0 rhBhq4zQ31z
s_phone 32-792-619-3155
s_comment jjwgwljRO63 n7OM2MP0hg3L1m1WBMLmM1S4Cgyr
LA5PwC2P0AS6g3C5mkoj072NPig
731m

s_acctbal 8096.98
s_name Supplier#000000574
n_name RUSSIA
p_partkey 323
p_mfgr Manufacturer#4
s_address hCOj4Cgx43xx jP4QkL7gLN65
s_phone 32-866-246-8752
s_comment Ohxnj651B56315B3k5S5CBzwQyLk76z1j4ow2Q
BC2wAckxh3S0RCyx6nARzSRQ2010k0
BCPhog6yQm

s_acctbal 7392.78
s_name Supplier#000000170
n_name UNITED KINGDOM
p_partkey 7655
p_mfgr Manufacturer#2
s_address PCxjjzNQiHLNxlw0SiMmQ
s_phone 33-803-340-5398
s_comment M116S1xzg54iC3k7OPLQi3ciMhghz2BC1Qk
g5Ag12QsB1hg1ANrw4MR MBS 72A

s_acctbal 7205.20
s_name Supplier#000000477
n_name GERMANY
p_partkey 10956
p_mfgr Manufacturer#5
s_address M1mj6403h zmAZAgg Bjy050 2z
s_phone 17-180-144-7991
s_comment yR1yR SnMxmhPjAmBw
S02AxQ6yOhBR1owzm1xz00A25x075kj1Aknn7z2 0057hy0Bi
knwOQn6Pmz3gL4gJz27

s_acctbal 6820.35
s_name Supplier#000000007
n_name UNITED KINGDOM
p_partkey 13217
p_mfgr Manufacturer#5
s_address z45m2jBRz15iLLNz4
s_phone 33-990-965-2201
s_comment 1Phngjm1sQ10RzRACp014S70xSL
QPSBM16072skMLCgm400MjARLNQk3g1P3BB32AgB
M1462B0CP7Rh24

s_acctbal 6721.70

```

```

s_name Supplier#000000954
n_name FRANCE
p_partkey 4191
p_mfgr Manufacturer#3
s_address OM7xnNnkgQ mzh2g3RQmg1g
s_phone 16-537-341-8517
s_comment 5ni3yCkmz5ymx0Kcg74zhLA B516S1w152AkiByx1N1
NgghAkkmNz1jASj4mxzxzn0
ySg7hAYM3MRRnBj

s_acctbal 6329.90
s_name Supplier#000000996
n_name GERMANY
p_partkey 10735
p_mfgr Manufacturer#2
s_address k6135gA3zPwN17L3R145m1NacjngOQQBB300iYA
s_phone 17-447-811-3282
s_comment PBO7wj1QmM1h3AAA 1NQA10kkiJnkRNqQ0 mh1z6Qs0Gc51P1
ykmzNR2001N506ARS0
z3j

s_acctbal 6173.87
s_name Supplier#000000408
n_name RUSSIA
p_partkey 18139
p_mfgr Manufacturer#1
s_address Cni6 zR5C41h104Pox5h05 mg53CQ2Sw4SAM2M2x
s_phone 32-858-724-2950
s_comment 10SxMowhJON3khzQ124gNnyw7Bn4L7m14L511SR

```

[Output truncated]

Query 3

```

-- Start Query 3
-- using default substitutions
-- QUERY 3 SHIPPING PRIORITY QUERY

```

```

begin work;
Started transaction.

```

```

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

```

| l_orderkey | revenue | o_orderdate | o_shippriority |
|------------|-------------|-------------|----------------|
| 260930 | 320547.2525 | 1995-03-12 | 0 |
| 402497 | 298879.5320 | 1995-02-12 | 0 |
| 457859 | 296490.6754 | 1995-01-17 | 0 |
| 509889 | 294068.8736 | 1995-02-03 | 0 |
| 58117 | 292632.8325 | 1995-02-21 | 0 |
| 538311 | 279665.9960 | 1995-03-07 | 0 |
| 588421 | 275477.1172 | 1995-03-03 | 0 |
| 416167 | 273765.4530 | 1995-02-22 | 0 |
| 97830 | 273227.0610 | 1995-03-04 | 0 |
| 90276 | 272233.9174 | 1995-03-04 | 0 |

10 row(s) retrieved.

```

commit work;
Data committed.

```

Query 4

```

-- Start Query 4
-- using default substitutions
-- QUERY 4 ORDER PRIORITY CHECKING QUERY

```

```

begin work;
Started transaction.

```

```

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

```

```
o_orderpriority    order_count
1-URGENT           999
2-HIGH             1002
3-MEDIUM          1021
4-NOT SPECIFIED   997
5-LOW              1089
```

5 row(s) retrieved.

commit work;
Data committed.

Query 5

```
-- Start Query 5
-- using default substitutions
-- QUERY 5 LOCAL SUPPLIER VOLUME QUERY
```

begin work;
Started transaction.

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

| n_name | revenue |
|-----------|--------------|
| CHINA | 7349391.4710 |
| INDONESIA | 6485853.4033 |
| INDIA | 5505346.8197 |
| JAPAN | 5388883.5941 |
| VIETNAM | 4728846.6018 |

5 row(s) retrieved.

commit work;
Data committed.

Query 6

```
-- Start Query 6
-- using default substitutions
-- QUERY 6 FORECASTING REVENUE CHANGE QUERY
```

begin work;
Started transaction.

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

| revenue |
|---------------|
| 11450588.0434 |

1 row(s) retrieved.

commit work;
Data committed.

Query 7

```
-- Start Query 7
-- using default substitutions
-- QUERY 7 VOLUME SHIPPING QUERY
```

begin work;
Started transaction.

```
select
  n1.n_name as supp_nation,
  n2.n_name as cust_nation,
  year(l_shipdate) as year,
  sum(l_extendedprice * (1 - l_discount)) as revenue
from
  supplier, lineitem, order, 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 date('1995-01-01') and date('1996-12-
31')
group by n1.n_name, n2.n_name, 3
order by n1.n_name, n2.n_name, 3;
```

| supp_nation | cust_nation | year |
|--------------|-------------|------|
| FRANCE | GERMANY | 1995 |
| 4611421.4400 | | |
| FRANCE | GERMANY | 1996 |
| 4828420.3721 | | |
| GERMANY | FRANCE | 1995 |
| 6755766.8409 | | |
| GERMANY | FRANCE | 1996 |
| 5810951.3958 | | |

4 row(s) retrieved.

commit work;
Data committed.

Query 8

```
-- Start Query 8
-- using default substitutions
-- QUERY 8 NATIONAL MARKET SHARE QUERY
```

begin work;
Started transaction.

```
select
  year(o_orderdate) as year,
  round(sum(case when n2.n_name= 'BRAZIL'
then (l_extendedprice * (1 - l_discount))
else 0
end)/sum(l_extendedprice * (1 - l_discount)),2) as
mkt_share
from
  part, supplier, lineitem, order, 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 date('1995-01-01') and
date('1996-12-31') and
p_type = 'ECONOMY ANODIZED STEEL'
```

| year | mkt_share |
|------|-----------|
| 1995 | 0.05 |
| 1996 | 0.09 |

2 row(s) retrieved.

commit work;
Data committed.

Query 9

```
-- Start Query 9
-- using default substitutions
-- QUERY 9 PRODUCT TYPE PROFIT MEASURE QUERY
```

begin work;
Started transaction.

```
select
  n_name as nation,
  year(o_orderdate) as year,
  sum(l_extendedprice *
```

