# TPC Benchmark™ H
# Full Disclosure Report

# Sun Microsystems Sun SPARC Enterprise M9000 Using Oracle Database 11g Enterprise Edition with Partitioning and Automatic Storage Management

**Submitted for Review**
**Report Date May 2, 2008 (Revised July 16, 2008)**

TPC Benchmark H Full Disclosure Report

First Printing



901 San Antonio Road, Palo Alto, California 94303 U.S.A.

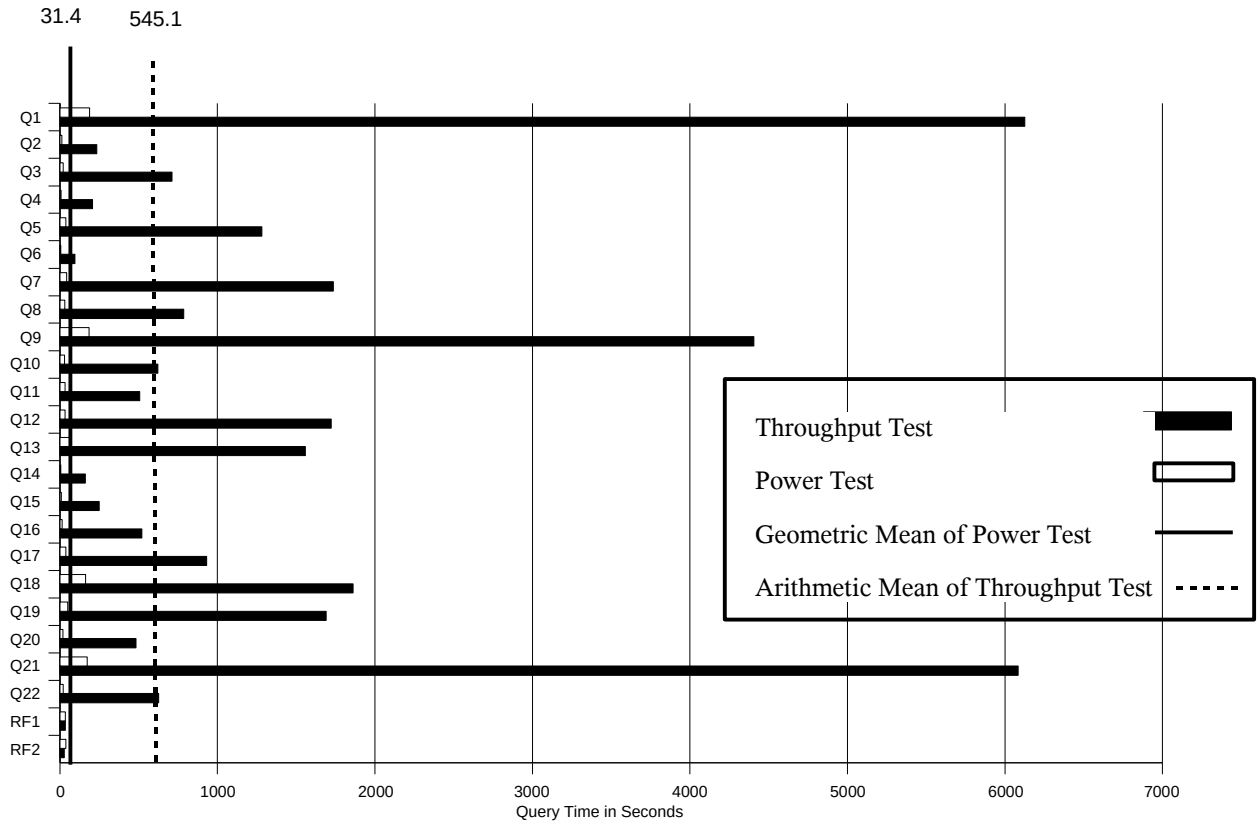
# Sun SPARC Enterprise M9000 with Oracle Database 11g

**TPC-H Rev. 2.6.2**

**May 2, 2008**
**Revised July 16, 2008**

| Total System Cost | Composite Query per Hour Metric | Price/Performance |
|---|---|---|
| **$2,859,795** | **118,573.3** QphH@1000GB | **$24.12** $/QphH@1000GB |

| Database Size | Database Manager | Operating System | Other Software | Availability Date |
|---|---|---|---|---|
| 1000GB | Oracle Database 11g Enterprise Edition with Partitioning and Automatic Storage Management | Solaris 10 | None | September 10, 2008 |




| Database Load Time = 1:35:27 | Load Includes Backup: N | Total Data Storage/Database Size=35.6 |
|---|---|---|
| RAID (Base tables): N | RAID (Base tables and auxiliary data structures): N | RAID (All): Y |

System Configuration: Sun SPARC Enterprise M9000 Server
Processors: 32 SPARC64 VI 2400 MHz processors on 32 chips, 64 cores, 128 threads
Memory: 512GB memory
Disks: 20 Sun StorageTek 2540 Arrays (20x12x146GB), 8 internal SAS disks (8x73GB)
Total Storage: 35,624GB (in this calculation one GB is defined as 1024*1024*1024 bytes)

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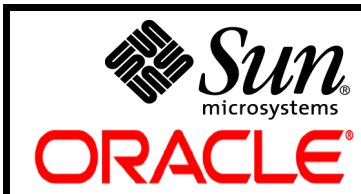
| Description | Part Number | Source | Unit Price | Qty | Ext. Price | 3 Yr. Maint. | Unit 3 Yr Maint. |
|---|---|---|---|---|---|---|---|
| **Server Hardware** | | | | | | | |
| Sun SE M9000-32 Base 1ph | SEHASY11Z | 1 | 275,000 | 1 | 275,000 | 147,654 | 147,654.48 |
| SE_CMU:4*SPARC64VI@2.4GHz w/64GB | SEMY4DE1Z | 1 | 404,000 | 8 | 3,232,000 | 172,775 | 21,596.89 |
| SE_PCI_E IO Unit: 8*slots | SEMY61Z | 1 | 18,000 | 8 | 144,000 | | |
| PWR Cord 1PHs M8000-9000 USA (included) | SEMX9P31Z | 1 | 0 | 5 | 0 | | |
| PCI-E Base IO Card | SEMY7BS1Z | 1 | 1,995 | 4 | 7,980 | | |
| 4GB PCIe Dual Host Bus Adapter, Emulex | SG-XPCIE2FC-EM4 | 1 | 1,995 | 20 | 39,900 | | |
| 15M Fibre Channel Cable | X9724A | 1 | 190 | 40 | 7,600 | | |
| ***Server Hardware Subtotal*** | | | | | **3,706,480** | **320,430** | |
| **Storage** | | | | | | | |
| 2540-1752G-12x146/15-2RAIDACRR | XTA2540R01A2E1752 | 1 | 14,320 | 20 | 286,400 | 102,010 | 5,100 |
| SE_73GB 10K RPM 2.5" SAS | SEMY3A11Z | 1 | 450 | 8 | 3600 | | |
| 72" StorEdge Expansion Rack | RSG-SG-XARY030A | 1 | 6,500 | 2 | 13,000 | | |
| Exp Cab 2U Universal Rack Mount Kit | TA-3000-2URK-19U | 1 | 350 | 40 | 14,000 | | |
| Power Cord for StorEdge | X3858A | 1 | 0 | 4 | 0 | | |
| ***Storage Subtotal*** | | | | | **317,000** | **102,010** | |
| **Server Software** | | | | | | | |
| Solaris 10 | | 3 | 0 | 1 | 0 | | |
| Sun Studio 12 | | 4 | 10 | 1 | 10 | 2,376 | 2,376 |
| Sun StorageTek Common Array Manager | | 1 | 0 | 1 | 0 | | |
| Oracle Database 11g Enterprise Edition, Named User Plus for 3 years | | 2 | 11,875 | 48 ‡ | 570,000 | | |
| Partitioning, Named User Plus for 3 years | | 2 | 2,875 | 48 ‡ | 138,000 | | |
| Oracle Database Server Support Package for 3 years | | 2 | 6,900 | 1 | | 6,900 | |
| ***Server Software Subtotal*** | | | | | **708,010** | **9,276** | |
| Sun Volume Discounts (50%) and Support Prepayment discount (35%) | | 1 | | | -2,011,745 | -148,685 | |
| Oracle Mandatory E-Business Discount (20%) | | 2 | | | -142,980 | | |
| | | | **Total** | | **2,576,765** | **283,030** | |
| Service for all Sun products is from Sun Microsystems, Inc. and is based on SunSpectrum Instant Upgrade Gold 7x24 | | | **3 Yr. Cost** | | **2,859,795** | | |
| Service for Oracle products is from Oracle Corp. | | | **QphH @1000GB** | | **118,573.30** | | |
| | | | **$/QphH @1000GB** | | **$24.12** | | |

**Notes (Source):**
1. Sun Microsystems, Inc. (see Appendix G)
2. Oracle Corp. (see Appendix G)
3. Download from SunSolve
4. Order media kit from sun.com

‡ 48 = 0.75 * 64. Explanation: For purposes of counting the number of processors which require licensing, a multicore chip with "n" cores shall be determined by multiplying "n" cores by a factor of 0.75

Audited by: François Raab, InfoSizing, Inc. (www.sizing.com)



# Sun SPARC Enterprise M9000 with Oracle Database 11g

**TPC-H Rev. 2.6.2**

**May 2, 2008**
**Revised July 16, 2008**

## Numerical Quantities

### Measurement Results:

| | |
|---|---|
| Database Scale Factor | = 1000GB |
| Total Data Storage / Database Size | = 35.6 |
| Start of database load time | = 04-11-2008 20:53:31 |
| End of database load time | = 04-11-2008 22:28:58 |
| Database Load Time | = 1:35:27 |
| Query Streams for Throughput Test | = 64 |
| TPC-H Power | = 114,725.4 |
| TPC-H Throughput | = 122,550.2 |
| TPC-H Composite Query-per-Hour Rating (QphH@1000GB) | = 118,573.3 |
| Total System Price Over 3 Years | = $2,859,795 |
| TPC-H Price/Performance Metric ($/QphH@1000GB) | = $24.12 |

### Measurement Intervals:

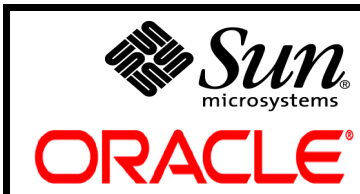
| | |
|---|---|
| Measurement Interval in Throughput Test (Ts) | = 41,361 seconds |

**Duration of Stream Execution:**

| Stream ID | Seed | Start Date | Start Time | End Date | End Time | Duration |
|---|---|---|---|---|---|---|
| Stream 0 | 411222858 | 04/11/08 | 22:30:20 | 04/11/08 | 22:51:26 | 00:21:06 |
| Stream 1 | 411222859 | 04/11/08 | 22:51:30 | 04/12/08 | 06:06:42 | 07:15:12 |
| Stream 2 | 411222860 | 04/11/08 | 22:51:30 | 04/12/08 | 04:49:59 | 05:58:29 |
| Stream 3 | 411222861 | 04/11/08 | 22:51:30 | 04/12/08 | 07:28:01 | 08:36:31 |
| Stream 4 | 411222862 | 04/11/08 | 22:51:30 | 04/12/08 | 08:50:00 | 09:58:30 |
| Stream 5 | 411222863 | 04/11/08 | 22:51:31 | 04/12/08 | 07:50:06 | 08:58:35 |
| Stream 6 | 411222864 | 04/11/08 | 22:51:31 | 04/12/08 | 08:16:33 | 09:25:02 |
| Stream 7 | 411222865 | 04/11/08 | 22:51:31 | 04/12/08 | 08:58:51 | 10:07:20 |
| Stream 8 | 411222866 | 04/11/08 | 22:51:31 | 04/12/08 | 07:04:53 | 08:13:22 |
| Stream 9 | 411222867 | 04/11/08 | 22:51:31 | 04/12/08 | 09:00:07 | 10:08:36 |
| Stream 10 | 411222868 | 04/11/08 | 22:51:31 | 04/12/08 | 08:51:53 | 10:00:22 |
| Stream 11 | 411222869 | 04/11/08 | 22:51:31 | 04/12/08 | 08:51:32 | 10:00:01 |
| Stream 12 | 411222870 | 04/11/08 | 22:51:31 | 04/12/08 | 04:45:10 | 05:53:39 |
| Stream 13 | 411222871 | 04/11/08 | 22:51:31 | 04/12/08 | 07:43:04 | 08:51:33 |
| Stream 14 | 411222872 | 04/11/08 | 22:51:31 | 04/12/08 | 08:42:38 | 09:51:07 |
| Stream 15 | 411222873 | 04/11/08 | 22:51:31 | 04/12/08 | 06:51:52 | 08:00:21 |
| Stream 16 | 411222874 | 04/11/08 | 22:51:31 | 04/12/08 | 07:15:35 | 08:24:04 |
| Stream 17 | 411222875 | 04/11/08 | 22:51:31 | 04/12/08 | 07:33:56 | 08:42:25 |
| Stream 18 | 411222876 | 04/11/08 | 22:51:31 | 04/12/08 | 08:39:56 | 09:48:25 |
| Stream 19 | 411222877 | 04/11/08 | 22:51:31 | 04/12/08 | 08:48:33 | 09:57:02 |
| Stream 20 | 411222878 | 04/11/08 | 22:51:31 | 04/12/08 | 07:29:13 | 08:37:42 |
| Stream 21 | 411222879 | 04/11/08 | 22:51:32 | 04/12/08 | 07:50:45 | 08:59:13 |
| Stream 22 | 411222880 | 04/11/08 | 22:51:32 | 04/12/08 | 08:54:39 | 10:03:07 |
| Stream 23 | 411222881 | 04/11/08 | 22:51:32 | 04/12/08 | 06:28:31 | 07:36:59 |
| Stream 24 | 411222882 | 04/11/08 | 22:51:32 | 04/12/08 | 08:36:19 | 09:44:47 |
| Stream 25 | 411222883 | 04/11/08 | 22:51:32 | 04/12/08 | 07:39:08 | 08:47:36 |
| Stream 26 | 411222884 | 04/11/08 | 22:51:32 | 04/12/08 | 08:00:07 | 09:08:35 |
| Stream 27 | 411222885 | 04/11/08 | 22:51:32 | 04/12/08 | 08:27:36 | 09:36:04 |
| Stream 28 | 411222886 | 04/11/08 | 22:51:32 | 04/12/08 | 08:09:58 | 09:18:26 |
| Stream 29 | 411222887 | 04/11/08 | 22:51:32 | 04/12/08 | 09:13:13 | 10:21:41 |
| Stream 30 | 411222888 | 04/11/08 | 22:51:32 | 04/12/08 | 08:45:55 | 09:54:23 |
| Stream 31 | 411222889 | 04/11/08 | 22:51:32 | 04/12/08 | 08:28:55 | 09:37:23 |
| Stream 32 | 411222890 | 04/11/08 | 22:51:32 | 04/12/08 | 09:12:35 | 10:21:03 |

**Duration of Stream Execution (continued):**

| Stream ID | Seed | Start Date | Start Time | End Date | End Time | Duration |
|---|---|---|---|---|---|---|
| Stream 33 | 411222891 | 04/11/08 | 22:51:32 | 04/12/08 | 08:57:46 | 10:06:14 |
| Stream 34 | 411222892 | 04/11/08 | 22:51:32 | 04/12/08 | 07:21:45 | 08:30:13 |
| Stream 35 | 411222893 | 04/11/08 | 22:51:32 | 04/12/08 | 08:18:27 | 09:26:55 |
| Stream 36 | 411222894 | 04/11/08 | 22:51:32 | 04/12/08 | 08:19:57 | 09:28:25 |
| Stream 37 | 411222895 | 04/11/08 | 22:51:32 | 04/12/08 | 09:08:24 | 10:16:52 |
| Stream 38 | 411222896 | 04/11/08 | 22:51:33 | 04/12/08 | 08:58:27 | 10:06:54 |
| Stream 39 | 411222897 | 04/11/08 | 22:51:33 | 04/12/08 | 08:46:00 | 09:54:27 |
| Stream 40 | 411222898 | 04/11/08 | 22:51:33 | 04/12/08 | 06:54:22 | 08:02:49 |
| Stream 41 | 411222899 | 04/11/08 | 22:51:33 | 04/12/08 | 08:53:28 | 10:01:55 |
| Stream 42 | 411222900 | 04/11/08 | 22:51:33 | 04/12/08 | 08:28:40 | 09:37:07 |
| Stream 43 | 411222901 | 04/11/08 | 22:51:33 | 04/12/08 | 08:28:00 | 09:36:27 |
| Stream 44 | 411222902 | 04/11/08 | 22:51:33 | 04/12/08 | 07:18:46 | 08:27:13 |
| Stream 45 | 411222903 | 04/11/08 | 22:51:33 | 04/12/08 | 08:00:50 | 09:09:17 |
| Stream 46 | 411222904 | 04/11/08 | 22:51:33 | 04/12/08 | 07:12:37 | 08:21:04 |
| Stream 47 | 411222905 | 04/11/08 | 22:51:33 | 04/12/08 | 09:07:38 | 10:16:05 |
| Stream 48 | 411222906 | 04/11/08 | 22:51:34 | 04/12/08 | 08:06:57 | 09:15:23 |
| Stream 49 | 411222907 | 04/11/08 | 22:51:34 | 04/12/08 | 09:02:26 | 10:10:52 |
| Stream 50 | 411222908 | 04/11/08 | 22:51:34 | 04/12/08 | 09:00:07 | 10:08:33 |
| Stream 51 | 411222909 | 04/11/08 | 22:51:34 | 04/12/08 | 08:52:04 | 10:00:30 |
| Stream 52 | 411222910 | 04/11/08 | 22:51:34 | 04/12/08 | 06:20:06 | 07:28:32 |
| Stream 53 | 411222911 | 04/11/08 | 22:51:34 | 04/12/08 | 06:19:57 | 07:28:23 |
| Stream 54 | 411222912 | 04/11/08 | 22:51:34 | 04/12/08 | 06:55:36 | 08:04:02 |
| Stream 55 | 411222913 | 04/11/08 | 22:51:34 | 04/12/08 | 09:05:24 | 10:13:50 |
| Stream 56 | 411222914 | 04/11/08 | 22:51:34 | 04/12/08 | 06:26:23 | 07:34:49 |
| Stream 57 | 411222915 | 04/11/08 | 22:51:34 | 04/12/08 | 08:16:33 | 09:24:59 |
| Stream 58 | 411222916 | 04/11/08 | 22:51:34 | 04/12/08 | 06:23:04 | 07:31:30 |
| Stream 59 | 411222917 | 04/11/08 | 22:51:35 | 04/12/08 | 07:49:06 | 08:57:31 |
| Stream 60 | 411222918 | 04/11/08 | 22:51:35 | 04/12/08 | 06:10:04 | 07:18:29 |
| Stream 61 | 411222919 | 04/11/08 | 22:51:35 | 04/12/08 | 05:16:11 | 06:24:36 |
| Stream 62 | 411222920 | 04/11/08 | 22:51:35 | 04/12/08 | 08:42:29 | 09:50:54 |
| Stream 63 | 411222921 | 04/11/08 | 22:51:35 | 04/12/08 | 08:26:03 | 09:34:28 |
| Stream 64 | 411222922 | 04/11/08 | 22:51:35 | 04/12/08 | 08:10:37 | 09:19:02 |
| Refresh | | 04/12/08 | 9:13:13 | 04/12/08 | 10:20:51 | 01:07:38 |



# Sun SPARC Enterprise M9000 with Oracle Database 11g

**TPC-H Rev. 2.6.2**

**May 2, 2008**
**Revised July 16, 2008**

## TPC-H Timing Intervals (in seconds):

| | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stream 0 | 188.0 | 12.7 | 20.4 | 7.8 | 38.1 | 5.5 | 42.7 | 31.8 | 185.1 | 29.9 | 32.3 | 33.3 |
| Stream 1 | 1,314.1 | 350.3 | 931.3 | 0.1 | 2,737.0 | 137.7 | 0.1 | 938.4 | 0.1 | 1,477.2 | 588.7 | 1,914.3 |
| Stream 2 | 0.1 | 213.1 | 834.7 | 365.9 | 2,763.4 | 6.7 | 2,040.4 | 905.0 | 5,113.1 | 0.1 | 606.3 | 2,022.1 |
| Stream 3 | 9,013.3 | 245.8 | 702.2 | 0.1 | 4,103.4 | 120.0 | 2,130.3 | 894.4 | 1,258.5 | 0.1 | 710.1 | 1,786.5 |
| Stream 4 | 6,364.0 | 222.7 | 228.5 | 0.1 | 1,324.2 | 141.6 | 919.9 | 801.4 | 5,421.5 | 1,238.1 | 518.4 | 2,214.4 |
| Stream 5 | 8,579.8 | 245.8 | 807.5 | 0.1 | 0.1 | 0.1 | 2,210.7 | 823.7 | 4,187.4 | 316.0 | 527.7 | 2,615.0 |
| Stream 6 | 0.1 | 234.5 | 1,620.5 | 292.0 | 2,892.3 | 118.2 | 1,972.5 | 800.3 | 5,583.7 | 1,224.9 | 492.0 | 1,975.1 |
| Stream 7 | 8,943.4 | 198.9 | 277.6 | 271.5 | 97.5 | 7.6 | 89.2 | 786.6 | 4,269.8 | 51.3 | 401.0 | 38.4 |
| Stream 8 | 9,819.1 | 181.3 | 0.1 | 325.2 | 1,810.0 | 0.1 | 2,193.7 | 783.2 | 5,649.2 | 983.0 | 465.3 | 2,583.5 |
| Stream 9 | 4,452.8 | 221.8 | 1,046.8 | 371.5 | 430.1 | 0.1 | 1,742.7 | 1,511.8 | 3,191.5 | 0.1 | 705.3 | 1,565.2 |
| Stream 10 | 8,290.2 | 245.8 | 541.1 | 134.2 | 756.4 | 693.5 | 2,290.0 | 371.0 | 5,487.1 | 0.1 | 274.4 | 2,969.1 |
| Stream 11 | 0.1 | 102.0 | 845.3 | 0.1 | 0.1 | 56.4 | 719.9 | 829.5 | 0.1 | 0.1 | 617.0 | 2,461.4 |
| Stream 12 | 4,500.8 | 226.6 | 917.5 | 304.3 | 0.1 | 134.6 | 2,354.5 | 827.1 | 1,199.7 | 1,111.7 | 558.1 | 2,375.5 |
| Stream 13 | 6,275.3 | 174.1 | 910.0 | 0.1 | 0.1 | 106.9 | 2,613.8 | 685.2 | 6,341.8 | 0.1 | 479.0 | 2,765.8 |
| Stream 14 | 8,254.4 | 43.6 | 347.5 | 386.5 | 1,972.8 | 0.1 | 2,474.2 | 476.4 | 396.1 | 0.1 | 243.3 | 576.8 |
| Stream 15 | 8,514.6 | 195.9 | 0.1 | 268.8 | 0.1 | 110.2 | 2,108.0 | 898.0 | 384.0 | 0.1 | 743.2 | 1,135.9 |
| Stream 16 | 5,647.7 | 259.6 | 834.3 | 308.9 | 1,250.9 | 109.5 | 2,170.5 | 776.6 | 4,539.8 | 0.1 | 499.2 | 1,762.4 |
| Stream 17 | 9,930.2 | 237.9 | 1,565.8 | 0.1 | 2,749.3 | 111.0 | 2,079.1 | 780.0 | 5,198.2 | 0.1 | 560.0 | 1,282.9 |
| Stream 18 | 3,601.1 | 235.2 | 1,043.2 | 327.3 | 95.7 | 122.2 | 1,077.0 | 714.8 | 4,202.4 | 1,291.1 | 542.4 | 1,209.2 |
| Stream 19 | 4,598.5 | 254.0 | 728.3 | 1,192.9 | 2,109.4 | 90.5 | 2,114.9 | 989.5 | 5,494.3 | 0.1 | 388.5 | 2,894.9 |
| Stream 20 | 8,274.2 | 198.5 | 901.7 | 306.8 | 0.1 | 95.4 | 2,530.8 | 578.1 | 5,006.8 | 0.1 | 448.2 | 2,135.5 |
| Stream 21 | 2,366.1 | 158.5 | 641.5 | 0.1 | 0.1 | 82.2 | 2,253.3 | 777.5 | 4,770.8 | 0.1 | 609.1 | 2,047.0 |
| Stream 22 | 8,620.5 | 209.1 | 0.1 | 318.2 | 1,598.8 | 77.5 | 1,520.2 | 546.1 | 2,742.6 | 0.1 | 545.2 | 2,191.4 |
| Stream 23 | 0.1 | 223.1 | 1,014.0 | 0.1 | 0.1 | 153.1 | 2,219.0 | 769.4 | 5,824.6 | 1,306.0 | 555.4 | 1,980.2 |
| Stream 24 | 2,580.1 | 200.6 | 968.0 | 0.1 | 1,073.3 | 0.1 | 2,541.1 | 819.9 | 6,562.0 | 1,530.8 | 248.6 | 1,553.5 |
| Stream 25 | 8,138.3 | 234.2 | 0.1 | 0.1 | 0.1 | 119.8 | 2,063.4 | 866.2 | 4,693.6 | 588.0 | 665.7 | 2,504.9 |
| Stream 26 | 8,764.7 | 213.5 | 1,035.0 | 381.3 | 453.2 | 0.1 | 2,578.2 | 673.0 | 6,307.5 | 0.1 | 524.2 | 1,727.3 |
| Stream 27 | 8,237.2 | 252.8 | 0.1 | 0.1 | 2,066.7 | 107.1 | 2,561.9 | 948.0 | 5,865.6 | 827.3 | 373.3 | 1,464.6 |
| Stream 28 | 8,747.3 | 203.1 | 897.7 | 356.2 | 2,375.5 | 107.7 | 2,374.6 | 677.2 | 5,030.4 | 1,930.6 | 312.5 | 2,291.0 |
| Stream 29 | 8,539.1 | 132.0 | 0.1 | 7.7 | 0.1 | 142.5 | 52.9 | 991.8 | 6,992.7 | 1,953.8 | 396.7 | 2,800.2 |
| Stream 30 | 8,154.9 | 87.8 | 824.8 | 0.1 | 2,584.2 | 0.1 | 2,532.6 | 345.1 | 6,249.0 | 0.1 | 259.1 | 1,134.4 |
| Stream 31 | 8,834.8 | 1,075.0 | 828.0 | 0.1 | 1,934.1 | 0.1 | 2,099.4 | 570.4 | 8,357.1 | 0.1 | 808.4 | 1,292.0 |
| Stream 32 | 7,789.5 | 19.4 | 1,151.5 | 327.8 | 2,448.1 | 138.6 | 2,540.5 | 800.3 | 2,950.0 | 29.2 | 204.5 | 1,949.4 |

## TPC-H Timing Intervals (continued):

| | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stream 33 | 3,447.0 | 289.7 | 0.1 | 366.0 | 2,282.1 | 89.0 | 2,402.5 | 676.5 | 5,743.2 | 1,443.3 | 581.9 | 1,027.5 |
| Stream 34 | 5,526.7 | 192.8 | 1,031.3 | 341.7 | 0.1 | 0.1 | 2,248.2 | 689.3 | 5,276.6 | 0.1 | 972.4 | 1,038.0 |
| Stream 35 | 8,986.1 | 227.1 | 564.6 | 0.1 | 2,511.3 | 0.1 | 0.1 | 804.4 | 4,178.6 | 1,306.6 | 307.3 | 1,589.5 |
| Stream 36 | 8,434.3 | 175.5 | 930.7 | 349.9 | 0.1 | 0.1 | 2,076.9 | 525.2 | 4,833.6 | 0.1 | 623.7 | 1,202.7 |
| Stream 37 | 7,765.2 | 128.1 | 888.0 | 0.1 | 2,152.1 | 0.1 | 2,259.0 | 1,037.1 | 5,856.3 | 0.1 | 640.6 | 1,122.5 |
| Stream 38 | 8,210.0 | 285.2 | 1,037.2 | 363.4 | 3,882.0 | 0.1 | 2,177.8 | 765.7 | 2,176.3 | 766.1 | 545.5 | 1,790.5 |
| Stream 39 | 9,038.8 | 87.2 | 1,524.5 | 276.7 | 2,708.0 | 137.2 | 3,003.0 | 460.3 | 4,399.3 | 0.1 | 258.2 | 701.5 |
| Stream 40 | 7,996.3 | 231.9 | 834.4 | 294.1 | 0.1 | 115.9 | 2,135.2 | 814.1 | 5,556.1 | 0.1 | 494.5 | 2,060.7 |
| Stream 41 | 7,614.4 | 314.0 | 0.1 | 345.7 | 0.1 | 137.9 | 781.6 | 878.8 | 7,237.4 | 762.3 | 516.4 | 79.4 |
| Stream 42 | 251.8 | 225.2 | 944.0 | 158.4 | 0.1 | 123.5 | 2,595.0 | 786.4 | 4,754.2 | 0.1 | 759.6 | 2,327.4 |
| Stream 43 | 0.1 | 249.5 | 861.6 | 0.1 | 1,965.7 | 340.9 | 2,125.8 | 817.3 | 6,198.8 | 1,389.1 | 538.1 | 2,184.5 |
| Stream 44 | 8,022.3 | 225.8 | 783.8 | 0.1 | 3,435.3 | 124.7 | 2,192.3 | 1,559.5 | 6,605.6 | 0.1 | 565.2 | 1,831.8 |
| Stream 45 | 0.1 | 174.5 | 509.2 | 0.1 | 1,316.2 | 147.7 | 1,649.8 | 700.7 | 7,485.2 | 938.0 | 472.0 | 2,350.7 |
| Stream 46 | 0.1 | 212.9 | 829.3 | 354.4 | 2,164.4 | 148.8 | 2,530.4 | 780.9 | 5,684.1 | 1,163.0 | 521.3 | 2,758.0 |
| Stream 47 | 9,719.0 | 158.6 | 1,022.1 | 0.1 | 1,792.3 | 0.1 | 2,024.3 | 880.1 | 5,487.0 | 1,952.2 | 503.8 | 2,509.3 |
| Stream 48 | 0.1 | 248.4 | 866.9 | 0.1 | 0.1 | 83.3 | 0.1 | 968.8 | 0.1 | 1,101.8 | 573.5 | 1,634.8 |
| Stream 49 | 9,856.7 | 221.5 | 921.1 | 0.1 | 2,024.7 | 0.1 | 2,277.7 | 796.1 | 5,080.6 | 0.1 | 39.6 | 2,918.3 |
| Stream 50 | 7,927.5 | 238.4 | 919.1 | 342.5 | 229.5 | 121.1 | 1,461.7 | 782.2 | 2,117.6 | 0.1 | 607.6 | 951.0 |
| Stream 51 | 8,088.8 | 223.3 | 544.0 | 107.4 | 681.6 | 373.2 | 0.1 | 382.9 | 1,946.3 | 0.1 | 260.9 | 2,240.0 |
| Stream 52 | 8,349.5 | 235.8 | 886.7 | 324.5 | 0.1 | 133.4 | 0.1 | 916.9 | 0.1 | 1,391.0 | 613.8 | 1,108.2 |
| Stream 53 | 5,893.8 | 260.5 | 887.8 | 313.3 | 2,913.6 | 124.6 | 2,140.8 | 835.6 | 5,147.0 | 1,385.7 | 468.4 | 1,059.7 |
| Stream 54 | 9,329.5 | 217.6 | 0.1 | 352.0 | 0.1 | 121.9 | 2,481.4 | 815.5 | 0.1 | 1,296.9 | 531.8 | 1,663.4 |
| Stream 55 | 9,212.1 | 945.1 | 27.7 | 369.0 | 0.1 | 0.1 | 1,667.7 | 74.9 | 10,853.0 | 0.1 | 35.2 | 43.1 |
| Stream 56 | 8,308.6 | 196.2 | 784.4 | 0.1 | 0.1 | 0.1 | 0.1 | 928.7 | 8,574.4 | 1,135.8 | 562.0 | 944.6 |
| Stream 57 | 5,437.2 | 258.8 | 979.3 | 351.7 | 1,314.0 | 108.7 | 2,293.2 | 956.6 | 5,768.1 | 1,279.5 | 643.8 | 0.1 |
| Stream 58 | 0.1 | 223.1 | 738.3 | 349.8 | 3,227.8 | 140.2 | 0.1 | 975.8 | 6,304.3 | 1,138.3 | 576.1 | 2,607.2 |
| Stream 59 | 8,568.5 | 215.6 | 1,080.4 | 264.2 | 2,639.2 | 146.0 | 1,683.7 | 942.2 | 3,317.6 | 0.1 | 602.1 | 1,731.8 |
| Stream 60 | 0.1 | 224.7 | 940.7 | 402.1 | 2,610.0 | 0.1 | 2,270.9 | 787.7 | 0.1 | 1,308.9 | 581.5 | 2,052.1 |
| Stream 61 | 8,188.7 | 236.8 | 0.1 | 341.5 | 0.1 | 126.0 | 0.1 | 877.5 | 0.1 | 1,414.6 | 586.4 | 0.1 |
| Stream 62 | 8,517.9 | 97.4 | 332.4 | 274.6 | 0.1 | 0.1 | 0.1 | 580.0 | 3,327.9 | 1,500.0 | 590.4 | 1,985.1 |
| Stream 63 | 0.1 | 238.5 | 744.2 | 437.6 | 2,127.2 | 106.2 | 2,122.6 | 655.1 | 3,567.9 | 1,236.8 | 558.8 | 2,293.0 |
| Stream 64 | 8,113.4 | 215.8 | 0.1 | 262.1 | 0.1 | 0.1 | 1,389.0 | 771.4 | 5,336.1 | 0.1 | 478.0 | 2,202.7 |
| Minimum | 0.1 | 19.35 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 74.94 | 0.1 | 0.1 | 35.21 | 0.1 |
| Average | 6126.4 | 234.2 | 711.5 | 207.9 | 1281.9 | 95.7 | 1736.3 | 786.3 | 4406.1 | 621.5 | 507.2 | 1721.5 |
| Maximum | 9930.2 | 1075.0 | 1620.5 | 1192.9 | 4103.4 | 693.5 | 3003.0 | 1559.5 | 10853.0 | 1953.8 | 972.4 | 2969.1 |

## TPC-H Timing Intervals (continued):

| | Q13 | Q14 | Q15 | Q16 | Q17 | Q18 | Q19 | Q20 | Q21 | Q22 | RF1 | RF2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stream 0 | 73.2 | 5.4 | 8.4 | 14.0 | 37.2 | 163.5 | 49.9 | 19.0 | 173.6 | 21.7 | 34.4 | 37.1 |
| Stream 1 | 3,613.4 | 0.1 | 0.1 | 496.1 | 985.5 | 0.1 | 2,127.1 | 477.7 | 7,278.1 | 745.4 | 34.5 | 28.4 |
| Stream 2 | 2,896.3 | 20.5 | 290.8 | 207.1 | 75.8 | 0.1 | 1,915.8 | 542.5 | 0.1 | 689.4 | 35.1 | 29.9 |
| Stream 3 | 0.1 | 0.1 | 0.1 | 459.2 | 1,037.2 | 1,110.5 | 1,975.0 | 441.7 | 4,052.1 | 950.3 | 34.2 | 27.9 |
| Stream 4 | 0.1 | 133.5 | 324.7 | 517.5 | 941.6 | 0.1 | 1,842.1 | 43.0 | 12,465.2 | 247.4 | 34.8 | 29.9 |
| Stream 5 | 0.1 | 0.1 | 0.1 | 612.5 | 870.4 | 0.1 | 2,306.5 | 474.2 | 7,044.4 | 693.9 | 33.4 | 28.0 |
| Stream 6 | 3,512.7 | 0.1 | 347.9 | 557.8 | 916.4 | 0.1 | 2,036.4 | 602.0 | 8,091.1 | 632.5 | 35.4 | 29.9 |
| Stream 7 | 1,092.7 | 7.4 | 0.1 | 23.7 | 1,184.7 | 6,629.1 | 986.2 | 445.0 | 9,911.6 | 726.7 | 34.2 | 28.9 |
| Stream 8 | 0.1 | 147.1 | 312.2 | 520.2 | 1,094.5 | 0.1 | 1,705.0 | 441.7 | 0.1 | 587.7 | 34.2 | 28.4 |
| Stream 9 | 5,061.3 | 15.6 | 360.0 | 31.9 | 1,018.1 | 0.1 | 2,358.9 | 472.9 | 11,261.8 | 695.8 | 33.8 | 28.5 |
| Stream 10 | 2,877.9 | 148.7 | 611.7 | 360.4 | 1,119.2 | 6,666.8 | 1,169.5 | 333.0 | 0.1 | 682.4 | 34.6 | 28.6 |
| Stream 11 | 0.1 | 254.2 | 698.7 | 576.3 | 1,203.0 | 17,455.9 | 161.4 | 587.1 | 8,720.5 | 713.1 | 34.1 | 29.9 |
| Stream 12 | 0.1 | 180.4 | 0.1 | 516.3 | 1,048.3 | 0.1 | 2,156.0 | 446.9 | 1,592.0 | 768.6 | 34.9 | 28.1 |
| Stream 13 | 0.1 | 110.3 | 260.3 | 448.0 | 1,013.9 | 0.1 | 1,386.7 | 433.7 | 7,135.3 | 753.0 | 33.5 | 29.8 |
| Stream 14 | 0.1 | 106.3 | 296.6 | 535.8 | 983.0 | 5,124.4 | 1,357.1 | 529.8 | 11,007.0 | 354.9 | 32.9 | 30.1 |
| Stream 15 | 0.1 | 248.5 | 0.1 | 57.9 | 91.7 | 0.1 | 1,925.6 | 525.1 | 10,930.0 | 683.7 | 34.2 | 29.4 |
| Stream 16 | 4,004.1 | 175.2 | 267.0 | 647.4 | 1,131.4 | 0.1 | 2,185.2 | 513.2 | 2,430.3 | 730.5 | 34.9 | 27.6 |
| Stream 17 | 0.1 | 175.4 | 323.0 | 702.9 | 940.6 | 0.1 | 2,052.4 | 453.5 | 1,699.0 | 503.6 | 34.1 | 28.4 |
| Stream 18 | 6,033.1 | 561.9 | 169.4 | 243.0 | 1,163.0 | 0.1 | 1,973.5 | 537.3 | 9,885.4 | 277.0 | 33.6 | 28.5 |
| Stream 19 | 0.1 | 149.8 | 306.1 | 529.1 | 1,125.4 | 0.1 | 1,440.8 | 393.6 | 10,354.5 | 666.6 | 35.0 | 28.5 |
| Stream 20 | 4,404.5 | 188.0 | 867.7 | 973.9 | 1,056.7 | 0.1 | 1,948.4 | 474.1 | 0.1 | 672.3 | 34.7 | 28.7 |
| Stream 21 | 0.1 | 318.7 | 0.1 | 594.0 | 968.1 | 0.1 | 2,092.1 | 1,246.2 | 12,763.8 | 664.9 | 35.0 | 28.2 |
| Stream 22 | 2,748.5 | 234.0 | 225.9 | 694.7 | 85.0 | 0.1 | 1,729.9 | 332.5 | 11,020.7 | 746.4 | 34.4 | 28.0 |
| Stream 23 | 0.1 | 155.3 | 0.1 | 570.4 | 1,156.8 | 7,971.2 | 2,354.3 | 503.0 | 0.1 | 664.1 | 34.5 | 27.8 |
| Stream 24 | 0.1 | 152.6 | 276.1 | 214.1 | 490.7 | 2,428.9 | 1,250.1 | 737.6 | 10,786.4 | 673.0 | 32.9 | 29.3 |
| Stream 25 | 0.1 | 154.9 | 0.1 | 545.8 | 1,017.3 | 6,628.0 | 2,191.8 | 495.3 | 49.1 | 700.3 | 32.9 | 28.7 |
| Stream 26 | 3,677.1 | 150.5 | 256.2 | 375.8 | 667.0 | 0.1 | 2,090.5 | 487.5 | 1,899.9 | 652.5 | 34.4 | 28.3 |
| Stream 27 | 0.1 | 554.9 | 0.1 | 446.4 | 110.2 | 0.1 | 981.3 | 265.9 | 8,666.1 | 834.9 | 34.3 | 28.6 |
| Stream 28 | 0.1 | 137.1 | 0.1 | 489.1 | 1,026.1 | 0.1 | 2,058.5 | 608.2 | 2,977.2 | 906.3 | 34.4 | 28.8 |
| Stream 29 | 2,094.7 | 10.8 | 0.1 | 386.7 | 728.8 | 8,469.2 | 96.2 | 492.2 | 2,554.6 | 458.5 | 33.9 | 29.1 |
| Stream 30 | 4,048.3 | 144.7 | 360.1 | 316.2 | 1,030.6 | 0.1 | 1,320.9 | 196.7 | 5,452.1 | 622.0 | 34.6 | 28.8 |
| Stream 31 | 0.1 | 69.4 | 152.0 | 476.7 | 678.8 | 0.1 | 1,568.9 | 400.8 | 5,166.4 | 330.9 | 35.1 | 28.7 |
| Stream 32 | 4,680.5 | 0.1 | 1,098.3 | 621.4 | 1,157.2 | 7,126.6 | 91.8 | 26.7 | 1,466.3 | 645.9 | 34.2 | 28.3 |

## TPC-H Timing Intervals (continued):

| | Q13 | Q14 | Q15 | Q16 | Q17 | Q18 | Q19 | Q20 | Q21 | Q22 | RF1 | RF2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stream 33 | 2,494.3 | 172.8 | 1,125.8 | 1,134.9 | 981.0 | 0.1 | 1,325.0 | 547.7 | 9,788.3 | 455.7 | 35.9 | 28.0 |
| Stream 34 | 4,056.9 | 148.3 | 0.1 | 522.5 | 849.7 | 0.1 | 1,662.2 | 420.6 | 4,973.4 | 662.3 | 36.2 | 28.4 |
| Stream 35 | 0.1 | 425.4 | 56.1 | 539.7 | 1,119.4 | 0.1 | 1,252.7 | 549.3 | 8,671.4 | 924.7 | 36.1 | 28.8 |
| Stream 36 | 0.1 | 102.1 | 0.1 | 451.1 | 1,070.4 | 0.1 | 1,074.1 | 344.7 | 11,166.3 | 743.9 | 35.0 | 27.7 |
| Stream 37 | 3,625.1 | 135.7 | 493.4 | 549.1 | 1,017.3 | 3,475.9 | 1,879.0 | 24.9 | 3,320.2 | 642.3 | 35.8 | 27.8 |
| Stream 38 | 0.1 | 154.0 | 160.9 | 514.5 | 656.0 | 0.1 | 1,334.5 | 1,237.8 | 9,716.9 | 640.5 | 35.9 | 29.2 |
| Stream 39 | 2,901.1 | 167.9 | 300.5 | 504.9 | 518.6 | 0.1 | 2,064.2 | 438.1 | 5,946.1 | 230.9 | 36.3 | 28.7 |
| Stream 40 | 3,624.8 | 123.4 | 313.5 | 550.0 | 1,001.6 | 0.1 | 1,742.7 | 457.5 | 0.1 | 622.9 | 35.8 | 28.1 |
| Stream 41 | 3,357.7 | 397.6 | 0.1 | 559.1 | 1,129.9 | 0.1 | 781.2 | 616.9 | 9,880.0 | 725.2 | 35.2 | 29.5 |
| Stream 42 | 0.1 | 129.7 | 0.1 | 536.1 | 1,022.7 | 10,043.2 | 1,700.9 | 490.9 | 7,419.5 | 358.4 | 34.9 | 28.2 |
| Stream 43 | 4,048.4 | 240.7 | 0.1 | 770.6 | 1,059.4 | 0.1 | 1,926.8 | 466.8 | 8,767.4 | 635.5 | 35.4 | 29.2 |
| Stream 44 | 0.1 | 149.4 | 366.9 | 466.0 | 1,085.0 | 0.1 | 1,998.8 | 430.9 | 0.1 | 589.0 | 35.2 | 31.7 |
| Stream 45 | 0.1 | 144.5 | 0.1 | 449.9 | 952.1 | 0.1 | 1,807.0 | 366.8 | 13,022.1 | 470.0 | 34.8 | 28.4 |
| Stream 46 | 0.1 | 133.3 | 321.0 | 536.7 | 1,019.9 | 0.1 | 2,132.9 | 539.0 | 7,577.1 | 656.5 | 35.1 | 28.8 |
| Stream 47 | 4,466.2 | 96.9 | 346.2 | 349.4 | 548.3 | 0.1 | 1,331.3 | 273.7 | 2,878.1 | 626.4 | 34.4 | 28.4 |
| Stream 48 | 3,749.3 | 97.3 | 207.1 | 381.2 | 1,008.0 | 7,920.9 | 2,081.7 | 465.9 | 11,159.7 | 774.6 | 34.8 | 28.2 |
| Stream 49 | 1,414.3 | 144.6 | 0.1 | 474.0 | 1,110.7 | 0.1 | 1,745.7 | 459.4 | 6,574.1 | 593.4 | 34.3 | 28.3 |
| Stream 50 | 6,116.9 | 16.7 | 364.4 | 32.5 | 1,076.8 | 0.1 | 2,222.7 | 568.3 | 9,690.6 | 726.3 | 33.8 | 28.3 |
| Stream 51 | 0.1 | 124.6 | 271.8 | 345.0 | 991.0 | 5,980.9 | 1,063.7 | 333.2 | 11,327.6 | 744.3 | 34.3 | 28.6 |
| Stream 52 | 0.1 | 407.7 | 1,072.2 | 613.0 | 1,116.0 | 6,488.8 | 1,996.9 | 551.2 | 0.1 | 706.9 | 33.9 | 28.6 |
| Stream 53 | 0.1 | 149.6 | 330.7 | 653.5 | 1,117.4 | 0.1 | 2,082.2 | 445.6 | 0.1 | 693.1 | 34.5 | 28.4 |
| Stream 54 | 0.1 | 140.8 | 0.1 | 598.4 | 1,059.4 | 0.1 | 1,716.2 | 473.1 | 7,540.9 | 703.3 | 34.2 | 28.7 |
| Stream 55 | 0.1 | 6.8 | 251.5 | 459.4 | 826.9 | 6,238.2 | 71.1 | 391.4 | 5,329.9 | 26.4 | 35.1 | 28.1 |
| Stream 56 | 0.1 | 155.8 | 0.1 | 1,299.1 | 1,128.6 | 0.1 | 2,233.0 | 405.2 | 0.1 | 632.7 | 36.5 | 28.8 |
| Stream 57 | 0.1 | 170.9 | 0.1 | 655.2 | 1,044.2 | 0.1 | 2,230.1 | 493.9 | 9,138.0 | 775.9 | 35.9 | 28.5 |
| Stream 58 | 0.1 | 150.8 | 272.9 | 1,051.8 | 1,065.2 | 3,048.7 | 2,274.7 | 462.6 | 1,823.6 | 658.4 | 35.3 | 27.8 |
| Stream 59 | 3,752.0 | 359.4 | 248.2 | 371.6 | 992.3 | 0.1 | 2,079.2 | 532.9 | 2,313.6 | 410.8 | 33.7 | 28.3 |
| Stream 60 | 0.1 | 143.8 | 281.7 | 479.8 | 1,127.6 | 0.1 | 2,228.9 | 461.2 | 9,704.9 | 702.6 | 35.3 | 28.1 |
| Stream 61 | 2,305.8 | 181.6 | 656.9 | 1,231.2 | 1,061.0 | 2,575.2 | 2,046.1 | 619.8 | 0.1 | 627.6 | 35.7 | 27.9 |
| Stream 62 | 0.1 | 350.6 | 280.0 | 429.4 | 897.2 | 0.1 | 1,910.3 | 1,175.4 | 12,772.7 | 433.0 | 36.1 | 27.6 |
| Stream 63 | 5,139.5 | 316.2 | 0.1 | 1,246.1 | 496.9 | 0.1 | 2,101.1 | 384.6 | 9,909.2 | 786.9 | 34.4 | 28.0 |
| Stream 64 | 0.1 | 134.3 | 0.1 | 585.1 | 797.0 | 7,919.5 | 1,548.7 | 333.4 | 2,785.7 | 670.5 | 35.4 | 28.1 |
| Minimum | 0.1 | 0.1 | 0.1 | 23.67 | 75.84 | 0.1 | 71.11 | 24.86 | 0.1 | 26.41 | 32.85 | 27.61 |
| Average | 1559.1 | 161.7 | 250.5 | 520.3 | 931.8 | 1861.1 | 1690.8 | 484.0 | 6083.3 | 626.9 | 34.7 | 28.6 |
| Maximum | 6116.9 | 561.9 | 1125.8 | 1299.1 | 1203.0 | 17455.9 | 2358.9 | 1246.2 | 13022.1 | 950.3 | 36.5 | 31.7 |

INFO SIZING

TPC TRANSACTION PROCESSING PERFORMANCE COUNCIL CERTIFIED AUDITOR

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April 29, 2008

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

Platform: **Sun SPARC Enterprise M9000**

Database Manager: **Oracle Database 11g**

Operating System: **Solaris 10**

The results were:

| CPU (Speed) | Memory | Disks | QphH@1000GB |
|---|---|---|---|
| Sun SPARC Enterprise M9000 Server | | | |
| 32 SPARC64 VI (2.4 GHz) | 512 GB Main | 240 x 146 GB ext.<br>8 x 73 GB (SAS) | **118,573.3** |

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

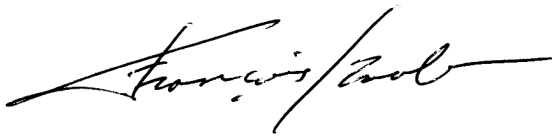
- The database records were defined with the proper layout and size
- The database population was generated using DBGEN and validated
- The database was properly scaled to 1,000GB and populated accordingly
- The compliance of the database auxiliary data structures was verified
- The database load time was correctly measured and reported
- The required ACID properties were verified and met

- The query input variables were generated by QGEN version 2.6.3, which was built using QGEN Version 2.6.0 plus code changes of Mantis Bug 595
- The query text was produced using minor modifications and no query variant
- The execution of the queries against the SF1 database produced compliant answers
- A compliant implementation specific layer was used to drive the tests
- The throughput tests involved 64 query streams
- The ratio between the longest and the shortest query was such that no query timing was adjusted
- The execution times for queries and refresh functions were correctly measured and reported
- The repeatability of the measured results was verified
- The required amount of database log was configured
- The system pricing was verified for major components and maintenance
- The major pages from the FDR were verified for accuracy

Additional Audit Notes:

none.

