TPC Benchmark™ C
Full Disclosure Report
IBM eserver iSeries 400
Model 840-2420

March 19, 2001

IBM®

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Abstract

This report documents the full disclosure information required by the TPC Benchmark™ C Standard Specification dated February 26, 2001 for measurements on the IBM @server iSeries 400 Model 840 with Feature Code 2420 running at 500 Mhz. The software used on the iSeries 400 Model 840-2420 systems includes OS/400 Version 4, Release 5, Modification 0, DB2 for AS/400 Version 4, Release 5, Modification 0, OS/400 Version 4, Release 5, Modification 0, INT LNG ENV COBOL OS/400 V4 R4, INT LNG ENV C OS/400 V4 R4, DB2 Query Manager and SQL Development Kit, BEA TUXEDO 6.4, and Application Development Tools.

IBM@server iSeries Model 840-2420

Company Name	System Name	Data Base Software	Operating System Software
IBM®	IBM @server iSeries Model 840-2420	DB2 for AS/400 Version 4 Release 5	OS/400 Version 4 Release 5
Availability Date: September 15, 2000			

Total System Cost	TPC-C Throughput	Price/Performance
- Hardware - Software -5 Years Maintenance	Sustained maximum throughput of system running TPC-C expressed in transactions per minute	Total system cost/tpmC ($/tpmC)
$6,782,752	152,346.25 tpmC	$44.52 per tpmC

IBM eserver iSeries 400 Model 840-2420

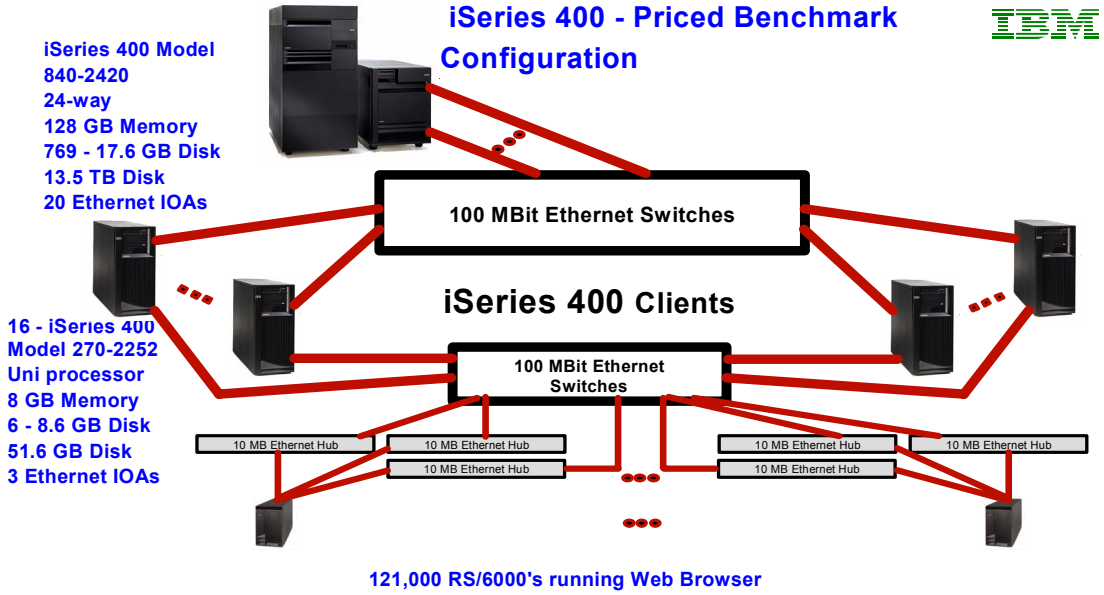
TPC-C Rev. 5.0

Report Date: March 19, 2001

Total System Cost	TPC-C Throughput	Price/Performance	Availability Date
$6,782,752	152,346.25	$44.52	September 15, 2000

Processors	Database Manager	Operating System	Other Software	Number of Users
1 iSeries 400 840-2420 (24-way) 16 iSeries 400 9406-270 2252	DB2 for AS/400 Version 4 Release 5	OS/400 Version 4 Release 5	BEA TUXEDO 6.4 INT LNG ENV COBOL OS/400 V4 R4 INT LNG ENV C OS/400 V4 R4	121,000

iSeries 400 Model 840-2420 Priced Configuration



System components:	Qty:	Description:
Server	1	
Processors	24	iSeries 400 Model 840-2420
Memory		128 GB main memory
Disk controllers	52	RAID Disk Unit Controller (4748)
Disk drives	769	17.6 GB DASD
		Total: 13.5 TB
Total storage		
Clients (each):	16	
Processor	1	iSeries 400 Model 270-2252
Memory		8 GB main memory
Disk controller	2	RAID Disk Unit Controller (4748)
Disk drives	6	8.6 GB DASD
		Total: 51.6 GB

IBM @server iSeries 400 Model 840-2420

TPC-C REV. 5.0
EXECUTIVE SUMMARY

Report Date: March 19, 2001

IBM iSeries 400 840-2420 Configuration

Item Description	Feature Number	Third Party Pricing	Unit Price	Quantity	Extended Price	Extended Maintenance	3-Year Price
Server Hardware:							
IBM iSeries 400 Model 840 24-way Base System Unit	9406-840		640,000	1	640,000	42,408	682,408
Processor - ISTAR 7S 500 Mhz 24-way, Cache 8x4 MB	2420		550,000	1	550,000	46,464	596,464
Interactive Card	1540		0	1	0		0
6m HSL Cable - Base I/O Tower	1461		550	20	11,000		11,000
8192 MB (RIVER - 256 MB technology)	3196		147,456	16	2,359,296		2,359,296
Programmable Regulator (req'd with 3196)	2730		750	2	1,500		1,500
PCI Ultra Magnetic Media Controller	2749		1,300	1	1,300		1,300
PCI IOP with 64 MB memory	2843		1,925	22	42,350		42,350
17.6 GB 10K RPM Disk Unit	4318		2,520	769	1,937,880		1,937,880
CD-ROM	4425		415	1	415		415
PCI Two Line WAS IOA (ECS) req'd with 5540	4745		425	1	425		425
PCI Twinaxial IOA - Req'd with 5540	4746		750	1	750		750
PCI RAID Disk Unit Contorller with 26 MB wirte cache	4748		6,000	52	312,000		312,000
PCI 100/10 mbps Ethernet IOA	4838		900	20	18,000		18,000
PCI100/16/4 MBPS Token Ring IOA	2744		840	2	1,680		1,680
PCI Expansion Tower / Mantis	5074		17,900	17	304,300	141,168	445,468
PCI Expansion Tower	5101		9,000	18	162,000	178,848	340,848
25 GB 1/4-Inch Tape Drive	4486		5,000	1	5,000		5,000
V.24/EIA232 50ft PCI Cable - System Console	0367		125	1	125		125
Server Subtotal					6,348,021	408,888	6,756,909
Client Hardware:							
IBM iSeries 400 Model 270 Base System Unit	9406-270		4,000	1	4,000	2,208	6,208
V.24/EIA 232 20ft PCI Cable for System Console	0348		125	1	125		125
6m HSL Cable - Base I/O Tower	1461		550	2	1,100		1,100
Processor Card	2252		16,000	1	16,000	3,912	19,912
PCI IOP with 32 MB memory	2842		1,800	3	5,400		5,400
Main Store - memory riser card - 16 slots	2884		2,200	1	2,200		2,200
512 MB DIMMS Main Storage	3025		2,048	16	32,768		32,768
8.6 GB 10K RPM Disk Unit	4317		1,400	6	8,400		8,400
CD-ROM	4525		415	1	415		415
4 GB 1/4-Inch Tape Drive	4582		1,300	1	1,300		1,300
PCI Expansion Tower	5075		6,000	1	6,000	2,928	8,928
PCI Two Line WAS IOA (ECS) req'd with 5540	4745		425	1	425		425
PCI Twinaxial IOA - Req'd with 5540	4746		750	1	750		750
PCI RAID Disk Unit Contorller with 26 MB wirte cache	4748		6,000	2	12,000		12,000
PCI 100/10 mbps Ethernet IOA	4838		900	3	2,700		2,700
Single Client Subtotal					93,583	9,048	102,631
Number of Clients				16			
Client Subtotal					1,497,328	144,768	1,642,096
Server Software:							
IBM Operating System/400 V4R5M0	Bundled			1	0	33,343	33,343
DB2 Query Manager Dev. Toolkit	QU1 and ST1		28,800	1	28,800		28,800
Client Software:							
IBM Operating System/400 V4R5M0	Bundled		0	16	0	251,313	251,313
BEA Tuxedo V6.4		1	3,000	16	48,000	33,120	81,120
ILE COBOL	5769CB1		2,400	1	2,400		2,400
Application Development Toolkit	5769PW1		3,020	1	3,020		3,020
DB2 Query Mgr and SQL Development kit	5769ST1		1,600	1	1,600		1,600
ILE C	5769CX2		2,400	1	2,400		2,400
Software Subtotal					86,220	317,776	403,996
3-year System Subtotal					7,931,569	871,432	8,803,001

Discounts:	%Allowance	Volume	Discount
Revenue Allowance	22	7,883,569	(1,734,385)
3-year Term Maintenance Contract Discount	3	553,656	(16,610)
3-year Maintenance Prepay Discount	10.36	537,046	(55,638)
Software Support Discount For Secondary Systems	85	251,313	(213,616)

	Purchase	Maintenance	Total
3-year System Total	6,197,184	585,568	6,782,752
tpmC			152346.25
$/tpmC			44.52

Note: All pricing is from IBM except items noted in the 3rd Party Pricing column. 1 - BEA Systems, Inc.;

Notes:
Server Hardware requires no charge RPQ 847109
Revenue Allowance is applied to hardware and software for the priced configuration.
3-Year Term Maintenance Contract Discount is given when 3-year contract is signed.
3-Year Maintenance Prepay Discount is given when 3-year maintenance costs are prepaid.
Software Support Discount For Secondary Systems is given for maintenance costs on Multiple systems in a single I/S shop.
Results audited by François Raab of InfoSizing Inc.

Three Year Cost of Ownership: $6,782,752

tpmC Rating: 152,346.25

$/tpmC: $44.52

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

Numerical Quantities Summary for IBM @server iSeries 400 Model 840-2420

MQTH, computed Maximum Qualified Throughput			152,346.25
% throughput difference, reported & repeated			0.99%
Response Times (in seconds)	90%	Avg.	Max.
- New Order	0.5	0.32	9.97
- Payment	0.3	0.20	4.99
- Order-Status	0.5	0.30	2.76
- Delivery (interactive portion)	0.2	0.11	0.19
- Delivery (deferred portion)	2.1	1.70	6.18
- Stock-Level	1.8	0.82	6.00
- Menu	0.1	0.10	0.37
- Response time delayed for emulated components	0.1		
Transaction Mix (in percent of total transactions)			
- New Order			44.85%
- Payment			43.06%
- Order-Status			4.03%
- Delivery			4.03%
- Stock-Level			4.02%
Keying/Think Times (in seconds)	Min.	Avg.	Max.
- New Order	18.00/0.00	18.00/12.01	18.23/120.23
- Payment	3.00/0.00	3.00/12.03	3.17/120.23
- Order-Status	2.00/0.00	2.00/10.01	2.10/100.20
- Delivery	2.00/0.00	2.00/5.05	2.07/50.22
- Stock-Level	2.00/0.00	2.00/5.03	2.21/50.21
Test Duration			
- Ramp-up time			75 minutes
- Measurement interval			20 minutes
- Number of checkpoints			N/A[1]
- Checkpoint interval			N/A[1]
- Number of transactions (all types) completed in Measurement Interval			6,792,938

1. Transparent file synchronization occurred at least five times during the measurement interval.

For additional information on the IBM @server iSeries 400 see: http://www.ibm.com/eserver/iseries

Preface

TPC Benchmark™ C Standard Specification was developed by the Transaction Processing Performance Council (TPC) and released August 13, 1992.

This is the full disclosure report for benchmark testing of the IBM @server iSeries 400 Model 840-2420 system according to the TPC Benchmark“ C Standard Specification. Measurements were done on the IBM @server iSeries 400 Model 840-2420 500 MHz. TPC Benchmark™ C exercises the system components necessary to perform tasks associated with that class of on-line transaction processing (OLTP) environments emphasizing a mixture of read-only and update intensive transactions. This is a complex OLTP application environment exercising a breadth of system components associated with such environments characterized by:

- The simultaneous execution of multiple transaction types that span a breadth of complexity.
- On-line and deferred transaction execution modes.
- Multiple on-line terminal sessions.
- Moderate system and application execution time.
- Significant disk input/output.
- Transaction integrity (ACID properties).
- Nonuniform distribution of data access through primary and secondary keys.
- Data bases consisting of many tables with a wide variety of sizes, attributes, and relationships.
- Contention on data access and update.

The benchmark defines four on-line transactions and one deferred transaction, intended to emulate functions that are common to many OLTP applications. However, this benchmark does not reflect the entire range of OLTP requirements. The extent to which a customer can achieve the results reported by a vendor is highly dependent on how closely TPC-C approximates the customer application. The relative performance of systems derived from this benchmark does not necessarily hold for other work loads or environments. Extrapolations to any other environment are not recommended.

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

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

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1.0 General Items

1.1 Application Code Disclosure

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

Appendix D contains the iSeries 400 application code for the five TPC Benchmark™ C transactions and the terminal functions.

1.2 Benchmark Sponsor

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

This benchmark was sponsored by **International Business Machines** Corporation.

1.3 Parameter Settings

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

- *Database tuning options.*
- *Recovery/commit options.*
- *Consistency/locking options.*
- *Operating system and application configuration parameters.*

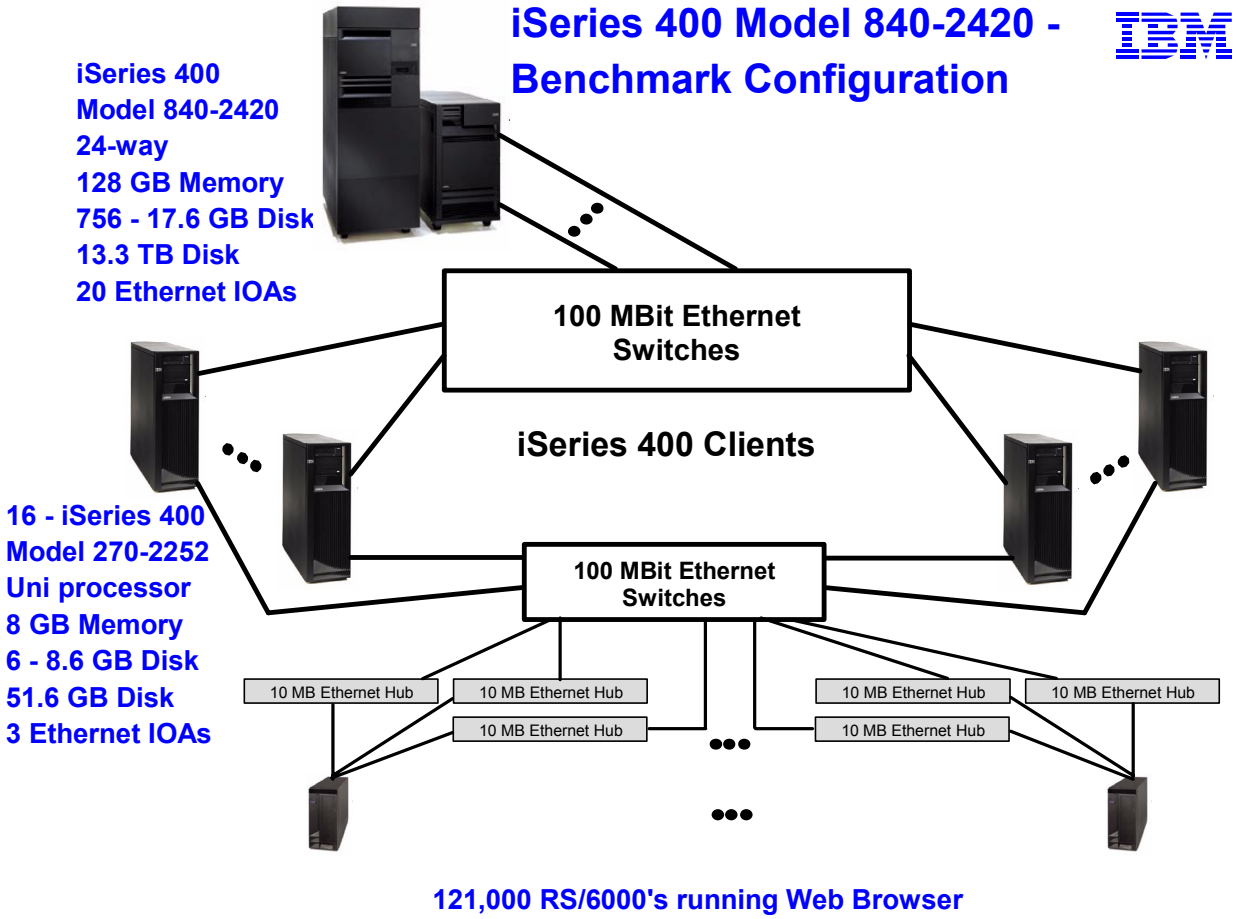
Appendix A contains the system, database, and application parameters changed from their default values used in these TPC Benchmark™ C tests.

1.4 Configuration Diagrams

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

- *Number and type of processors.*
- *Size of allocated memory, and any specific mapping/partitioning of memory unique to the test.*
- *Number and type of disk units (and controllers if applicable).*
- *Number of channels or bus connections to disk units, including the protocol type.*
- *Number of LAN (e.g., Ethernet) connections, including routers, workstations, terminals, etc., that were physically used in the test or are incorporated into the pricing structure (see Clause 8.1.8).*
- *Type and run-time execution location of software components (e.g., DBMS, client processes, transaction monitors, software drivers, etc.).*

1.5 IBM @server iSeries 400 Model 840-2420 Benchmark Configuration



2.0 Clause 1: Logical Database Design - Related Items

2.1 Table Definitions

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

The listings for all file definitions to create the database files are available in Appendix B and the programs used for loading the database (minimal population) are provided in Appendix C.

2.2 Database Organization

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

Physical space for each file (table) is allocated by OS/400 as the file is filled. Although the initial build and the application transactions add records (rows) to several files in the same transaction, each file's extent will reside in separate areas on physical disk. OS/400 will spread the extents for each file across all available disk units to ensure that multiple access requests to the same file may be handled simultaneously. Records are added contiguously within extents, crossing page boundaries where necessary.

Files are created in sequential order according to their primary key.

Indices are generated concurrently with data for Warehouse, District, and Item tables. All other indices are generated after the database is populated. The available space within the index is included in the space reported in this disclosure.

2.3 Insert and/or Delete Operations

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

During the course of the testing, records were inserted into the ITEM file while users were executing the defined TPC-C transactions.

All of the files used by TPC-C transactions were created with the following attributes:

Authority	*PUBLIC	(Any user can view and modify the files).
ALWUPD	*YES	(Allow update and insert of records).
ALWDLT	*YES	(Allow delete of records).
ALWWRT	*YES	(Allow write of records).

Static files were created with *NOMAX specified on the number of records allowed. This limit is therefore set by the operating system at 2,147,483,648 records. Dynamic files were created with an initial size that is slightly larger than initial database requirement, and extent definitions that would allow expansion, as needed.

2.4 Horizontal or Vertical Partitioning

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

Horizontal partitioning was implemented on all the files except ITEM. The partitioning was done based on the Warehouse ID key field. The following eight tables: Warehouse, District, Customer, History, Neworder, Orders, Orderline, and Stock were split such that records for Warehouse ID's 1 through 6,100 were in the first partition and 6,101 through 12,200 were in the second partition.

3.0 Clause 2: Transaction and Terminal Profiles - Related Items

3.1 Verification for the Random Number Generator

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

The srandom(), getpid(), and gettimeofday() functions are used to produce unique random seeds for each driver. The drivers use these seeds to seed the srand(), srandom(), and srand48() functions. Random numbers are produced using wrappers around the standard system random number generators.

The negative exponential distribution uses the following function to generate the distribution. This function has the property of producing a negative exponential curve with a specified average and a maximum value 4 times the average.

```
const double RANDOM_4_Z=0.89837799236185
const double RANDOM_4_K=0.97249842407114

double neg_exp_4(double average {
        return - average * (1/RANDOM_4_Z * log (1 - RANDOM_4_K * drand48())));
}
```

The random functions used by the driver system and the database generation program were verified. The C_LAST column was queried to verify the random values produced by the database generation program. After a measurement, the HISTORY, ORDER, and ORDER_LINE tables were queried to verify the randomness of values generated by the driver. The rows were counted and grouped by customer and item numbers.

Here is an example of one SQL query used to verify the random number generation functions:

- create table TEMP (W_ID int, D_ID, C_LAST char(16), CNTR int);
- insert into TEMP select C_W_ID, C_D_ID, C_LAST, COUNT(*) from CUSTOMER group by C_W_ID, C_D_ID, C_LAST;
- select CNTR, COUNT(*) from TEMP group by CNTR order by 1;

3.2 Input/Output Screens

The actual layouts of the terminal input/out screens must be disclosed. (8.1.3.2)
The screen layouts are based on those in Clauses 2.4.3, 2.5.3, 2.6.3, 2.7.3 and 2.8.3 of the TPC Benchmark C Standard Specification. .

3.3 Terminal Features

The method used to verify that the emulated terminals provide all the features described in Clause 2.2.2.4 must be explained. Although not specifically priced, the type and model of the terminals used must for the demonstration in 8.1.3.3 must be disclosed and commercially available (including supporting software and maintenance). (8.1.3.3)
The auditor verified terminal features by direct experimentation. The benchmarked configuration uses a browser and HTML scripts as the terminal interface
The following numbered items correspond directly to the seven items listed under Clause 2.2.2.4 with a description of how the requirement was met.

3.4 Presentation Managers

Any usage of presentation managers or intelligent terminals must be explained. (8.1.3.4)
The terminals emulated in the priced configuration are IBM RS/6000 desktop computer systems. All processing of the input/output screens was handled by the IBM iSeries 400 clients. The screen input/output was managed via HTML strings that comply with the HTML Version 2.0 specification. A listing of the code used to implement the intelligent terminals is provided in Appendix A. All data manipulation was handled by the IBM iSeries 400 clients.

3.5 Home and Remote Order Lines

The percentage of home and remote order lines in the New-Order transactions must be disclosed.

Table 1 on page 21 shows the percentage of home and remote transactions that occurred during the measurement period for the New-Order transactions.

3.6 New-Order Rollback transactions

The percentage of New-Order transactions that were rolled back as a result of an illegal item number must be disclosed.

Table 1 on page 21 shows the percentage of New-Order transactions that were rolled back due to an illegal item being entered.

3.7 Number of Items per Order

The number of items per orders entered by New-Order transactions must be disclosed.

Table 1 on page 21 shows the average number of items ordered per New-Order transaction.

3.8 Home and Remote Payment Transactions

The percentage of Home and Remote Payment transactions must be disclosed.

Table 1 on page 21 shows the percentage of Home and Remote transactions that occurred during the measurement period for the Payment transactions.

3.9 Nonprimary Key Transactions

The percentage of Payment and Order-Status transactions that used nonprimary key (C_LAST) access to the database must be disclosed.

Table 1 on page 21 shows the percentage of nonprimary key access to the database by the Payment and Order-Status transactions.

3.10 Skipped Delivery Transactions

The percentage of Delivery transactions that were skipped as a result of an insufficient number of rows in the NEW-ORDER table must be disclosed.

Table 1 on page 21 shows the percentage of Delivery transactions missed due to a shortage of supply in the NEW-ORDER table.

3.11 Mix of Transaction Types

The mix (ie, percentages) of transaction types seen by the SUT must be disclosed.

Table 1 on page 21 shows the mix percentage for each of the transaction types executed by the SUT.

3.12 Queuing Mechanism of Delivery

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

Deferred queuing of the Delivery transaction is handled within standard support from the Tuxedo transaction monitor.

Table 1. Numerical Quantities for Transaction and Terminal Profiles

New Order	IBM @server iSeries 400 Model 840-2420
Percentage of Home order lines	99.00%
Percentage of Remote order lines	1.00%
Rolled Back Transactions	0.99%
Number of Items per order	10
Payment	
Percentage of Home transactions	85.02%
Percentage of Remote transactions	14.98%
Nonprimary Key Access	
Percentage of Payment using C_LAST	59.95%
Percentage of Order-Status using C_LAST	59.92%
Delivery	
Delivery transactions skipped	0
Transaction Mix	
New-Order	44.85%
Payment	43.06%
Order-Status	4.03%
Stock-Level	4.02%
Delivery	4.03%

4.0 Clause 3: Transaction and System Properties - Related Items

The results of the ACID test must be disclosed along with a description of how the ACID requirements were met.

4.1 Atomicity Requirements

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

4.1.1 Atomicity of Completed Transaction

Perform the Payment transaction for a randomly selected warehouse, district, and customer (by customer number) and verify that the records in the CUSTOMER, DISTRICT, and WAREHOUSE tables have been changed appropriately.

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

1. Randomly select a Customer, District, and Warehouse, and query the Customer, District, and Warehouse tables.
2. Execute a Payment transaction for the Customer, District, and Warehouse used in Step1 above. Commit the transaction.
3. Repeat the query performed in Step1 to demonstrate that the appropriate changes have been made.

4.1.2 Atomicity of Aborted Transactions

Perform the Payment transaction for a randomly selected warehouse, district, and customer (by customer number) and substitute a ROLLBACK of the transaction for the COMMIT of the transaction. Verify that the records in the CUSTOMER, DISTRICT, and WAREHOUSE tables have NOT been changed.

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

1. Randomly select a Customer, District, and Warehouse, and query the Customer, District, and Warehouse tables.
2. Execute a Payment transaction for the Customer, District, and Warehouse used in Step1 above. Roll-back the transaction.
3. Repeat the query performed in Step1 to verify that no changes have been made to the database.

4.2 Consistency Requirements

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

4.2.1 Consistency Condition 1

Entries in the WAREHOUSE and DISTRICT tables must satisfy the relationship:

W_YTD = sum(D_YTD)

for each warehouse defined by (W_ID = D_W_ID)

The following SQL queries were executed before and after transactions were run to show that the database was always in a consistent state.

```
Select WID, WYTD from WRHS
Select DWID, sum(DYTD) from DSTRCT group by DWID
```

The results of these two queries were then compared to verify consistency.

4.2.2 Consistency Condition 2

Entries in the DISTRICT, ORDER, and NEW-ORDER tables must satisfy the relationship:

D_NEXT_O_ID -1 = max(O_ID) = max(NO_O_ID)

for each district defined by (D_W_ID = O_W_ID) = NO_W_ID) and (D_ID = O_D_ID = NO_D_ID). This condition does not apply to the NEW-ORDER table for any districts which have no outstanding new orders.

The following SQL queries were executed before and after transactions were run to show that the database was always in a consistent state.

```
Create View QRYTEMP1(OWID, ODID, MAXOID)
  As Select OWID, ODID, MAX(OID) from ORDERS group by OWID, ODID
Create View QRYTEMP2(NOWID, NODID, MAXNOOID)
  As Select NOWID, NODID, MAX(NOOID) from NEWORDS group by NOWID, NODID
Select DWID, DID, (DNXTOR-1), MAXOID, MAXNOOID
  from DSTRCT, QRYTEMP1, QRYTEMP2 where DWID = OWID and DWID=NOWID
  and DID =ODID and DID = NODID and (((DNXTOR-1) <> MAXOID)
  or ((DNXTOR-1) <> MAXNOOID) or (MAXOID <> MAXNOOID))
```

If any records are produced by these queries, the database would be inconsistent. No records were produced by these queries.