```

(1 - l_discount) - ps_supplycost * l_quantity) as
sum_profit
from
part, supplier, lineitem, partsupp, order, 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%'
group by n_name,2
order by n_name,2 desc;

```

| nation | year | sum_profit |
|-----------|------|--------------|
| ALGERIA | 1998 | 1946316.0053 |
| ALGERIA | 1997 | 2973825.6921 |
| ALGERIA | 1996 | 3308881.5165 |
| ALGERIA | 1995 | 3092227.2988 |
| ALGERIA | 1994 | 3406958.7104 |
| ALGERIA | 1993 | 3140744.0263 |
| ALGERIA | 1992 | 3330704.4066 |
| ARGENTINA | 1998 | 3045410.0081 |
| ARGENTINA | 1997 | 4255378.5927 |
| ARGENTINA | 1996 | 4651751.9367 |
| ARGENTINA | 1995 | 4897797.0030 |
| ARGENTINA | 1994 | 4823465.7691 |
| ARGENTINA | 1993 | 4499810.7131 |
| ARGENTINA | 1992 | 4764593.3861 |
| BRAZIL | 1998 | 2932051.3632 |
| BRAZIL | 1997 | 3784531.3499 |
| BRAZIL | 1996 | 3965665.6899 |
| BRAZIL | 1995 | 4063060.8607 |
| BRAZIL | 1994 | 4236277.3501 |
| BRAZIL | 1993 | 4363461.3131 |
| BRAZIL | 1992 | 4684749.2328 |
| CANADA | 1998 | 2217064.0383 |
| CANADA | 1997 | 2950110.6103 |
| CANADA | 1996 | 3184049.9686 |
| CANADA | 1995 | 3962540.1948 |
| CANADA | 1994 | 3365251.0225 |
| CANADA | 1993 | 3617013.3667 |
| CANADA | 1992 | 3407955.2491 |
| CHINA | 1998 | 3048192.0230 |
| CHINA | 1997 | 5001207.6910 |
| CHINA | 1996 | 4800958.3133 |
| CHINA | 1995 | 5154927.7284 |
| CHINA | 1994 | 5882634.5341 |
| CHINA | 1993 | 4733364.8206 |
| CHINA | 1992 | 5014704.0793 |
| EGYPT | 1998 | 1892538.7444 |
| EGYPT | 1997 | 3849220.0749 |
| EGYPT | 1996 | 3418656.5535 |
| EGYPT | 1995 | 3766170.6034 |
| EGYPT | 1994 | 3520025.5593 |
| EGYPT | 1993 | 4375424.7450 |
| EGYPT | 1992 | 4586034.3943 |
| ETHIOPIA | 1998 | 1860117.7283 |
| ETHIOPIA | 1997 | 3705722.3335 |
| ETHIOPIA | 1996 | 3577215.3925 |
| ETHIOPIA | 1995 | 3425219.5519 |
| ETHIOPIA | 1994 | 3428616.1848 |
| ETHIOPIA | 1993 | 3459815.4314 |
| ETHIOPIA | 1992 | 3280072.9080 |
| FRANCE | 1998 | 1592531.5484 |
| FRANCE | 1997 | 2746176.5385 |
| FRANCE | 1996 | 2505844.8797 |
| FRANCE | 1995 | 2902077.0045 |
| FRANCE | 1994 | 2532229.5603 |
| FRANCE | 1993 | 2305725.4424 |
| FRANCE | 1992 | 2955126.6886 |
| GERMANY | 1998 | 3538625.7338 |
| GERMANY | 1997 | 4425943.3995 |
| GERMANY | 1996 | 4266344.9555 |
| GERMANY | 1995 | 3952963.5162 |
| GERMANY | 1994 | 4462655.7983 |
| GERMANY | 1993 | 4435094.6575 |
| GERMANY | 1992 | 4521715.4116 |
| INDIA | 1998 | 3378369.3369 |
| INDIA | 1997 | 4186477.8481 |
| INDIA | 1996 | 5074383.9250 |
| INDIA | 1995 | 4487435.3793 |
| INDIA | 1994 | 4718312.6259 |
| INDIA | 1993 | 4499573.8099 |
| INDIA | 1992 | 4712930.3331 |
| INDONESIA | 1998 | 2902077.1015 |
| INDONESIA | 1997 | 4973644.2283 |
| INDONESIA | 1996 | 4977652.4887 |
| INDONESIA | 1995 | 5359380.1510 |
| INDONESIA | 1994 | 4854637.1996 |
| INDONESIA | 1993 | 4213131.4235 |
| INDONESIA | 1992 | 4999478.5062 |
| IRAN | 1998 | 2415763.1012 |
| IRAN | 1997 | 4227175.1094 |
| IRAN | 1996 | 4527365.0271 |
| IRAN | 1995 | 4139514.7174 |
| IRAN | 1994 | 4166316.3907 |
| IRAN | 1993 | 3366959.5882 |
| IRAN | 1992 | 3599399.7018 |
| IRAQ | 1998 | 2596922.6334 |
| IRAQ | 1997 | 3707054.1118 |
| IRAQ | 1996 | 3726138.3835 |
| IRAQ | 1995 | 4350503.8921 |
| IRAQ | 1994 | 4131512.7911 |
| IRAQ | 1993 | 3787196.4208 |
| IRAQ | 1992 | 4043738.1336 |
| JAPAN | 1998 | 2265666.9424 |
| JAPAN | 1997 | 3988819.2811 |
| JAPAN | 1996 | 4319004.5339 |
| JAPAN | 1995 | 4262698.6369 |
| JAPAN | 1994 | 3545212.6196 |
| JAPAN | 1993 | 4051565.9746 |
| JAPAN | 1992 | 3692137.4454 |

| | | |
|----------------|------|--------------|
| JORDAN | 1998 | 1978591.7418 |
| JORDAN | 1997 | 3315454.2870 |
| JORDAN | 1996 | 3236531.9798 |
| JORDAN | 1995 | 2778207.9861 |
| JORDAN | 1994 | 2420301.0715 |
| JORDAN | 1993 | 3272130.9349 |
| JORDAN | 1992 | 2649126.0864 |
| KENYA | 1998 | 2265677.7268 |
| KENYA | 1997 | 3493019.3230 |
| KENYA | 1996 | 3346373.2964 |
| KENYA | 1995 | 3537360.3249 |
| KENYA | 1994 | 2800950.7159 |
| KENYA | 1993 | 3477468.3019 |
| KENYA | 1992 | 2719618.0405 |
| MOROCCO | 1998 | 2549499.9295 |
| MOROCCO | 1997 | 3891824.8983 |
| MOROCCO | 1996 | 3730777.7351 |
| MOROCCO | 1995 | 3469641.1344 |
| MOROCCO | 1994 | 3747593.2076 |
| MOROCCO | 1993 | 3620742.6983 |
| MOROCCO | 1992 | 4303609.2486 |
| MOZAMBIQUE | 1998 | 2024719.4607 |
| MOZAMBIQUE | 1997 | 3706003.0867 |
| MOZAMBIQUE | 1996 | 3376430.9303 |
| MOZAMBIQUE | 1995 | 2737631.6427 |
| MOZAMBIQUE | 1994 | 3373146.4811 |
| MOZAMBIQUE | 1993 | 3608300.3738 |
| MOZAMBIQUE | 1992 | 3551263.9502 |
| PERU | 1998 | 2142791.9724 |
| PERU | 1997 | 4664076.1540 |
| PERU | 1996 | 3623628.9338 |
| PERU | 1995 | 3908939.7912 |
| PERU | 1994 | 3386204.1565 |
| PERU | 1993 | 3877048.4889 |
| PERU | 1992 | 3768394.2488 |
| ROMANIA | 1998 | 1760625.7030 |
| ROMANIA | 1997 | 2707685.3292 |
| ROMANIA | 1996 | 2553345.4786 |
| ROMANIA | 1995 | 2715901.5896 |
| ROMANIA | 1994 | 3023644.0564 |
| ROMANIA | 1993 | 2873247.3205 |
| ROMANIA | 1992 | 2728060.7073 |
| RUSSIA | 1998 | 2975973.2167 |
| RUSSIA | 1997 | 3785806.4681 |
| RUSSIA | 1996 | 4217625.5866 |
| RUSSIA | 1995 | 3883445.5153 |
| RUSSIA | 1994 | 4395855.0063 |
| RUSSIA | 1993 | 3900944.1769 |
| RUSSIA | 1992 | 4691358.6091 |
| SAUDI ARABIA | 1998 | 2931482.8334 |
| SAUDI ARABIA | 1997 | 5498943.1556 |
| SAUDI ARABIA | 1996 | 4473723.7384 |
| SAUDI ARABIA | 1995 | 5939212.9339 |
| SAUDI ARABIA | 1994 | 4527695.7092 |
| SAUDI ARABIA | 1993 | 4928702.0169 |
| SAUDI ARABIA | 1992 | 5527261.5215 |
| UNITED KINGDOM | 1998 | 3198731.3729 |
| UNITED KINGDOM | 1997 | 4363882.7444 |
| UNITED KINGDOM | 1996 | 4730956.6742 |
| UNITED KINGDOM | 1995 | 4842014.5464 |
| UNITED KINGDOM | 1994 | 4912706.5567 |
| UNITED KINGDOM | 1993 | 4415255.9632 |
| UNITED KINGDOM | 1992 | 4375524.2303 |
| UNITED STATES | 1998 | 1892045.1604 |
| UNITED STATES | 1997 | 3102027.8595 |
| UNITED STATES | 1996 | 3334320.2579 |
| UNITED STATES | 1995 | 3168244.6043 |
| UNITED STATES | 1994 | 3296960.1009 |
| UNITED STATES | 1993 | 3558109.0546 |
| UNITED STATES | 1992 | 2755129.3878 |
| VIETNAM | 1998 | 2906627.0252 |
| VIETNAM | 1997 | 4544560.4478 |
| VIETNAM | 1996 | 4314258.9990 |
| VIETNAM | 1995 | 4365340.8614 |
| VIETNAM | 1994 | 3686987.7125 |
| VIETNAM | 1993 | 3764237.1787 |
| VIETNAM | 1992 | 3420922.0038 |

175 row(s) retrieved.

commit work;
Data committed.

Database closed.

Query 10

```

-- Start Query 10
-- using default substitutions
-- QUERY 10 RETURNED ITEM REPORTING QUERY

```

begin work;
Started transaction.

```

select
FIRST 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, order, lineitem, nation

```

```

where
  c_custkey = o_custkey and
  l_orderkey = o_orderkey and
  o_orderdate >= date('1993-10-01') and
  o_orderdate < date('1993-10-01') + interval (3) month to
month and
  l_returnflag = 'R' and
  c_nationkey = n_nationkey
group by
  c_custkey, c_name, c_acctbal, c_phone, n_name, c_address, c_comment
order by revenue desc;

c_custkey 9722
c_name Customer#000009722
revenue 464618.2584
c_acctbal 474.04
n_name CANADA
c_address 1 Mwzn4NAk6j
c_phone 13-518-602-8070
c_comment 5L 500y RSGBAzPxm0Si5wk6xxOR7kh2nnP1gy7LBNg2how5B01
RmCM120L24Pkg7PS
1zwc11Bczn4L6i15PkixP26166

c_custkey 12800
c_name Customer#000012800
revenue 444265.6422
c_acctbal 1900.84
n_name PERU
c_address 57zjB3CQx4P40B2R2Mbi2mwhs11M4mn 4 nC6
c_phone 27-142-205-3552
c_comment 0hwg1S77RB56Rx4361Q0N16CxhOPnmhgwz
5z64wmj1kiC4jL350mM41y71hnxB11Pj
yA4hiN1wzjjm7SCxAN244mk2A

c_custkey 1025
c_name Customer#00001025
revenue 442028.0224
c_acctbal 3363.46
n_name INDIA
c_address 1kiSn154M5Roi
c_phone 18-588-456-4616
c_comment 0B145z233Rniw00o064nPBGP16kiM00y74iLh73g1N4 m310 jQ
yQzPA50ic3MA75g
2Bj162Nw4P

c_custkey 13028
c_name Customer#000013028
revenue 441692.2402
c_acctbal -452.66
n_name UNITED KINGDOM
c_address yP714ORSngN2LA3L5B
c_phone 33-253-660-2127
c_comment xPkmhL2Bkhknyww4kh1xwAyMn h11PSjBCNmi50LkyOh06CC
5nzoQCALz1iok2R66
w 105hrP03isP

c_custkey 3694
c_name Customer#00003694
revenue 438180.0696
c_acctbal 2960.44
n_name UNITED KINGDOM
c_address 2Cck1mCBOCC
c_phone 33-421-331-3127
c_comment MZLxQXL1Lx3MPx1Awg1B5g61zXkPnk xiAm6PhMMAAQ2nzN3S6zzgP
x70w01hhPx4Q
Rz1MMy02041A13mBo7jh2jAP0N60w367z