Respectfully Yours,



François Raab
President

# Table of Contents

# TPC Benchmark H Overview

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

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

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

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

# 1. General Items

## 1.1 Benchmark Sponsor

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

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

## 1.2 Parameter Settings

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

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

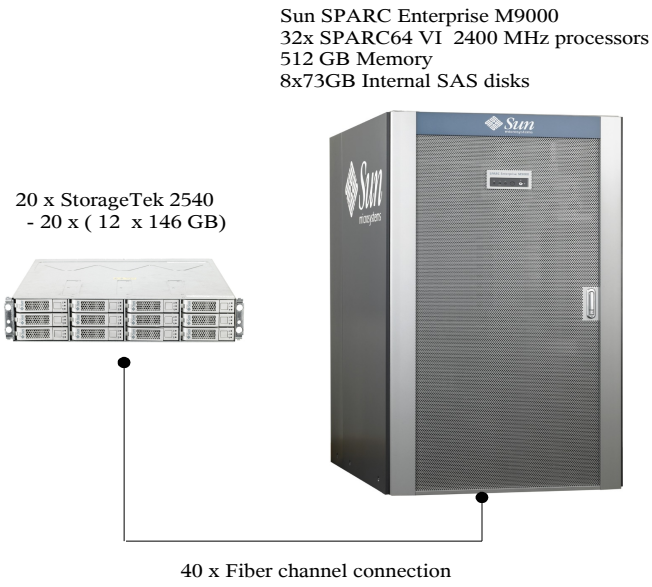
Appendix A contains the Solaris and Oracle parameters used in this benchmark.

## 1.3 Configuration Diagram

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

Sun SPARC Enterprise M9000 Server, was configured with:

- 32 SPARC64 VI 2400 MHz processors
- 512 GB memory
- 1 Ethernet controller
- 8 x 73GB internal SAS disk drives
- 20 Sun StorageTek 2540 disk arrays, each containing 12 x 146GB disk drives
- Priced and measured configuration are identical.




Configuration diagram

# 2. Clause 1 Logical Database Design

## 2.1 Database Definition Statements

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

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

## 2.2 Physical Organization

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

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

## 2.3 Horizontal Partitioning

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

Horizontal partitioning was used for all tables except NATION and REGION. Refer to the table/index create statements in Appendix B for more details.

## 2.4 Replication

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

No replication was used.

# 3. Clause 2 Queries and Refresh Functions

## 3.1 Query Language

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

SQL was the query language used to implement all queries.

## 3.2 Verifying Method for Random Number Generation

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

TPC DBGEN 2.6.0 and QGEN 2.6.3 were used for the random number generation..

## 3.3 Generating Values for Substitution Parameters

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

TPC QGEN 2.6.3 was used for query parameter substitution.

## 3.4 Query Text and Output Data from Qualification Database

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

Appendix C contains the qualification query text and query output.

## 3.5 Query Substitution Parameters and Seeds Used

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

Appendix D contains the seed and query substitution parameters.

## 3.6 Query Isolation Level

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

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

## 3.7 Source Code of Refresh Functions

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

The refresh function is part of the driver code included in Appendix E.

# 4. Clause 3 Database System Properties

## 4.1 ACID Properties

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

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

## 4.2 Atomicity

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

### 4.2.1 Completed Transaction

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

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

### 4.2.2 Aborted Transaction

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

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

## 4.3 Consistency

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

### 4.3.1 Consistency Test

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

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

## 4.4 Isolation

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

### 4.4.1 Read-Write Conflict with Commit

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

1. An ACID Transaction was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID Transaction was suspended prior to COMMIT.
2. An ACID Query was started for the same O_KEY used in step 1. The ACID Query blocked and did not see the 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.

### 4.4.2 Read-Write Conflict with Rollback

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

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

### 4.4.3 Write-Write Conflict with Commit

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

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

4. T1 was allowed to COMMIT and T2 completed.
5. It was verified that T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE + (DELTA1*(T1.L_EXTENDEDPRICE/T1.L_QUANTITY))

### 4.4.4 Write-Write Conflict with Rollback

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

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

### 4.4.5 Concurrent Progress of Read and Write Transactions

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

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

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

### 4.4.6 Read-Only Query Conflict with Update Transaction

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

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

## 4.5 Durability

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

### 4.5.1 Failure of a Durable Medium

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

The disks containing TPC-H tables and, log files were mirrored. During the durability test the disk containing one side of a data file mirror was removed from its cabinet. Similarly the disk containing one side of a log file mirror was removed from its cabinet. The test continued uninterrupted, using the remaining side of the mirror.

### 4.5.2 System Crash

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

The system crash and memory failure tests were combined. Power to the server was turned off by flipping breakers at the main electrical panel 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 successfully.

### 4.5.3 Memory Failure

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

See section 4.5.2.

# 5. Clause 4 Scaling and Database Population

## 5.1 Ending Cardinality of Tables

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

| Table | Rows |
|---|---|
| Lineitem | 5,999,989,709 |
| Orders | 1,500,000,000 |
| Partsupp | 800,000,000 |
| Part | 200,000,000 |
| Customer | 150,000,000 |
| Supplier | 10,000,000 |
| 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.*

- All tables, indexes, redo logs and temporary tablespace were mirrored and striped across all 240 disks in the Sun StorageTek 2540 disk arrays. The control file resided on a filesystem that was mirrored on a single StorageTek 2540 disk array.
- For more details refer to disk configuration section in Appendix B.

## 5.3 Database partition/replication mapping

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

The database was not replicated.

Horizontal partitioning was used for base tables LINEITEM, ORDERS, PARTSUPP, PART, SUPPLIER and CUSTOMER. The details for this partitioning can be understood by examining the syntax of the table and index definition statments in Appendix B.

## 5.4 RAID Feature

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

| Table/Index | RAID type |
|---|---|
| tables | RAID 1 |
| indexes | RAID 1 |
| temp tablespace | RAID 1 |
| log | RAID 1 |
| System tablespace | RAID 1 |

## 5.5 Modifications to the DBGEN

*Any modifications to the DBGEN (see Clause 4.2.1) source code must be disclosed. In the event that a program other than DBGEN was used to populate the database, it must be disclosed in its entirety.*

No modifications were made to TPC DBGEN 2.6.0

## 5.6 Database Load Time

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

The database load time was 1:35:27.

## 5.7 Data Storage Ratio

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

The data storage ratio is computed from the following information:

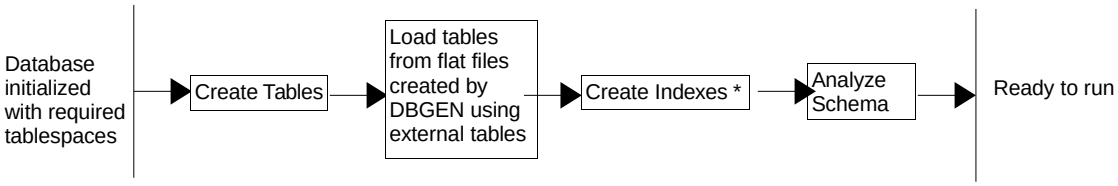
| Disk Type | # Of Disks | Space Per Disk* | Sub-Total Disk Space** |
|---|---|---|---|
| External (ST2540) | 240 | 146GB | 35,040GB |
| Internal | 8 | 73GB | 584 GB |
| | | **Total Space** | **35,624** |
| | | **Data Storage Ratio** | **35.6** |

** Disk manufacturer definition of one GB is 10^9 bytes*
***In this calculation one GB is defined as 2^30 bytes*

## 5.8 Database Load Mechanism Details and Illustration

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

The database was loaded using data generation stored on flat files all on the tested and priced configurations. Oracle created external tables using the files that were created by the DBGEN program.




* Analyze index performed during index creation

## 5.9 Qualification Database Configuration

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

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

# 6. Clause 5 Performance Metrics and Execution Rules

## 6.1 System Activity Between Load and Performance Tests

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

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

All scripts and queries used are included in Appendix F

## 6.2 Steps in the Power Test

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

The following steps were used to implement the power test:

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

## 6.3 Timing Intervals for Each Query and Refresh Functions

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

The timing intervals for each query and for both refresh functions are contained in the Numerical Quantity Summary earlier in this document.

## 6.4 Number of Streams for the Throughput Test

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

64 streams were used for the throughput test.

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

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

The throughput test start time and finish time for each stream are contained in the Numerical Quantity Summary earlier in this document.

## 6.6 Total Elapsed Time of the Measurement Interval

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

The total elapsed time of the throughput test is contained in the Numerical Quantity Summary earlier in this document.

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

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

The start and finish times for each refresh function in the refresh stream are contained in the Numerical Quantity Summary earlier in this document.

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

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

The timing intervals for each query and each refresh function for the throughput test are contained in the Numerical Quantity Summary earlier in this document.

## 6.9 Performance Metrics

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

The performance metrics, and the numbers on which they are based, are contained in the Numerical Quantity Summary earlier in this document.

## 6.10 The Performance Metric and Numerical Quantities from Both Runs

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

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

| Run ID | QppH@1000GB | QthH@1000GB | QphH@1000GB |
|---|---|---|---|
| Run 1 | 114,725.4 | 122,550.2 | 118,573.3 |
| Run 2 | 118,018.5 | 122,165.3 | 120,074.5 |
| % Difference | 2.79 % | -0.32 % | 1.25% |

## 6.11 System Activity Between Performance Tests

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

There was no activity on the SUT between run1 and run2.

# 7. Clause 6 SUT and Driver Implementation

## 7.1 Driver

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

The Power Test and Throughput Test are performed by a shell script called runTPCpt. QGEN is first called with a stream id of 0 to generate the queries for the Power Test. UF1 is then started by executing the runuf1.sh script. Query submission follows, with the qexecpl.c ISL program. The execution of the UF2 script runuf2.sh rounds out the Power Test execution. Both wall-clock and high-resolution times are collected for all measurement intervals.

Following the Power Test, QGEN is again called with the subsequent 64 stream ids to generate new queries for each Throughput Test. qexecpl.c is called simultaneously for all 64 streams to execute the queries as above.Then the runTPCHus script is called to run all 64 update pairs to finish the throughput run.

## 7.2 Implementation-Specific Layer

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

Query execution text generated by QGEN is picked up by the ISL program which submits the query to the SUT.

The ISL program (qexecpl.c) utilizes the Oracle Call Interface (OCI) to communicate with the Oracle database on the SUT. EQTs directly generated by QGEN are read and submitted to the SUT via the ISL program (qexecpl.c) as dynamic SQL statements. The ISL program then fetches the query execution output and reports it to the user. Timings are taken at intervals specified in Section 5.3.7 of the TPC-H benchmark specification.

## 7.3 Profile-Directed Optimization

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

Profile-directed optimization was not used.

# 8. Clause 7 Pricing

## 8.1 Hardware and Software Used

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

Refer to the Executive Summary.

## 8.2 Total Three Year Price

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

The total 3-year price of the configuration is $2,859,795. For details of pricing, see the second page of the Executive Summary.

The following generally available discounts to any buyer with like conditions were applied to the priced configuration:

- a 35% Sun support volume and yearly pre-payment discount
- a 50% discount from list for Sun supplied system components

## 8.3 Availability Date

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

| | |
|---|---|
| Server Hardware | Available Now |
| Server Software | Available Now |
| Storage | Available Now |
| Oracle Database 11g Enterprise Edition with Partitioning and Automatic Storage management | 09/10/2008 |

# 9. Auditor's Information and Attestation Letter

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

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

# Appendix A. Solaris 10 and Oracle11g Parameters

This Appendix contains Solaris kernel parameters and environment variables and Oracle initialization parameters.

==========

## Oracle 11g Parameters

==========

### inittpch.ora

```
aq_tm_processes                 = 0
audit_trail                     = FALSE
compatible                      = 11.1.0.6
control_files                   = /ff1/control.dbf
db_block_checksum               = FALSE
db_block_size                   = 32768
db_cache_advice                 = OFF
db_cache_size                   = 50g
db_create_file_dest             = +dg_tpch
db_file_multiblock_read_count   = 32
db_files                        = 1023
db_name                         = tpch
db_writer_processes             = 20
dml_locks                       = 80000
global_names                    = FALSE
java_pool_size                  = 0
job_queue_processes             = 0
log_buffer                      = 134217728
log_checkpoints_to_alert        = TRUE
log_checkpoint_interval         = 3000
max_dump_file_size              = unlimited
nls_date_format                 = YYYY-MM-DD
open_cursors                    = 1024
optimizer_features_enable       = 11.1.0.6.1
optimizer_index_cost_adj        = 200
optimizer_mode                  = CHOOSE
parallel_execution_message_size = 32768
parallel_max_servers            = 2500
parallel_min_servers            = 800
parallel_threads_per_cpu        = 1
pga_aggregate_target            = 60g
processes                       = 4000
recovery_parallelism            = 64
replication_dependency_tracking = FALSE
result_cache_mode               = force
sessions                        = 2048
session_cached_cursors          = 0
shared_pool_size                = 12g
statistics_level                = basic
undo_management                 = AUTO
undo_tablespace                 = ts_undo
undo_retention                  = 400000
```

### Solaris Parameters

```
/etc/system:
    no entry in /etc/system

/etc/project:

system:0::::
user.root:1::::
noproject:2::::
default:3::::
group.staff:10::::
user.oracle:100:Oracle:oracle:dba:process.max-shm-
memory=(priv,536870912000,deny)
```

# Appendix B. Build Programs and ACID Scripts

==========

## Database Load Scripts

==========
==========

## dbcre.sh

==========

```
#!/bin/ksh
############################
# create tpch database
############################
echo Start Database Creation at `date`

sqlplus / as sysdba<<EOF
set echo on
set timing on

shutdown abort;

startup pfile=?/dbs/inittpch.ora nomount;
create database
  controlfile reuse
  set default bigfile tablespace
  logfile '+dg_tpch' size 30000m reuse,
          '+dg_tpch' size 30000m reuse
  datafile '+dg_tpch'
           size 2000m reuse
  sysaux datafile '+dg_tpch'
           size 2000m reuse
  smallfile undo tablespace ts_undo
       datafile  '+dg_tpch'
         size 5000m reuse
  default temporary tablespace ts_temp
       tempfile '+dg_tpch'
         size 3000000m reuse
       extent management local uniform size 10m
  maxdatafiles 2000
  maxinstances 1
;

set termout off
set echo off
spool /tmp/cat
@?/rdbms/admin/catalog.sql;
@?/rdbms/admin/catparr.sql;
@?/rdbms/admin/catproc.sql;
@?/rdbms/admin/utlxplan.sql;

connect system/manager
@?/sqlplus/admin/pupbld.sql;
exit;
EOF

echo End Database Creation at `date`
```

==========

## sctso.sh

==========

```
#!/bin/ksh
#########################################################
######################
# Schema Creation Phase - datafiles only (no tables or
users)
# creating data tablespaces, datafiles
# creating tpch's ts_default tablespace
#########################################################
######################

echo START Tablespace Creation at `date`

# create ts_default tablespace
sqlplus / as sysdba<<! &
set echo on;
set timing on;

drop tablespace ts_default;
create tablespace ts_default
datafile '+dg_tpch' size 5000m reuse
extent management local autoallocate ;
exit;
!

# create ts_s tablespace
sqlplus / as sysdba<<! &
set echo on;
set timing on;
drop tablespace ts_s;
create tablespace ts_s
datafile '+dg_tpch' size 2000m reuse
extent management local autoallocate nologging ;
exit;
!

# create ts_c tablespace
sqlplus / as sysdba<<! &
set echo on;
set timing on;drop tablespace ts_c;
create tablespace ts_c
datafile '+dg_tpch' size 30000m reuse
extent management local autoallocate nologging ;
exit;
!
# create ts_o tablespaces
let i=1
while ((i<=21))
do
sqlplus / as sysdba<<! &
set echo on;
set timing on;
drop tablespace ts_o${i};
create tablespace ts_o${i}
datafile '+dg_tpch' size 12000m reuse
extent management dictionary default storage
(initial 10m next 10m pctincrease 0) nologging;
exit;
!
let i+=1
done
# create ts_ps tablespace
sqlplus / as sysdba<<! &
set echo on;
set timing on;
drop tablespace ts_ps;
create tablespace ts_ps
datafile '+dg_tpch' size 160000m reuse
extent management local autoallocate nologging ;
exit;
!

# create ts_p tablespace
sqlplus / as sysdba<<! &
set echo on;
set timing on;
drop tablespace ts_p;
create tablespace ts_p
datafile '+dg_tpch' size 30000m reuse
extent management local autoallocate nologging ;
exit;
!
wait
# create ts_l tablespaces
let i=1
while ((i<=21))
```

```
do
sqlplus / as sysdba<<! &
set echo on;
set timing on;
drop tablespace ts_l${i};
create tablespace ts_l${i}
datafile '+dg_tpch' size 40000m reuse
extent management dictionary default storage
(initial 10m next 10m pctincrease 0) nologging;
exit;
!
let i+=1
done
wait
# create tpch's ts_i_lorderkey tablespace
sqlplus / as sysdba<<! &
set echo on;
set timing on;
drop tablespace ts_i_lorderkey;
create tablespace ts_i_lorderkey
datafile '+dg_tpch' size 200000m reuse
extent management local autoallocate nologging ;
exit;
!

# create tpch's ts_i_oorderkey tablespace
sqlplus / as sysdba<<! &
set echo on;
set timing on;
drop tablespace ts_i_oorderkey;
create tablespace ts_i_oorderkey
datafile '+dg_tpch' size 50000m reuse
extent management local autoallocate nologging ;
exit;
!

# creating tpch's ts_i_ccustkey tablespace
sqlplus / as sysdba<<! &
set echo on;
set timing on;
drop tablespace ts_i_ccustkey;
create tablespace ts_i_ccustkey
datafile '+dg_tpch' size 5000m reuse
extent management local autoallocate nologging ;
exit;
!

# adding tpch's ts_undo datafiles
let i=1
while ((i<=4))
do
sqlplus / as sysdba<<! &
set echo on;
set timing on;
alter tablespace ts_undo
  add datafile '+dg_tpch' size 100000m reuse;
exit;
!
let i+=1
done

wait

echo END Tablespace Creation at `date`
```

==========

## dapop.sh

==========

```
#!/bin/ksh
##########################################################
######################
# Schema Creation Phase - User and Tables and Database
Population Phase
##########################################################
######################

echo Start Data Loading at `date`

sqlplus / as sysdba <<!
set timing on
set echo on;
set termout on;

drop user tpch cascade;
grant DBA
to tpch identified by tpch;

alter user tpch default tablespace ts_default;
alter user tpch temporary tablespace ts_temp;

connect tpch/tpch;
drop directory data_dir1;
drop directory data_dir2;
drop directory data_dir3;
drop directory data_dir4;
drop directory data_dir5;
drop directory data_dir6;
drop directory data_dir7;
drop directory data_dir8;
drop directory data_dir9;
drop directory data_dir10;
drop directory data_dir11;
drop directory data_dir12;
drop directory data_dir13;
drop directory data_dir14;
drop directory data_dir15;
drop directory data_dir16;
drop directory data_dir17;
drop directory data_dir18;
drop directory data_dir19;
drop directory data_dir20;
drop directory data_dir21;
drop directory data_dir22;
drop directory data_dir23;
drop directory data_dir24;
drop directory data_dir25;
drop directory data_dir26;
drop directory data_dir27;
drop directory data_dir28;
drop directory data_dir29;
drop directory data_dir30;
drop directory data_dir31;
drop directory data_dir32;
drop directory data_dir33;
drop directory data_dir34;
drop directory data_dir35;
drop directory data_dir36;
drop directory data_dir37;
drop directory data_dir38;
drop directory data_dir39;
drop directory data_dir40;
create directory data_dir1 as '/ff1';
create directory data_dir2 as '/ff2';
create directory data_dir3 as '/ff3';
create directory data_dir4 as '/ff4';
create directory data_dir5 as '/ff5';
create directory data_dir6 as '/ff6';
create directory data_dir7 as '/ff7';
create directory data_dir8 as '/ff8';
create directory data_dir9 as '/ff9';
create directory data_dir10 as '/ff10';
create directory data_dir11 as '/ff11';
create directory data_dir12 as '/ff12';
create directory data_dir13 as '/ff13';
create directory data_dir14 as '/ff14';
create directory data_dir15 as '/ff15';
create directory data_dir16 as '/ff16';
```

```
create directory data_dir17 as '/ff17';
create directory data_dir18 as '/ff18';
create directory data_dir19 as '/ff19';
create directory data_dir20 as '/ff20';
create directory data_dir21 as '/ff21';
create directory data_dir22 as '/ff22';
create directory data_dir23 as '/ff23';
create directory data_dir24 as '/ff24';
create directory data_dir25 as '/ff25';
create directory data_dir26 as '/ff26';
create directory data_dir27 as '/ff27';
create directory data_dir28 as '/ff28';
create directory data_dir29 as '/ff29';
create directory data_dir30 as '/ff30';
create directory data_dir31 as '/ff31';
create directory data_dir32 as '/ff32';
create directory data_dir33 as '/ff33';
create directory data_dir34 as '/ff34';
create directory data_dir35 as '/ff35';
create directory data_dir36 as '/ff36';
create directory data_dir37 as '/ff37';
create directory data_dir38 as '/ff38';
create directory data_dir39 as '/ff39';
create directory data_dir40 as '/ff40';

rem drop table l_et;
create table l_et(
    l_orderkey          number ,
    l_partkey           number ,
    l_suppkey           number ,
    l_linenumber        number ,
    l_quantity          number ,
    l_extendedprice     number ,
    l_discount          number ,
    l_tax               number ,
    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)
)
organization external (
type ORACLE_LOADER
default directory data_dir1
access parameters
(
                records delimited by newline
                badfile 'l_et.bad'
                logfile 'l_et.log'
                fields terminated by '|'
                missing field values are null
        )
        location (
        data_dir1:'lineitem.tbl.1',
        data_dir2:'lineitem.tbl.2',
        data_dir3:'lineitem.tbl.3',
        data_dir4:'lineitem.tbl.4',
        data_dir5:'lineitem.tbl.5',
        data_dir6:'lineitem.tbl.6',
        data_dir7:'lineitem.tbl.7',
        data_dir8:'lineitem.tbl.8',
        data_dir9:'lineitem.tbl.9',
        data_dir10:'lineitem.tbl.10',
        data_dir11:'lineitem.tbl.11',
        data_dir12:'lineitem.tbl.12',
        data_dir13:'lineitem.tbl.13',
        data_dir14:'lineitem.tbl.14',
        data_dir15:'lineitem.tbl.15',
        data_dir16:'lineitem.tbl.16',
        data_dir17:'lineitem.tbl.17',
        data_dir18:'lineitem.tbl.18',
        data_dir19:'lineitem.tbl.19',
        data_dir20:'lineitem.tbl.20',
        data_dir21:'lineitem.tbl.21',
        data_dir22:'lineitem.tbl.22',
        data_dir23:'lineitem.tbl.23',
        data_dir24:'lineitem.tbl.24',
        data_dir25:'lineitem.tbl.25',
        data_dir26:'lineitem.tbl.26',
        data_dir27:'lineitem.tbl.27',
        data_dir28:'lineitem.tbl.28',
        data_dir29:'lineitem.tbl.29',
        data_dir30:'lineitem.tbl.30',
        data_dir31:'lineitem.tbl.31',
        data_dir32:'lineitem.tbl.32',
        data_dir33:'lineitem.tbl.33',
        data_dir34:'lineitem.tbl.34',
        data_dir35:'lineitem.tbl.35',
        data_dir36:'lineitem.tbl.36',
        data_dir37:'lineitem.tbl.37',
        data_dir38:'lineitem.tbl.38',
        data_dir39:'lineitem.tbl.39',
        data_dir40:'lineitem.tbl.40'
))
reject limit unlimited
parallel 128;

rem drop table o_et;
create table o_et(
    o_orderkey          number ,
    o_custkey           number ,
    o_orderstatus       char(1) ,
    o_totalprice        number ,
    o_orderdate         date ,
    o_orderpriority     char(15) ,
    o_clerk             char(15) ,
    o_shippriority      number ,
    o_comment           varchar(79)
)
organization external (
type ORACLE_LOADER
default directory data_dir1
access parameters
(
                records delimited by newline
                badfile 'o_et.bad'
                logfile 'o_et.log'
                fields terminated by '|'
                missing field values are null
        )
        location (
        data_dir1:'orders.tbl.1',
        data_dir2:'orders.tbl.2',
        data_dir3:'orders.tbl.3',
        data_dir4:'orders.tbl.4',
        data_dir5:'orders.tbl.5',
        data_dir6:'orders.tbl.6',
        data_dir7:'orders.tbl.7',
        data_dir8:'orders.tbl.8',
        data_dir9:'orders.tbl.9',
        data_dir10:'orders.tbl.10',
        data_dir11:'orders.tbl.11',
        data_dir12:'orders.tbl.12',
        data_dir13:'orders.tbl.13',
        data_dir14:'orders.tbl.14',
        data_dir15:'orders.tbl.15',
        data_dir16:'orders.tbl.16',
        data_dir17:'orders.tbl.17',
        data_dir18:'orders.tbl.18',
        data_dir19:'orders.tbl.19',
        data_dir20:'orders.tbl.20',
        data_dir21:'orders.tbl.21',
        data_dir22:'orders.tbl.22',
        data_dir23:'orders.tbl.23',
        data_dir24:'orders.tbl.24',
```

```
       data_dir25:'orders.tbl.25',
       data_dir26:'orders.tbl.26',
       data_dir27:'orders.tbl.27',
       data_dir28:'orders.tbl.28',
       data_dir29:'orders.tbl.29',
       data_dir30:'orders.tbl.30',
       data_dir31:'orders.tbl.31',
       data_dir32:'orders.tbl.32',
       data_dir33:'orders.tbl.33',
       data_dir34:'orders.tbl.34',
       data_dir35:'orders.tbl.35',
       data_dir36:'orders.tbl.36',
       data_dir37:'orders.tbl.37',
       data_dir38:'orders.tbl.38',
       data_dir39:'orders.tbl.39',
       data_dir40:'orders.tbl.40'
        ))
reject limit unlimited
parallel 128;

rem drop table ps_et;
create table ps_et(
    ps_partkey          number ,
    ps_suppkey          number ,
    ps_availqty         number ,
    ps_supplycost       number ,
    ps_comment          varchar(199)
)
organization external (
type ORACLE_LOADER
default directory data_dir1
access parameters
(
                records delimited by newline
                badfile 'ps_et.bad'
                logfile 'ps_et.log'
                fields terminated by '|'
                missing field values are null
        )
        location (
        data_dir1:'partsupp.tbl.1',
        data_dir2:'partsupp.tbl.2',
        data_dir3:'partsupp.tbl.3',
        data_dir4:'partsupp.tbl.4',
        data_dir5:'partsupp.tbl.5',
        data_dir6:'partsupp.tbl.6',
        data_dir7:'partsupp.tbl.7',
        data_dir8:'partsupp.tbl.8',
        data_dir9:'partsupp.tbl.9',
        data_dir10:'partsupp.tbl.10',
        data_dir11:'partsupp.tbl.11',
        data_dir12:'partsupp.tbl.12',
        data_dir13:'partsupp.tbl.13',
        data_dir14:'partsupp.tbl.14',
        data_dir15:'partsupp.tbl.15',
        data_dir16:'partsupp.tbl.16',
        data_dir17:'partsupp.tbl.17',
        data_dir18:'partsupp.tbl.18',
        data_dir19:'partsupp.tbl.19',
        data_dir20:'partsupp.tbl.20',
        data_dir21:'partsupp.tbl.21',
        data_dir22:'partsupp.tbl.22',
        data_dir23:'partsupp.tbl.23',
        data_dir24:'partsupp.tbl.24',
        data_dir25:'partsupp.tbl.25',
        data_dir26:'partsupp.tbl.26',
        data_dir27:'partsupp.tbl.27',
        data_dir28:'partsupp.tbl.28',
        data_dir29:'partsupp.tbl.29',
        data_dir30:'partsupp.tbl.30',
        data_dir31:'partsupp.tbl.31',
        data_dir32:'partsupp.tbl.32',
        data_dir33:'partsupp.tbl.33',
        data_dir34:'partsupp.tbl.34',
        data_dir35:'partsupp.tbl.35',
        data_dir36:'partsupp.tbl.36',
        data_dir37:'partsupp.tbl.37',
        data_dir38:'partsupp.tbl.38',
        data_dir39:'partsupp.tbl.39',
        data_dir40:'partsupp.tbl.40'
        ))
reject limit unlimited
parallel 128;

rem drop table p_et;
create table p_et(
    p_partkey           number ,
    p_name              varchar(55) ,
    p_mfgr              char(25) ,
    p_brand             char(10) ,
    p_type              varchar(25) ,
    p_size              number ,
    p_container         char(10) ,
    p_retailprice       number ,
    p_comment           varchar(23)
)
organization external (
type ORACLE_LOADER
default directory data_dir1
access parameters
(
                records delimited by newline
                badfile 'p_et.bad'
                logfile 'p_et.log'
                fields terminated by '|'
                missing field values are null
        )
        location (
        data_dir1:'part.tbl.1',
        data_dir2:'part.tbl.2',
        data_dir3:'part.tbl.3',
        data_dir4:'part.tbl.4',
        data_dir5:'part.tbl.5',
        data_dir6:'part.tbl.6',
        data_dir7:'part.tbl.7',
        data_dir8:'part.tbl.8',
        data_dir9:'part.tbl.9',
        data_dir10:'part.tbl.10',
        data_dir11:'part.tbl.11',
        data_dir12:'part.tbl.12',
        data_dir13:'part.tbl.13',
        data_dir14:'part.tbl.14',
        data_dir15:'part.tbl.15',
        data_dir16:'part.tbl.16',
        data_dir17:'part.tbl.17',
        data_dir18:'part.tbl.18',
        data_dir19:'part.tbl.19',
        data_dir20:'part.tbl.20',
        data_dir21:'part.tbl.21',
        data_dir22:'part.tbl.22',
        data_dir23:'part.tbl.23',
        data_dir24:'part.tbl.24',
        data_dir25:'part.tbl.25',
        data_dir26:'part.tbl.26',
        data_dir27:'part.tbl.27',
        data_dir28:'part.tbl.28',
        data_dir29:'part.tbl.29',
        data_dir30:'part.tbl.30',
        data_dir31:'part.tbl.31',
        data_dir32:'part.tbl.32',
        data_dir33:'part.tbl.33',
        data_dir34:'part.tbl.34',
        data_dir35:'part.tbl.35',
        data_dir36:'part.tbl.36',
        data_dir37:'part.tbl.37',
        data_dir38:'part.tbl.38',
        data_dir39:'part.tbl.39',
        data_dir40:'part.tbl.40'
```

```
))
reject limit unlimited
parallel 128;

rem drop table c_et;
create table c_et(
    c_custkey            number ,
    c_name               varchar(25) ,
    c_address            varchar(40) ,
    c_nationkey          number ,
    c_phone              char(15) ,
    c_acctbal            number ,
    c_mktsegment         char(10) ,
    c_comment            varchar(117)
)
organization external (
type ORACLE_LOADER
default directory data_dir1
access parameters
(
                records delimited by newline
                badfile 'c_et.bad'
                logfile 'c_et.log'
                fields terminated by '|'
                missing field values are null
        )
        location (
        data_dir1:'customer.tbl.1',
        data_dir2:'customer.tbl.2',
        data_dir3:'customer.tbl.3',
        data_dir4:'customer.tbl.4',
        data_dir5:'customer.tbl.5',
        data_dir6:'customer.tbl.6',
        data_dir7:'customer.tbl.7',
        data_dir8:'customer.tbl.8',
        data_dir9:'customer.tbl.9',
        data_dir10:'customer.tbl.10',
        data_dir11:'customer.tbl.11',
        data_dir12:'customer.tbl.12',
        data_dir13:'customer.tbl.13',
        data_dir14:'customer.tbl.14',
        data_dir15:'customer.tbl.15',
        data_dir16:'customer.tbl.16',
        data_dir17:'customer.tbl.17',
        data_dir18:'customer.tbl.18',
        data_dir19:'customer.tbl.19',
        data_dir20:'customer.tbl.20',
        data_dir21:'customer.tbl.21',
        data_dir22:'customer.tbl.22',
        data_dir23:'customer.tbl.23',
        data_dir24:'customer.tbl.24',
        data_dir25:'customer.tbl.25',
        data_dir26:'customer.tbl.26',
        data_dir27:'customer.tbl.27',
        data_dir28:'customer.tbl.28',
        data_dir29:'customer.tbl.29',
        data_dir30:'customer.tbl.30',
        data_dir31:'customer.tbl.31',
        data_dir32:'customer.tbl.32',
        data_dir33:'customer.tbl.33',
        data_dir34:'customer.tbl.34',
        data_dir35:'customer.tbl.35',
        data_dir36:'customer.tbl.36',
        data_dir37:'customer.tbl.37',
        data_dir38:'customer.tbl.38',
        data_dir39:'customer.tbl.39',
        data_dir40:'customer.tbl.40'
))
reject limit unlimited
parallel 128;

rem drop table s_et;
create table s_et(
    s_suppkey            number ,
    s_name               char(25) ,
    s_address            varchar(40) ,
    s_nationkey          number ,
    s_phone              char(15) ,
    s_acctbal            number,
    s_comment            varchar(101)
)
organization external (
type ORACLE_LOADER
default directory data_dir1
access parameters
(
                records delimited by newline
                badfile 's_et.bad'
                logfile 's_et.log'
                fields terminated by '|'
                missing field values are null
        )
        location (
        data_dir1:'supplier.tbl.1',
        data_dir2:'supplier.tbl.2',
        data_dir3:'supplier.tbl.3',
        data_dir4:'supplier.tbl.4',
        data_dir5:'supplier.tbl.5',
        data_dir6:'supplier.tbl.6',
        data_dir7:'supplier.tbl.7',
        data_dir8:'supplier.tbl.8',
        data_dir9:'supplier.tbl.9',
        data_dir10:'supplier.tbl.10',
        data_dir11:'supplier.tbl.11',
        data_dir12:'supplier.tbl.12',
        data_dir13:'supplier.tbl.13',
        data_dir14:'supplier.tbl.14',
        data_dir15:'supplier.tbl.15',
        data_dir16:'supplier.tbl.16',
        data_dir17:'supplier.tbl.17',
        data_dir18:'supplier.tbl.18',
        data_dir19:'supplier.tbl.19',
        data_dir20:'supplier.tbl.20',
        data_dir21:'supplier.tbl.21',
        data_dir22:'supplier.tbl.22',
        data_dir23:'supplier.tbl.23',
        data_dir24:'supplier.tbl.24',
        data_dir25:'supplier.tbl.25',
        data_dir26:'supplier.tbl.26',
        data_dir27:'supplier.tbl.27',
        data_dir28:'supplier.tbl.28',
        data_dir29:'supplier.tbl.29',
        data_dir30:'supplier.tbl.30',
        data_dir31:'supplier.tbl.31',
        data_dir32:'supplier.tbl.32',
        data_dir33:'supplier.tbl.33',
        data_dir34:'supplier.tbl.34',
        data_dir35:'supplier.tbl.35',
        data_dir36:'supplier.tbl.36',
        data_dir37:'supplier.tbl.37',
        data_dir38:'supplier.tbl.38',
        data_dir39:'supplier.tbl.39',
        data_dir40:'supplier.tbl.40'
        ))
reject limit unlimited
parallel 128;

rem drop table n_et;
create table n_et(
    n_nationkey          number ,
    n_name               char(25) ,
    n_regionkey          number ,
    n_comment            varchar(152)
)
organization external (
type ORACLE_LOADER
default directory data_dir1
access parameters
```

```
(
                records delimited by newline
                badfile 'n_et.bad'
                logfile 'n_et.log'
                fields terminated by '|'
                missing field values are null
        )
        location (
        data_dir40:'nation.tbl'))
reject limit unlimited;

rem drop table r_et;
create table r_et(
    r_regionkey          number ,
    r_name               char(25) ,
    r_comment            varchar(152)
)
organization external (
type ORACLE_LOADER
default directory data_dir1
access parameters
(
                records delimited by newline
                badfile 'r_et.bad'
                logfile 'r_et.log'
                fields terminated by '|'
                missing field values are null
        )
        location (
        data_dir40:'region.tbl'))
reject limit unlimited;

rem drop table lineitem;
create table lineitem(
    l_shipdate           ,
    l_orderkey           NOT NULL,
    l_discount           NOT NULL,
    l_extendedprice      NOT NULL,
    l_suppkey            NOT NULL,
    l_quantity           NOT NULL,
    l_returnflag         ,
    l_partkey            NOT NULL,
    l_linestatus         ,
    l_tax                NOT NULL,
    l_commitdate         ,
    l_receiptdate        ,
    l_shipmode           ,
    l_linenumber         NOT NULL,
    l_shipinstruct       ,
    l_comment
)
pctfree 2
pctused 98
initrans 10
storage (freelist groups 4 freelists 84)
parallel 128
nologging
compress
partition by range (l_shipdate)
subpartition by hash (l_partkey)
subpartitions 128
(
partition item1 values less than (to_date('1992-01-
01','YYYY-MM-DD'))
tablespace ts_l1
,
partition item2 values less than (to_date('1992-02-
01','YYYY-MM-DD'))
tablespace ts_l2
,
partition item3 values less than (to_date('1992-03-
01','YYYY-MM-DD'))
tablespace ts_l3
,
partition item4 values less than (to_date('1992-04-
01','YYYY-MM-DD'))
tablespace ts_l4
,
partition item5 values less than (to_date('1992-05-
01','YYYY-MM-DD'))
tablespace ts_l5
,
partition item6 values less than (to_date('1992-06-
01','YYYY-MM-DD'))
tablespace ts_l6
,
partition item7 values less than (to_date('1992-07-
01','YYYY-MM-DD'))
tablespace ts_l7
,
partition item8 values less than (to_date('1992-08-
01','YYYY-MM-DD'))
tablespace ts_l8
,
partition item9 values less than (to_date('1992-09-
01','YYYY-MM-DD'))
tablespace ts_l9
,
partition item10 values less than (to_date('1992-10-
01','YYYY-MM-DD'))
tablespace ts_l10
,
partition item11 values less than (to_date('1992-11-
01','YYYY-MM-DD'))
tablespace ts_l11
,
partition item12 values less than (to_date('1992-12-
01','YYYY-MM-DD'))
tablespace ts_l12
,
partition item13 values less than (to_date('1993-01-
01','YYYY-MM-DD'))
tablespace ts_l13
,
partition item14 values less than (to_date('1993-02-
01','YYYY-MM-DD'))
tablespace ts_l14
,
partition item15 values less than (to_date('1993-03-
01','YYYY-MM-DD'))
tablespace ts_l15
,
partition item16 values less than (to_date('1993-04-
01','YYYY-MM-DD'))
tablespace ts_l16
,
partition item17 values less than (to_date('1993-05-
01','YYYY-MM-DD'))
tablespace ts_l17
,
partition item18 values less than (to_date('1993-06-
01','YYYY-MM-DD'))
tablespace ts_l18
,
partition item19 values less than (to_date('1993-07-
01','YYYY-MM-DD'))
tablespace ts_l19
,
partition item20 values less than (to_date('1993-08-
01','YYYY-MM-DD'))
tablespace ts_l20
,
partition item21 values less than (to_date('1993-09-
01','YYYY-MM-DD'))
tablespace ts_l21
,
partition item22 values less than (to_date('1993-10-
01','YYYY-MM-DD'))
```

```
tablespace ts_l1
,
partition item23 values less than (to_date('1993-11-
01','YYYY-MM-DD'))
tablespace ts_l2
,
partition item24 values less than (to_date('1993-12-
01','YYYY-MM-DD'))
tablespace ts_l3
,
partition item25 values less than (to_date('1994-01-
01','YYYY-MM-DD'))
tablespace ts_l4
,
partition item26 values less than (to_date('1994-02-
01','YYYY-MM-DD'))
tablespace ts_l5
,
partition item27 values less than (to_date('1994-03-
01','YYYY-MM-DD'))
tablespace ts_l6
,
partition item28 values less than (to_date('1994-04-
01','YYYY-MM-DD'))
tablespace ts_l7
,
partition item29 values less than (to_date('1994-05-
01','YYYY-MM-DD'))
tablespace ts_l8
,
partition item30 values less than (to_date('1994-06-
01','YYYY-MM-DD'))
tablespace ts_l9
,
partition item31 values less than (to_date('1994-07-
01','YYYY-MM-DD'))
tablespace ts_l10
,
partition item32 values less than (to_date('1994-08-
01','YYYY-MM-DD'))
tablespace ts_l11
,
partition item33 values less than (to_date('1994-09-
01','YYYY-MM-DD'))
tablespace ts_l12
,
partition item34 values less than (to_date('1994-10-
01','YYYY-MM-DD'))
tablespace ts_l13
,
partition item35 values less than (to_date('1994-11-
01','YYYY-MM-DD'))
tablespace ts_l14
,
partition item36 values less than (to_date('1994-12-
01','YYYY-MM-DD'))
tablespace ts_l15
,
partition item37 values less than (to_date('1995-01-
01','YYYY-MM-DD'))
tablespace ts_l16
,
partition item38 values less than (to_date('1995-02-
01','YYYY-MM-DD'))
tablespace ts_l17
,
partition item39 values less than (to_date('1995-03-
01','YYYY-MM-DD'))
tablespace ts_l18
,
partition item40 values less than (to_date('1995-04-
01','YYYY-MM-DD'))
tablespace ts_l19
,
partition item41 values less than (to_date('1995-05-
01','YYYY-MM-DD'))
tablespace ts_l20
,
partition item42 values less than (to_date('1995-06-
01','YYYY-MM-DD'))
tablespace ts_l21
,
partition item43 values less than (to_date('1995-07-
01','YYYY-MM-DD'))
tablespace ts_l1
,
partition item44 values less than (to_date('1995-08-
01','YYYY-MM-DD'))
tablespace ts_l2
,
partition item45 values less than (to_date('1995-09-
01','YYYY-MM-DD'))
tablespace ts_l3
,
partition item46 values less than (to_date('1995-10-
01','YYYY-MM-DD'))
tablespace ts_l4
,
partition item47 values less than (to_date('1995-11-
01','YYYY-MM-DD'))
tablespace ts_l5
,
partition item48 values less than (to_date('1995-12-
01','YYYY-MM-DD'))
tablespace ts_l6
,
partition item49 values less than (to_date('1996-01-
01','YYYY-MM-DD'))
tablespace ts_l7
,
partition item50 values less than (to_date('1996-02-
01','YYYY-MM-DD'))
tablespace ts_l8
,
partition item51 values less than (to_date('1996-03-
01','YYYY-MM-DD'))
tablespace ts_l9
,
partition item52 values less than (to_date('1996-04-
01','YYYY-MM-DD'))
tablespace ts_l10
,
partition item53 values less than (to_date('1996-05-
01','YYYY-MM-DD'))
tablespace ts_l11
,
partition item54 values less than (to_date('1996-06-
01','YYYY-MM-DD'))
tablespace ts_l12
,
partition item55 values less than (to_date('1996-07-
01','YYYY-MM-DD'))
tablespace ts_l13
,
partition item56 values less than (to_date('1996-08-
01','YYYY-MM-DD'))
tablespace ts_l14
,
partition item57 values less than (to_date('1996-09-
01','YYYY-MM-DD'))
tablespace ts_l15
,
partition item58 values less than (to_date('1996-10-
01','YYYY-MM-DD'))
tablespace ts_l16
,
partition item59 values less than (to_date('1996-11-
01','YYYY-MM-DD'))
```

```
tablespace ts_l17
,
partition item60 values less than (to_date('1996-12-
01','YYYY-MM-DD'))
tablespace ts_l18
,
partition item61 values less than (to_date('1997-01-
01','YYYY-MM-DD'))
tablespace ts_l19
,
partition item62 values less than (to_date('1997-02-
01','YYYY-MM-DD'))
tablespace ts_l20
,
partition item63 values less than (to_date('1997-03-
01','YYYY-MM-DD'))
tablespace ts_l21
,
partition item64 values less than (to_date('1997-04-
01','YYYY-MM-DD'))
tablespace ts_l1
,
partition item65 values less than (to_date('1997-05-
01','YYYY-MM-DD'))
tablespace ts_l2
,
partition item66 values less than (to_date('1997-06-
01','YYYY-MM-DD'))
tablespace ts_l3
,
partition item67 values less than (to_date('1997-07-
01','YYYY-MM-DD'))
tablespace ts_l4
,
partition item68 values less than (to_date('1997-08-
01','YYYY-MM-DD'))
tablespace ts_l5
,
partition item69 values less than (to_date('1997-09-
01','YYYY-MM-DD'))
tablespace ts_l6
,
partition item70 values less than (to_date('1997-10-
01','YYYY-MM-DD'))
tablespace ts_l7
,
partition item71 values less than (to_date('1997-11-
01','YYYY-MM-DD'))
tablespace ts_l8
,
partition item72 values less than (to_date('1997-12-
01','YYYY-MM-DD'))
tablespace ts_l9
,
partition item73 values less than (to_date('1998-01-
01','YYYY-MM-DD'))
tablespace ts_l10
,
partition item74 values less than (to_date('1998-02-
01','YYYY-MM-DD'))
tablespace ts_l11
,
partition item75 values less than (to_date('1998-03-
01','YYYY-MM-DD'))
tablespace ts_l12
,
partition item76 values less than (to_date('1998-04-
01','YYYY-MM-DD'))
tablespace ts_l13
,
partition item77 values less than (to_date('1998-05-
01','YYYY-MM-DD'))
tablespace ts_l14
,
partition item78 values less than (to_date('1998-06-
01','YYYY-MM-DD'))
tablespace ts_l15
,
partition item79 values less than (to_date('1998-07-
01','YYYY-MM-DD'))
tablespace ts_l16
,
partition item80 values less than (to_date('1998-08-
01','YYYY-MM-DD'))
tablespace ts_l17
,
partition item81 values less than (to_date('1998-09-
01','YYYY-MM-DD'))
tablespace ts_l18
,
partition item82 values less than (to_date('1998-10-
01','YYYY-MM-DD'))
tablespace ts_l19
,
partition item83 values less than (to_date('1998-11-
01','YYYY-MM-DD'))
tablespace ts_l20
,
partition item84 values less than (MAXVALUE)
tablespace ts_l21
)
as select l_shipdate,l_orderkey,l_discount,
l_extendedprice,l_suppkey,l_quantity,
l_returnflag,l_partkey,l_linestatus,l_tax,
l_commitdate,l_receiptdate,l_shipmode,
l_linenumber,l_shipinstruct,l_comment from l_et
order by l_orderkey;

rem drop table orders;
create table orders(
    o_orderdate          ,
    o_orderkey           NOT NULL,
    o_custkey            NOT NULL,
    o_orderpriority      ,
    o_shippriority       ,
    o_clerk              ,
    o_orderstatus        ,
    o_totalprice         ,
    o_comment            )
pctfree 2
pctused 98
initrans 10
storage (freelist groups 4 freelists 84)
parallel 128
nologging
compress
partition by range (o_orderdate)
subpartition by hash (o_custkey)
subpartitions 128
(
partition ord1 values less than (to_date('1992-01-
01','YYYY-MM-DD'))
tablespace ts_o1
,
partition ord2 values less than (to_date('1992-02-
01','YYYY-MM-DD'))
tablespace ts_o2
,
partition ord3 values less than (to_date('1992-03-
01','YYYY-MM-DD'))
tablespace ts_o3
,
partition ord4 values less than (to_date('1992-04-
01','YYYY-MM-DD'))
tablespace ts_o4
,
partition ord5 values less than (to_date('1992-05-
01','YYYY-MM-DD'))
```

```
tablespace ts_o5
,
partition ord6 values less than (to_date('1992-06-
01','YYYY-MM-DD'))
tablespace ts_o6
,
partition ord7 values less than (to_date('1992-07-
01','YYYY-MM-DD'))
tablespace ts_o7
,
partition ord8 values less than (to_date('1992-08-
01','YYYY-MM-DD'))
tablespace ts_o8
,
partition ord9 values less than (to_date('1992-09-
01','YYYY-MM-DD'))
tablespace ts_o9
,
partition ord10 values less than (to_date('1992-10-
01','YYYY-MM-DD'))
tablespace ts_o10
,
partition ord11 values less than (to_date('1992-11-
01','YYYY-MM-DD'))
tablespace ts_o11
,
partition ord12 values less than (to_date('1992-12-
01','YYYY-MM-DD'))
tablespace ts_o12
,
partition ord13 values less than (to_date('1993-01-
01','YYYY-MM-DD'))
tablespace ts_o13
,
partition ord14 values less than (to_date('1993-02-
01','YYYY-MM-DD'))
tablespace ts_o14
,
partition ord15 values less than (to_date('1993-03-
01','YYYY-MM-DD'))
tablespace ts_o15
,
partition ord16 values less than (to_date('1993-04-
01','YYYY-MM-DD'))
tablespace ts_o16
,
partition ord17 values less than (to_date('1993-05-
01','YYYY-MM-DD'))
tablespace ts_o17
,
partition ord18 values less than (to_date('1993-06-
01','YYYY-MM-DD'))
tablespace ts_o18
,
partition ord19 values less than (to_date('1993-07-
01','YYYY-MM-DD'))
tablespace ts_o19
,
partition ord20 values less than (to_date('1993-08-
01','YYYY-MM-DD'))
tablespace ts_o20
,
partition ord21 values less than (to_date('1993-09-
01','YYYY-MM-DD'))
tablespace ts_o21
,
partition ord22 values less than (to_date('1993-10-
01','YYYY-MM-DD'))
tablespace ts_o1
,
partition ord23 values less than (to_date('1993-11-
01','YYYY-MM-DD'))
tablespace ts_o2
,
partition ord24 values less than (to_date('1993-12-
01','YYYY-MM-DD'))
tablespace ts_o3
,
partition ord25 values less than (to_date('1994-01-
01','YYYY-MM-DD'))
tablespace ts_o4
,
partition ord26 values less than (to_date('1994-02-
01','YYYY-MM-DD'))
tablespace ts_o5
,
partition ord27 values less than (to_date('1994-03-
01','YYYY-MM-DD'))
tablespace ts_o6
,
partition ord28 values less than (to_date('1994-04-
01','YYYY-MM-DD'))
tablespace ts_o7
,
partition ord29 values less than (to_date('1994-05-
01','YYYY-MM-DD'))
tablespace ts_o8
,
partition ord30 values less than (to_date('1994-06-
01','YYYY-MM-DD'))
tablespace ts_o9
,
partition ord31 values less than (to_date('1994-07-
01','YYYY-MM-DD'))
tablespace ts_o10
,
partition ord32 values less than (to_date('1994-08-
01','YYYY-MM-DD'))
tablespace ts_o11
,
partition ord33 values less than (to_date('1994-09-
01','YYYY-MM-DD'))
tablespace ts_o12
,
partition ord34 values less than (to_date('1994-10-
01','YYYY-MM-DD'))
tablespace ts_o13
,
partition ord35 values less than (to_date('1994-11-
01','YYYY-MM-DD'))
tablespace ts_o14
,
partition ord36 values less than (to_date('1994-12-
01','YYYY-MM-DD'))
tablespace ts_o15
,
partition ord37 values less than (to_date('1995-01-
01','YYYY-MM-DD'))
tablespace ts_o16
,
partition ord38 values less than (to_date('1995-02-
01','YYYY-MM-DD'))
tablespace ts_o17
,
partition ord39 values less than (to_date('1995-03-
01','YYYY-MM-DD'))
tablespace ts_o18
,
partition ord40 values less than (to_date('1995-04-
01','YYYY-MM-DD'))
tablespace ts_o19
,
partition ord41 values less than (to_date('1995-05-
01','YYYY-MM-DD'))
tablespace ts_o20
,
partition ord42 values less than (to_date('1995-06-
01','YYYY-MM-DD'))
```

```
tablespace ts_o21
,
partition ord43 values less than (to_date('1995-07-
01','YYYY-MM-DD'))
tablespace ts_o1
,
partition ord44 values less than (to_date('1995-08-
01','YYYY-MM-DD'))
tablespace ts_o2
,
partition ord45 values less than (to_date('1995-09-
01','YYYY-MM-DD'))
tablespace ts_o3
,
partition ord46 values less than (to_date('1995-10-
01','YYYY-MM-DD'))
tablespace ts_o4
,
partition ord47 values less than (to_date('1995-11-
01','YYYY-MM-DD'))
tablespace ts_o5
,
partition ord48 values less than (to_date('1995-12-
01','YYYY-MM-DD'))
tablespace ts_o6
,
partition ord49 values less than (to_date('1996-01-
01','YYYY-MM-DD'))
tablespace ts_o7
,
partition ord50 values less than (to_date('1996-02-
01','YYYY-MM-DD'))
tablespace ts_o8
,
partition ord51 values less than (to_date('1996-03-
01','YYYY-MM-DD'))
tablespace ts_o9
,
partition ord52 values less than (to_date('1996-04-
01','YYYY-MM-DD'))
tablespace ts_o10
,
partition ord53 values less than (to_date('1996-05-
01','YYYY-MM-DD'))
tablespace ts_o11
,
partition ord54 values less than (to_date('1996-06-
01','YYYY-MM-DD'))
tablespace ts_o12
,
partition ord55 values less than (to_date('1996-07-
01','YYYY-MM-DD'))
tablespace ts_o13
,
partition ord56 values less than (to_date('1996-08-
01','YYYY-MM-DD'))
tablespace ts_o14
,
partition ord57 values less than (to_date('1996-09-
01','YYYY-MM-DD'))
tablespace ts_o15
,
partition ord58 values less than (to_date('1996-10-
01','YYYY-MM-DD'))
tablespace ts_o16
,
partition ord59 values less than (to_date('1996-11-
01','YYYY-MM-DD'))
tablespace ts_o17
,
partition ord60 values less than (to_date('1996-12-
01','YYYY-MM-DD'))
tablespace ts_o18
,
partition ord61 values less than (to_date('1997-01-
01','YYYY-MM-DD'))
tablespace ts_o19
,
partition ord62 values less than (to_date('1997-02-
01','YYYY-MM-DD'))
tablespace ts_o20
,
partition ord63 values less than (to_date('1997-03-
01','YYYY-MM-DD'))
tablespace ts_o21
,
partition ord64 values less than (to_date('1997-04-
01','YYYY-MM-DD'))
tablespace ts_o1
,
partition ord65 values less than (to_date('1997-05-
01','YYYY-MM-DD'))
tablespace ts_o2
,
partition ord66 values less than (to_date('1997-06-
01','YYYY-MM-DD'))
tablespace ts_o3
,
partition ord67 values less than (to_date('1997-07-
01','YYYY-MM-DD'))
tablespace ts_o4
,
partition ord68 values less than (to_date('1997-08-
01','YYYY-MM-DD'))
tablespace ts_o5
,
partition ord69 values less than (to_date('1997-09-
01','YYYY-MM-DD'))
tablespace ts_o6
,
partition ord70 values less than (to_date('1997-10-
01','YYYY-MM-DD'))
tablespace ts_o7
,
partition ord71 values less than (to_date('1997-11-
01','YYYY-MM-DD'))
tablespace ts_o8
,
partition ord72 values less than (to_date('1997-12-
01','YYYY-MM-DD'))
tablespace ts_o9
,
partition ord73 values less than (to_date('1998-01-
01','YYYY-MM-DD'))
tablespace ts_o10
,
partition ord74 values less than (to_date('1998-02-
01','YYYY-MM-DD'))
tablespace ts_o11
,
partition ord75 values less than (to_date('1998-03-
01','YYYY-MM-DD'))
tablespace ts_o12
,
partition ord76 values less than (to_date('1998-04-
01','YYYY-MM-DD'))
tablespace ts_o13
,
partition ord77 values less than (to_date('1998-05-
01','YYYY-MM-DD'))
tablespace ts_o14
,
partition ord78 values less than (to_date('1998-06-
01','YYYY-MM-DD'))
tablespace ts_o15
,
partition ord79 values less than (to_date('1998-07-
01','YYYY-MM-DD'))
```

```
tablespace ts_o16
,
partition ord80 values less than (to_date('1998-08-
01','YYYY-MM-DD'))
tablespace ts_o17
,
partition ord81 values less than (to_date('1998-09-
01','YYYY-MM-DD'))
tablespace ts_o18
,
partition ord82 values less than (to_date('1998-10-
01','YYYY-MM-DD'))
tablespace ts_o19
,
partition ord83 values less than (to_date('1998-11-
01','YYYY-MM-DD'))
tablespace ts_o20
,
partition ord84 values less than (MAXVALUE)
tablespace ts_o21
)
as select o_orderdate, o_orderkey, o_custkey,
o_orderpriority, o_shippriority, o_clerk,
o_orderstatus, o_totalprice, o_comment from o_et
order by o_orderkey;

rem drop table partsupp;
create table partsupp(
    ps_partkey          NOT NULL,
    ps_suppkey          NOT NULL,
    ps_supplycost       ,
    ps_availqty         ,
    ps_comment
)
pctfree 0
pctused 99
parallel 128
nologging
compress
partition by hash (ps_partkey)
partitions 128
tablespace ts_ps
storage (initial 20m)
as select ps_partkey, ps_suppkey, ps_supplycost,
ps_availqty, ps_comment from ps_et;

rem drop table part;
create table part(
    p_partkey           NOT NULL,
    p_type              ,
    p_size              ,
    p_brand             ,
    p_name              ,
    p_container         ,
    p_mfgr              ,
    p_retailprice       ,
    p_comment           )
pctfree 0
pctused 99
tablespace ts_p
storage (freelists 99)
parallel 128
nologging
compress
partition by hash (p_partkey)
partitions 128
as select p_partkey, p_type, p_size, p_brand, p_name,
p_container, p_mfgr, p_retailprice, p_comment  from
p_et;

rem drop table customer;
create table customer(
    c_custkey           NOT NULL,
    c_mktsegment        ,
    c_nationkey         ,
    c_name              ,
    c_address           ,
    c_phone             ,
    c_acctbal           ,
    c_comment           )
pctfree 0
pctused 99
tablespace ts_c
storage (freelists 99)
parallel 128
nologging
compress
partition by hash (c_custkey)
partitions 128
as select c_custkey, c_mktsegment, c_nationkey,
c_name, c_address, c_phone, c_acctbal, c_comment from
c_et;

rem drop table supplier;
create table supplier(
    s_suppkey           NOT NULL,
    s_nationkey         ,
    s_comment           ,
    s_name              ,
    s_address           ,
    s_phone             ,
    s_acctbal           )
pctfree 0
pctused 99
tablespace ts_s
storage (freelists 99)
parallel 128
nologging
compress
partition by hash (s_suppkey)
partitions 128
as select s_suppkey, s_nationkey, s_comment, s_name,
s_address, s_phone, s_acctbal from s_et;

rem drop table nation;
create table nation(
    n_nationkey         NOT NULL,
    n_name              ,
    n_regionkey         ,
    n_comment           )
tablespace ts_default
as select * from n_et;

rem drop table region;
create table region(
    r_regionkey         ,
    r_name              ,
    r_comment           )
tablespace ts_default
as select * from r_et;

drop table l_et;
drop table o_et;
drop table ps_et;
drop table p_et;
drop table c_et;
drop table s_et;
drop table n_et;
drop table r_et;

!

echo END Data Loading at `date`

================================================
```