4.2.3 Consistency Condition 3

Entries in NEW-ORDER table must satisfy the relationship:

max(NO_O_ID) - min(NO_O_ID) + 1 = {number of rows in the NEW-ORDER table for this district}

for each district defined by NO_W_ID and NO_D_ID. This condition does not apply to any districts which have no outstanding new orders.

The following SQL queries were executed before and after transactions were run to show that the database was always in a consistent state.

```
Create View QRYTEMP3(NOWID, NODID, MAXNOOID, MINNOOID, MAXMIN, COUNTO ID)
  As Select NOWID, NODID, MAX(NOOID), MIN(NOOID), (MAX(NOOID) -
  MIN(NOOID) +1), COUNT(*) from NEWORD group by NOWID, NODID
Select * from QRYTEMP3 where MAXMIN <> COUNTOID
```

If any records are produced by these queries, the database would be inconsistent. No records were produced by these queries.

4.2.4 Consistency Condition 4

Entries in the ORDER and ORDER-LINE tables must satisfy the relationship:

sum(O_OL_CNT) = {number of rows in the ORDER-LINE table for this district}

for each district defined by (O_W_ID = OL_W_ID) and (O_D_ID = OL_D_ID).

The following SQL queries were executed before and after transactions were run to show that the database was always in a consistent state.

```
Create View QRYTEMP4(OLWID, OLDID, COUNTORD)
  As Select OLWID, OLDID, COUNT(*)
  From ORDERLINE Group by OLWID, OLDID
Create View QRYTEMP5(OWID, ODID, SUMOLINES)
  As Select OWID, ODID, SUM(OLINES)
  From ORDERS Group by OWID, ODID
Select OWID, ODID, SUMOLINES, COUNTORD
  From QRYTEMP4, QRYTEMP5 Where OWID = OLWID and ODID = OLDID
  and SUMOLINES <> COUNTORD Order by OWID, ODID
```

If any records are produced by these queries, the database would be inconsistent. No records were produced by these queries.

4.2.5 Consistency Condition 5

For any row in the ORDER table, O_CARRIER_ID is set to a null value if and only if there is a corresponding row in the NEW-ORDER table defined by (O_W_ID, O_D_ID, O_ID) = (NO_W_ID, NO_D_ID, NO_O_ID).

This consistency test completed successfully.

4.2.6 Consistency Condition 6

For any row in the ORDER table, O_OL_CNT must equal the number of rows in the ORDER-LINE table for the corresponding order defined by (O_W_ID, O_D_ID, O_ID) = (OL_W_ID, OL_D_ID, OL_O_ID).

This consistency test completed successfully.

4.2.7 Consistency Condition 7

For any row in the ORDER-LINE table, OL_DELIVERY_D is set to a null date/time if and only if the corresponding row in the ORDER table defined by (O_W_ID, O_D_ID, O_ID) = (OL_W_ID, OL_D_ID, OL_O_ID) has (O_CARRIER_ID) set to a null value.

This consistency test completed successfully.

4.2.8 Consistency Condition 8

Entries in the WAREHOUSE and HISTORY tables must satisfy the relationship:

W_YTD = sum(H_AMOUNT)

for each warehouse defined by (W_ID = H_W_ID).

This consistency test completed successfully.

4.2.9 Consistency Condition 9

Entries in the DISTRICT and HISTORY tables must satisfy the relationship:

D_YTD = sum(H_AMOUNT)

for each district defined by (D_W_ID, D_ID = H_W_ID, H_D_ID).

This consistency test completed successfully.

4.2.10 Consistency Condition 10

Entries in the CUSTOMER, HISTORY, ORDER, and ORDER-LINE tables must satisfy the relationship:

C_BALANCE = sum(OL_AMOUNT) - sum(H_AMOUNT)
where:
H_AMOUNT is selected by (C_W_ID, C_D_ID, C_ID) = (H_C_W_ID, H_C_D_ID, H_C_ID)
and:
OL_AMOUNT is selected by:
(OL_W_ID, OL_D_ID, OL_O_ID) = (O_W_ID, O_D_ID, O_ID) and
(O_W_ID, O_D_ID, O_C_ID) = (C_W_ID, C_D_ID, C_ID) and
(OL_DELIVERY_D is not a null value)

This consistency test completed successfully.

4.2.11 Consistency Condition 11

Entries in the CUSTOMER, ORDER, and NEW-ORDER tables must satisfy the relationship:

(count(*) from ORDER) - (count(*)from NEW-ORDER) = sum(C_DELIVERY_CNT)

for each district defined by (O_W_ID, O_D_ID) = (NO_W_ID, NO_D_ID)= (C_W_ID, C_D_ID).

This consistency test completed successfully.

4.2.12 Consistency Condition 12

Entries in the CUSTOMER, and ORDER-LINE table must satisfy the relationship:

C_BALANCE + C_YTD_PAYMENT = sum(OL_AMOUNT)

for any randomly selected customers and where OL_DELIVERY_ID is not set to a null date/time.

This consistency test completed successfully.

All 12 consistency tests were completed successfully.

4.2.13 Consistency Tests

Verify that the database is initially consistent by verifying that it meets the consistency conditions defined in Clauses 3.3.2.1 to 3.3.2.4. Describe the steps used to do this in sufficient detail so that the steps are independently repeatable.

The queries defined in 4.2.1 through 4.2.4 were run after initial database build and prior to executing any transactions. All queries showed that the database was in a consistent state.

After executing transactions at full load for approximately 10 minutes, the queries defined in 4.2.1 through 4.2.4 were run again. All queries showed that the database was still in a consistent state.

4.3 Isolation Requirements

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

4.3.1 Isolation Test 1

This test demonstrates isolation for read-write conflicts of Order-Status and New-Order transactions.

The following steps were performed to satisfy the test of isolation for Order-Status and New-Order transactions:

1. First terminal: Start a New-Order transaction with the necessary inputs. The transaction is delayed to pause the program execution.
2. Second terminal: Start an Order-Status transaction for the same customer as used in the New-Order transaction.

3. Second terminal: The Order-Status transaction attempts to read the CUSTOMER file but is locked out by the New-Order transaction waiting to complete.
4. First terminal: The New-Order transaction is released and the Commit is executed releasing the record. With the CUSTOMER record now released, the Order-Status transaction can now complete.
5. Second terminal: Verify that the Order-Status transaction completes after the New-Order transaction. and that the results displayed for the Order-Status transaction match the input for the New-Order transaction.

4.3.2 Isolation Test 2

This test demonstrates isolation for read-write conflicts of Order-Status and New-Order transactions when the New-Order transaction is rolled back.

The following steps were performed to satisfy the test of isolation for Order-Status and a rolled back New-Order transaction.

1. First terminal: Perform a New-Order transaction for the same customer in the Order-Status transaction in Isolation Test 1; include an invalid item number in the order. The transaction is delayed just prior to the rollback.
2. Second terminal: Start an Order-Status transaction for the same customer used in the New-Order transaction. The Order-Status transaction attempts to read the CUSTOMER file but is locked by the New-Order transaction.
3. First terminal: Roll back the New-Order transaction. With the CUSTOMER record now released, the Order-Status transaction completes.
4. Verify the results from the Order-Status transaction matches those in Isolation Test 1.

4.3.3 Isolation Test 3

This test demonstrates isolation for write-write conflicts of two New-Order transactions.

1. The following steps were performed to verify isolation of two New-Order transactions:
2. First terminal: Start a New-Order transaction using the necessary inputs. The transaction is delayed just prior to the Commit.
3. Second terminal: Start a second New-Order transaction for the same customer used by the first terminal. This transaction is forced to wait while the first terminal holds a lock on the DISTRICT record requested by the second terminal.
4. First terminal: The New-Order transaction is allowed to complete and Commit the transaction. With the DISTRICT record released, the second terminal New-Order transaction will complete.
5. Verify the order number from the second terminal New-Order transaction is one greater than the order number from the first terminal.

4.3.4 Isolation Test 4

This test demonstrates isolation for write-write conflicts of two New-Order transactions when one transaction is rolled back.

The following steps were performed to verify isolation of two New-Order transactions after one is rolled back:

1. First terminal: Start a New-Order transaction using the necessary inputs to cause a roll back (invalid item number). The transaction is delayed just prior to the rollback.

2. Second terminal: Start a second New-Order transaction for the same customer used by the first terminal. This transaction is forced to wait while the first terminal holds a lock on the DISTRICT record requested by the second terminal.
3. First terminal: The New-Order transaction is allowed to complete, and the transaction is rolled back due to the invalid item number.
4. Second terminal: With the DISTRICT record released, the second terminal New-Order transaction will complete normally.
5. Verify the order number from the second terminal New-Order transaction is equal to the next order number before either New-Order transaction was started.

4.3.5 Isolation Test 5

This test demonstrates isolation for write-write conflicts of Payment and Delivery transactions.

The following steps were performed to successfully conduct this test:

1. First terminal: A Delivery transaction is started. The transaction is delayed just prior to the Commit.
2. Second terminal: Start a Payment transaction for a customer that will have an order delivered in this transaction started in Step 1. The Payment transaction is forced to wait while the Delivery transaction holds a lock on the CUSTOMER record.
3. The Delivery transaction completes.
4. Second terminal: With the CUSTOMER record released, the Payment transaction is now able to complete.

4.3.6 Isolation Test 6

This test demonstrates isolation for write-write conflicts of Payment and Delivery transactions when the Delivery transaction is rolled back.

The following steps were performed to successfully conduct this test:

1. First terminal: Start a Delivery transaction. The transaction is delayed just prior to the rollback.
2. Second terminal: Start a Payment transaction for a customer that will have an order delivered in this transaction started in Step 1. The Payment transaction is forced to wait while the Delivery transaction holds a lock on the CUSTOMER record.
3. The Delivery transaction rolls back.
4. Second terminal: With the CUSTOMER record released, the Payment transaction is now able to complete.

4.3.7 Isolation Test 7

This test demonstrates repeatable reads for the New-Order transaction while an interactive transaction updates the price of an item.

The following steps were performed to successfully conduct this test:

1. First terminal: Execute a New Order transaction including items x and y.
2. First terminal: A New-Order transaction is started that contains item x twice and item y once. This transaction is stopped after reading the price of item x from the item file the first time.

3. Second terminal: Using interactive SQL, an update transaction is started for items x and y, increasing their price by 10%. Case A, transaction 3 stalls, occurs.
4. First terminal: The New-Order transaction is allowed to complete. It is verified that the prices for items x and y are the same throughout the entire transaction and that they match the results of Step 1.
5. Second terminal: After the New-Order transaction completes, the update transaction completes and is committed.
6. First terminal: Step1 is repeated, noting that the prices of items x and y now match those set in Step 3.

4.3.7.1 Isolation Test 8

This test demonstrates isolation for phantom protection between a Delivery and a New-Order transaction.

The following steps were performed to successfully conduct this test:

1. First terminal: All rows for a randomly selected district and warehouse were removed from the NEW-ORDER table.
2. First terminal: A Delivery transaction for the selected warehouse was started.
3. First terminal: The Delivery transaction was stopped immediately after reading the NEW-ORDER table for the selected district. No qualifying row was found.
4. Second terminal: A New-Order transaction was started for the same warehouse and district. Case A, Transaction 2 stalled.
5. First terminal: Repeated read of the NEW-ORDER table for the selected district.
6. Again no qualifying row was found.
7. First terminal: The Delivery transaction was allowed to complete and was COMMITTED.
8. Second terminal: The NEW-ORDER transaction completed successfully.

4.3.7.2 Isolation Test 9

This test demonstrates isolation for phantom protection between an Order-Status and a New-Order transaction.

The following steps were performed to successfully conduct this test:

1. First terminal: An Order-Status transaction for a selected customer was started.
2. First terminal: The Order-Status transaction was stopped immediately after reading the ORDER table for the selected customer. The most recent order for that customer was found.
3. Second terminal: A NEW-ORDER transaction was started for the same customer. Case A, Transaction 2 stalled.
4. First terminal: Repeated read of the ORDER table for the selected customer.
5. Verified the order found was the same as in step 3.
6. First terminal: The Order-Status transaction was allowed to complete and was COMMITTED.
7. Second terminal: The NEW-ORDER transaction completed successfully.

4.4 Durability Requirements

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

4.4.1 Permanent Unrecoverable Failure of any Single Durable Medium

Permanent unrecoverable failure of any single durable medium containing TPC-C database tables or recovery log data.

The iSeries 400 Model 840-2420 implementation of the TPC Benchmark™ C divides the configured disk space into two available auxiliary storage pools (ASP): System ASP and User ASP. The system ASP contains the operating system, integrated relational database, the application libraries, and the TPC-C tables. The System ASP is protected by device parity protection (RAID-5) and the User ASP, which contains the journal receiver (recovery log), is mirrored.

4.4.1.1 Failure of Durable Medium of Journal Receiver and Instantaneous Interruption and Memory Failure

The following steps were performed to successfully complete the test of the Durability of the journal receiver:

1. The current count of the total number of orders was determined by the sum of D_NEXT_O_ID of all rows in the DISTRICT table giving SUM_1.
2. A full scale test was started on the SUT. The test was allowed to run for 10 minutes before creating the failure.
3. The signal cable from a single disk unit in the User ASP was disconnected. Since the User ASP is protected by mirroring, the system continued to process transactions. Detection of the device failure caused a diagnostic message to be issued. Processing of transactions continued without performance degradation.
4. Processing was allowed to continue for an additional 10 minutes.
5. An instantaneous power failure was simulated by issuing an immediate power-off at the service panel.
6. The system was then powered on and IPLed.
7. The number of New-Order transactions executed by the SUT is verified against the number of successful transactions logged by the RTE.
8. Step1 above was performed again retrieving the new total of orders processed, SUM_2. The difference between SUM_2 and SUM_1 was compared to the number of transactions reported by RTE.

4.4.1.2 Failure of Durable Medium of Database

The following steps were performed to successfully perform the Durability test of failure of a disk unit with database tables:

Note: This test was combined with the tests in 4.4.1.1, because the ASP with the disk units containing the database tables is protected by device parity protection (RAID5).

1. The database tables reside on the system ASP.
2. After a disk unit in user ASP was disconnected as mentioned in step 3 in 4.4.1.1, and we let the processing continue for about 10 minutes as mentioned in step 4 in 4.4.1.1, a disk unit in the system ASP was disconnected. Since the system ASP is protected by device parity protection, (RAID 5) the system continued to process transactions. Detection of the device failure caused a diagnostic message to be issued. This also resulted in

parity protection being suspended for the parity set that that disk unit was in. Processing of transactions continued without performance degradation.

3. After the system was powered off, the disk unit was plugged in.
4. After the system was powered back on, the disk was reinstalled and the parity protection was resumed again for that parity set.

5.0 Clause 4: Scaling and Database Population - Related Items

5.1 Cardinality of Tables

The cardinality (ie, the number of rows) of each table, as it existed at the start of the benchmark run, must be disclosed.

Table 2 portrays the TPC Benchmark™ C defined tables and the number of rows for each table as they were built initially.

Table 2. Initial Database Build (# of rows per table)

TPC Benchmark C Tables	IBM @server iSeries 400 Model 840-2420
WAREHOUSE	12,200
CUSTOMER	366,000,000
NEW-ORDER	109,800,000
DISTRICT	122,000
STOCK	1,220,000,000
ORDERS	366,000,000
ORDER-LINE	3,660,140,702
HISTORY	366,000,000
ITEM	100,000

5.2 Distribution of Tables and Logs

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

The iSeries 400 system utilizes a Single-Level Storage concept where OS/400 views all drives in an Auxiliary Storage Pool (ASP) as a single virtual drive. This technique spreads information across all available drives in an ASP, attempting to maintain equivalent percentages of free storage. For this Benchmark, a 630-Disk RAID-5 ASP was used for system code, application code, and the database. A separate, fully mirrored, 126-Disk ASP was used for log data.

5.3 Database Model Implemented

A statement must be provided that describes the database model implemented by the DBMS used.

The type of database implemented in all iSeries 400 systems is an integrated relational database. The database is integrated into the OS/400 operating system.

5.4 Partitions/Replications Mapping

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

Horizontal partitioning was implemented on all the files except ITEM. The partitioning was done based on the Warehouse ID key field. The following eight tables: Warehouse, District, Customer, History, Neworder, Orders, Orderline, and Stock were split such that records for Warehouse ID's 1 through 6,100 were in the first partition and 6,101 through 12,200 were in the second partition.

6.0 Clause 5: Performance Metrics and Response Time - Related Items

6.1 Response Times

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

Table 3 lists the response times and the ninetieth percentiles for each of the transaction types for the IBM @server iSeries 400 Model 840-2420 system.

6.2 Keying and Think Times

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

Table 3 lists the keying and think times from the measured TPC-C tests for the IBM iSeries 400e Model 840-2420.

Table 3. IBM @server iSeries 400 Model 840-2420 - Response, Keying, and Think Times

Response Times	NewOrder	Payment	Order Status	Delivery (int/def)	Stock Level	Menus
90%	0.5	0.3	0.5	0.2/2.1	1.8	0.1
Average	0.32	0.20	0.30	0.10/1.70	0.82	0.10
Maximum	9.97	4.99	2.76	0.19/6.18	6.00	0.37
			Think Times			
Minimum	0.00	0.00	0.00	0.00	0.00	N/A
Average	12.01	12.03	10.01	5.05	5.03	N/A
Maximum	120.23	120.23	100.21	50.22	50.21	N/A
			Keying Times			
Minimum	18.00	3.00	2.00	2.00	2.00	N/A
Average	18.00	3.00	2.00	2.00	2.00	N/A
Maximum	18.23	3.17	2.10	2.07	2.21	N/A

6.3 Response Time Frequency Distribution

Response time frequency distribution curves must be reported for each transaction type.

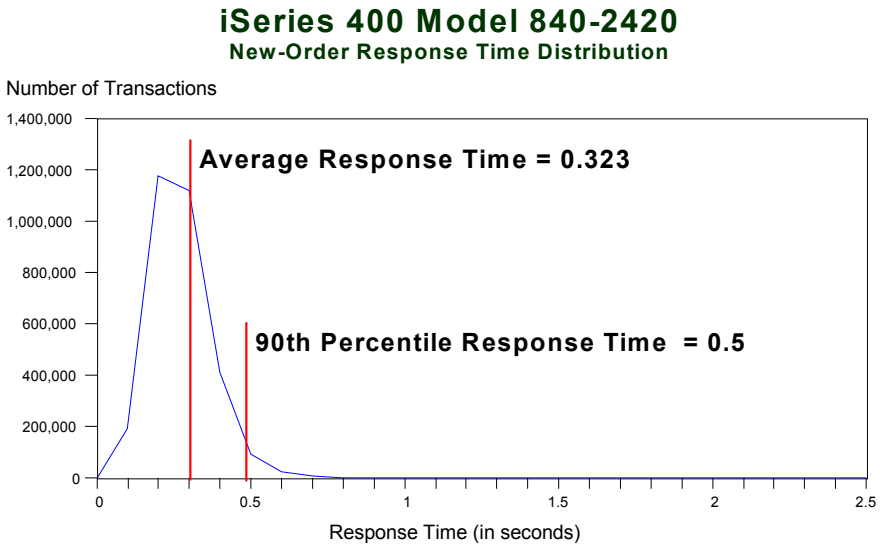


Figure 1. iSeries 400 Model 840-2420 New-Order Response Time Distribution

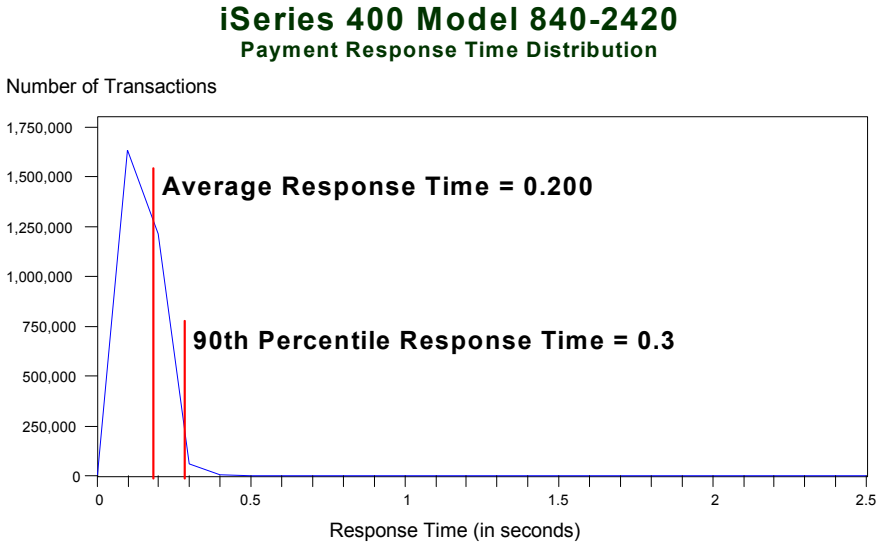


Figure 2. iSeries 400 Model 840-2420 Payment Response Time Distribution

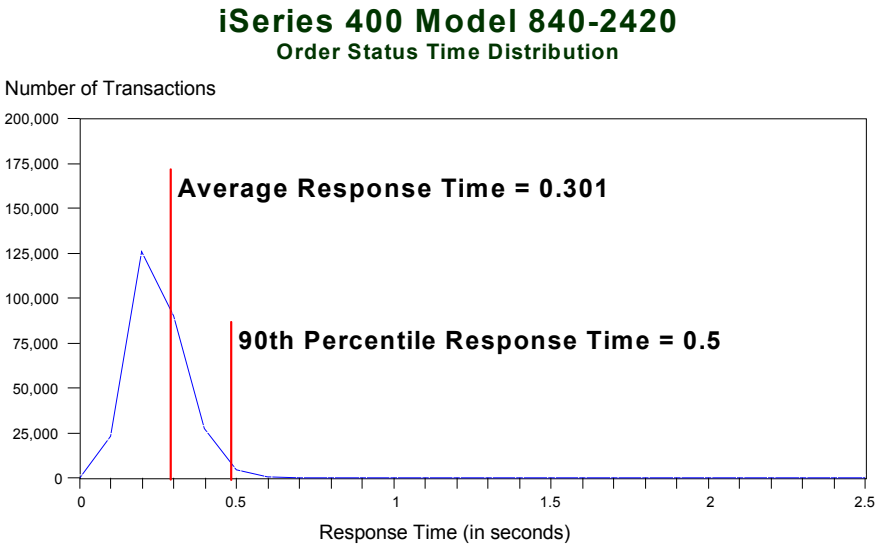


Figure 3. iSeries 400 Model 840-2420 Order Status Response Time Distribution

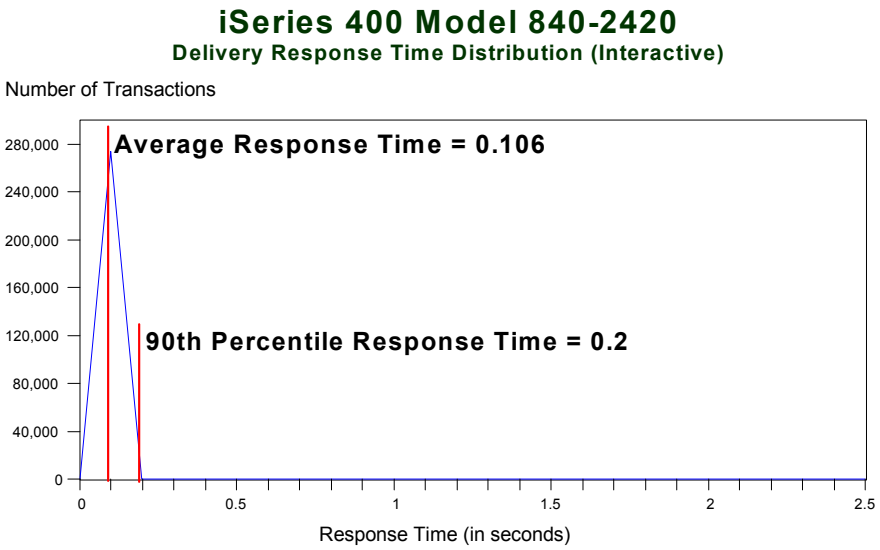


Figure 4. iSeries 400 Model 840-2420 Delivery (Interactive) Response Time Distribution

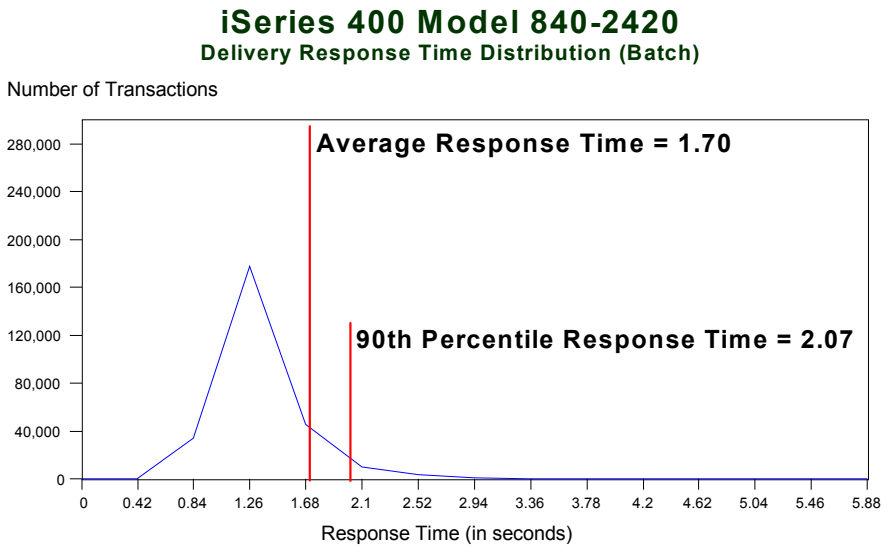


Figure 5. iSeries 400 Model 840-2420 Delivery (Batch) Response Time Distribution

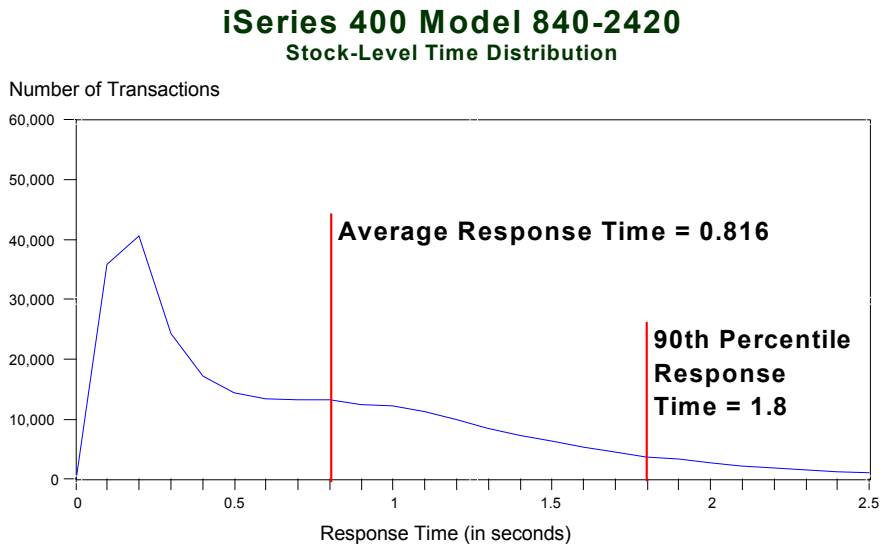


Figure 6. iSeries 400 Model 840-2420 Stock-Level Response Time Distribution

6.4 Performance Curve for Response Time versus Throughput

The performance curve for response times versus throughput must be reported for the New-Order transaction.