c_custkey 976
c_name Customer#00000976
revenue 435897.6317
c_acctbal 7772.85
n_name ROMANIA
c_address QzR 56Px1kg5 wANNAz02RS 30n Pm
c_phone 29-436-660-4732
c_comment kzn32776 gwzKzZzo4yx0Ankr7hR4R4x2SMwi1z3x6h
nN7OnNLRMm13 kz5SLwi1yk
1oxiws4g0wma5A 4hmgBSwRRiQ1

c_custkey 8206
c_name Customer#000008206
revenue 429905.1096
c_acctbal 6046.36
n_name ARGENTINA
c_address P yMg30BBBxB NmGCO3AmzN2
c_phone 11-571-859-1370
c_comment hLi122RMPmLC36oy0kx071zz2wCR0QQc17z26h1q3mm

c_custkey 13532
c_name Customer#000013532
revenue 427731.8043
c_acctbal -924.18
n_name KENYA
c_address 6i j7M5PBMx2kwwy26z0j4SL5S0mRCw13m1Rmw
c_phone 24-525-332-7244
c_comment 7ih7yrz214z067A1NPx64no515k
yJ6i3jLASpC15Q4Q1A31160iM1P iBXCixg6 1h
ch2RCnjozk5R ono 1ohhC3m4631m5

c_custkey 12745
c_name Customer#000012745
revenue 422327.6927
c_acctbal 9691.33
n_name CHINA
c_address SgS1LMC4gB2NM3wh
c_phone 28-985-189-6174
c_comment j172wjSw0 s6 7L4Cgwx Pky05N12LL7LBR

c_custkey 2344
c_name Customer#00002344
revenue 411240.1086
c_acctbal 5597.22
n_name MOROCCO
c_address 03PC71kBgw OAZPA1m2P 426zm3BNBN6Q10 6N
c_phone 25-593-745-7663

```

```

c_comment 5NBn0WRNngLw2z5kyn1AhL0ASyG6SMHM
i2kMOyxARAn100Q5j4CBNARix7AB1MAC

c_custkey 2656
c_name Customer#00002656
revenue 401185.9523
c_acctbal 8115.55
n_name ALGERIA
c_address On551AS3Rm5RXS m
c_phone 10-667-469-8092
c_comment 46ABx4jgn i m1BMPCLxRhyPQM4RNS 5y01L7zSomk
MHPxAxQQ61QnLj 17LymOhi415
innzOyB201 xzmw3gmX0SxiyBN5CSMNgCkLCKmgo

c_custkey 59
c_name Customer#00000059
revenue 400759.1501
c_acctbal 3458.60
n_name ARGENTINA
c_address wP6CMyC11y01S4CAM1mzm
c_phone 11-355-584-3112
c_comment 11g7xBcXxc75M 5AkmmnAk0067701MZA2R7A0Cx0Njixj56jL2iN
PNkSNQiy55m6ki3
OgnmM47mSR7B

c_custkey 7069
c_name Customer#00007069
revenue 396217.5195
c_acctbal 8198.94
n_name INDONESIA
c_address 55Cw7ChL4Bi50Nn2A4m2i2n4nSNQMQjm1
c_phone 19-644-744-1798
c_comment 6jNS624175z1xN1i41xo5zyPykPS1xni1S0NhkgOaksX7P

c_custkey 6553
c_name Customer#00006553
revenue 385863.5946
c_acctbal 8985.90
n_name MOZAMBIQUE
c_address R3LnnxONBjCLC0MRkxy7
c_phone 26-166-724-4677
c_comment 57cKNLWA3kh006j711wa1c25Bw6AMQ6i 6C00S607ARNny60ogh
3642mRxyiAgys
yk 3nP04473wkNg5R6gz041z3zmM2m7MiLAi1CC

c_custkey 3095
c_name Customer#00003095
revenue 384246.1083
c_acctbal 8829.21
n_name IRAQ
c_address S1gMCnBLwzi mCgB664 j100L11Sh1iPmGcGr5
c_phone 21-847-218-8188
c_comment 3LSx7Pxs A4A5C13gAy3mg4Qj2xQ1yx7xM1ka664AM7zmMzORh3C1h
MO3rw6Mymilj
AmG65hOMB4Sn44ko w01in7

c_custkey 3391
c_name Customer#00003391
revenue 382541.7762
c_acctbal 7742.35
n_name CANADA
c_address m3 CORMQNLzkShymLS imkCimRS120 NB
c_phone 13-592-494-2668
c_comment ynm1mHMBASikC1ncgh1mAhQ0 675S3y2R33yjknPQOS

c_custkey 13678
c_name Customer#000013678
revenue 376280.5564
c_acctbal 9030.40
n_name MOROCCO
c_address BMK771Qm11wNA0LghAkG3hCwN14
c_phone 25-306-951-3937
c_comment mo55SRASx1wp136nq5xBLznLhgw1kQ6P06imnxQ7kR0x71P0SzByMzh

c_custkey 6062
c_name Customer#00006062
revenue 374512.6544
c_acctbal 1370.35
n_name CANADA
c_address n5zzi160zyxA1kzx7x1nihigPzR OBkr znMOMh
c_phone 13-756-700-4918
c_comment 4zAm4wNB
1i4QRpPz2wM541x043hmLj403LBKALCP16hj2RQBO1OMN1y7ww1QP7w5i
Ssn0jNhAR yQnmz1h15j3

c_custkey 554
c_name Customer#00000554
revenue 373004.4702
c_acctbal 8395.57
n_name BRAZIL
c_address jC5zhQky4zQB271B5Sm AQHq Px0
c_phone 12-938-503-7317
c_comment 0nxCT3 xSmilQ0 1M
2n0NCiR1nmMxP25j26x2igLhN0xjgmGmmy70kzCACog0z2LA
jOm0RPRmOPiCAAQWL1Qsg 1ys3 gLCM1M2BzjnsjP13nwakk

c_custkey 13126
c_name Customer#000013126
revenue 371722.0011
c_acctbal 6172.91
n_name INDIA
c_address xPAS4MnPh40i5Q2h4NQ61zz4RkyAWANA
c_phone 18-288-190-4145
c_comment nm1mKAN6C0C1Q0mMmPz271iz4hk6L
2M1wPxh42N10R2hrwxz1wMkxO4MAYz7RCj43
NXLwQ3m6P27yAj

```

20 row(s) retrieved.

commit work;
Data committed.

Query 11

```
-- Start Query 11
-- using default substitutions
-- QUERY 11 IMPORTANT STOCK IDENTIFICATION QUERY
```

```
begin work;
Started transaction.
```

```
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) * 0.0010000000
   from
     partsupp, supplier, nation
   where
     ps_suppkey = s_suppkey and
     s_nationkey = n_nationkey and
     n_name = 'GERMANY')
order by value desc;
```

| ps_partkey | value |
|------------|-------------|
| 12098 | 16227681.21 |
| 5134 | 15709338.52 |
| 13334 | 15023662.41 |
| 17052 | 14351644.20 |
| 3452 | 14070870.14 |
| 12552 | 13332469.18 |
| 1084 | 13170428.29 |
| 5797 | 13038622.72 |
| 12633 | 12892561.61 |
| 403 | 12856217.34 |
| 1833 | 12024581.72 |
| 2084 | 11502875.36 |
| 17349 | 11354213.05 |
| 18427 | 11282385.24 |
| 2860 | 11262529.95 |
| 17852 | 10934711.93 |
| 9871 | 10889253.68 |
| 12231 | 10841131.39 |
| 6366 | 10759786.81 |
| 12146 | 10257362.66 |
| 5043 | 10226395.88 |
| 12969 | 10125777.93 |

```
22 row(s) retrieved.
```

```
commit work;
Data committed.
```

Query 12

```
-- Start Query 12
-- using default substitutions
-- QUERY 12 SHIPPING MODES AND ORDER PRIORITY QUERY
```

```
begin work;
Started transaction.
```

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

| l_shipmode | high_line_count | low_line_count |
|------------|-----------------|----------------|
| MAIL | 654 | 950 |
| SHIP | 684 | 1004 |

```
2 row(s) retrieved.
```

```
commit work;
Data committed.
```

Query 13

```
-- Start Query 13
-- using default substitutions
-- QUERY 13 SALES CLERK PERFORMANCE QUERY
```

```
begin work;
Started transaction.
```

```
select
  year(o_orderdate) as year,
  sum(l_extendedprice * (1 - l_discount)) as revenue
from
  lineitem, order
where
  o_orderkey = l_orderkey and
  o_clerk = 'Clerk#00000088' and
  l_returnflag = 'R'
group by 1
order by 1;
```

| year | revenue |
|------|--------------|
| 1992 | 1262855.7306 |
| 1993 | 964121.0328 |
| 1994 | 1750395.2936 |
| 1995 | 198820.2992 |

```
4 row(s) retrieved.
```

```
commit work;
Data committed.
```

Query 14

```
-- Start Query 14
-- using default substitutions
-- QUERY 14 PROMOTION EFFECT QUERY
```

```
begin work;
Started transaction.
```

```
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 >= date('1995-09-01') and
  l_shipdate < date('1995-09-01') + interval (1) month to
  month;
```

```
promo_revenue
16.7294166482723
```

```
1 row(s) retrieved.
```

```
commit work;
Data committed.
```

Query 15

```
-- Start Query 15b
-- using default substitutions
-- QUERY 15b TOP SUPPLIER QUERY
```

```
begin work;
Started transaction.
```

```
create table revenue0
(supplier_no integer,
total_revenue decimal(13,3)
) in o1ind;
Table created.
```

```
insert into revenue0
select
  l_suppkey,
  sum(l_extendedprice * (1 - l_discount))
from
  lineitem
```

```

where
    l_shipdate >= date('1996-01-01') and
    l_shipdate < date('1996-01-01') + interval (3) month to
month
group by l_suppkey;
1000 row(s) inserted.

```

```

select
    s_suppkey,
    s_name,
    s_address,
    s_phone,
    total_revenue
from
    supplier, revenue0
where
    s_suppkey = supplier_no and
    total_revenue = (select
        from
            max(total_revenue)
        revenue0)
order by s_suppkey;

```

```

s_suppkey      389
s_name         Supplier#000000389
s_address      P81Lx0xx6LMz3h7Rx63m6j3QmMx
s_phone        34-885-883-5717
total_revenue  1418538.214

```

1 row(s) retrieved.