## ixcre.sh

```
#!/bin/ksh
#########################################################
#######################
# Index Creation Phase
#########################################################
#######################
echo START Index Creation at `date`

sqlplus / as sysdba<<EOF
connect tpch/tpch;

set echo on
set timing on

rem drop index i_l_orderkey;
create index i_l_orderkey
on lineitem (l_orderkey)
global partition by hash (l_orderkey)
partitions 128
pctfree 5
initrans 10
tablespace ts_i_lorderkey
storage (freelist groups 4 freelists 84)
parallel 128
compute statistics
nologging ;

rem drop index i_o_orderkey;
create unique index i_o_orderkey
on orders (o_orderkey)
global partition by hash (o_orderkey)
partitions 128
pctfree 5
initrans 10
tablespace ts_i_oorderkey
storage (freelist groups 4 freelists 84 )
parallel 128
compute statistics
nologging ;

rem drop index i_c_custkey;
create unique index i_c_custkey
on customer (c_custkey)
pctfree 0
initrans 10
tablespace ts_i_ccustkey
storage (freelists 84)
parallel 128
compute statistics
nologging ;

rem drop index ps_pkey_skey;
create unique index ps_pkey_skey
on partsupp (ps_partkey,ps_suppkey)
global partition by hash (ps_partkey)
partitions 128
pctfree 0
initrans 10
tablespace ts_ps
parallel 128
compute statistics
nologging ;

alter index i_o_orderkey allocate extent (size 100m
instance 1);
alter index i_l_orderkey allocate extent (size 40m
instance 1);
EOF

echo END Index Creation at `date`
```

==========

## anlyz.sh

```
#!/bin/ksh
#########################################################
#######################
# Analyze Phase
###################

echo START Analyze at `date`
sqlplus / as sysdba<<EOF
connect tpch/tpch;
set echo on
set timing on
execute dbms_stats.gather_schema_stats('TPCH' ,
estimate_percent => 1, degree => 64
, granularity => 'GLOBAL', method_opt => 'for all
columns size 1' );
connect / as sysdba
execute dbms_stats.gather_system_stats;
EOF

echo END Analyze at `date`
```

==========

# ACID Test Source Code

==========

==========

## atranspl.c

```
#include <stdio.h>
#include <stdlib.h>
#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>

#include "atranspl.h"

/* Declare error handling functions */

double gettime();
void sql_error();
void usage();
void ACIDinit();
void ACIDexit();
int atoi();
void srand48();
long lrand48();

/* declarations for ORDERS */

int o_key = 0;
double o_tprice = 0.0;
double o_newtprice = 0.0;

/* declarations for LINEITEM */

int l_key = 0;
int l_pkey = 0;
int l_skey = 0;

int l_quan = 0;
int l_newquan = 0;
double l_eprice = 0.0;
double l_neweprice = 0.0;
double l_disc = 0.0;
double l_tax = 0.0;

sb2 l_npricei;

/* other declarations */
```

```
int delta = 0;
double rprice;
double cost;

int proc_no = 1;          /* process number, global
*/
int num_streams = 1;      /* number of transaction
streams       */
int trig = 0;             /* Trigger Time
*/
int slp = 0;              /* Sleep Time
*/

int logfile;              /* fdes for logfile for
durability (optional)   */
int outfile = 1;          /* output file (optional)
*/
#ifdef LINUX
FILE *infile;     /* input file (optional)
*/
#else
  FILE *infile = stdin;     /* input file (optional)
*/
                            /* in the format of
<o_key> <delta>    */
#endif
char lname[UNAME_LEN];    /* username/passwd combo
*/
char *passwd;             /* pointer to password
*/

char buf[WRITE_BUF_LEN];  /* buffer to write
*/

unsigned flag = (unsigned) 0;       /* flag to store
all sorts of options  */

#define INFILE  0x01u
#define OUTFILE 0x02u
#define LOGFILE 0x04u
#define COMMIT  0x08u
#define DELTA   0x10u

double tr_end = 0.0;      /* transaction end time
*/
double tr_start = 0.0;    /* transaction start time
*/

int num_iter = 0;         /* number of iterations
*/

time_t curr_time;         /* Current Time
*/

/* OCI handles */

OCIEnv *tpcenv = NULL;
OCIServer *tpcsrv = NULL;
OCIError *errhp = NULL;
OCISvcCtx *tpcsvc = NULL;
OCISession *tpcusr = NULL;
OCIStmt *curi = NULL;
OCIStmt *curr = NULL;
OCIStmt *cure1 = NULL;
OCIStmt *cure2 = NULL;

/* OCI bind handles */

#ifdef NOLKEY
OCIBind *l_keyi_bp = NULL;
OCIBind *o_keyi_bp = NULL;
#endif /* NOLKEY */

OCIBind *l_key_bp = NULL;
OCIBind *o_key_bp = NULL;
OCIBind *delta_bp = NULL;
OCIBind *l_pkey_bp = NULL;
OCIBind *l_skey_bp = NULL;
OCIBind *l_quan_bp = NULL;
OCIBind *l_newquan_bp = NULL;
OCIBind *l_tax_bp = NULL;
OCIBind *l_disc_bp = NULL;
OCIBind *l_eprice_bp = NULL;
OCIBind *l_neweprice_bp = NULL;
OCIBind *o_tprice_bp = NULL;
OCIBind *o_newtprice_bp = NULL;
OCIBind *rprice_bp = NULL;
OCIBind *cost_bp = NULL;

OCIBind *l_neweprice1_bp = NULL;
OCIBind *l_newquan1_bp = NULL;
OCIBind *o_key1_bp = NULL;
OCIBind *l_key1_bp = NULL;

OCIBind *o_newtprice2_bp = NULL;
OCIBind *o_key2_bp = NULL;

sword status = OCI_SUCCESS;  /* OCI return value */

char sqlstmt[1024];

/* usage: prints the usage of the program */

void usage()
{

  fprintf (stderr,"\nUsage: atrans.o[st]t <proc_no>
<num_streams> <commit> <delta>\n[i<pathname for
input>] [o<pathname for output>] [d<pathname for
durability file>] [u<uid/passwd>] \n\n");

  fprintf(stderr,"    proc_no      :the process number
within this ACID\n");
  fprintf(stderr,"    num_streams  :the total number
of ACID transaction streams\n");
  fprintf(stderr,"    commit       :1 to commit
transaction, abort otherwise\n\n");
  fprintf(stderr,"    delta        :1 to generate new
random delta, otherwise obtain delta from input\n\n");
  fprintf(stderr,"    OPTIONAL PARAMETERS:\n");
  fprintf(stderr,"    i<pathname for input>      :full
path name for input file - default is stdin\n");
  fprintf(stderr,"    o<pathname for output>     :full
path name for output file - default is stdout\n");
  fprintf(stderr,"    d<pathname for durability> :full
path name for durability success file - must specify
for durability test\n");
  fprintf(stderr,"    u<uid/passwd>
:Username/Password string - default is tcpd/tpcd\n");
  fprintf(stderr,"    t<trigger>
:Trigger Time - sleep <trigger> seconds before
start\n\n");
  fprintf(stderr,"    s<sleep>
:Sleep Time - sleep <sleep> seconds before commit or
rollback\n\n");
  exit(-1);

}


void ACIDexit() {

  OCILogoff(tpcsvc,errhp);
  OCIhfree(tpcenv,OCI_HTYPE_STMT);
  OCIhfree(tpcsvc,OCI_HTYPE_SVCCTX);
  OCIhfree(tpcsrv,OCI_HTYPE_SERVER);
  OCIhfree(tpcusr,OCI_HTYPE_SESSION);
```

```
}


/* type: 0 if environment handle is passed, 1 if error
handle is passwd */

void sql_error(errhp,status,type)
     OCIError *errhp;
     sword status;
     sword type;
{
  char msg[2048];
  ub4 errcode;
  ub4 msglen;
  int i,j;

  switch(status) {
  case OCI_SUCCESS_WITH_INFO:
    fprintf(stderr, "Error: Statement returned with
info.\n");
    if (type)
      (void) OCIErrorGet(errhp,1,NULL,(sb4*) &errcode,
(text*) msg,
                         2048, OCI_HTYPE_ERROR);
    else
      (void) OCIErrorGet(errhp,1,NULL,(sb4*) &errcode,
(text*) msg,
                         2048, OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  case OCI_ERROR:
    fprintf(stderr, "Error: OCI call error.\n");
    if (type)
      (void) OCIErrorGet(errhp,1,NULL, (sb4 *)
&errcode, (text*) msg,
                         2048,OCI_HTYPE_ERROR);
    else
      (void) OCIErrorGet(errhp,1,NULL, (sb4 *)
&errcode, (text*) msg,
                         2048,OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  case OCI_INVALID_HANDLE:
    fprintf(stderr, "Error: Invalid Handle.\n");
    if (type)
      (void) OCIErrorGet(errhp,1,NULL, (sb4 *)
&errcode, (text*) msg,
                         2048,OCI_HTYPE_ERROR);
    else
      (void) OCIErrorGet(errhp,1,NULL, (sb4 *)
&errcode, (text*) msg,
                         2048,OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  }
  /* Rollback just in case */

  (void) OCITransRollback(tpcsvc,errhp,OCI_DEFAULT);

  fprintf(stderr, "Exiting Oracle...\n");
  fflush(stderr);

  ACIDexit();

  exit(1);
}

#ifdef LINUX
int main(argc,argv)
#else
void main(argc,argv)
#endif
     int argc;
     char *argv[];
{

  int i;
  char line[64];
  ub4 errcode;
  char msg[2048];
  int need_commit = 0;

  /* Initialize some variables */
#ifdef LINUX
  infile=fopen("/dev/stdin","r");
#endif
  strcpy((char *) lname, "tpcd/tpcd");

  if ((argc > 10) || (argc < 5)) {
    usage();
  }

  /* argv[1] -- Process Number */

  proc_no = atoi(argv[1]);

  /* argv[2] -- Number of Streams */

  num_streams = atoi(argv[2]);

  /* argv[3] -- Commit? */

  if (atoi(argv[3]) == 1)
    BIS(flag, COMMIT);

  /* argv[4] -- Delta? */

  if (atoi(argv[4]) == 1)
    BIS(flag, DELTA);

  /* Process  optional parameters */

  argc -= 4;
  argv += 4;

  while(--argc) {
    ++argv;
    switch(argv[0][0]) {
   case 'u':
      strncpy((char *) lname, ++(argv[0]), UNAME_LEN);
      if (strchr((char *) lname, '/') == NULL) {
        fprintf(stderr, "Login name must be in the
format of userid/passwd\n");
        usage();
        exit(-1);
      }
      break;
    case 'i':
      if ((infile = fopen(++(argv[0]), "r")) == NULL)
{fprintf(stderr,"Cannot open input file %s\n",
argv[0]);
        fprintf(stderr,"%s\n",strerror(errno));
        exit(-1);
      }
      BIS(flag, INFILE);
      break;
    case 'o':
      if ((outfile = open(++(argv[0]), (O_RDWR |
O_SYNC | O_CREAT), S_IRWXU)) == -1) {
        fprintf(stderr,"Cannot open output file %s\n",
argv[0]);
        fprintf(stderr,"%s\n",strerror(errno));
        exit(-1);
      }
      BIS(flag, OUTFILE);
      break;
    case 'd':
```

```
      if ((logfile = open(++(argv[0]), (O_RDWR |
O_SYNC | O_CREAT), S_IRWXU)) == -1) {
        fprintf(stderr,"Cannot open durability success
file %s\n", argv[0]);
        fprintf(stderr,"%s\n",strerror(errno));
        exit(-1);
      }
      BIS(flag, LOGFILE);
      break;
    case 'b':
      num_iter = atoi(++(argv[0]));
      break;
    case 't':
      trig = atoi(++(argv[0]));
      break;
    case 's':
      slp = atoi(++(argv[0]));
      break;
    default:
      fprintf(stderr, "Unknown argument %s\n",
argv[0]);
      usage();
      break;
    }
  }

  FPRTF(outfile,"----------------------------------
----------\n");

  /* Initialize the cursors etc. */

  (void) ACIDinit();

  /* sleep for some time (triggering) */

  sleep(trig);

  /* start doing the ACID transactions */

  tr_start = gettime();

  /* The number of iteration we will run depends on
the number of */
  /* input lines
*/

  while (fgets(line, 64, infile) != NULL) {

#ifdef NOLKEY
    sscanf(line, "%d %d\n", &o_key, &delta);

    /* Obtain l_key from l_key query */

    OCIsexec(tpcsvc,curi,errhp,1);

    /* l_key is the highest l_linenumber available.
We need to pick */
    /* at random a number between 1..l_key.
*/

    l_key = (int) ((lrand48() % l_key) + 1);
#else
    sscanf(line, "%d %d %d\n", &o_key, &l_key,
&delta);
#endif /* NOLKEY */

    /* Generate delta if necessary */

    if (BIT(flag, DELTA))
      delta = (int) (floor((drand48() * 100)) + 1);

    /* Now, we are ready to run the ACID transaction.
*/

    curr_time = time(NULL);

    FPRTF2(outfile, "Starting ACID transaction %d at
%s...\n", (++num_iter),
            ctime(&curr_time));

    FPRTF1(outfile, "o_key: %d\n", (int) o_key);
    FPRTF1(outfile, "l_key: %d\n", (int) l_key);
    FPRTF1(outfile, "delta: %d\n", (int) delta);

    OCIsexec(tpcsvc,curr,errhp,1);

    curr_time = time(NULL);

    if (!BIT(flag, LOGFILE)) {
    FPRTF1(outfile, "BEFORE COMMIT/ROLLBACK
TRANSACTION at %s\n", ctime(&curr_time));
    FPRTF1(outfile, "l_extendedprice: %.2f\n",
l_eprice);
    FPRTF1(outfile, "l_quantity:      %d\n", (int)
l_quan);
    FPRTF1(outfile, "o_totalprice:    %.2f\n\n",
o_tprice);
    }

    FPRTF1(outfile, "Sleep %d seconds before
COMMIT/ROLLBACK...\n\n", slp);
    sleep(slp);

    /* Shall we commit? */

    if (BIT(flag, COMMIT)) {
      need_commit = 1;
      while (need_commit) {
        if((status=OCITransCommit(tpcsvc,errhp,OCI_DEF
AULT)) != OCI_SUCCESS) {
             OCIrol(tpcsvc,errhp);
             OCIsexec(tpcsvc,curr,errhp,1);
        } else {
            need_commit = 0;
            curr_time = time(NULL);
            FPRTF2(outfile, "ACID Transaction
iteration %d COMMITED at %s\n",
              num_iter, ctime(&curr_time));
        }
      }
    } else {
      OCIrol(tpcsvc,errhp);
      curr_time = time(NULL);
      FPRTF2(outfile, "ACID Transaction iteration %d
ROLLBACK at %s\n",
             num_iter, ctime(&curr_time));
    }

    /* Report all results to outfile and if necessary,
to success file. */

    /* Report initial and new values for o_totalprice,
l_extendedprice, */
    /* l_quantity.
*/

    /*
    curr_time = time(NULL);
   FPRTF1(outfile, "Transaction Completed at %s\n",
ctime(&curr_time));
    */

    /* Get the values in LINEITEM and ORDERS after the
transaction */

    if (BIT(flag, LOGFILE)) {
      FPRTF1(logfile, "p_key:      %d\n", (int)
l_pkey);
```

```
      FPRTF1(logfile, "s_key:      %d\n", (int)
l_skey);
      FPRTF1(logfile, "o_key:      %d\n", (int)
o_key);
      FPRTF1(logfile, "l_key:      %d\n", (int)
l_key);
      FPRTF1(logfile, "delta:      %d\n", (int)
delta);
      FPRTF1(logfile, "Transaction Completed at %s\n",
ctime(&curr_time));
      FPRTF(logfile,
"------------------------------------------------
\n");
    } else {

      OCIsexec(tpcsvc,cure1,errhp,1);
      OCIsexec(tpcsvc,cure2,errhp,1);

      FPRTF(outfile, "AFTER TRANSACTION:\n");
      FPRTF1(outfile, "l_extendedprice: %.2lf\n",
l_neweprice);
      FPRTF1(outfile, "l_quantity:      %d\n", (int)
l_newquan);
      FPRTF1(outfile, "o_totalprice:    %.2lf\n\n",
o_newtprice);
      FPRTF1(outfile, "l_tax:           %.2lf\n",
l_tax);
      FPRTF1(outfile, "l_discount:      %.2lf\n",
l_disc);
      FPRTF1(outfile, "rprice:          %.2lf\n",
rprice);
      FPRTF1(outfile, "cost:            %.2lf\n",
cost);
      FPRTF(outfile,
"------------------------------------------------
\n");
    }
  }

  tr_end = gettime();

  if (!BIT(flag,LOGFILE)) {
    FPRTF1(outfile, "Start Time: %.2f\n", tr_start);
    FPRTF1(outfile, "End Time: %.2f\n", tr_end);
    FPRTF1(outfile, "Elapsed Time: %.2f\n", (tr_end -
tr_start));
    FPRTF1(outfile, "Transaction Count: %d\n",
num_iter);
    FPRTF1(outfile, "Transaction Rate: %.2f\n",
num_iter/(tr_end - tr_start));
  } else {
    FPRTF1(logfile, "Start Time: %.2f\n", tr_start);
    FPRTF1(logfile, "End Time: %.2f\n", tr_end);
    FPRTF1(logfile, "Elapsed Time: %.2f\n", (tr_end -
tr_start));
    FPRTF1(logfile, "Transaction Count: %d\n",
num_iter);
  }

  /*  Disconnect from ORACLE. */

  if (BIT(flag, INFILE))
    fclose(infile);
  if (BIT(flag, OUTFILE))
    close(outfile);
  if (BIT(flag, LOGFILE))
    close(logfile);

  ACIDexit();

  exit(0);
}
```

```
void ACIDinit()
{

  /* run random seed */

  srand48(getpid());

  /* Connect to ORACLE.  Program will call sql_error()
     if an error occurs in connecting to the default
database. */

  (void) OCIInitialize(OCI_DEFAULT,(dvoid *)0,0,0,0);
  if((status=OCIEnvInit((OCIEnv
**)&tpcenv,OCI_DEFAULT,0,(dvoid **)0)) !=
     OCI_SUCCESS)
    sql_error(tpcenv, status, 0);

  OCIhalloc(tpcenv,&errhp,OCI_HTYPE_ERROR);
  OCIhalloc(tpcenv,&curi,OCI_HTYPE_STMT);
  OCIhalloc(tpcenv,&curr,OCI_HTYPE_STMT);
  OCIhalloc(tpcenv,&cure1,OCI_HTYPE_STMT);
  OCIhalloc(tpcenv,&cure2,OCI_HTYPE_STMT);
  OCIhalloc(tpcenv,&tpcsvc,OCI_HTYPE_SVCCTX);
  OCIhalloc(tpcenv,&tpcsrv,OCI_HTYPE_SERVER);
  OCIhalloc(tpcenv,&tpcusr,OCI_HTYPE_SESSION);

  /* Disables auto commit */
/*
  if (ocof(&tpclda)) {
    sql_error(&tpclda, &tpclda);
    ologof(&tpclda);
    exit(-1);
  }
*/

  /* get username and password */

  passwd = strchr(lname, '/');
  *passwd = '\0';
  passwd++;

  if ((status = OCIServerAttach(tpcsrv,errhp,(text
*)0,0,OCI_DEFAULT)) != OCI_SUCCESS)
    sql_error(errhp,status,1);

  OCIaset(tpcsvc,OCI_HTYPE_SVCCTX,tpcsrv,0,OCI_ATTR_SE
RVER,errhp);
  OCIaset(tpcusr,OCI_HTYPE_SESSION,lname,strlen(lname)
,OCI_ATTR_USERNAME,
          errhp);
  OCIaset(tpcusr,OCI_HTYPE_SESSION,passwd,strlen(passw
d),OCI_ATTR_PASSWORD,
          errhp);

  if ((status = OCISessionBegin(tpcsvc, errhp, tpcusr,
OCI_CRED_RDBMS,
                                OCI_DEFAULT)) !=
OCI_SUCCESS)
    sql_error(errhp,status,1);

  OCIaset(tpcsvc,OCI_HTYPE_SVCCTX,tpcusr,0,OCI_ATTR_SE
SSION,errhp);

  /* Enable session parallel dml */

  sprintf((char *) sqlstmt, PDMLTXT);
  OCIStmtPrepare(curi,errhp,(text
*)sqlstmt,strlen((char *)sqlstmt),
                 OCI_NTV_SYNTAX,OCI_DEFAULT);
  OCIsexec(tpcsvc,curi,errhp,1);

  /* Enable session parallel ddl */

  /*sprintf((char *) sqlstmt, PDDLTXT);
```

```
  OCIStmtPrepare(curi,errhp,(text
*)sqlstmt,strlen((char *)sqlstmt),
                 OCI_NTV_SYNTAX,OCI_DEFAULT);
  OCIsexec(tpcsvc,curi,errhp,1);*/


  /* Make session serializable */

  sprintf ((char *) sqlstmt, ISOTXT);
  OCIStmtPrepare(curi,errhp,(text
*)sqlstmt,strlen((char *)sqlstmt),
                 OCI_NTV_SYNTAX,OCI_DEFAULT);
  OCIsexec(tpcsvc,curi,errhp,1);

  /* Set optimizer_index_cost_adj = 25 */

  sprintf ((char *) sqlstmt, OICATXT);
  OCIStmtPrepare(curi,errhp,(text
*)sqlstmt,strlen((char *)sqlstmt),
                 OCI_NTV_SYNTAX,OCI_DEFAULT);
  OCIsexec(tpcsvc,curi,errhp,1);

  curr_time = time(NULL);
  printf("\nConnected to ORACLE as user: %s at
%s\n\n", lname, ctime(&curr_time));


#ifdef NOLKEY
  /* Open and Parse cursor for query to choose
determine l_key. */
  /* Binds l_key to :l_key.
*/

  sprintf((char *) sqlstmt,SQLTXT1);
  OCIStmtPrepare(curi,errhp,sqlstmt,strlen((char
*)sqlstmt),OCI_NTV_SYNTAX,OCI_DEFAULT);


  OCIbbname(curi,&l_keyi_bp,errhp,":l_key",ADR(l_key),
SIZ(l_key),SQLT_INT);
  OCIbbname(curi,&o_keyi_bp,errhp,":o_key",ADR(o_key),
SIZ(o_key),SQLT_INT);

#endif /* NOLKEY */

  /* Open and Parse cursor for the ACID transaction.
*/

  sprintf((char *) sqlstmt,SQLTXT2);
  OCIStmtPrepare(curr,errhp,(text
*)sqlstmt,strlen((char *)sqlstmt),
                 OCI_NTV_SYNTAX,OCI_DEFAULT);

  /* bind variables */

  OCIbbname(curr,l_key_bp,errhp,":l_key",ADR(l_key),SI
Z(l_key),SQLT_INT);
  OCIbbname(curr,o_key_bp,errhp,":o_key",ADR(o_key),SI
Z(o_key),SQLT_INT);
  OCIbbname(curr,delta_bp,errhp,":delta",ADR(delta),SI
Z(delta),SQLT_INT);
  OCIbbname(curr,l_pkey_bp,errhp,":l_pkey",ADR(l_pkey)
,SIZ(l_pkey),SQLT_INT);
  OCIbbname(curr,l_skey_bp,errhp,":l_skey",ADR(l_skey)
,SIZ(l_skey),SQLT_INT);
  OCIbbname(curr,l_quan_bp,errhp,":l_quan",ADR(l_quan)
,SIZ(l_quan),SQLT_INT);
  OCIbbname(curr,l_newquan_bp,errhp,":l_newquan",ADR(l
_newquan),
            SIZ(l_newquan),SQLT_INT);
  OCIbbname(curr,l_tax_bp,errhp,":l_tax",ADR(l_tax),SI
Z(l_tax),SQLT_FLT);
  OCIbbname(curr,l_disc_bp,errhp,":l_disc",ADR(l_disc)
,SIZ(l_disc),SQLT_FLT);
  OCIbbname(curr,l_eprice_bp,errhp,":l_eprice",ADR(l_e
price),SIZ(l_eprice),
            SQLT_FLT);
  OCIbbname(curr,l_neweprice_bp,errhp,":l_neweprice",A
DR(l_neweprice),
            SIZ(l_neweprice),SQLT_FLT);

  OCIbbname(curr,o_tprice_bp,errhp,":o_tprice",ADR(o_t
price),SIZ(o_tprice),
            SQLT_FLT);
  OCIbbname(curr,o_newtprice_bp,errhp,":o_newtprice",A
DR(o_newtprice),
            SIZ(o_newtprice), SQLT_FLT);
  OCIbbname(curr,rprice_bp,errhp,":rprice",ADR(rprice)
,SIZ(rprice), SQLT_FLT);
  OCIbbname(curr,cost_bp,errhp,":cost",ADR(cost),SIZ(c
ost), SQLT_FLT);

  /* Open & Parse cursor for end values query */

  sprintf((char *) sqlstmt,SQLTXT3);
  OCIStmtPrepare(cure1,errhp,(text
*)sqlstmt,strlen((char *)sqlstmt),
                 OCI_NTV_SYNTAX,OCI_DEFAULT);

  sprintf((char *) sqlstmt,SQLTXT4);
  OCIStmtPrepare(cure2,errhp,(text
*)sqlstmt,strlen((char *)sqlstmt),
                 OCI_NTV_SYNTAX,OCI_DEFAULT);

  /* bind variables */

  OCIbbname(cure1,l_neweprice1_bp,errhp,":l_neweprice"
,ADR(l_neweprice),
            SIZ(l_neweprice),SQLT_FLT);
  OCIbbname(cure1,l_newquan1_bp,errhp,":l_newquan",ADR
(l_newquan),
            SIZ(l_newquan),SQLT_INT);
  OCIbbname(cure1,o_key1_bp,errhp,":o_key",ADR(o_key),
SIZ(o_key),SQLT_INT);
  OCIbbname(cure1,l_key1_bp,errhp,":l_key",ADR(l_key),
SIZ(l_key),SQLT_INT);

  OCIbbname(cure2,o_newtprice2_bp,errhp,":o_newtprice"
,ADR(o_newtprice),
            SIZ(o_newtprice),SQLT_FLT);
  OCIbbname(cure2,o_key2_bp,errhp,":o_key",ADR(o_key),
SIZ(o_key),SQLT_INT);

}
```

==========

## atranspl.h

```
#ifndef ATRANSPL_H

#define ATRANSPL_H

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <sys/param.h>
#include <sys/types.h>
#include <time.h>
#include <errno.h>
#include <math.h>

#include <oratypes.h>
#ifndef OCIDFN
#include <ocidfn.h>
#endif /* OCIDFN */

#ifndef OCI_ORACLE
```

```
#include <oci.h>
#endif /* OCI_ORACLE */

/*
#ifdef __STDC__
#include <ociapr.h>
#else
#include <ocikpr.h>
#endif */ /* __STDC__ */

extern int errno;

#ifndef NULL
#define NULL 0
#endif

#ifndef NULLP
# define NULLP (void *)NULL
#endif /* NULLP */

#ifndef DISCARD
# define DISCARD (void)
#endif

#ifndef sword
# define sword int
#endif

#ifndef ub1
#define ub1 unsigned char
#endif

#define UNAME_LEN 64
#define WRITE_BUF_LEN 1024

#define NA              -1      /* ANSI SQL NULL */
#define VER7            2
#define NOT_SERIALIZABLE  8177  /* ORA-08177:
transaction not serializable */
#define WRITE_BUF_LEN 1024

#define ADR(object) ((ub1 *)&(object))
#define SIZ(object) ((sword)sizeof(object))
#define BIS(flg,mask) (unsigned) (flg |= (unsigned)
mask)
#define BIT(flg,mask) (unsigned) ((unsigned) flg &
(unsigned) mask)

#define FPRTF(fd,s) \
{sprintf(buf,s); write(fd, buf, strlen(s));}
#define FPRTF1(fd,s,p) \
{sprintf(buf,s,p); write(fd, buf, strlen(buf));}
#define FPRTF2(fd,s,p1,p2) \
{sprintf(buf,s,p1,p2); write(fd, buf, strlen(buf));}

#define OCIhalloc(envh,hndl,htyp) \
    if((status=OCIHandleAlloc((dvoid *)envh,(dvoid
**)hndl,htyp,0,(dvoid **)0))!=OCI_SUCCESS) \
       sql_error(envh,status,0); \
    else \
       DISCARD 0

#define OCIhfree(hndl,htyp) \
    if((status=OCIHandleFree((dvoid *)hndl,htyp)) ==
OCI_SUCCESS) \
       fprintf(stderr, "Error freeing handle of type
%d\n", htyp)

#define OCIaget(hndl,htyp,attp,size,atyp,errh) \
    if((status=OCIAttrGet((dvoid *)hndl,htyp,(dvoid
*)attp,(dvoid *)size,atyp,errh)) != OCI_SUCCESS) \
       sql_error(errh,status,1); \
    else \
       DISCARD 0

#define OCIaset(hndl,htyp,attp,size,atyp,errh) \
    if((status=OCIAttrSet((dvoid *)hndl,htyp,(dvoid
*)attp,size,atyp,errh)) != OCI_SUCCESS) \
       sql_error(errh,status,1); \
    else \
       DISCARD 0

#define OCIsexec(svch,stmh,errh,iter) \
    if((status=OCIStmtExecute(svch,stmh,errh,iter,0,NU
LL,NULL,OCI_DEFAULT)) != OCI_SUCCESS) \
       sql_error(errh,status,1); \
    else \
       DISCARD 0

#define
OCIbbname(stmh,bindp,errh,sqlvar,progv,progvl,ftype) \
    if((status=OCIBindByName(stmh,&bindp,errh,(text
*)sqlvar,strlen(sqlvar), \
                progv,progvl,ftype,0,0,0,0,0,OCI_DEFAUL
T)) != OCI_SUCCESS) \
       sql_error(errh,status,1); \
    else \
       DISCARD 0

#define
OCIbbnamei(stmh,bindp,errh,sqlvar,progv,progvl,ftype,i
ndp) \
    if((status=OCIHandleAlloc((dvoid *)stmh,(dvoid
**)&bindp,OCI_HTYPE_BIND, \
                                0,(dvoid
**)0))!=OCI_SUCCESS) \
       sql_error(stmh,status,0); \
    if((status=OCIBindByName(stmh,&bindp,errh,(text
*)sqlvar,strlen(sqlvar), \
                progv,progvl,ftype,indp,0,0,0,0,OCI_DEF
AULT)) != OCI_SUCCESS) \
       sql_error(errh,status,1); \
    else \
       DISCARD 0

#define OCIcom(svcp,errh) \
     if((status=OCITransCommit(svcp,errh,OCI_DEFAULT))
!= OCI_SUCCESS) \
        sql_error(errh,status,1); \
     else \
        DISCARD 0

#define OCIrol(svcp,errh) \
     if((status=OCITransRollback(svcp,errh,OCI_DEFAULT
)) != OCI_SUCCESS) \
        sql_error(errh,status,1); \
     else \
        DISCARD 0

#define ISOTXT "alter session set isolation_level =
serializable"
#define PDMLTXT "alter session force parallel dml
parallel (degree 4)"
#define PDDLTXT "alter session force parallel ddl
parallel (degree 4)"
#define OICATXT "alter session set
optimizer_index_cost_adj=25"

#define SQLTXT1 "BEGIN SELECT /*+
index(lineitem,i_l_orderkey) */ MAX(l_linenumber) INTO
:l_key FROM lineitem \
WHERE l_orderkey = :o_key; END;"

#define SQLTXT2 "BEGIN d_atrans.doatrans(:l_key,
:o_key, :delta, :l_pkey, \
:l_skey, :l_quan, :l_newquan, :l_tax, :l_disc,
:l_eprice, :l_neweprice, \
:o_tprice, :o_newtprice, :rprice, :cost); END;"
```

```
#define SQLTXT3 "BEGIN SELECT l_extendedprice,
l_quantity \
INTO :l_neweprice, :l_newquan \
FROM lineitem \
WHERE l_orderkey = :o_key \
AND l_linenumber = :l_key; END;"

#define SQLTXT4 "BEGIN SELECT o_totalprice INTO
:o_newtprice \
FROM orders \
WHERE o_orderkey = :o_key; END;"

#define SQLTXT5 "BEGIN SELECT l_extendedprice,
l_quantity \
INTO :l_eprice, :l_quan \
FROM lineitem \
WHERE l_orderkey = :o_key \
AND l_linenumber = :l_key; END;"

#define SQLTXT6 "BEGIN SELECT o_totalprice INTO
:o_tprice \
FROM orders \
WHERE o_orderkey = :o_key; END;"

#endif /* ATRANSPL_H */
```