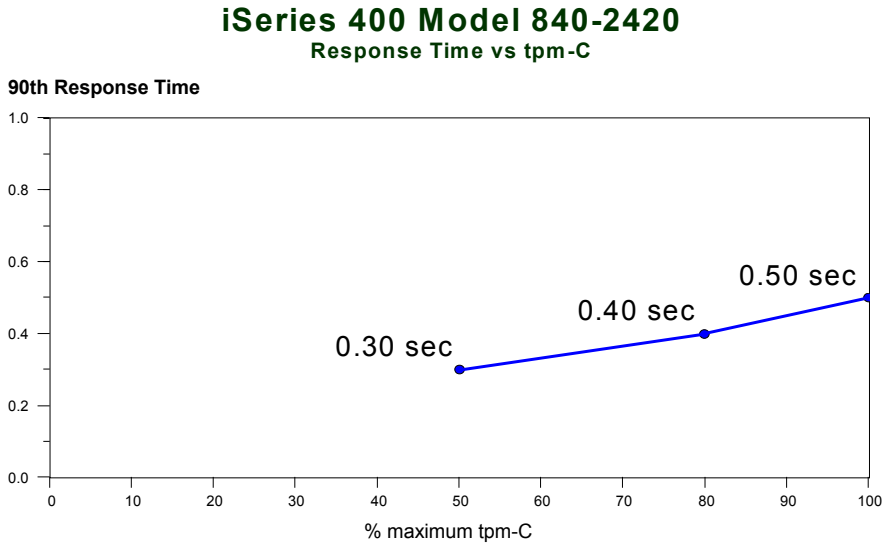


Figure 7. iSeries 400 Model 840-2420 New-Order Response Time Versus Throughput

6.5 Think Time Frequency Distribution

Think time frequency distribution curves must be reported for each transaction type.

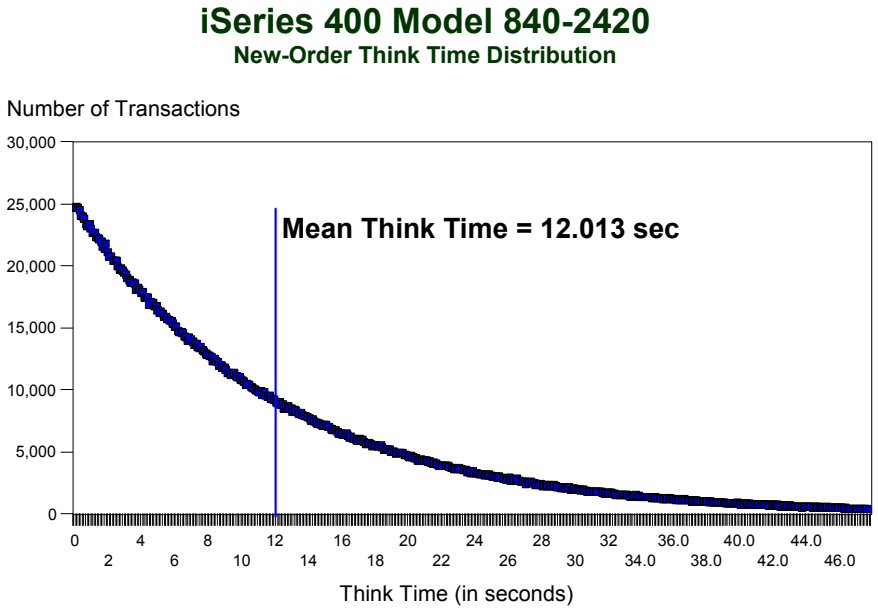


Figure 8. iSeries 400 Model 840-2420 New-Order Think Time Distribution

6.6 Throughput Versus Elapsed Time

A graph of throughput versus elapsed time must be reported for each the New-Order transaction.

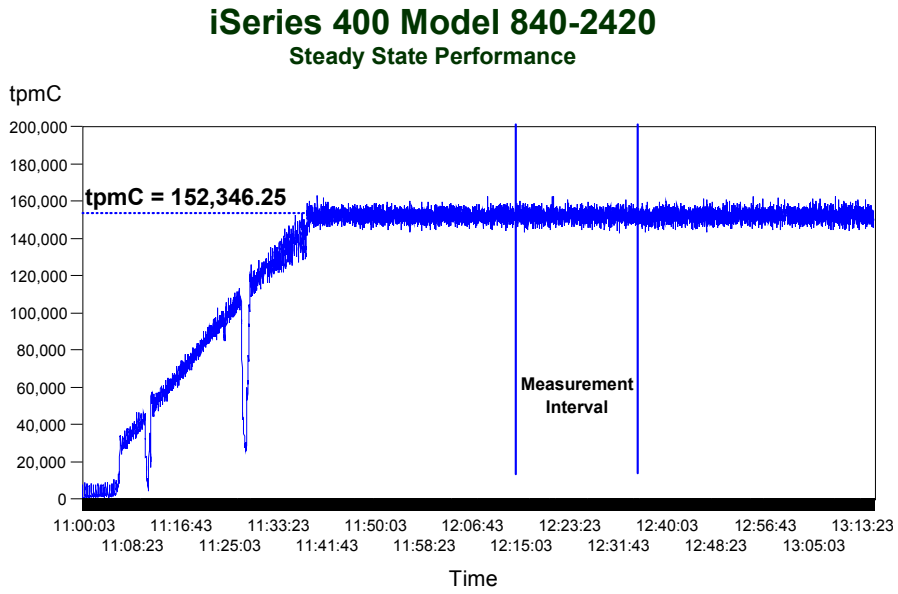


Figure 9. iSeries 400 Model 840-2420 New-Order Throughput Versus Elapsed Time

6.7 Work Performed During Steady State

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

For each of the TPC Benchmark™ C transaction types the following steps are executed:

- At the database transaction start, a "start of commit cycle" entry is recorded in the journal.
- For each of the files updated by a transaction:
  - The database record being updated is locked by the transaction preventing further updates or reads until the journal records are written.
  - A before image of the record is written to the journal receiver.
  - An after image of the record is written to the journal receiver.
- At the end of the database transaction, the records are committed in the journal and all locks on the database records by the transaction are released.

Recording a block of journal entries does not correspond directly to a disk write, since the iSeries 400 journal management function has the ability to block journal writes from one or more jobs into a single physical I/O.

The iSeries 400 system's integrated relational database does not require an overt checkpointing system to ensure that data is written to disk. The iSeries 400 system's standard journal management function ensures that data in disk files is synchronized with that in memory in a transparent, non-disruptive fashion.

As database I/Os are committed, the journal entries associated with the change are written prior to the completion of the commitment function. The database I/Os are issued as asynchronous I/Os which may be delayed by other

requests to use the same data. To ensure that all data updates are completed in a reasonable period of time, iSeries 400 system's journal management ensures that unwritten pages from all tables being journaled are forced to disk at least once for every 17,000,000 entries to the journal. That is, for the 17 tables in TPC-C, one table is forced to disk every 1,000,000 journal entries, so that all 17 tables are synchronized within the period of time it takes to log 17,000,000 journal entries.

The iSeries 400 Model 840-2420 system operating at 152,346.25 tpm-C completes 17,000,000 entries to the journal in approximately 3.5 minutes. A minimum measurement interval of 20 minutes includes approximately 6 complete cycles.

6.8 Reproducibility

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

A repeatability measurement was taken on the IBM @server iSeries 400 Model 840-2420 for the same length of time as the measured run. The repeatability interval was taken from the same measurement as the reported interval and the intervals were separated by 8 minutes and 54 seconds. The repeatability measurement was 152,344.15 tpmC.

6.9 Measurement Interval

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

The measurement interval for the tpmC reported was for 20 minutes in duration. The reproducibility measurement was also for a 20-minute interval.

7.0 Clause 6: SUT, Driver, and Communication Definition-Related Items

7.1 RTE Availability

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

Appendix E contains the scripts used in the Remote Terminal Emulator testing.

7.2 Functionality and Performance of Emulated Components

It must be demonstrated that the functionality and performance of the components being emulated in the Driver System are equivalent to that of the priced system.

In the benchmark configuration the Remote Terminal Emulator (RTE) communicates with the client system over Ethernet. The communications mechanism used in the benchmarked and priced configurations are the same.

7.3 Network Bandwidth

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

RTE network used 10 MB/second Ethernet. The tested configuration of front-end iSeries 400 systems and RTEs was physically connected on a 10/100 Ethernet switched network. The tested configuration of front-end iSeries 400 systems and backend iSeries 400 system was physically connected with a 100 mbps Ethernet switched network.

The priced configuration observed the physical limitation of 1024 physical devices connected to a single Ethernet segment.

7.4 Operator Intervention

If the configuration requires operator intervention, the mechanism and the frequency of this intervention must be disclosed.

The iSeries 400 configurations reported do not require any operator intervention to sustain the reported throughput during the 8-hour period.

8.0 Clause 7: Pricing - Related Items

8.1 Hardware and Programs Used

A detailed list of the 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) must also be reported.

The detailed list of all hardware and programs for the priced configuration is listed in the pricing sheets (please refer to Section 8.3.1 for details) for each system reported. The prices for all products and features are provided by IBM and available the same day as product or feature availability. All products are currently orderable for delivery on or before the published availability date.

8.2 Three Year Cost of System Configuration

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 price sheet for the iSeries 400 Model 840-2420 and associated client systems is contained on the following pages. The discounts used are disclosed below.

Revenue Allowance

This allowance of 22% was based on total hardware and software purchase price of the configuration.

3-year Term Maintenance Contract Discount

This discount is available for customers who sign a 3-year maintenance agreement on the hardware. A discount of 3% is available for customers when they sign a 3-year maintenance agreement.

3-year Maintenance Prepay Discount

This is a discount for prepayment of maintenance costs. A discount of 10.36% is available for this configuration based on payment for three years maintenance at time of purchase. This discount is applied to the balance after the 3-year term maintenance contract discount is applied.

Software Support Discount For Secondary Systems

This is a discount for multiple systems supported in a single I/S shop. The maintenance for secondary systems is heavily discounted and is available at 15% of the price of maintenance of a single system.

8.3 Statement of tpmC and Price/Performance

A statement of the measure tpmC, as well as the respective calculations for 3-year pricing, price/performance (price/tpmC), and the availability date must be disclosed.

The IBM @server iSeries 400 Model 840-2420 was measured at 152,346.25 tpmC with a 3-year system price of $6,782,752. The respective price-performance for the iSeries 400 Model 840-2420 is $44.52 per tpmC. The iSeries 400 Model 840-2420 priced configuration is currently orderable and deliverable.

8.3.1 IBM @server iSeries 400 Model 840-2420 Three Year System Price Configuration

IBM	IBM @server iSeries 400 Model 840-2420	TPC-C REV 5.0 EXECUTIVE SUMMARY Report Date: March 19, 2001

IBM iSeries 400 840-2420 Configuration

Item Description	Feature Number	Third Party Pricing	Unit Price	Quantity	Extended Price	Extended Maintenance	3-Year Price
Server Hardware:							
IBM iSeries 400 Model 840 24-way Base System Unit	9406-840		640,000	1	640,000	42,408	682,408
Processor - ISTAR 7S 500 Mhz 24-way, Cache 8x4 MB	2420		550,000	1	550,000	46,464	596,464
Interactive Card	1540		0	1	0		0
Battery Backup	Bundled			1	0		0
Twinax Work Station Controller (5540)	Bundled			1	0		0
200V 14ft Locking Power Cord	Bundled			1	0		0
Line Cord 200V 14 ft Locking for CEC	Bundled			1	0		0
6m HSL Cable - Base I/O Tower	1461		550	20	11,000		11,000
SPCN Cables - 6m SPCN Cable (1464)	Bundled			16	0		0
8192 MB (RIVER - 256 MB technology)	3196		147,456	16	2,359,296		2,359,296
Programmable Regulator (req'd with 3196)	2730		750	2	1,500		1,500
PCI Ultra Magnetic Media Controller	2749		1,300	1	1,300		1,300
PCI IOP with 64 MB memory	2843		1,925	22	42,350		42,350
17.6 GB 10K RPM Disk Unit	4318		2,520	769	1,937,880		1,937,880
CD-ROM	4425		415	1	415		415
PCI Two Line WAS IOA (ECS) req'd with 5540	4745		425	1	425		425
PCI Twinaxial IOA - Req'd with 5540	4746		750	1	750		750
PCI RAID Disk Unit Contorller with 26 MB wirte cache	4748		6,000	52	312,000		312,000
PCI 100/10 mbps Ethernet IOA	4838		900	20	18,000		18,000
PCI100/16/4 MBPS Token Ring IOA	2744		840	2	1,680		1,680
PCI Expansion Tower / Mantis	5074		17,900	17	304,300	141,168	445,468
PCI Expansion Tower	5101		9,000	18	162,000	178,848	340,848
25 GB 1/4-Inch Tape Drive	4486		5,000	1	5,000		5,000
V.24/EIA232 50ft PCI Cable - System Console	0367		125	1	125		125
Server Subtotal					6,348,021	408,888	6,756,909
Client Hardware:							
IBM iSeries 400 Model 270 Base System Unit	9406-270		4,000	1	4,000	2,208	6,208
Twinax Work Station Controller	Bundled			1	0		0
V.24/EIA 232 20ft PCI Cable for System Console	0348		125	1	125		125
125V 6 ft Line Cord	Bundled			1	0		0
System Expansion Tower - 200V 6ft Locking Cord	Bundled			1	0		0
6m HSL Cable - Base I/O Tower	1461		550	2	1,100		1,100
Processor Card	2252		16,000	1	16,000	3,912	19,912
PCI IOP with 32 MB memory	2842		1,800	3	5,400		5,400
Main Store - memory riser card - 16 slots	2884		2,200	1	2,200		2,200
512 MB DIMMS Main Storage	3025		2,048	16	32,768		32,768
8.6 GB 10K RPM Disk Unit	4317		1,400	6	8,400		8,400
CD-ROM	4525		415	1	415		415
4 GB 1/4-Inch Tape Drive	4582		1,300	1	1,300		1,300
PCI Expansion Tower	5075		6,000	1	6,000	2,928	8,928
PCI Two Line WAS IOA (ECS) req'd with 5540	4745		425	1	425		425
PCI Twinaxial IOA - Req'd with 5540	4746		750	1	750		750
PCI RAID Disk Unit Contorller with 26 MB wirte cache	4748		6,000	2	12,000		12,000
PCI 100/10 mbps Ethernet IOA	4838		900	3	2,700		2,700
Single Client Subtotal					93,583	9,048	102,631
Number of Clients				16			
Client Subtotal					1,497,328	144,768	1,642,096
Server Software:							
IBM Operating System/400 V4R5M0	Bundled			1	0	33,343	33,343
DB2 Query Manager Dev. Toolkit	QU1 and ST1		28,800	1	28,800		28,800
Client Software:							
IBM Operating System/400 V4R5M0	Bundled		0	16	0	251,313	251,313
BEA Tuxedo V6.4		1	3,000	16	48,000	33,120	81,120
ILE COBOL	5769CB1		2,400	1	2,400		2,400
Application Development Toolkit	5769PW1		3,020	1	3,020		3,020
DB2 Query Mgr and SQL Development kit	5769ST1		1,600	1	1,600		1,600
ILE C	5769CX2		2,400	1	2,400		2,400
Software Subtotal					86,220	317,776	403,996
3-year System Subtotal					7,931,569	871,432	8,803,001

Discounts:	%Allowance	Volume	Discount
Revenue Allowance	22	7,883,569	(1,734,385)
3-year Term Maintenance Contract Discount	3	553,656	(16,610)
3-year Maintenance Prepay Discount	10.36	537,046	(55,638)
Software Support Discount For Secondary Systems	85	251,313	(213,616)

	Purchase	Maintenance	Total
3-year System Total	6,197,184	585,568	6,782,752
tpmC			152346.25
$/tpmC			44.52

Note: All pricing is from IBM except items noted in the 3rd Party Pricing column. 1 - BEA Systems, Inc.;

Notes:
Server Hardware requires no charge RPQ 847109
Revenue Allowance is applied to hardware and software for the priced configuration.
3-Year Term Maintenance Contract Discount is given when 3-year contract is signed.
3-Year Maintenance Prepay Discount is given when 3-year maintenance costs are prepaid.
Software Support Discount For Secondary Systems is given for maintenance costs on Multiple systems in a single I/S shop.
Results audited by François Raab of InfoSizing Inc.

Three Year Cost of Ownership: $6,782,752

tpmC Rating: 152,346.25

$/tpmC: $44.52

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

9.0 Clause 8: Audit - Related Items

If the benchmark has been independently audited, then the auditor's name, address, phone number, and a brief audit summary report indicating compliance must be included in the Full Disclosure Report. A statement should be included, specifying when the complete audit report will become available and who to contact in order to obtain a copy.

These TPC Benchmark™ C results have been audited by François Raab of InfoSizing, Inc. The attestation letter is included at the end of this report.

Appendix A. System Parameters and User Profile

A.1 System Parameters

Table 4 shows the system parameters changed for these TPC-C measurements.

Table 4. iSeries 400 System Parameters

System Parameters	Modified value	Shipped value
QABNORMSW	1	0
QACTJOB	5000	20
QADLACTJ	1000	10
QADLTOTJ	1000	10
QASTLVL	*INTERMED	*BASIC
QAUTOVRT	500	0
QBASACTLVL	32767	6
QCMNRCYLMT	7 1	0 0
QCONSOLE	DSP01	QCONSOLE
QCTLSBSD	QSYS/QCTL	QSYS/QBASE
EDTRCYAP	*OFF	50
QHSTLOGSIZ	32767	5000
QINACTMSGQ	*DSCJOB	*ENDJOB
QJOBMSGQFL	*PRTWRAP	*NOWRAP
QJOBMSGQMX	64	16
QJOBMSGQSZ	16384	16
QJOBMSGQTL	16384	24
QJORECRA	17000000	50000
QLMTSECOFR	0	1
QMAXSIGN	5	3
QPFRADJ	0	2
QPWDEXPITV	186	*NOMAX
QPWDMAXLEN	10	8
QPWDRQDDGT	1	0
QPWDRQDDIF	5	0
QRCLSPLSTG	*NOMAX	8
QSECURITY	20	40
QTOTJOB	5000	30
QUTCOFFSET	-500	0

A.2 Transaction Subsystem Description

The memory on the system was divided into separate pools as shown below.

```
                        Work with Shared Pools Print Panel                    Page     1
5769SS1 V4R5M0  000526
    WILBER    06/15/00  15:24:40
 Main storage size (M)  . :      131072.00
              Defined      Max     Allocated    Pool   --Paging Option--
 Pool         Size (M)    Active   Size (M)      ID    Defined   Current   Text
 *MACHINE       7371.6    +++++       7371.6      1    *FIXED    *FIXED    Machine pool
 *BASE         37200.3    32767      37200.3      2    *FIXED    USRDFN    Base pool
 *SHRPOOL1     14900.0    32767      14900.0      3    *FIXED    USRDFN
 *SHRPOOL2     14900.0    32767      14900.0      4    *FIXED    USRDFN
 *SHRPOOL3     14900.0    32767      14900.0      5    *FIXED    USRDFN
 *SHRPOOL4     14900.0    32767      14900.0      6    *FIXED    USRDFN
 *SHRPOOL5      5000.0    32767       5000.0      7    *FIXED    USRDFN
 *SHRPOOL6     14900.0    32767      14900.0      8    *FIXED    USRDFN
 *SHRPOOL7      7000.0    32767       7000.0      9    *FIXED    USRDFN
                * * * * *   E N D   O F   L I S T I N G   * * * * *
```

Appendix B. Database File Definitions

B.1 AREFFIL: Reference File

```
A* OCO Source Materials
A* The Source code for this program is not published or otherwise
A* divested of its trade secrets, irrespective of what has been
A* deposited with the U.S. Copyright office
A* (C) Copyright IBM Corp. 1993, 1996, 1998

A*B:H2.AREFFIL:  Reference File
          R REFRCD                    TEXT('TPCC Reference File')
A*This file contains the field definition for most of the other
A*files used in the TPC-C benchmark.  For example to define the
A*warehouse ID field, both the warehouse file (WRHS) and the
A*district file (DSTRCT) reference WRHSID in this file.  This
A*helps when field definitions need to change, the change only
A*needs to be made in one place.
A*
A*UPDATED:10/23/93
A*Changes BALANC and CRDLMT to 12 digit fields as required
A*by the TPC-C V1.1 Specification
A*UPDATED:03/04/96
A*Changes BALANC and CRDLMT to 13 digit fields for effieiency.
A*Added ITMIMAGE perf v3.0 spec.  Converted many fields to binary.
A* wrhsid, distid, custid, itemid, ordid, oline, ytd2, qty2, qty4
A*UPDATED:03/31/98
A*
A*
A*Code Identifiers
A* Note Binary nubers are 4B for two byte shorts and 9B
A* for long integer 32 byte numbers  comforms to SQL defintions
A*
A            WRHSID         4B          TEXT('Warehouse ID')
A                                       COLHDG('W/H ID')
A            DISTID         4B          TEXT('District ID')
A                                       COLHDG('District')
A                                       EDTCDE(1)
A            CUSTID         9B          TEXT('Customer ID')
A                                       COLHDG('Customer')
A            ITEMID         9B          TEXT('Item ID')
A                                       COLHDG('Item')
A            ITMIMAGE       9B          TEXT('ImageID')
A                                       COLHDG('Image#')
A            ORDID          9B          TEXT('Order ID')
A                                       COLHDG('Order #')
A                                       EDTCDE(4)
A*                                      EDTWRD('        0')
A            OLINE          3P          TEXT('Order Line Number')
A                                       COLHDG('Order' 'Line #')
A*Name, Address and Descriptor Information
A            LOCNAM        10           TEXT('Name of W/H or District')
A                                       COLHDG('Location' 'Name')
A            FNAME         16           TEXT('First Name')
A                                       COLHDG('First' 'Name')
A            MINIT          2           TEXT('Middle Initial')
A                                       COLHDG('Middle' 'Init')
A            LNAME         16           TEXT('Last Name')
A                                       COLHDG('Last' 'Name')
A            ADDR1         20           TEXT('Address Line 1')
A                                       COLHDG('Address' 'Line 1')
A            ADDR2         20           TEXT('Address Line 2')
A                                       COLHDG('Address' 'Line 2')
A            CITY          20           TEXT('City')
A            STATE          2           TEXT('State')
A            ZIPCD          9A          TEXT('Zip Code')
A                                       COLHDG('Zip' 'Code')
A            PHONE         16           TEXT('Phone Number')
A* Item name change to 20 characters 3/31/98 Chuck  Kingsbury
A* VERSION4  ITMNAM        20           TEXT('Item Name')
A            ITMNAM        24           TEXT('Item Name')
A                                       COLHDG('Item' 'Name')
A            CARRID         2           TEXT('Carrier ID')
A                                       COLHDG('Carrier' 'Number')
A            LOCAL          1  0        TEXT('Flag to indicate local')
A*Financial and Inventory Numbers
A            TAX            5  4        TEXT('Tax Percentage')
A                                       EDTWRD('0.     ')
A            DSCNT          5  4        TEXT('Discount Percentage')
A                                       COLHDG('Discount')
A                                       EDTWRD('0.     ')
A            BALANC        13  2        TEXT('Balance Information')
A                                       COLHDG('Balance')
A                                       EDTWRD('         $0  .  -')
A            CREDIT         2           TEXT('Credit Status-GC or BC')
A                                       COLHDG('Credit' 'Status')
A            CRDLMT        13  2        TEXT('Credit Limit')
A                                       COLHDG('Credit' 'Limit')
A                                       EDTWRD('         $0  .  -')
A            AMOUNT7        7P 2        TEXT('Amount')
A                                       EDTWRD('  $0  .  -'  )
A            YTD           13  2        TEXT('YTD Amount')
A                                       EDTWRD('         $0  .  -'  )
A            YTD2           9B          TEXT('YTD Amount')
A                                       EDTCDE(4)
A            QTY2           3P 0        TEXT('Quantity')
A                                       COLHDG('Quantity')
A                                       EDTCDE(1)
A            QTY4           3P 0        TEXT('Quantity')
A                                       COLHDG('Quantity')
A                                       EDTCDE(1)
A            QTY3           3  0        TEXT('Quantity')
A                                       COLHDG('Quantity')
A                                       EDTCDE(1)
A            PRICE          5  2        TEXT('Price')
A                                       EDTWRD('$0  .  -')
A*Date and Time Information
A            TIMEDATE       8           TEXT('Internal Time Date')
A            DATE           8S          TEXT('Date')
A                                       EDTWRD('  -  -    ')
A            TIME           6S          TEXT('Time')
A                                       EDTWRD('  :  :  ')
A*Pad Information
A            CDATA        500           TEXT('Customer Data')
A                                       COLHDG('Cust' 'Filler')
A            HDATA         24           TEXT('History Information')
A                                       COLHDG('Hist' 'Filler')
A            IDATA         50           TEXT('Item Data')
A                                       COLHDG('Item' 'Filler')
A            DISTINFO      24           TEXT('Dist Info')
A                                       COLHDG('Dist' 'Info')
A*TPCC - Plus Information
A            CPHNTC        10           COLHDG('Phonetic Search')
A            DSPDID         2  0        TEXT('District ID')
A                                       COLHDG('District')
A                                       EDTCDE(4)
A            DSPOID         8  0        TEXT('Order ID')
A                                       COLHDG('Order #')
A                                       EDTCDE(4)
A            DSPOLN         2  0        TEXT('Order Line Number')
A                                       COLHDG('Order' 'Line #')
A            AMOUNT6        6  2        TEXT('Amount')
A                                       EDTWRD('$0   .  -')
A            DSPQTY        3S 0         TEXT('Quantity')
A                                       COLHDG('Quantity')
A            EDTCDE(1)
```

B.2 CSTMRLFCRT: Customer Logical File

```
A* CSTMRLFCR: Customer Logical File     Split  DB version
A*
A          R CSRCD                      PFILE(CSTMRPF01 CSTMRPF02)
A          K CWID
A          K CDID
A          K CLAST
A          K CFIRST
A          K CID
```

B.3 CSTMRLFNAM: Customer Names Logical File

```
A* CSTMRLFNA:  Customer File Names Logical File       SPLIT  DB version
A*
A          R CSRCD                      PFILE(CSTMRPF01 CSTMRPF02)
A          K CWID
A          K CDID
A          K CLAST
```

B.4 CSTMR: Customer Logical File

```
A* CSTMR:  Customer File          SPLIT  DB version
A*
A* This is the file definition for the customer data base file.
A* All fields that are stored in the customer file are defined
A* here, the actual field definitions are in AREFFIL (the
A* reference file) and are pulled into this file when it is
A* compiled (CRTPF command executed against this source).
A* The UNIQUE keyword guarantees that there will be not duplicate
A* key values inserted into the file.
A                                       UNIQUE
A          R CSRCD                      PFILE(CSTMRPF01 CSTMRPF02)
A                                       TEXT('CUSTOMER MASTER FILE - TPCC')
A          K CID
A          K CDID
A          K CWID
```