```

drop table revenue0;
Table dropped.

```

```

commit work;
Data committed.

```

Query 16

```

-- Start Query 16
-- using default substitutions
-- QUERY 16 PARTS/SUPPLIER RELATIONSHIP QUERY

```

```

begin work;
Started transaction.

```

```

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 '%Better Business
Bureau%Complaints%')
group by p_brand,p_type,p_size
order by supplier_cnt desc,p_brand,p_type,p_size;

```

| p_brand | p_type | p_size | supplier_cnt |
|----------|--------------------------|--------|--------------|
| Brand#14 | SMALL ANODIZED NICKEL | 45 | 12 |
| Brand#22 | SMALL BURNISHED BRASS | 19 | 12 |
| Brand#25 | PROMO POLISHED COPPER | 14 | 12 |
| Brand#35 | LARGE ANODIZED STEEL | 45 | 12 |
| Brand#35 | PROMO BRUSHED COPPER | 9 | 12 |
| Brand#51 | ECONOMY ANODIZED STEEL | 9 | 12 |
| Brand#53 | LARGE BRUSHED NICKEL | 45 | 12 |
| Brand#11 | ECONOMY POLISHED COPPER | 14 | 8 |
| Brand#11 | LARGE PLATED STEEL | 23 | 8 |
| Brand#11 | PROMO POLISHED STEEL | 23 | 8 |
| Brand#11 | STANDARD ANODIZED COPPER | 9 | 8 |
| Brand#12 | ECONOMY BURNISHED BRASS | 9 | 8 |
| Brand#12 | LARGE ANODIZED BRASS | 14 | 8 |
| Brand#12 | SMALL ANODIZED TIN | 23 | 8 |
| Brand#12 | SMALL BRUSHED NICKEL | 23 | 8 |
| Brand#12 | STANDARD ANODIZED BRASS | 3 | 8 |
| Brand#12 | STANDARD BURNISHED TIN | 23 | 8 |
| Brand#13 | ECONOMY POLISHED BRASS | 9 | 8 |
| Brand#13 | LARGE BURNISHED COPPER | 45 | 8 |
| Brand#13 | MEDIUM ANODIZED STEEL | 23 | 8 |
| Brand#13 | MEDIUM PLATED NICKEL | 3 | 8 |
| Brand#13 | PROMO BURNISHED BRASS | 9 | 8 |
| Brand#13 | PROMO POLISHED BRASS | 3 | 8 |
| Brand#13 | PROMO POLISHED TIN | 36 | 8 |
| Brand#13 | SMALL BURNISHED STEEL | 23 | 8 |
| Brand#13 | STANDARD BRUSHED STEEL | 9 | 8 |
| Brand#14 | ECONOMY BRUSHED TIN | 3 | 8 |
| Brand#14 | ECONOMY BURNISHED TIN | 23 | 8 |
| Brand#14 | PROMO BRUSHED STEEL | 9 | 8 |
| Brand#14 | PROMO PLATED TIN | 45 | 8 |
| Brand#15 | ECONOMY PLATED TIN | 9 | 8 |
| Brand#15 | STANDARD BRUSHED COPPER | 14 | 8 |

| | | | |
|----------|--------------------------|----|---|
| Brand#15 | STANDARD PLATED TIN | 3 | 8 |
| Brand#21 | ECONOMY POLISHED TIN | 3 | 8 |
| Brand#21 | PROMO POLISHED COPPER | 9 | 8 |
| Brand#21 | PROMO POLISHED TIN | 49 | 8 |
| Brand#21 | STANDARD PLATED BRASS | 49 | 8 |
| Brand#21 | STANDARD PLATED NICKEL | 49 | 8 |
| Brand#22 | ECONOMY ANODIZED TIN | 49 | 8 |
| Brand#22 | ECONOMY BRUSHED BRASS | 14 | 8 |
| Brand#22 | LARGE BURNISHED TIN | 36 | 8 |
| Brand#22 | MEDIUM ANODIZED STEEL | 36 | 8 |
| Brand#22 | MEDIUM PLATED STEEL | 9 | 8 |
| Brand#22 | PROMO POLISHED NICKEL | 9 | 8 |
| Brand#22 | SMALL ANODIZED STEEL | 19 | 8 |
| Brand#22 | STANDARD ANODIZED COPPER | 23 | 8 |
| Brand#23 | ECONOMY BRUSHED NICKEL | 23 | 8 |
| Brand#23 | LARGE ANODIZED BRASS | 9 | 8 |
| Brand#23 | LARGE ANODIZED STEEL | 23 | 8 |
| Brand#23 | SMALL BRUSHED COPPER | 23 | 8 |

[Output truncated]

Query 17

```

-- Start Query 17a
-- using default substitutions
-- QUERY 17a MINIMUM COST SUPPLIER QUERY

```

```

begin work;
Started transaction.

```

```

create table avg_quantity0
(partkey integer,
avgqty decimal(13,3)
) in o1ind;
Table created.

```

```

insert into avg_quantity0
select
    p_partkey,
    0.2 * avg(l_quantity)
from
    part, lineitem
where
    p_partkey=l_partkey and
    p_brand= 'Brand#23' and
    p_container= 'MED BOX'
group by p_partkey;
18 row(s) inserted.

```

```

select
    sum(l_extendedprice)/7.0 as avg_yearly
from
    lineitem, avg_quantity0
where
    partkey = l_partkey and
    l_quantity < avgqty;

avg_yearly
24436.8800000000
1 row(s) retrieved.

```

```

drop table avg_quantity0;
Table dropped.

```

```

commit work;
Data committed.

```

Appendix D: Seed and Query Substitution Parameters

Seed

1021075513

Substitution Parameters

| | | | | | | |
|----|-----------------|--------------|-------------------|----|----|----|
| 1 | 90 | | | | | |
| 4 | 1995-07-01 | | | | | |
| 15 | 1995-07-01 | | | | | |
| 10 | 1994-02-01 | | | | | |
| 11 | JAPAN | 0.0000003333 | | | | |
| 6 | 1995-01-01 | 0.07 | 24 | | | |
| 2 | 26 | TIN | AFRICA | | | |
| 16 | Brand#34 | STANDARD | BURNISHED | 4 | 12 | 26 |
| | 29 | 25 | 22 | 33 | 15 | |
| 14 | 1995-08-01 | | | | | |
| 8 | JAPAN | ASIA | LARGE BRUSHED TIN | | | |
| 12 | TRUCK | MAIL | 1993-01-01 | | | |
| 17 | Brand#34 | SM BOX | | | | |
| 3 | FURNITURE | 1995-03-20 | | | | |
| 5 | ASIA | 1996-01-01 | | | | |
| 13 | Clerk#000000507 | | | | | |
| 7 | JAPAN | MOROCCO | | | | |
| 9 | linen | | | | | |

Appendix E: Implementation Specific Layer/Driver Code

```
#!/bin/ksh
# TPC-D Benchmark Query Stream Driver
set -u

if (( $# > 6 || $# < 3 )); then
    print "usage:\t$0 [-u ufset] runid seed sid [pdq]"
    print "\t-u run uf1/uf2 for power test. sid must be 0."
    print "\tufset is the set number of the update set to use"
    print "\trunid is a string identifying the run"
    print "\tseed must be an integer"
    print "\tsid, the stream ID, must be in the range [0..40]"
    print "\tpdq is per-stream pdqpriority in the range [1..100]"
    exit 2
fi

# External variables (expected to be set externally)
#
# TOP - directory containing config files for this database instance

DRIVETOP=${TOP}/drive
PATH=${DRIVETOP}/bin:${PATH}

# Internal variables (configurable here)
#
# DBGENDIR - location of the dbgen (and qgen) binary
# DBNAME - name of the database to use
# DSS_CONFIG - location of configuration data for dbgen
# NQUERIES - number of queries to run
# SF - Scale factor for this TPC-D database instance

DBGENDIR=${DRIVETOP}/dbgen.v1.3.1/appendix/dbgen
DBNAME=tpcd
export DSS_CONFIG=${DBGENDIR}
NQUERIES=17
SF=300

# NO CHANGES should be required below this line

if [[ $1 = "-u" ]]; then
    (( update = 1 )); shift
    (( ufset = $1 )); shift
    (( sid = 0 ));
    run="p"
else
    if (( $3 < 0 || $3 > 40 )); then
        print "$0: Error: sid out of range"
        print "usage:\t$0 runid seed sid [pdq]"
        print "\tsid must be in the range [1..40]"
        exit 2
    fi
    (( sid = $3 ))
    (( update = 0 ))
    run="t"
fi

runid=$1
seed=$2

# DSS_QUERY - location of TPC-D query-templates
# QGEN - path to the qgen program
# QUERY_DIR - directory where queries will be written by qgen
# RES_DIR - location to be used for storing results

export DSS_QUERY=${DRIVETOP}/templates
QGEN=${DBGENDIR}/qgen
QUERY_DIR=${DRIVETOP}/queries
RES_DIR=${DRIVETOP}/results/res_${runid}

if (( $# == 4 )); then
    pdq=$4
    if (( pdq < 1 || pdq > 100 )); then
        print "usage:\t$0 runid seed sid [pdq]"
        print "\tif specified, pdq must be in the range [1..100]"
        exit 2
    fi
else
    (( pdq = 100 ))
fi

if [[ ! -d $RES_DIR ]]; then
    mkdir -p $RES_DIR >/dev/null 2>&1
fi

# Generate session control file for this stream
rm -f session_input.${sid}
# save stdout as fd 3 and open session_input.${sid} as stdout (fd 1)
exec 3>&1 1>session_input.${sid}
print "set pdqpriority $pdq;"
print "set isolation repeatable read;"
print "set lock mode to wait;"

print -R "-- SF ${SF}" >${RES_DIR}/Timing.${sid}
```

```
print "!echo Stream ${sid} start - Timer: `timer` Date: `date`"
>>${RES_DIR}/Timing.${sid}"

if (( update )); then
    print -R "-- Start uf1.${sid}"
    sed -e s/{s}/{ufset}/ ${DSS_QUERY}/uf1.sql
    print "!echo Update uf1.${sid} end - Timer: `timer` Date: `date`"
    >>${RES_DIR}/Timing.${sid}"
fi