==========

## randpsup.c

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

#define PS_PER_SF 200000.0
#define S_PER_SF 10000.0
#define SUPP_PER_PART 4

/* borrowed from build.c in the dbgen distribution */

#define PART_SUPP_BRIDGE(tgt, p, s) \
    { \
    long tot_scnt = (long) (S_PER_SF * sf); \
    tgt = (p + s *  (tot_scnt / SUPP_PER_PART +  \
        (long) ((p - 1) / tot_scnt))) % tot_scnt + 1;
\
    }

void usage();
double atof();
void srand48();
long lrand48();


main(argc, argv)
     int argc;
     char **argv;
{

  double sf = 0.1;           /* scale factor      */
  long supp;                 /* the i-th supplier */
  long pkey;                 /* partkey           */
  long maxpkey;              /* highest partkey   */
  long ps_skey;              /* ps_suppkey        */

  if (argc < 2) {
    usage();
    exit(-1);
  }

  /* seed the random number generator */

  srand48(getpid());

  sf = atof(argv[1]);
  maxpkey = (long) (sf * PS_PER_SF);
  supp = lrand48() % 4;
  pkey = lrand48() % maxpkey + 1;

  PART_SUPP_BRIDGE(ps_skey, pkey, supp);

  fprintf(stdout, "%ld %ld", pkey, ps_skey);

  exit(0);
}


void usage()
{
  fprintf(stderr, "Usage: randpsup <SF>\n\n");
}
```

==========

## randkey.c

```
#include <stdio.h>
#include <stdlib.h>
#include <math.h>
#include "atranspl.h"

#define ORDERCNT 150000.0

/* MK_SPARSE adopted from dss.h */

#define  MK_SPARSE(key, seq) \
         (((((key>>3)<<2)|(seq & 0x0003))<<3)|(key &
0x0007))

void sql_error();
void usage();
void ACIDinit();
long atol();
void srand48();
long lrand48();

/* Not really used here, but retained it for future
purposes. */

typedef struct aciddef {
  long okey;
  long lkey;
  int delta;
} adef;

long l_key = 0;
long o_key = 0;
char lname[UNAME_LEN];
char *passwd;

/* OCI handles */

OCIEnv *tpcenv;
OCIServer *tpcsrv;
OCIError *errhp;
OCISvcCtx *tpcsvc;
OCISession *tpcusr;
OCIStmt *curi;

OCIBind *l_key_bp;
OCIBind *o_key_bp;

sword status = OCI_SUCCESS;  /* OCI return value */

char sqlstmt[1024];
```

```
void ACIDexit() {
  OCILogoff(tpcsvc,errhp);
  OCIhfree(tpcenv,OCI_HTYPE_STMT);
  OCIhfree(tpcsvc,OCI_HTYPE_SVCCTX);
  OCIhfree(tpcsrv,OCI_HTYPE_SERVER);
  OCIhfree(tpcusr,OCI_HTYPE_SESSION);
}


/* type: 0 if environment handle is passed, 1 if error
handle is passwd */

void sql_error(errhp,status,type)
     OCIError *errhp;
     sword status;
     sword type;
{
  char msg[2048];
  sb4 errcode;
  ub4 msglen;
  int i,j;

  switch(status) {
  case OCI_SUCCESS_WITH_INFO:
    fprintf(stderr, "Error: Statement returned with
info.\n");
    if (type)
      (void) OCIErrorGet(errhp,1,NULL,(sb4 *)
&errcode,(text *)msg,
                         2048,OCI_HTYPE_ERROR);
    else
      (void) OCIErrorGet(errhp,1,NULL,(sb4 *)
&errcode,(text *)msg,
                         2048,OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  case OCI_ERROR:
    fprintf(stderr, "Error: OCI call error.\n");
    if (type)
      (void) OCIErrorGet(errhp,1,NULL,(sb4 *)
&errcode,(text *)msg,
                         2048,OCI_HTYPE_ERROR);
    else
      (void) OCIErrorGet(errhp,1,NULL,(sb4 *)
&errcode,(text *)msg,
                         2048,OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  case OCI_INVALID_HANDLE:
    fprintf(stderr, "Error: Invalid Handle.\n");
    if (type)
      (void) OCIErrorGet(errhp,1,NULL,(sb4 *)
&errcode,(text *)msg,
                         2048,OCI_HTYPE_ERROR);
    else
      (void) OCIErrorGet(errhp,1,NULL,(sb4 *)
&errcode,(text *)msg,
                         2048,OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  }
  /* Rollback just in case */

  (void) OCITransRollback(tpcsvc,errhp,OCI_DEFAULT);

  fprintf(stderr, "Exiting Oracle...\n");
  fflush(stderr);

  ACIDexit();

  exit(1);
}
```

```
main(argc, argv)
     int argc;
     char **argv;
{

  long count;
  long i;
  double sf;         /* need to accomodate sf 0.1 */
  double random;
  double ordcnt;
  adef *res;

  if ((argc < 3) || (argc > 4)) {
    usage();
    exit(-1);
  }

  strcpy((char *) lname, "tpcd/tpcd");

  count = atol(argv[1]);
  sf = atof(argv[2]);

  argc -= 2;
  argv += 2;

  while (--argc) {
    ++argv;
    switch(argv[0][0]) {
    case 'u':
      strncpy((char *) lname, ++(argv[0]), UNAME_LEN);
      if (strchr((char *) lname, '/') == NULL) {
        usage();
        exit(-1);
      }
      break;
    default:
      fprintf(stderr, "Unknown argument %s\n",
argv[0]);
      usage();
      break;
    }
  }

  ACIDinit();

  /* initialize array for random numbers */

  res = (adef *) malloc(count*sizeof(adef));
  ordcnt = (double) ORDERCNT * (double) sf;

  for (i=0; i<count; i++) {

    /* The algorithm:
*/
    /* Assumes drand's output is 'unique', first get a
number within */
    /* the range of [0..sf*ORDERCNT) and then maps the
different     */
    /* ranges to generate the real output.
*/

    random = floor(drand48() * (double) ordcnt) + 1;
    res[i].okey = o_key = (long) MK_SPARSE((long)
random, 0);
    res[i].delta = (long) floor(drand48() * 100) + 1;

    /* Obtain l_key from l_key query */

    OCIsexec(tpcsvc,curi,errhp,1);

    /* l_key is the highest l_linenumber available.
We need to pick */
    /* at random a number between 1..l_key.
```

```
*/

    res[i].lkey = (lrand48() % l_key) + 1;

    printf("%ld %ld %d\n", res[i].okey, res[i].lkey,
res[i].delta);
  }

  ACIDexit();
  free(res);

}


void usage() {

  fprintf(stderr, "Usage: randkey <number of random
keys to generate> <SF> u<user/password>\n");
  fprintf(stderr, "\n");
}

void ACIDinit()
{

  /* run random seed */

  srand48(getpid());

  /* Connect to ORACLE.  Program will call sql_error()
     if an error occurs in connecting to the default
database. */

  (void) OCIInitialize(OCI_DEFAULT,(dvoid *)0,0,0,0);
  if((status=OCIEnvInit((OCIEnv
**)&tpcenv,OCI_DEFAULT,0,(dvoid **)0)) !=
     OCI_SUCCESS)
    sql_error(tpcenv, status, 0);

  OCIhalloc(tpcenv,&errhp,OCI_HTYPE_ERROR);
  OCIhalloc(tpcenv,&curi,OCI_HTYPE_STMT);
  OCIhalloc(tpcenv,&tpcsvc,OCI_HTYPE_SVCCTX);
  OCIhalloc(tpcenv,&tpcsrv,OCI_HTYPE_SERVER);
  OCIhalloc(tpcenv,&tpcusr,OCI_HTYPE_SESSION);

  /* get username and password */

  passwd = strchr(lname, '/');
  *passwd = '\0';
  passwd++;

  if ((status=OCIServerAttach(tpcsrv,errhp,(text
*)0,0,OCI_DEFAULT))!=OCI_SUCCESS)
    sql_error(errhp,status,1);

  OCIaset(tpcsvc,OCI_HTYPE_SVCCTX,tpcsrv,0,OCI_ATTR_SE
RVER,errhp);
  OCIaset(tpcusr,OCI_HTYPE_SESSION,lname,strlen(lname)
,OCI_ATTR_USERNAME,
          errhp);
  OCIaset(tpcusr,OCI_HTYPE_SESSION,passwd,strlen(passw
d),OCI_ATTR_PASSWORD,
          errhp);

  if ((status = OCISessionBegin(tpcsvc, errhp, tpcusr,
OCI_CRED_RDBMS,
                                OCI_DEFAULT)) !=
OCI_SUCCESS)
    sql_error(errhp,status,1);

  OCIaset(tpcsvc,OCI_HTYPE_SVCCTX,tpcusr,0,OCI_ATTR_SE
SSION,errhp);

  /* Open and Parse cursor for query to choose
determine l_key. */

  /* Binds l_key to :l_key.
*/

  sprintf((char *) sqlstmt,SQLTXT1);
  OCIStmtPrepare(curi,errhp,(text
*)sqlstmt,strlen((char *)sqlstmt),
                 OCI_NTV_SYNTAX,OCI_DEFAULT);

  OCIbbname(curi,l_key_bp,errhp,":l_key",ADR(l_key),SI
Z(l_key),SQLT_INT);
  OCIbbname(curi,o_key_bp,errhp,":o_key",ADR(o_key),SI
Z(o_key),SQLT_INT);
}
```

==========

## gettime.c

```
#define SUN_OS5

#if defined(SUN_OS5)
#define TIME_W_GETTIME
#define CPU_W_TIMES
#undef GETRU_STATS
#undef CPU_W_GETRU
#endif /* SUN_OS5 */

#if defined(sequent) || defined(SEQ_PSX)
# define GET_P_STATS
#endif /* sequent */

#if defined(aix) || defined(AIXRIOS)
# define TIME_W_GETTIME
# define CPU_W_TIMES
# define GETRU_STATS
#endif /* AIXRIOS */

#if defined(a_osf) || defined(A_OSF)
# define TIME_W_GETTIME
# define CPU_W_GETRU
# define GETRU_STATS
#endif /* AIXRIOS */

#if defined(HPUX) || defined(XENIX_386) ||
defined(SYSV_386) || defined(ATT_3B)
# define TIME_W_TIMES
# define CPU_W_TIMES
#endif /* HPUX || XENIX_386 || SYSV_386 */

#if !defined(TIME_W_GETTIME) && !defined(TIME_W_TIMES)
# define TIME_W_TIMES
#endif

#if !defined(CPU_W_GETRU) && !defined(CPU_W_TIMES)
# define CPU_W_TIMES
#endif

#ifdef GET_P_STATS
# ifdef GETRU_STATS
#  undef GETRU_STATS
# endif
#endif

#if defined(TIME_W_GETTIME) || defined(CPU_W_GETRU) ||
defined(GETRU_STATS)
# include <sys/time.h>
#endif /* TIME_W_GETTIME || CPU_W_GETRU || GETRU_STATS
*/

#if defined(CPU_W_GETRU) || defined(GETRU_STATS)
# include <sys/resource.h>
#endif /* CPU_W_GETRU || GETRU_STATS */
```

```
#if defined(TIME_W_TIMES) || defined (CPU_W_TIMES)
# include <sys/types.h>
# include <sys/times.h>
# include <sys/param.h>  /* most systems define HZ
here */
#endif /* TIME_W_TIMES or CPU_W_TIMES */

#ifdef GET_P_STATS
# include <sys/types.h>
# include <sys/procstats.h>
#endif /* GET_P_STATS */

# include <stdio.h>

#ifdef GETRU_STATS
struct rusage selfru;
struct rusage kidsru;
#endif /* GETRU_STATS */

#ifdef GET_P_STATS
struct process_stats selfru;
struct process_stats kidsru;
#endif /* GET_P_STATS */



double gettime ()

{

#ifdef TIME_W_GETTIME
   struct timeval tv;

   (void) gettimeofday (&tv, (struct timezone *) 0);
   return ((double) tv.tv_sec + (1.0e-6 * (double)
tv.tv_usec));
#endif /* TIME_W_GETTIME */

#ifdef TIME_W_TIMES
   struct tms buf;

   return ((double) times (&buf) / HZ);
#endif /* TIME_W_TIMES */

}



double getcpu ()

{

#ifdef CPU_W_TIMES
   struct tms buf;

   (void) times (&buf);
   return (((double) buf.tms_utime + (double)
buf.tms_stime) / HZ);
#endif /* CPU_W_TIMES */

#ifdef CPU_W_GETRU
   struct rusage ru;
   double usecs;

   (void) getrusage (0, &ru);
   usecs = 1.0e-6 * (double) (ru.ru_utime.tv_usec +
ru.ru_stime.tv_usec);
   return ((double) (ru.ru_utime.tv_sec +
ru.ru_stime.tv_sec) + usecs);
#endif /* CPU_W_GETRU */

}
```

```
getru (fp, kids, config, runname, proc_no)

FILE *fp;
int kids;
char *config;
char *runname;
int proc_no;

{

#ifdef GETRU_STATS
   struct rusage ru;

   fprintf (fp, "%-10.10s %-10.10s %10d %10d ",
config,runname, proc_no, kids);
   getrusage (kids ? RUSAGE_CHILDREN : RUSAGE_SELF,
&ru);
   print_ru (fp, &ru);
   fprintf (fp, "\n");
#endif /* GETRU_STATS */

#ifdef GET_P_STATS
   timeval_t tv;
   struct process_stats ru;

   fprintf (fp, "%-10.10s %-10.10s %10d %10d ",
config,runname, proc_no, kids);
   if (kids)
      get_process_stats (&tv, PS_SELF, (struct
process_stats *) 0, &ru);
   else
      get_process_stats (&tv, PS_SELF, &ru, (struct
process_stats *) 0);
   print_ru (fp, &ru);
   fprintf (fp, "\n");
#endif /* GET_P_STATS */

}



getru1 (kids)

int kids;

{

#ifdef GETRU_STATS
   if (kids) {
      memset (&kidsru, 0, sizeof (kidsru));
      getrusage (RUSAGE_CHILDREN, &kidsru);
   }
   else {
      memset (&selfru, 0, sizeof (selfru));
      getrusage (RUSAGE_SELF, &selfru);
   }
#endif /* GETRU_STATS */

#ifdef GET_P_STATS
   timeval_t tv;

   if (kids) {
      memset (&kidsru, 0, sizeof (kidsru));
      get_process_stats (&tv, PS_SELF, (struct
process_stats *) 0, &kidsru);
   }
   else {
      memset (&selfru, 0, sizeof (selfru));
      get_process_stats (&tv, PS_SELF, &selfru,
(struct process_stats *) 0);
   }
#endif /* GET_P_STATS */
```

```
}



getru2 (fp, kids, config, runname, proc_no)

FILE *fp;
int kids;
char *config;
char *runname;
int proc_no;

{

#ifdef GETRU_STATS
   struct rusage ru;

   fprintf (fp, "%-10.10s %-10.10s %10d %10d ",
config, runname, proc_no, kids);
   getrusage (kids ? RUSAGE_CHILDREN : RUSAGE_SELF,
&ru);
   if (kids)
      diffru (&ru, &kidsru);
   else
      diffru (&ru, &selfru);
   print_ru (fp, &ru);
   fprintf (fp, "\n");
#endif /* GETRU_STATS */

#ifdef GET_P_STATS
   timeval_t tv;
   struct process_stats ru;

   fprintf (fp, "%-10.10s %-10.10s %10d %10d ",
config, runname, proc_no, kids);
   if (kids)
      get_process_stats (&tv, PS_SELF, (struct
process_stats *) 0, &ru);
   else
      get_process_stats (&tv, PS_SELF, &ru, (struct
process_stats *) 0);
   if (kids)
      diffru (&ru, &kidsru);
   else
      diffru (&ru, &selfru);
   print_ru (fp, &ru);
   fprintf (fp, "\n");
#endif /* GET_P_STATS */

}



#ifdef GETRU_STATS

print_ru (fp, ru)

FILE *fp;
struct rusage *ru;

{

   fprintf (fp, "%10ld ", ru->ru_utime.tv_sec * 1000 +
                          (ru->ru_utime.tv_usec/1000));
   fprintf (fp, "%10ld ", ru->ru_stime.tv_sec * 1000 +
                          (ru->ru_stime.tv_usec/1000));
   fprintf (fp, "%10ld ", ru->ru_maxrss);
   fprintf (fp, "%10ld ", ru->ru_majflt);
   fprintf (fp, "%10ld ", ru->ru_minflt);
   fprintf (fp, "%10ld ", 0);
   fprintf (fp, "%10ld ", 0);
   fprintf (fp, "%10ld ", 0);
   fprintf (fp, "%10ld ", ru->ru_nswap);
   fprintf (fp, "%10ld ", 0);
   fprintf (fp, "%10ld ", ru->ru_nvcsw);
   fprintf (fp, "%10ld ", ru->ru_nivcsw);
   fprintf (fp, "%10ld ", ru->ru_nsignals);
   fprintf (fp, "%10ld ", 0);
   fprintf (fp, "%10ld ", 0);
   fprintf (fp, "%10ld ", ru->ru_inblock);
   fprintf (fp, "%10ld ", ru->ru_oublock);
   fprintf (fp, "%10ld ", 0);
   fprintf (fp, "%10ld",  0);
}



diffru (ru2, ru)

struct rusage *ru2;
struct rusage *ru;

{

   ru2->ru_utime.tv_sec -= ru->ru_utime.tv_sec;
   ru2->ru_utime.tv_usec -= ru->ru_utime.tv_usec;
   ru2->ru_stime.tv_sec -= ru->ru_stime.tv_sec;
   ru2->ru_stime.tv_usec -= ru->ru_stime.tv_usec;
   ru2->ru_maxrss -= ru->ru_maxrss;
   ru2->ru_ixrss -= ru->ru_ixrss;
   ru2->ru_idrss -= ru->ru_idrss;
   ru2->ru_minflt -= ru->ru_minflt;
   ru2->ru_majflt -= ru->ru_majflt;
   ru2->ru_nswap -= ru->ru_nswap;
   ru2->ru_inblock -= ru->ru_inblock;
   ru2->ru_oublock -= ru->ru_oublock;
   ru2->ru_msgsnd -= ru->ru_msgsnd;
   ru2->ru_msgrcv -= ru->ru_msgrcv;
   ru2->ru_nsignals -= ru->ru_nsignals;
   ru2->ru_nvcsw -= ru->ru_nvcsw;
   ru2->ru_nivcsw -= ru->ru_nivcsw;

}

#endif /* GETRU_STATS */



#ifdef GET_P_STATS

print_ru (fp, ps)

FILE *fp;
struct process_stats *ps;

{

   fprintf (fp, "%lu ", ps->ps_utime.tv_sec * 1000 +
                        (ps->ps_utime.tv_usec/1000));
   fprintf (fp, "%lu ", ps->ps_stime.tv_sec * 1000 +
                        (ps->ps_stime.tv_usec/1000));
   fprintf (fp, "%lu ", ps->ps_maxrss);
   fprintf (fp, "%lu ", ps->ps_pagein);
   fprintf (fp, "%lu ", ps->ps_reclaim);
   fprintf (fp, "%lu ", ps->ps_zerofill);
   fprintf (fp, "%lu ", ps->ps_pffincr);
   fprintf (fp, "%lu ", ps->ps_pffdecr);
   fprintf (fp, "%lu ", ps->ps_swap);
   fprintf (fp, "%lu ", ps->ps_syscall);
   fprintf (fp, "%lu ", ps->ps_volcsw);
   fprintf (fp, "%lu ", ps->ps_involcsw);
   fprintf (fp, "%lu ", ps->ps_signal);
   fprintf (fp, "%lu ", ps->ps_lread);
   fprintf (fp, "%lu ", ps->ps_lwrite);
   fprintf (fp, "%lu ", ps->ps_bread);
   fprintf (fp, "%lu ", ps->ps_bwrite);
   fprintf (fp, "%lu ", ps->ps_phread);
   fprintf (fp, "%lu",  ps->ps_phwrite);
```

```
}


diffru (ru2, ru)

struct process_stats *ru2;
struct process_stats *ru;

{

   ru2->ps_utime.tv_sec -= ru->ps_utime.tv_sec;
   ru2->ps_utime.tv_usec -= ru->ps_utime.tv_usec;
   ru2->ps_stime.tv_sec -= ru->ps_stime.tv_sec;
   ru2->ps_stime.tv_usec -= ru->ps_stime.tv_usec;
   ru2->ps_maxrss -= ru->ps_maxrss;
   ru2->ps_pagein -= ru->ps_pagein;
   ru2->ps_reclaim -= ru->ps_reclaim;
   ru2->ps_zerofill -= ru->ps_zerofill;
   ru2->ps_pffincr -= ru->ps_pffincr;
   ru2->ps_pffdecr -= ru->ps_pffdecr;
   ru2->ps_swap -= ru->ps_swap;
   ru2->ps_syscall -= ru->ps_syscall;
   ru2->ps_volcsw -= ru->ps_volcsw;
   ru2->ps_involcsw -= ru->ps_involcsw;
   ru2->ps_signal -= ru->ps_signal;
   ru2->ps_lread -= ru->ps_lread;
   ru2->ps_lwrite -= ru->ps_lwrite;
   ru2->ps_bread -= ru->ps_bread;
   ru2->ps_bwrite -= ru->ps_bwrite;
   ru2->ps_phread -= ru->ps_phread;
   ru2->ps_phwrite -= ru->ps_phwrite;

}

#endif /* GET_P_STATS */
```

```
=====================================================
```

## a_query.sql

```
=====================================================
set serverout on;

select
'BEFORE ACID QUERY' as STAGE,
substr(TO_CHAR(sysdate,'YYYY-MM-DD HH:MI:SS'),1,20) as
CURRENT_TIME
from dual;

select SUM(trunc(trunc(l_extendedprice * (1-
l_discount),2) * (1+l_tax),2)) AS RESULT
from lineitem
where l_orderkey = &&1;

select
'AFTER ACID QUERY' as STAGE,
substr(TO_CHAR(sysdate,'YYYY-MM-DD HH:MI:SS'),1,20) as
CURRENT_TIME
from dual;

exit;
```

```
=====================================================
```

## a_query2.sql

```
=====================================================

set serverout on;

select
'BEFORE PARTSUPP QUERY' as STAGE,
substr(TO_CHAR(sysdate,'YYYY-MM-DD HH:MI:SS'),1,20) as
CURRENT_TIME
from dual;

select *
rom partsupp
where ps_partkey = &&1
and ps_suppkey = &&2;

select
'AFTER PARTSUPP QUERY' as STAGE,
substr(TO_CHAR(sysdate,'YYYY-MM-DD HH:MI:SS'),1,20) as
CURRENT_TIME
from dual;

exit;
```

```
=====================================================
```

## atom.sh

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

. $KIT_DIR/env

ITER=3
SF=1
PROG=atranspl
OUT=${ACID_OUT}/atom
USER=${DATABASE_USER}

echo "Starting Atomicity Test at `date`..."
echo ""
echo "Performing $ITER ACID transactions with COMMIT"
echo ""

randkey $ITER $SF u$USER | $PROG 1 1 1 0 u$USER >
${OUT}c 2>&1

echo "ACID transactions with COMMIT ended. Output in
${OUT}c"
echo ""
echo "Performing $ITER ACID transactions with
ROLLBACK"
echo ""

randkey $ITER $SF u$USER | $PROG 1 1 0 0 u$USER >
${OUT}r 2>&1

echo "ACID transactions with ROLLBACK ended. Output in
${OUT}r"
echo ""
echo "Ending Atomicity Test at `date`..."
```

```
=====================================================
```

## ckpt.sh

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

. $KIT_DIR/env

sqlplus -s /NOLOG<< !

        connect / as sysdba;
        alter system switch logfile;
        alter system switch logfile;
        exit;
!
```

```
=====================================================
```

## cnt_hist.sql

```
=====================================================
select count(*) from history;
```

```
exit;

====================================================
```

## consist.sh

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

. $KIT_DIR/env

KEY=${ACID_OUT}/key$$_
OUTFILE=${ACID_OUT}/consrte
CON1=${ACID_OUT}/conb
CON2=${ACID_OUT}/cona
CHK=${ACID_OUT}/consckpt
SF=1

/bin/rm -rf ${KEY}* $CON1 $CON2 $OUTFILE $CHK

trap "/bin/rm -rf ${KEY}*; exit 1" 1 2 3 15

STREAM=${NUM_STREAMS}
let STREAM="$STREAM + 1" # add one for the update
stream
ITER=100
PROG=atranspl
USER=${DATABASE_USER}
CK=10

usage() {

   echo ""
   echo "Usage: $0 [-n iter] [-s number of stream] [-p
prog] [-u usr/pswd] -h"
   echo ""
   echo "-n iter             : number of iterations,
default is 100"
   echo "-s number of stream : number of streams,
default is 2"
   echo "-p prog             : program to run, default
is atranspl.ott"
   echo "-u usr/pswd         : user/password for
database access, default is tpcd/tpcd"
   echo "-t chkpt            : time after the start of
ACID transaction to perform the checkpoint"
   echo "                      default is 10 seconds"
   echo "-h                  : print this usage
summary"
   exit 1;
}

set -- `getopt "n:p:u:s:h" "$@"` || usage

while :
do
   case "$1" in
   -s) shift; STREAM=$1;;
   -n) shift; ITER=$1;;
   -p) shift; PROG=$1;;
   -u) shift; USER=$1;;
   -t) shift; CK=$1;;
   -h) usage; exit 0;;
   --) break;;
   esac
   shift
done


if [ $ITER -lt 100 ]
then
echo "Error: Must at least run 100 iterations!"
echo "Exiting..."
exit 1
fi

if [ $STREAM -lt 2 ]
then
echo "Error: Must at least run 2 streams!"
echo "Exiting..."
exit 1
fi

echo "Starting Consistency Test at `date`..."
echo ""
echo "Generate some keys first"
echo ""

i=0

while [ $i -lt $STREAM ]
do
   echo randkey $ITER 1 u$USER
   randkey $ITER 1 u$USER > ${KEY}$i
   i=`expr $i + 1`
done
echo "Check consistency before Submitting Transactions
`date`"
echo "Check consistency before Submitting Transactions
`date`" >> $CON1
echo "Obtain 10 keys from the each key file to check
consistency"

i=0
while [ $i -lt $STREAM ]
do
KEYS=`head -10 ${KEY}${i} | awk '{printf "%d ", $1}'`
echo "The 10 Keys for file $i are: $KEYS"
#for j in `head -10 ${KEY}${i} | awk '{printf "%d ",
$1}'`
for j in $KEYS
do
    sqlplus $USER @consist $j >> $CON1
    echo "------------------------------" >> $CON1
done
    i=`expr $i + 1`
done

echo ""
echo "Starting ACID transactions at `date`"
echo ""

i=0

while [ $i -lt $STREAM ]
do
    $PROG $i $STREAM 1 0 u${USER} i${KEY}${i}
o${OUTFILE}${i} s1 &
    i=`expr $i + 1`
done

echo "Schedule a Checkpoint"
echo "Checkpoint scheduled at $CK seconds after
`date`"

(sleep $CK; $ACID_DIR/consistency/ckpt.sh) &

wait

echo ""
echo "Ending ACID transactions at `date`"
echo ""

echo "Completed $STREAM transaction streams with $ITER
iterations each"
echo ""

echo "Check consistency after Submitting Transactions
`date`"
echo "Check consistency after Submitting Transactions
```

```
`date`" >> $CON2

cat
${ORACLE_HOME}/log/diag/rdbms/qual/qual/trace/alert_${
ORACLE_SID}.log >> $CHK


i=0
while [ $i -lt $STREAM ]
do
KEYS=`head -10 ${KEY}$i | awk '{printf "%d ", $1}'`
#for j in `head -10 ${KEY}$i | awk '{printf "%d ",
$1}'`
echo "The keys to check for consistency after the test
from file $i are:"
echo "$KEYS"
for j in $KEYS
do
    sqlplus $USER @consist $j >> $CON2
    echo "------------------------------" >> $CON2
done
    i=`expr $i + 1`
done
```

```
=====================================================
```

## consist.sql

```
=====================================================
SET FEEDBACK 1
SET NUMWIDTH 10
SET LINESIZE 80
SET TRIMSPOOL ON
SET TAB OFF
SET PAGESIZE 100
SET ECHO ON

set verify off

select
substr(TO_CHAR(sysdate,'YYYY-MM-DD HH:MI:SS'),1,20) as
CURRENT_TIME
from dual;
set serverout on;

DECLARE

       o_okey         number;
       o_tprice       number;
       l_tprice       number;
       diff           number;
BEGIN
    select o_totalprice
       into o_tprice
       from orders
       where o_orderkey = &&1;


    select sum(trunc((trunc((l_extendedprice * (1-
l_discount)), 2)
           * (1+l_tax)), 2))
       into l_tprice
       from lineitem
       where l_orderkey = &&1;

    diff := l_tprice - o_tprice;

    dbms_output.put_line('O_TOTALPRICE: ' ||
TO_CHAR(trunc(o_tprice,2)));
    dbms_output.put_line('L_TOTALPRICE: ' ||
TO_CHAR(trunc(l_tprice,2)));
    dbms_output.put_line('Difference:   ' ||
TO_CHAR(trunc(diff,2)));

END;
.
/
spool off
exit
```

```
=====================================================
```

## end_acid.sh

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

. $KIT_DIR/env

OH=$ORACLE_HOME
OUT_DIR=$ACID_OUT/
DURA_DIR=$ACID_OUT
RUN_ID_FILE=$ACID_DIR/run_id

ITER=100
STEM=${NUM_STREAMS}
let STEM="$STEM + 1" # add one for the update stream

PROG=${ACID_DIR}/atranspl
IN=${ACID_DIR}/acid_in
DURA=${DURA_DIR}/drate
OUT=${DURA_DIR}/drate
DSMPL=${DURA_DIR}/durasmpl
KEY=${DURA_DIR}/key${1}_
USER=${DATABASE_USER}
TRIG=1
HCNT=duracnta

# get history count

sqlplus $USER @cnt_hist > $DURA_DIR/$HCNT 2>&1

# perform the consistency

i=0
while [ $i -lt $STEM ]
do
   for j in `head -10 ${KEY}${i} | awk '{printf "%d
",$1}'`
   do
      sqlplus ${DATABASE_USER} @consist $j >>
$DURA_DIR/duraconsa
   done
   i=`expr $i + 1`
done

i=0
while [ $i -lt $STEM ]
do
sample.sh $DURA${i} > ${DSMPL}${i} 2>&1
i=`expr $i + 1`
done

cp
${ORACLE_HOME}/log/diag/rdbms/qual/qual/trace/alert_${
ORACLE_SID}.log  $DURA_DIR/dsysdblog
```

```
=====================================================
```

## iso1.sh

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

. $KIT_DIR/env

RSH=rsh

OH=$ORACLE_HOME
OUT_DIR=$ACID_OUT

TXN1FILE=$OUT_DIR/txn1$$.out
TXN2FILE=$OUT_DIR/txn2$$.out
```

```
KEYFILE=$OUT_DIR/key$$.out
ISOFILE=$OUT_DIR/iso1

USER=$DATABASE_USER
PROG=atranspl

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

trap "/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE; exit
1" 1 2 3 15

usage() {

   echo ""
   echo "Usage: $0 [-u user/passwd] [-n remote_node]
-h"
   echo ""
   exit 1;
}

set -- `getopt "u:n:h" "$@"` || usage

while :
do
   case "$1" in
   -u) shift; USER=$1;;
   -n) shift; HOST="$1";;
   -h) usage; exit 0;;
   --) break;;
   esac
   shift;
done


de=`direxists.sh $ACID_OUT c` # I am not using $de
afterward, but I want to avoid the output of direxists

# generate key files

randkey 1 0.1 u"$USER" > $KEYFILE

OKEY=`cat $KEYFILE | awk '{print $1}'`
echo "o_key is "$OKEY

# before the ACID transaction, let's run a ACID query
to record the
# initial state of lineitem

echo "Running ACID query BEFORE the start of Isolation
Test 1" >> $TXN2FILE
echo "`date`" >> $TXN2FILE
echo "" >> $TXN2FILE
sqlplus $USER @$ACID_DIR/isolation/a_query $OKEY >>
$TXN2FILE
echo "" >> $TXN2FILE
echo
"-----------------------------------------------" >>
$TXN2FILE

sleep 1

# start ACID transaction, Sleep for 60 second before
COMMIT

$PROG 1 1 1 0 i$KEYFILE u$USER s60 >> $TXN1FILE &

# let's sleep 10 seconds before starting ACID query

sleep 10

# start ACID query with the same OKEY

echo "Running ACID query 10 seconds AFTER the start of
ACID Transaction" \
>> $TXN2FILE
echo "`date`" >> $TXN2FILE
if [ "$HOST" != "" ]
then
echo "Starting ACID query on node $HOST" >> $TXN2FILE
${RSH} -n ${HOST}  sqlplus $USER
@$ACID_DIR/isolation/a_query $OKEY >> $TXN2FILE
else
sqlplus $USER @$ACID_DIR/isolation/a_query $OKEY >>
$TXN2FILE
fi

echo
"-----------------------------------------------" >>
$TXN2FILE
wait
echo
"-----------------------------------------------" >>
$TXN1FILE

cat $TXN1FILE $TXN2FILE >> $ISOFILE

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

==================================================
```

## iso2.sh

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

. $KIT_DIR/env

RSH=rsh

OH=$ORACLE_HOME
OUT_DIR=$ACID_OUT

DURA_DIR=$ACID_DIR/dura

TXN1FILE=$OUT_DIR/txn1$$.out
TXN2FILE=$OUT_DIR/txn2$$.out
KEYFILE=$OUT_DIR/key$$.out
ISOFILE=$OUT_DIR/iso2

USER=$DATABASE_USER
PROG=atranspl

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

trap "/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE; exit
1" 1 2 3 15

usage() {

   echo ""
   echo "Usage: $0 [-u user/passwd] [-n remote_node]
-h"
   echo ""
   exit 1;
}

set -- `getopt "u:n:h" "$@"` || usage

while :
do
   case "$1" in
   -u) shift; USER=$1;;
   -n) shift; HOST="$1";;
   -h) usage; exit 0;;
   --) break;;
   esac
   shift;
done
```

```
# generate key files

randkey 1 0.1 u"$USER" > $KEYFILE

OKEY=`cat $KEYFILE | awk '{print $1}'`
echo "o_key is "$OKEY

# before the ACID transaction, let's run a ACID query
to record the
# initial state of lineitem

echo "Running ACID query BEFORE the start of Isolation
Test 1" >> $TXN2FILE
echo "`date`" >> $TXN2FILE
echo "" >> $TXN2FILE
sqlplus $USER @$ACID_DIR/isolation/a_query $OKEY >>
$TXN2FILE
echo "" >> $TXN2FILE
echo
"-----------------------------------------------" >>
$TXN2FILE

sleep 1

# start ACID transaction, Sleep for 30 second before
ROLLBACK

$PROG 1 1 0 0 i$KEYFILE u$USER s30 >> $TXN1FILE &

# let's sleep 10 seconds before starting ACID query

sleep 10

# start ACID query with the same OKEY

echo "Running ACID query 10 seconds AFTER the start of
ACID transaction" \
>> $TXN2FILE
echo "`date`" >> $TXN2FILE
if [ "$HOST" != "" ]
then
echo "Starting ACID query on node $HOST" >> $TXN2FILE
${RSH} -n ${HOST}  sqlplus $USER
@$ACID_DIR/isolarion/a_query $OKEY >> $TXN2FILE
else
sqlplus $USER @$ACID_DIR/isolation/a_query $OKEY >>
$TXN2FILE
fi

echo
"-----------------------------------------------" >>
$TXN2FILE
wait
echo
"-----------------------------------------------" >>
$TXN1FILE

cat $TXN1FILE $TXN2FILE >> $ISOFILE

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

=====================================================
```

## iso3.sh

```
=====================================================
#!/bin/ksh
. $KIT_DIR/env

RSH=rsh

OH=$ORACLE_HOME
OUT_DIR=$ACID_OUT

DURA_DIR=$ACID_DIR/dura

TXN1FILE=$OUT_DIR/txn1$$.out
TXN2FILE=$OUT_DIR/txn2$$.out
KEYFILE=$OUT_DIR/key$$.out
ISOFILE=$OUT_DIR/iso3

USER=$DATABASE_USER
PROG=atranspl

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

trap "/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE; exit
1" 1 2 3 15

usage() {

   echo ""
   echo "Usage: $0 [-u user/passwd] [-n remote_node]
-h"
   echo ""
   exit 1;
}

set -- `getopt "u:n:h" "$@"` || usage

while :
do
   case "$1" in
   -u) shift; USER=$1;;
   -n) shift; HOST="$1";;
   -h) usage; exit 0;;
   --) break;;
   esac
   shift
done


# generate key files

randkey 1 0.1 u"$USER" > $KEYFILE

sleep 1

# start ACID transaction, Sleep for 30 second before
COMMIT

$PROG 1 2 1 0 i$KEYFILE u$USER s30 >> $TXN1FILE &

# let's sleep 10 seconds before starting second ACID
transaction

sleep 10

# start another ACID transaction with the same LKEY
and OKEY
# but different DELTA

# Do not sleep before COMMIT so that we can see TXN2
has waited.

if [ "$HOST" != "" ]
then
echo "Starting TXN2 on node $HOST" >> $TXN2FILE
${RSH} -n ${HOST} $PROG 2 2 1 1 i$KEYFILE u$USER s1 >>
$TXN2FILE &
else
$PROG 2 2 1 1 i$KEYFILE u$USER s1 >> $TXN2FILE &
fi

wait
echo
"-----------------------------------------------" >>
$TXN2FILE
echo
"-----------------------------------------------" >>
```

```
$TXN1FILE

cat $TXN1FILE $TXN2FILE >> $ISOFILE

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

=====================================================
```

## iso4.sh

```
=====================================================
#!/bin/ksh
. $KIT_DIR/env

RSH=rsh

OH=$ORACLE_HOME
OUT_DIR=$ACID_OUT

DURA_DIR=$ACID_DIR/dura
TXN1FILE=$OUT_DIR/txn1$$.out
TXN2FILE=$OUT_DIR/txn2$$.out
KEYFILE=$OUT_DIR/key$$.out
ISOFILE=$OUT_DIR/iso4

USER=$DATABASE_USER
PROG=atranspl

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

trap "/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE; exit
1" 1 2 3 15

usage() {

   echo ""
   echo "Usage: $0 [-u user/passwd] [-n remote_node]
-h"
   echo ""
   exit 1;
}

set -- `getopt "u:n:h" "$@"` || usage

while :
do
   case "$1" in
   -u) shift; USER=$1;;
   -n) shift; HOST="$1";;
   -h) usage; exit 0;;
   --) break;;
   esac
   shift
done


# generate key files

randkey 1 0.1 u"$USER" > $KEYFILE

sleep 1

# start ACID transaction, Sleep for 30 second before
ROLLBACK

$PROG 1 2 0 0 i$KEYFILE u$USER s30 >> $TXN1FILE &

# let's sleep 10 seconds before starting second ACID
transaction

sleep 10

# start another ACID transaction with the same LKEY
and OKEY
# but different DELTA

# Do not sleep before COMMIT so that we can see TXN2
has waited.

if [ "$HOST" != "" ]
then
echo "Starting TXN2 on node $HOST" >> $TXN2FILE
${RSH} -n ${HOST} $PROG 2 2 1 1 i$KEYFILE u$USER s1 >>
$TXN2FILE &
else
$PROG 2 2 1 1 i$KEYFILE u$USER s1 >> $TXN2FILE &
fi

wait
echo
"-----------------------------------------------" >>
$TXN2FILE
echo
"-----------------------------------------------" >>
$TXN1FILE

cat $TXN1FILE $TXN2FILE >> $ISOFILE

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE
=====================================================
```

## iso5.sh

```
=====================================================
#!/bin/ksh
. $KIT_DIR/env

RSH=rsh

OH=$ORACLE_HOME
OUT_DIR=$ACID_OUT
DURA_DIR=$ACID_DIR/dura

TXN1FILE=$OUT_DIR/txn1$$.out
TXN2FILE=$OUT_DIR/txn2$$.out
KEYFILE=$OUT_DIR/key$$.out
ISOFILE=$OUT_DIR/iso5

USER=$DATABASE_USER
PROG=atranspl

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

trap "/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE; exit
1" 1 2 3 15

usage() {

   echo ""
   echo "Usage: $0 [-u user/passwd] [-n remote_node]
-h"
   echo ""
   exit 1;
}

set -- `getopt "u:n:h" "$@"` || usage

while :
do
   case "$1" in
   -u) shift; USER=$1;;
   -n) shift; HOST="$1";;
   -h) usage; exit 0;;
   --) break;;
   esac
   shift;
done


# generate key files

randkey 1 0.1 u"$USER" > $KEYFILE
```

```
OKEY=`cat $KEYFILE | awk '{print $1}'`
echo "o_key is "$OKEY

# before the ACID transaction, let's run a ACID query
to record the
# initial state of lineitem

echo "Running ACID query BEFORE the start of Isolation
Test 5" >> $TXN1FILE
echo "`date`" >> $TXN1FILE
echo "" >> $TXN1FILE
sqlplus $USER @$ACID_DIR/isolation/a_query $OKEY >>
$TXN1FILE
echo "" >> $TXN1FILE
echo
"-----------------------------------------------" >>
$TXN1FILE

sleep 1

# start ACID transaction, Sleep for 60 second before
COMMIT

$PROG 1 1 1 0 i$KEYFILE u$USER s60 >> $TXN1FILE &

# let's sleep 5 seconds before starting PARTSUPP query

sleep 5

# First generate PS_PARTKEY and PS_SUPPKEY

PSKEY=`randpsup 1`

echo "Running PARTSUPP query 5 seconds AFTER the start
of ACID Transaction" \
>> $TXN2FILE
echo "`date`" >> $TXN2FILE
echo "PS_PARTKEY and PS_SUPPKEY are: $PSKEY" >>
$TXN2FILE

if [ "$HOST" != "" ]
then
echo "Starting PARTSUPP query on node $HOST" >>
$TXN2FILE
${RSH} -n ${HOST} sqlplus $USER
@$ACID_DIR/isolation/a_query2 ${PSKEY} >> $TXN2FILE &
else
sqlplus $USER @$ACID_DIR/isolation/a_query2 ${PSKEY}
>> $TXN2FILE &
fi

wait

echo
"-----------------------------------------------" >>
$TXN2FILE
echo
"-----------------------------------------------" >>
$TXN1FILE

cat $TXN1FILE $TXN2FILE >> $ISOFILE

/bin/rm -rf $TXN1FILE $TXN2FILE $KEYFILE

=====================================================
```

## iso6.sh

```
=====================================================
#!/bin/ksh
. $KIT_DIR/env

RSH=rsh

OH=/private/tpcd

# ACID_DIR=$TPCD_KIT_DIR/audit is set in env
OUT_DIR=$ACID_OUT

DURA_DIR=$ACID_DIR/dura

TXN1FILE=$OUT_DIR/txn1$$.out
TXN2FILE=$OUT_DIR/txn2$$.out
TXN3FILE=$OUT_DIR/txn3$$.out
KEYFILE=$OUT_DIR/key$$.out
ISOFILE=$OUT_DIR/iso6

USER=$DATABASE_USER
PROG=atranspl

/bin/rm -rf $TXN1FILE $TXN2FILE $TXN3FILE $KEYFILE

trap "/bin/rm -rf $TXN1FILE $TXN2FILE $TXN3FILE
$KEYFILE; exit 1" 1 2 3 15

usage() {

   echo ""
   echo "Usage: $0 [-u user/passwd] [-n remote_node]
-h"
   echo ""
   exit 1;
}

set -- `getopt "u:n:h" "$@"` || usage

while :
do
   case "$1" in
   -u) shift; USER=$1;;
   -n) shift; HOST="$1";;
   -h) usage; exit 0;;
   --) break;;
   esac
   shift;
done


# generate key files

randkey 1 0.1 u"$USER" > $KEYFILE

OKEY=`cat $KEYFILE | awk '{print $1}'`
echo "o_key is "$OKEY

# before the any transaction, let's run a ACID query
to record the
# initial state of lineitem

echo "Running ACID query BEFORE the start of Isolation
Test 6" >> $TXN2FILE
echo "`date`" >> $TXN2FILE
echo "" >> $TXN2FILE
sqlplus $USER @$ACID_DIR/isolation/a_query $OKEY >>
$TXN2FILE
echo "" >> $TXN2FILE
echo
"-----------------------------------------------" >>
$TXN2FILE

sleep 1

# start Query 1, use 0 as the delta

echo "Running Query 1 at `date`" >> $TXN1FILE
sqlplus $USER @q1 >> $TXN1FILE &

# sleep 2 seconds before starting ACID transaction

sleep 2
```

```
# start ACID transaction, COMMIT after one second

echo "Starting AICD transaction at `date`" >>
$TXN2FILE

if [ "$HOST" != "" ]
then
echo "Starting ACID transaction on node $HOST" >>
$TXN2FILE
${RSH} -n ${HOST} $PROG 1 1 1 0 i$KEYFILE u$USER s1 >>
$TXN2FILE &
else
$PROG 1 1 1 0 i$KEYFILE u$USER s1 >> $TXN2FILE &
fi

# start Query 1

sleep 2

echo "Running 2nd Query 1 at `date`" >> $TXN3FILE
sqlplus $USER @q1 >> $TXN3FILE &
# wait for everyone to finish

wait

echo
"------------------------------------------------" >>
$TXN3FILE
echo
"------------------------------------------------" >>
$TXN2FILE
echo
"------------------------------------------------" >>
$TXN1FILE

cat $TXN1FILE $TXN2FILE $TXN3FILE >> $ISOFILE

/bin/rm -rf $TXN1FILE $TXN2FILE $TXN3FILE $KEYFILE

====================================================
```

## run_acid.sh

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

. $KIT_DIR/env

OH=$ORACLE_HOME
ACID_DIR=$ACID_DIR
OUT_DIR=acid_out

usage() {

   echo ""
   echo "Usage: $0 [-n iter] [-s stream] [-p prog] [-i
infile] [-o outfile]"
   echo "          [-d durafile] [-u usr/pswd] -h"
   echo ""
   echo "-n iter     : number of iterations, default
is 100"
   echo "-s stream   : number of streams, default is
2"
   echo "-p prog     : program to run, default is
atranspl.ott"
   echo "-i infile   : input file prefix, suffix by
process number within a"
   echo "              stream and run ID, default is
./acid_in"
   echo "-o outfile  : output file prefix, similar to
input file"
   echo "              default is ./out/acid_out"
   echo "-d durafile : durability file prefix, used
for durability tests"
   echo "              default is ./dura/acid_dura"
   echo "-u usr/pswd : user/password combo for
database access, default is tpch/tpch"
   echo "-t trigger  : trigger time between process
starts, default is 1 second"
   echo "-h          : print this usage summary"
   exit 1;
}

ITER=600
STEM=${NUM_STREAMS}
let STEM="$STEM + 1" # add one for the update stream
SF=1
PROG=atranspl
IN=${ACID_DIR}/acid_in
DURA_DIR=$ACID_OUT
OUT=$DURA_DIR/drate
DURA=$DURA_DIR/dura
KEY=${DURA_DIR}/key$$_
USER=${DATABASE_USER}
TRIG=1
HCNT=duracntb

set -- `getopt "n:s:p:i:o:d:u:ht:f:" "$@"` || usage

# get all the options

while :
do
   case "$1" in
   -n) shift; ITER=$1;;
   -s) shift; STEM=$1;;
   -p) shift; PROG=$1;;
   -i) shift; IN=$1;;
   -o) shift; OUT=$1;;
   -d) shift; DURA=$1;;
   -u) shift; USER=$1;;
   -h) usage; exit 0;;
   -t) shift; TRIG=$1;;
   -f) shift; SF=$1;;
   --) break;;
   esac
   shift;
done


echo "Starting ACID run..."

i=0
T=`expr $STEM \* $TRIG + 6`

# Get history count before the run

sqlplus $USER @cnt_hist > $DURA_DIR/$HCNT 2>&1

while [ $i -lt $STEM ]
do
   randkey $ITER ${SF} u${USER} > ${KEY}${i} &
   i=`expr $i + 1`
done

wait
# perform the consistency

i=0
while [ $i -lt $STEM ]
do
   for j in `head -10 ${KEY}${i} | awk '{printf "%d
",$1}'`
   do
      sqlplus ${USER} @consist $j >>
$DURA_DIR/duraconsb
   done
   i=`expr $i + 1`
done
```

```
echo "Starting Transaction Counting Program"
count_tx.sh $STEM 100 $DURA_DIR &

i=0
while [ $i -lt $STEM ]
do

   $PROG $i $STEM 1 0 i${KEY}${i} o${OUT}${i}
d${DURA}${i} u$USER s1 &
   T=`expr $T - $TRIG`
   i=`expr $i + 1`

done

wait

echo "ACID run completed"
```

==========

## sample.sh

```
#!/bin/ksh

# $1 durability output file

. $KIT_DIR/env

cat $1 | grep o_key | awk '{printf "%d \n", $2}' |
head -106 > /tmp/okey$$
cat $1 | grep l_key | awk '{printf "%d \n", $2}' |
head -106 > /tmp/lkey$$



paste /tmp/okey$$ /tmp/lkey$$ > /tmp/keys$$
tail -6 /tmp/keys$$ > /tmp/6keys$$

echo "Keys chosen are:"
cat /tmp/6keys$$

i=1
while [ $i -le 6 ]
do

j=`cat /tmp/6keys$$ | tail -${i} | head -1`
sqlplus ${DATABASE_USER} @sample $j
i=`expr $i + 1`
done
```

==========

## sample.sql

```
alter session set nls_date_format = 'YYYY-MM-DD
HH:MI:SS';
select * from history where  h_o_key = &&1 and h_l_key
= &&2;

exit;
```

## Disk Configuration Details

**Basic Assumptions:**

1. Use hardware RAID-1 capabilities of Sun StorageTek 2540 Arrays

2. Use Oracle Automatic Storage Management (ASM) for striping

3. Use Solaris Volume Manager (SVM) for file systems to store flat files.

**Disk Config:**

- 8 x 73GB (10Krpm) internal disks
  Used for boot, swap, storing the scripts and files except database files.