B.5 CSTMRPF: Customer Physical File

```
A*B:H2.CSTMRPF:  Customer File
A                                       REF(AREFFIL)
A* This is the file definition for the customer data base file.
A* All fields that are stored in the customer file are defined
A* here, the actual field definitions are in AREFFIL (the
A* reference file) and are pulled into this file when it is
A* compiled (CRTPF command executed against this source).
A*
A* NOTE: in COMMONTPCC H file is a #define for the record length.
A*       Changes in record length need to be updated in the H file also.
A*
A          R CSRCD                      TEXT('CUSTOMER MASTER FILE - TPCC')
A            CID      R                 REFFLD(CUSTID)
A            CDID     R                 REFFLD(DISTID)
A            CWID     R                 REFFLD(WRHSID)
A            CFIRST   R                 REFFLD(FNAME)
A            CINIT    R                 REFFLD(MINIT)
A            CLAST    R                 REFFLD(LNAME)
A            CLTOD    R                 REFFLD(TIMEDATE)
A                                       COLHDG('Date of' 'Last Order')
A                                       TEXT('Date of DB Build')
A            CADDR1   R                 REFFLD(ADDR1)
A            CCREDT   R                 REFFLD(CREDIT)
A                                       COLHDG('Credit' 'Status')
A                                       TEXT('Credit Status')
A            CADDR2   R                 REFFLD(ADDR2)
A            CDCT     R                 REFFLD(DSCNT)
A            CCITY    R                 REFFLD(CITY)
A            CSTATE   R                 REFFLD(STATE)
A            CZIP     R                 REFFLD(ZIPCD)
A            CPHONE   R                 REFFLD(PHONE)
A            CBAL     R                 REFFLD(BALANC)
A                                       TEXT('Customer Balance')
A            CCRDLM   R                 REFFLD(CRDLMT)
A                                       TEXT('Credit Limit')
A            CYTD     R                 REFFLD(YTD)
A                                       TEXT('Customer YTD')
A            CPAYCNT  R                 REFFLD(QTY4)
A                                       TEXT('Customer Payments')
A            CDELCNT  R                 REFFLD(QTY4)
A                                       TEXT('Customer Deliveries')
A*           CLTIME   R                 REFFLD(TIME)
A*                                      COLHDG('Time of' 'Last Order')
A*                                      TEXT('Time of DB Build')
A            CDATA    R
```

B.6 DSTRCTLF: District Logical File

```
A* DSTRCTLF:  District File  (SPLIT  DB version)
A*
          R DSRCD                      PFILE(DSTRCT01 DSTRCT02)
          K DID
          K DWID
```

B.7 DSTRCT: District Physical File

```
A*B:H2.DSTRCT:  District File
                                        REF(AREFFIL)
A*This is the file definition for the district data base file.
A*All fields that are stored in the district file are defined
A*here, the actual field definitions are in AREFFIL (the
A*reference file) and are pulled into this file when it is
A*compiled (CRTPF command executed against this source).
A*The UNIQUE keyword guarantees that there will be not duplicate
A*key values inserted into the file.
A*
A                                       UNIQUE
A          R DSRCD                      TEXT('District Master File - TPCC')
A            DID       R                REFFLD(DISTID)
A            DWID      R                REFFLD(WRHSID)
A            DNAME     R                REFFLD(LOCNAM)
A                                       COLHDG('District' 'Name')
A            DADDR1    R                REFFLD(ADDR1)
A            DADDR2    R                REFFLD(ADDR2)
A            DCITY     R                REFFLD(CITY)
A            DSTATE    R                REFFLD(STATE)
A            DZIP      R                REFFLD(ZIPCD)
A            DTAX      R                REFFLD(TAX)
A            DYTD      R                REFFLD(YTD)
A                                       COLHDG('YTD' 'Balance')
A                                       TEXT('YTD Balance')
A            DNXTOR    R                REFFLD(ORDID)
A                                       COLHDG('Next' 'Order #')
A                                       TEXT('Next Order Number')
A          K DID
A          K DWID
```

B.8 HSTRY: History Logical File

```
A* HSTRYLF:  History file  (SPLIT  DB version)
A*
A          R HSRCD                      PFILE(HSTRY01 HSTRY02)
A          K HDID
A          K HWID
A          K HCID
```

B.9 HSTRYLF: History Logical File

```
A*B:H2.HSTRY:  History File
                                        REF(AREFFIL)
A          R HSRCD                      TEXT('History File for TPCC')
A*This is the file definition for the history data base file.
A*All fields that are stored in the history file are defined
A*here, the actual field definitions are in AREFFIL (the
A*reference file) and are pulled into this file when it is
A*compiled (CRTPF command executed against this source).
A*The UNIQUE keyword is not needed in this file because there
A*are no key fields for this file.
A*
A            HDID      R                REFFLD(DISTID)
A            HWID      R                REFFLD(WRHSID)
A            HCID      R                REFFLD(CUSTID)
A            HCDID     R                REFFLD(DISTID)
A            HCWID     R                REFFLD(WRHSID)
A            HTOD      R                REFFLD(TIMEDATE)
A                                       COLHDG('Payment' 'Time Date')
A*           HTIME     R                REFFLD(TIME)
A*                                      COLHDG('Payment' 'Time')
A            HAMT      R                REFFLD(AMOUNT7)
A                                       COLHDG('Payment' 'Amount')
A                                       TEXT('Payment Amount')
A            HDATA     R                REFFLD(HDATA)
```

B.10 ITEM: Item Physical File

```
A*B:H2.ITEM:  Item File
A                                       REF(AREFFIL)
A*This is the file definition for the item data base file.
A*All fields that are stored in the item file are defined
A*here, the actual field definitions are in AREFFIL (the
A*reference file) and are pulled into this file when it is
A*compiled (CRTPF command executed against this source).
A*The UNIQUE keyword guarantees that there will be not duplicate
A*key values inserted into the file.
A*
A                                       UNIQUE
A          R ITRCD                      TEXT('Item File for TPCC')
A            IID       R                REFFLD(ITEMID)
A            IMAGEID   R                REFFLD(ITMIMAGE)
A            INAME     R                REFFLD(ITMNAM)
A            IPRICE    R                REFFLD(PRICE)
A            IDATA     R
A          K IID
```

B.11 NEWORD: New Order Logical File

```
A* NEWORD:  New Order File              Spilt  DB version
A*
A* This is the file definition for the new order data base file.
A* All fields that are stored in the new order file are defined
A* here, the actual field definitions are in AREFFIL (the
A* reference file) and are pulled into this file when it is
A* compiled (CRTPF command executed against this source).
A* The UNIQUE keyword guarantees that there will not be duplicate
A* key values inserted into the file.
A                                       UNIQUE
A          R NORCD                      PFILE(NEWORDPF01 NEWORDPF02)
                                        TEXT('New Orders File - TPCC')
A          K NOWID
A          K NODID
A          K NOOID
```

B.12 NEWORDLF: New Order Logical File

```
A* NEWORDLF:  New Order File Logical file    Spilt  DB version
A*
A          R NORCD                      PFILE(NEWORDPF01 NEWORDPF02)
A          K NOWID
A          K NODID
```

B.13 NEWORDPF: New Order Physical File

```
A*B:H2.NEWORDPF:  New Order File
                                        REF(AREFFIL)
A*This is the file definition for the new order data base file.
A*All fields that are stored in the new order file are defined
A*here, the actual field definitions are in AREFFIL (the
A*reference file) and are pulled into this file when it is
A*compiled (CRTPF command executed against this source).
A          R NORCD                      TEXT('New Orders File - TPCC')
A            NOOID     R                REFFLD(ORDID)
A            NODID     R                REFFLD(DISTID)
A            NOWID     R                REFFLD(WRHSID)
```

B.14 ORDERS: Orders Logical File

```
A* ORDERS:  Orders File          Split  DB
A*
A* This is the file definition for the orders data base file.
A* All fields that are stored in the orders file are defined
A* here, the actual field definitions are in AREFFIL (the
A* reference file) and are pulled into this file when it is
A* compiled (CRTPF command executed against this source).
A*
A          R ORRCD                      PFILE(ORDERSPF01 ORDERSPF02)
A            OWID
A            ODID
A            OCID                       EDTWRD('0        ')
A            OID
A            OENTTOD
A*           OENTTM
A            OCARID
A            OLINES
A            OLOCAL
A          K OWID
A          K ODID
A          K OCID
A          K OID
```

B.15 ORDERSLF: Orders Logical File

```
A* ORDERSLF:  Orders Logical file  (Split  DB version)
A*
A                                       UNIQUE
A          R ORRCD                      PFILE(ORDERSPF01 ORDERSPF02)
A          K OWID
A          K ODID
A          K OID
```

B.16 ORDERSPF: Orders Physical File

```
A*B:H2.ORDERSPF:  Orders File
                                        REF(AREFFIL)
A*This is the file definition for the orders data base file.
A*All fields that are stored in the orders file are defined
A*here, the actual field definitions are in AREFFIL (the
A*reference file) and are pulled into this file when it is
A*compiled (CRTPF command executed against this source).
A          R ORRCD                      TEXT('Orders Master File for TPCC')
A            OWID      R                REFFLD(WRHSID)
A            ODID      R                REFFLD(DISTID)
A            OCID      R                REFFLD(CUSTID)
A            OID       R                REFFLD(ORDID)
A            OENTTOD   R                REFFLD(TIMEDATE)
A                                       COLHDG('Order' 'Date')
A                                       TEXT('Order Entry Time Date')
A*           OENTTM    R                REFFLD(TIME)
A*                                      COLHDG('Order' 'Time')
A*                                      TEXT('Order Entry Time')
A            OCARID    R                REFFLD(CARRID)
A            OLINES    R                REFFLD(OLINE)
A                                       COLHDG('Number of' 'Order Lines')
A                                       TEXT('Number of Lines in Order')
A            OLOCAL    R                REFFLD(LOCAL)
A                                       TEXT('Flag to indicate local order')
```

B.17 ORDLIN: Order Lines Logical File

```
A* ORDLIN:  Order Lines file         (SPLIT  DB)
A*
A                                       UNIQUE
A          R OLRCD                      TEXT('Order Line File for TPCC')
A                                       PFILE(ORDLINPF01 ORDLINPF02)
A          K OLWID
A          K OLDID
A          K OLOID
A          K OLNBR
```

B.18 ORDLINLF: Order Lines Logical File

```
A* ORDLINLF:  Order Lines logical file     (SPLIT  DB)
A*
A          R OLRCD                      PFILE(ORDLINPF01 ORDLINPF02)
A          K OLWID
A          K OLDID
A          K OLOID
```

B.19 ORDLINPF: Order Lines Physical File

```
A*B:H2.ORDLINPF:  Order Lines File
A                                       REF(AREFFIL)
A          R OLRCD                      TEXT('Order Line File for TPCC')
A            OLOID     R                REFFLD(ORDID)
A            OLDID     R                REFFLD(DISTID)
A                                       TEXT('Customers District')
A            OLWID     R                REFFLD(WRHSID)
A                                       COLHDG('Customers' 'Warehouse')
A                                       TEXT('Customers Warehouse')
A            OLNBR     R                REFFLD(OLINE)
A                                       TEXT('Line Number of Order')
A            OLSPWH    R                REFFLD(WRHSID)
A                                       COLHDG('Supply' 'Warehouse')
A                                       TEXT('Supply Warehouse ID')
A            OLIID     R                REFFLD(ITEMID)
A                                       TEXT('Item Ordered')
A            OLQTY     R                REFFLD(QTY2)
A                                       COLHDG('Qty' 'Ordered')
A                                       TEXT('Quantity Ordered')
A            OLAMNT    R                REFFLD(AMOUNT7)
A                                       TEXT('Order Line Amount')
A            OLDLVTOD  R                REFFLD(TIMEDATE)
A                                       COLHDG('Delivery' 'Time Date')
A                                       TEXT('Delivery Time Date')
A*           OLDLVT    R                REFFLD(TIME)
A*                                      COLHDG('Delivery' 'Time')
A*                                      TEXT('Delivery Time')
A            OLDSTI    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Information')
```

B.20 STOCK: Stock Logical File

```
A* STOCK:  Stock File       (SPLIT  DB version)
A*
A                                      UNIQUE
A          R STRCD                      PFILE(STOCKPF01 STOCKPF02)
A          K STIID
A          K STWID
```

B.21 STOCKPF: Stock Logical File

```
A*B:H2.STOCKPF:  Stock File
A*
A* NOTE: in COMMONTPCC H file is a #define for the record length.
A*       Changes in record length need to be updated in the H file also.
A*
A                                       REF(AREFFIL)
A          R STRCD                      TEXT('Stock File for TPCC')
A            STWID     R                REFFLD(WRHSID)
A            STIID     R                REFFLD(ITEMID)
A                                       TEXT('Warhouse Nbr of Stock Item')
A            STQTY     R                REFFLD(QTY4)
A                                       COLHDG('Qty in' 'Stock')
A                                       TEXT('Quantity on hand')
A            STDI01    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 1')
A            STDI02    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 2')
A            STDI03    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 3')
A            STDI04    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 4')
A            STDI05    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 5')
A            STDI06    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 6')
A            STDI07    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 7')
A            STDI08    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 8')
A            STDI09    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 9')
A            STDI10    R                REFFLD(DISTINFO)
A                                       TEXT('Dist Info 10')
A            STYTD     R                REFFLD(YTD2)
A                                       TEXT('Qty ordered YTD')
A            STORDRS   R                REFFLD(QTY4)
A                                       TEXT('# times ordered')
A            STREMORD  R                REFFLD(QTY4)
A                                       TEXT('# times ordered remotely')
A            STDATA    R                REFFLD(IDATA)
```

B.22 WRHSLF: Warehouse Logical File

```
A* WRHSLF:  Warehouses logical file  (Split  DB version)
           R WRRCD                      PFILE(WRHS01 WRHS02)
           K WID
```

B.23 WRHS: Warehouse Physical File

```
A*B:H2.WRHSPF:  Warehouse File
                                        REF(AREFFIL)
A                                      UNIQUE
A          R WRRCD                      TEXT('Warehouse Master File - TPCC')
A            WID       R                REFFLD(WRHSID)
A            WNAME     R                REFFLD(LOCNAM)
A                                       COLHDG('W/H' 'Name')
A            WADDR1    R                REFFLD(ADDR1)
A            WADDR2    R                REFFLD(ADDR2)
A            WCITY     R                REFFLD(CITY)
A            WSTATE    R                REFFLD(STATE)
A            WZIP      R                REFFLD(ZIPCD)
A            WTAX      R                REFFLD(TAX)
A            WYTD      R                REFFLD(YTD)
A                                       COLHDG('YTD' 'Balance')
A                                       TEXT('Warehouse YTD Balance')
A          K WID
```

Appendix C. Database Build Programs

Program Flow For Build of Server, Client, and Database

This list shows the order of invocation of the database build programs. Each level of indentation is a call. If a program is indented more than the previous program, it was called by the previous program. If it is at the same margin as the previous program (or as earlier program), it was called by the same program as the previous (or earlier) program. To make determining the level of call easier, the level number will follow the program enclosed in parenthesis.

```
CRTTPCCDB(1)
CRTDBDTA(1)
CHKWHSPACE (1)
FILLPARTS (1)
        CRTBLDSPCE (2)
                TPCCSPACE(3)
        CRTSTOCKLF (2)
        CSTMRVIEW (2)
        CRTHASH (2)
        CRTORDFILE (2)
                MASTORD (3)
                        FILLORD(4)
        FILCUSFILE (2)
                MASTCUSSTK (3)
                        FILLCUS (4)
        FILSTKFILE (2)
                MASTCUSSTK (3)
                        FILLSTOCK (4)
        CRTHISFILE (2)
                        FILLHIST (4)
        CRTITEM (2)
                        FILLITEM (4)
        CRTWHFILE (2)
                        FILLWH (4)
        CRTDIST (2)
                        FILLDIST (4)
        CRTDBIX (2)
                CHKIXSPACE (3)
                CRT2VIEW (3)
        CRTINDEX (2)
                CRTHSTRYLF (3)
                CRT1VIEW (3)
COMMON (1)
COMMONTPCC (1)
CRTTPCCJRN (1)
STRTPCCJRN (1)
```

C.1 CHKIXSPACE.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* FILE: CHKWHSPACE                                                */
/*                                                                 */
/* PURPOSE: Check if there is enough space available.              */
/*                                                                 */
/*-----------------------------------------------------------------*/

  #include <stdlib.h>               /* Has atoi() prototype.       */
  #include <os4msg.h>
  #include <commontool.h>           /* Has get_ASP_stg() prototype. */
  #include <decimal.h>

  #define NUMWH_PARM   1
  #define ASP_PARM     2
  #define IX_PARM      3

  #define ORDLIN     '1'
  #define CSTMRLFCRT '2'
  #define STOCK      '3'
  #define ORDERS     '4'
  #define ORDERSLF   '5'
  #define CSTMR      '6'
  #define NEWORD     '7'

  #define ORDLIN_SIZE_MB      771.214
  #define STOCK_SIZE_MB       319.083
  #define CSTMRLFCRT_SIZE_MB  204.235
  #define ORDERS_SIZE_MB       98.456
  #define CSTMR_SIZE_MB        93.002
  #define ORDERSLF_SIZE_MB     87.032
  #define NEWORD_SIZE_MB       17.276

  #define STOCKPF_SIZE_MB    3070.027
  #define CSTMRPF_SIZE_MB    2004.044
  #define ORDERSPF_SIZE_MB     93.605


/*-----------------------------------------------------------------*/
/*                                                                 */
/* Procedure: main                                                 */
/*                                                                 */
/*-----------------------------------------------------------------*/
int main(int argc, char ** argv)
{
   int  aspid;
   int  num_whs;

   decimal(19,3)  size_needed_GB, ix_size_GB, PF_size_GB;
   decimal(9,2)   num_whs_100;
   unsigned long  bytes_avail_MB, bytes_cap_MB;
   decimal(19,3)  bytes_avail_GB, bytes_cap_GB;

   char  msgtxt[130] = "Not enough space for parallel index build. ";
   char  index[11] = "\0";
   char  temp[7] = "\0";
   /*--------------------------------------------------------------*/
   /* setup addressability to TPCCBUILD user space                 */
   /*--------------------------------------------------------------*/

   aspid   = atoi(argv[ASP_PARM]);
   memcpy(temp,argv[NUMWH_PARM],6);   /* copy warehouse count field   */
   num_whs = atoi(temp);              /* Convert count to binary      */

   /*--------------------------------------------------------------*/
   /* Get ASP capacity and space available in GB (1,000,000)       */
   /*--------------------------------------------------------------*/
   if (0 != get_ASP_stg(aspid, &bytes_avail_MB, &bytes_cap_MB))
   {
      QsendMsg(IBM_MSG_FILE, "CPF9897", "CHKIXSPACE program failed!",
               ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }
   bytes_avail_GB =(decimal(19,3)) bytes_avail_MB/1000 + .0005;
   bytes_cap_GB   = (decimal(19,3)) bytes_cap_MB/1000 + .0005;

   /*--------------------------------------------------------------*/
   /* Total size needed for parallel index build                   */
   /*      size needed = index size * 5                            */
   /*--------------------------------------------------------------*/
   PF_size_GB = 0.0;                  /* initalize file size field    */
   num_whs_100 = num_whs;             /* get warehouse count          */
   num_whs_100  = num_whs_100/100;    /* Number of 100 warehouse sets */
   switch (argv[IX_PARM][0])
   {
     case ORDLIN:                     /* ORDLIN     index             */
      ix_size_GB = (num_whs_100 * ORDLIN_SIZE_MB + .0005)/1000 +.0005;
      PF_size_GB = (num_whs_100 * STOCKPF_SIZE_MB + .0005)/1000 +.0005;
      memcpy(index,"ORDLIN",6);
     break;
     case CSTMRLFCRT:                 /* CSTMRLFCRT index             */
      ix_size_GB = (num_whs_100 * CSTMRLFCRT_SIZE_MB + .0005)/1000 +.0005;
      PF_size_GB = (num_whs_100 * ORDERSPF_SIZE_MB + .0005)/1000 +.0005;
      memcpy(index,"CSTMRLFCRT",10);
     break;
     case STOCK:                      /* STOCK      index             */
      ix_size_GB = (num_whs_100 * STOCK_SIZE_MB + .0005)/1000 +.0005;
      PF_size_GB = (num_whs_100 * CSTMRPF_SIZE_MB + .0005)/1000 +.0005;
      memcpy(index,"STOCK",5);
     break;
     case ORDERS:                     /* ORDERS     index             */
      ix_size_GB = (num_whs_100 * ORDERS_SIZE_MB + .0005)/1000 +.0005;
      memcpy(index,"ORDERS",6);
     break;
     case ORDERSLF:                   /* ORDERSLF   index             */
      ix_size_GB = (num_whs_100 * ORDERSLF_SIZE_MB + .0005)/1000 +.0005;
      memcpy(index,"ORDERSLF",8);
     break;
     case CSTMR:                      /* CSTMR      index             */
      ix_size_GB = (num_whs_100 * CSTMR_SIZE_MB + .0005)/1000 +.0005;
      memcpy(index,"CSTMR",5);
     break;
     case NEWORD:                     /* NEWORD     index             */
      ix_size_GB = (num_whs_100 * NEWORD_SIZE_MB + .0005)/1000 +.0005;
      memcpy(index,"NEWORD",6);
     break;
   }
      size_needed_GB = ix_size_GB * 5;
      /*
    printf("Space required for next file load of %D(19,3)GB\n", PF_size_GB);
      */

   if (bytes_avail_GB < size_needed_GB)
   {
      sprintf(msgtxt + 43,
"ASP %d capacity: %D(19,3)GB, available space: %D(19,3)GB, %s size: %D(19,3)GB,\
 Required space: %D(19,3)GB",
      aspid, bytes_cap_GB, bytes_avail_GB, index, ix_size_GB, size_needed_GB);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt,ESCAPE_MSG,CS_CTLBDY,1);
      return(-1);
   }
   else
   {
      /*****************************************************/
      /* Enough storage for loading DB into this ASP.       */
      /*****************************************************/
      memcpy(msgtxt,"Space available for parallel index build.  ",43);
            sprintf(msgtxt + 43,
"ASP %d capacity: %D(19,3)GB, available space: %D(19,3)GB, %s size: %D(19,3)GB,\
 Required space: %D(19,3)GB",
      aspid, bytes_cap_GB, bytes_avail_GB, index, ix_size_GB, size_needed_GB);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, CS_CTLBDY, 1);
      if (bytes_avail_GB > (size_needed_GB + PF_size_GB))
      {
         size_needed_GB = size_needed_GB + PF_size_GB;
         /*
    printf("Space needed %D(19,3)GB for index and file\n", size_needed_GB);
         */
      }
   }

   return(0);

} /* End: main() */
```

C.2 CHKWHSPACE.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* FILE: CHKWHSPACE                                                */
/*                                                                 */
/* PURPOSE: Check if there is enough space available.              */
/*                                                                 */
/*-----------------------------------------------------------------*/

  #include <stdlib.h>               /* Has atoi() prototype.       */
  #include <os4msg.h>
  #include <commontool.h>           /* Has get_ASP_stg() prototype. */
  #include <decimal.h>

  #define NUMWH_PARM   1
  #define ASP_PARM     2

  #define FILE_SIZE_MB   73.453
  /* INDEX_SIZE_MB modified for 2way split - was 13.815             */
  #define INDEX_SIZE_MB  15.903


/*-----------------------------------------------------------------*/
/*                                                                 */
/* Procedure: main                                                 */
/*                                                                 */
/*-----------------------------------------------------------------*/
int main(int argc, char ** argv)
{
   int  aspid;
   int  num_whs;

   decimal(19,3)  size_needed_MB, size_needed_GB, size_needed;
   unsigned long  bytes_avail_MB, bytes_cap_MB;
   decimal(19,3)  bytes_avail_GB, bytes_cap_GB;

   char  msgtxt[130] = "Not enough space to build TPCC Database. ";

   /*--------------------------------------------------------------*/
   aspid   = atoi(argv[ASP_PARM]);
   num_whs = atoi(argv[NUMWH_PARM]);

   /*--------------------------------------------------------------*/
   /* Get ASP capacity and space available in GB (1,000,000)       */
   /*--------------------------------------------------------------*/
   if (0 != get_ASP_stg(aspid, &bytes_avail_MB, &bytes_cap_MB))
   {
      QsendMsg(IBM_MSG_FILE, "CPF9897", "CHKWHSPACE program failed!",
               ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }
   bytes_avail_GB =(decimal(19,3)) bytes_avail_MB/1000 + .0005;
   bytes_cap_GB   = (decimal(19,3)) bytes_cap_MB/1000 + .0005;

   /*--------------------------------------------------------------*/
   /* Total size needed = table size + index size.                 */
   /*--------------------------------------------------------------*/
   size_needed_MB = num_whs * (FILE_SIZE_MB + INDEX_SIZE_MB + .0005);
   size_needed_GB = size_needed_MB/1000 + .0005;

   if (bytes_avail_GB < size_needed_GB)
   {
      sprintf(msgtxt + 41,
"ASP %d capacity: %D(19,3)GB, available space: %D(19,3)GB, DB size: %D(19,3)GB",
      aspid, bytes_cap_GB, bytes_avail_GB, size_needed_GB);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt,ESCAPE_MSG,CS_CTLBDY,1);
      return(-1);
   }
   else
   {
      /*****************************************************/
      /* Enough storage for loading DB into this ASP.       */
      /*****************************************************/
      memcpy(msgtxt,"Space available for TPCC database build. ",41);
            sprintf(msgtxt + 41,
"ASP %d capacity: %D(19,3)GB, available space: %D(19,3)GB, DB size: %D(19,3)GB",
      aspid, bytes_cap_GB, bytes_avail_GB, size_needed_GB);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, CS_CTLBDY, 1);
   }

   return(0);

} /* End: main() */
```