(( q = 1 ))
while (( q <= NQUERIES )); do
    $QGEN -c -s ${SF} -l ${RES_DIR}/params.${sid} -r ${seed} -p
    ${sid} ${q} \
    tee ${QUERY_DIR}/${sid}_${q}.sql \
    qn=$(nawk '/^--.*[Qq][Uu][Ee][Rr][Yy]/ { print $3 }')
    print -R "-- Start Query ${qn}"
    cat ${QUERY_DIR}/${sid}_${q}.sql
    print "!echo Query ${qn} end - Timer: `timer` Date: `date`"
    >>${RES_DIR}/Timing.${sid}"
    (( q += 1 ))
done

if (( update )); then
    print -R "-- Start uf2.${sid}"
    sed -e s/{s}/{ufset}/ ${DSS_QUERY}/uf2.sql
    print "!echo Update uf2.${sid} end - Timer: `timer` Date: `date`"
    >>${RES_DIR}/Timing.${sid}"
fi

exec 1>&- 1>&3 3>&- # close session_input (fd 1) and reset stdout to fd 1

# Run the query stream
dbaccess -e ${DBNAME} - <session_input.${sid} \
    >${RES_DIR}/session_out.${sid} 2>&1

mv session_input.${sid} ${RES_DIR}

# Process session_out to provide per-query results
nawk '
BEGIN { output = "/dev/null"; }
$1 ~ "^--" {
    if ($3 == "query") {
        close output;
        output = "${RES_DIR}/${sid}_" $4 ".out";
    } else if ($3 ~ "[Uu][Ff]") {
        split($3, id, "."); id[1] = tolower(id[1]); close
        output = sprintf("%s/mp%s%02d", "${RES_DIR}",
            "${runid}", id[1], "${sid}"); } }
{ print $0 >> output; }
END { close output; }' <${RES_DIR}/session_out.${sid}

# Prepare per-query results for audit per Francois Raab
if (( sid < 10 )); then
    psid="0${sid}"
fi
for q in ${RES_DIR}/${sid}_[1-9].out; do
    qn=${q##*_}
    qn=${qn%%.*}
    head -300 $q >${RES_DIR}/m${run}${runid}qry${qn}${psid}
done

uf1.sql
begin work;
create external table orderuf1_ext
sameas order using (
    format 'delimited',
    datafiles (
        "disk:1:/Tools/ufdata/order.tbl.u{s}.1",
        "disk:1:/Tools/ufdata/order.tbl.u{s}.2",
        "disk:1:/Tools/ufdata/order.tbl.u{s}.3",
        "disk:1:/Tools/ufdata/order.tbl.u{s}.4",
        "disk:2:/Tools/ufdata/order.tbl.u{s}.5",
        "disk:2:/Tools/ufdata/order.tbl.u{s}.6",
        "disk:2:/Tools/ufdata/order.tbl.u{s}.7",
        "disk:2:/Tools/ufdata/order.tbl.u{s}.8",
        "disk:3:/Tools/ufdata/order.tbl.u{s}.9",
        "disk:3:/Tools/ufdata/order.tbl.u{s}.10",
        "disk:3:/Tools/ufdata/order.tbl.u{s}.11",
        "disk:3:/Tools/ufdata/order.tbl.u{s}.12",
        "disk:4:/Tools/ufdata/order.tbl.u{s}.13",
        "disk:4:/Tools/ufdata/order.tbl.u{s}.14",
        "disk:4:/Tools/ufdata/order.tbl.u{s}.15",
        "disk:4:/Tools/ufdata/order.tbl.u{s}.16"
    ),
    deluxe
);
create external table lineuf1_ext
sameas lineitem using (
```

```

        format "delimited",
        datafiles (
            "disk:1:/Tools/ufdata/lineitem.tbl.u{s}.1",
            "disk:1:/Tools/ufdata/lineitem.tbl.u{s}.2",
            "disk:1:/Tools/ufdata/lineitem.tbl.u{s}.3",
            "disk:1:/Tools/ufdata/lineitem.tbl.u{s}.4",
            "disk:2:/Tools/ufdata/lineitem.tbl.u{s}.5",
            "disk:2:/Tools/ufdata/lineitem.tbl.u{s}.6",
            "disk:2:/Tools/ufdata/lineitem.tbl.u{s}.7",
            "disk:2:/Tools/ufdata/lineitem.tbl.u{s}.8",
            "disk:3:/Tools/ufdata/lineitem.tbl.u{s}.9",
            "disk:3:/Tools/ufdata/lineitem.tbl.u{s}.10",
            "disk:3:/Tools/ufdata/lineitem.tbl.u{s}.11",
            "disk:3:/Tools/ufdata/lineitem.tbl.u{s}.12",
            "disk:4:/Tools/ufdata/lineitem.tbl.u{s}.13",
            "disk:4:/Tools/ufdata/lineitem.tbl.u{s}.14",
            "disk:4:/Tools/ufdata/lineitem.tbl.u{s}.15",
            "disk:4:/Tools/ufdata/lineitem.tbl.u{s}.16"
        ),
        deluxe
    );

insert into order
select * from orderuf1_ext;

insert into lineitem
select * from lineuf1_ext;

commit work;

drop table orderuf1_ext;
drop table lineuf1_ext;
!xctl -b onmode -c

```

uf2.sql

```

begin work;
create scratch table orderufd_tmp
(d_orderkey integer)
fragment by hash (d_orderkey)
in psdbs;

create external table order_delete_ext
sameas orderufd_tmp using (
    format "delimited",
    datafiles (
        "disk:1:/Tools/ufdata/delete.{s}"
    ),
    rejectfile "/tmp/deleter.{s}.*c"
);

insert into orderufd_tmp
select * from order_delete_ext;

delete from lineitem where
l_orderkey in (
    select d_orderkey from orderufd_tmp
);
!xctl -b onmode -c
delete from order where
o_orderkey in (
    select d_orderkey from orderufd_tmp
);

commit work;

drop table orderufd_tmp;
drop table order_delete_ext;

```

timer.c

```

#include <stdio.h>
#include <sys/time.h>

main()
{
    struct timeval tp;
    double secs;

    gettimeofday(&tp, NULL);
    secs = tp.tv_sec + (double )tp.tv_usec / 1000000 ;
    printf("%.2f", secs);
}

```

Appendix F: First 10 records

select first 10 * from region;

```
r_regionkey 0
r_name      AFRICA
r_comment   XSx31zz31C1z40Amm05Aj1OxC3AMNOC0KACgwngg3g1P7LLLyw1Qy7R

r_regionkey 1
r_name      AMERICA
r_comment   kgyh3LSnc7k6z1Az0LP3k2L4QB1QL10673ojo1SPj0hgq7CO100SBgmQR41gPCMK
21A4251k1yAR4yBRAWR4Cm5miNW 4j1I3mMnxw17B

r_regionkey 2
r_name      ASIA
r_comment   NSg6x1M1A1z1m6mOR0Ajx nhRA77NgRxBwL1M6Py
RjySB3RLwkyPkWm2R1BQ xAZ
kOgKjm1lOgAgh1nP5inmNm76M1ijMS3S2zxONR15

r_regionkey 3
r_name      EUROPE
r_comment   z1SL7Qwg12hMBL5lh1z0M45QkjshwSy1004MLOh7wn1ARLQPyPayaii15761Li7A1
nr1S RQ45Lny7B2RyJ5P66MLhn NxhwB4C3ig050

r_regionkey 4
r_name      MIDDLE EAST
r_comment   R1lXmhPL23Cy2m1nG4QBnNASM Acki MPki7oi
```

select first 10 * from nation;

```
n_nationkey 0
n_name      ALGERIA
n_regionkey 0
n_comment   2Cxh17 L1iwk6Hm300izngN32CPwCikyLk6khmZSRA

n_nationkey 1
n_name      ARGENTINA
n_regionkey 1
n_comment   zQn3Okwz1wLn7PLS30hCgn56kP5Pyrikgi1B71L

n_nationkey 2
n_name      BRAZIL
n_regionkey 1
n_comment   gLmS0hACAmBCj2k1ki7RCPngPxnCOjNg4k
OtiAg57C05om1NWcnOyLx4OR SC y20
gPPAKnk5HxRhr50mgS1iPQz2NAXPL30n670ygc 1617sh4L5

n_nationkey 3
n_name      CANADA
n_regionkey 1
n_comment   4yMO AhnQ5Lh wZQAM662Aw1ByC17CxmzRwNR5nA104 x

n_nationkey 4
n_name      EGYPT
n_regionkey 4
n_comment   11im5126 Cxj NMQmLxOikni02j2m3Ah4yNR1QqiL507j2Q51yn

n_nationkey 5
n_name      ETHIOPIA
n_regionkey 0
n_comment   NS7n LSOP Oz5n1A1B2S02nN01Mh4SBXP irhBO 047R26 2B1M

n_nationkey 6
n_name      FRANCE
n_regionkey 3
n_comment   3mjmiZl s 3L3k2hNHN1P4w370xRxyN15wn

n_nationkey 7
n_name      GERMANY
n_regionkey 3
n_comment   z nOP4Rkwo CmzBB 516mAg 1Byw40M3QYNPA

n_nationkey 8
n_name      INDIA
n_regionkey 2
n_comment   MN1R5RCiRMj1l11wJn7Myn M1y1n1MmBQ17PL4C
kkxQkgPQ7i3w6B67R2QkO040
x14Q2iW76jRL7ihR5Q 0xc7Rrm5iQ2NAX2LiBm3Qio27j

n_nationkey 9
n_name      INDONESIA
n_regionkey 2
n_comment   SjpM0Q71Lj
7ABj6Mx1AQk3nLwi7B3PxcWjzmn4z1Lzgg6nnz0j0w zxc66gP6ykr
PMg
```

select first 10 * from supplier;