- 20 x Sun StorageTek 2540 Array (each Array 12 x 146GB drives at 15Krpm). Used for all database objects (tables, indexes, control files, redo logs, temporary tablespace, undo tablespace, system tablespace) and for storing flat files generated by dbgen.

Mirroring was implemented by creating 2 x RAID-1 (3+3) volumes on each Sun StorageTek 2540 Array using 512KB segment size. The volumes were then presented to the SUT and partitioned.

Striping was implemented using Oracle Automatic Storage Management (ASM).

**ASM instance information:**

initasm.ora:

```
instance_type = asm
processes     = 1024
shared_pool_size = 2g
sort_area_size = 10485760
ASM_DISKSTRING = '/links/asm/d*'
ASM_DISKGROUPS = dg_tpch
memory_target  = 2960m
```

**ASM disk information:**

A disk partition was created from each Sun StorageTek 2540 volume (total 40 volumes) for the ASM disks. Soft link (e.g. /links/asm/d1 -> /dev/rdsk/c4t0d0s3) was used to point to the physical device.

Script to create 'dg_tpch' ASM diskgroup

```
#!/bin/ksh
export ORACLE_SID=asm

sqlplus /NOLOG <<!
connect / as sysdba;

drop DISKGROUP dg_tpch including contents;
CREATE DISKGROUP dg_tpch EXTERNAL REDUNDANCY
DISK
'/links/asm/d1' size 143300m,
'/links/asm/d2' size 143300m,
'/links/asm/d3' size 143300m,
'/links/asm/d4' size 143300m,
'/links/asm/d5' size 143300m,
   --- more lines for d6-d35 --
'/links/asm/d36' size 143300m,
'/links/asm/d37' size 143300m,
'/links/asm/d38' size 143300m,
'/links/asm/d39' size 143300m,
'/links/asm/d40' size 143300m;

exit
!
```

# Appendix C. Query Text and Query Output

==========

## qual01

```
-- using default substitutions
-- @(#)1.sql    2.1.6.2
-- TPC-H/TPC-R Pricing Summary Report Query (Q1)
-- Functional Query Definition
-- Approved February 1998


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 <= to_date ('1998-12-01','YYYY-MM-DD')  -
90
group by
l_returnflag,
l_linestatus
order by
l_returnflag,
l_linestatus

L_RETURNFLAG L_LINESTATUS SUM_QTY
SUM_BASE_PRICE
SUM_DISC_PRICE         SUM_CHARGE              AVG_QTY
AVG_PRICE              AVG_DISC
COUNT_ORDER
A            F            37734107.00
56586554400.73
53758257134.87         55909065222.83         25.52
38273.13               0.05
1478493.00
N            F            991417.00
1487504710.38
1413082168.05          1469649223.19          25.52
38284.47               0.05                   38854.00
N            O            74476040.00
111701729697.74
106118230307.61        110367043872.50        25.50
38249.12               0.05
2920374.00
R            F            37719753.00
56568041380.90
53741292684.60         55889619119.83         25.51
38250.85               0.05
1478870.00


4 rows processed.
Query Processed in 3.00 seconds.
```

==========

## qual02

```
-- using default substitutions
-- @(#)2.sql    2.1.6.2
-- TPC-H/TPC-R Minimum Cost Supplier Query (Q2)
-- Functional Query Definition
-- Approved February 1998

select * from (
select
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
)
where rownum <= 100

S_ACCTBAL              S_NAME
N_NAME
P_PARTKEY              P_MFGR
S_ADDRESS                                      S_PHONE
S_COMMENT
9938.53                Supplier#000005359
UNITED KINGDOM
185358.00              Manufacturer#4
QKuHYh,vZGiwu2FWEJoLDx04                 33-429-790-
6131
uriously regular requests hag
9937.84                Supplier#000005969
ROMANIA
108438.00              Manufacturer#1
ANDENSOSmk,miq23Xfb5RWt6dvUcvt6Qa        29-520-692-
3537
efully express instructions. regular requests against
the slyly fin
9936.22                Supplier#000005250
UNITED KINGDOM
249.00                 Manufacturer#4
B3rqp0xbSEim4Mpy2RH J                    33-320-228-
2957
etect about the furiously final accounts. slyly ironic
pinto beans sleep inside the furiously
```

```
9923.77                 Supplier#000002324
GERMANY
29821.00                Manufacturer#4
y3OD9UywSTOk                            17-779-299-
1839
ackages boost blithely. blithely regular deposits c
9871.22                 Supplier#000006373
GERMANY
43868.00                Manufacturer#5
J8fcXWsTqM                              17-813-485-
8637
etect blithely bold asymptotes. fluffily ironic
platelets wake furiously; blit
9870.78                 Supplier#000001286
GERMANY
81285.00                Manufacturer#2
YKA,E2fjiVd7eUrzp2Ef8j1QxGo2DFnosaTEH   17-516-924-
4574
 regular accounts. furiously unusual courts above the
fi
9870.78                 Supplier#000001286
GERMANY
181285.00               Manufacturer#4
YKA,E2fjiVd7eUrzp2Ef8j1QxGo2DFnosaTEH   17-516-924-
4574
 regular accounts. furiously unusual courts above the
fi
9852.52                 Supplier#000008973
RUSSIA
18972.00                Manufacturer#2
t5L67YdBYYH6o,Vz24jpDyQ9                32-188-594-
7038
rns wake final foxes. carefully unusual depende
9847.83                 Supplier#000008097
RUSSIA
130557.00               Manufacturer#2
xMe97bpE69NzdwLoX                       32-375-640-
3593
 the special excuses. silent sentiments serve
carefully final ac
9847.57                 Supplier#000006345
FRANCE
86344.00                Manufacturer#1
VSt3rzk3qG698u6ld8HhOByvrTcSTSvQlDQDag  16-886-766-
7945
ges. slyly regular requests are. ruthless, express
excuses cajole blithely across the unu

9847.57                 Supplier#000006345
FRANCE
173827.00               Manufacturer#2
VSt3rzk3qG698u6ld8HhOByvrTcSTSvQlDQDag  16-886-766-
7945
ges. slyly regular requests are. ruthless, express
excuses cajole blithely across the unu
9836.93                 Supplier#000007342
RUSSIA
4841.00                 Manufacturer#4
JOlK7C1,7xrEZSSOw                       32-399-414-
5385
blithely carefully bold theodolites. fur
9817.10                 Supplier#000002352
RUSSIA
124815.00               Manufacturer#2
4LfoHUZjgjEbAKw TgdKcgOc4D4uCYw         32-551-831-
1437
wake carefully alongside of the carefully final ex
9817.10                 Supplier#000002352
RUSSIA
152351.00               Manufacturer#3
4LfoHUZjgjEbAKw TgdKcgOc4D4uCYw         32-551-831-
1437
wake carefully alongside of the carefully final ex
9739.86                 Supplier#000003384
FRANCE
138357.00               Manufacturer#2
o,Z3v4POifevE k9U1b 6J1ucX,I            16-494-913-
5925
s after the furiously bold packages sleep fluffily
idly final requests: quickly final
9721.95                 Supplier#000008757
UNITED KINGDOM
156241.00               Manufacturer#3
Atg6GnM4dT2                             33-821-407-
2995
eep furiously sauternes; quickl
                --------  lines deleted  --------

8042.09                 Supplier#000003245
RUSSIA
150729.00               Manufacturer#1
Dh8Ikg39onrbOL4DyTfGw8a9oKUX3d9Y        32-836-132-
8872
osits. packages cajole slyly. furiously regular
deposits cajole slyly. q
7992.40                 Supplier#000006108
FRANCE
118574.00               Manufacturer#1
8tBydnTDwUqfBfFV4l3                     16-974-998-
8937
 ironic ideas? fluffily even instructions wake.
blithel
7980.65                 Supplier#000001288
FRANCE
13784.00                Manufacturer#4
zE,7HgVPrCn                             16-646-464-
8247
ully bold courts. escapades nag slyly. furiously
fluffy theodo
7950.37                 Supplier#000008101
GERMANY
33094.00                Manufacturer#5
kkYvL6IuvojJgTNG IKkaXQDYgx8ILohj       17-627-663-
8014
arefully unusual requests x-ray above the quickly
final deposits.
7937.93                 Supplier#000009012
ROMANIA
83995.00                Manufacturer#2
iUiTziH,Ek3i4lwSgunXMgrcTzwdb           29-250-925-
9690
to the blithely ironic deposits nag sly
7914.45                 Supplier#000001013
RUSSIA
125988.00               Manufacturer#2
riRcntps4KEDtYScjpMIWeYF6mNnR           32-194-698-
3365
 busily bold packages are dolphi
7912.91                 Supplier#000004211
GERMANY
159180.00               Manufacturer#5
2wQRVovHrm3,v03IKzfTd,1PYsFXQFFOG       17-266-947-
7315
ay furiously regular platelets. cou
7912.91                 Supplier#000004211
GERMANY
184210.00               Manufacturer#4
2wQRVovHrm3,v03IKzfTd,1PYsFXQFFOG       17-266-947-
7315
ay furiously regular platelets. cou
7894.56                 Supplier#000007981
GERMANY
85472.00                Manufacturer#4
NSJ96vMROAbeXP                          17-963-404-
3760
ic platelets affix after the furiously
7887.08                 Supplier#000009792
GERMANY
```

```
164759.00               Manufacturer#3
Y28ITVeYriT3kIGdV2K8fSZ V2UqT5H1Otz      17-988-938-
4296
ckly around the carefully fluffy theodolites. slyly
ironic pack
7871.50                 Supplier#000007206
RUSSIA
104695.00               Manufacturer#1
3w fNCnrVmvJjE95sgWZzvW                  32-432-452-
7731
ironic requests. furiously final theodolites cajole.
final, express packages sleep. quickly reg
7852.45                 Supplier#000005864
RUSSIA
8363.00                 Manufacturer#4
WCNfBPZeSXh3h,c                          32-454-883-
3821
usly unusual pinto beans. brave ideas sleep carefully
quickly ironi
7850.66                 Supplier#000001518
UNITED KINGDOM
86501.00                Manufacturer#1
ONda3YJiHKJOC                            33-730-383-
3892
ifts haggle fluffily pending pai
7843.52                 Supplier#000006683
FRANCE
11680.00                Manufacturer#4
2Z0JGkiv01Y00oCFwUGfviIbhzCdy            16-464-517-
8943
 express, final pinto beans x-ray slyly asymptotes.
unusual, unusual


100 rows processed.
Query Processed in 0.63 seconds.


=====================================================
```

## qual03

```
-- using default substitutions
-- @(#)3.sql    2.1.6.2
-- TPC-H/TPC-R Shipping Priority Query (Q3)
-- Functional Query Definition
-- Approved February 1998

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

L_ORDERKEY              REVENUE
O_ORDERDATE O_SHIPPRIORITY
2456423.00              406181.01               1995-03-
05  0.00
3459808.00              405838.70               1995-03-
04  0.00
492164.00               390324.06               1995-02-
19  0.00
1188320.00              384537.94               1995-03-
09  0.00
2435712.00              378673.06               1995-02-
26  0.00
4878020.00              378376.80               1995-03-
12  0.00
5521732.00              375153.92               1995-03-
13  0.00
2628192.00              373133.31               1995-02-
22  0.00
993600.00               371407.46               1995-03-
05  0.00
2300070.00              367371.15               1995-03-
13  0.00


10 rows processed.
Query Processed in 0.85 seconds.

=====================================================
```

## qual04

```
-- using default substitutions
-- @(#)4.sql    2.1.6.2
-- TPC-H/TPC-R Order Priority Checking Query (Q4)
-- Functional Query Definition
-- Approved February 1998

select
o_orderpriority,
count(*) as order_count
from
orders
where
o_orderdate >= to_date( '1993-07-01',  'YYYY-MM-DD')
and o_orderdate < add_months(to_date( '1993-07-01',
'YYYY-MM-DD'),3)
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        10594.00
2-HIGH          10476.00
3-MEDIUM        10410.00
4-NOT SPECIFIED 10556.00
5-LOW           10487.00


5 rows processed.
Query Processed in 0.60 seconds.

=====================================================
```

## qual05

```
-- using default substitutions
-- @(#)5.sql    2.1.6.2
-- TPC-H/TPC-R Local Supplier Volume Query (Q5)
```

```
-- Functional Query Definition
-- Approved February 1998


select
n_name,
sum(l_extendedprice * (1 - l_discount)) as revenue
from
customer,
orders,
lineitem,
supplier,
nation,
region
where
c_custkey = o_custkey
and l_orderkey = o_orderkey
and l_suppkey = s_suppkey
and c_nationkey = s_nationkey
and s_nationkey = n_nationkey
and n_regionkey = r_regionkey
and r_name = 'ASIA'
and o_orderdate >= to_date( '1994-01-01',  'YYYY-MM-
DD')
and o_orderdate < add_months(to_date( '1994-01-01',
'YYYY-MM-DD'),  12)
group by
n_name
order by
revenue desc

N_NAME                    REVENUE
INDONESIA                 55502041.17
VIETNAM                   55295087.00
CHINA                     53724494.26
INDIA                     52035512.00
JAPAN                     45410175.70


5 rows processed.
Query Processed in 0.80 seconds.

==================================================
```

## qual06

```
-- using default substitutions
-- @(#)6.sql   2.1.6.2
-- TPC-H/TPC-R Forecasting Revenue Change Query (Q6)
-- Functional Query Definition
-- Approved February 1998

select
sum(l_extendedprice * l_discount) as revenue
from
lineitem
where
l_shipdate >= to_date( '1994-01-01',  'YYYY-MM-DD')
and l_shipdate < add_months(to_date( '1994-01-01',  'YYYY-MM-DD'),  12)
and l_discount between .06 - 0.01 and .06 + 0.01
and l_quantity < 24

REVENUE
123141078.23


1 row processed.
Query Processed in 0.12 seconds.

==================================================
```

## qual07

```
-- using default substitutions
-- @(#)7.sql    2.1.6.2
-- TPC-H/TPC-R Volume Shipping Query (Q7)
-- Functional Query Definition
-- Approved February 1998

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

SUPP_NATION               CUST_NATION
L_YEAR
REVENUE
FRANCE                    GERMANY
1995.00
54639732.73
FRANCE                    GERMANY
1996.00
54633083.31
GERMANY                   FRANCE
1995.00
52531746.67
GERMANY                   FRANCE
1996.00
52520549.02


4 rows processed.
Query Processed in 0.87 seconds.

==================================================
```

## qual08

```
-- using default substitutions
-- @(#)8a.sql   2.1.6.2
-- TPC-H/TPC-R National Market Share Query (Q8)
-- Variant A
-- Approved February 1998

select
```

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

O_YEAR                MKT_SHARE
1995.00               0.03
1996.00               0.04


2 rows processed.
Query Processed in 0.81 seconds.
```

==========

## qual09

==========

```
-- using default substitutions
-- @(#)9.sql    2.1.6.2
-- TPC-H/TPC-R Product Type Profit Measure Query (Q9)
-- Functional Query Definition
-- Approved February 1998


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

NATION                    O_YEAR
SUM_PROFIT
ALGERIA                   1998.00
31342867.23
ALGERIA                   1997.00
57138193.02
ALGERIA                   1996.00
56140140.13
ALGERIA                   1995.00
53051469.65
ALGERIA                   1994.00
53867582.13
ALGERIA                   1993.00
54942718.13
ALGERIA                   1992.00
54628034.71
ARGENTINA                 1998.00
30211185.71
ARGENTINA                 1997.00
50805741.75
ARGENTINA                 1996.00
51923746.58
ARGENTINA                 1995.00
49298625.77
ARGENTINA                 1994.00
50835610.11
ARGENTINA                 1993.00
51646079.18
ARGENTINA                 1992.00
50410314.99
BRAZIL                    1998.00
27217924.38
BRAZIL                    1997.00
48378669.20
BRAZIL                    1996.00
50482870.36
BRAZIL                    1995.00
47623383.63
BRAZIL                    1994.00
47840165.73
BRAZIL                    1993.00
49054694.04
BRAZIL                    1992.00
48667639.08
CANADA                    1998.00
30379833.77
CANADA                    1997.00
50465052.31
CANADA                    1996.00
52560501.39
CANADA                    1995.00
52375332.81
CANADA                    1994.00
52600364.66
CANADA                    1993.00
52644504.07
CANADA                    1992.00
53932871.70
CHINA                     1998.00
```

```
31075466.16
CHINA                    1997.00
50551874.45
CHINA                    1996.00
51039293.88
CHINA                    1995.00
49287534.62
CHINA                    1994.00
50851090.07
CHINA                    1993.00
54229629.83
CHINA                    1992.00
52400529.37
EGYPT                    1998.00
29054433.39
EGYPT                    1997.00
50627611.45
EGYPT                    1996.00
49542212.84
EGYPT                    1995.00
48311550.32
EGYPT                    1994.00
49790644.74
EGYPT                    1993.00
48904292.97
EGYPT                    1992.00
49434932.62
ETHIOPIA                 1998.00
28040717.27
ETHIOPIA                 1997.00
47455009.87
ETHIOPIA                 1996.00
46491097.57
ETHIOPIA                 1995.00
46804449.30
ETHIOPIA                 1994.00
48516143.92
ETHIOPIA                 1993.00
46551891.56
ETHIOPIA                 1992.00
44934648.64
               ---  lines deleted  ---
PERU                     1998.00
29326102.32
PERU                     1997.00
49753780.40
PERU                     1996.00
50935170.29
PERU                     1995.00
53309883.41
PERU                     1994.00
50643531.80
PERU                     1993.00
51584622.00
PERU                     1992.00
47523899.05
ROMANIA                  1998.00
30368667.40
ROMANIA                  1997.00
50365683.85
ROMANIA                  1996.00
49598999.01
ROMANIA                  1995.00
47537642.87
ROMANIA                  1994.00
51455283.01
ROMANIA                  1993.00
50407136.89
ROMANIA                  1992.00
48185385.13
RUSSIA                   1998.00
28322384.03
RUSSIA                   1997.00
50106685.18
RUSSIA                   1996.00
51753342.43
RUSSIA                   1995.00
49215820.36
RUSSIA                   1994.00
52205666.44
RUSSIA                   1993.00
51860230.03
RUSSIA                   1992.00
53251677.15
SAUDI ARABIA             1998.00
31541259.81
SAUDI ARABIA             1997.00
52438750.81
SAUDI ARABIA             1996.00
52543737.82
SAUDI ARABIA             1995.00
52938696.53
SAUDI ARABIA             1994.00
51389601.97
SAUDI ARABIA             1993.00
52937508.88
SAUDI ARABIA             1992.00
54843459.64
UNITED KINGDOM           1998.00
28494874.00
UNITED KINGDOM           1997.00
49381810.90
UNITED KINGDOM           1996.00
51386853.96
UNITED KINGDOM           1995.00
51509586.79
UNITED KINGDOM           1994.00
48086499.71
UNITED KINGDOM           1993.00
49166827.22
UNITED KINGDOM           1992.00
49349122.08
UNITED STATES            1998.00
25126238.95
UNITED STATES            1997.00
50077306.42
UNITED STATES            1996.00
48048649.47
UNITED STATES            1995.00
48809032.42
UNITED STATES            1994.00
49296747.18
UNITED STATES            1993.00
48029946.80
UNITED STATES            1992.00
48671944.50
VIETNAM                  1998.00
30442736.06
VIETNAM                  1997.00
50309179.79
VIETNAM                  1996.00
50488161.41
VIETNAM                  1995.00
49658284.61
VIETNAM                  1994.00
50596057.26
VIETNAM                  1993.00
50953919.15
VIETNAM                  1992.00
49613838.32

175 rows processed.
Query Processed in 1.92 seconds.

==================================================
```

## qual10

```
-- using default substitutions
-- @(#)10.sql   2.1.6.2
-- TPC-H/TPC-R Returned Item Reporting Query (Q10)
-- Functional Query Definition
-- Approved February 1998

select  *  from  (
select
c_custkey,
c_name,
sum(l_extendedprice * (1 - l_discount)) as revenue,
c_acctbal,
n_name,
c_address,
c_phone,
c_comment
from
customer,
orders,
lineitem,
nation
where
c_custkey = o_custkey
and l_orderkey = o_orderkey
and o_orderdate >= to_date ('1993-10-01',  'YYYY-MM-
DD')
and o_orderdate < add_months(  to_date( '1993-10-01',
'YYYY-MM-DD'),  3)
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)
where rownum <= 20

C_CUSTKEY              C_NAME
REVENUE
C_ACCTBAL              N_NAME
C_ADDRESS                                  C_PHONE
C_COMMENT
57040.00               Customer#000057040
734235.25
632.87                 JAPAN
Eioyzjf4pp                                 22-895-641-
3466
sits. slyly regular requests sleep alongside of the
regular inst
143347.00              Customer#000143347
721002.69
2557.47                EGYPT
1aReFYv,Kw4                                14-742-935-
3718
ggle carefully enticing requests. final deposits use
bold, bold pinto beans. ironic, idle re
60838.00               Customer#000060838
679127.31
2454.77                BRAZIL
64EaJ5vMAHWJlBOxJklpNc2RJiWE               12-913-494-
9813
 need to boost against the slyly regular account
101998.00              Customer#000101998
637029.57
3790.89                UNITED KINGDOM
01c9CILnNtfOQYmZj                          33-593-865-
6378
ress foxes wake slyly after the bold excuses. ironic
platelets are furiously carefully bold theodolites
125341.00              Customer#000125341
633508.09
4983.51                GERMANY
S29ODD6bceU8QSuuEJznkNaK                   17-582-695-
5962
arefully even depths. blithely even excuses sleep
furiously. foxes use except the dependencies. ca
25501.00               Customer#000025501
620269.78
7725.04                ETHIOPIA
  W556MXuoiaYCCZamJI,Rn0B4ACUGdkQ8DZ       15-874-808-
6793
he pending instructions wake carefully at the pinto
beans. regular, final instructions along the slyly
fina
115831.00              Customer#000115831
596423.87
5098.10                FRANCE
rFeBbEEyk dl ne7zV5fDrmiq1oK09wV7pxqCgIc 16-715-386-
3788
l somas sleep. furiously final deposits wake blithely
regular pinto b
84223.00               Customer#000084223
594998.02
528.65                 UNITED KINGDOM
nAVZCs6BaWap rrM27N 2qBnzc5WBauxbA         33-442-824-
8191
 slyly final deposits haggle regular, pending
dependencies. pending escapades wake
54289.00               Customer#000054289
585603.39
5583.02                IRAN
vXCxoCsU0Bad5JQI ,oobkZ                    20-834-292-
4707
ely special foxes are quickly finally ironic p
39922.00               Customer#000039922
584878.11
7321.11                GERMANY
Zgy4s50l2GKN4pLDPBU8m342gIw6R              17-147-757-
8036
y final requests. furiously final foxes cajole
blithely special platelets. f
6226.00                Customer#000006226
576783.76
2230.09                UNITED KINGDOM
8gPu8,NPGkfyQQ0hcIYUGPIBWc,ybP5g,          33-657-701-
3391
ending platelets along the express deposits cajole
carefully final
922.00                 Customer#000000922
576767.53
3869.25                GERMANY
Az9RFaut7NkPnc5zSD2PwHgVwr4jRzq            17-945-916-
9648
luffily fluffy deposits. packages c
147946.00              Customer#000147946
576455.13
2030.13                ALGERIA
iANyZHjqhyy7Ajah0pTrYyhJ                   10-886-956-
3143
ithely ironic deposits haggle blithely ironic
requests. quickly regu
115640.00              Customer#000115640
569341.19
6436.10                ARGENTINA
Vtgfia9qI 7EpHgecU1X                       11-411-543-
4901
ost slyly along the patterns; pinto be
73606.00               Customer#000073606
568656.86
1785.67                JAPAN
xuR0Tro5yChDfOCrjkd2ol                     22-437-653-
```

```
6966
he furiously regular ideas. slowly
110246.00               Customer#000110246
566842.98
7763.35                 VIETNAM
7KzflgX MDOq7sOkI                          31-943-426-
9837
egular deposits serve blithely above the fl
142549.00               Customer#000142549
563537.24
5085.99                 INDONESIA
ChqEoK43OysjdHbtKCp6dKqjNyvvi9             19-955-562-
2398
sleep pending courts. ironic deposits against the
carefully unusual platelets cajole carefully express
accounts.
146149.00               Customer#000146149
557254.99
1791.55                 ROMANIA
s87fvzFQpU                                 29-744-164-
6487
 of the slyly silent accounts. quickly final accounts
across the
52528.00                Customer#000052528
556397.35
551.79                  ARGENTINA
NFztyTOR10UOJ                              11-208-192-
3205
 deposits hinder. blithely pending asymptotes breach
slyly regular re
23431.00                Customer#000023431
554269.54
3381.86                 ROMANIA
HgiV0phqhaIa9aydNoIlb                      29-915-458-
2654
nusual, even instructions: furiously stealthy n


20 rows processed.
Query Processed in 1.63 seconds.
```

==========

## qual11

```
-- using default substitutions
-- @(#)11.sql   2.1.6.2
-- TPC-H/TPC-R Important Stock Identification Query
(Q11)
-- Functional Query Definition
-- Approved February 1998

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

PS_PARTKEY              VALUE
129760.00               17538456.86
166726.00               16503353.92
191287.00               16474801.97
161758.00               16101755.54
34452.00                15983844.72
139035.00               15907078.34
9403.00                 15451755.62
154358.00               15212937.88
38823.00                15064802.86
85606.00                15053957.15
33354.00                14408297.40
154747.00               14407580.68
82865.00                14235489.78
76094.00                14094247.04
222.00                  13937777.74
121271.00               13908336.00
55221.00                13716120.47
22819.00                13666434.28
76281.00                13646853.68
85298.00                13581154.93
85158.00                13554904.00
139684.00               13535538.72
31034.00                13498025.25
87305.00                13482847.04
10181.00                13445148.75
62323.00                13411824.30
26489.00                13377256.38
96493.00                13339057.83
56548.00                13329014.97
55576.00                13306843.35
159751.00               13306614.48
92406.00                13287414.50
182636.00               13223726.74
199969.00               13135288.21
62865.00                13001926.94
7284.00                 12945298.19
197867.00               12944510.52
11562.00                12931575.51
75165.00                12916918.12
97175.00                12911283.50
140840.00               12896562.23
65241.00                12890600.46
166120.00               12876927.22
9035.00                 12863828.70
144616.00               12853549.30
176723.00               12832309.74
170884.00               12792136.58
29790.00                12723300.33
95213.00                12555483.73
183873.00               12550533.05
        ---  lines deleted ---
13141.00                7942730.34
193327.00               7941036.25
152612.00               7940663.71
139680.00               7939242.36
31134.00                7938318.30
45636.00                7937240.85
56694.00                7936015.95
8114.00                 7933921.88
71518.00                7932261.69
72922.00                7930400.64
146699.00               7929167.40
92387.00                7928972.67
186289.00               7928786.19
95952.00                7927972.78
196514.00               7927180.70
4403.00                 7925729.04
2267.00                 7925649.37
```

```
45924.00                7925047.68
11493.00                7916722.23
104478.00               7916253.60
166794.00               7913842.00
161995.00               7910874.27
23538.00                7909752.06
41093.00                7909579.92
112073.00               7908617.57
92814.00                7908262.50
88919.00                7907992.50
79753.00                7907933.88
108765.00               7905338.98
146530.00               7905336.60
71475.00                7903367.58
36289.00                7901946.50
61739.00                7900794.00
52338.00                7898638.08
194299.00               7898421.24
105235.00               7897829.94
77207.00                7897752.72
96712.00                7897575.27
10157.00                7897046.25
171154.00               7896814.50
79373.00                7896186.00
113808.00               7893353.88
27901.00                7892952.00
128820.00               7892882.72
25891.00                7890511.20
122819.00               7888881.02
154731.00               7888301.33
101674.00               7879324.60
51968.00                7879102.21
72073.00                7877736.11
5182.00                 7874521.73


1048 rows processed.
Query Processed in 0.86 seconds.

==================================================
```

## qual12

```
-- using default substitutions
-- @(#)12.sql   2.1.6.2
-- TPC-H/TPC-R Shipping Modes and Order Priority Query
(Q12)
-- Functional Query Definition
-- Approved February 1998


select
l_shipmode,
sum(case
when o_orderpriority = '1-URGENT'
or o_orderpriority = '2-HIGH'
then 1
else 0
end) as high_line_count,
sum(case
when o_orderpriority <> '1-URGENT'
and o_orderpriority <> '2-HIGH'
then 1
else 0
end) as low_line_count
from
orders,
lineitem
where
o_orderkey = l_orderkey
and l_shipmode in ('MAIL', 'SHIP')
and l_commitdate < l_receiptdate
and l_shipdate < l_commitdate
and l_receiptdate >= to_date( '1994-01-01',  'YYYY-MM-
DD')
and l_receiptdate < add_months(to_date ('1994-01-01',
'YYYY-MM-DD'),  12)
group by
l_shipmode
order by
l_shipmode

L_SHIPMODE HIGH_LINE_COUNT        LOW_LINE_COUNT
MAIL       6202.00                9324.00
SHIP       6200.00                9262.00


2 rows processed.
Query Processed in 1.23 seconds.

==================================================
```

## qual13

```
-- using default substitutions
-- @(#)13.sql   2.1.6.2
-- TPC-H/TPC-R Customer Distribution Query (Q13)
-- Functional Query Definition
-- Approved February 1998

select
c_count,
count(*) as custdist
from
(
select
c_custkey,
count(o_orderkey)  as  c_count
from
customer, orders where
c_custkey = o_custkey(+)
and o_comment(+) not like '%special%requests%'
group by
c_custkey
) c_orders
group by
c_count
order by
custdist desc,
c_count desc

C_COUNT                CUSTDIST
0.00                   50005.00
9.00                   6641.00
10.00                  6532.00
11.00                  6014.00
8.00                   5937.00
12.00                  5639.00
13.00                  5024.00
19.00                  4793.00
7.00                   4687.00
17.00                  4587.00
18.00                  4529.00
20.00                  4516.00
15.00                  4505.00
14.00                  4446.00
16.00                  4273.00
21.00                  4190.00
22.00                  3623.00
6.00                   3265.00
23.00                  3225.00
24.00                  2742.00
25.00                  2086.00
5.00                   1948.00
26.00                  1612.00
27.00                  1179.00
4.00                   1007.00
28.00                  893.00
29.00                  593.00
3.00                   415.00
```

```
30.00                    376.00
31.00                    226.00
32.00                    148.00
2.00                     134.00
33.00                    75.00
34.00                    50.00
35.00                    37.00
1.00                     17.00
36.00                    14.00
38.00                    5.00
37.00                    5.00
40.00                    4.00
41.00                    2.00
39.00                    1.00


42 rows processed.
Query Processed in 0.42 seconds.
```

==========

## qual14

```
-- using default substitutions
-- @(#)14.sql   2.1.6.2
---TPC-H/TPC-R Promotion Effect Query (Q14)
-- Functional Query Definition
-- Approved February 1998

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

PROMO_REVENUE
16.38


1 row processed.
Query Processed in 0.09 seconds.
```

==========

## qual15

```
-- using default substitutions
-- @(#)15.sql   2.1.6.2
-- TPC-H/TPC-R Top Supplier Query (Q15)
-- Functional Query Definition
-- Approved February 1998

with revenue as (
select
l_suppkey supplier_no,
sum(l_extendedprice * (1-l_discount)) total_revenue
from
lineitem
where
l_shipdate >= to_date ( '1996-01-01', 'YYYY-MM-DD')
and l_shipdate < add_months(to_date ( '1996-01-01', 'YYYY-MM-DD'), 3)
group by
l_suppkey
)
select
s_suppkey,
s_name,
s_address,
s_phone,
total_revenue
from
supplier,
revenue
where
s_suppkey = supplier_no
and total_revenue = (
select
max(total_revenue)
from
revenue
)
order by
s_suppkey

S_SUPPKEY          S_NAME
S_ADDRESS                      S_PHONE       TOTAL_REVENUE
8449.00            Supplier#000008449
Wp34zim9qYFbVctdW                  20-469-856-8873 1772627.21


1 row processed.
Query Processed in 0.46  seconds.
```

==========

## qual16

```
-- using default substitutions
-- @(#)16.sql   2.1.6.2
-- TPC-H/TPC-R Parts/Supplier Relationship Query (Q16)
-- Functional Query Definition
-- Approved February 1998


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 '%Customer%Complaints%'
)
group by
p_brand,
p_type,
p_size
order by
supplier_cnt desc,
p_brand,
p_type,
p_size


P_BRAND    P_TYPE                    P_SIZE
SUPPLIER_CNT
Brand#41   MEDIUM BRUSHED TIN        3.00
28.00
Brand#54   STANDARD BRUSHED COPPER   14.00
27.00
Brand#11   STANDARD BRUSHED TIN      23.00
```

```
24.00
Brand#11   STANDARD BURNISHED BRASS  36.00
24.00
Brand#15   MEDIUM ANODIZED NICKEL    3.00
24.00
Brand#15   SMALL ANODIZED BRASS      45.00
24.00
Brand#15   SMALL BURNISHED NICKEL    19.00
24.00
Brand#21   MEDIUM ANODIZED COPPER    3.00
24.00
Brand#22   SMALL BRUSHED NICKEL      3.00
24.00
Brand#22   SMALL BURNISHED BRASS     19.00
24.00
Brand#25   MEDIUM BURNISHED COPPER   36.00
24.00
Brand#31   PROMO POLISHED COPPER     36.00
24.00
Brand#33   LARGE POLISHED TIN        23.00
24.00
Brand#33   PROMO POLISHED STEEL      14.00
24.00
Brand#35   PROMO BRUSHED NICKEL      14.00
24.00
Brand#41   ECONOMY BRUSHED STEEL     9.00
24.00
Brand#41   ECONOMY POLISHED TIN      19.00
24.00
Brand#41   LARGE PLATED COPPER       36.00
24.00
Brand#42   ECONOMY PLATED BRASS      3.00
24.00
Brand#42   STANDARD POLISHED TIN     49.00
24.00
Brand#43   PROMO BRUSHED TIN         3.00
24.00
Brand#43   SMALL ANODIZED COPPER     36.00
24.00
Brand#44   STANDARD POLISHED NICKEL  3.00
24.00
Brand#52   ECONOMY PLATED TIN        14.00
24.00
Brand#52   STANDARD BURNISHED NICKEL 3.00
24.00
Brand#53   MEDIUM ANODIZED STEEL     14.00
24.00
Brand#14   PROMO ANODIZED NICKEL     45.00
23.00
Brand#32   ECONOMY PLATED BRASS      9.00
23.00
Brand#52   SMALL ANODIZED COPPER     3.00
23.00
Brand#11   ECONOMY BRUSHED COPPER    45.00
20.00
Brand#11   ECONOMY PLATED BRASS      23.00
20.00
Brand#11   LARGE BRUSHED COPPER      49.00
20.00
Brand#11   LARGE POLISHED COPPER     49.00
20.00
Brand#12   STANDARD ANODIZED TIN     49.00
20.00
Brand#12   STANDARD PLATED BRASS     19.00
20.00
Brand#13   ECONOMY BRUSHED BRASS     9.00
20.00
Brand#13   ECONOMY BURNISHED STEEL   14.00
20.00
Brand#13   LARGE BURNISHED NICKEL    19.00
20.00
Brand#13   MEDIUM BURNISHED COPPER   36.00
20.00
Brand#13   SMALL BRUSHED TIN         45.00
20.00
Brand#13   STANDARD ANODIZED COPPER  3.00
20.00
Brand#13   STANDARD PLATED NICKEL    23.00
20.00
Brand#14   ECONOMY ANODIZED COPPER   14.00
20.00
Brand#14   ECONOMY PLATED TIN        36.00
20.00
Brand#14   ECONOMY POLISHED NICKEL   3.00
20.00
Brand#14   MEDIUM ANODIZED NICKEL    3.00
20.00
Brand#14   SMALL POLISHED TIN        14.00
20.00
Brand#15   MEDIUM ANODIZED COPPER    9.00
20.00
Brand#15   MEDIUM PLATED TIN         23.00
20.00
Brand#15   PROMO PLATED BRASS        14.00
20.00
                  ---  lines deleted  ----

Brand#55   STANDARD BURNISHED STEEL  36.00
4.00
Brand#55   STANDARD BURNISHED STEEL  45.00
4.00
Brand#55   STANDARD BURNISHED TIN    9.00
4.00
Brand#55   STANDARD BURNISHED TIN    19.00
4.00
Brand#55   STANDARD BURNISHED TIN    36.00
4.00
Brand#55   STANDARD BURNISHED TIN    49.00
4.00
Brand#55   STANDARD PLATED BRASS     9.00
4.00
Brand#55   STANDARD PLATED BRASS     45.00
4.00
Brand#55   STANDARD PLATED BRASS     49.00
4.00
Brand#55   STANDARD PLATED COPPER    9.00
4.00
Brand#55   STANDARD PLATED COPPER    45.00
4.00
Brand#55   STANDARD PLATED NICKEL    3.00
4.00
Brand#55   STANDARD PLATED NICKEL    19.00
4.00
Brand#55   STANDARD PLATED NICKEL    45.00
4.00
Brand#55   STANDARD PLATED STEEL     14.00
4.00
Brand#55   STANDARD PLATED STEEL     23.00
4.00
Brand#55   STANDARD PLATED STEEL     49.00
4.00
Brand#55   STANDARD PLATED TIN       9.00
4.00
Brand#55   STANDARD PLATED TIN       14.00
4.00
Brand#55   STANDARD PLATED TIN       36.00
4.00
Brand#55   STANDARD POLISHED BRASS   3.00
4.00
Brand#55   STANDARD POLISHED BRASS   9.00
4.00
Brand#55   STANDARD POLISHED BRASS   23.00
4.00
Brand#55   STANDARD POLISHED COPPER  3.00
4.00
Brand#55   STANDARD POLISHED COPPER  23.00
4.00
Brand#55   STANDARD POLISHED COPPER  45.00
```

```
4.00
Brand#55   STANDARD POLISHED NICKEL  3.00
4.00
Brand#55   STANDARD POLISHED NICKEL  23.00
4.00
Brand#55   STANDARD POLISHED NICKEL  36.00
4.00
Brand#55   STANDARD POLISHED NICKEL  45.00
4.00
Brand#55   STANDARD POLISHED NICKEL  49.00
4.00
Brand#55   STANDARD POLISHED STEEL   14.00
4.00
Brand#55   STANDARD POLISHED STEEL   23.00
4.00
Brand#55   STANDARD POLISHED TIN     9.00
4.00
Brand#55   STANDARD POLISHED TIN     19.00
4.00
Brand#55   STANDARD POLISHED TIN     36.00
4.00
Brand#11   SMALL BRUSHED TIN         19.00
3.00
Brand#15   LARGE PLATED NICKEL       45.00
3.00
Brand#15   LARGE POLISHED NICKEL     9.00
3.00
Brand#21   PROMO BURNISHED STEEL     45.00
3.00
Brand#22   STANDARD PLATED STEEL     23.00
3.00
Brand#25   LARGE PLATED STEEL        19.00
3.00
Brand#32   STANDARD ANODIZED COPPER  23.00
3.00
Brand#33   SMALL ANODIZED BRASS      9.00
3.00
Brand#35   MEDIUM ANODIZED TIN       19.00
3.00
Brand#51   SMALL PLATED BRASS        23.00
3.00
Brand#52   MEDIUM BRUSHED BRASS      45.00
3.00
Brand#53   MEDIUM BRUSHED TIN        45.00
3.00
Brand#54   ECONOMY POLISHED BRASS    9.00
3.00
Brand#55   PROMO PLATED BRASS        19.00
3.00
Brand#55   STANDARD PLATED TIN       49.00
3.00


18314 rows processed.
Query Processed in 0.29 seconds.
```

==========

## qual17

```
-- using default substitutions
-- @(#)17.sql   2.1.6.2
-- TPC-H/TPC-R Small-Quantity-Order Revenue Query (Q17)
-- Functional Query Definition
-- Approved February 1998

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

AVG_YEARLY
348406.05


1 row processed.
Query Processed in 1.03 seconds.
```

==========

## qual18

```
-- using default substitutions
-- @(#)18.sql   2.1.6.2
-- TPC-H/TPC-R Large Volume Customer Query (Q18)
-- Function Query Definition
-- Approved February 1998

select  *  from  (
select
c_name,
c_custkey,
o_orderkey,
o_orderdate,
o_totalprice,
sum(l_quantity)
from
customer,
orders,
lineitem
where
o_orderkey in (
select
l_orderkey
from
lineitem
group by
l_orderkey having
sum(l_quantity) > 300
)
and c_custkey = o_custkey
and o_orderkey = l_orderkey
group by
c_name,
c_custkey,
o_orderkey,
o_orderdate,
o_totalprice
order by
o_totalprice desc,
o_orderdate
)
where rownum <= 100