C.3 COMMON.C:

```
#define _COMMON_C
#include <Common.h>

/* Establish a listening port */
int Listen(int port) {
  struct sockaddr_in    sin;
  int                   sd, on=1;

  /* Get a socket descriptor */
  if ((sd=socket(AF_INET,SOCK_STREAM,0))<0)  {
    perror("socket() failed");
    exit(-1);
  }

  /* Allow socket descriptor to be reuseable */
  if (setsockopt(
                 sd,
                 SOL_SOCKET,
                 SO_REUSEADDR,
                 (char *)&on,
                 sizeof(on)
                 )<0) {
    perror("setsockopt() failed");
    close(sd);
    exit(-1);
  }

  /* bind to an address */
  memset(&sin, 0x00, sizeof(struct sockaddr_in));
  sin.sin_family        =AF_INET;
  sin.sin_port          =htons(port);
  sin.sin_addr.s_addr   =htonl(INADDR_ANY);

  if(bind(sd,(struct sockaddr *)&sin,sizeof(sin))<0)  {
    perror("bind() failed");
    close(sd);
    exit(-1);
  }

  if(listen(sd,500)<0)  {
    perror("listen() failed");
    close(sd);
    exit(-1);
  }
```

```
  return sd;
}

/* bind to a port and address  */
/* returns the socket desciptor */
int Bind(int ipAddr, int port) {
  struct sockaddr_in    sin;
  int                   sd, on=1;

  /* Get a socket descriptor */
  if ((sd=socket(AF_INET,SOCK_STREAM,0))<0)  {
    perror("socket() failed");
    exit(-1);
  }

  /* Allow socket descriptor to be  reuseable */
  if (setsockopt(
                 sd,
                 SOL_SOCKET,
                 SO_REUSEADDR,
                 (char *)&on,
                 sizeof(on)
                 )<0) {
    perror("setsockopt() failed");
    close(sd);
    exit(-1);
  }

  /* bind to an address */
  memset(&sin, 0x00, sizeof(struct sockaddr_in));
  sin.sin_family        =AF_INET;
  sin.sin_port          =htons(port);
  sin.sin_addr.s_addr   =htonl(ipAddr);

  if(bind(sd,(struct sockaddr *)&sin,sizeof(sin))<0)  {
    perror("bind() failed");
    close(sd);
    exit(-1);
   }

   return sd;
 }


/* Establish connection to specified address  */
int Connect(int ipAddr, int port) {
  struct sockaddr_in    sin;
  int                   sd;

  /* Get a socket descriptor */
  if ((sd=socket(AF_INET,SOCK_STREAM,0))<0)  {
    perror("socket() failed");
    exit(-1);
  }

  memset(&sin, 0x00, sizeof(struct sockaddr_in));
  sin.sin_family        =AF_INET;
  sin.sin_port          =htons(port);
  sin.sin_addr.s_addr   =htonl(ipAddr);

  if(connect(sd,(struct sockaddr *)&sin,sizeof(sin))<0)  {
    perror("connect() failed");
    close(sd);
    exit(-1);
  }

  return sd;
}
#ifdef SEMAPHORE
int CreateSemaphore(Semaphore_t *s, unsigned int count) {
  _Mutex_Create_T       attr;
  int                   rc;

  s->xCount=count;
  memset(&attr,0,sizeof(attr));
  attr.Mutex_Type=_Shared;
  attr.Name_Option=_Not_Named;
  attr.Keep_Valid=_MUTEX_DESTROY_MUTEX;
  attr.Recursive_Option=_MUTEX_NO_RECURSION;

  memset(&s->xTemplate,0,sizeof(s->xTemplate));

  if((rc=_CRTMTX(&s->xMutex,&attr))>=0)
    if((rc=msgget(IPC_PRIVATE,S_IRUSR|S_IWUSR|S_IROTH|S_IWOTH))>=0)  {
      s->xSleep=rc;
      rc=0;
    }

  return rc;
}

void WaitSemaphore(Semaphore_t *s) {
  int myCount, msg;

  _LOCKMTX(&s->xMutex,&s->xTemplate);
  myCount=--s->xCount;
  _UNLKMTX(&s->xMutex);

  /* Need to await the count? */
  if(s->xCount<0)
    msgrcv(s->xSleep,&msg,0,0,0);
}

void SignalSemaphore(Semaphore_t *s) {
  _LOCKMTX(&s->xMutex,&s->xTemplate);

  if(s->xCount<0) {
    int msg=1;

    msgsnd(s->xSleep,&msg,0,0);
  }

  ++s->xCount;

  _UNLKMTX(&s->xMutex);
}

void DestroySemaphore(Semaphore_t *s) {
  _Mutex_Destroy_Opt_T  mDo=_Destroy;

  _DESMTX(&s->xMutex,&mDo);
}
#endif
```

C.4 COMMON.H:

```
#ifndef _COMMON_H
#define _COMMON_H

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <spawn.h>
#include <qp0z1170.h>
#include <sys/shm.h>
#include <sys/stat.h>
#include <sys/wait.h>
#include <mih/mattod>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <sys/msg.h>
 #include <netinet/in.h>
 #include <errno.h>
 #include <unistd.h>
 #include <iconv.h>
 #include <sys/uio.h>
 #include <decimal.h>
 #ifdef SEMAPHORE
 typedef struct Semaphore {
   _Mutex_T      xMutex;
   _Mutex_Lock_T xTemplate;
   int           xCount, xSleep;
 } Semaphore_t;
 #endif
 #define BufferSize 3078


 extern int Listen(int port);
 extern int Connect(int ipAddr, int port);
 extern int Bind(int ipAddr, int port);

 #endif /* _COMMON_H */
```

C.5 COMMONTOOL.H:

```
#ifndef _COMMONTOOL_H
  #define _COMMONTOOL_H

/*********************************************************************/
/*                                                                   */
/* Header File Name: COMMONTOOL                                      */
/*                                                                   */
/* Description: Miscellaneous functions.                             */
/*                                                                   */
/*********************************************************************/

  #include <stdio.h>                      /* FILE declare. */
  #include <qsysinc/mih/matrmd>

  /*-------------------------------------------------------------------*/
  /* Local declares.                                                   */
  /*-------------------------------------------------------------------*/
  typedef struct ASP_info {
                short ASP_num;       /*  number of the ASP              */
                int   num_megabytes; /*  number of "megabytes" in ASP.  */
  } ASP_info;


  #define MEG_BYTES 1000000         /* 1,000,000 bytes of DASD        */
                                    /* Not 1,048,576 (1024*1024)      */

/*-------------------------------------------------------------------*/
/*                                                                   */
/* NAME: get_ASP_info                                                */
/*                                                                   */
/* Purpose: Gets the size available in an ASP.                       */
/*                                                                   */
/*-------------------------------------------------------------------*/
 int get_ASP_info(int last_ASP, ASP_info *data);
 int mat_ASP(_MATRMD_Template_T **mdata, int aspid);
 int get_ASP_stg(int aspid, unsigned long *bytes_avail_MB,
                            unsigned long  *bytes_cap_MB);

/*-------------------------------------------------------------------*/
/*                                                                   */
/* NAME: clientGet                                                   */
/*                                                                   */
/* Purpose: Get the client info.                                     */
/*-------------------------------------------------------------------*/
int clientGet(char *serv400, char *client, char *clientLib, char *serverLib,
              char *dbLib,   char *clientSys);

/* --------------------> End of COMMONTOOL.H <----------------------  */
#endif  /* if _COMMONTOOL_H */
```

C.6 COMMONTPCC.C:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* File name: COMMONTPCC                                             */
/*                                                                   */
/* Purpose: common functions                                         */
/*                                                                   */
/*-------------------------------------------------------------------*/

  /*-----------------------------------------------------------------*/
  /* Start include files.                                            */
  /*-----------------------------------------------------------------*/
  #include <stdlib.h>
  #include <stdio.h>
  #include <string.h>
  #include <QSYSINC/MIH/MATTOD>
  #include <QSYSINC/MIH/MIDTTM>
  #include <qp0z1170.h>
  #include <mih/cpybytes.h>
  #include <commontpcc.h>
  #include <tpccspace.h>
  #include <os4wait.h>
  #include <os4msg.h>

  /*---------------------------------------------------------------*/
  /* Spawn declares                                                */
  /*---------------------------------------------------------------*/
  #include <spawn.h>
  #include <sys/stat.h>
  #include <qp0wpid.h>
  #include <errno.h>
  #include <unistd.h>        /* Has unlink()  */


/*********************************************************************/
/*                                                                   */
/* Function: CreateCust_lastname                                     */
/*                                                                   */
/*      Build cust last name from predefined syllables.              */
/*                                                                   */
/* PARMS: num => num used to build last name                         */
/*        nameStr => address to store last name                      */
/*                                                                   */
/*********************************************************************/
void CreateCust_lastname(int num, char *nameStr)
{
  static char *sylble[] = {
                           "BAR", "OUGHT", "ABLE",  "PRI", "PRES",
                           "ESE", "ANTI", "CALLY", "ATION", "EING"};

  strcpy(nameStr, sylble[num/100]);
  strcat(nameStr, sylble[(num/10)%10]);
  strcat(nameStr, sylble[(num%10)]);
  return;

} /* end of CreateCust_lastname(() */


/*********************************************************************/
/*                                                                   */
/* Function: CreateStr                                               */
/*                                                                   */
/*      Create string of random alphanumeric characters.             */
/*                                                                   */
/* PARMS: min => minimum length of string                            */
/*        max => maximum length of string                            */
/*        newStr => address to store created string                  */
/*                                                                   */
/*  If string is not variable length, then set  iMin and iMax to     */
/*  the actual fixed length.                                         */
```

```
/*******************************************************************/
void CreateStr(int min, int max, char *newStr)
{
   int  i, newlen;
   char Alpha[63] =
          "abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789";

   /*----------------------------------------------------------------*/
   newlen = RANDOM(min, max);       /* Determine new string length. */
   for (i=0; i < newlen; i++)
   {
      newStr[i] = Alpha[(RANDOM(0,61))];
   }
   newStr[newlen] = ' ';
   return;

} /* end of CreateStr() */


/*******************************************************************/
/*                                                                 */
/* Function: CreateStrPAD                                          */
/*                                                                 */
/*      Create string of random alphanumeric characters.           */
/*      Pad remaining length to max with ' '                       */
/*                                                                 */
/* PARMS: min => minimum length of string                          */
/*        max => maximum length of string                          */
/*        newStr => address to store created string                */
/*******************************************************************/
void CreateStrPad(int min, int max, char *newStr)
{
   int  i, newlen;
   char Alpha[63] =
          "abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789";

   /*----------------------------------------------------------------*/
   newlen = RANDOM(min, max);       /* Determine new string length. */
   for (i=0; i < newlen; i++)
   {
      newStr[i] = Alpha[(RANDOM(0,61))];
   }
   newStr[newlen] = ' ';
   memset((newStr+newlen+1), ' ', (max-newlen+1));
   return;

} /* end of CreateStrPad() */


/*******************************************************************/
/*                                                                 */
/* Function: CreateStrPAD_extra                                    */
/*                                                                 */
/*      Create string of random alphanumeric characters.           */
/*      Insert extra text in String 10% of the time.               */
/*      Pad remaining length to max with ' '                       */
/*                                                                 */
/* PARMS: min => minimum length of string                          */
/*        max => maximum length of string                          */
/*        newStr => address to store created string                */
/*******************************************************************/
void CreateStrPad_extra(int min, int max, char *newStr, char *text)
{
   int  i, newlen;
   int  work;/* rnadom value for cheking extra */
   int  length;/* string length                 */
   int  max_end;/* the maximum end of the string */
   char Alpha[63] =
          "abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789";

   /*----------------------------------------------------------------*/
   newlen = RANDOM(min, max);       /* Determine new string length. */
   for (i=0; i < newlen; i++)
   {
      newStr[i] = Alpha[(RANDOM(0,61))];
   }
   newStr[newlen] = ' ';
   memset((newStr+newlen+1), ' ', (max-newlen+1));
   work = RANDOM(0, 999);
   if ( work < 100 )/* check for 10 percent of the time */
   {
      /* Over part of string with special text. */
      length = strlen(text);
      max_end = newlen - length;
       _CPYBYTES(&newStr[(RANDOM(0,max_end))], text, strlen(text));
   }
   return;

} /* end of CreateStrPad_extra() */


/*******************************************************************/
/*                                                                 */
/* Function: CreateZip                                             */
/*                                                                 */
/*      Create zip code string.                                    */
/*                                                                 */
/* PARMS: Returns zip code string                                  */
/*                                                                 */
/* USE the CREATE_ZIP macro defined in the COMMONTPCC Header file!! */
/*                                                                 */
/*******************************************************************/
void CreateZip(char *zipstr)
{
   sprintf(zipstr, "%04d11111", (RANDOM(0, 9999)));
   return;

} /* end of CreateZip() */


/* Redefine max generated random number. Default is 32,767.  */
#undef RAND_MAX
#define RAND_MAX +99999
/*******************************************************************/
/*                                                                 */
/* Function: MaxRand                                               */
/*                                                                 */
/*      Create random number larger than 32767.                    */
/*                                                                 */
/*  NOTE: This is the rand() function used by AS/400 with one      */
/*      slight modification.  In the rand() function, rand_next is  */
/*      shifted right by 16 rather than the 14 used here.  Shifting  */
/*      by 16 produces a max value of 65535.                       */
/*                                                                 */
/*  PARMS:                                                         */
/*                                                                 */
/*******************************************************************/
int MaxRand(unsigned long int *rand_next)
{
  *rand_next = *rand_next * 1103515245 + 12345;
  return(((*rand_next)  >> 14) % ((unsigned long)(RAND_MAX)+1));

} /* end of MaxRand() */


/*******************************************************************/
/*                                                                 */
/* Function: GetSeed                                               */
/*                                                                 */
/*      Get a  random number to use as a seed value                */
/*                                                                 */
/*  NOTE: use micro seconds of the time as the random number base.  */
/*                                                                 */
/*******************************************************************/
unsigned long int get_seed(void)
{
    struct timeval set_value;
    _MI_Time set_time;
    mattod(set_time);
    Qp0zCvtToTimeval(&set_value,set_time,  QP0Z_CVTTIME_TO_TIMESTAMP);

    /* Get the time and conver to sec and micro sec */
    return (unsigned long int)  set_value.tv_usec;
}


/*-----------------------------------------------------------------*/
/*                                                                 */
/* Function: spawn_FILL_job                                        */
/*                                                                 */
/* Purpose:                                                        */
/*                                                                 */
/*-----------------------------------------------------------------*/
int spawn_FILL_job(char *dblib, char *dbfile, int file_id, int inst_num,
                   int str_wh,
                   int num_wh, char *temp_file, char *work_path,
                   char *call_level)
{
   int           rc, times;
   int           fd_count = 0;
   char          strwh_string[8];
   char          numwh_string[8];
   char          instance_string[3];
   char         *env_arg[1];
   char         *wp_arg[9];
   pid_t         pid;
   inheritance_t inherit;

   char          msgtxt[60];

   /*----------------------------------------------------------------*/
   sprintf(strwh_string, "%06d", str_wh);
   sprintf(numwh_string, "%06d", num_wh);
   sprintf(instance_string, "%01d", inst_num);

   /*----------------------------------------------------------------*/
   /* Set parms for the spawn.                                       */
   /*----------------------------------------------------------------*/
   wp_arg[0] = "dummy";
   wp_arg[1] = dblib;
   wp_arg[2] = dbfile;
   wp_arg[3] = strwh_string;
   wp_arg[4] = numwh_string;
   wp_arg[5] = call_level;
   wp_arg[6] = instance_string;
   wp_arg[7] = temp_file;
   wp_arg[8] = NULL;

   env_arg[0] = NULL;
   inherit.flags = 0;
   inherit.pgroup = SPAWN_NEWPGROUP;

   /*----------------------------------------------------------------*/
   /* Get the number of jobs available for us to use.                */
   /*----------------------------------------------------------------*/
   times = 0;
   while ((0 == get_available_jobs(dblib))  && (-1 != rc))
   {
     /*-----------------------------------------------------------*/
     /* Wait and try again...                                     */
     /*-----------------------------------------------------------*/
     tpcc_Wait(5, 0, NULL, NULL);     /* Wait 5 seconds.      */

     ++times;
     if (2880 == times)  /* wait for 4 hours for an available job.  */
     {
        sprintf(msgtxt,
                "No available %s jobs. Tired of waiting for one. Quitting!",
                get_DB_filename(file_id));
        QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG,CS_CUR_PGM,1);
        rc = -1;  /* Exit from loop. */
     }
   }

   times = 0;
   while ((0 != add_started_jobs(dblib,file_id,inst_num))&&(-1  != rc))
   {
      /*-----------------------------------------------------------*/
      /* wait and try again...                                     */
      /*-----------------------------------------------------------*/
      tpcc_Wait(3, 0, NULL, NULL);     /* Wait 3 seconds.      */

      ++times;
      if (100 == times)       /* Total of 5 minutes wait time.  */
      {
         sprintf(msgtxt,"I can't add to the number of %s jobs I am starting!",
                 get_DB_filename(file_id));
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_PGMBDY, 1);
         return(-1);
      }
   }

   pid = spawn(work_path, fd_count, NULL, &inherit,
               (char **)(&wp_arg), (char **)(&env_arg));

   if (pid < 0)
   {
      sprintf(msgtxt, "%.02s - '%s' not spawned.", work_path, wp_arg[1]);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);

      rc = 0;
      times = 0;
      while ((0 != add_error_jobs(dblib,HISTORY_JOBS,  inst_num))&&(-1 != rc))
      {
         /*-----------------------------------------------------------*/
         /* Wait and try again...                                     */
         /*-----------------------------------------------------------*/
         tpcc_Wait(3, 0, NULL, NULL);       /* Wait 3 seconds.      */

         ++times;
         if (100 == times)          /* Total of 5 minutes wait time.  */
         {
            sprintf(msgtxt, "I can't set 'error' jobs value for %s files!",
                    get_DB_filename(file_id));
            QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
            rc = -1;
         }
      }
      return(-1);
   }
   return(0);

} /* End of: spawn_FILL_job() */


/*-----------------------------------------------------------------*/
/*                                                                 */
/* Function: wait_on_spawned_jobs                                  */
/*                                                                 */
/* Purpose: jobs have been spawned to fill a database file.        */
/*          This function will check that the jobs for that        */
/*          file_id have completed.                                */
/*                                                                 */
/* Parms: dblib = database library name                            */
/*        file_id = from TPCCSPACE, the int representing the file.  */
/*        num_spawned = number of jobs YOU think have been spawned  */
/*                                                                 */
/*-----------------------------------------------------------------*/
int wait_on_spawned_jobs(char *dblib, int file_id, int inst_num,
                         int num_spawned)
{
   int   rc, times;
   int   str_jobs, done_jobs, succj, errj;
   char  msgtxt[100];

   rc = 0;
   if (num_spawned < 1)
```

```
   {
      while ((0 == (str_jobs = get_started_jobs(dblib, file_id, inst_num))) &&
             (-1 != rc))
      {
          /*-----------------------------------------------------------*/
          /* Wait and try again...                                     */
          /*-----------------------------------------------------------*/
          tpcc_Wait(3, 0, NULL, NULL);     /* Wait 3 seconds.      */

          ++times;
          if (60 == times)
          {
             sprintf(msgtxt,
                     "Warning.  Number of started %s jobs is 0.",
                     get_DB_filename(file_id));
             QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
             return(-1);
          }
      } /* End: while loop. */

      if (-1 == str_jobs)
      {
         sprintf(msgtxt,
                 "Error getting the number of started %s jobs!",
                 get_DB_filename(file_id));
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
         return(-1);
      }
   } /* end: num_spawned < 1 */

   done_jobs = 0;
   rc = 0;
   while (done_jobs < num_spawned)
   {
      /*-----------------------------------------------------------*/
      /* Wait so we are not constantly checking for completion.    */
      /*-----------------------------------------------------------*/
      tpcc_Wait(15, 0, NULL, NULL);      /* Wait 15 seconds.      */

      times = 0;
      if (-1 == (succj = get_successful_jobs(dblib, file_id, inst_num)))
      {
         sprintf(msgtxt,"I can't get the number of successful %s jobs!",
                 get_DB_filename(file_id));
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
         return(-1);
      }

      times = 0;
      if (-1 == (errj = get_error_jobs(dblib, file_id, inst_num)))
      {
         sprintf(msgtxt,"I can't get the number of %s jobs in error!",
                 get_DB_filename(file_id));
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
         return(-1);
      }

      done_jobs = succj + errj;

   } /* end: (done_jobs < num_spawned) */

   return(0);

} /* End of: wait_on_spawned_jobs() */
```

C.7 COMMONTPCC.H:

```
#ifndef _COMMONTPCC_H
 #define _COMMONTPCC_H
/*********************************************************************/
/*                                                                   */
/* Header file name: COMMONTPCC                                      */
/*                                                                   */
/* Purpose: common functions for TPCC DB Build                       */
/*                                                                   */
/*********************************************************************/

  /*-----------------------------------------------------------------*/
  /* DEFINES                                                         */
  /*-----------------------------------------------------------------*/
  #define BASE_TIME             'B'
  #define MAX_DISTRICTS          10
  #define CUSTPERDIST          3000
  #define ORDERSPERDIST CUSTPERDIST
  #define MAXITEMS           100000

  #define MAX_JOBS               60
  #define IO_BLOCK_SIZE      257000
  #define NUM_IO_BLOCKS          10
  #define MSG_LENGTH              1
  #define BLD_MSGQ_NAME_10  "TPCCMSG   "

  /*-----------------------------------------------------------------*/
  /* The following is so we don't have to have the file created in   */
  /* order to compile the program.                                   */
  /*-----------------------------------------------------------------*/
  #define CUSTOMER_RECORD_SIZE    667
  #define STOCK_RECORD_SIZE       306

  /*-----------------------------------------------------------------*/
  /* TYPEDEFs                                                        */
  /*-----------------------------------------------------------------*/
  typedef struct {
                  int  bytes_prov;
                  int  bytes_avail;
                  char except_id[7];
                  char reserved[1];
                  char except_data[50];
  } error_structure;

  /*-----------------------------------------------------------------*/
  /* Prototypes                                                      */
  /*-----------------------------------------------------------------*/
  void  CreateCust_lastname(int num, char *name);
  void  CreateStr(int min, int max, char *string);
  void  CreateStrPad(int min, int max, char *string);
  void  CreateStrPad_extra(int min, int max, char *string, char *text);
  void  CreateZip(char *zipcode);
  unsigned long int get_seed(void);
  int   MaxRand(unsigned long int *rand_next);

/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: spawn_FILL_job                                          */
/*                                                                   */
/* Purpose: spawn a fill job for a  TPCC database file.              */
/*                                                                   */
/* Parms: dblib = database library name                              */
/*                                                                   */
/*-------------------------------------------------------------------*/
 int spawn_FILL_job(char *dblib, char *dbfile, int  file_id,
                    int inst_num, int str_wh,
                    int num_wh, char *temp_file, char *work_path,
                    char *call_level);


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: wait_on_spawned_jobs                                    */
/*                                                                   */
/* Purpose: jobs have been spawned to fill a database file.          */
/*          This function will check that the jobs for the           */
/*          file_id have completed.                                  */
/*                                                                   */
/* Parms: dblib = database library name                              */
/*        file_id = from TPCCSPACE, the int representing the file.   */
/*        inst_number = the instance number 0 when not a split       */
/*                      database and 0 or 1 when a split database    */
/*        num_spawned = number of jobs YOU think have been spawned .*/
/*                                                                   */
/*-------------------------------------------------------------------*/
 int wait_on_spawned_jobs(char *dblib, int file_id, int inst_numb,
                          int num_spawned);

  /*-----------------------------------------------------------------*/
  /* Macros                                                          */
  /*-----------------------------------------------------------------*/

/*-------------------------------------------------------------------*/
/*                                                                   */
/* Macro: RANDOM                                                     */
/*                                                                   */
/* Purpose: generate a random number.                                */
/*                                                                   */
/* RANDOM is for existing code.                                      */
/*                                                                   */
/* RANDOM2 is for code that wants checking to ensure that the two    */
/*         values (a & b) do not result in an attempt to divide by   */
/*         0.                                                        */
/*-------------------------------------------------------------------*/
#define RANDOM(a,b) (rand() % (b-a+1))+a

#define RANDOM2(a, b, r2)   \
{ \
   int rr = b-a+1;          \
   if (0 == rr) ++rr;       \
   r2 = (rand() % rr) + a;  \
}

/*-------------------------------------------------------------------*/
/*                                                                   */
/* Macro: GET_CWD_IDS                                                */
/*                                                                   */
/* Purpose: get the correct customer, warehouse, district ids for    */
/*          the Customer file.                                       */
/*                                                                   */
/* PARMS: (input)                                                    */
/*          recnum: (int)   relative record number                   */
/*          whs:    (int)   number of warehouses per customer        */
/*                                                                   */
/*        (output)                                                   */
/*          cid: (int)  customer id                                  */
/*          wid: (int)  warehouse id                                 */
/*          did: (int)  district id                                  */
/*                                                                   */
/* Example:                                                          */
/*   10 districts, 3 warehouses                                      */
/*                                                                   */
/*  1.  1  1  1  ((1-1)%10)+1=1,((1-1)/10)%3+1=1,((1-1)/(10*3))+1  = 1*/
/*  2.  1  1  2  ((2-1)%10)+1=2,((2-1)/10)%3+1=1,((2-1)/(10*3))+1  = 1*/
/*  3.  1  1  3                                                      */
/*  4.  1  1  4                                                      */
/*  5.  1  1  5                                                      */
/*  6.  1  1  6                                                      */
/*  7.  1  1  7                                                      */
/*  8.  1  1  8                                                      */
/*  9.  1  1  9                                                      */
/* 10.  1  1 10(10-1)%10)+1=10,((10-1)/10)%3+1=1,((10-1)/(10*3))+1=1*/
/* 11.  1  2  1(11-1)%10)+1= 1,((11-1)/10)%3+1=2,((11-1)/(10*3))+1=1*/
/* 12.  1  2  2                                                      */
/* 13.  1  2  3                                                      */
/* 14.  1  2  4                                                      */
/* 15.  1  2  5                                                      */
/* 16.  1  2  6                                                      */
/* 17.  1  2  7                                                      */
/* 18.  1  2  8                                                      */
/* 19.  1  2  9                                                      */
/* 20.  1  2 10(20-1)%10)+1=10,((20-1)/10)%3+1=2,((20-1)/(10*3))+1=1*/
/* 21.  1  3  1(21-1)%10)+1= 1,((21-1)/10)%3+1=3,((21-1)/(10*3))+1=1*/
/* 22.  1  3  2                                                      */
/* 23.  1  3  3                                                      */
/* 24.  1  3  4                                                      */
/* 25.  1  3  5                                                      */
/* 26.  1  3  6                                                      */
/* 27.  1  3  7                                                      */
/* 28.  1  3  8                                                      */
/* 29.  1  3  9                                                      */
/* 30.  1  3 10(30-1)%10)+1=10,((30-1)/10)%3+1=3,((30-1)/(10*3))+1=1*/
/* 31.  2  1  1(31-1)%10)+1= 1,((31-1)/10)%3+1=1,((31-1)/(10*3))+1=2*/
/* 32.  2  1  2                                                      */
/* 33.  2  1  3                                                      */
/* 34.  2  1  4                                                      */
/* 35.  2  1  5                                                      */
/* 36.  2  1  6                                                      */
/* 37.  2  1  7                                                      */
/* 38.  2  1  8                                                      */
/* 39.  2  1  9                                                      */
/* 40.  2  1 10(40-1)%10)+1=10,((40-1)/10)%3+1=1,((40-1)/(10*3))+1=2*/
/* 41.  2  2  1(41-1)%10)+1= 1,((41-1)/10)%3+1=2,((41-1)/(10*3))+1=2*/
/*                                                                   */
/*-------------------------------------------------------------------*/
#define GET_CWD_IDS(recnum, whs, cid, wid, did) \
{ \
   did = ((recnum - 1) % MAX_DISTRICTS) + 1;          \
   wid = (((recnum - 1) / MAX_DISTRICTS) % whs) + 1;  \
   cid = ((recnum - 1) / (MAX_DISTRICTS * whs)) + 1;  \
}


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Macro: CREATE_ZIP                                                 */
/*                                                                   */
/* Purpose: Create zip code string.                                  */
/*                                                                   */
/* Parm: char string the Zip code will be placed into.               */
/*                                                                   */
/*-------------------------------------------------------------------*/
#define CREATE_ZIP(zipstring) \
{ \
   sprintf(zipstring, "%04d11111", (RANDOM(0, 9999))); \
}