```
s_supplierkey 400030
s_name        Supplier#000400030
s_address     xPhA5603gmhi4MAzLnLkLyk04
s_nationkey   2
s_phone       12-599-961-7648
s_acctbal    6830.19
s_comment     AzwmnQR25BhjLR4hm1k1ON0CC15j1BO1xgLNL

s_supplierkey 400125
s_name        Supplier#000400125
s_address     mOOL mORLijx5nhkAm3R2g3ALQnN6wL16mmg44M
s_nationkey   14
s_phone       24-420-269-5538
s_acctbal    4053.26
```

```
s_comment     7P7 jg
h615yS74N07xBkgMhB11hmpK060L1gB1mOxOnm00ziAACziABw4Q1k

s_supplierkey 400268
s_name        Supplier#000400268
s_address     RAC55mnBQm02i
s_nationkey   8
s_phone       18-598-200-9002
s_acctbal    6281.65
s_comment     PRonnmRNjBPzi6gz2MMWnKx74S1AAwmmOR3S
j2x1l3yP1wLB2kSRhOPSg4Q10x33

s_supplierkey 400385
s_name        Supplier#000400385
s_address     5Mx1iSM124gk Oz3MxRC
s_nationkey   16
s_phone       26-866-419-4008
s_acctbal    4109.15
s_comment     Swg35jMhO6x400POAh75R BniAkkLm3M wyi3RC5L46GLQAxwOg

s_supplierkey 400414
s_name        Supplier#000400414
s_address     LxOAMhgCkww
s_nationkey   2
s_phone       12-841-978-3621
s_acctbal    7039.60
s_comment     Ogmj2706LA2xCL
k23NSAA6ww26j7my6AOkYLL47y4L1khLznnQmhz0 Am10 maxM
NkmMPL7jwOmMZABiS3B

s_supplierkey 400667
s_name        Supplier#000400667
s_address     jgC0jhMa4RSC55B3hM1g
s_nationkey   21
s_phone       31-841-224-4536
s_acctbal    144.04
s_comment     yn1MBwR1m0NsiNmMnBylBnQg7B43c25j0gk0mk45xBPCR3m7C3003CAnASHxLLkj

s_supplierkey 400769
s_name        Supplier#000400769
s_address     kxnh6njC MQA2Bcx1kj6AnkChl1L 7nA1nLz6C
s_nationkey   3
s_phone       13-711-613-3709
s_acctbal    9375.66
s_comment     3wkQiy w7RSghNA0m6x2i
Bmj3w0y1zZi2100wLMgRR3R5xg61M3yj w 45ji411R

s_supplierkey 401185
s_name        Supplier#000401185
s_address     7POMxR54SnPy703y2kn kSg2N
s_nationkey   7
s_phone       17-293-761-7018
s_acctbal    7745.00
s_comment     4mjm Qqh0z70B5m7ix1Lh107gP50kQLh gL6x1k
SA5LCNK5A5Aj06zQis7n 27SnA
z40142hxSBK2675z 3cjjCCOM5NR07AjK

s_supplierkey 401820
s_name        Supplier#000401820
s_address     QS6QAL1jAOCP611xm1ji73wAjiQCohmz
s_nationkey   1
s_phone       11-452-686-5670
s_acctbal    5509.05
s_comment     5kwlXmOjzgmkiAQxQxgOL1A6Sny3hM1P56Lw
2xL10g3S04150skNN7n

s_supplierkey 401934
s_name        Supplier#000401934
s_address     6xSx1MhBjmc12x P1hA4N
s_nationkey   7
s_phone       17-358-365-6564
s_acctbal    6546.13
s_comment     OCO2QBL2g53g6Q
6MP1x31lQy03R15iP3gk160LmBwM2gBANLQk6CzxBM0M6WmRShk
1mhZ1x3m2 L mBC6yLy

select first 10 * from customer;

C_custkey    9750086
C_name       Customer#009750086
C_address    Sw3NCRhxlA1R001hgw
C_nationkey  10
C_phone      20-470-398-2534
C_acctbal   2007.99
C_mktsegment MACHINERY
C_comment    Mj40X MxzgkLjniQwk6N3073 PsiAhwRxs OQ5

C_custkey    9750450
C_name       Customer#009750450
C_address    TRNi3655kiwRhSPPohm6BL0nSanN0R1R1w1PO
C_nationkey  10
C_phone      20-677-877-3542
C_acctbal   2755.36
C_mktsegment AUTOMOBILE
C_comment    xxRw1QWR6 1wrzn
mBRkyM60k4kJL7N31B5hCx5g554ny5Q7h0A1k0n5CLwL4310
w

C_custkey    9750496
C_name       Customer#009750496
C_address    77ziMMxkjzn1x4kRA 5 y6Nxxk7zBxk
C_nationkey  5
C_phone      15-239-596-6395
C_acctbal   7600.62
C_mktsegment MACHINERY
C_comment    1nclgMy27LR26yxx12mhPMiy1Qm1M45PM0LQw1NkMCQCjPjOCJLB1PM2ym6Rng61n
ON130 LRmR3y204C25S 6gc1N17C3jiP3

C_custkey    9750658
C_name       Customer#009750658
C_address    5Lk85y11x Ah71wnigi1w3sjA16Q
C_nationkey  17
```

```

c_phone      27-581-380-1520
c_acctbal    8387.07
c_mktsegment BUILDING
c_comment     B4P
i0BjSR3N4nz4MgXL3SRiKaZL4KRS24BQm6AS3Q0B6g1451jB1Q73PxzyM0Mi
405Ci PRP4ogg

c_custkey    9750935
c_name       Customer#009750935
c_address    1c07h71g2Q14 xcQ1yo o1BaG5B0gni4mH
c_nationkey  22
c_phone      32-286-144-8765
c_acctbal    3541.78
c_mktsegment FURNITURE
c_comment     LQ1NQ3wnn6mPyQyJAMgh
N3zAgSAhikN17sy41Bmmhn4iB12Lg6gk2S1NB4RkyxO1
MC52jB1wo

c_custkey    9750955
c_name       Customer#009750955
c_address    L52CzPm4 1yLM4zmg7QQPOMOC
c_nationkey  5
c_phone      15-805-663-9729
c_acctbal    7116.07
c_mktsegment HOUSEHOLD
c_comment     gj0 zg6Lhg2h nMxy2Lh1
jRAPL y6hMLjKx2wyy05n4gj iNx1mNgyB16RmRm

c_custkey    9751231
c_name       Customer#009751231
c_address    AA z5wxA1LO
c_nationkey  11
c_phone      21-113-763-2612
c_acctbal    -719.20
c_mktsegment BUILDING
c_comment     2wmLmRANKw4P7ywg3zSBSOmBNj1414y3MKAQjma5R624ShL0jmOm03Sn1xgxj

c_custkey    9751291
c_name       Customer#009751291
c_address    Og6RORkn743B1nyAxBO4MQ7jjiOz0LBW0CL2A5 P
c_nationkey  18
c_phone      28-969-883-9048
c_acctbal    3018.45
c_mktsegment HOUSEHOLD
c_comment     zC1k71MPPjsnj51Ck1ig0B
24z43B5wgh3nL4wxw1Pn3Q2xRLwRA4nL66WPwj5M
05Lk1SgzBRog54kxgjSk2N13SR

c_custkey    9751315
c_name       Customer#009751315
c_address    mnrwqml34nyn
c_nationkey  6
c_phone      16-241-346-2438
c_acctbal    8099.65
c_mktsegment MACHINERY
c_comment     mQ5RnNR7nR y6B3k1y1 10P0QxBnxz7

c_custkey    9751367
c_name       Customer#009751367
c_address    7ij4i1mCg037 jx 7116y5Q
c_nationkey  5
c_phone      15-809-556-3572
c_acctbal    4588.29
c_mktsegment MACHINERY
c_comment     Qy6yKANSho2S1s iQxNj2x7 wn4230
zQXN316g3nimQSO2LCL3RMMQw1NOAWzW
5kL1Om31g BijxPLXS02171Bm7k nMwmo

select first 10 * from part;

p_partkey    14000074
p_name       purple white khaki saddle peach
p_mfgr       Manufacturer#5
p_brand      Brand#55
p_type       PROMO ANODIZED NICKEL
p_size       14
p_container  LG CASE
p_retailprice 1173.38
p_comment    g27Qj11jzwoyhx3j01

p_partkey    14000159
p_name       sandy light magenta navy sky
p_mfgr       Manufacturer#1
p_brand      Brand#12
p_type       LARGE BRUSHED STEEL
p_size       13
p_container  WRAP PACK
p_retailprice 1258.46
p_comment    k7C4Cwj7M4h4M

p_partkey    14000543
p_name       moccasin pale smoke tan chocolate
p_mfgr       Manufacturer#3
p_brand      Brand#33
p_type       PROMO BURNISHED STEEL
p_size       34
p_container  JUMBO CAN
p_retailprice 1642.85
p_comment    k0h6

p_partkey    14001135
p_name       lavender steel orange chartreuse forest
p_mfgr       Manufacturer#2
p_brand      Brand#22
p_type       SMALL PLATED STEEL
p_size       34
p_container  SM BOX
p_retailprice 1035.43
p_comment    N6zx01j12 PjOLC1g23B

p_partkey    14001144
p_name       papaya floral blanchd peach
p_mfgr       Manufacturer#5

```