C_NAME                    C_CUSTKEY
O_ORDERKEY              O_ORDERDATE
O_TOTALPRICE            SUM(L_QUANTITY)
Customer#000128120         128120.00
4722021.00              1994-04-07
544089.09               323.00
Customer#000144617         144617.00
3043270.00              1997-02-12
530604.44               317.00
Customer#000013940         13940.00
2232932.00              1997-04-13
522720.61               304.00
Customer#000066790         66790.00
```

2199712.00 1996-09-30
515531.82 327.00
Customer#000046435 46435.00
4745607.00 1997-07-03
508047.99 309.00
Customer#000015272 15272.00
3883783.00 1993-07-28
500241.33 302.00
Customer#000146608 146608.00
3342468.00 1994-06-12
499794.58 303.00
Customer#000096103 96103.00
5984582.00 1992-03-16
494398.79 312.00
Customer#000024341 24341.00
1474818.00 1992-11-15
491348.26 302.00
Customer#000137446 137446.00
5489475.00 1997-05-23
487763.25 311.00
Customer#000107590 107590.00
4267751.00 1994-11-04
485141.38 301.00
Customer#000050008 50008.00
2366755.00 1996-12-09
483891.26 302.00
Customer#000015619 15619.00
3767271.00 1996-08-07
480083.96 318.00
Customer#000077260 77260.00
1436544.00 1992-09-12
479499.43 307.00
Customer#000109379 109379.00
5746311.00 1996-10-10
478064.11 302.00
Customer#000054602 54602.00
5832321.00 1997-02-09
471220.08 307.00
Customer#000105995 105995.00
2096705.00 1994-07-03
469692.58 307.00
Customer#000148885 148885.00
2942469.00 1992-05-31
469630.44 313.00
Customer#000114586 114586.00
551136.00 1993-05-19
469605.59 308.00
Customer#000105260 105260.00
5296167.00 1996-09-06
469360.57 303.00
Customer#000147197 147197.00
1263015.00 1997-02-02
467149.67 320.00
Customer#000064483 64483.00
2745894.00 1996-07-04
466991.35 304.00
Customer#000136573 136573.00
2761378.00 1996-05-31
461282.73 301.00
Customer#000016384 16384.00
502886.00 1994-04-12
458378.92 312.00
Customer#000117919 117919.00
2869152.00 1996-06-20
456815.92 317.00
Customer#000012251 12251.00
735366.00 1993-11-24
455107.26 309.00
Customer#000120098 120098.00
1971680.00 1995-06-14
453451.23 308.00
Customer#000066098 66098.00
5007490.00 1992-08-07
453436.16 304.00
Customer#000117076 117076.00
4290656.00 1997-02-05
449545.85 301.00
Customer#000129379 129379.00
4720454.00 1997-06-07
448665.79 303.00
Customer#000126865 126865.00
4702759.00 1994-11-07
447606.65 320.00
Customer#000088876 88876.00
983201.00 1993-12-30
446717.46 304.00
Customer#000036619 36619.00
4806726.00 1995-01-17
446704.09 328.00
Customer#000141823 141823.00
2806245.00 1996-12-29
446269.12 310.00
Customer#000053029 53029.00
2662214.00 1993-08-13
446144.49 302.00
Customer#000018188 18188.00
3037414.00 1995-01-25
443807.22 308.00
Customer#000066533 66533.00
29158.00 1995-10-21
443576.50 305.00
Customer#000037729 37729.00
4134341.00 1995-06-29
441082.97 309.00
Customer#000003566 3566.00
2329187.00 1998-01-04
439803.36 304.00
Customer#000045538 45538.00
4527553.00 1994-05-22
436275.31 305.00
Customer#000081581 81581.00
4739650.00 1995-11-04
435405.90 305.00
Customer#000119989 119989.00
1544643.00 1997-09-20
434568.25 320.00
Customer#000003680 3680.00
3861123.00 1998-07-03
433525.97 301.00
Customer#000113131 113131.00
967334.00 1995-12-15
432957.75 301.00
Customer#000141098 141098.00
565574.00 1995-09-24
430986.69 301.00
Customer#000093392 93392.00
5200102.00 1997-01-22
425487.51 304.00
Customer#000015631 15631.00
1845057.00 1994-05-12
419879.59 302.00
Customer#000112987 112987.00
4439686.00 1996-09-17
418161.49 305.00
Customer#000012599 12599.00
4259524.00 1998-02-12
415200.61 304.00
Customer#000105410 105410.00
4478371.00 1996-03-05
412754.51 302.00
Customer#000149842 149842.00
5156581.00 1994-05-30
411329.35 302.00
Customer#000010129 10129.00
5849444.00 1994-03-21
409129.85 309.00
Customer#000069904 69904.00
1742403.00 1996-10-19

```
408513.00               305.00
Customer#000017746         17746.00
6882.00                 1997-04-09
408446.93               303.00
Customer#000013072         13072.00
1481925.00              1998-03-15
399195.47               301.00
Customer#000082441         82441.00
857959.00               1994-02-07
382579.74               305.00
Customer#000088703         88703.00
2995076.00              1994-01-30
363812.12               302.00


57 rows processed.
Query Processed in 1.16 seconds.
```

==========

## qual19

```
-- using default substitutions
-- @(#)19.sql   2.1.6.2
-- TPC-H/TPC-R Discounted Revenue Query (Q19)
-- Functional Query Definition
-- Approved February 1998


select
sum(l_extendedprice* (1 - l_discount)) as revenue
from
lineitem,
part
where
(
p_partkey = l_partkey
and p_brand = 'Brand#12'
and p_container in ('SM CASE', 'SM BOX', 'SM PACK', 'SM PKG')
and l_quantity >= 1 and l_quantity <= 1 + 10
and p_size between 1 and 5
and l_shipmode in ('AIR', 'AIR REG')
and l_shipinstruct = 'DELIVER IN PERSON'
)
or
(
p_partkey = l_partkey
and p_brand = 'Brand#23'
and p_container in ('MED BAG', 'MED BOX', 'MED PKG', 'MED PACK')
and l_quantity >= 10 and l_quantity <= 10 + 10
and p_size between 1 and 10
and l_shipmode in ('AIR', 'AIR REG')
and l_shipinstruct = 'DELIVER IN PERSON'
)
or
(
p_partkey = l_partkey
and p_brand = 'Brand#34'
and p_container in ('LG CASE', 'LG BOX', 'LG PACK', 'LG PKG')
and l_quantity >= 20 and l_quantity <= 20 + 10
and p_size between 1 and 15
and l_shipmode in ('AIR', 'AIR REG')
and l_shipinstruct = 'DELIVER IN PERSON'
)

REVENUE
3083843.06


1 row processed.
Query Processed in 0.93  seconds.
```

==========

## qual20

```
-- using default substitutions
-- @(#)20.sql   2.1.6.2
-- TPC-H/TPC-R Potential Part Promotion Query (Q20)
-- Function Query Definition
-- Approved February 1998

select
s_name,
s_address
from
supplier,
nation
where
s_suppkey in (
select
ps_suppkey
from
partsupp
where
ps_partkey in (
select
p_partkey
from
part
where
p_name like 'forest%'
)
and ps_availqty > (
select
0.5 * sum(l_quantity)
from
lineitem
where
l_partkey = ps_partkey
and l_suppkey = ps_suppkey
and l_shipdate >= to_date ('1994-01-01', 'YYYY-MM-DD')
and l_shipdate < add_months( to_date ('1994-01-01',
'YYYY-MM-DD'), 12)
)
)
and s_nationkey = n_nationkey
and n_name = 'CANADA'
order by
s_name


    S_NAME                    S_ADDRESS
Supplier#000000020        iybAE,RmTymrZVYaFZva2SH,j
Supplier#000000091
YV45D7TkfdQanOOZ7q9QxkyGUapU1oOWU6q3
Supplier#000000197
YC2Acon6kjY3zj3Fbxs2k4Vdf7X0cd2F
Supplier#000000226        83qOdU2EYRdPQAQhEtn GRZEd
Supplier#000000285
Br7e1nnt1yxrw6ImgpJ7YdhFDjuBf
Supplier#000000378        FfbhyCxWvcPrO8ltp9
Supplier#000000402        i9Sw4DoyMhzhKXCH9By,AYSgmD
Supplier#000000530        0qwCMwobKY
OcmLyfRXlagA8ukENJv,
Supplier#000000688        D
fw5ocppmZpYBBIPI718hCihLDZ5KhKX
Supplier#000000710        f19YPvOyb
QoYwjKC,oPycpGfieBAcwKJo
Supplier#000000736
l6i2nMwVuovfKnuVgaSGK2rDy65DlAFLegiL7
Supplier#000000761
zlSLelQUj2XrvTTFnv7WAcYZGvvMTx882d4
Supplier#000000884        bmhEShejaS
Supplier#000000887        urEaTejH5POADP2ARrf
Supplier#000000935        ij98czM
2KzWe7dDTOxB8sq0UfCdvrX
Supplier#000000975        ,AC e,tBpNwKb5xMUzeohxlRn,
```

```
hdZJo73gFQF8y
Supplier#000001263        rQWr6nf8ZhB2TAiIDIvo5Io
Supplier#000001399        LmrocnIMSyYOWuANx7
Supplier#000001446        lch9HMNU1R7a0LIybsUodVknk6
Supplier#000001454        TOpimgu2TVXIjhiL93h,
Supplier#000001500        wDmF5xLxtQch9ctVu,
Supplier#000001602        uKNWIeafaM644
Supplier#000001626        UhxNRzUu1dtFmp0
Supplier#000001682        pXTkGxrTQVyH1Rr
Supplier#000001699        Q9C4rfJ26oijVPqqcqVXeRI
Supplier#000001700        7hMlCof1Y5zLFg
Supplier#000001726        TeRY7TtTH24sEword7yAaSkjx8
Supplier#000001730        Rc8e,1Pybn r6zo0VJIEiD0UD
vhk
Supplier#000001746
qWsendlOekQG1aW4uq06uQaCm51se8lirv7 hBRd
Supplier#000001752        Fra7outx41THYJaRThdOGiBk
Supplier#000001856
jXcRgzYF0ah05iR8p6w5SbJJLcUGyYiURPvFwUWM
Supplier#000001931        FpJbMU2h6ZR2eBv8I9NIxF
Supplier#000001939        Nrk,JA4bfReUs
Supplier#000001990
DSDJkCgBJzuPg1yuM,CUdLnsRliOxkkHezTCA
Supplier#000002020        jB6r1d7MxP6co
Supplier#000002022         dwebGX7Id2pc25YvY33
Supplier#000002036        20ytTtVObjKUUI2WCB0A
Supplier#000002204
uYmlr46C06udCqanj0KiRsoTQakZsEyssL
Supplier#000002243        nSOEV3JeOU79
Supplier#000002245
hz2qWXWVjOyKhqPYMoEwz6zFkrTaDM
Supplier#000002282
ES21K9dxoW1I1TzWCj7ekdlNwSWnv1Z  6mQ,BKn
Supplier#000002303        nCoWfpB6YOymbgOht7ltfklpkHl
Supplier#000002373        RzHSxOTQmElCjxIBiVA52Z
JB58rJhPRylR
Supplier#000002419        qydBQd14I5l5mVXa4fYY
Supplier#000002481
nLKHUOn2Ml9TOA06Znq9GEMcIlMO2
Supplier#000002571        JZUugz04c iJFLrlGsz9O N,W
1rVHNIReyq
Supplier#000002585
CsPoKpw2QuTY4AV1NkWuttneIa4SN
Supplier#000002630        ZIQAvjNUY9KH5ive zm7k
VlPiDl7CCo21
          ---  lines deleted  ---
Supplier#000007398        V8eE6oZ00OFNU,
Supplier#000007402        4UVv58ery1rjmqSR5
Supplier#000007448        yhhpWiJi7EJ6Q5VCaQ
Supplier#000007477        9m9j0wfhWzCvVHxkU,PpAxwSH0h
Supplier#000007509        q8,V6LJRoHJjHcOuSG7aLTMg
Supplier#000007561        rMcFg2530VC
Supplier#000007789
rQ7cUcPrtudOyO3svNSkimqH6qrfWT2Sz
Supplier#000007801        69fi,U1r6enUb
Supplier#000007818        yhhc2CQec Jrvc8zqBi83
Supplier#000007885
u3sicchh5ZpyTUpN1cJKNcAoabIWgY
Supplier#000007918        r,v9mBQ6LoEYyj1
Supplier#000007926        ErzCF80K9Uy
Supplier#000007957        ELwnio14ssoU1 dRyZIL OK3Vtzb
Supplier#000007965        F7Un5lJ7p5hhj
Supplier#000007968
DsF9UlZ2Fo6HXN9aErvyg1ikHoD582HSGZpP
Supplier#000007998        LnASFBfYRFOo9d6d,asBvVq9Lo2P
Supplier#000008168        aOa82a8ZbKCnfDLX
Supplier#000008231        IK7eGw Yj90sTdpsP,vcqWxLB
Supplier#000008243        2AyePMkDqmzVzjGTizXthFLo8h
EiudCMxOmIIG
Supplier#000008275        BlbNDfWg,gpXKQlLN
Supplier#000008323        75I18sZmASwm
POeheRMdj9tmpyeQ,BfCXN5BIAb
Supplier#000008366
h778cEj14BuW9OEKlvPTWq4iwASR6EBBXN7zeS8
Supplier#000008423
RQhKnkAhR0DAr3Ix4Q1weMMn00hNe Kq
Supplier#000008480        4sSDA4ACReklNjEm5T6b
Supplier#000008532
Uc29q4,5xVdDOF87UZrxhr4xWS0ihEUXuh
Supplier#000008595        MH0iB73GQ3z UW3O DbCbqmc
Supplier#000008610
SgVgP90vP452sUNTgzL9zKwXHXAzV6tV
Supplier#000008705        aE,trRNdPx,4yinTD9O3DebDIp
Supplier#000008742        HmPlQEzKCPEcTUL14,kKq
Supplier#000008841        I 85Lu1sekbg2xrSIzm0
Supplier#000008895
2cH4okfaLSZTTg8sKRbbJQxkmeFu2Esj
Supplier#000008967        2kwEHyMG
7FwozNImAUE6mH0hYtqYculJM
Supplier#000008972        w2vF6 D5YZO3visPXsqVfLADTK
Supplier#000009032        qK,trB6Sdy4Dz1BRUFNy
Supplier#000009147        rOAuryHxpZ9eOvx
Supplier#000009252        F7cZaPUHwh1 ZKyj3xmAVWC1XdP
ue1p5m,i
Supplier#000009278        RqYTzgxj93CLX 0mcYfCENOefD
Supplier#000009327        uoqMdf7e7Gj9dbQ53
Supplier#000009430        igRqmneFt
Supplier#000009567        r4Wfx4c3xsEAjcGj71HHZByornl
D9vrztXlv4
Supplier#000009601        51m637bO,Rw5DnHWFUvLacRx9
Supplier#000009709        rRnCbHYgDgl9PZYnyWKVYSUW0vKg
Supplier#000009753        wLhVEcRmd7PkJF4FBnGK7Z
Supplier#000009796        z,y4Idmr15DOvPUqYG
Supplier#000009799         4wNjXGa4OKWl
Supplier#000009811        E3iuyq7UnZxU7oPZIe2Gu6
Supplier#000009812
APFRMy3lCbgFga53n5t9DxzFPQPgnjrGt32
Supplier#000009862        rJzweWeN58
Supplier#000009868        ROjGgx5gvtkmnUUoeyy7v
Supplier#000009869
ucLqxzrpBTRMewGSM29t0rNTM30g1Tu3Xgg3mKag
Supplier#000009899        7XdpAHrzr1t,UQFZE
Supplier#000009974
7wJ,J5DKcxSU4Kp1cQLpbcAvB5AsvKT


204 rows processed.
Query Processed in 0.41 seconds.


==================================================
```

## qual21

```
-- using default substitutions
-- @(#)21.sql   2.1.6.2
-- TPC-H/TPC-R Suppliers Who Kept Orders Waiting Query
(Q21)
-- Functional Query Definition
-- Approved February 1998

select * from (
select
s_name,
count(*)  numwait
from
supplier,
lineitem l1,
orders,
nation
where
s_suppkey = l1.l_suppkey
and o_orderkey = l1.l_orderkey
and o_orderstatus = 'F'
and l1.l_receiptdate > l1.l_commitdate
and exists (
select
*
from
```

```
lineitem l2
where
l2.l_orderkey = l1.l_orderkey
and l2.l_suppkey <> l1.l_suppkey
)
and not exists (
select
*
from
lineitem l3
where
l3.l_orderkey = l1.l_orderkey
and l3.l_suppkey <> l1.l_suppkey
and l3.l_receiptdate > l3.l_commitdate
)
and s_nationkey = n_nationkey
and n_name = 'SAUDI ARABIA'
group by
s_name
order by
numwait desc,
s_name)
where rownum <= 100
```

| S_NAME | NUMWAIT |
|---|---|
| Supplier#000002829 | 20.00 |
| Supplier#000005808 | 18.00 |
| Supplier#000000262 | 17.00 |
| Supplier#000000496 | 17.00 |
| Supplier#000002160 | 17.00 |
| Supplier#000002301 | 17.00 |
| Supplier#000002540 | 17.00 |
| Supplier#000003063 | 17.00 |
| Supplier#000005178 | 17.00 |
| Supplier#000008331 | 17.00 |
| Supplier#000002005 | 16.00 |
| Supplier#000002095 | 16.00 |
| Supplier#000005799 | 16.00 |
| Supplier#000005842 | 16.00 |
| Supplier#000006450 | 16.00 |
| Supplier#000006939 | 16.00 |
| Supplier#000009200 | 16.00 |
| Supplier#000009727 | 16.00 |
| Supplier#000000486 | 15.00 |
| Supplier#000000565 | 15.00 |
| Supplier#000001046 | 15.00 |
| Supplier#000001047 | 15.00 |
| Supplier#000001161 | 15.00 |
| Supplier#000001336 | 15.00 |
| Supplier#000001435 | 15.00 |
| Supplier#000003075 | 15.00 |
| Supplier#000003335 | 15.00 |
| Supplier#000005649 | 15.00 |
| Supplier#000006027 | 15.00 |
| Supplier#000006795 | 15.00 |
| Supplier#000006800 | 15.00 |
| Supplier#000006824 | 15.00 |
| Supplier#000007131 | 15.00 |
| Supplier#000007382 | 15.00 |
| Supplier#000008913 | 15.00 |
| Supplier#000009787 | 15.00 |
| Supplier#000000633 | 14.00 |
| Supplier#000001960 | 14.00 |
| Supplier#000002323 | 14.00 |
| Supplier#000002490 | 14.00 |
| Supplier#000002993 | 14.00 |
| Supplier#000003101 | 14.00 |
| Supplier#000004489 | 14.00 |
| Supplier#000005435 | 14.00 |
| Supplier#000005583 | 14.00 |
| Supplier#000005774 | 14.00 |
| Supplier#000007579 | 14.00 |
| Supplier#000008180 | 14.00 |
| Supplier#000008695 | 14.00 |
| Supplier#000009224 | 14.00 |
| Supplier#000000357 | 13.00 |
| Supplier#000000436 | 13.00 |
| Supplier#000000610 | 13.00 |
| Supplier#000000788 | 13.00 |
| Supplier#000000889 | 13.00 |
| Supplier#000001062 | 13.00 |
| Supplier#000001498 | 13.00 |
| Supplier#000002056 | 13.00 |
| Supplier#000002312 | 13.00 |
| Supplier#000002344 | 13.00 |
| Supplier#000002596 | 13.00 |
| Supplier#000002615 | 13.00 |
| Supplier#000002978 | 13.00 |
| Supplier#000003048 | 13.00 |
| Supplier#000003234 | 13.00 |
| Supplier#000003727 | 13.00 |
| Supplier#000003806 | 13.00 |
| Supplier#000004472 | 13.00 |
| Supplier#000005236 | 13.00 |
| Supplier#000005906 | 13.00 |
| Supplier#000006241 | 13.00 |
| Supplier#000006326 | 13.00 |
| Supplier#000006384 | 13.00 |
| Supplier#000006394 | 13.00 |
| Supplier#000006624 | 13.00 |
| Supplier#000006629 | 13.00 |
| Supplier#000006682 | 13.00 |
| Supplier#000006737 | 13.00 |
| Supplier#000006825 | 13.00 |
| Supplier#000007021 | 13.00 |
| Supplier#000007417 | 13.00 |
| Supplier#000007497 | 13.00 |
| Supplier#000007602 | 13.00 |
| Supplier#000008134 | 13.00 |
| Supplier#000008234 | 13.00 |
| Supplier#000009435 | 13.00 |
| Supplier#000009436 | 13.00 |
| Supplier#000009564 | 13.00 |
| Supplier#000009896 | 13.00 |
| Supplier#000000379 | 12.00 |
| Supplier#000000673 | 12.00 |
| Supplier#000000762 | 12.00 |
| Supplier#000000811 | 12.00 |
| Supplier#000000821 | 12.00 |
| Supplier#000001337 | 12.00 |
| Supplier#000001916 | 12.00 |
| Supplier#000001925 | 12.00 |
| Supplier#000002039 | 12.00 |
| Supplier#000002357 | 12.00 |
| Supplier#000002483 | 12.00 |

```
100 rows processed.
Query Processed in 4.93 seconds.

==================================================
```

## qual22

```
-- using default substitutions
-- @(#)22.sql   2.1.4.2
-- TPC-D Global Sales Opportunity Query (Q22)
-- Functional Query Definition
-- Approved February 1998

select
cntrycode,
count(*) as numcust,
sum(c_acctbal) as totacctbal
from
(
select
substr(c_phone, 1, 2) as cntrycode,
c_acctbal
```

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

CNTRYCODE NUMCUST                TOTACCTBAL
13        888.00                 6737713.99
17        861.00                 6460573.72
18        964.00                 7236687.40
23        892.00                 6701457.95
29        948.00                 7158866.63
30        909.00                 6808436.13
31        922.00                 6806670.18


7 rows processed.
Query Processed in 0.38 seconds.
```

# Appendix D. Seed and Query Substitution Parameters

This Appendix contains Seed values and substitution parameters for each stream

## seed values

```
Stream0  411222858
Stream1  411222859
Stream2  411222860
Stream3  411222861
Stream4  411222862
Stream5  411222863
Stream6  411222864
Stream7  411222865
Stream8  411222866
Stream9  411222867
Stream10 411222868
Stream11 411222869
Stream12 411222870
Stream13 411222871
Stream14 411222872
Stream15 411222873
Stream16 411222874
Stream17 411222875
Stream18 411222876
Stream19 411222877
Stream20 411222878
Stream21 411222879
Stream22 411222880
Stream23 411222881
Stream24 411222882
Stream25 411222883
Stream26 411222884
Stream27 411222885
Stream28 411222886
Stream29 411222887
Stream30 411222888
Stream31 411222889
Stream32 411222890
Stream33 411222891
Stream34 411222892
Stream35 411222893
Stream36 411222894
Stream37 411222895
Stream38 411222896
Stream39 411222897
Stream40 411222898
Stream41 411222899
Stream42 411222900
Stream43 411222901
Stream44 411222902
Stream45 411222903
Stream46 411222904
Stream47 411222905
Stream48 411222906
Stream49 411222907
Stream50 411222908
Stream51 411222909
Stream52 411222910
Stream53 411222911
Stream54 411222912
Stream55 411222913
Stream56 411222914
Stream57 411222915
Stream58 411222916
Stream59 411222917
Stream60 411222918
Stream61 411222919
Stream62 411222920
Stream63 411222921
Stream64 411222922
```

## stream 00 substitution parameters

```
14      1994-10-01
2       6       TIN     AFRICA
9       antique
20      moccasin        1995-01-01      INDONESIA
6       1995-01-01      0.02    24
17      Brand#14        WRAP PKG
18      314
8       IRAN    MIDDLE EAST     STANDARD ANODIZED
STEEL
21      KENYA
13      special requests
3       AUTOMOBILE      1995-03-01
22      19      26      23      20      15      24
10
16      Brand#51        ECONOMY BURNISHED       48
30      6       40
28      29      22      14
4       1993-03-01
11      ALGERIA 0.0000001000
15      1994-11-01
1       70
10      1993-10-01
19      Brand#53        Brand#32        Brand#31
9       12      26
5       AMERICA 1995-01-01
7       ARGENTINA       IRAN
12      TRUCK   REG AIR 1994-01-01
```

## stream 01 substitution parameters

```
21      FRANCE
3       FURNITURE       1995-03-18
18      312
5       EUROPE  1995-01-01
11      JORDAN  0.0000001000
7       CHINA   BRAZIL
6       1995-01-01      0.07    24
20      almond  1994-01-01      UNITED KINGDOM
17      Brand#11        SM CASE
12      RAIL    REG AIR 1995-01-01
16      Brand#31        STANDARD PLATED 26      35
20      48      5
6       21      16
15      1997-06-01
13      special requests
10      1994-07-01
2       44      COPPER  ASIA
8       BRAZIL  AMERICA PROMO POLISHED STEEL
14      1995-01-01
19      Brand#11        Brand#25        Brand#35
5       13      22
9       turquoise
22      18      26      29      20      17      15
31
1       78
4       1995-09-01
```

## stream 02 substitution parameters

```
6       1996-01-01      0.05    25
17      Brand#13        SM JAR
14      1995-04-01
16      Brand#21        MEDIUM BRUSHED  5       22
```

```
25      12      21
46      47      20
19      Brand#13        Brand#53        Brand#34
10      14      29
10      1993-04-01
9       snow
2       32      STEEL   AFRICA
15      1995-02-01
8       ROMANIA EUROPE  PROMO BURNISHED STEEL
5       MIDDLE EAST     1996-01-01
22      23      31      28      33      19      24
34
12      AIR     TRUCK   1995-01-01
7       IRAN    ROMANIA
13      special requests
18      313
1       86
4       1993-06-01
20      khaki   1997-01-01      JORDAN
3       MACHINERY       1995-03-03
11      ARGENTINA       0.0000001000
21      UNITED KINGDOM
================================================
```

## stream 03 substitution parameters

```
================================================
8       IRAQ    MIDDLE EAST     ECONOMY BRUSHED STEEL
5       AFRICA  1996-01-01
4       1996-01-01
6       1996-01-01      0.02    24
17      Brand#15        SM PKG
7       BRAZIL  IRAQ
1       94
18      315
22      26      18      24      25      22      23
27
14      1995-08-01
9       sandy
10      1994-02-01
15      1997-09-01
11      KENYA   0.0000001000
20      sienna  1996-01-01      CANADA
2       19      BRASS   EUROPE
21      MOROCCO
19      Brand#15        Brand#41        Brand#23
5       15      25
13      special accounts
16      Brand#51        PROMO ANODIZED  8       20
40      7       46      30      19      25
12      REG AIR AIR     1995-01-01
3       FURNITURE       1995-03-20
================================================
```

## stream 04 substitution parameters

```
================================================
5       AMERICA 1996-01-01
21      INDIA
14      1995-11-01
19      Brand#22        Brand#24        Brand#23
10      16      22
15      1995-06-01
17      Brand#12        LG CASE
12      FOB     AIR     1995-01-01
6       1996-01-01      0.08    24
4       1993-10-01
9       red
8       CANADA  AMERICA ECONOMY PLATED STEEL
16      Brand#31        SMALL PLATED    36      8
1       19      2       27      45      47
11      BRAZIL  0.0000001000
2       7       TIN     AFRICA
10      1994-11-01
18      312
1       102
13      special accounts
7       ROMANIA CANADA
22      26      17      11      34      12      24
30
3       MACHINERY       1995-03-05
20      dodger  1994-01-01      CHINA
================================================
```

## stream 05 substitution parameters

```
================================================
21      ALGERIA
15      1993-03-01
4       1996-05-01
6       1996-01-01      0.05    25
7       IRAQ    SAUDI ARABIA
16      Brand#21        LARGE POLISHED  20      19
13      46      11      1       18      39
19      Brand#24        Brand#12        Brand#22
6       17      29
18      314
14      1996-02-01
22      14      19      10      12      18      16
23
11      MOROCCO 0.0000001000
13      pending accounts
3       BUILDING        1995-03-22
1       110
2       45      COPPER  EUROPE
5       ASIA    1996-01-01
8       SAUDI ARABIA    MIDDLE EAST     ECONOMY
ANODIZED COPPER
20      peach   1993-01-01      GERMANY
12      MAIL    AIR     1996-01-01
17      Brand#14        LG JAR
10      1993-08-01
9       peru
================================================
```

## stream 06 substitution parameters

```
================================================
10      1994-05-01
3       MACHINERY       1995-03-07
15      1995-09-01
13      pending accounts
6       1997-01-01      0.03    25
8       JAPAN   ASIA    LARGE POLISHED COPPER
9       olive
7       CANADA  JAPAN
4       1994-02-01
11      CANADA  0.0000001000
22      26      31      11      13      29      22
10
18      312
12      TRUCK   RAIL    1996-01-01
1       118
5       EUROPE  1997-01-01
16      Brand#51        STANDARD ANODIZED       19
5       4       25      7       31      35      47
2       33      STEEL   AMERICA
14      1996-05-01
19      Brand#21        Brand#45        Brand#11
1       18      25
20      blue    1996-01-01      RUSSIA
17      Brand#11        LG PKG
21      PERU
================================================
```

## stream 07 substitution parameters

```
================================================
18      313
8       EGYPT   MIDDLE EAST     LARGE BURNISHED COPPER
20      magenta 1994-01-01      JAPAN
21      INDONESIA
2       21      BRASS   EUROPE
4       1996-09-01
22      33      11      34      25      31      24
19
```

```
17      Brand#12        MED CASE
1       65
11      MOZAMBIQUE      0.0000001000
9       midnight
19      Brand#33        Brand#23        Brand#15
6       19      21
3       BUILDING        1995-03-24
13      pending accounts
5       MIDDLE EAST     1997-01-01
7       SAUDI ARABIA    EGYPT
10      1993-02-01
16      Brand#31        MEDIUM BURNISHED        18
2       20      5       45      38      29      10
6       1997-01-01      0.08    24
14      1996-08-01
15      1993-06-01
12      RAIL    FOB     1993-01-01
================================================
```

## stream 08 substitution parameters

```
================================================
19      Brand#35        Brand#11        Brand#55
1       20      28
1       73
15      1996-01-01
17      Brand#14        MED JAR
5       AFRICA  1997-01-01
8       VIETNAM ASIA    MEDIUM BRUSHED COPPER
9       lime
12      AIR     RAIL    1996-01-01
14      1996-12-01
7       JAPAN   VIETNAM
4       1994-06-01
3       HOUSEHOLD       1995-03-09
20      thistle 1993-01-01      BRAZIL
16      Brand#21        ECONOMY POLISHED        25
8       22      49      7       30      2       24
6       1997-01-01      0.05    25
22      24      26      14      15      23      27
20
10      1993-12-01
13      pending deposits
2       8       NICKEL  AMERICA
21      ARGENTINA
18      315
11      EGYPT   0.0000001000
================================================
```

## stream 09 substitution parameters

```
================================================
8       JORDAN  MIDDLE EAST     MEDIUM PLATED COPPER
13      pending deposits
2       46      COPPER  MIDDLE EAST
20      goldenrod       1996-01-01      MOZAMBIQUE
17      Brand#21        MED PKG
3       AUTOMOBILE      1995-03-26
6       1997-01-01      0.03    25
21      CHINA
18      312
11      PERU    0.0000001000
19      Brand#32        Brand#44        Brand#54
7       10      25
10      1994-09-01
15      1993-09-01
4       1997-01-01
22      26      14      19      25      20      32
33
1       81
7       EGYPT   JORDAN
12      REG AIR RAIL    1997-01-01
9       khaki
14      1997-03-01
5       AMERICA 1997-01-01
16      Brand#52        STANDARD BRUSHED        46
35      8       33      3       20      32      38
================================================
```

## stream 10 substitution parameters

```
================================================
6       1993-01-01      0.08    24
15      1996-04-01
18      314
17      Brand#23        JUMBO CASE
12      FOB     TRUCK   1997-01-01
1       89
7       VIETNAM ETHIOPIA
2       34      STEEL   AMERICA
22      16      28      12      14      13      23
33
13      pending deposits
21      IRAQ
10      1993-06-01
14      1997-06-01
9       green
3       HOUSEHOLD       1995-03-11
16      Brand#32        LARGE BURNISHED 32      39
46      14      25      9       47      8
20      rose    1995-01-01      FRANCE
19      Brand#44        Brand#32        Brand#53
2       11      21
11      ETHIOPIA        0.0000001000
4       1994-10-01
8       ETHIOPIA        AFRICA  MEDIUM BURNISHED TIN
5       ASIA    1993-01-01
================================================
```

## stream 11 substitution parameters

```
================================================
15      1994-01-01
14      1997-09-01
18      315
17      Brand#25        JUMBO JAR
10      1994-03-01
20      coral   1993-01-01      VIETNAM
16      Brand#22        PROMO PLATED    46      14
7       3       25      19      34      12
11      CHINA   0.0000001000
1       97
8       RUSSIA  EUROPE  SMALL BRUSHED TIN
4       1997-04-01
22      20      29      19      26      12      11
31
5       EUROPE  1993-01-01
12      MAIL    TRUCK   1997-01-01
3       AUTOMOBILE      1995-03-28
9       floral
21      CANADA
2       22      BRASS   MIDDLE EAST
13      pending deposits
6       1993-01-01      0.06    25
19      Brand#41        Brand#15        Brand#42
7       12      28
7       JORDAN  RUSSIA
================================================
```

## stream 12 substitution parameters

```
================================================
1       105
7       ETHIOPIA        KENYA
16      Brand#52        SMALL BRUSHED   38      7
44      22      13      19      8       16
17      Brand#22        JUMBO PKG
18      313
22      20      30      15      22      32      10
21
12      TRUCK   SHIP    1996-01-01
6       1993-01-01      0.03    25
8       KENYA   AFRICA  SMALL PLATED TIN
9       dark
11      FRANCE  0.0000001000
4       1995-01-01
```

```
2       10      NICKEL  ASIA
5       AFRICA  1993-01-01
20      navajo  1997-01-01      IRAN
21      SAUDI ARABIA
13      unusual deposits
10      1994-12-01
19      Brand#44        Brand#53        Brand#42
3       13      24
3       FURNITURE       1995-03-13
14      1997-12-01
15      1996-08-01
================================================
```

## stream 13 substitution parameters

```
================================================
21      JAPAN
17      Brand#24        WRAP CASE
7       RUSSIA  FRANCE
3       AUTOMOBILE      1995-03-30
1       113
10      1993-10-01
12      RAIL    TRUCK   1993-01-01
22      10      25      26      17      18      34
31
9       chocolate
16      Brand#32        ECONOMY ANODIZED        17
38      26      8       33      41      11      13
6       1993-01-01      0.09    24
11      ROMANIA 0.0000001000
2       47      TIN     MIDDLE EAST
4       1997-08-01
5       AMERICA 1993-01-01
14      1993-04-01
8       FRANCE  EUROPE  SMALL ANODIZED TIN
20      antique 1995-01-01      ALGERIA
13      unusual packages
18      314
15      1994-04-01
19      Brand#51        Brand#31        Brand#41
8       14      20
================================================
```

## stream 14 substitution parameters

```
================================================
2       35      STEEL   ASIA
9       blush
5       ASIA    1993-01-01
4       1995-05-01
18      312
1       61
20      lace    1993-01-01      MOROCCO
15      1996-11-01
16      Brand#22        STANDARD PLATED 45      21
10      44      32      24      13      17
17      Brand#21        WRAP JAR
7       KENYA   UNITED KINGDOM
21      EGYPT
13      unusual packages
14      1993-07-01
19      Brand#53        Brand#14        Brand#35
3       15      28
8       UNITED KINGDOM  EUROPE  STANDARD POLISHED
NICKEL
22      15      17      31      23      22      28
13
11      GERMANY 0.0000001000
10      1994-07-01
3       FURNITURE       1995-03-15
12      AIR     MAIL    1993-01-01
6       1993-01-01      0.06    25
================================================
```

## stream 15 substitution parameters

```
================================================
16      Brand#52        MEDIUM POLISHED 13      8
27      11      12      38      4       30
9       azure
17      Brand#23        WRAP CAN
8       MOROCCO AFRICA  STANDARD BURNISHED NICKEL
14      1993-10-01
11      SAUDI ARABIA    0.0000001000
10      1993-04-01
12      SHIP    MAIL    1993-01-01
6       1994-01-01      0.03    25
21      VIETNAM
7       FRANCE  MOROCCO
3       MACHINERY       1995-03-01
15      1994-08-01
5       EUROPE  1994-01-01
22      15      22      20      32      24      30
12
20      sky     1997-01-01      ETHIOPIA
1       69
13      unusual packages
19      Brand#55        Brand#52        Brand#34
8       16      24
2       23      BRASS   AFRICA
4       1993-02-01
18      313
================================================
```

## stream 16 substitution parameters

```
================================================
1       77
3       FURNITURE       1995-03-17
6       1994-01-01      0.09    24
5       MIDDLE EAST     1994-01-01
2       11      NICKEL  ASIA
16      Brand#42        PROMO ANODIZED  1       26
29      3       11      44      16      13
14      1994-01-01
22      15      22      34      14      18      29
24
17      Brand#25        SM CASE
20      dodger  1995-01-01      ROMANIA
4       1995-09-01
9       wheat
10      1994-01-01
11      INDIA   0.0000001000
15      1997-02-01
8       GERMANY EUROPE  PROMO BRUSHED NICKEL
12      FOB     MAIL    1994-01-01
19      Brand#12        Brand#34        Brand#33
4       17      20
18      315
13      unusual packages
7       UNITED KINGDOM  GERMANY
21      KENYA
================================================
```

## stream 17 substitution parameters

```
================================================
3       MACHINERY       1995-03-03
16      Brand#22        SMALL BURNISHED 5       35
13      20      12      23      42      17
5       AFRICA  1994-01-01
11      VIETNAM 0.0000001000
21      FRANCE
9       steel
2       48      TIN     AFRICA
15      1994-11-01
10      1994-10-01
18      312
17      Brand#22        SM JAR
7       MOROCCO UNITED STATES
8       UNITED STATES   AMERICA PROMO PLATED NICKEL
19      Brand#14        Brand#22        Brand#23
9       18      27
14      1994-04-01
13      unusual requests
1       85
```

```
4       1993-06-01
22      19      10      18      16      11      27
23
20      peru    1994-01-01      INDONESIA
6       1994-01-01      0.06    25
12      MAIL    AIR     1994-01-01
================================================
```

## stream 18 substitution parameters

```
================================================
14      1994-08-01
4       1996-01-01
13      unusual requests
5       AMERICA 1994-01-01
21      UNITED KINGDOM
11      INDONESIA       0.0000001000
8       MOZAMBIQUE      AFRICA  PROMO ANODIZED NICKEL
6       1994-01-01      0.04    25
3       BUILDING        1995-03-19
17      Brand#24        SM CAN
2       36      COPPER  EUROPE
20      blush   1997-01-01      UNITED STATES
1       93
19      Brand#11        Brand#55        Brand#22
4       19      23
10      1993-08-01
9       sienna
12      TRUCK   FOB     1994-01-01
18      314
15      1997-06-01
7       GERMANY MOZAMBIQUE
22      28      27      20      19      31      18
33
16      Brand#52        LARGE POLISHED  8       36
47      10      15      25      19      14
================================================
```

## stream 19 substitution parameters

```
================================================
4       1993-10-01
12      RAIL    FOB     1994-01-01
22      11      15      30      20      34      25
19
14      1994-11-01
5       ASIA    1995-01-01
15      1995-03-01
16      Brand#42        PROMO BRUSHED   41      27
32      8       12      30      14      49
2       24      BRASS   AFRICA
8       INDIA   ASIA    ECONOMY POLISHED BRASS
10      1994-05-01
17      Brand#25        LG CASE
9       rosy
21      MOROCCO
7       UNITED STATES   INDIA
3       HOUSEHOLD       1995-03-05
6       1995-01-01      0.09    24
13      express requests
18      315
11      RUSSIA  0.0000001000
20      maroon  1996-01-01      KENYA
19      Brand#23        Brand#43        Brand#21
9       20      20
1       101

================================================
```

## stream 20 substitution parameters

```
================================================
16      Brand#22        MEDIUM BURNISHED        15
3       35      34      4       50      17      16
15      1997-09-01
14      1995-02-01
13      express requests
4       1996-05-01
22      19      14      34      23      10      26
17
18      313
19      Brand#25        Brand#21        Brand#15
5       10      27
7       MOZAMBIQUE      ALGERIA
1       109
12      AIR     FOB     1995-01-01
17      Brand#22        LG JAR
5       EUROPE  1995-01-01
10      1993-02-01
20      tomato  1994-01-01      CANADA
3       BUILDING        1995-03-21
9       plum
21      GERMANY
11      IRAN    0.0000001000
2       12      NICKEL  EUROPE
6       1995-01-01      0.07    24
8       ALGERIA AFRICA  ECONOMY BURNISHED BRASS
================================================
```

## stream 21 substitution parameters

```
================================================
20      goldenrod       1997-01-01      CHINA
14      1995-05-01
21      UNITED STATES
12      SHIP    FOB     1995-01-01
15      1995-06-01
17      Brand#24        LG CAN
4       1994-01-01
19      Brand#22        Brand#54        Brand#15
10      11      23
13      express requests
10      1993-11-01
11      UNITED KINGDOM  0.0000001000
1       117
16      Brand#52        ECONOMY PLATED  18      26
27      37      5       36      6       8
5       MIDDLE EAST     1995-01-01
18      315
7       INDIA   PERU
8       PERU    AMERICA LARGE BRUSHED BRASS
22      32      13      30      14      16      17
27
9       orchid
6       1995-01-01      0.04    25
3       HOUSEHOLD       1995-03-07
2       50      TIN     AMERICA
================================================
```

## stream 22 substitution parameters

```
================================================
16      Brand#42        STANDARD BRUSHED        22
42      30      4       10      34      27      12
14      1995-08-01
13      express accounts
2       37      COPPER  EUROPE
21      PERU
10      1994-08-01
11      IRAQ    0.0000001000
4       1996-08-01
1       64
22      28      18      26      33      15      34
30
18      312
12      FOB     SHIP    1995-01-01
19      Brand#34        Brand#42        Brand#14
5       12      30
5       AMERICA 1995-01-01
7       ALGERIA INDONESIA
8       INDONESIA       ASIA    LARGE PLATED BRASS
6       1995-01-01      0.02    24
3       AUTOMOBILE      1995-03-23
15      1993-03-01
20      rosy    1996-01-01      INDIA
9       misty
```

```
17      Brand#21        MED CASE
================================================
```

## stream 23 substitution parameters

```
================================================
18      314
15      1995-10-01
9       magenta
14      1995-12-01
12      MAIL    SHIP    1995-01-01
2       25      STEEL   AMERICA
8       ARGENTINA       AMERICA LARGE ANODIZED BRASS
11      UNITED STATES   0.0000001000
22      16      21      14      32      11      22
28
21      INDONESIA
16      Brand#22        LARGE ANODIZED  2       5
19      15      48      8       25      17
1       72
6       1996-01-01      0.07    24
17      Brand#23        MED JAR
5       ASIA    1996-01-01
10      1993-06-01
19      Brand#31        Brand#25        Brand#53
1       13      26
4       1994-05-01
20      cornflower      1994-01-01      RUSSIA
13      express accounts
3       HOUSEHOLD       1995-03-09
7       MOZAMBIQUE      ARGENTINA
================================================
```

## stream 24 substitution parameters

```
================================================
7       INDIA   CHINA
3       AUTOMOBILE      1995-03-25
10      1994-03-01
14      1996-03-01
13      express accounts
21      ARGENTINA
18      315
6       1996-01-01      0.04    25
20      navy    1993-01-01      JAPAN
4       1996-12-01
9       lavender
8       CHINA   ASIA    MEDIUM POLISHED STEEL
22      25      17      27      32      20      16
33
15      1993-06-01
2       13      NICKEL  MIDDLE EAST
1       80
5       EUROPE  1996-01-01
12      TRUCK   SHIP    1996-01-01
19      Brand#34        Brand#13        Brand#52
6       14      22
17      Brand#25        MED CAN
11      IRAQ    0.0000001000
16      Brand#52        PROMO PLATED    6       47
3       11      21      15      29      35
================================================
```

## stream 25 substitution parameters

```
================================================
18      313
1       88
13      express accounts
7       ALGERIA IRAN
16      Brand#42        SMALL POLISHED  31      29
7       5       12      11      34      26
10      1994-12-01
14      1996-06-01
2       1       TIN     AMERICA
19      Brand#41        Brand#41        Brand#52
1       15      30
5       MIDDLE EAST     1996-01-01
21      CHINA
11      UNITED STATES   0.0000001000
22      12      13      15      30      21      33
31
15      1996-01-01
8       IRAN    MIDDLE EAST     MEDIUM BURNISHED STEEL
17      Brand#22        JUMBO CASE
20      aquamarine      1996-01-01      BRAZIL
3       FURNITURE       1995-03-11
4       1994-09-01
12      RAIL    SHIP    1996-01-01
6       1996-01-01      0.02    24
9       honeydew
================================================
```

## stream 26 substitution parameters

```
================================================
13      express accounts
2       38      COPPER  MIDDLE EAST
22      27      19      23      31      25      21
18
5       AFRICA  1996-01-01
11      JAPAN   0.0000001000
21      IRAN
20      lavender        1995-01-01      PERU
14      1996-09-01
7       PERU    BRAZIL
10      1993-09-01
4       1997-04-01
9       frosted
19      Brand#43        Brand#34        Brand#41
6       16      26
18      314
6       1996-01-01      0.07    24
3       MACHINERY       1995-03-27
1       96
8       BRAZIL  AMERICA SMALL BRUSHED STEEL
15      1993-10-01
12      REG AIR SHIP    1996-01-01
17      Brand#24        JUMBO JAR
16      Brand#22        ECONOMY ANODIZED        35
47      13      6       17      1       32      45
================================================
```

## stream 27 substitution parameters

```
================================================
14      1996-12-01
17      Brand#21        JUMBO CAN
21      BRAZIL
8       ROMANIA EUROPE  SMALL PLATED STEEL
2       26      STEEL   ASIA
9       dim
6       1997-01-01      0.05    25
4       1995-01-01
5       AMERICA 1997-01-01
13      special deposits
22      16      34      13      32      10      20
28
7       INDONESIA       ROMANIA
15      1996-04-01
3       FURNITURE       1995-03-13
1       104
18      312
16      Brand#52        STANDARD BURNISHED      38
44      28      14      26      7       46      35
11      ALGERIA 0.0000001000
10      1994-07-01
12      SHIP    REG AIR 1996-01-01
20      slate   1993-01-01      FRANCE
19      Brand#45        Brand#12        Brand#45
2       17      22
================================================
```

## stream 28 substitution parameters

```
================================================
10      1993-04-01
22      13      25      18      11      29      32
```

```
28
1       112
12      FOB     REG AIR 1997-01-01
13      special deposits
18      313
21      SAUDI ARABIA
20      drab    1997-01-01      VIETNAM
2       14      BRASS   MIDDLE EAST
14      1997-04-01
16      Brand#42        MEDIUM POLISHED 47      19
1       44      12      50      22      40
7       ARGENTINA       IRAQ
15      1994-01-01
3       MACHINERY       1995-03-29
4       1997-08-01
17      Brand#23        WRAP CASE
5       ASIA    1997-01-01
19      Brand#52        Brand#55        Brand#44
7       18      29
6       1997-01-01      0.02    24
8       IRAQ    MIDDLE EAST     SMALL ANODIZED STEEL
9       cornflower
11      JORDAN  0.0000001000
================================================
```

## stream 29 substitution parameters

```
================================================
10      1994-01-01
8       CANADA  AMERICA STANDARD POLISHED COPPER
9       burlywood
18      315
12      MAIL    REG AIR 1997-01-01
6       1997-01-01      0.08    24
1       120
5       EUROPE  1997-01-01
20      pink    1995-01-01      IRAQ
11      ARGENTINA       0.0000001000
17      Brand#25        WRAP JAR
22      18      23      15      14      31      11
27
16      Brand#22        ECONOMY BRUSHED 12      35
25      36      17      1       9       31
3       BUILDING        1995-03-15
13      special deposits
2       2       TIN     ASIA
15      1996-08-01
21      JAPAN
14      1997-07-01
19      Brand#54        Brand#33        Brand#33
2       19      25
7       CHINA   CANADA
4       1995-05-01
================================================
```

## stream 30 substitution parameters

```
================================================
7       IRAN    SAUDI ARABIA
17      Brand#22        WRAP CAN
22      20      30      19      31      15      34
13
5       MIDDLE EAST     1997-01-01
3       MACHINERY       1995-03-01
10      1994-10-01
13      special deposits
18      312
9       bisque
1       67
14      1997-10-01
15      1994-05-01
21      EGYPT
19      Brand#51        Brand#11        Brand#33
7       20      22
16      Brand#52        SMALL BURNISHED 22      6
5       8       33      30      35      25
12      TRUCK   REG AIR 1997-01-01
8       SAUDI ARABIA    MIDDLE EAST     STANDARD
BURNISHED COPPER
6       1997-01-01      0.05    25
11      KENYA   0.0000001000
20      brown   1993-01-01      ARGENTINA
4       1993-02-01
2       40      COPPER  AFRICA
================================================
```