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Macro: NEW_RAND                                                   */
/*                                                                   */
/* Purpose: return integer value.                                    */
/*                                                                   */
/*    Aint is constant chosen according to size of range  [x..y]     */
/*                                                                   */
/*  PARMS: Aint = integer value                                      */
/*         Xmin = minimum value in range                             */
/*         Ymax = maximum value in range                             */
/*-------------------------------------------------------------------*/
#define NEW_RAND(Aint, Xmin, Ymax) \
        ((((RANDOM(0,Aint) | RANDOM(Xmin,Ymax)) + 7) % (Ymax-Xmin+1)) + Xmin)
/* Refer to Page 20 TPCBenchmarkTMC - Standard Specification, Revision */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Macro: IO_BLOCKS_PER_JOB                                          */
/*                                                                   */
/* Purpose: calculate the number of IO blocks per stock or customer */
/*          job.                                                     */
/*          The maximum number of IO blocks is the #define value.    */
/*          The purpose of this macro is to determine if we will     */
/*          use all the IO blocks allowed by the #define value.      */
/*                                                                   */
/*  PARMS: nbpj = number IO blocks per job  (OUTPUT)                 */
/*         num_rec_per_IO_block =                                    */
/*         final_rec = last record number                            */
/*         njobs     = number of jobs                                */
/*-------------------------------------------------------------------*/
```

```
#define IO_BLOCKS_PER_JOB(nbpj, num_rec_per_IO_block, final_rec, njobs) \
   nbpj = (final_rec / num_rec_per_IO_block) / njobs;   \
   if (0 != (final_rec % num_rec_per_IO_block) / njobs)  \
   {                                                     \
      ++nbpj;                                            \
   }                                                     \
   if (NUM_IO_BLOCKS < nbpj)                             \
   {                                                     \
      nbpj = NUM_IO_BLOCKS;                              \
   }

/* ---------------------> End of COMMONTPCC.H <---------------------  */
#endif
```

C.8 CRT1VIEW.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* NAME: CRT1VIEW                                                  */
/*                                                                 */
/* PURPOSE: create one logical view from input file name.          */
/*                                                                 */
/*          Note that Split DB file names have source members with */
/*          the number 2 in their name.                            */
/*          Create the district or warehouse logical files         */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&FILE &DBLIB &NUMPARTS)

   DCL &FILE       TYPE(*CHAR) LEN(6)
   DCL &DBLIB      TYPE(*CHAR) LEN(10)
   DCL &NUMPARTS   TYPE(*CHAR) LEN(2)

   DCL &FILESRCLF  TYPE(*CHAR) LEN(10)

   /*-------------------------------------------------------------*/
   /* Note if number of parts is 1 these files are not created  */
   MONMSG (CPF7302 CPF0001) EXEC(GOTO ERREXIT)
   IF COND(&NUMPARTS *EQ '01') THEN(GOTO ERREXIT)
   IF COND(&FILE *EQ 'WRHS  ') THEN( +
      CHGVAR &FILESRCLF VALUE(WRHSLF0000))
   ELSE CMD( +
   DO)
        IF COND(&FILE *EQ 'DSTRCT') THEN( +
        CHGVAR &FILESRCLF VALUE(DSTRCTLF00))
        ELSE CMD( +
        DO)
           IF         COND(&FILE *EQ 'HSTRY ') THEN( +
           CHGVAR &FILESRCLF VALUE(HSTRYLF000))
           ELSE CMD(GOTO ERREXIT)
        ENDDO
   ENDDO
   CHGVAR %SST(&FILESRCLF 9 2) VALUE(&NUMPARTS)

      /* Create PARTIAL key view.  */
   CHKOBJ OBJ(&DBLIB/&FILE) OBJTYPE(*FILE)
   MONMSG CPF9801 EXEC( +
   DO)
        IF         COND(&FILE *EQ 'HSTRY ') THEN(CRTLF +
                         FILE(&DBLIB/&FILE) SRCMBR(&FILESRCLF) +
                         MAINT(*REBLD) WAITRCD(*NOMAX) LVLCHK(*NO))
        ELSE CMD( +
                CRTLF FILE(&DBLIB/&FILE) SRCMBR(&FILESRCLF) +
                                 WAITRCD(2) LVLCHK(*NO))
   ENDDO

   SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRT1VIEW completed successfully!') MSGTYPE(*COMP)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRT1VIEW failed!') MSGTYPE(*ESCAPE)
ENDPGM: ENDPGM
```

C.9 CRT2VIEW.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* NAME: CRT2VIEW                                                  */
/*                                                                 */
/* PURPOSE: create two logical views; one based on the file name   */
/*          and the other ending with LF.                          */
/*                                                                 */
/*          Note that Split DB file names have source members with */
/*          has the patition number as the last 2 characters.      */
/*          Characters 9 and 10 the name is filed with  zers.      */
/*          All names have 6 characters. ORDERS, NEWORD, and       */
/*          ORDLIN.                                                */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&FILE &DBLIB &NUMPARTS)

   DCL &FILE       TYPE(*CHAR) LEN(6)
   DCL &DBLIB      TYPE(*CHAR) LEN(10)
   DCL &NUMPARTS   TYPE(*CHAR)  LEN(2)

   DCL &FILELF     TYPE(*CHAR) LEN(10)
   DCL &FILESRC    TYPE(*CHAR) LEN(10)
   DCL &FILESRCLF  TYPE(*CHAR) LEN(10)

  /*-----------------------------------------------------*/
  MONMSG (CPF7302 CPF0001) EXEC(GOTO ERREXIT)

  /* setup the first part of the names  */
  IF COND(%SST(&FILE  6 1) = ' ') THEN( +
  GOTO ERREXIT)
  CHGVAR VAR(&FILESRC)      VALUE(&FILE)
  CHGVAR VAR(&FILESRCLF)    VALUE(&FILE)
  CHGVAR VAR(%SST(&FILESRCLF 7 2))    VALUE('LF')
  CHGVAR VAR(&FILELF) VALUE(&FILESRCLF)
  IF COND(&NUMPARTS *GT '01') THEN( +
  DO)
    CHGVAR VAR(%SST(&FILESRC 7 2))     VALUE('00')
    CHGVAR VAR(%SST(&FILESRC 9 2))     VALUE(&NUMPARTS)
    CHGVAR VAR(%SST(&FILESRCLF 9 2))  VALUE(&NUMPARTS)
  ENDDO
          /* Create the UNIQUE view over the physical file.  */
TAKEACTION:
          CHKOBJ OBJ(&DBLIB/&FILE) OBJTYPE(*FILE)
            MONMSG CPF9801 EXEC(CRTLF FILE(&DBLIB/&FILE)  SRCMBR(&FILESRC)  +
                                      WAITRCD(*NOMAX)  LVLCHK(*NO))

          /* Create PARTIAL key view.  */
          CHKOBJ OBJ(&DBLIB/&FILELF) OBJTYPE(*FILE)
            MONMSG CPF9801 EXEC(CRTLF FILE(&DBLIB/&FILELF)  SRCMBR(&FILESRCLF)  +
                                      WAITRCD(*NOMAX)  LVLCHK(*NO))

          SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                    MSGDTA('CRT2VIEW completed successfully!') MSGTYPE(*COMP)
          GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRT2VIEW failed!') MSGTYPE(*ESCAPE)
ENDPGM:  ENDPGM
```

C.10 CRTBLDSPCE.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* File name: CRTBLDSPCE                                           */
/*                                                                 */
/* Purpose: Build space.                                           */
/*                                                                 */
/*-----------------------------------------------------------------*/

  /*-----------------------------------------------------------------*/
  /* Start include files.                                            */
  /*-----------------------------------------------------------------*/
  #include <stdio.h>
  #include <stdlib.h>
  #include <string.h>
  #include <qusrtvus.h>
  #include <quscrtus.h>
  #include <qusptrus.h>
  #include <qusgen.h>
  #include <time.h>
  #include <mih/cpybytes.h>
  #include <qcnfig.h>
  #include <usrspc.h>
  #include <qcmdexc.h>
  #include <os4msg.h>
  #include <commontpcc.h>
  #include <tpccspacei.h>

  #define DBLIB_PARM          1
  #define STRWH_PARM          2
  #define NUMWH_PARM          3
  #define SPLIT_PARM          4

  #define CNFIG_SPACE   "TPCCBLDCPU"

  /*-----------------------------------------------------------------*/
  /* Globals                                                         */
  /*-----------------------------------------------------------------*/
  int  number_processors;


/*-----------------------------------------------------------------*/
void init_job_data(job_data *jobs_ptr)
{
    jobs_ptr->max_allowed = number_processors + 1;
    jobs_ptr->planned     = 0;
    jobs_ptr->running     = 0;
    jobs_ptr->completed   = 0;
    jobs_ptr->error       = 0;
}


/*-----------------------------------------------------------------*/
int create_user_space(control_space **control_ptr, char *space_name)
{
    Qus_Generic_Header_0100_t *space;
    char initial_char;
    char replace[10];           /* user space parameter creation */
    char text_desc[50];
    error_structure err;

    err.bytes_prov = 0;
    _CPYBYTES(replace, "*YES      ",10);
    cpyblap(text_desc, 50, "Job info for DB build.", 22,  ' ');
    initial_char = 0;    /* Initialize to binary zero, user not active.  */

    QUSCRTUS(space_name, "PF        ", sizeof(control_space),  &initial_char,
             "*ALL      ", text_desc, replace, &err);

    err.bytes_prov = 0;  /* set number of bytes and error reporting mode  */

    QUSPTRUS(space_name, &space, &err); /* get the pointer */

    *control_ptr = (control_space *)space->User_Area;  /* get the address. */

    /*-----------------------------------------------------------------*/
    /* Set max and available jobs as the total of processors for each  */
    /* of the DB jobs plus 1 for each for luck.  This should be        */
    /* more than we ever need.                                         */
    /*-----------------------------------------------------------------*/
    (*control_ptr)->available_jobs  = (number_processors * 4) + 4;
    (*control_ptr)->max_jobs        = (number_processors * 4) + 4;
    (*control_ptr)->actual_cpu_cnt  = number_processors;

    (*control_ptr)->working[0].start_whs   = 1; /* set starting to 1       */
    (*control_ptr)->working[0].number_whs  = 0; /* set for zero warehouses */

    init_job_data(&(*control_ptr)->working[0].orders   );
    init_job_data(&(*control_ptr)->working[0].stock    );
    init_job_data(&(*control_ptr)->working[0].customer);
    init_job_data(&(*control_ptr)->working[0].history  );

    (*control_ptr)->working[1].start_whs   = 1; /* set starting to 1       */
    (*control_ptr)->working[1].number_whs  = 0; /* set for zero warehouses */

    init_job_data(&(*control_ptr)->working[1].orders   );
    init_job_data(&(*control_ptr)->working[1].stock    );
    init_job_data(&(*control_ptr)->working[1].customer);
    init_job_data(&(*control_ptr)->working[1].history  );

    return(0);

} /* end of create_user_space */


/*-----------------------------------------------------------------*/
int main(int argc, char **argv)
{
    int  start_whs;
    int  numb_whs;
    int  split_low;       /* number of warehouse in the low section    */
    unsigned int lib_len;
    char  *slash_pos;

    char cmd[100];
    char dblib[11];             /* full program string                 */
    char pgm_name[11];          /* full program string                 */
    char pgm_lib[11];           /* the program library name.           */
    char dataspace[21];         /* data space name                     */
    char space_name[21];        /* space name used to tranfer data.    */
    char output_block[7];       /* output block for writing.           */
    char msgq[20];
    char msgtxt[132];
    error_code err;                         /* error for check pointer    */
    control_space *control_ptr;             /* pointer to user space.     */
    Qcnfig *data_ptr;                       /* configuration data pointer */
    Qus_Generic_Header_0100_t *space;       /* user space header          */

    ExcData_t volatile exD = {0 ,"*HANDLE   "};

    /*-----------------------------------------------------------------*/
    /* Get the library name that we are running in now.                */
    /*-----------------------------------------------------------------*/
    slash_pos = strchr(argv[0], '/');
    lib_len   = slash_pos - argv[0];
    _CPYBYTES(pgm_lib, argv[0], lib_len);
    pgm_lib[lib_len] = '\0';

    ++slash_pos;   /* Skip the '/'  */
    _CPYBYTES(pgm_name, slash_pos, 10);
    pgm_name[triml(pgm_name, ' ')] = '\0';

    /* TPCC message queue to send our build messages to.  */
    _CPYBYTES(msgq, "TPCCMSG   ", 10);
    _CPYBYTES(&(msgq[10]), argv[DBLIB_PARM], 10);

    dblib[10] = '\0';
    _CPYBYTES(dblib, argv[DBLIB_PARM], 10);
    dblib[triml(dblib, ' ')] = '\0';

    /*-----------------------------------------------------------------*/
    /* Get config values.                                              */
```

```
   /*-----------------------------------------------------------------*/
   sprintf(cmd,"TPCCTOOLS/QCNFIG RUNLIB(%s) SPCNAME(%s) RESET(*YES)",
         dblib, CNFIG_SPACE);

   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler

   if (0 != exD.error)
   {
      QsendMsg(IBM_MSG_FILE, "CPF9897", "QCNFIG program call failed.",
               ESCAPE_MSG, CS_CTLBDY, 1);
   }

   _CPYBYTES(dataspace, CNFIG_SPACE, 10);
   _CPYBYTES(&dataspace[10], argv[DBLIB_PARM], 10);
   err.bytes_prov = 0;

   QUSPTRUS(dataspace, &space, &err);       /* get the pointer. */

   data_ptr = (Qcnfig*)(space->User_Area);  /* get the address. */
   if (data_ptr->prcmlttsk[0] == '0')
   {
      number_processors = data_ptr->CPUcnt;
      sprintf(msgtxt, "CRTBLDSPCE: number of processors = %d.  HMT is OFF.",
              number_processors);
   } else {
      number_processors = 2 * data_ptr->CPUcnt;
      sprintf(msgtxt,
         "CRTBLDSPCE: number of processors = %d.  HMT ON, so processors = %d.",
              data_ptr->CPUcnt, number_processors);
   }
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq, 1, NULL);

   /*-----------------------------------------------------------------*/
   /* Delete the CNFIG user space.                                    */
   /*-----------------------------------------------------------------*/
   sprintf(cmd,"DLTUSRSPC %s/%s", dblib, CNFIG_SPACE);

   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler


   _CPYBYTES(space_name, USERSPACE, 10); /* get first part of the name */
   _CPYBYTES(&space_name[10],argv[DBLIB_PARM], 10);
   space_name[20] = '\0';

   create_user_space(&control_ptr, space_name);

   start_whs = atoi(argv[STRWH_PARM]);
   numb_whs  = atoi(argv[NUMWH_PARM]);

   if (argv[SPLIT_PARM][0] == 'Y')
   {
      split_low = numb_whs / 2;

      control_ptr->max_instance = 2;  /* set number of instance to 2 */
      control_ptr->working[0].start_whs  = start_whs;
      control_ptr->working[0].number_whs = split_low;
      control_ptr->working[1].start_whs  = start_whs + split_low;
      control_ptr->working[1].number_whs = split_low + (numb_whs % 2);
   } else {
      control_ptr->max_instance = 1;
      control_ptr->working[0].start_whs  = start_whs;
      control_ptr->working[0].number_whs = numb_whs;
   }
   return;

} /* end: main()  */
```

C.11 CRTDBDTA.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: CRTDBDTA                                               */
/*                                                                 */
/* Purpose: create TPCC data areas if they do not exist already.   */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB)

   DCL &DBLIB   TYPE(*CHAR) LEN(10)
   DCL &PGMLIB  TYPE(*CHAR) LEN(10)
/*-----*/
         MONMSG MSGID(CPF0000 MCH0000) EXEC(GOTO ERREXIT)

         SNDPGMMSG MSGID(CPF9897) +
                   MSGDTA('CRTDBDTA: creating data areas...') +
                   MSGF(QCPFMSG) TOPGMQ(*EXT) MSGTYPE(*STATUS)

         RTVOBJD OBJ(CRTDBDTA) OBJTYPE(*PGM) RTNLIB(&PGMLIB)

         CRTDTAARA &PGMLIB/TPCCDBLIB TYPE(*CHAR) LEN(10) VALUE(&DBLIB) +
                   TEXT('Data Base library')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCDBVRS  TYPE(*CHAR) LEN(10) VALUE('32') +
                   TEXT('Data Base Version')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCJRNLIB TYPE(*CHAR) LEN(10) +
                   VALUE(JRNRCVLIB) TEXT('Journal receiver library')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCWRHS   TYPE(*DEC) LEN(6) VALUE(0) +
                   TEXT('Number of warehouses')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCAPLLIB TYPE(*CHAR) LEN(10) VALUE(' ') +
                   TEXT('Application library')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCRUNLIB TYPE(*CHAR)  LEN(10) VALUE(' ') +
                   TEXT('Run performance data library')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCUSERS  TYPE(*DEC) LEN(7 0) VALUE(0) +
                   TEXT('Number of real users in TPCC')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCSAVLIB TYPE(*CHAR) LEN(10) +
                   VALUE(TPCCSFMDD) TEXT('Save library name')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         /*---------------------------------------------*/
         CRTDTAARA &DBLIB/TPCCSLJOB  TYPE(*DEC) LEN(5) +
                   VALUE(25) TEXT('Number of users per Stock Level Job')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCDLVJOB TYPE(*DEC) LEN(5) +
                   VALUE(40) TEXT('Number of users per Delivery Job')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCMNGRCV TYPE(*CHAR) LEN(10) +
                   VALUE(*SYSEM) TEXT('Manage journal receiver')
         MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCNOJOB  TYPE(*DEC) LEN(5) +
                   VALUE(50) TEXT('Number of users per New Order Job')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCPAYJOB TYPE(*DEC) LEN(5) +
                   VALUE(25) TEXT('Number of users per Payment Job')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCRCVSIZ TYPE(*CHAR) LEN(10) +
                   VALUE(*NONE) TEXT('Journal receiver size option')
         MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCRCVTRH TYPE(*DEC) LEN(10 0) +
                   VALUE(150000) TEXT('Journal receiver threshold')
         MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCOSJOB TYPE(*DEC) LEN(5) +
                   VALUE(8) TEXT('Number of users per Order Status Job')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         /*---------------------------------------------*/

         CRTDTAARA &DBLIB/HDWRPEXDFN TYPE(*CHAR) LEN(10) +
                   VALUE(HDWTS1TO57) TEXT('HDWR PEX definition name')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/HDWRTIME TYPE(*DEC) LEN(5) VALUE(1800) +
                   TEXT('HDWR data time')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TSKSPEXDFN TYPE(*CHAR) LEN(10) +
                   VALUE(TASKSWT) TEXT('Task Switch PEX definition name')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TSKSTIME TYPE(*DEC) LEN(5) +
                   VALUE(60) TEXT('Task switch data time')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPRFPEXDFN TYPE(*CHAR) LEN(10) +
                   VALUE(TPROFRC) TEXT('TPROF PEX definition name')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPRFTIME TYPE(*DEC) LEN(5) VALUE(1800) +
                   TEXT('TPROF data time')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPSTPEXDFN TYPE(*CHAR) LEN(10) VALUE(TPST) +
                   TEXT('TPST PEX definition name')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPSTTIME TYPE(*DEC) LEN(5) VALUE(1800) +
                   TEXT('TPST data time')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/SAVEMEDIA TYPE(*CHAR) LEN(10) VALUE(*SAVF) +
                   TEXT('Save media')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR1PEXDFN TYPE(*CHAR) LEN(10) +
                   TEXT('User PEX definition name 1')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR1TIME TYPE(*DEC) LEN(5) VALUE(0) +
                   TEXT('User data time 1')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR2PEXDFN TYPE(*CHAR) LEN(10) +
                   TEXT('User PEX definition name 2')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR2TIME TYPE(*DEC) LEN(5) VALUE(0) +
                   TEXT('User data time 2')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR3PEXDFN TYPE(*CHAR) LEN(10) +
                   TEXT('User PEX definition name 3')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR3TIME TYPE(*DEC) LEN(5) VALUE(0) +
                   TEXT('User data time 3')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR4PEXDFN TYPE(*CHAR) LEN(10) +
                   TEXT('User PEX definition name 4')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR4TIME TYPE(*DEC) LEN(5) VALUE(0) +
                   TEXT('User data time 4')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR5PEXDFN TYPE(*CHAR) LEN(10) +
                   TEXT('User PEX definition name 5')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/USR5TIME TYPE(*DEC) LEN(5) VALUE(0) +
                   TEXT('User data time 5')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/PFRMONTIME TYPE(*DEC) LEN(5) VALUE(3840) +
                   TEXT('Performance Monitor data time')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCRPTDSC TYPE(*CHAR) LEN(40) VALUE(TPCC) +
                   TEXT('Collection/Report description')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))


         CRTDTAARA &DBLIB/CNFIG      TYPE(*CHAR) LEN(5) VALUE(*MON) +
                   TEXT('Configuration type')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/CNTVALUE   TYPE(*CHAR) LEN(10) VALUE('*MINUTES  ') +
                   TEXT('Counter value')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/LOGOPT     TYPE(*CHAR) LEN(5) VALUE('*ON  ') +
                   TEXT('Data logging')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/MEASURE    TYPE(*CHAR) LEN(10) VALUE('*FOREVER  ') +
                   TEXT('Measurement time to run')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/RSPLOG     TYPE(*CHAR) LEN(10) VALUE('RSPLOG    ') +
                   TEXT('Response log')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/RUN        TYPE(*CHAR) LEN(4) VALUE('*YES') +
                   TEXT('Run a measurement')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCCSRVR   TYPE(*CHAR) LEN(10) VALUE('UNKNOWN   ') +
                   TEXT('Server system name')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TPCXACTLIB TYPE(*CHAR) LEN(10) VALUE('TPCCDATA  ') +
                   TEXT('Transaction library name')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/TRNMIX     TYPE(*CHAR) LEN(4) VALUE('*MIX') +
                   TEXT('Transaction mixture')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/WARMUP     TYPE(*CHAR) LEN(7) VALUE('*NONE  ') +
                   TEXT('Warmup time')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/WHRNG1     TYPE(*DEC) LEN(10 0) VALUE(1) +
                   TEXT('Starting warehouse number')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))

         CRTDTAARA &DBLIB/WHRNG2     TYPE(*DEC) LEN(10 0) VALUE(0) +
                   TEXT('Ending warehouse number')
           MONMSG CPF1023 EXEC(RCVMSG RMV(*YES))


         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
```

```
                 MSGDTA('CRTDBDTA completed successfully!') MSGTYPE(*COMP)
        GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                 MSGDTA('CRTDBDTA failed!') MSGTYPE(*ESCAPE)
ENDPGM:  ENDPGM
```

C.12 CRTDBIX.CL:

```
            PGM        PARM(&IXD &DBLIB &ASPD &TEMPSTG &NUMPARTS &WHS)
            DCL        VAR(&IXD) TYPE(*DEC) LEN(1)
            DCL        VAR(&IX) TYPE(*CHAR) LEN(1)
            DCL        VAR(&DBLIB)      TYPE(*CHAR)  LEN(10)
            DCL        VAR(&WHSD)       TYPE(*DEC)   LEN(6)
            DCL        VAR(&WHS)        TYPE(*CHAR)  LEN(6)
            DCL        VAR(&ASPD)       TYPE(*DEC)   LEN(2)
            DCL        VAR(&NUMPARTS)   TYPE(*DEC)   LEN(2)
            DCL        VAR(&NUMPARTSC)  TYPE(*CHAR)  LEN(2)
            DCL        VAR(&ASP)        TYPE(*CHAR)  LEN(2)
            DCL        VAR(&TEMPSTG)    TYPE(*CHAR)  LEN(1)
            DCL        VAR(&PGMLIB)     TYPE(*CHAR)  LEN(10)
            DCL        VAR(&BLDJOBQ)    TYPE(*CHAR)  LEN(10) VALUE(TPCBLDJOBQ)
            DCL        VAR(&MSGQ) TYPE(*CHAR) LEN(10) VALUE(INDEXMSGQ)
            CHGVAR     VAR(&IX) VALUE(&IXD)
            CHGVAR     VAR(&WHS) VALUE(&WHSD)
            CHGVAR     VAR(&ASP) VALUE(&ASPD)
            CHGVAR     VAR(&NUMPARTSC) VALUE(&NUMPARTS)
            RTVOBJD    OBJ(CRTDBIX)     OBJTYPE(*PGM) RTNLIB(&PGMLIB)
/*****************************************************************/
/* Decide whether to use ASP1 or ASP2 for index builds           */
/*  ASP2 requires special modules loaded in SLIC code            */
/*****************************************************************/
            IF         COND(&TEMPSTG *EQ 'D') THEN( +
            DO)
               CALL       PGM(CHKIXSPACE) PARM(&WHS &ASP &IX)
               MONMSG     MSGID(CPF9897) EXEC(GOTO CMDLBL(NONPAR))
            ENDDO
            ELSE   CMD( +
            DO)
               /* Check the temp storage in the system ASP */
               CALL       PGM(CHKIXSPACE) PARM(&WHS '01' &IX)
               MONMSG     MSGID(CPF9897) EXEC(GOTO CMDLBL(NONPAR))
            ENDDO
/*************************************************************/
/* Parallel index build                                      */
/*************************************************************/
            SNDPGMMSG  MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                         MSGDTA('Starting parallel index build') +
                         MSGTYPE(*INFO)
            CHGQRYA    DEGREE(*MAX)
/*          CHGQRYA    DEGREE(*NBRTASKS 9)  */
            WRKSYSSTS  OUTPUT(*PRINT) RESET(*YES)
            IF COND(&IXD = 1) THEN( +
            DO)
                   CALL PGM(&PGMLIB/CRT2VIEW) PARM('ORDLIN' +
                          &DBLIB &NUMPARTSC)
               GOTO PARENDACT
            ENDDO
            IF COND(&IXD = 2) THEN( +
            DO)
            CALL PGM(&PGMLIB/CSTMRVIEW) PARM(&DBLIB +
                          &NUMPARTSC)
              GOTO PARENDACT
            ENDDO
            IF COND(&IXD = 3) THEN( +
            DO)
                           CALL PGM(&PGMLIB/CRTSTOCKLF) PARM(&DBLIB +
                          &NUMPARTSC)
              GOTO PARENDACT
            ENDDO
            IF COND(&IXD = 4) THEN( +
            DO)
                         CALL PGM(&PGMLIB/CRT2VIEW) PARM('ORDERS' +
                          &DBLIB &NUMPARTSC)
              GOTO PARENDACT
            ENDDO
            IF COND(&IXD = 5) THEN( +
            DO)
                 CALL PGM(&PGMLIB/CRT2VIEW) PARM('NEWORD' +
                          &DBLIB &NUMPARTSC)
              GOTO PARENDACT
            ENDDO
PARENDACT:  WRKSYSSTS  OUTPUT(*PRINT) RESET(*NO)
            CHGQRYA    DEGREE(*NONE)
            GOTO ENDPGM
/*************************************************************/
/* Non-Parallel index build                                  */
/*  ASP does not have enough DASD space (5X index size)      */
/*************************************************************/
 NONPAR:    SNDPGMMSG  MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                         MSGDTA('NOT ENOUGH SPACE FOR A PARALLEL +
                         BUILD') MSGTYPE(*INFO)
            CHGQRYA    DEGREE(*NONE)
            WRKSYSSTS  OUTPUT(*PRINT) RESET(*YES)
            IF COND(&IXD = 1) THEN( +
            DO)
               CALL &PGMLIB/CRT2VIEW PARM('ORDLIN' &DBLIB    +
                 &NUMPARTSC)
               GOTO NORMEXIT
            ENDDO
            IF COND(&IXD = 2) THEN( +
            DO)
        SBMJOB CMD(CALL &PGMLIB/CSTMRVIEW PARM(&DBLIB &NUMPARTSC)) +
               JOB(CSTMRINDEX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
      GOTO NORMEXIT
    ENDDO
            IF COND(&IXD = 3) THEN( +
            DO)
            CALL       PGM(&PGMLIB/CRTSTOCKLF) PARM(&DBLIB &NUMPARTSC)
              GOTO NORMEXIT
            ENDDO
            IF COND(&IXD = 4) THEN( +
            DO)
              CALL &PGMLIB/CRT2VIEW PARM('ORDERS' &DBLIB           +
              &NUMPARTSC)
              GOTO NORMEXIT
            ENDDO
            IF COND(&IXD = 5) THEN( +
            DO)
              CALL &PGMLIB/CRT2VIEW PARM('NEWORD' &DBLIB           +
              &NUMPARTSC)
              GOTO NORMEXIT
            ENDDO
NORMEXIT:
 ENDPGM:      ENDPGM
```

C.13 CRTDIST.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: CRTDIST                                                */
/*                                                                 */
/* Purpose: Create and fill the DSTRCT file.                       */
/*                                                                 */
/* Parms: Database library name                                    */
/*        File name                                                */
/*        Starting warehouse id  (null terminated)                 */
/*        Number of warehouses   (null terminated)                 */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &DISTFILE &STRWH &NUMWH &RECOMPILE)

   DCL &DBLIB      TYPE(*CHAR) LEN(10)
   DCL &DISTFILE   TYPE(*CHAR) LEN(10)
   DCL &STRWH      TYPE(*DEC)  LEN(6)
   DCL &NUMWH      TYPE(*DEC)  LEN(6)
   DCL &RECOMPILE  TYPE(*CHAR) LEN(1)

   DCL &STRWHC     TYPE(*CHAR) LEN(6)
   DCL &NUMWHC     TYPE(*CHAR) LEN(6)
   DCL &STRWHNULL  TYPE(*CHAR) LEN(7)
   DCL &NUMWHNULL  TYPE(*CHAR) LEN(7)
   DCL &NULLCH     TYPE(*CHAR) LEN(1) VALUE(X'00')

   DCL &DISTDEF    TYPE(*CHAR) LEN(10) VALUE(DSTRCT)

   DCL &NUM1       TYPE(*DEC)  LEN(6 0)
   DCL &NUM2       TYPE(*DEC)  LEN(6 0)

   DCL &PGMLIB     TYPE(*CHAR) LEN(10)
   DCL &MSGQ       TYPE(*CHAR) LEN(10) VALUE(TPCCMSG)

   DCL &MDATA      TYPE(*CHAR) LEN(49) +
           VALUE('CRTDIST program is filling the         db file...')

         MONMSG MSGID(CPF0000 MCH0000) EXEC(GOTO ERREXIT)


         /* Other pgms will be called from library we are running in.  */
         RTVOBJD OBJ(CRTDIST) OBJTYPE(*PGM) RTNLIB(&PGMLIB)

         /*-----------------------------------------------*/
         /* Create the DISTRICT and WRHS files and  programs.*/
         /*-----------------------------------------------*/
         CHGVAR VAR(%SST(&MDATA 32 7)) VALUE(&DISTFILE)
         SNDPGMMSG MSGID(CPF9897) MSGDTA(&MDATA) +
                   MSGF(QSYS/QCPFMSG) TOPGMQ(*EXT) MSGTYPE(*STATUS)
         SNDPGMMSG MSGID(CPF9897) MSGDTA(&MDATA) +
                   MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) TOMSGQ(&DBLIB/&MSGQ)

         DLTF &DBLIB/&DISTFILE
           MONMSG MSGID(CPF2105) EXEC(RCVMSG RMV(*YES))

             CRTPF      FILE(&DBLIB/&DISTFILE) SRCMBR(DSTRCT) +
                          SIZE(*NOMAX) WAITRCD(2) LVLCHK(*NO)

         IF (&RECOMPILE *EQ 'Y') THEN(DO)

            OVRDBF FILE(&DISTDEF)   TOFILE(&DBLIB/&DISTFILE)

            CRTCMOD &PGMLIB/FILLDIST

            CRTPGM PGM(&PGMLIB/FILLDIST) +
                 MODULE(&PGMLIB/FILLDIST &PGMLIB/COMMONTPCC &PGMLIB/TPCCSPACE) +
                   ENTMOD(&PGMLIB/FILLDIST) BNDSRVPGM(TPCCTOOLS/TPCCTOOLS)

            DLTOVR FILE(&DISTDEF)
         ENDDO

         CHGVAR &STRWHC     VALUE(&STRWH)
         CHGVAR &STRWHNULL  VALUE(&STRWHC *CAT &NULLCH)
         CHGVAR &NUMWHC     VALUE(&NUMWH)
         CHGVAR &NUMWHNULL  VALUE(&NUMWHC *CAT &NULLCH)

         CALL &PGMLIB/FILLDIST PARM(&DBLIB &DISTFILE &STRWHNULL &NUMWHNULL)

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('CRTDIST program completed successfully!') +
                   TOMSGQ(&DBLIB/TPCCMSG)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRTDIST failed!') MSGTYPE(*ESCAPE)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('CRTDIST failed!') TOMSGQ(&DBLIB/&MSGQ)
ENDPGM: ENDPGM
```