```

p_brand      Brand#54
p_type       MEDIUM ANODIZED BRASS
p_size       45
p_container  WRAP PACK
p_retailprice 1044.44
p_comment    NLjxQ6iA1nj6CAw

p_partkey    14001383
p_name       papaya spring tomato saddle lavender
p_mfgr       Manufacturer#2
p_brand      Brand#25
p_type       LARGE BURNISHED STEEL
p_size       30
p_container  MED PKG
p_retailprice 1283.68
p_comment    hiOwB

p_partkey    14001451
p_name       bisque chiffon tomato maroon spring
p_mfgr       Manufacturer#4
p_brand      Brand#42
p_type       STANDARD BURNISHED COPPER
p_size       10
p_container  JUMBO PKG
p_retailprice 1351.75
p_comment    Ck yN1PRL31P Sz12kOAPn

p_partkey    14001646
p_name       chiffon tomato spring dodger burlywood
p_mfgr       Manufacturer#3
p_brand      Brand#35
p_type       STANDARD POLISHED COPPER
p_size       9
p_container  MED JAR
p_retailprice 1546.94
p_comment    n2SMwxR3hjmA

p_partkey    14001669
p_name       red saddle green maroon blanchd
p_mfgr       Manufacturer#1
p_brand      Brand#12
p_type       STANDARD ANODIZED COPPER
p_size       38
p_container  WRAP CAN
p_retailprice 1569.96
p_comment    Qg2MPZP

p_partkey    14001814
p_name       pink burlywood almond aquamarine cornsilk
p_mfgr       Manufacturer#3
p_brand      Brand#33
p_type       ECONOMY BURNISHED BRASS
p_size       30
p_container  MED PACK
p_retailprice 1715.11
p_comment    S jx41n11

select first 10 * from partsupp;

ps_partkey   8000060
ps_suppkey   2000061
ps_availqty  7281
ps_supplycost 472.33
ps_comment   6RKA7NCB5jN0z2ACP 6xxj0Rj4ALyL2jyhkh7Am11Ax
QQwhC2kQP05BBiNj2nr0
1iL hwa203cc7 SM4RR6COMpN7N
ix0y1g2SANPm13Qwy1B71jiQzQg66S1CQB0A
2P3wnNm kQiQy n1i6w4zoiz1ksczCqML7gkw771

ps_partkey   8000060
ps_suppkey   2750063
ps_availqty  1966
ps_supplycost 597.31
ps_comment   jw31047yw1114jok0P jwiJ21L5OLL
2Rhn5M6k1B5SP2267P1w1QyknYAN113js
LCi2z7MxC6y

ps_partkey   8000060
ps_suppkey   500065
ps_availqty  1730
ps_supplycost 133.67
ps_comment   zkSQAgNx75yLk717mrx4x6jkz hj
nRZ0yRhjnw70CzSL6imw2gk0PP3hh5jP67i
2Qs OyCOM0j S7ANQ3gQyA
i46yRS1BynCRMQ6z1315znh0wmkg3LS11wPAZmy0
w5x2wjByzwj04wmghNkjNyQyYh0kRR0m7

ps_partkey   8000060
ps_suppkey   1250067
ps_availqty  2820
ps_supplycost 93.02
ps_comment   kQRM1ghxB4R3AnQ744Nzm50R5Oh
A1TL0hwrjzPNaw610OPz5L7AygikOQ1mZajk
RCRwj35MM57B055nN15LMCA5ggnjmz10cJRAJ6mjgzCxxQx35k

h301

ps_partkey   8000275
ps_suppkey   2000276
ps_availqty  1680
ps_supplycost 590.15
ps_comment   0k6R1x2zw25 62m41SyC kjj4L76zksxMQ4 RhiNPL
CjxMy0RS1 4RCCN61Bz1A
S1 S1N5m7SQoz432is2n5yxgB

ps_partkey   8000275
ps_suppkey   2750278
ps_availqty  6103
ps_supplycost 806.48
ps_comment   wn5A0Pi1nzLg1Snsyh1B7CCnyRC4gRnMC6Snk76211m1Q6j1
myCPQwP

ps_partkey   8000275
ps_suppkey   500280
ps_availqty  5558

```

```

ps_supplycost 237.53
ps_comment z1 MByz3yLzBn05iNwzP36x77RN7Mk5
341mXmPP17CR4PBh5CszPwo2nxzAR4Pz
Pkxz0xN0mh3kM4yAnnnw12BBA1mi5NO5ozg33RQWCNSPgO
n0y3wM1LM7143Rnk
2k83Lw5BQ3Nxi5
ps_partkey 8000275
ps_supkey 1250282
ps_availqty 1086
ps_supplycost 336.40
ps_comment 60S0670mmPywWNOzknSkR10zLkgyLmkMCO06
QXOPi67m0i7CCmn1m46BPLZyPg
MowCBAN0BS50zQ2gj3MwBg01x
ps_partkey 8000311
ps_supkey 2000312
ps_availqty 3480
ps_supplycost 599.13
ps_comment zj iL6MOhQ7NSmxBk632xz4x172h1370h11shmy1L3
Q5B3Rgk2LS41hAn1g2z1
B13GL57Rhkjrh2onjzmgP5 SAxgjn0ML7P37CnLmBRQxyy1RQ
LC6RNxB0j2S6
0j5hq6S6B4
Pnn5KA1nh5QMR3S005h21g2zWjJh1xQw4ihm26PwMh6P51L2z1mMS
P156
ps_partkey 8000311
ps_supkey 2750314
ps_availqty 7543
ps_supplycost 888.20
ps_comment h6 OSRhmyn4B71QCSC2B40kx0WazkCAAnj1wQxLYrgjBN6CAx
select first 10 * from order;
o_orderkey 210010855
o_custkey 17803579
o_orderstatus F
o_totalprice 235226.35
o_orderdate 1992-01-01
o_orderpriority 1-URGENT
o_clerk Clerk#000105288
o_shippriority 0
o_comment LwgAchLNOxk2g21hj B3imORM5RRjP45iw27kzWlZ
o_orderkey 210012448
o_custkey 15106837
o_orderstatus F
o_totalprice 213033.19
o_orderdate 1992-01-27
o_orderpriority 1-URGENT
o_clerk Clerk#000040868
o_shippriority 0
o_comment Ajkmr1C 40yLR0iQ3gxSM3PQ1gnwN
o_orderkey 210030307
o_custkey 14897828
o_orderstatus F
o_totalprice 76903.17
o_orderdate 1992-01-05
o_orderpriority 2-HIGH
o_clerk Clerk#000289433
o_shippriority 0
o_comment RjNlN1w7x25QLBnrXMM07BS76
o_orderkey 210036325
o_custkey 38615225
o_orderstatus F
o_totalprice 141395.09
o_orderdate 1992-01-27
o_orderpriority 4-NOT SPECIFIED
o_clerk Clerk#000207257
o_shippriority 0
o_comment 1 46Q 1AczBmAjhgYk471Lyh5 CQQ
o_orderkey 210040099
o_custkey 33980890
o_orderstatus F
o_totalprice 24171.07
o_orderdate 1992-01-14
o_orderpriority 3-MEDIUM
o_clerk Clerk#000166166
o_shippriority 0
o_comment PBmO2QgjmPPRkNA0jNz3
o_orderkey 210043141
o_custkey 16024166
o_orderstatus F
o_totalprice 15896.60
o_orderdate 1992-01-30
o_orderpriority 4-NOT SPECIFIED
o_clerk Clerk#000174342
o_shippriority 0
o_comment mwOXPSjh1h2xx5mN61NiB475nk0
o_orderkey 210055747
o_custkey 18848915
o_orderstatus F
o_totalprice 85158.08
o_orderdate 1992-01-15
o_orderpriority 3-MEDIUM
o_clerk Clerk#000216109
o_shippriority 0
o_comment PSAjiQ70oS5jS3AC0hc61kQzxm10w1145zLn
KARi1l3PzLz4LYSNZLRLl
o_orderkey 210058470
o_custkey 8969954
o_orderstatus F
o_totalprice 185628.67
o_orderdate 1992-01-28
o_orderpriority 1-URGENT
o_clerk Clerk#000152775
o_shippriority 0

```