## stream 31 substitution parameters

```
================================================
2       27      STEEL   ASIA
9       yellow
21      VIETNAM
3       BUILDING        1995-03-17
4       1995-08-01
7       BRAZIL  JAPAN
1       75
11      BRAZIL  0.0000001000
16      Brand#42        LARGE PLATED    1       31
44      35      20      16      11      21
5       AFRICA  1997-01-01
20      medium  1997-01-01      MOROCCO
19      Brand#13        Brand#54        Brand#22
3       10      29
18      314
8       JAPAN   ASIA    PROMO BRUSHED COPPER
17      Brand#23        SM CASE
13      special packages
10      1993-07-01
12      RAIL    AIR     1993-01-01
15      1996-11-01
6       1997-01-01      0.02    24
14      1993-01-01
22      25      14      22      15      19      23
18
================================================
```

## stream 32 substitution parameters

```
================================================
15      1994-08-01
12      REG AIR AIR     1993-01-01
8       EGYPT   MIDDLE EAST     PROMO PLATED COPPER
4       1993-05-01
22      17      19      13      14      32      34
26
13      special packages
16      Brand#22        PROMO BRUSHED   21      48
33      45      17      7       38      8
17      Brand#25        SM JAR
18      315
3       HOUSEHOLD       1995-03-03
7       ROMANIA EGYPT
5       AMERICA 1993-01-01
6       1993-01-01      0.08    24
1       83
9       thistle
11      MOROCCO 0.0000001000
21      JORDAN
10      1994-05-01
14      1993-05-01
20      turquoise       1995-01-01      ETHIOPIA
19      Brand#15        Brand#32        Brand#21
8       11      25
2       15      BRASS   AFRICA
================================================
```

## stream 33 substitution parameters

```
================================================
15      1997-03-01
16      Brand#12        MEDIUM ANODIZED 8       34
12      40      13      29      14      9
2       3       NICKEL  ASIA
11      CANADA  0.0000001000
17      Brand#22        SM CAN
7       IRAQ    VIETNAM
```

```
5       EUROPE  1993-01-01
14      1993-08-01
20      green   1994-01-01      SAUDI ARABIA
4       1995-12-01
21      ETHIOPIA
3       BUILDING        1995-03-19
10      1993-02-01
9       slate
12      SHIP    AIR     1993-01-01
8       VIETNAM ASIA    PROMO ANODIZED COPPER
13      special packages
6       1993-01-01      0.05    25
18      313
19      Brand#12        Brand#25        Brand#25
3       12      21
22      30      16      34      15      14      25
18
1       91
================================================
```

## stream 34 substitution parameters

```
================================================
1       99
13      pending packages
11      MOZAMBIQUE      0.0000001000
3       HOUSEHOLD       1995-03-05
4       1993-09-01
21      UNITED KINGDOM
6       1993-01-01      0.03    25
14      1993-11-01
15      1994-11-01
22      19      20      17      10      31      13
24
18      314
9       saddle
7       CANADA  JORDAN
5       MIDDLE EAST     1993-01-01
10      1993-11-01
20      royal   1997-01-01      INDONESIA
12      FOB     AIR     1993-01-01
16      Brand#42        ECONOMY PLATED  33      40
47      14      11      42      2       13
17      Brand#24        LG CASE
8       JORDAN  MIDDLE EAST     ECONOMY BRUSHED TIN
19      Brand#24        Brand#52        Brand#15
8       13      28
2       41      COPPER  AFRICA
================================================
```

## stream 35 substitution parameters

```
================================================
14      1994-02-01
17      Brand#31        LG JAR
22      16      31      10      19      20      17
34
20      cornsilk        1996-01-01      UNITED STATES
8       ETHIOPIA        AFRICA  ECONOMY PLATED TIN
16      Brand#23        STANDARD POLISHED       10
2       14      3       28      21      17      36
5       AFRICA  1993-01-01
10      1994-08-01
1       107
13      pending packages
2       28      STEEL   EUROPE
21      MOROCCO
12      MAIL    RAIL    1994-01-01
9       puff
4       1996-04-01
18      312
3       AUTOMOBILE      1995-03-21
7       SAUDI ARABIA    ETHIOPIA
6       1993-01-01      0.08    24
19      Brand#22        Brand#45        Brand#14
4       14      25
15      1997-06-01
11      EGYPT   0.0000001000
================================================
```

## stream 36 substitution parameters

```
================================================
9       papaya
17      Brand#33        LG CAN
7       JAPAN   RUSSIA
4       1994-01-01
5       AMERICA 1994-01-01
13      pending requests
21      GERMANY
18      314
11      PERU    0.0000001000
3       FURNITURE       1995-03-07
22      24      11      25      33      29      23
20
1       115
6       1994-01-01      0.06    25
16      Brand#13        LARGE ANODIZED  18      32
2       29      17      9       8       6
20      olive   1994-01-01      KENYA
14      1994-05-01
15      1995-03-01
10      1993-05-01
8       RUSSIA  EUROPE  ECONOMY ANODIZED TIN
2       16      BRASS   AFRICA
12      TRUCK   RAIL    1994-01-01
19      Brand#24        Brand#23        Brand#13
9       15      21
================================================
```

## stream 37 substitution parameters

```
================================================
13      pending requests
14      1994-09-01
5       ASIA    1994-01-01
22      14      34      22      12      15      33
31
19      Brand#31        Brand#51        Brand#52
4       16      28
11      ETHIOPIA        0.0000001000
9       navajo
6       1994-01-01      0.03    25
18      315
15      1997-10-01
8       KENYA   AFRICA  LARGE POLISHED TIN
10      1994-03-01
7       EGYPT   KENYA
4       1996-08-01
17      Brand#35        MED CASE
16      Brand#43        PROMO BURNISHED 22      30
50      9       49      41      6       31
3       AUTOMOBILE      1995-03-23
1       62
12      AIR     RAIL    1994-01-01
2       4       NICKEL  EUROPE
21      UNITED STATES
20      azure   1997-01-01      EGYPT
================================================
```

## stream 38 substitution parameters

```
================================================
13      pending requests
14      1994-09-01
5       ASIA    1994-01-01
22      14      34      22      12      15      33
31
19      Brand#31        Brand#51        Brand#52
4       16      28
11      ETHIOPIA        0.0000001000
9       navajo
6       1994-01-01      0.03    25
18      315
15      1997-10-01
8       KENYA   AFRICA  LARGE POLISHED TIN
```

```
10      1994-03-01
7       EGYPT   KENYA
4       1996-08-01
17      Brand#35        MED CASE
16      Brand#43        PROMO BURNISHED 22      30
50      9       49      41      6       31
3       AUTOMOBILE      1995-03-23
1       62
12      AIR     RAIL    1994-01-01
2       4       NICKEL  EUROPE
21      UNITED STATES
20      azure   1997-01-01      EGYPT
================================================
```

## stream 39 substitution parameters

```
================================================
3       MACHINERY       1995-03-25
7       JORDAN  UNITED KINGDOM
14      1995-03-01
15      1993-03-01
6       1994-01-01      0.06    25
5       MIDDLE EAST     1994-01-01
21      INDIA
20      smoke   1994-01-01      INDIA
18      314
10      1993-09-01
4       1996-12-01
16      Brand#13        LARGE BRUSHED   16      44
18      9       24      12      22      23
19      Brand#35        Brand#22        Brand#51
5       18      20
1       78
13      pending requests
9       lemon
8       UNITED KINGDOM  EUROPE  MEDIUM BRUSHED NICKEL
17      Brand#34        MED CAN
11      FRANCE  0.0000001000
12      SHIP    TRUCK   1995-01-01
22      22      15      10      14      29      28
26
2       30      STEEL   EUROPE
================================================
```

## stream 40 substitution parameters

```
================================================
13      pending requests
15      1995-10-01
17      Brand#31        JUMBO CASE
1       86
22      18      29      25      11      12      28
34
11      ROMANIA 0.0000001000
3       FURNITURE       1995-03-11
4       1994-09-01
7       ETHIOPIA        MOROCCO
20      firebrick       1993-01-01      UNITED KINGDOM
14      1995-06-01
21      ARGENTINA
9       indian
8       MOROCCO AFRICA  MEDIUM PLATED NICKEL
2       17      BRASS   AMERICA
18      312
16      Brand#43        STANDARD BURNISHED      32
12      3       47      10      19      22      45
6       1995-01-01      0.03    25
10      1994-06-01
12      FOB     TRUCK   1995-01-01
5       AFRICA  1995-01-01
19      Brand#42        Brand#15        Brand#45
10      19      28
================================================
```

## stream 41 substitution parameters

```
================================================
14      1995-09-01
2       5       NICKEL  MIDDLE EAST
9       ghost
20      plum    1996-01-01      JAPAN
6       1995-01-01      0.09    24
17      Brand#33        JUMBO JAR
18      313
8       GERMANY EUROPE  MEDIUM ANODIZED NICKEL
21      CHINA
13      unusual accounts
3       MACHINERY       1995-03-27
22      23      24      29      10      34      19
13
16      Brand#23        MEDIUM PLATED   19      17
37      49      1       30      25      50
4       1997-03-01
11      GERMANY 0.0000001000
15      1993-07-01
1       94
10      1993-03-01
19      Brand#44        Brand#43        Brand#44
5       20      24
5       AMERICA 1995-01-01
7       RUSSIA  GERMANY
12      MAIL    TRUCK   1995-01-01
================================================
```

## stream 42 substitution parameters

```
================================================
21      IRAN
3       BUILDING        1995-03-13
18      315
5       ASIA    1995-01-01
11      SAUDI ARABIA    0.0000001000
7       KENYA   UNITED STATES
6       1995-01-01      0.06    25
20      burlywood       1995-01-01      BRAZIL
17      Brand#35        JUMBO CAN
12      RAIL    TRUCK   1996-01-01
16      Brand#13        ECONOMY BRUSHED 2       7
9       22      20      30      24      15
15      1996-01-01
13      unusual accounts
10      1994-01-01
2       43      TIN     AMERICA
8       UNITED STATES   AMERICA SMALL POLISHED NICKEL
14      1996-01-01
19      Brand#41        Brand#31        Brand#43
1       10      20
9       drab
22      13      15      29      12      18      22
19
1       102
4       1994-12-01
================================================
```

## stream 43 substitution parameters

```
================================================
6       1995-01-01      0.04    25
17      Brand#31        WRAP CASE
14      1996-04-01
16      Brand#43        SMALL ANODIZED  36      1
44      3       2       23      27      32
19      Brand#53        Brand#14        Brand#33
6       11      27
10      1994-10-01
9       cream
2       31      COPPER  MIDDLE EAST
15      1993-10-01
8       MOZAMBIQUE      AFRICA  SMALL BURNISHED NICKEL
5       MIDDLE EAST     1995-01-01
22      15      29      21      34      16      10
18
12      AIR     MAIL    1996-01-01
7       FRANCE  MOZAMBIQUE
13      unusual accounts
18      312
```

```
1       110
4       1997-07-01
20      medium  1993-01-01      PERU
3       HOUSEHOLD       1995-03-29
11      INDIA   0.0000001000
21      BRAZIL
================================================
```

## stream 44 substitution parameters

```
================================================
8       INDIA   ASIA    STANDARD BRUSHED BRASS
5       AFRICA  1996-01-01
4       1995-04-01
6       1996-01-01      0.09    24
17      Brand#33        WRAP JAR
7       UNITED KINGDOM  INDIA
1       118
18      314
22      32      19      12      25      24      18
28
14      1996-07-01
9       chartreuse
10      1993-07-01
15      1996-05-01
11      VIETNAM 0.0000001000
20      violet  1996-01-01      GERMANY
2       18      BRASS   ASIA
21      ROMANIA
19      Brand#55        Brand#42        Brand#32
1       12      23
13      unusual accounts
16      Brand#23        LARGE PLATED    26      49
22      33      25      10      19      8
12      REG AIR MAIL    1996-01-01
3       BUILDING        1995-03-15
================================================
```

## stream 45 substitution parameters

```
================================================
5       AMERICA 1996-01-01
21      IRAQ
14      1996-10-01
19      Brand#52        Brand#35        Brand#31
6       13      20
15      1994-01-01
17      Brand#35        WRAP CAN
12      SHIP    MAIL    1996-01-01
6       1996-01-01      0.06    24
4       1997-11-01
9       blanched
8       ALGERIA AFRICA  STANDARD PLATED BRASS
16      Brand#13        PROMO POLISHED  9       19
39      44      26      15      31      18
11      INDONESIA       0.0000001000
2       6       NICKEL  MIDDLE EAST
10      1994-04-01
18      315
1       65
13      unusual deposits
7       MOROCCO ALGERIA
22      15      29      21      24      16      31
18
3       HOUSEHOLD       1995-03-31
20      grey    1995-01-01      VIETNAM
================================================
```

## stream 46 substitution parameters

```
================================================
21      EGYPT
15      1996-08-01
4       1995-08-01
6       1996-01-01      0.04    25
7       GERMANY PERU
16      Brand#43        MEDIUM ANODIZED 2       8
28      5       38      17      7       39
19      Brand#14        Brand#13        Brand#25
2       14      27
18      313
14      1997-01-01
22      29      12      27      13      11      31
24
11      RUSSIA  0.0000001000
13      unusual deposits
3       AUTOMOBILE      1995-03-17
1       73
2       44      TIN     ASIA
5       ASIA    1996-01-01
8       PERU    AMERICA STANDARD ANODIZED BRASS
20      saddle  1993-01-01      IRAQ
12      FOB     MAIL    1997-01-01
17      Brand#32        SM CASE
10      1995-01-01
9       antique
================================================
```

## stream 47 substitution parameters

```
================================================
10      1993-11-01
3       HOUSEHOLD       1995-03-02
15      1994-05-01
13      unusual deposits
6       1996-01-01      0.09    24
8       INDONESIA       ASIA    PROMO POLISHED BRASS
9       turquoise
7       UNITED STATES   INDONESIA
4       1993-05-01
11      IRAN    0.0000001000
22      29      18      30      26      28      21
11
18      314
12      MAIL    FOB     1997-01-01
1       81
5       EUROPE  1996-01-01
16      Brand#33        ECONOMY BURNISHED       31
11      4       13      14      44      17      27
2       32      COPPER  AFRICA
14      1997-05-01
19      Brand#12        Brand#51        Brand#25
7       15      23
20      cream   1997-01-01      ARGENTINA
17      Brand#34        SM JAR
21      VIETNAM
================================================
```

## stream 48 substitution parameters

```
================================================
18      312
8       ARGENTINA       AMERICA PROMO BURNISHED BRASS
20      orange  1995-01-01      MOZAMBIQUE
21      JORDAN
2       20      STEEL   ASIA
4       1995-12-01
22      33      19      10      14      22      34
21
17      Brand#31        SM CAN
1       89
11      UNITED KINGDOM  0.0000001000
9       snow
19      Brand#14        Brand#34        Brand#24
2       16      30
3       AUTOMOBILE      1995-03-19
13      express deposits
5       MIDDLE EAST     1996-01-01
7       MOZAMBIQUE      ARGENTINA
10      1994-08-01
16      Brand#13        STANDARD POLISHED       3
30      24      26      11      34      9       2
6       1996-01-01      0.07    24
14      1997-08-01
15      1996-12-01
12      RAIL    FOB     1997-01-01
```

```
================================================
```

## stream 49 substitution parameters

```
================================================
19      Brand#21        Brand#22        Brand#13
8       17      26
1       97
15      1994-08-01
17      Brand#33        LG CASE
5       AFRICA  1997-01-01
8       CHINA   ASIA    ECONOMY BRUSHED STEEL
9       sandy
12      AIR     FOB     1997-01-01
14      1997-11-01
7       INDIA   CHINA
4       1993-09-01
3       FURNITURE       1995-03-04
20      beige   1994-01-01      ETHIOPIA
16      Brand#43        MEDIUM BRUSHED  37      35
1       2       6       27      36      11
6       1997-01-01      0.04    25
22      20      13      33      27      11      14
17
10      1993-05-01
13      express deposits
2       7       NICKEL  AFRICA
21      ETHIOPIA
18      313
11      IRAQ    0.0000001000
================================================
```

## stream 50 substitution parameters

```
================================================
8       IRAN    MIDDLE EAST     ECONOMY PLATED STEEL
13      express packages
2       45      TIN     EUROPE
20      lawn    1997-01-01      SAUDI ARABIA
17      Brand#35        LG JAR
3       AUTOMOBILE      1995-03-21
6       1997-01-01      0.02    24
21      RUSSIA
18      315
11      UNITED STATES   0.0000001000
19      Brand#23        Brand#55        Brand#12
3       18      23
10      1994-02-01
15      1997-03-01
4       1996-04-01
22      30      11      22      32      10      31
20
1       105
7       ALGERIA IRAN
12      REG AIR FOB     1993-01-01
9       red
14      1993-02-01
5       AMERICA 1997-01-01
16      Brand#33        PROMO BURNISHED 15      38
46      6       41      11      7       37
================================================
```

## stream 51 substitution parameters

```
================================================
6       1997-01-01      0.07    24
15      1994-12-01
18      313
17      Brand#32        LG CAN
12      SHIP    REG AIR 1995-01-01
1       113
7       PERU    BRAZIL
2       33      COPPER  AFRICA
22      18      20      19      28      13      22
26
13      express packages
21      KENYA
10      1994-11-01
14      1993-05-01
9       peru
3       FURNITURE       1995-03-06
16      Brand#13        SMALL PLATED    6       26
30      21      18      13      36      46
20      snow    1995-01-01      IRAN
19      Brand#25        Brand#33        Brand#12
8       19      30
11      JAPAN   0.0000001000
4       1993-12-01
8       BRAZIL  AMERICA ECONOMY ANODIZED STEEL
5       ASIA    1997-01-01
================================================
```

## stream 52 substitution parameters

```
================================================
15      1997-06-01
14      1993-09-01
18      314
17      Brand#34        MED CASE
10      1993-09-01
20      floral  1994-01-01      UNITED STATES
16      Brand#43        LARGE BRUSHED   41      16
17      49      10      20      3       4
11      ALGERIA 0.0000001000
1       60
8       ROMANIA EUROPE  LARGE POLISHED STEEL
4       1996-07-01
22      34      12      16      17      23      20
33
5       EUROPE  1997-01-01
12      FOB     SHIP    1993-01-01
3       MACHINERY       1995-03-23
9       olive
21      GERMANY
2       21      STEEL   EUROPE
13      express packages
6       1997-01-01      0.04    25
19      Brand#32        Brand#25        Brand#51
3       20      26
7       INDONESIA       ROMANIA
================================================
```

## stream 53 substitution parameters

```
================================================
1       68
7       ARGENTINA       IRAN
16      Brand#33        STANDARD ANODIZED       19
36      14      31      33      46      35      3
17      Brand#31        MED JAR
18      312
22      24      17      14      30      32      15
22
12      TRUCK   SHIP    1993-01-01
6       1993-01-01      0.02    24
8       IRAN    MIDDLE EAST     LARGE BURNISHED STEEL
9       midnight
11      JORDAN  0.0000001000
4       1994-04-01
2       9       BRASS   AMERICA
5       MIDDLE EAST     1993-01-01
20      powder  1997-01-01      KENYA
21      UNITED STATES
13      express packages
10      1994-06-01
19      Brand#34        Brand#53        Brand#55
9       10      22
3       BUILDING        1995-03-08
14      1993-12-01
15      1995-03-01
================================================
```

## stream 54 substitution parameters

```
================================================
21      MOZAMBIQUE
17      Brand#33        MED CAN
7       CHINA   BRAZIL
```

```
3       MACHINERY       1995-03-25
1       76
10      1993-03-01
12      RAIL    SHIP    1994-01-01
22      14      25      34      24      10      31
15
9       lime
16      Brand#13        MEDIUM PLATED   20      7
13      31      23      11      41      4
6       1993-01-01      0.07    24
11      ARGENTINA       0.0000001000
2       46      TIN     EUROPE
4       1996-11-01
5       AMERICA 1993-01-01
14      1994-03-01
8       BRAZIL  AMERICA MEDIUM BRUSHED COPPER
20      burnished       1996-01-01      EGYPT
13      express packages
18      313
15      1997-10-01
19      Brand#31        Brand#41        Brand#44
4       11      29
================================================
```

## stream 55 substitution parameters

```
================================================
2       34      COPPER  AMERICA
9       khaki
5       ASIA    1993-01-01
4       1994-08-01
18      315
1       84
20      metallic        1994-01-01      ROMANIA
15      1995-07-01
16      Brand#43        ECONOMY POLISHED        32
3       18      39      16      24      44      14
17      Brand#34        JUMBO CASE
7       IRAN    ROMANIA
21      INDIA
13      express requests
14      1994-06-01
19      Brand#43        Brand#24        Brand#43
9       12      25
8       ROMANIA EUROPE  MEDIUM PLATED COPPER
22      29      28      17      31      32      23
18
11      KENYA   0.0000001000
10      1993-12-01
3       BUILDING        1995-03-10
12      AIR     SHIP    1994-01-01
6       1993-01-01      0.05    25
================================================
```

## stream 56 substitution parameters

```
================================================
16      Brand#33        SMALL ANODIZED  35      3
49      18      33      23      15      37
9       green
17      Brand#31        JUMBO JAR
8       IRAQ    MIDDLE EAST     MEDIUM ANODIZED COPPER
14      1994-10-01
11      BRAZIL  0.0000001000
10      1994-09-01
12      REG AIR RAIL    1993-01-01
6       1993-01-01      0.02    24
21      ALGERIA
7       BRAZIL  IRAQ
3       HOUSEHOLD       1995-03-27
15      1993-03-01
5       EUROPE  1993-01-01
22      18      26      21      19      15      12
28
20      wheat   1993-01-01      INDIA
1       93
13      special requests
19      Brand#45        Brand#12        Brand#43
4       13      22
2       22      STEEL   MIDDLE EAST
4       1997-03-01
18      312
================================================
```

## stream 57 substitution parameters

```
================================================
1       101
3       BUILDING        1995-03-12
6       1994-01-01      0.08    24
5       MIDDLE EAST     1994-01-01
2       10      BRASS   AMERICA
16      Brand#13        LARGE BURNISHED 38      18
40      4       30      14      21      23
14      1995-01-01
22      11      24      20      14      16      12
23
17      Brand#33        JUMBO CAN
20      honeydew        1996-01-01      UNITED KINGDOM
4       1994-12-01
9       floral
10      1993-07-01
11      MOROCCO 0.0000001000
15      1995-10-01
8       CANADA  AMERICA SMALL POLISHED COPPER
12      SHIP    REG AIR 1995-01-01
19      Brand#42        Brand#45        Brand#32
10      15      29
18      314
13      special requests
7       ROMANIA CANADA
21      PERU
================================================
```

## stream 58 substitution parameters

```
================================================
3       HOUSEHOLD       1995-03-29
16      Brand#43        PROMO POLISHED  42      41
21      27      26      7       12      28
5       AFRICA  1994-01-01
11      CANADA  0.0000001000
21      IRAN
9       dark
2       47      NICKEL  MIDDLE EAST
15      1993-07-01
10      1994-04-01
18      315
17      Brand#35        WRAP CASE
7       IRAQ    SAUDI ARABIA
8       SAUDI ARABIA    MIDDLE EAST     SMALL
BURNISHED COPPER
19      Brand#55        Brand#33        Brand#31
5       16      25
14      1995-04-01
13      special requests
1       109
4       1997-07-01
22      23      22      13      14      10      11
31
20      salmon  1995-01-01      JORDAN
6       1994-01-01      0.05    25
12      FOB     REG AIR 1995-01-01
================================================
```

## stream 59 substitution parameters

```
================================================
14      1995-07-01
4       1995-04-01
13      special accounts
5       AMERICA 1994-01-01
21      BRAZIL
11      MOZAMBIQUE      0.0000001000
8       JAPAN   ASIA    SMALL ANODIZED TIN
6       1994-01-01      0.02    25
```

```
3       AUTOMOBILE      1995-03-14
17      Brand#32        WRAP JAR
2       35      COPPER  ASIA
20      cyan    1993-01-01      CANADA
1       117
19      Brand#52        Brand#11        Brand#35
10      17      21
10      1995-01-01
9       chocolate
12      TRUCK   REG AIR 1995-01-01
18      313
15      1996-02-01
7       BRAZIL  JAPAN
22      27      21      34      22      25      19
16
16      Brand#33        SMALL BRUSHED   19      30
5       7       23      29      49      22
```

==========

## stream 60 substitution parameters

==========

```
4       1997-11-01
12      RAIL    AIR     1995-01-01
22      27      19      30      22      28      10
23
14      1995-10-01
5       ASIA    1994-01-01
15      1993-10-01
16      Brand#13        ECONOMY BURNISHED       28
33      31      36      19      42      4       37
2       23      STEEL   MIDDLE EAST
8       EGYPT   MIDDLE EAST     STANDARD POLISHED TIN
10      1993-10-01
17      Brand#34        WRAP CAN
9       blush
21      ROMANIA
7       ROMANIA EGYPT
3       FURNITURE       1995-03-31
6       1994-01-01      0.08    24
13      special accounts
18      314
11      EGYPT   0.0000001000
20      orange  1996-01-01      PERU
19      Brand#54        Brand#44        Brand#25
5       18      28
1       64
```

==========

## stream 61 substitution parameters

==========

```
16      Brand#54        STANDARD PLATED 2       11
24      15      25      31      32      14
15      1996-05-01
14      1996-02-01
13      special accounts
4       1995-07-01
22      11      10      32      20      30      22
14
18      312
19      Brand#11        Brand#32        Brand#24
1       19      25
7       IRAQ    VIETNAM
1       72
12      AIR     MAIL    1996-01-01
17      Brand#41        SM CASE
5       EUROPE  1995-01-01
10      1994-07-01
20      bisque  1995-01-01      GERMANY
3       AUTOMOBILE      1995-03-17
9       azure
21      IRAQ
11      PERU    0.0000001000
2       11      BRASS   ASIA
6       1995-01-01      0.05    25
8       VIETNAM ASIA    STANDARD BURNISHED TIN
```

==========

## stream 62 substitution parameters

==========

```
20      lemon   1993-01-01      RUSSIA
14      1996-05-01
21      CANADA
12      REG AIR AIR     1996-01-01
15      1994-02-01
17      Brand#43        SM JAR
4       1993-04-01
19      Brand#13        Brand#15        Brand#23
6       20      21
13      special accounts
10      1993-05-01
11      ETHIOPIA        0.0000001000
1       80
16      Brand#34        MEDIUM BRUSHED  5       6
1       45      12      9       28      32
5       MIDDLE EAST     1995-01-01
18      313
7       CANADA  JORDAN
8       JORDAN  MIDDLE EAST     PROMO BRUSHED TIN
22      19      18      11      27      30      23
31
9       wheat
6       1995-01-01      0.03    25
3       FURNITURE       1995-03-02
2       49      NICKEL  AFRICA
```

==========

## stream 63 substitution parameters

==========

```
16      Brand#14        PROMO ANODIZED  20      45
42      15      9       30      18      16
14      1996-08-01
13      pending accounts
2       36      COPPER  ASIA
21      SAUDI ARABIA
10      1994-02-01
11      CHINA   0.0000001000
4       1995-11-01
1       88
22      31      13      33      28      21      29
23
18      315
12      SHIP    AIR     1996-01-01
19      Brand#15        Brand#53        Brand#12
1       10      28
5       AFRICA  1995-01-01
7       SAUDI ARABIA    ETHIOPIA
8       ETHIOPIA        AFRICA  PROMO PLATED NICKEL
6       1995-01-01      0.08    24
3       MACHINERY       1995-03-19
15      1996-08-01
20      spring  1997-01-01      IRAQ
9       steel
17      Brand#45        SM CAN
```

==========

## stream 64 substitution parameters

==========

```
18      312
15      1994-05-01
9       sienna
14      1996-11-01
12      MAIL    RAIL    1996-01-01
2       24      STEEL   AFRICA
8       RUSSIA  EUROPE  PROMO ANODIZED NICKEL
11      FRANCE  0.0000001000
22      21      32      14      17      10      20
13
21      JORDAN
16      Brand#54        SMALL PLATED    15      42
26      10      8       20      6       49
1       96
```

```
6       1995-01-01      0.06    25
17      Brand#42        LG BOX
5       ASIA    1995-01-01
10      1994-11-01
19      Brand#22        Brand#31        Brand#12
7       11      24
4       1993-08-01
20      forest  1995-01-01      ARGENTINA
13      pending deposits
3       FURNITURE       1995-03-04
7       JAPAN   RUSSIA
```

# Appendix E. Benchmark Scripts

==========

## runTPCHall

```
#!/bin/ksh
. $KIT_DIR/env

ECHO=echo

sqlplus=$ORACLE_HOME/bin/sqlplus
svrmgrl=$ORACLE_HOME/bin/svrmgrl
GTIME=${KIT_DIR}/utils/gtime

RUN_ID_FILE=${KIT_DIR}/audit/r_id

if [ ! -f $RUN_ID_FILE ]
then
  echo "0" > $RUN_ID_FILE
fi

RUN_ID=`cat $RUN_ID_FILE`
RUN_ID=`expr $RUN_ID + 1`
echo $RUN_ID > $RUN_ID_FILE

OUT_DIR=${KIT_DIR}/audit/tests/${RUN_ID}
if [ ! -d $OUT_DIR ]
then
  mkdir $OUT_DIR
fi

SCRIPT_LOG_FILE=${OUT_DIR}/main.out
RDB_TABLES=${OUT_DIR}/rdbtablest
FIRST_TEN=${OUT_DIR}/firstten
LD1DBCRE=${OUT_DIR}/Ld1dbcre
LD2SCTSO=${OUT_DIR}/Ld2sctso
LD3DAPOP=${OUT_DIR}/Ld3dapop
LD4IXCRE=${OUT_DIR}/Ld4ixcre
LD5ANLYZ=${OUT_DIR}/Ld5anlyz

echo Start TPC-H Benchmark SEQUENCE NUMBER: $RUN_ID >
$SCRIPT_LOG_FILE
echo >> $SCRIPT_LOG_FILE
echo "Starting a new Oracle log file:
$ORACLE_HOME/log/diag/rdbms/tpch/tpch/trace/alert_${OR
ACLE_SID}.log" >> $SCRIPT_LOG_FILE
echo >> $SCRIPT_LOG_FILE

mv
$ORACLE_HOME/log/diag/rdbms/tpch/tpch/trace/alert_${OR
ACLE_SID}.log
$ORACLE_HOME/log/diag/rdbms/tpch/tpch/trace/alert_${OR
ACLE_SID}.log.preAudit.$RUN_ID
touch
$ORACLE_HOME/log/diag/rdbms/tpch/tpch/trace/alert_${OR
ACLE_SID}.log

echo "Start: load database `date`" >> $SCRIPT_LOG_FILE

STIME=`$GTIME`
echo "Start: timed load portion `date`" >>
$SCRIPT_LOG_FILE
dbcre.sh > $LD1DBCRE
sctso.sh > $LD2SCTSO
dapop.sh > $LD3DAPOP
ixcre.sh > $LD4IXCRE
anlyz.sh > $LD5ANLYZ
$KIT_DIR/audit/gen_seed.sh $KIT_DIR/audit/seed
echo Generated seed: `cat $KIT_DIR/audit/seed` >>
$SCRIPT_LOG_FILE

echo "Start: dbtables.sql and count.sql" >>
$SCRIPT_LOG_FILE
$sqlplus ${DATABASE_USER} @$KIT_DIR/audit/dbtables >
${RDB_TABLES} 2>&1
$sqlplus ${DATABASE_USER} @$KIT_DIR/audit/firstten >
${FIRST_TEN} 2>&1

echo "End: dbtables.sql and count.sql `date`" >>
$SCRIPT_LOG_FILE


runTPCHpt ${SCALE_FACTOR} 1 ${RUN_ID}

runTPCHpt ${SCALE_FACTOR} 2 ${RUN_ID}

sleep 10
#tshut >> $SCRIPT_LOG_FILE

cp
$ORACLE_HOME/log/diag/rdbms/tpch/tpch/trace/alert_${OR
ACLE_SID}.log $OUT_DIR

echo "End TPC-H Benchmark SEQUENCE NUMBER: $RUN_ID
`date`" >> $SCRIPT_LOG_FILE
```

==========

## runTPCHpt

```
#!/bin/ksh
. $KIT_DIR/env

SCRIPT_DIR=${KIT_DIR}/scripts
SQL_DIR=${KIT_DIR}/sql
UPD_DIR=${KIT_DIR}/update
SRC_DIR=${KIT_DIR}/utils
QRY_DIR=${KIT_DIR}/queries # this is the location of
the query template file
QGEN_DIR=${KIT_DIR}/dbgen
QGEN=${QGEN_DIR}/qgen
QEXEC=${SRC_DIR}

DSS_QUERY=${KIT_DIR}/queries
export DSS_QUERY

UPD_SQL=${UPD_DIR}/sql
UPD_SPT=${UPD_DIR}/scripts
UPD_SRC=${UPD_DIR}/source
UPD_DAT=${UPD_DIR}/data

TPCD_BIN=${KIT_DIR}/audit/bin

GTIME=${SRC_DIR}/gtime
SEED_FILE=${KIT_DIR}/audit/seed

DF=/dev/null
HID=1
INTERVAL=60
COUNT=1200

# The defaults

QPROG=${QEXEC}/qexec

usage () {

echo " "
echo "Usage: $0 [-p <program for query stream>] [-u1
<program for UF1>]"
echo "          [-u2 <program for UF2>] [-o] [-s] [-h]
[-u <user/password>]"
echo "          <scale factor> <run_number>"
echo ""
echo "scale factor     : The scale factor of the run."
echo "update ||ism     : The parallelism to use for
```

```
the UFs."
echo ""
echo "-p <program>     : Program for Query Stream."
echo "                   Default is $QPROG."
echo "-u1 <program>    : Program for UF1."
echo "                   Default is $U1PROG."
echo "-u2 <program>    : Program for UF2."
echo "                   Default is $U2PROG."
echo "-o               : Collect Oracle statistics."
echo "-s               : Collect System statistics."
echo "-u <user/passwd> : User/Password. Default is
tpch/tpch."
echo "-h               : Displays this message."
}
set -- `getopt "p:u1:u2:osu:h" "$@"` || usage

while :
do
   case "$1" in
   -u1) shift; U1PROG=$1;;
   -u2) shift; U2PROG=$1;;
   -p) shift; QPROG=$1;;
   -o) OSTAT=1;;
   -s) SSTAT=1;;
   -h) usage; exit 0;;
   --) shift; break;;
   esac
   shift;
done


if [ "$#" -ne "3" ]
then
  usage
  exit 1
fi

SF=$1
PARA=$2
RUN_ID=$3

OUT_DIR=${KIT_DIR}/audit/tests/${RUN_ID}
if [ ! -d $OUT_DIR ]
then
        mkdir $OUT_DIR
fi

TPCD_LOG=${OUT_DIR}
TPCD_RPT=${OUT_DIR}
OUT=${OUT_DIR}

let UF_SET="($PARA-1)*($NUM_STREAMS+1)+1"
START_SET=1
let STOP_SET=$NUM_STREAMS
let START_SET_UPDATE="($PARA-1)*($NUM_STREAMS+1)+2"
let STOP_SET_UPDATE="$START_SET_UPDATE+$NUM_STREAMS-1"

TPCD_LOG_FILE=${TPCD_LOG}/m${PARA}s0
TPCD_RPT_FILE=${TPCD_RPT}/m${PARA}s0inter
QRY_FILE=${TPCD_RPT}/qtemp.${PARA}s0
QUERY_PARAMETER=${TPCD_LOG}/qp${PARA}.0
SCRIPT_LOG_FILE=${TPCD_LOG}/m${PARA}timing
UF1_LOG=${TPCD_LOG}/m${PARA}s0rf1
UF2_LOG=${TPCD_LOG}/m${PARA}s0rf2
STREAM_COUNT_LOG=${TPCD_LOG}/m${PARA}tstrcnt

echo "TPC-H Test - RUN:${PARA} SEQUENCE:${RUN_ID}
`date`" > $SCRIPT_LOG_FILE
echo "TPC-H Test - RUN:${PARA} SEQUENCE:${RUN_ID}
`date`" > $TPCD_RPT_FILE
echo "Generates query template file with seed: `cat
$SEED_FILE` for stream 0" >> $SCRIPT_LOG_FILE
echo >> $SCRIPT_LOG_FILE

${QGEN} -c -r `cat $SEED_FILE` -p 0 -s ${SF} -l
$QUERY_PARAMETER > ${QRY_FILE}

START=`$GTIME`
echo "Start Power Test - RUN:${PARA}
SEQUENCE:${RUN_ID} Execution Starts $START, `date`" >>
$SCRIPT_LOG_FILE
echo "" >> $SCRIPT_LOG_FILE

# Execute UF1

SDATE=`date`
UF1_START=`$GTIME`
echo "Start UF1  $UF1_START, `date`" >>
$SCRIPT_LOG_FILE

${ECHO} ${UPD_SPT}/runuf1.sh ${UF_SET} >> $UF1_LOG
2>&1
# Execute Query Stream

UF1_END=`${GTIME}`
E1DATE=`date`

UF1_TIME=`echo $UF1_END - $UF1_START | bc`
echo UF1: Execution Time: $UF1_TIME >>
${TPCD_RPT_FILE}
echo Start Time: $UF1_START, $SDATE >>
${TPCD_RPT_FILE}
echo End Time: $UF1_END, $E1DATE >> ${TPCD_RPT_FILE}
echo "" >> ${TPCD_RPT_FILE}

echo "End UF1 $UF1_END, ${E1DATE}" >> $SCRIPT_LOG_FILE
echo >> $SCRIPT_LOG_FILE

echo "Start Query Part `$GTIME`, `date` " >>
$SCRIPT_LOG_FILE

${QPROG} ${DATABASE_USER} q${QRY_FILE}
l${TPCD_LOG_FILE} r${TPCD_RPT_FILE}  > $DF  2>&1

# Execute UF2

UF2_START=`${GTIME}`
E2DATE=`date`

echo "End Query Part `$GTIME`, ${E2DATE}" >>
$SCRIPT_LOG_FILE
echo "" >> $SCRIPT_LOG_FILE

echo "Start UF2  $UF2_START, `date`" >>
$SCRIPT_LOG_FILE
${ECHO} ${UPD_SPT}/runuf2.sh ${UF_SET} >> $UF2_LOG
2>&1
UF2_END=`${GTIME}`
END=`${GTIME}`
EDATE=`date`

echo "End UF2 $UF2_END, $EDATE" >>  $SCRIPT_LOG_FILE
echo >>  $SCRIPT_LOG_FILE

echo "End TPC-H Power Test - RUN:${PARA}
SEQUENCE:${RUN_ID}, $END, $EDATE" >> $SCRIPT_LOG_FILE
MEA_INT=`echo $END - $START | bc`
echo "Elapsed Time for TPC-H Power Test - RUN:${PARA}
SEQUENCE:${RUN_ID} is $MEA_INT" >> $SCRIPT_LOG_FILE
echo >> $SCRIPT_LOG_FILE
UF2_TIME=`echo $UF2_END - $UF2_START | bc`
echo UF2: Execution Time: $UF2_TIME >>
${TPCD_RPT_FILE}
echo Start Time: $UF2_START, $E2DATE >>
${TPCD_RPT_FILE}
echo End Time: $UF2_END, $EDATE >> ${TPCD_RPT_FILE}

${KIT_DIR}/audit/abridge.pl ${TPCD_LOG_FILE}
```

```
i=$START_SET
PSEED=`cat $SEED_FILE`

while [ $i -le $STOP_SET ]; do
  TPCD_LOG_FILE=${TPCD_LOG}/mt${RUN_ID}_${i}.log
  TPCD_RPT_FILE=${TPCD_RPT}/mt${RUN_ID}_${i}.rpt
        QUERY_PARAMETER=${TPCD_LOG}/qp${PARA}.${i}
  QRY_FILE=${TPCD_RPT}/qtemp.${PARA}s${i}

  PSEED=`expr $PSEED + 1`
  ${QGEN} -c -r ${PSEED} -p ${i} -s ${SF} -l
$QUERY_PARAMETER > ${QRY_FILE}

  i=`expr $i + 1`
done

TH_START_D=`date`
TH_START_T=`${GTIME}`
echo >> $SCRIPT_LOG_FILE

rm -f /tmp/th_pipe1
mknod /tmp/th_pipe1 p
rm -f /tmp/th_pipe2
mknod /tmp/th_pipe2 p
i=$START_SET

echo "Start Throughput Test - RUN:${PARA}
SEQUENCE:${RUN_ID} $TH_START_T, $TH_START_D"  >>
$SCRIPT_LOG_FILE

# starts a script to count the streams during the
throughtput run
(scnt.sh $PARA $RUN_ID > $STREAM_COUNT_LOG &)
scnt_PID=$!

while [ $i -le $STOP_SET ]; do
  M_SDATE=`date`
  M_STIME=`${GTIME}`
        TPCD_LOG_FILE=${TPCD_LOG}/m${PARA}s${i}
        TPCD_RPT_FILE=${TPCD_RPT}/m${PARA}s${i}inter
  echo "Start Query Stream $i $M_STIME, ${M_SDATE}" >>
$SCRIPT_LOG_FILE
        QRY_FILE=${TPCD_RPT}/qtemp.${PARA}s${i}
        ${QPROG} ${DATABASE_USER} q${QRY_FILE}
l${TPCD_LOG_FILE} r${TPCD_RPT_FILE} | grep -v
"Connected to ORACLE" >> $SCRIPT_LOG_FILE &
  i=`expr $i + 1`
done

(${KIT_DIR}/audit/runTPCHus $RUN_ID $START_SET_UPDATE
$STOP_SET_UPDATE ${SF} $PARA >> $SCRIPT_LOG_FILE 2>&1
&)

wait
THQ_END_T=`$GTIME`
THQ_END_D=`date`
echo End all Query Streams $THQ_END_T, $THQ_END_D >>
$SCRIPT_LOG_FILE
print > /tmp/th_pipe1
read < /tmp/th_pipe2

TH_END_D=`date`
TH_END_T=`$GTIME`
echo End Update Stream ${TH_END_T}, ${TH_END_D} >>
$SCRIPT_LOG_FILE
echo >> $SCRIPT_LOG_FILE
echo "End Throughput Test ${TH_END_T}, ${TH_END_D}" >>
$SCRIPT_LOG_FILE
echo Execution Time Throughput Test: `echo ${TH_END_T}
- ${TH_START_T} | bc` >> $SCRIPT_LOG_FILE

i=$START_SET
while [ $i -le $STOP_SET ]; do
        TPCD_LOG_FILE=${TPCD_LOG}/m${PARA}s${i}
  ${KIT_DIR}/audit/abridge.pl ${TPCD_LOG_FILE}
        i=`expr $i + 1`
done
/opt/GOODies/bin/killpat scnt
```

## runTPCHus

```
#!/bin/ksh
. $KIT_DIR/env


SCRIPT_DIR=${KIT_DIR}/scripts
SQL_DIR=${KIT_DIR}/sql
UPD_DIR=${KIT_DIR}/update
UPD_SPT=${UPD_DIR}/scripts
SRC_DIR=${KIT_DIR}/utils
QRY_DIR=${KIT_DIR}/queries # this is the location of
the query template file
QGEN_DIR=${KIT_DIR}/dbgen
QGEN=${QGEN_DIR}/qgen

DSS_QUERY=${KIT_DIR}/queries
export DSS_QUERY

RUN_ID=$1
START_SET_UPDATE=$2
STOP_SET_UPDATE=$3
SF=$4
PARA=$5

OUT_DIR=${KIT_DIR}/audit/tests/${RUN_ID}
if [ ! -d $OUT_DIR ]
then
        mkdir $OUT_DIR
fi


TPCD_RPT=$OUT_DIR
SCRIPT_LOG_FILE=${OUT_DIR}/m${PARA}timing
OUT=$OUT_DIR

GTIME=${SRC_DIR}/gtime
HID=1

START=`$GTIME`
echo "Start Update Stream $START, `date`" >>
$SCRIPT_LOG_FILE
echo "" >> $SCRIPT_LOG_FILE


#waiting for all the query streams to finish first
read < /tmp/th_pipe1

i=$START_SET_UPDATE
j=1
while [ $i -le $STOP_SET_UPDATE ]; do

  # Execute UF1

  UF1_LOG=${OUT_DIR}/m${PARA}s${j}rf1
  UF2_LOG=${OUT_DIR}/m${PARA}s${j}rf2
  RPT_FILE=${OUT_DIR}/m${PARA}s${j}inter

  SDATE=`date`
  UF1_START=`$GTIME`
        echo "Start UF1-${j} at ${UF1_START},
${SDATE}" >> ${RPT_FILE}

  ${UPD_SPT}/runuf1.sh ${i} >> ${UF1_LOG} 2>&1
  UF1_END=`${GTIME}`
        EDATE=`date`
  echo "End UF1-${j} at ${UF1_END}, ${EDATE}" >>
${RPT_FILE}
```

```
        echo UF1-${j} Execution Time: `echo ${UF1_END}
- ${UF1_START} | bc` >> ${RPT_FILE}

  # Execute UF2

  SDATE=`date`
  UF2_START=`${GTIME}`
  echo "Start UF2-${j} ${UF2_START}, ${SDATE}" >>
${RPT_FILE}

  ${UPD_SPT}/runuf2.sh ${i} >> ${UF2_LOG} 2>&1
  UF2_END=`${GTIME}`
  EDATE=`date`
  echo "End UF2-${j} at $UF2_END, ${EDATE}" >>
${RPT_FILE}
        echo UF2-${j} Execution Time: `echo ${UF2_END}
- ${UF2_START} | bc` >> ${RPT_FILE}

  i=`expr $i + 1`
  j=`expr $j + 1`
done

print > /tmp/th_pipe2

=====================================================
```