C.14 CRTHASH.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: CRTHASH                                                */
/*                                                                 */
/* Parms:  argv[1] = Database library name                         */
/*         argv[2] = Number of warehouses                          */
/*         argv[3] = Physical file name                            */
/*         argv[4] = Logical  file name                            */
/*         argv[5] = Create userspace flag  '0' = no '1' = yes     */
/*                                                                 */
/*-----------------------------------------------------------------*/
 #include <stdlib.h>
 #include <stdio.h>

 /* The following is from the TPCCTOOLS project.                   */
 #include <os4msg.h>

/*=================================================================*/
/* internal defines                                                */
/*=================================================================*/

 #define DBLIB_PARM  1
 #define WH_PARM     2
 #define PFFILE_PARM 3
 #define LFFILE_PARM 4
 #define CREATE_PARM 5
 #define TOTAL_PARM  5

 typedef _Packed struct key_struct {
                                   char  name[10];
                                   long value;
  } key_ranges_structure[5];

  long qdbcrtha(char flag, char *hash_name, char *pf, char *pf_lib,
                char *lf, char *lf_lib,
                key_ranges_structure key_ranges, char *expression);


/*-----------------------------------------------------------------*/
void main(int argc, char *argv[])
{
  int   wh;
  char  whc[7];
  char  pgm_lib[11];
  char  create;
  char  db_lib[11];
  char  lf_arg[11];
  char  pf_arg[11];
  char  msgtxt[35];
  key_ranges_structure key_ranges;

  /*-----------------------------------------------------------------*/
  if (argc < TOTAL_PARM)
  {
     sprintf(msgtxt, "Expected %s parms, received %d parm",
                   (TOTAL_PARM - 1), (argc-1));
     QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
     exit;
  }

  if (0 == strncmp(argv[PFFILE_PARM], "ITEM", 4))
  {
     key_ranges[0].value = 100000;
  } else {
     memcpy(whc, argv[WH_PARM], 6);
     whc[6] = '\0';
     wh = atoi(whc);
     if (0 == wh)
     {
        sprintf(msgtxt, "Error: the warehouse parameter has a length of 0.");
```

```
        QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
        exit;
     }
     if (0 == strncmp(argv[PFFILE_PARM], "STOCK", 5))
     {
        key_ranges[0].value = 100000;
        key_ranges[1].value = wh;
     } else {
        key_ranges[0].value = 3000;                    /* Customer ID */
        key_ranges[1].value = 10;                      /* District ID */
        key_ranges[2].value = wh;
     }
  }

  pgm_lib[0] = '\0';   /* Not used. */

  _CPYBYTES(db_lib,  argv[DBLIB_PARM],  10);
  db_lib[10] = '\0';
  _CPYBYTES(pf_arg,  argv[PFFILE_PARM], 10);
  pf_arg[10] = '\0';
  _CPYBYTES(lf_arg,  argv[LFFILE_PARM], 10);
  lf_arg[10] = '\0';

  if ('N' == *(argv[CREATE_PARM]))
     create = '0';
  else
     create = '1';

  if (-1 == qdbcrtha(create, lf_arg, pf_arg, db_lib, lf_arg,
                     db_lib, key_ranges,
                     "*DPT                          "))
  {
     QsendMsg(IBM_MSG_FILE, "CPF9897", "Error received from QDBCRTHA program.",
              ESCAPE_MSG, CS_CTLBDY, 1);
  }
  QsendMsg(IBM_MSG_FILE, "CPF9897", "CRTHASH completed successfully.",
           COMP_MSG, CS_CTLBDY, 1);
  return;

} /* End of: main() */
```

C.15 CRTHISFILE.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* NAME: CRTHISFILE                                                */
/*                                                                 */
/* PURPOSE: create and fill a History database file.               */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &DBFILE &STRWH &NUMWHS &RECOMPILE)

         DCL &DBLIB      TYPE(*CHAR) LEN(10)
         DCL &DBFILE     TYPE(*CHAR) LEN(10)
         DCL &DBFILEDEF  TYPE(*CHAR) LEN(10) VALUE(HSTRY)
         DCL &STRWH      TYPE(*DEC)  LEN(6 0)
         DCL &NUMWHS     TYPE(*DEC)  LEN(6 0)
         DCL &RECOMPILE  TYPE(*CHAR) LEN(1)

         DCL &NUM1       TYPE(*DEC)  LEN(6 0)
         DCL &NUM2       TYPE(*DEC)  LEN(6 0)

         DCL &STRWHC     TYPE(*CHAR) LEN(6)
         DCL &NUMWHC     TYPE(*CHAR) LEN(6)
         DCL &STRWHNULL  TYPE(*CHAR) LEN(7)
         DCL &NUMWHNULL  TYPE(*CHAR) LEN(7)
         DCL &NULLCH     TYPE(*CHAR) LEN(1) VALUE(X'00')

         DCL &PGMLIB     TYPE(*CHAR) LEN(10)
         DCL &REUSEREC   TYPE(*CHAR) LEN(4)  VALUE(*YES)
         DCL &ORDSIZ     TYPE(*DEC)  LEN(9 0)

         DCL &MDATA1     TYPE(*CHAR) LEN(43) +
                         VALUE('CRTHISFILE: filling the         db file...')
         DCL &MDATA      TYPE(*CHAR) LEN(58) +
             VALUE('CRTHISFILE: calling FILLHIST pgm to fill        db file...')

         /*-------------------------------------------------------*/
         MONMSG MSGID(CPF0000 CEE9901 MCH0000) EXEC(GOTO ERREXIT)


         RTVOBJD OBJ(CRTHISFILE) OBJTYPE(*PGM) RTNLIB(&PGMLIB)
           MONMSG CPF9811 EXEC(DO)
             SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
                  MSGDTA('Add the library with CRTHISFILE pgm to lib list!')
             GOTO ERREXIT
          ENDDO

         CRTMSGQ MSGQ(&DBLIB/TPCCMSG)
           MONMSG CPF2112 EXEC(RCVMSG RMV(*YES))

         CHGVAR VAR(%SST(&MDATA1 25 7)) VALUE(&DBFILE)
         SNDPGMMSG MSGID(CPF9897) MSGDTA(&MDATA1) +
                   MSGF(QSYS/QCPFMSG) TOPGMQ(*EXT) MSGTYPE(*STATUS)

         IF COND(&NUMWHS < 3000) THEN(CHGVAR &REUSEREC VALUE(*NO))

         CALL TPCCTOOLS/SETTOOLIBL
         CALL &PGMLIB/SETBLDLIBL   /* So we can do a CRTPF. */

         ADDLIBLE &DBLIB
           MONMSG MSGID(CPF2103) EXEC(RCVMSG RMV(*YES))

         DLTF &DBLIB/&DBFILE
           MONMSG MSGID(CPF2105) EXEC(RCVMSG RMV(*YES))

         CHGVAR &ORDSIZ VALUE(&NUMWHS * 36000)
             CRTPF       FILE(&DBLIB/&DBFILE) SRCMBR(&DBFILEDEF) +
                           SIZE(&ORDSIZ 30000 30000) ALLOCATE(*YES) +
                           WAITRCD(*NOMAX) SHARE(*YES) DLTPCT(50) +
                           REUSEDLT(&REUSEREC) LVLCHK(*NO)

         /*-------------------------------------------------------*/
         /* Now that the HSTRY file has been created...           */
         /* Create programs to fill the HSTRY file.               */
         /*-------------------------------------------------------*/
         IF (&RECOMPILE *EQ 'Y') THEN(DO)

            OVRDBF FILE(&DBFILEDEF) TOFILE(&DBLIB/&DBFILE) OVRSCOPE(*JOB)
            CRTCMOD MODULE(&PGMLIB/FILLHIST) SRCFILE(QCSRC)

            CRTPGM PGM(&PGMLIB/FILLHIST) +
                 MODULE(&PGMLIB/FILLHIST &PGMLIB/COMMONTPCC &PGMLIB/TPCCSPACE) +
                   ENTMOD(&PGMLIB/FILLHIST) BNDSRVPGM(TPCCTOOLS/TPCCTOOLS)

            DLTOVR FILE(&DBFILEDEF) LVL(*JOB)
         ENDDO

         CHGVAR &STRWHC     VALUE(&STRWH)
         CHGVAR &STRWHNULL  VALUE(&STRWHC *CAT &NULLCH)
         CHGVAR &NUMWHC     VALUE(&NUMWHS)
         CHGVAR &NUMWHNULL  VALUE(&NUMWHC *CAT &NULLCH)

         /*-------------------------------------------------------*/
         /* Call pgm to fill HSTRY file.                          */
         /*-------------------------------------------------------*/
         CHGVAR VAR(%SST(&MDATA 42 6)) VALUE(&DBFILE)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA(&MDATA) TOMSGQ(&DBLIB/TPCCMSG)

     /*  WRKSYSSTS OUTPUT(*PRINT) RESET(*YES)  */

         CALL &PGMLIB/FILLHIST +
              PARM(&DBLIB &DBFILE &STRWHNULL &NUMWHNULL '000' '000')

     /*  WRKSYSSTS OUTPUT(*PRINT) RESET(*NO)   */

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('CRTHISFILE program completed successfully!') +
                   TOMSGQ(&DBLIB/TPCCMSG)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
                   MSGDTA('CRTHISFILE failed!') TOMSGQ(&DBLIB/TPCCMSG)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRTHISFILE failed!') MSGTYPE(*ESCAPE)
ENDPGM: ENDPGM
```

C.16 CRTHSTRYLF.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* NAME: CRTHSTRYLF                                                */
/*                                                                 */
/* PURPOSE: create logical view from history file.                 */
/*          has delayed maintinence option                         */
/*          Note that Split DB file names have source members with */
/*          the partition number in their name.                    */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &NUMPARTS)

   DCL &FILE       TYPE(*CHAR) LEN(10) VALUE(HSTRY)
   DCL &DBLIB      TYPE(*CHAR) LEN(10)
   DCL &NUMPARTS   TYPE(*CHAR) LEN(2)

   DCL &FILESRCLF  TYPE(*CHAR) LEN(10) VALUE(HSTRYLF000)

         /*-------------------------------------------------------*/
         MONMSG (CPF7302 CPF0001) EXEC(GOTO ERREXIT)
         IF COND(&NUMPARTS *EQ '01') THEN(GOTO ERREXIT)
         CHGVAR %SST(&FILESRCLF 9 2) VALUE(&NUMPARTS)
         /* Create PARTIAL key view. */
         CHKOBJ OBJ(&DBLIB/&FILE) OBJTYPE(*FILE)
         MONMSG     MSGID(CPF9801) EXEC(CRTLF FILE(&DBLIB/&FILE) +
                          SRCMBR(&FILESRCLF) MAINT(*REBLD) +
                          WAITRCD(*NOMAX) LVLCHK(*NO))

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRT1VIEW completed successfully!') MSGTYPE(*COMP)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRT1VIEW failed!') MSGTYPE(*ESCAPE)
ENDPGM: ENDPGM
```

C.17 CRTINDEX.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: CRTINDEX                                               */
/*                                                                 */
/* Create an index with the given name                             */
/* Call check index build status then build the index in line      */
/* or submit the index build                                       */
/* Parms: Where to put pgm objects                                 */
/*        Database library name                                    */
/*        Database library asp                                     */
/*        Number of warehouses                                     */
/*        Number of partitions                                     */
/*                                                                 */
/*  Build files and index mixed                                    */
/*-----------------------------------------------------------------*/
PGM PARM(&INDEX &DBLIB &DBASPCN &NUMWHS &NUMPARTSC &PARIND)

   DCL &INDEX     TYPE(*CHAR) LEN(6)
   DCL &DBLIB      TYPE(*CHAR) LEN(10)
   DCL &DBASPCN    TYPE(*CHAR) LEN(3) /* DB ASP number w/null   */
   DCL &NUMWHS     TYPE(*DEC)  LEN(6)
   DCL &PARIND     TYPE(*CHAR) LEN(1)

   DCL &PGMLIB     TYPE(*CHAR) LEN(10)
   DCL &MSGQ       TYPE(*CHAR) LEN(10) VALUE(INDEXMSGQ)
   DCL &NUMPARTSC TYPE(*CHAR)  LEN(2)

         /* Other pgms will be called from library we are running in.  */
         RTVOBJD OBJ(CRTINDEX) OBJTYPE(*PGM) RTNLIB(&PGMLIB)

         /*-------------------------------------------------------*/
    IF COND(&INDEX *EQ 'CSTMR ') THEN( +
    DO)
        SBMJOB CMD(CALL &PGMLIB/CSTMRVIEW PARM(&DBLIB &NUMPARTSC)) +
                JOB(CSTMRINDEX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
       GOTO NORMEXIT
    ENDDO
    IF COND(&INDEX *EQ 'DSTRCT') THEN( +
    DO)
         SBMJOB CMD(CALL &PGMLIB/CRT1VIEW PARM('DSTRCT' &DBLIB  +
             &NUMPARTSC)) +
                JOB(DSTRCTINDX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
       GOTO NORMEXIT
    ENDDO
    IF COND(&INDEX *EQ 'HSTRY ') THEN( +
    DO)
         SBMJOB     CMD(CALL PGM(&PGMLIB/CRTHSTRYLF) PARM(  +
                          &DBLIB &NUMPARTSC)) JOB(HSTRYINDEX) +
                          JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
       GOTO NORMEXIT
    ENDDO
    IF COND(&INDEX *EQ 'NEWORD') THEN( +
    DO)
        SBMJOB CMD(CALL &PGMLIB/CRT2VIEW PARM('NEWORD' &DBLIB          +
                &NUMPARTSC)) +
                JOB(NEWORDINDX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
       GOTO NORMEXIT
    ENDDO
    IF COND(&INDEX *EQ 'ORDERS') THEN( +
    DO)
        SBMJOB CMD(CALL &PGMLIB/CRT2VIEW PARM('ORDERS' &DBLIB          +
                &NUMPARTSC)) +
                JOB(ORDERSINDX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
       GOTO NORMEXIT
    ENDDO
    IF COND(&INDEX *EQ 'ORDLIN') THEN( +
    DO)
        SBMJOB CMD(CALL &PGMLIB/CRT2VIEW PARM('ORDLIN' &DBLIB          +
                &NUMPARTSC)) +
                JOB(ORDLININDX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
       GOTO NORMEXIT
    ENDDO
    IF COND(&INDEX *EQ 'STOCK ') THEN( +
    DO)
        SBMJOB CMD(CALL &PGMLIB/CRTSTOCKLF PARM(&DBLIB                 +
                &NUMPARTSC)) +
                JOB(STOCKINDEX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
       GOTO NORMEXIT
    ENDDO
    IF COND(&INDEX *EQ 'WRHS  ') THEN( +
    DO)
         SBMJOB     CMD(CALL PGM(&PGMLIB/CRT1VIEW) PARM('WRHS  ' +
                          &DBLIB &NUMPARTSC)) JOB(WHINDEX) +
                          JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)
       GOTO NORMEXIT
    ENDDO
NORMEXIT:
    ENDPGM
```

C.18 CRTITEM.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: CRTITEM                                                */
/*                                                                 */
/* Purpose: Create the ITEM PF and fill it.                        */
/*                                                                 */
/* Parms: Database library name                                    */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &NUMPARTS)

   DCL &DBLIB    TYPE(*CHAR) LEN(10)
   DCL &NUMPARTS TYPE(*DEC)  LEN(2 0)
   DCL &ITEMFILE TYPE(*CHAR) LEN(10)
   DCL &NEWFILE  TYPE(*CHAR) LEN(10)
   DCL &PGMLIB   TYPE(*CHAR) LEN(10)
   DCL &CURRPARTC TYPE(*CHAR) LEN(2)
   DCL &CURRPART  TYPE(*DEC)  LEN(2 0)
   DCL &MSGQ     TYPE(*CHAR) LEN(10) VALUE(TPCCMSG)


         MONMSG MSGID(CPF0000 MCH0000) EXEC(GOTO ERREXIT)

         /* Other pgms will be called from library we are running in.  */
         RTVOBJD OBJ(CRTITEM) OBJTYPE(*PGM) RTNLIB(&PGMLIB)

         /*-----------------------------------------------------------*/
         /* Create the ITEM file and program.                         */
         /*-----------------------------------------------------------*/
         DLTF &DBLIB/ITEMLF
           MONMSG MSGID(CPF2105) EXEC(RCVMSG RMV(*YES))

         IF COND(&NUMPARTS *EQ 1) THEN(DO)
             CHGVAR &ITEMFILE VALUE(ITEM)
         ENDDO
         ELSE DO
             CHGVAR &ITEMFILE VALUE(ITEM01)
         ENDDO

         DLTF &DBLIB/&ITEMFILE
           MONMSG MSGID(CPF2105) EXEC(RCVMSG RMV(*YES))
           CRTPF      FILE(&DBLIB/&ITEMFILE) SRCMBR(ITEM)  +
                        SIZE(*NOMAX) WAITRCD(*NOMAX) LVLCHK(*NO)

         OVRDBF FILE(ITEM) TOFILE(&DBLIB/&ITEMFILE)

         CRTCMOD &PGMLIB/FILLITEM
         CRTPGM  &PGMLIB/FILLITEM +
                 MODULE(&PGMLIB/FILLITEM &PGMLIB/TPCCSPACE &PGMLIB/COMMONTPCC) +
                 BNDSRVPGM(TPCCTOOLS/TPCCTOOLS)

         DLTOVR FILE(ITEM)

         CALL &PGMLIB/FILLITEM PARM(&DBLIB &ITEMFILE)
         IF COND(&NUMPARTS *GT 1) THEN(DO)
         CHGVAR VAR(&CURRPART) VALUE(2)
         CHGVAR VAR(&NEWFILE) VALUE(&ITEMFILE)
             CRTCLPGM   PGM(&DBLIB/TRIGGERFIN)
             CRTCLPGM   PGM(&DBLIB/TRIGGERSET)
             CRTCLPGM   PGM(&DBLIB/TRIGGERIT)
 ITEMLOOP:   CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
             CHGVAR VAR(%SST(&NEWFILE 5 2)) VALUE(&CURRPARTC)
             CRTDUPOBJ  OBJ(&ITEMFILE) FROMLIB(&DBLIB) +
                        OBJTYPE(*FILE) NEWOBJ(&NEWFILE) DATA(*YES)
             RNMM       FILE(&NEWFILE) MBR(&ITEMFILE) NEWMBR(&NEWFILE)
             SNDPGMMSG &NEWFILE
             ADDPFTRG   FILE(&NEWFILE) TRGTIME(*BEFORE)  +
                          TRGEVENT(*INSERT) PGM(&DBLIB/TRIGGERSET)
             ADDPFTRG   FILE(&NEWFILE) TRGTIME(*BEFORE)  +
                          TRGEVENT(*DELETE) PGM(&DBLIB/TRIGGERSET)
             ADDPFTRG   FILE(&NEWFILE) TRGTIME(*BEFORE)  +
                          TRGEVENT(*UPDATE) PGM(&DBLIB/TRIGGERSET)
             ADDPFTRG   FILE(&NEWFILE) TRGTIME(*AFTER)  +
                          TRGEVENT(*INSERT) PGM(&DBLIB/TRIGGERFIN)
             ADDPFTRG   FILE(&NEWFILE) TRGTIME(*AFTER)  +
                          TRGEVENT(*DELETE) PGM(&DBLIB/TRIGGERFIN)
             ADDPFTRG   FILE(&NEWFILE) TRGTIME(*AFTER)  +
                          TRGEVENT(*UPDATE) PGM(&DBLIB/TRIGGERFIN)
             CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
             IF         COND(&CURRPART *LE &NUMPARTS) THEN(GOTO +
                          CMDLBL(ITEMLOOP))
         ENDDO