```

o_comment L 40gy3zi336jPOQx3zzwK01 OR342B0n5hmKcCocxzmKj0
Sjj2i hkwog712w
NNCAw6Nw1RC
o_orderkey 210059170
o_custkey 37003823
o_orderstatus F
o_totalprice 95154.58
o_orderdate 1992-01-19
o_orderpriority 4-NOT SPECIFIED
o_clerk Clerk#000025537
o_shippriority 0
o_comment ix3mCyLA76PBki1hjBNnz3MQRgr40
o_orderkey 210059555
o_custkey 13224080
o_orderstatus F
o_totalprice 49894.68
o_orderdate 1992-01-09
o_orderpriority 3-MEDIUM
o_clerk Clerk#000052161
o_shippriority 0
o_comment ilh3yQPyMxSQmhi0MQSNQGS0BP22xxin
LmNwNRh6hm33L1hMMc40j66Lym71
select first 10 * from lineitem;
l_orderkey 75000449
l_partkey 14875205
l_suppkey 625210
l_linenum 4
l_quantity 3.00
l_extendedprice 3538.38
l_discount 0.02
l_tax 0.03
l_returnflag A
l_linestatus F
l_shipdate 1992-03-19
l_commitdate 1992-02-18
l_receiptdate 1992-03-22
l_shipinstruct DELIVER IN PERSON
l_shipmode REG AIR
l_comment h4m1iwwn6GNxms w
l_orderkey 750001153
l_partkey 16629268
l_suppkey 129279
l_linenum 1
l_quantity 20.00
l_extendedprice 23928.60
l_discount 0.07
l_tax 0.01
l_returnflag R
l_linestatus F
l_shipdate 1992-03-15
l_commitdate 1992-05-20
l_receiptdate 1992-03-18
l_shipinstruct TAKE BACK RETURN
l_shipmode RAIL
l_comment N11g3hh2MMCjy340gnSM0574gsz1okBh6PyQj6
l_orderkey 750003363
l_partkey 56586502
l_suppkey 2586503
l_linenum 3
l_quantity 34.00
l_extendedprice 53913.12
l_discount 0.06
l_tax 0.08
l_returnflag R
l_linestatus F
l_shipdate 1992-03-18
l_commitdate 1992-02-15
l_receiptdate 1992-04-10
l_shipinstruct NONE
l_shipmode REG AIR
l_comment RPRJLCA7g7BQxL6j2jCNP
l_orderkey 750006724
l_partkey 13595660
l_suppkey 2345665
l_linenum 2
l_quantity 2.00
l_extendedprice 3509.98
l_discount 0.08
l_tax 0.07
l_returnflag A
l_linestatus F
l_shipdate 1992-03-13
l_commitdate 1992-04-03
l_receiptdate 1992-04-09
l_shipinstruct TAKE BACK RETURN
l_shipmode FOB
l_comment ij6iKsry11s7iq4A n35L im55ic43mCj11xis1cG
l_orderkey 750006724
l_partkey 13550540
l_suppkey 800553
l_linenum 5
l_quantity 17.00
l_extendedprice 27027.79
l_discount 0.05
l_tax 0.07
l_returnflag R
l_linestatus F
l_shipdate 1992-03-12
l_commitdate 1992-04-28
l_receiptdate 1992-03-19
l_shipinstruct TAKE BACK RETURN
l_shipmode FOB
l_comment hOm1400jc6713A13Q4wkz2001yP4MhAywR7CP401MB
l_orderkey 750010433
l_partkey 37507396

```

| | |
|-----------------|---|
| l_suppkey | 2257409 |
| l_linenumbr | 3 |
| l_quantity | 4.00 |
| l_extendedprice | 5606.08 |
| l_discount | 0.04 |
| l_tax | 0.05 |
| l_returnflag | R |
| l_linestatus | F |
| l_shipdate | 1992-03-11 |
| l_commitdate | 1992-04-30 |
| l_receiptdate | 1992-04-10 |
| l_shipinstruct | NONE |
| l_shipmode | SHIP |
| l_comment | Wsi6MmB 4 0y0k5RSQ4nQmi nL |
| l_orderkey | 750010433 |
| l_partkey | 26798691 |
| l_suppkey | 2798692 |
| l_linenumbr | 4 |
| l_quantity | 26.00 |
| l_extendedprice | 46497.36 |
| l_discount | 0.00 |
| l_tax | 0.08 |
| l_returnflag | A |
| l_linestatus | F |
| l_shipdate | 1992-03-10 |
| l_commitdate | 1992-04-17 |
| l_receiptdate | 1992-03-28 |
| l_shipinstruct | DELIVER IN PERSON |
| l_shipmode | FOB |
| l_comment | xjmmCh1C11m7i6PRBPh6PA16y |
| l_orderkey | 750010433 |
| l_partkey | 45583957 |
| l_suppkey | 1333973 |
| l_linenumbr | 5 |
| l_quantity | 40.00 |
| l_extendedprice | 81547.20 |
| l_discount | 0.02 |
| l_tax | 0.02 |
| l_returnflag | R |
| l_linestatus | F |
| l_shipdate | 1992-03-08 |
| l_commitdate | 1992-05-08 |
| l_receiptdate | 1992-03-14 |
| l_shipinstruct | TAKE BACK RETURN |
| l_shipmode | SHIP |
| l_comment | 1Cywzjy0C4iNxm5PhCznB03RyM75Mn1SRShhh10 |
| l_orderkey | 750010433 |
| l_partkey | 49562302 |
| l_suppkey | 2312319 |
| l_linenumbr | 6 |
| l_quantity | 39.00 |
| l_extendedprice | 53111.37 |
| l_discount | 0.02 |
| l_tax | 0.06 |
| l_returnflag | R |
| l_linestatus | F |
| l_shipdate | 1992-03-14 |
| l_commitdate | 1992-04-02 |
| l_receiptdate | 1992-03-30 |
| l_shipinstruct | NONE |
| l_shipmode | REG AIR |
| l_comment | nhPwOy2jSz0AxRC1NCMA3xinSg1hgN |
| l_orderkey | 750010979 |
| l_partkey | 12980059 |
| l_suppkey | 980060 |
| l_linenumbr | 3 |
| l_quantity | 4.00 |
| l_extendedprice | 4553.64 |
| l_discount | 0.01 |
| l_tax | 0.05 |
| l_returnflag | A |
| l_linestatus | F |
| l_shipdate | 1992-03-07 |
| l_commitdate | 1992-03-18 |
| l_receiptdate | 1992-03-16 |
| l_shipinstruct | NONE |
| l_shipmode | SHIP |
| l_comment | Q5nm12hBy4mCz |

Appendix G: Third Party Price



SYSTEM SOLUTIONS

Quotation No.131549.3

Monday, October 19, 1998

Maria D. Lopez
 COMPAQ Computer Corporation
 Mail Stop: ZK02-3/M31

Dear Maria:

Thank you for your inquiry. We are please to quote as follows:

| ITEM | QTY | MODEL | DESCRIPTION | (\$)UNIT | EXTENSION |
|-------------------------|-----|-------------|-----------------------------------|-----------|---------------------|
| SERVER HARDWARE: | | | | | |
| 01 | 04 | DA-393GG-BA | Compaq AS GS140 6/525 | 269,610. | 1,038,440.00 |
| 02 | 04 | FM-8Z724-60 | 5YR 7X24/4HR AS8400 Dual 4GB | 81,741. | 326,964.00 |
| 03 | 04 | DWLPB-AA | PCI PIU for 8400 for System Cab. | 5,850. | 23,400.00 |
| 04 | 08 | DWLPB-BA | 2nd 12-Slot PCI for DWLPB-AA | 5,850. | 46,800.00 |
| 05 | 04 | KFTHA-AA | System I/O Module w/4I/O Channels | 5,330. | 21,320.00 |
| 06 | 04 | 17-03085-01 | Coaxial Assy.9.5'L 100 Conn | 189. | 758.00 |
| 07 | 04 | 762P2-AX | Dual 6/525 SMP CPU \$CREDIT | (42,250.) | (169,000.00) |
| 08 | 20 | 2T-762T8-AX | Dual 6/575 SMP Add-On CPU | 60,450. | 1,209,000.00 |
| 09 | 16 | FM-8UP24-60 | 5YR 7X24/4HR AS82/8400 CPU Up | 19,793. | 316,688.00 |
| 10 | 04 | MS7CC-GA | 4GB AlphaServer 8XXX Memory | 42,640. | 170,560.00 |
| 11 | 04 | FM-8MEM4-60 | 5YR 7X24/4HR AS82/8400 | 13,616. | 54,464.00 |
| 12 | 04 | SN-DE450-CA | PCI Ethernet Card (TW,TP,AUI) | 72. | 288.00 |
| 13 | 04 | FM-N1724-60 | 5YR 7X24/4HR NTWK \$0-\$499 | 110. | 440.00 |
| 14 | 04 | CCMAB-AA | Memory Channel Adapter | 2,725. | 10,900.00 |
| 15 | 04 | FM-MA724-60 | 5YR 7X24/4HR PCI Mem.Ch.Adpt | 1,531. | 6,124.00 |
| 16 | 04 | BC12N-10 | PCI-RM Link Cable | 163. | 652.00 |
| 17 | 01 | CCMHB-AA | Memory Channel Hub | 6,365. | 6,365.00 |
| 18 | 01 | FM-MH724-60 | 5YR 7X24/4HR PCI Mem Chnl.Hu. | 4,064. | 4,064.00 |
| 19 | 04 | VT510-AA | White North American, No Key | 244. | 976.00 |
| 20 | 04 | PCXLA-NA | US/CANADA W95 Kybd.Wht. | 16. | 64.00 |
| SERVER TOTAL | | | | | 3,069,285.00 |
| STORAGE: | | | | | |
| 01 | 06 | SW800-AA | Cab w/Tan Tray/7200RPM Device | 4,562. | 27,372.00 |
| 02 | 06 | FM-HASPS-60 | 1-5YR HW & SW 7X24 Service | 593. | 3,558.00 |
| 03 | 96 | DWZZB-VW | SCSI Signal Converter 16-bit SBB | 429. | 41,184.00 |
| 04 | 96 | FM-PS724-60 | 5YR 7X24/4HR P/S.Adpt & Floppy | 335. | 32,160.00 |

All information on this document is deemed by the writer to be highly confidential and is intended solely for use by the recipient.



SYSTEM SOLUTIONS

STORAGE: Continued

| | | | | | |
|----|-----|-------------|-----------------------------------|---------|------------|
| 05 | 96 | BA356-JC | 7-Dev Rackmount pwr no I/O Module | 789. | 75,744.00 |
| 06 | 96 | FM-EN724-60 | 5YR 7X24/4HR,Enclosures | 869. | 64,224.00 |
| 07 | 02 | DS-SWXES-BA | ESA High BW Building Blk 60Hz | 57,400. | 114,800.00 |
| 08 | 02 | FM-HASGA-60 | 5YR 7X24/4HR Integrated Svc. | 31,394. | 62,788.00 |
| 09 | 04 | KZPBA-CB | PCI to SCSI UWD Adapter | 536. | 2,144.00 |
| 10 | 04 | FM-PS4HR-60 | 5YR 7X24/4HR,P/S,Adpt. | 335. | 1,340.00 |
| 11 | 564 | DS-RZ1CB-VW | 4.3GB 7200 RPM Ultra SCSI HDD | 584 | 336,968.00 |
| 12 | 96 | BN21K-10 | 10M Cable,SCSI-3 "P" 1S/1R | 138. | 13,248.00 |
| 13 | 96 | KZPSA-BB | PCI-Host Bus Adapter (FWD) | 712. | 68,352.00 |
| 14 | 96 | FM-PS724-60 | 5YR 7X24/4HR P/S,Adapt & Floppy | 335. | 32,160.00 |

STORAGE TOTAL 868,450.00

SOFTWARE:

| | | | | | |
|----|----|-------------|------------------------------|---------|------------|
| 01 | 08 | QB-5SBAB-SB | HSZ70 SW U/A Lic/MCD/No Doc. | 488. | 3,904.00 |
| 02 | 04 | FM-D84US-60 | 5YR AS8400 Dual UNIX BRZ24X7 | 34,603. | 138,412.00 |
| 03 | 04 | QA-MT4AA-HB | Digital UNIX Alpha CDRM | 257. | 1,028.00 |
| 04 | 04 | QB-3RLAQ-KA | StorageWorks RAID O/S | 22,667. | 91,468.00 |

SOFTWARE TOTAL 234,812.00

Quote Vaid for 60 days from date.

The Compaq AlphaServer GS140 carries a 5 year,7X24/4hr response warranty. The storage products have a 5 year on-site, 4-hour, 7-day per week response with a 5 year return to manufacture warranty. All other products carry a standard warranty of 5 years on-site service: 4-hour X 7-days per week.

35% discount based on total dollar volume: Server Hardware and Software

10% discount based on total dollar volume: FM part numbers

Terms: TBD

Delivery:15 Days ARO

Shipping: FOB Origin

Warranty: Manufacturers' New Equipment Warranty

Installation: Included

Sincerely,

Philip K. Nolan
 Vice President
 (201)666-1122 ext. 111

All information on this document is deemed by the writer to be highly confidential and is intended solely for use by the recipient.

270 Broadway, Hillsdale, NJ 07642 Tel. 201-666-1122 Fax 201-666-0956
 www.lcssolutions.com