## runuf1.sh

```
#!/bin/ksh
. $KIT_DIR/env
O=${ORACLE_HOME}
UPDATE_DIR=${KIT_DIR}/update
SCRIPT_DIR=${UPDATE_DIR}/scripts
UTILS_DIR=${KIT_DIR}/utils
LOG_DIR=${UPDATE_DIR}/log
GTIME=${SCRIPT_DIR}/gtime
SF=${SCALE_FACTOR}
PAR_HINT=${UPDATE_DOP_INS}
LOGPATH=.
PASSWD=${DATABASE_USER}
if [ $# -lt 1 ];
then
echo runuf1.sh setnum
exit 1
fi
SETNUM=$1
i=1
PID=""

# perform the update function 1
START=`$GTIME`

# first create the temp tables
sqlplus /NOLOG << !
connect $PASSWD;
set timing on
set serveroutput on
set echo on
drop directory data_dir;
create directory data_dir as '/ff_updates';
drop table temp_l_et;
create table temp_l_et(
        l_orderkey number ,
        l_partkey number ,
        l_suppkey number ,
        l_linenumber number ,
        l_quantity number ,
        l_extendedprice number ,
        l_discount number ,
        l_tax number ,
        l_returnflag char(1) ,
        l_linestatus char(1) ,
        l_shipdate date ,
        l_commitdate date ,
        l_receiptdate date ,
        l_shipinstruct char(25) ,
        l_shipmode char(10) ,
        l_comment varchar(44)
)
organization external (
        type ORACLE_LOADER
        default directory data_dir
        access parameters
        (
                records delimited by newline
                nobadfile
                nologfile
                fields terminated by '|'
                missing field values are null
        )
        location (
                'lineitem.tbl.u${SETNUM}'
))
reject limit unlimited parallel 24;


drop table temp_o_et;
;
create table temp_o_et(
        o_orderkey number ,
        o_custkey number ,
        o_orderstatus char(1) ,
        o_totalprice number ,
        o_orderdate date ,
        o_orderpriority char(15) ,
        o_clerk char(15) ,
        o_shippriority number ,
        o_comment varchar(79)
)
organization external (
        type ORACLE_LOADER
        default directory data_dir
        access parameters
        (
                records delimited by newline
                nobadfile
                nologfile
                fields terminated by '|'
                missing field values are null
        )
        location (
        'orders.tbl.u${SETNUM}'
))
reject limit unlimited parallel  24;

alter session force parallel dml parallel (degree
${PAR_HINT});
alter session set isolation_level = serializable;
alter session set optimizer_index_cost_adj=25;


insert into orders
select
o_orderdate ,
o_orderkey ,
o_custkey ,
o_orderpriority ,
o_shippriority ,
o_clerk ,
o_orderstatus ,
o_totalprice ,
o_comment
from temp_o_et;

insert into lineitem
select
l_shipdate ,
l_orderkey ,
l_discount ,
```

```
l_extendedprice ,
l_suppkey ,
l_quantity ,
l_returnflag ,
l_partkey ,
l_linestatus ,
l_tax ,
l_commitdate ,
l_receiptdate ,
l_shipmode ,
l_linenumber ,
l_shipinstruct ,
l_comment
from temp_l_et;


commit;
drop table temp_l_et;
drop table temp_o_et;

exit;
!

END=`$GTIME`

# Done

echo ""
echo "Update Function 1 Set $SETNUM done!"
echo "Elapsed Time is `echo $END - $START | bc`"
echo ""
=====================================================
```

## runuf2.sh

```
=====================================================
#!/bin/ksh
. $KIT_DIR/env
UPDATE_DIR=${KIT_DIR}/update
SCRIPT_DIR=${UPDATE_DIR}/scripts
UTILS_DIR=${KIT_DIR}/utils
GTIME=${SCRIPT_DIR}/gtime
LOG_DIR=${UPDATE_DIR}/log
PAR_HINT=${UPDATE_DOP_DEL}
SF=${SCALE_FACTOR}
PASSWD=${DATABASE_USER}

if [ $# -lt 1 ]
then
usage
exit 1
fi

SETNUM=$1

i=1
PID=""

START=`$GTIME`
# first create the temp tables

sqlplus /NOLOG << !
connect $PASSWD;
set timing on
set serveroutput on
set echo on
drop directory data_dir;
create directory data_dir as '/ff_updates';
drop table temp_okey_et;
drop table temp_okey;

create table temp_okey_et_${SETNUM} (
    t_orderkey number
)
organization external (
type ORACLE_LOADER
default directory data_dir
access parameters
(
        records delimited by newline
        badfile 'okey.${SETNUM}.bad'
        logfile 'okey.${SETNUM}.log'
        fields terminated by '|'
        missing field values are null
    )
    location (
    'delete.${SETNUM}'))
reject limit unlimited parallel 16;


create table temp_okey parallel 16 nologging as select
* from temp_okey_et_${SETNUM};
create unique index i_temp_okey on temp_okey
(t_orderkey) parallel 16  nologging compute
statistics;



execute dbms_stats.gather_table_stats('TPCH' ,
'temp_okey', estimate_percent => 1, degree => 16);

alter session force parallel dml parallel ${PAR_HINT};
alter session set isolation_level=serializable;
alter session set optimizer_index_cost_adj=25;

delete from (select /*+ use_nl(t o) */ o.rowid from
orders o, temp_okey t
    where o.o_orderkey = t.t_orderkey order by 1);

delete from (select /*+ use_nl(t l) */ l.rowid from
lineitem l,temp_okey t
    where l.l_orderkey = t.t_orderkey order by 1);

commit;

drop table temp_okey;
drop table temp_okey_et;
exit;
!

END=`$GTIME`

# Done

echo ""
echo "Update Function 2 Set $SETNUM done!"
echo "Elapsed Time is `echo $END - $START | bc`"
echo ""
=====================================================
```

## env

```
########### PATHS ###################################
export KIT_DIR=/export/home/oracle/tpch/kit
export SCHEMA_DIR=$KIT_DIR/schema
export PERL=/opt/PERL/bin/perl
export BUMPX_DIR=$KIT_DIR/bumpx
export BUMPX_OUT=$KIT_DIR/bumpx
export UTILS=$KIT_DIR/utils
# change to a regular directory
export TEST_DB=$KIT_DIR/acid
export QUAL_DB=$TEST_DB
export DBGEN=$KIT_DIR/dbgen
export ACID_DIR=$KIT_DIR/acid
export QEXEC=$KIT_DIR/utils
export QUERIES=$KIT_DIR/queries
export ANSWERS=$KIT_DIR/answers
export ANS2VAL=$KIT_DIR/acid/answers
export ACID_OUT=$ACID_DIR/acid_out
export DSS_CONFIG=$DBGEN
```

```
export DSS_QUERY=$KIT_DIR/queries
export DSS_PATH=$ADE_VIEW_ROOT
export MAINT=$KIT_DIR/maintenance
export CC=cc
export FRAME=$KIT_DIR/frame
export REGR_TEST=$KIT_DIR/internal/regression_test
export SCALE_FACTOR=1000
export UPDATE_DOP_INS=32
export UPDATE_DOP_DEL=64
############ FRAME STUFF
export FRAME_PATH=$KIT_DIR/frame

export ORACORE3INCL=$ORACLE_HOME/rdbms/demo
export ORACORE3PUBL=$ORACLE_HOME/rdbms//public
export RDBMSPUBL=$ORACLE_HOME/rdbms/public
export NETWORKPUBL=$ORACLE_HOME/network/public
export RDBMSDEMO=$ORACLE_HOME/rdbms/demo
export PLSQLDEMO=$ORACLE_HOME/plsql/demo
export PLSQLPUBL=$ORACLE_HOME/plsql/public
export O=$ORACLE_HOME
export
PATH=./:${BUMPX_DIR}:${UTILS}:${DBGEN}:${MAINT}:${ACID
_DIR}:${FRAME}/bin:${FRAME}/bin:${
#
########### ENVIRONMENT VARIABLES ##################
export WORKLOAD=TPCH
export HOST=
export OPTLEVEL=X02
export GETOPT=-DSTDLIB_HAS_GETOPT
export PLATFORM=

########### ALIASES ################################

########### RULES - do not change these #############
case "$SCALE_FACTOR" in
  1) export NUM_STREAMS=2;;
  10) export NUM_STREAMS=3;;
  100) export NUM_STREAMS=4;;
  300) export NUM_STREAMS=6;;
  1000) export NUM_STREAMS=64;;
  3000) export NUM_STREAMS=8;;
  10000) export NUM_STREAMS=9;;
esac
DATABASE_USER=tpch/tpch
=====================================================
```

## qexecpl.c

```
#include <stdio.h>
#include <string.h>
#include <setjmp.h>
#include <sys/param.h>
#include <errno.h>
#include <math.h>
#include <string.h>
#include <sys/types.h>
#include <time.h>
#include <stdlib.h>

#include "qexecpl.h"

/* Function Prototypes */

extern double gettime();

/* function prototypes from gen.c */

int get_statement();

/* Declare error handling functions */

void sql_error();

/* Other prototypes */

int define_output_variables();
void process_select_list();
void usage();
void SQLinit();
void SQLexec();
void SQLexit();
void *memalloc();
void print_header();
void print_rows();
int OFEN();
void remove_newline();

char logname[UNAME_LEN];  /* username/passwd combo */
char *passwd;

double tr_start = 0.0;    /* query start time
*/
double tr_end = 0.0;      /* query end time
*/

double s_tr_start = 0.0;  /* statement start time
*/
double s_tr_end = 0.0;    /* statement end time
*/

/* For our purpose of timing, we will treat comments
as delimiters */
/* for queries.   Thus, we will collect query timings
whenever we  */
/* encounter a comment (of course not for the first
comment in a   */
/* file).
*/

int end_flag = 0;         /* flag to indicate that we
have reached */
                          /* the end of a query
*/

int stmt_cnt = 0;         /* Number of statements
processed.     */
int qry_cnt = 0;          /* Number of query
processed.          */

double product = 1.0;     /* cumulative product of
query times   */
int rows_ret = 0;         /* the number of rows
fetched          */
int num_sel_list = 0;     /* the number of select list
item      */

long num_to_fetch = -1;   /* Number of rows to fetch.
-1 means fetch all */

sltype slist[MAX_SEL_LIST];  /* Array for describing
Select List        */
dltype *dlist[MAX_SEL_LIST]; /* Array of ptrs for
Defining Select List   */

char stmt[SQL_LEN];       /* The SQL statement or
comment line.  */
char qn[3];               /* Number of the query being
executed  */
char qnp[3];              /* Number of the previous
query executed  */
char cmnt[5000];            /* Buffer to save the
comment.         */
#ifdef LINUX
FILE *qtemp;      /* fd for query template
*/
FILE *logfile;   /* log and report files
*/
FILE *rep;
```

```
#else
FILE *qtemp = stdin;      /* fd for query template
*/
FILE *logfile = stdout;   /* log and report files
*/
FILE *rep = stdout;
#endif
void *defbuf;             /* Buffer pointer for ODEFIN
*/
int deflen = 0;           /* Size of data type for
ODEFIN        */
int deftype = 1;          /* Oracle type number for
ODEFIN       */

int pfmem = PFMEMSIZE;    /* Memory to prefetch rows
*/

time_t tim;               /* To get wall clock time
*/

/* OCI handles */

OCIEnv *tpcenv = NULL;
OCIServer *tpcsrv = NULL;
OCIError *errhp = NULL;
OCISvcCtx *tpcsvc = NULL;
OCISession *tpcusr = NULL;
OCIStmt *curq = NULL;
OCIStmt *cur_dml = NULL;
OCIStmt *cur_ddl = NULL;
OCIParam *tpcpar = NULL;

sword status = OCI_SUCCESS;  /* OCI return value */

/* usage: prints the usage of the program */

void usage() {

  fprintf(stderr,"\nUsage: qexec username/password
[q<path name for query template file>]\n");
  fprintf(stderr,"                [l<path name for
log>] [r<path name for reports>]\n\n");
  fprintf(stderr,"Options:\n");
  fprintf(stderr,"q<path for query>         : full
path name for the query template file.\n");
  fprintf(stderr,"                            (default
is stdin)\n");
  fprintf(stderr,"l<path name for log>      : full
path name for log files\n");
  fprintf(stderr,"                            (default
is stdout)\n");
  fprintf(stderr,"r<path name for reports>  : full
path name for reports\n");
  fprintf(stderr,"                            (default
is stdout)\n");
  exit(-1);
}



/* type: 0 if environment handle is passed, 1 if error
handle is passwd */

void sql_error(errhp,status,type)
     OCIError *errhp;
     sword status;
     sword type;
{
  char msg[2048];
  ub4 errcode;
  ub4 msglen;
  int i,j;

  switch(status) {
  case OCI_SUCCESS_WITH_INFO:
    fprintf(stderr, "Error: Statement returned with
info.\n");
    if (type)
      (void)
OCIErrorGet(errhp,1,NULL,(sb4*)&errcode,(text*)msg,
                        2048,OCI_HTYPE_ERROR);
    else
      (void)
OCIErrorGet(errhp,1,NULL,(sb4*)&errcode,(text*)msg,
                        2048,OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  case OCI_ERROR:
    fprintf(stderr, "Error: OCI call error.\n");
    if (type)
      (void)
OCIErrorGet(errhp,1,NULL,(sb4*)&errcode,(text*)msg,
                        2048,OCI_HTYPE_ERROR);
    else
      (void)
OCIErrorGet(errhp,1,NULL,(sb4*)&errcode,(text*)msg,
                        2048,OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  case OCI_INVALID_HANDLE:
    fprintf(stderr, "Error: Invalid Handle.\n");
    if (type)
      (void)
OCIErrorGet(errhp,1,NULL,(sb4*)&errcode,(text*)msg,
                        2048,OCI_HTYPE_ERROR);
    else
      (void)
OCIErrorGet(errhp,1,NULL,(sb4*)&errcode,(text*)msg,
                        2048,OCI_HTYPE_ENV);
    fprintf(stderr,"%s\n",msg);
    break;
  }

  /* Rollback just in case */

  (void) OCITransRollback(tpcsvc,errhp,OCI_DEFAULT);

  fprintf(stderr, "Exiting Oracle...\n");
  fflush(stderr);

  SQLexit();

  exit(1);
}

#ifdef LINUX
int main(argc,argv)
#else
void main(argc,argv)
#endif
     int argc;
     char *argv[];
{

  int i,pos,pos2;
  int retcode;      /* Return code for get_statement
*/
#ifdef LINUX
  logfile=fopen("/dev/stdout","w");
  qtemp=fopen("/dev/stdin","rw");
  rep=fopen("/dev/stdout","w");
#endif
  /* Initialize some variables */

  if ((argc > 5) || (argc < 2)) {
    usage();
  }
```

```
  /* argv[1] -- User and Password for Database */

  strcpy(logname, argv[1]);

  /* Process  optional parameters */

  argc -= 1;
  argv += 1;

  while(--argc) {
    ++argv;
    switch(argv[0][0]) {
    case 'q':
      if ((qtemp = fopen(++(argv[0]),"r")) == NULL) {
       fprintf(stderr,"Unable to open file '%s'\n",
argv[0]);
       fprintf(stderr,"%s: %s\n", argv[0],
strerror(errno));
       exit(-1);
      }
      break;
    case 'r':
      if ((rep = fopen(++(argv[0]),"a")) == NULL) {
       fprintf(stderr,"Unable to open file '%s'\n",
argv[0]);
       fprintf(stderr,"%s: %s\n", argv[0],
strerror(errno));
       exit(-1);
      }
      break;
    case 'l':
      if ((logfile = fopen(++(argv[0]),"a")) == NULL)
{
       fprintf(stderr,"Unable to open file '%s'\n",
argv[0]);
       fprintf(stderr,"%s: %s\n", argv[0],
strerror(errno));
       exit(-1);
      }
      break;
    default:
      fprintf(stderr,"Invalid Option: %c\n",
argv[0][0]);
      usage();
      break;
    }
  }

  /* Do some initialization and establish connection
with the database */

  SQLinit();

  /* May want to add some triggering mechanism here */

  time(&tim);
  fprintf(logfile, "Begin Execution at %s\n\n",
ctime(&tim));
  fprintf(rep, "Begin Executing this Stream at
%s\n\n", ctime(&tim));
  /* Get the next statement and start processing it */

  while ((retcode = get_statement()) > 0) {

   switch (retcode) {

      /* If this is a comment, skips it */
    case COMMENT:
      /*if (end_flag) {
       end_flag = 0;  */    /* reset query end flag
*/
       /* save the comment so that we can print it
out later on  */
       /* strcpy(cmnt, stmt);
        break;
       } */
       if (stmt[3]== '@') {
          pos=4;
          strcpy(qnp,qn);
          while (stmt[pos] != ')') {
            pos++;
          }
          pos2=0;
          pos++;
          while (stmt[pos] != '.') {
            /*printf ("qn %d %c \n",pos2,stmt[pos]);*/
            qn[pos2]=stmt[pos];
            pos2++;
            pos++;
          }
          qn[pos2] = 0;
          /* printf("found a new query: %s\n",qn); */
       }
       /* save the comment so that we can print it out
later on  */
       strcat(cmnt, stmt);
       break;

       /* if this is a set_row_fetch command */
     case SET_FETCHROW:
       fprintf(logfile,"Setting the number of rows to
fetch to: %ld\n\n",
               num_to_fetch);
       break;

       /* if this is a SQL statement */
     case SQL_STMT:

       /* Executes the query */
       SQLexec();

       stmt_cnt++;
       qry_cnt++;
       fflush(rep);
       fflush(logfile);
       /*
       fprintf(logfile,"\nStatement Started at %.2f\n",
s_tr_start);
       fprintf(logfile,"Statement Ended at %.2f\n",
s_tr_end);

       fprintf(logfile,"Statement Processed in %.2f
seconds.\n",
               (s_tr_end - s_tr_start));
       fprintf(rep, "Query %s: Execution Time: %.2f
started %.2f ended %.2f\n",
                       qn,(s_tr_end -
s_tr_start)s_tr_start,s_tr_end);
       fflush(rep);
       fflush(logfile);*/
       break;

       /* Should never reach here */
     default:
       fprintf(stderr, "Invalid statement type!!\n");
       SQLexit();
       break;
     }
   }

   /* Get Timing for the last query */

   tr_end = gettime();

   fprintf(logfile,"Query Processed in %.2f
seconds.\n\n",(tr_end - s_tr_start));

   /* print comments for this query that we have saved
```

```
*/

  /* fprintf(logfile, "%s\n", cmnt); */

  /* fprintf(rep, "Query %s : Execution time %.2f\n",
qn,(tr_end - s_tr_start));*/
  fprintf(rep, "Query %s: Execution Time: %.2f started
%.2f ended %.2f\n",
                    qn,(tr_end -
s_tr_start),s_tr_start,tr_end);

  time(&tim);
  fprintf(logfile,"\nEnded Executing this Stream at
%s\n", ctime(&tim));
  fprintf(logfile,"\nStream Started at %.2f\n",
tr_start);
  fprintf(logfile,"Stream Ended at %.2f\n", tr_end);
  fprintf(logfile,"Stream Processed in %.2f
seconds\n\n",(tr_end - tr_start));

  fprintf(rep,"\nEnded Executing this Stream at %s\n",
ctime(&tim));
  fprintf(rep,"\nStream Started at %.2f\n", tr_start);
  fprintf(rep,"Stream Ended at %.2f\n", tr_end);
  fprintf(rep,"Stream Processed in %.2f seconds\n\n",
         (tr_end - tr_start));

  fprintf(logfile, "\nSQL statements processed: %d\n",
stmt_cnt);
  /*fprintf(logfile, "Queries processed: %d\n",
qry_cnt);*/

  fflush(rep);
  fflush(logfile);

  /* Close the query template file */

  fclose(qtemp);

  /*  Disconnect from ORACLE. */

  SQLexit();
  exit(0);
}


/* SQLinit(): Perform initialization tasks.
*/
/*            Logs on to Oracle, opens some files and
open a cursor for */
/*            later use.
*/

void SQLinit() {

  int i;

  /* preallocate MAX_PREALLOC members of the dlist
array                    */
  /* initializes others to NULL so that we can
determine who to free later */

  for (i=0; i<MAX_SEL_LIST; i++) {
    if (i < MAX_PREALLOC) {
      dlist[i] = (dltype *) memalloc (sizeof(dltype));
      dlist[i]->defhdl = NULL;
/*      OCIhalloc(curq,&(dlist[i]-
>defhdl),OCI_HTYPE_DEFINE); */
    }
    else
      dlist[i] = NULL;
  }

  /* Connect to ORACLE.  Program will call sql_error()
*/
  /* if an error occurs in connecting to the default
database. */

  (void) OCIInitialize(OCI_DEFAULT,(dvoid *)0,0,0,0);

  if((status=OCIEnvInit((OCIEnv
**)&tpcenv,OCI_DEFAULT,0,(dvoid **)0)) !=
     OCI_SUCCESS)
    sql_error(tpcenv, status, 0);

  OCIhalloc(tpcenv,&errhp,OCI_HTYPE_ERROR);
  OCIhalloc(tpcenv,&curq,OCI_HTYPE_STMT);
  OCIhalloc(tpcenv,&cur_dml,OCI_HTYPE_STMT);
  OCIhalloc(tpcenv,&cur_ddl,OCI_HTYPE_STMT);
  OCIhalloc(tpcenv,&tpcsvc,OCI_HTYPE_SVCCTX);
  OCIhalloc(tpcenv,&tpcsrv,OCI_HTYPE_SERVER);
  OCIhalloc(tpcenv,&tpcusr,OCI_HTYPE_SESSION);

  /* get username and password */

  passwd = strchr(logname, '/');
  *passwd = '\0';
  passwd++;

  if ((status = OCIServerAttach(tpcsrv,errhp,(text
*)0,0,OCI_DEFAULT)) != OCI_SUCCESS)
    sql_error(errhp,status,1);

  OCIaset(tpcsvc,OCI_HTYPE_SVCCTX,tpcsrv,0,OCI_ATTR_SE
RVER,errhp);
  OCIaset(tpcusr,OCI_HTYPE_SESSION,logname,strlen(logn
ame),OCI_ATTR_USERNAME,
          errhp);
  OCIaset(tpcusr,OCI_HTYPE_SESSION,passwd,strlen(passw
d),OCI_ATTR_PASSWORD,
          errhp);

  if ((status = OCISessionBegin(tpcsvc, errhp, tpcusr,
OCI_CRED_RDBMS,
                                OCI_DEFAULT)) !=
OCI_SUCCESS)
    sql_error(errhp,status,1);

  OCIaset(tpcsvc,OCI_HTYPE_SVCCTX,tpcusr,0,OCI_ATTR_SE
SSION,errhp);

/*
  if ((status=OCILogon((OCIEnv *)tpcenv,(OCIError
*)errhp,(OCISvcCtx *)tpcsvc,
                (text *)logname, strlen(logname),
(text *)passwd,
                strlen(passwd), (text *) 0, 0)) !=
OCI_SUCCESS)
    sql_error(errhp, status, 1);
*/
  printf("\nConnected to ORACLE as user: %s\n\n",
logname);

}




/* SQLexec()  Executes the SQL statement.
*/
/*            Parse the SQL statement.
*/
/*            If DDL or DML statements, execute right
away.            */
/*            Else describe and define select list
outputs,              */
/*                 execute and fetch results.
*/
```

```
void SQLexec()
{
  int i;
  ub2 stmttyp = OCI_STMT_SELECT;     /* default is a
SELECT statement */

  /* Clause 5.3.6.2: QI(i,s) is the time between the
first character */
  /*                 of this query text is submitted
and the first   */
  /*                 character of the next query text
is submitted.  */

  if (qry_cnt) {
     time(&tim);
     s_tr_end = gettime();
     fprintf(logfile,"Query Processed in %.2f
seconds.\n\n",
      (s_tr_end - s_tr_start));

     /* print comments for this query that we have
saved */

     /* fprintf(logfile, "%s\n", cmnt); */

     /*fprintf(rep, "Query %s : Execution time
%.2f\n", qnp,(s_tr_end - s_tr_start));*/
     fprintf(rep, "Query %s: Execution Time: %.2f
started %.2f ended %.2f\n",
                    qnp,(s_tr_end -
s_tr_start),s_tr_start,s_tr_end);

     /* Let's fflush stuff so that we can see what's
going on */

     fflush(logfile);
     fflush(rep);
  }
  else
     tr_start = gettime();

  s_tr_start = gettime();

  /* prepare the statement */

  if ((status = OCIStmtPrepare(curq, errhp, (text*)
stmt, (ub4) strlen(stmt),
                               OCI_NTV_SYNTAX,
OCI_DEFAULT)) != OCI_SUCCESS)
    sql_error(errhp,status,1);

  /* Prints the query text and comment to the logfile
*/

  fprintf(logfile, "\n%s\n", cmnt);
  cmnt[0]=0;
  fprintf(logfile, "\n%s\n", stmt);

  /* if this is a DDL or DML statement, execute it
right away */
  /* only worries about SELECT statements right now,
cannot   */
  /* execute a stored PL/SQL procedure in thie version
*/

  OCIaget(curq,OCI_HTYPE_STMT,&stmttyp,NULL,OCI_ATTR_S
TMT_TYPE,errhp);

  if (stmttyp != OCI_STMT_SELECT) {
    OCIsexec(tpcsvc,curq,errhp,1);
    return;
  }

  /* otherwise, this is a select statement */
  /* Describe and define output variables  */

  /* first let's execute it to get the select-list
definition */

  OCIaset(curq, OCI_HTYPE_STMT, &pfmem, 0,
OCI_ATTR_PREFETCH_MEMORY, errhp);

  OCIsexec(tpcsvc,curq,errhp,0);

  num_sel_list = define_output_variables();

  /* Executes the query and fetches the rows */

  (void) process_select_list(num_sel_list);

  /* Need to get the number of rows fetched first   */
  /* since the following statments will screw it up */

  OCIaget(curq,OCI_HTYPE_STMT,&rows_ret,NULL,OCI_ATTR_
ROW_COUNT,errhp);

  /* To control memory usage, let's free up the extra
dlist entries */
  /* that we have allocated.
*/

  i=MAX_PREALLOC;
  while(dlist[i] != NULL) {
    free(dlist[i]);
    dlist[i++] = NULL;
  }

  /* reset set_fetchrows */

  num_to_fetch = -1;

}


void SQLexit() {

  int i;

  OCILogoff(tpcsvc,errhp);
  OCIhfree(tpcenv,OCI_HTYPE_STMT);
  OCIhfree(tpcsvc,OCI_HTYPE_SVCCTX);
  OCIhfree(tpcsrv,OCI_HTYPE_SERVER);
  OCIhfree(tpcusr,OCI_HTYPE_SESSION);

  /* free all memory */

  for (i=0; i<MAX_SEL_LIST; i++) {
    if (dlist[i] != NULL) {
      free(dlist[i]);
    }
  }

  /* Flush all output */

  fflush(rep);
  fflush(logfile);

}


/* define_output_variables(): Describe and define
select-list items for */
/*                            a query statement.
*/
/*                            Returns the number of
select-list items   */
/*                            for this query.
```

```
*/

int define_output_variables()
{

  int i;
  int retflag = 0;

  for (i=0; i<MAX_SEL_LIST; i++) {

    slist[i].buflen = MAX_COLNAME_SIZE;

    if (OCIParamGet(curq, OCI_HTYPE_STMT, errhp,
(dvoid **) &tpcpar,
                            POS(i)) != OCI_SUCCESS)
      break;


    /* dsize and nullok fields of dlist not used */

    OCIaget(tpcpar, OCI_DTYPE_PARAM,
&(slist[i].dbsize),
            NULL, OCI_ATTR_DATA_SIZE, errhp);
    OCIaget(tpcpar, OCI_DTYPE_PARAM,
&(slist[i].dbtype),
            NULL, OCI_ATTR_DATA_TYPE, errhp);
    OCIaget(tpcpar, OCI_DTYPE_PARAM, &(slist[i].buf),
            &(slist[i].buflen), OCI_ATTR_NAME, errhp);
    OCIaget(tpcpar, OCI_DTYPE_PARAM,
&(slist[i].precision),
            NULL, OCI_ATTR_PRECISION, errhp);
    OCIaget(tpcpar, OCI_DTYPE_PARAM,
&(slist[i].scale),
            NULL, OCI_ATTR_SCALE, errhp);

    /* For formatting purpose, remove trailing blanks
in select-list name. */

/*
    if (slist[i].buflen < MAX_COLNAME_SIZE)
      (slist[i].buf)[slist[i].buflen] = '\0';
*/
    /* Well, we need to allocate for entries for dlist
*/

    if (i >= MAX_PREALLOC) {
      dlist[i] = (dltype *) memalloc(sizeof(dltype));
      dlist[i]->defhdl = NULL;
    }

    /* Let's check the sizes and types for this select
list item */

    switch (slist[i].dbtype) {

    case OCI_TYPECODE_NUMBER:

      /* The odescr will not give a good estimate to
the scale if */
      /* no scale was given in the Oracle table
definition.       */

#ifdef HAVE_SCALE
      if (slist[i].scale != 0) {
        defbuf = (double *) dlist[i]->fbuf;
        deflen = FLT;
        deftype = OCI_TYPECODE_DOUBLE;
        slist[i].dbtype = OCI_TYPECODE_DOUBLE;
      } else {
        defbuf = (int *) dlist[i]->ibuf;
        deflen = INT;
        deftype = OCI_TYPECODE_INTEGER;
        slist[i].dbtype = OCI_TYPECODE_INTEGER;
      }
#else
      defbuf = (double *) dlist[i]->fbuf;
      deflen = FLT;
      deftype = OCI_TYPECODE_FLOAT;
      slist[i].dbtype = OCI_TYPECODE_FLOAT;
#endif /* HAVE_SCALE */

      break;

    default:

      /* default is character string */

      defbuf = (char **) dlist[i]->sbuf;
      deflen = MAX_STR_LEN;
      deftype = SQLT_STR;
/*      deftype = OCI_TYPECODE_CHAR; */
      break;
    }

    /* Define the column */

    if ((status=OCIDefineByPos(curq,&(dlist[i]-
>defhdl),errhp,POS(i),

defbuf,deflen,deftype,NULL,
                               dlist[i]-
>rlen,NULL,OCI_DEFAULT))!=OCI_SUCCESS)
      sql_error(errhp,status,1);
  }
  return i;
}


/* process_select_list(): Fetch rows from a query.
*/

void process_select_list(num)
     int num;        /* number of select list items */
{

  int i,j;
  int ntf;
  int num_so_far;
  sword stats = OCI_SUCCESS;

  /* Print the headers for the query execution result
*/

  print_header(num);

  /* See if we need to limit the rows to fetch */

  ntf = (num_to_fetch >= 0) ? num_to_fetch :
MAX_ARRAY;

  /* Fetch the rows and print them out */

  if ((ntf > MAX_ARRAY) || (num_to_fetch == -1)) {

    stats = OCIStmtFetch(curq, errhp, MAX_ARRAY,
OCI_FETCH_NEXT, OCI_DEFAULT);

    OCIaget(curq,OCI_HTYPE_STMT,&rows_ret,NULL,OCI_ATT
R_ROW_COUNT,errhp);

    print_rows(num,rows_ret);

    /* To avoid 1022 from OFEN */
    /* More rows to fetch...   */

    if (stats != OCI_NO_DATA) {
      if (num_to_fetch == -1) {
        while ((stats =
```

```
OCIStmtFetch(curq,errhp,MAX_ARRAY,OCI_FETCH_NEXT,
                                    OCI_DEFAULT)) ==
OCI_SUCCESS) {

OCIaget(curq,OCI_HTYPE_STMT,&num_so_far,NULL,
                    OCI_ATTR_ROW_COUNT,errhp);
          print_rows(num,(num_so_far-rows_ret));
          rows_ret = num_so_far;
        }
        /* Print the final rows */
        OCIaget(curq,OCI_HTYPE_STMT,&num_so_far,NULL,
                   OCI_ATTR_ROW_COUNT,errhp);
        print_rows(num,(num_so_far-rows_ret));
        rows_ret = num_so_far;
      } else {
        ntf -= MAX_ARRAY;

        while ((stats = OCIStmtFetch(curq,errhp,
                                    ((ntf>MAX_ARRAY) ?
MAX_ARRAY:ntf),
                                    OCI_FETCH_NEXT,
OCI_DEFAULT)) ==
                OCI_SUCCESS) {
          ntf -= MAX_ARRAY;

OCIaget(curq,OCI_HTYPE_STMT,&num_so_far,NULL,
                    OCI_ATTR_ROW_COUNT,errhp);
          print_rows(num,(num_so_far-rows_ret));
         rows_ret = num_so_far;
          if (ntf <= 0) break;
        }
        OCIaget(curq,OCI_HTYPE_STMT,&num_so_far,NULL,
                   OCI_ATTR_ROW_COUNT,errhp);
        print_rows(num,(num_so_far-rows_ret));
        rows_ret = num_so_far;
      }
    }
  } else {
    OCIStmtFetch(curq, errhp, ntf, OCI_FETCH_NEXT,
OCI_DEFAULT);
    OCIaget(curq,OCI_HTYPE_STMT,&rows_ret,NULL,OCI_ATT
R_ROW_COUNT,errhp);
    print_rows(num,rows_ret);
  }

  fprintf(logfile,"\n\n%d row%c processed.\n",
rows_ret,
          rows_ret == 1 ? '\0' : 's');

}


int get_statement()
{

  char line[128];
  char *pos, *str;

  /* Reset statement buffer */

  stmt[0] = '\0';

  while (fgets(line, 127, qtemp) != NULL) {

    /* skip blank lines */
    if (line[0] == '\n')
      continue;

    /* remove blanks */

    str = line;

    while (*str == ' ') str++;

    /* Let's get the line together first */

    strcat(stmt, str);

    /* if this is a comment line */
    if ((str[0] == '-') && (str[1] == '-'))
      return COMMENT;

    /* see if this is a set_fetchrows line */
    if (strncmp(str, "set_fetchrows", 13) == 0) {
      pos = strchr(str, ';');
      *pos = '\0';
      pos = strchr(str, '=');
      num_to_fetch = atol(++pos);
      return SET_FETCHROW;
    }

    /* if this is the end of the current statement */
    if ((pos = strchr(stmt, ';')) != NULL) {
      *pos = '\0';
      return SQL_STMT;
    }
  }
  return END_OF_FILE;
}


/* memalloc(): Allocates memory, exit program if we
have a problem. */

void *memalloc(size)
     int size;
{

  void *tmp;

  if ((tmp = (void *) malloc(size)) == NULL) {
    fprintf(stderr, "Error in malloc\n");
    SQLexit();
    return NULL;       /* should never reach here */
  } else {
    return tmp;
  }
}



void print_header(nsel)
     int nsel;           /* Number of select list
items */
{

  int i, diff;
  char colname[MAX_COLNAME_SIZE];
  int len = 0;           /* Running column length */
  int cwid = 0;

  fprintf(logfile, "\n");

  for (i=0; i<nsel; i++) {

    /* extract the column name */

    strncpy((char *)colname, (char *)slist[i].buf,
slist[i].buflen);
    colname[slist[i].buflen] = '\0';

    /* format the output a little */

    cwid = MAX(slist[i].dbsize, slist[i].buflen);

    /* do a little bit of formatting */

    if (cwid > 80) {
```

```
      fprintf(logfile,"\n");
      len = 0;
    } else if ((len += cwid) > 80) {
      fprintf(logfile,"\n");
      len = cwid;
    }
#ifdef FORMAT1
    if ((slist[i].dbtype == INT_TYPE) ||
(slist[i].dbtype == FLT_TYPE))
      fprintf(logfile, "%*s ", cwid, slist[i].buf);
    else  /* string type */
      fprintf(logfile, "%*s ", -cwid, slist[i].buf);
#else
      fprintf(logfile, "%*s ", -cwid, colname);
#endif /* FORMAT1 */
  }

  fprintf(logfile,"\n");
}


void print_rows(ncol, nrow)
     int ncol;
     int nrow;
{

  int i,j;
  int len;
  int diff;
  int cwid;

  for (i=0;i<nrow;i++) {

    len = 0;

    for (j=0;j<ncol;j++) {

      cwid = MAX(slist[j].dbsize, slist[j].buflen);

      /* do a little bit of formatting */

      if (cwid > 80) {
        fprintf(logfile,"\n");
        len = 0;
      } else if ((len += cwid) > 80) {
        fprintf(logfile,"\n");
        len = cwid;
      }

      switch(slist[j].dbtype) {
      case INT_TYPE:
#ifdef HAVE_SCALE
        fprintf(logfile, "%*ld|", cwid,
(dlist[j]->ibuf)[i]);
        break;
#endif /* HAVE_SCALE */
      case FLT_TYPE:
#ifdef FORMAT1
        fprintf(logfile,"%*.2f ", cwid, (dlist[j]-
>fbuf)[i]);
#else
        fprintf(logfile,"%*.2f ", -cwid, (dlist[j]-
>fbuf)[i]);
#endif /* FORMAT1 */
        break;
      default:
        fprintf(logfile, "%*s ", -(cwid), (dlist[j]-
>sbuf)[i]);
        break;
      }
    }
    fprintf(logfile, "\n");
  }
}
```

```
/* remove_newline(): Remove newline character from
str. */

void remove_newline(str)
     char *str;
{

  char *p;

  while ((p = strchr(str,'\n')) != NULL)
    *p = ' ';
}
```

==========

## qexecpl.h

```
#ifndef QSTREAMPL_H

#define QSTREAMPL_H

#include <stdio.h>
#include <string.h>
#include <sys/param.h>
#include <sys/types.h>
#include <time.h>
#include <errno.h>
#include <math.h>

#include <oratypes.h>

#include <oratypes.h>

#ifndef OCIDFN
#include <ocidfn.h>
#endif /* OCIDFN */

#ifndef OCI_ORACLE
#include <oci.h>
#endif /* OCI_ORACLE */
/*
#ifdef __STDC__
#include <ociapr.h>
#else
#include <ocikpr.h>
#endif *//* __STDC__ */

/* some basic definitions */

#define UNAME_LEN 64
#define MAX_FILE_PATH_LEN 128

#ifndef TRUE
#define TRUE 1
#endif /* TRUE */

#ifndef FALSE
#define FALSE 1
#endif /* FALSE */
#ifndef LINUX
#define MAX(x,y) ((x >= y) ? x : y)
#define MIN(x,y) ((x <= y) ? x : y)
#endif
/* defines and typedefs for parsing */

#define CRT_TBL  1
#define INS_STMT 3
#define SEL_STMT 4
#define UPD_STMT 5
#define DRP_VIEW 7
#define DRP_TBL  8
#define DEL_STMT 9
#define CRT_VIEW 10
```

```
/* defines and typedefs for query description */

#define MAX_COLNAME_SIZE 32   /* Maximum length of
Column name  */
#define MAX_SEL_LIST 16       /* Maximum items on a
select list */

#define END_OF_LIST 1007      /* Error code when we
reach the end of the */
                              /* select list.
*/

/* types for describe */

#define CHAR_TYPE 1
#define NUM_TYPE  2
#define INT_TYPE  3
#define FLT_TYPE  4
#define STR_TYPE  5
#define DATE_TYPE 12

#define NUMWIDTH 16           /* Width of the numeric
fields    */

#define POS(i) (i+1)          /* The position is 1...n
instead  */
#define IND(i) (i-1)          /* of 0..n-1 as in an
array.      */

typedef struct des
{
  ub2 dbsize;
  ub4 buflen;
/*  sb2 dsize;  */
  sb4 scale;
/*  sb2 nullok; */
  OCITypeCode dbtype;
/*  text buf[MAX_COLNAME_SIZE]; */
  text *buf;
  ub1 precision;
} sltype;


/* defines and typedefs for query select list
definition */

#define MAX_ARRAY 50       /* Maximum array size for
array fetch */
#define PFMEMSIZE 65536    /* Memory size of prefetch
buffer     */

#define MAX_STR_LEN 256    /* Maximum size for string
variables          */
#define MAX_PREALLOC 8     /* Maximum number of
preallocated select list */
                           /* definitions.
*/

#define INT sizeof(long)
#define STR sizeof(char)
#define FLT sizeof(double)

#define FLTP (double *)
#define INTP (long *)
#define STRP (char **)

typedef struct def
{
  long ibuf[MAX_ARRAY];
  double fbuf[MAX_ARRAY];
  char sbuf[MAX_ARRAY][MAX_STR_LEN];
  ub2 rlen[MAX_ARRAY];         /* return length     */
  OCIDefine *defhdl;
} dltype;

extern int errno;

#define SQL_LEN 2048

#ifndef NULL
#define NULL 0
#endif

#ifndef NULLP
# define NULLP (void *)NULL
#endif /* NULLP */

#ifndef DISCARD
# define DISCARD (void)
#endif

#ifndef sword
# define sword int
#endif

#ifndef ub1
#define ub1 unsigned char
#endif

#define NA              -1      /* ANSI SQL NULL */
#define VER7            2
#define NOT_SERIALIZABLE  8177  /* ORA-08177:
transaction not serializable */

#define ADR(object) ((ub1 *)&(object))
#define SIZ(object) ((sword)sizeof(object))
#define SID(sid) ((sid == -1) ? 0 : sid)

/* For get_statement */

#define END_OF_FILE -1
#define COMMENT 1
#define SQL_STMT   2
#define SET_FETCHROW 3


#define OCIhalloc(envh,hndl,htyp) \
    if((status=OCIHandleAlloc((dvoid *)envh,(dvoid
**)hndl,htyp,0,(dvoid **)0))!=OCI_SUCCESS) \
       sql_error(envh,status,0); \
    else \
       DISCARD 0

#define OCIhfree(hndl,htyp) \
    if((status=OCIHandleFree((dvoid *)hndl,htyp)) ==
OCI_SUCCESS) \
       fprintf(stderr, "Error freeing handle of type
%d\n", htyp)

#define OCIaget(hndl,htyp,attp,size,atyp,errh) \
    if((status=OCIAttrGet((dvoid *)hndl,htyp,(dvoid
*)attp,(dvoid *)size,atyp,errh)) != OCI_SUCCESS) \
       sql_error(errh,status,1); \
    else \
       DISCARD 0

#define OCIaset(hndl,htyp,attp,size,atyp,errh) \
    if((status=OCIAttrSet((dvoid *)hndl,htyp,(dvoid
*)attp,size,atyp,errh)) != OCI_SUCCESS) \
       sql_error(errh,status,1); \
    else \
       DISCARD 0

#define OCIsexec(svch,stmh,errh,iter) \
    if((status=OCIStmtExecute(svch,stmh,errh,iter,0,NU
LL,NULL,OCI_DEFAULT)) != OCI_SUCCESS) \
       sql_error(errh,status,1); \
```

```
    else \
       DISCARD 0


#define ISOTXT "alter session set isolation_level =
serializable"
#define PDMLTXT "alter session force parallel dml
parallel (degree 84)"
#define PDDLTXT "alter session force parallel ddl
parallel (degree 84)"

#endif /* QSTREAMPL_H */
```

==========

## gtime.c

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

# include <sys/time.h>

main ()
{

  struct timeval tv;

        (void) gettimeofday (&tv, (struct timezone *)
0);

  printf ("%.2f\n", ((double) tv.tv_sec + (1.0e-6 *
(double) tv.tv_usec)) ) ;

}

/* end of file gtime.c */
```

==========

## firstten.sql

```
set echo on
set numwidth 25
spool count.out
select * from lineitem where rownum < 11;
select * from orders where rownum < 11;
select * from part where rownum < 11;
select * from partsupp where rownum < 11;
select * from supplier where rownum < 11;
select * from customer where rownum < 11;
select * from nation where rownum < 11;
select * from region where rownum < 11;
spool off
exit;
```

==========

## dbtables.sql

==========

```
set echo on
set numwidth 25
spool rdbtablesq
SELECT COUNT(*) FROM LINEITEM;

SELECT * FROM LINEITEM
WHERE L_ORDERKEY IN
 ( 4, 26598,  148577,  387431, 56704, 517442, 600000)
AND L_LINENUMBER = 1
ORDER BY L_ORDERKEY;



SELECT * FROM REGION;

SELECT COUNT(*) FROM NATION;

SELECT * FROM NATION
WHERE N_NATIONKEY IN (3,10,14,20)
ORDER BY N_NATIONKEY;



SELECT COUNT(*) FROM ORDERS;

SELECT * FROM ORDERS
WHERE O_ORDERKEY IN ( 7, 44065, 287590, 411111,
483876, 599942 )
ORDER BY O_ORDERKEY;



SELECT COUNT(*) FROM PART;

SELECT * FROM PART
WHERE P_PARTKEY IN (1,984,8743,9028,13876,17899,20000)
ORDER BY P_PARTKEY;



SELECT COUNT(*) FROM PARTSUPP;

SELECT* FROM PARTSUPP
   WHERE PS_PARTKEY = 3398
   AND PS_SUPPKEY = (SELECT MIN(PS_SUPPKEY)
      FROM PARTSUPP WHERE PS_PARTKEY = 3398);

SELECT* FROM PARTSUPP
   WHERE PS_PARTKEY =15873
   AND PS_SUPPKEY = (SELECT MIN(PS_SUPPKEY)
      FROM PARTSUPP WHERE PS_PARTKEY = 15873);

SELECT* FROM PARTSUPP
   WHERE PS_PARTKEY = 11394
   AND PS_SUPPKEY = (SELECT MIN(PS_SUPPKEY)
      FROM PARTSUPP WHERE PS_PARTKEY = 11394);

SELECT* FROM PARTSUPP
   WHERE PS_PARTKEY = 6743
   AND PS_SUPPKEY = (SELECT MIN(PS_SUPPKEY)
      FROM PARTSUPP WHERE PS_PARTKEY = 6743);

SELECT* FROM PARTSUPP
   WHERE PS_PARTKEY = 19763
   AND PS_SUPPKEY = (SELECT MIN(PS_SUPPKEY)
      FROM PARTSUPP WHERE PS_PARTKEY =19763);



SELECT COUNT(*) FROM SUPPLIER;

SELECT * FROM SUPPLIER
WHERE  S_SUPPKEY IN (83,265,492,784,901,1000)
ORDER BY S_SUPPKEY;



DROP TABLE MINMAX;

CREATE TABLE MINMAX
(TNAME CHAR(15),
KEYMIN INTEGER,
KEYMAX INTEGER);

INSERT INTO MINMAX
SELECT 'LINEITEM_ORD',MIN(L_ORDERKEY),MAX(L_ORDERKEY)
FROM LINEITEM ;

INSERT INTO MINMAX
SELECT
```

```
'LINEITEM_NBR',MIN(L_LINENUMBER),MAX(L_LINENUMBER)
FROM LINEITEM;

INSERT INTO MINMAX
SELECT 'ORDERTBL',MIN(O_ORDERKEY),MAX(O_ORDERKEY)
FROM ORDERS;

INSERT INTO MINMAX
SELECT 'CUSTOMER',MIN(C_CUSTKEY),MAX(C_CUSTKEY)
FROM CUSTOMER;

INSERT INTO MINMAX
SELECT 'PART',MIN(P_PARTKEY),MAX(P_PARTKEY)
FROM PART;

INSERT INTO MINMAX
SELECT 'SUPPLIER',MIN(S_SUPPKEY),MAX(S_SUPPKEY)
FROM SUPPLIER;

INSERT INTO MINMAX
SELECT 'PARTSUPP_PART',MIN(PS_PARTKEY),MAX(PS_PARTKEY)
FROM PARTSUPP;

INSERT INTO MINMAX
SELECT 'PARTSUPP_SUPP',MIN(PS_SUPPKEY),MAX(PS_SUPPKEY)
FROM PARTSUPP ;

INSERT INTO MINMAX
SELECT 'NATION',MIN(N_NATIONKEY),MAX(N_NATIONKEY)
FROM NATION;

INSERT INTO MINMAX
SELECT 'REGION',MIN(R_REGIONKEY),MAX(R_REGIONKEY)
FROM REGION;

SELECT * FROM MINMAX;
spool off
exit;
```

## Appendix F. Pricing information

For Oracle pricing please contact:

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