         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG)  +
                  MSGDTA('CRTITEM failed!') MSGTYPE(*ESCAPE)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                  MSGDTA('CRTITEM failed!') TOMSGQ(&DBLIB/&MSGQ)
ENDPGM: ENDPGM
```

C.19 CRTORDFILE.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* NAME: CRTORDFILE                                                */
/*                                                                 */
/* PURPOSE: create and fill the following Database files:          */
/*          - ORDERSPF                                             */
/*          - ORDLINPF                                             */
/*          - NEWORDPF                                             */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &ORDERSNAME &ORDLINNAME &NEWORDNAME &STRWH &NUMWH +
         &RECOMPILE)

         DCL &DBLIB      TYPE(*CHAR) LEN(10)
         DCL &ORDERSNAME TYPE(*CHAR) LEN(10)
         DCL &ORDLINNAME TYPE(*CHAR) LEN(10)
         DCL &NEWORDNAME TYPE(*CHAR) LEN(10)
         DCL &STRWH      TYPE(*DEC)  LEN(6 0)
         DCL &NUMWH      TYPE(*DEC)  LEN(6 0)
         DCL &RECOMPILE  TYPE(*CHAR) LEN(1)

         DCL &STRWHC     TYPE(*CHAR) LEN(6)
         DCL &STRWHNULL  TYPE(*CHAR) LEN(7)
         DCL &NUMWHC     TYPE(*CHAR) LEN(6)
         DCL &NUMWHNULL  TYPE(*CHAR) LEN(7)

         DCL &NUM1       TYPE(*DEC)  LEN(6 0)
         DCL &NUM2       TYPE(*DEC)  LEN(6 0)

         DCL &ORDERSNAMN TYPE(*CHAR) LEN(11)
         DCL &ORDLINNAMN TYPE(*CHAR) LEN(11)
         DCL &NEWORDNAMN TYPE(*CHAR) LEN(11)
         DCL &ORDERSFILE TYPE(*CHAR) LEN(10) VALUE(ORDERSPF)
         DCL &ORDLINFILE TYPE(*CHAR) LEN(10) VALUE(ORDLINPF)
         DCL &NEWORDFILE TYPE(*CHAR) LEN(10) VALUE(NEWORDPF)

         DCL &PGMLIB     TYPE(*CHAR) LEN(10)
         DCL &NULLCH     TYPE(*CHAR) LEN(1)  VALUE(X'00')

         DCL &REUSEREC   TYPE(*CHAR) LEN(4)  VALUE(*YES)
         DCL &ORDSIZ     TYPE(*DEC)  LEN(9 0)
         DCL &ORDLINSIZ  TYPE(*DEC)  LEN(10 0)
         DCL &ORDLINSIZW TYPE(*DEC)  LEN(10 0)
         DCL &NEWORDSIZ  TYPE(*DEC)  LEN(9 0)

         DCL &MDATA      TYPE(*CHAR) LEN(43) +
                         VALUE('CRTORDFILE: filling all the ORDER  files...')

         /*-----------------------------------------------------------*/

         MONMSG MSGID(CPF0000 MCH0000 CZM0000) EXEC(GOTO ERREXIT)

         RTVOBJD OBJ(CRTORDFILE) OBJTYPE(*PGM) RTNLIB(&PGMLIB)
           MONMSG CPF9811 EXEC(DO)
             SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
                       MSGDTA('Add the library with CRTORDFILE pgm to lib list!')
             GOTO ERREXIT
          ENDDO

         SNDPGMMSG MSGID(CPF9897) MSGF(QCPFMSG) MSGTYPE(*STATUS) TOPGMQ(*EXT) +
                   MSGDTA('CRTORDFILE: starting...')

         ADDLIBLE &DBLIB
            MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))

         CRTMSGQ MSGQ(&DBLIB/TPCCMSG)
           MONMSG CPF2112 EXEC(RCVMSG RMV(*YES))

         IF COND(&NUMWH < 3000) THEN(CHGVAR &REUSEREC VALUE(*NO))

         DLTF &DBLIB/&ORDERSNAME
           MONMSG CPF2105 EXEC(RCVMSG RMV(*YES))

         DLTF &DBLIB/&ORDLINNAME
           MONMSG CPF2105 EXEC(RCVMSG RMV(*YES))

         DLTF &DBLIB/&NEWORDNAME
           MONMSG CPF2105 EXEC(RCVMSG RMV(*YES))

         CHGVAR &ORDSIZ     VALUE(&NUMWH * 36000)
         CHGVAR &ORDLINSIZ  VALUE(&NUMWH * 360000)
         CHGVAR &ORDLINSIZW VALUE(&ORDLINSIZ)
         /* Save the required size for extra filling.  */
         IF COND(&ORDLINSIZ > 2147483646)  THEN(DO)
            IF COND(&ORDLINSIZ < 3024000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479552)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 3168000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479553)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 3312000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479554)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 3456000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479555)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 3600000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479556)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 3744000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479557)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 3888000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479558)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 4032000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479559)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 4176000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479560)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 4294800000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479561)
               GOTO CRTFILES
            ENDDO
            IF COND(&ORDLINSIZ < 4032000000) THEN(DO)
               CHGVAR &ORDLINSIZW VALUE(2147479562)
               GOTO CRTFILES
            ENDDO
         ENDDO
CRTFILES:
         CHGVAR &NEWORDSIZ VALUE(&NUMWH * 11000)

             CRTPF      FILE(&DBLIB/&ORDERSNAME) SRCMBR(&ORDERSFILE)  +
                          SIZE(&ORDSIZ 30000 1000) ALLOCATE(*YES)  +
                          WAITRCD(*NOMAX)  SHARE(*YES)  DLTPCT(50)  +
                          REUSEDLT(&REUSEREC)  LVLCHK(*NO)

             CRTPF      FILE(&DBLIB/&ORDLINNAME) SRCMBR(&ORDLINFILE)  +
                          SIZE(&ORDLINSIZW 00000 00000) +
                          ALLOCATE(*YES)  WAITRCD(*NOMAX)  +
                          SHARE(*YES)  DLTPCT(50)  +
                          REUSEDLT(&REUSEREC)  LVLCHK(*NO)

             CRTPF      FILE(&DBLIB/&NEWORDNAME) SRCMBR(&NEWORDFILE)  +
                          SIZE(&NEWORDSIZ 30000 30000) +
                          ALLOCATE(*YES)  WAITRCD(*NOMAX)  +
                          SHARE(*YES)  DLTPCT(50)  +
                          REUSEDLT(&REUSEREC)  LVLCHK(*NO)

         IF  (&RECOMPILE *EQ 'Y') THEN(DO)

            OVRDBF &ORDERSFILE TOFILE(&DBLIB/&ORDERSNAME)  OVRSCOPE(*JOB)
              MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))
            OVRDBF &ORDLINFILE TOFILE(&DBLIB/&ORDLINNAME)  OVRSCOPE(*JOB)
              MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))
            OVRDBF &NEWORDFILE TOFILE(&DBLIB/&NEWORDNAME)  OVRSCOPE(*JOB)
              MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))

            /*-----------------------------------------------------------*/
            /* Now that the files have been created...                   */
            /* Create programs to fill the orders file.                  */
            /*-----------------------------------------------------------*/
            CALL TPCCTOOLS/SETTOOLIBL /* So we get correct header file.  */

            CRTCMOD &PGMLIB/FILLORD
            CRTCMOD &PGMLIB/MASTORD

            CRTPGM &PGMLIB/FILLORD +
                  MODULE(&PGMLIB/FILLORD  &PGMLIB/COMMONTPCC  &PGMLIB/TPCCSPACE)  +
                   ENTMOD(&PGMLIB/FILLORD)  BNDSRVPGM(TPCCTOOLS/TPCCTOOLS)
            CRTPGM &PGMLIB/MASTORD +
                  MODULE(&PGMLIB/MASTORD  &PGMLIB/COMMONTPCC  &PGMLIB/TPCCSPACE)  +
                   ENTMOD(&PGMLIB/MASTORD)  BNDSRVPGM(TPCCTOOLS/TPCCTOOLS)

            DLTOVR FILE(&NEWORDFILE)  LVL(*JOB)
              MONMSG CPF9841
            DLTOVR FILE(&ORDLINFILE)  LVL(*JOB)
              MONMSG CPF9841
            DLTOVR FILE(&ORDERSFILE)  LVL(*JOB)
              MONMSG CPF9841
         ENDDO

         CHGVAR &STRWHC     VALUE(&STRWH)
         CHGVAR &STRWHNULL  VALUE(&STRWHC  *CAT  &NULLCH)
         CHGVAR &NUMWHC     VALUE(&NUMWH)
         CHGVAR &NUMWHNULL  VALUE(&NUMWHC  *CAT  &NULLCH)
         CHGVAR &ORDERSNAMN VALUE(&ORDERSNAME  *TCAT  &NULLCH)
         CHGVAR &ORDLINNAMN VALUE(&ORDLINNAME  *TCAT  &NULLCH)
         CHGVAR &NEWORDNAMN VALUE(&NEWORDNAME  *TCAT  &NULLCH)

         /*-----------------------------------------------------------*/
         /* Call pgm to fill ORDERS, ORDLINPF and NEWORDERS file.  */
         /*-----------------------------------------------------------*/
         SNDPGMMSG MSGID(CPF9897) MSGDTA(&MDATA)  +
                   MSGF(QSYS/QCPFMSG)  TOPGMQ(*EXT)  MSGTYPE(*STATUS)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG)  MSGTYPE(*INFO)  +
                   MSGDTA(&MDATA)  TOMSGQ(&DBLIB/TPCCMSG)

      /*  WRKSYSSTS OUTPUT(*PRINT)  RESET(*YES)  */
```

```
         CALL &PGMLIB/MASTORD PARM(&DBLIB &ORDERSNAMN &ORDLINNAMN +
                                   &NEWORDNAMN &STRWHNULL &NUMWHNULL)
     /*  WRKSYSSTS OUTPUT(*PRINT) RESET(*NO)   */

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('CRTORDFILE program completed successfully!') +
                   TOMSGQ(&DBLIB/TPCCMSG)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*ESCAPE) +
                   MSGDTA('CRTORDFILE failed!')
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('CRTORDFILE failed!') TOMSGQ(&DBLIB/TPCCMSG)
ENDPGM: ENDPGM
```

C.20 CRTTPCCDB.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: CRTTPCCDB                                              */
/*                                                                 */
/* Purpose: Guess what?  Create the TPCC database!                 */
/*                                                                 */
/* Parms: Database library name                                    */
/*        ASP for DB                                               */
/*        Journal receiver library name                            */
/*        ASP for Journal receiver library                         */
/*        How to manage journal receivers                          */
/*        Number of warehouses                                     */
/*        Creating a Split Database?                               */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB  &DBASP &PARSUP  +
         &JRNLIB &JRNASP &MNGRCV &RCVSIZEOPT &THRESHOLD  +
         &WHS +
         &NUMPARTS &SAVEDB &MEDIA &SAVFLIB &SAVFASP &DEVNAME)

     DCL &DBLIB      TYPE(*CHAR)  LEN(10)
     DCL &DBASP      TYPE(*DEC)   LEN(2 0)
     DCL &PARSUP     TYPE(*CHAR)  LEN(1)
     DCL &JRNLIB     TYPE(*CHAR)  LEN(10)
     DCL &JRNASP     TYPE(*DEC)   LEN(2 0)
     DCL &MNGRCV     TYPE(*CHAR)  LEN(10)
     DCL &RCVSIZEOPT TYPE(*CHAR)   LEN(10)
     DCL &THRESHOLD  TYPE(*DEC)    LEN(10)
     DCL &WHS        TYPE(*DEC)   LEN(6 0)
     DCL &NUMPARTS   TYPE(*DEC)   LEN(2 0)
     DCL &NUMPARTSC  TYPE(*CHAR)  LEN(2)
     DCL &SAVEDB     TYPE(*CHAR)  LEN(1)
     DCL &MEDIA            *CHAR  LEN(5)
     DCL &SAVFLIB          *CHAR  LEN(10)
     DCL &SAVFASP          *DEC   LEN(2 0)
     DCL &DEVNAME          *CHAR  LEN(10)

     DCL &WHSC       TYPE(*CHAR)  LEN(6)
     DCL &WHSCN      TYPE(*CHAR)  LEN(7)
     DCL &DBASPC     TYPE(*CHAR)  LEN(2)
     DCL &DBASPCN    TYPE(*CHAR)  LEN(3)

     DCL &NULL       TYPE(*CHAR)  LEN(1)  VALUE(X'00')
     DCL &DATE       TYPE(*CHAR)  LEN(6)
     DCL &PGMLIB     TYPE(*CHAR)  LEN(10)
     DCL &MSGQ       TYPE(*CHAR)  LEN(10)  VALUE(TPCCMSG)
     DCL &BLDSBS     TYPE(*CHAR)  LEN(10)  VALUE(TPCCBLDSBS)
     DCL &RCVSIZEMOD TYPE(*CHAR)   LEN(32)

     DCL &MSGDATA TYPE(*CHAR)  LEN(65) +
  VALUE('CRTTPCCDB: starting warehouse id = 1 and the total equals       .')

 /*-----------------------------------------------------------------*/
 /* Start of executable code                                        */
 /*-----------------------------------------------------------------*/
     MONMSG MSGID(CPF2556 CPF1023 CPF1054 CPF2103 CPF2105 CPA0701 CPF9898)

     /* Monitor ERROR msgs, then exit. */
     MONMSG (CPF0001 CPF0801 CPF1338 CPF2161 CPF9897 CPF9999) EXEC(GOTO ERREXIT)

         IF COND(&WHS < 1) THEN(DO)
           SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
                     MSGDTA('WHS parameter must be greater than 0!')
           GOTO ERREXIT
         ENDDO
         IF COND(&NUMPARTS > &WHS) THEN( +
         DO)
            SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*ESCAPE) +
            MSGDTA('Number of warehouses must be greater or equal +
            to the number of partitions.')
            GOTO ERREXIT
         ENDDO
     CHGSYSVAL SYSVAL(QQRYDEGREE) VALUE(*NONE)
     /* set the system value so the index build does not blow up    */

         /*-----------------------------------------------------------*/
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*STATUS) +
                   MSGDTA('CRTTPCCDB is starting...') TOPGMQ(*EXT)

         RTVSYSVAL SYSVAL(QDATE) RTNVAR(&DATE)

         CHKOBJ OBJ(QSYS/&DBLIB) OBJTYPE(*LIB)
           MONMSG CPF9801 EXEC(DO)
              RCVMSG RMV(*YES)
              GOTO CRTLIB
           ENDDO
           SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
           MSGDTA('Database library exist delete first then call CRTTPCCDB')
           GOTO ENDPGM
 CRTLIB: CRTLIB &DBLIB TEXT('Data base library ' *CAT  &DATE) ASP(&DBASP)
           MONMSG CPF2111 EXEC(RCVMSG RMV(*YES))

         /* MSGQ for Status and Info messages.  */
         CRTMSGQ MSGQ(&DBLIB/&MSGQ)
           MONMSG CPF2112 EXEC(CLRMSGQ MSGQ(&DBLIB/&MSGQ))

         CRTMSGQ MSGQ(&DBLIB/TPCCBLDMSG)
           MONMSG CPF2112 EXEC(CLRMSGQ MSGQ(&DBLIB/TPCCBLDMSG))

         CHGVAR VAR(%SST(&MSGDATA 59 6)) VALUE(&WHS)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA(&MSGDATA) TOMSGQ(&DBLIB/&MSGQ)

         /* Other pgms will be called from library we are running in.  */
         RTVOBJD OBJ(CRTTPCCDB) OBJTYPE(*PGM) RTNLIB(&PGMLIB)

         /*-----------------------------------------------------------*/
         ENDSBS  &BLDSBS OPTION(*IMMED)
         DLTSBSD &PGMLIB/&BLDSBS
           MONMSG CPF2105 EXEC(RCVMSG RMV(*YES))
         DLTJOBD &PGMLIB/TPCBLDJOBD
           MONMSG CPF2105 EXEC(RCVMSG RMV(*YES))
         CRTSBSD &PGMLIB/&BLDSBS POOLS((1 *BASE)) TEXT('TPCCBLD Jobs Subsystem')

         DLTCLS &PGMLIB/TPCCBLDCLS
           MONMSG CPF2105 EXEC(RCVMSG RMV(*YES))
         CRTCLS &PGMLIB/TPCCBLDCLS RUNPTY(21) TIMESLICE(2000) PURGE(*NO)

         DLTJOBQ JOBQ(&PGMLIB/TPCBLDJOBQ)
           MONMSG CPF2105 EXEC(RCVMSG RMV(*YES))
         CRTJOBQ JOBQ(&PGMLIB/TPCBLDJOBQ)
         ADDJOBQE SBSD(&PGMLIB/&BLDSBS) JOBQ(&PGMLIB/TPCBLDJOBQ) MAXACT(*NOMAX)

         CRTJOBD  JOBD(&PGMLIB/TPCBLDJOBD) JOBQ(&PGMLIB/TPCBLDJOBQ) +
                  RTGDTA(&PGMLIB) INLLIBL(&PGMLIB QTEMP QGPL) +
                  LOG(4 0 *SECLVL) INQMSGRPY(*DFT)
         ADDRTGE SBSD(&PGMLIB/&BLDSBS) SEQNBR(99) CMPVAL(*ANY) PGM(QCMD) +
                 CLS(&PGMLIB/TPCCBLDCLS)
         STRSBS &PGMLIB/&BLDSBS

         /*-----------------------------------------------------------*/
         /* Create the TPCC data areas needed.                        */
         /*-----------------------------------------------------------*/
         SBMJOB CMD(CALL PGM(&PGMLIB/CRTDBDTA) PARM(&DBLIB)) +
                JOB(CRTDBDTA) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/TPCCBLDMSG)

         /*-----------------------------------------------------------*/
         /* Before we start filling the DB, check if enough space  */
         /* exists in the specified ASP.                              */
         /*-----------------------------------------------------------*/
         CHGVAR &WHSC     VALUE(&WHS)
         CHGVAR &WHSCN    VALUE(&WHSC *CAT &NULL)
         CHGVAR &DBASPC   VALUE(&DBASP)
         CHGVAR &DBASPCN VALUE(&DBASPC *CAT &NULL)

         CALL &PGMLIB/CHKWHSPACE PARM(&WHSCN &DBASPCN)

         RCVMSG MSGQ(&DBLIB/TPCCBLDMSG) MSGTYPE(*ANY) WAIT(*MAX)
         /*-----------------------------------------------------------*/
         /* Update TPCC data areas values.                            */
         /*-----------------------------------------------------------*/
         CHGDTAARA &PGMLIB/TPCCDBLIB  VALUE(&DBLIB)
         CHGDTAARA &DBLIB/TPCCJRNLIB  VALUE(&JRNLIB)
         CHGDTAARA &DBLIB/TPCCWRHS    VALUE(&WHS)
         CHGDTAARA &DBLIB/TPCCDBVRS   VALUE('34')
         /* set the version to 3.4 for the database with new stock  */

         /*-----------------------------------------------------------*/
         /* Create Database files and fill them.                      */
         /*-----------------------------------------------------------*/
         CALL &PGMLIB/FILLPARTS PARM(&DBLIB &DBASP &WHS &NUMPARTS +
                                     &PARSUP)
         /*-----------------------------------------------------------*/
         /* Post-Database file and pgm creation...                    */
         /*-----------------------------------------------------------*/

         CHKOBJ     OBJ(&DBLIB/TPCCMNGRCV) OBJTYPE(*DTAARA)
         MONMSG     MSGID(CPF9801) EXEC(CRTDTAARA +
                    DTAARA(&DBLIB/TPCCMNGRCV) TYPE(*CHAR) +
                    LEN(10) VALUE(*SYSTEM))
         CHGDTAARA  DTAARA(&DBLIB/TPCCMNGRCV) VALUE(&MNGRCV)
         CHKOBJ     OBJ(&DBLIB/TPCCRCVSIZ) OBJTYPE(*DTAARA)
         MONMSG     MSGID(CPF9801) EXEC(CRTDTAARA +
                    DTAARA(&DBLIB/TPCCRCVSIZ) TYPE(*CHAR) +
                    LEN(10) TEXT('TPCC Journal receiver size +
                    option'))
         CHGDTAARA  DTAARA(&DBLIB/TPCCRCVSIZ) VALUE(&RCVSIZEOPT)
         CHKOBJ     OBJ(&DBLIB/TPCCRCVTRH) OBJTYPE(*DTAARA)
         MONMSG     MSGID(CPF9801) EXEC(CRTDTAARA +
                    DTAARA(&DBLIB/TPCCRCVTRH) TYPE(*DEC) +
                    LEN(10) TEXT('Journal receiver threshold'))
         CHGDTAARA  DTAARA(&DBLIB/TPCCRCVTRH) VALUE(&THRESHOLD)

         IF COND(&SAVEDB *EQ 'Y') THEN(DO)
            CHGVAR VAR(&NUMPARTSC) VALUE(&NUMPARTS)
             CHKOBJ     OBJ(&JRNLIB) OBJTYPE(*LIB)
             MONMSG     MSGID(CPF9801) EXEC( +
             CRTLIB     LIB(&JRNLIB) ASP(&JRNASP))
             SAVTPCC    DBLIB(&DBLIB) +
                          MEDIA(&MEDIA) +
                          SAVFLIB(&SAVFLIB)  SAVFASP(&SAVFASP) +
                          DEVD(*DEVNAME)
         ENDDO
         ELSE       CMD(DO)
             CHGVAR VAR(%SST(&RCVSIZEMOD 1 2)) VALUE('  ')
             CHGVAR VAR(%SST(&RCVSIZEMOD 3 10)) VALUE(&RCVSIZEOPT)
             CALL &PGMLIB/CRTTPCCJRN PARM(&DBLIB &JRNLIB &JRNASP +
                                      &MNGRCV &RCVSIZEMOD &THRESHOLD)
             CALL &PGMLIB/STRTPCCJRN PARM(&DBLIB)
         ENDDO

         RMVLIBLE &DBLIB
           MONMSG CPF2104 EXEC(RCVMSG RMV(*YES))
         ENDSBS &BLDSBS OPTION(*IMMED)

         /*-----------------------------------------------------------*/
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('CRTTPCCDB completed successfully!')
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('CRTTPCCDB completed successfully!') +
                   TOMSGQ(TPCCDATM/&MSGQ)
         MONMSG    MSGID(CPF2403) EXEC(RCVMSG RMV(*YES))
         MONMSG    MSGID(CPF2469) EXEC(RCVMSG RMV(*YES))
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('CRTTPCCDB completed successfully!') +
                   TOMSGQ(&DBLIB/&MSGQ)
         MONMSG    MSGID(CPF2403) EXEC(RCVMSG RMV(*YES))
         MONMSG    MSGID(CPF2469) EXEC(RCVMSG RMV(*YES))

         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('CRTTPCCDB failed!') TOMSGQ(&DBLIB/&MSGQ)
           /* Ignore errors so we don't get in an infinite loop.  */
           MONMSG CPF0000

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRTTPCCDB failed!') MSGTYPE(*ESCAPE)
ENDPGM:
         ENDPGM
```

C.21 CRTTPCCJRN.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: CRTTPCCJRN                                             */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &JRNLIB &JRNASP &MNGRCV &RCVSIZEOPT +
         &THRESHOLD)

     DCL &DBLIB      TYPE(*CHAR)  LEN(10)
     DCL &JRNLIB     TYPE(*CHAR)  LEN(10)
     DCL &JRNASP     TYPE(*DEC)   LEN(2)
     DCL &MNGRCV     TYPE(*CHAR)  LEN(10)
     DCL &NUMPARTS   TYPE(*DEC)   LEN(2 0)
     DCL &CURRPART   TYPE(*DEC)   LEN(2 0)
     DCL &CURRPARTC  TYPE(*CHAR)  LEN(2)
     DCL &JRNNAME    TYPE(*CHAR)  LEN(10)  VALUE('TPCCJRN   ')
     DCL &JRNRCVNAME TYPE(*CHAR)  LEN(10)
     DCL        VAR(&RCVSIZEOPT)  TYPE(*CHAR) LEN(32)
     DCL &RCVSIZOUT1 TYPE(*CHAR)  LEN(10)  VALUE('          ')
     DCL &RCVSIZOUT2 TYPE(*CHAR)  LEN(10)  VALUE('          ')
     DCL &RCVSIZOUT3 TYPE(*CHAR)  LEN(10)  VALUE('          ')
     DCL &THRESHOLD  TYPE(*DEC)   LEN(10)
     DCL &TESTASP    TYPE(*DEC)   LEN(2 0)

     DCL &DBASP     TYPE(*DEC)   LEN(2 0)  /* Must be (2 0)  */

     /*-----------------------------------------------------------------*/
     MONMSG MSGID(CPF9801 CPF2105 CPF2125)
     MONMSG (CPF0001 CPF0801 CPF9897 CEE9901) EXEC(GOTO ERREXIT)

     SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
               MSGDTA('CRTTPCCJRN: creating journals, etc ...') +
               TOPGMQ(*EXT) MSGTYPE(*STATUS)

     CHKOBJ OBJ(&JRNLIB) OBJTYPE(*LIB)
       MONMSG MSGID(CPF9801) EXEC( +
       DO)
         CRTLIB LIB(&JRNLIB) ASP(&JRNASP) +
                TEXT('TPCC library to hold the journal receivers')
         GOTO NORMA
       ENDDO
       RTVLIBD    LIB(&JRNLIB) ASP(&TESTASP)
```

```
        IF COND(&JRNASP *NE &TESTASP) THEN( +
        DO)
          DLTLIB LIB(&JRNLIB)
          CRTLIB LIB(&JRNLIB) ASP(&JRNASP) +
                 TEXT('TPCC library to hold the journal receivers')
        ENDDO
NORMA:
     /*********************************************************/
     /*                                                       */
     /*    Get the number of parts                            */
     /*                                                       */
     /*********************************************************/
     RTVMBRD     FILE(&DBLIB/WRHS) NBRDTAMBRS(&NUMPARTS)
     CHGJOB INQMSGRPY(*SYSRPYL)
     CHGVAR VAR(&RCVSIZOUT1) VALUE(%SST(&RCVSIZEOPT 3 10))
     IF COND(&RCVSIZOUT1 *NE '*NONE     ') THEN( +
     DO)
        IF COND(%SST(&RCVSIZEOPT 13 1) *EQ '*') THEN( +
        DO)
           CHGVAR VAR(&RCVSIZOUT2) VALUE(%SST(&RCVSIZEOPT 13 10))
           IF COND(%SST(&RCVSIZEOPT 23 1) *EQ '*') THEN( +
           CHGVAR VAR(&RCVSIZOUT3) VALUE(%SST(&RCVSIZEOPT 23 10)))
        ENDDO
             ELSE       CMD(DO)
                IF COND(&RCVSIZOUT1 *EQ *MAXOPT1) THEN( +
                CHGVAR VAR(&RCVSIZOUT2) VALUE(*MINFIXLEN))
             ENDDO
     ENDDO
     IF COND(&NUMPARTS *EQ 1) THEN(DO)
        ENDJRNPF FILE(*ALL) JRN(&DBLIB/TPCCJRN)
        MONMSG MSGID(CPF9801) EXEC(RCVMSG RMV(*YES))
     ENDDO
     ELSE DO
        CHGVAR VAR(&CURRPART) VALUE(1)
ENDJRNLOOP: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
        CHGVAR VAR(%SST(&JRNNAME 8 2)) VALUE(&CURRPARTC)
        ENDJRNPF FILE(*ALL) JRN(&DBLIB/&JRNNAME)
        MONMSG MSGID(CPF9801) EXEC(RCVMSG RMV(*YES))
        CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
        IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO ENDJRNLOOP)
     ENDDO

     CRTMSGQ MSGQ(&DBLIB/TPCCJRNMSG)
       MONMSG CPF2112 EXEC(CLRMSGQ MSGQ(&DBLIB/TPCCJRNMSG))

     DLTJRN    JRN(&DBLIB/TPCCJRN*)
     DLTJRNRCV JRNRCV(&JRNLIB/TPC*)
             MONMSG     MSGID(CPF2117) EXEC(DO)
             SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                       MSGDTA('Reciever library in use!') MSGTYPE(*INFO)
             GOTO ERREXIT
             ENDDO

     IF COND(&NUMPARTS *EQ 1) THEN(DO)
       CRTJRNRCV JRNRCV(&JRNLIB/TPCCJRNRCV) ASP(&JRNASP) +
                 THRESHOLD(&THRESHOLD) TEXT('TPCC Journal Receiver')
     ENDDO
     ELSE DO
             CHGVAR VAR(&CURRPART) VALUE(1)
             CHGVAR VAR(%SST(&JRNRCVNAME 1 4)) VALUE(TPCJ)
             CHGVAR VAR(%SST(&JRNRCVNAME 7 4)) VALUE(NRCV)
CRTJRNRCVL: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
             CHGVAR VAR(%SST(&JRNRCVNAME 5 2)) VALUE(&CURRPARTC)
       CRTJRNRCV JRNRCV(&JRNLIB/&JRNRCVNAME) ASP(&JRNASP) +
                 THRESHOLD(&THRESHOLD) +
                 TEXT('TPCC Journal Receiver (Split DB)')
        CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
        IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO CRTJRNRCVL)
     ENDDO

     /* Get the DBLIB's ASP id. */
     RTVOBJD OBJ(&DBLIB) OBJTYPE(*LIB) ASP(&DBASP)
     IF COND(%SST(&RCVSIZOUT3 1 1) *NE ' ') THEN( +
     DO)
     IF COND(&MNGRCV *EQ '*SYSTEM') THEN(DO)
       IF COND(&NUMPARTS *EQ 1) THEN(DO)
             CRTJRN      JRN(&DBLIB/TPCCJRN) +
                           JRNRCV(&JRNLIB/TPCCJRNRCV) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*SYSTEM) +
                           DLTRCV(*YES) RCVSIZOPT(&RCVSIZOUT1) +
                           &RCVSIZOUT2 &RCVSIZOUT3) TEXT('TPCC Journal')
       ENDDO
       ELSE DO
             CHGVAR VAR(&CURRPART) VALUE(1)
CRTJRNSYSM: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
             CHGVAR VAR(%SST(&JRNNAME 8 2)) VALUE(&CURRPARTC)
             CHGVAR VAR(%SST(&JRNRCVNAME 5 2)) VALUE(&CURRPARTC)
              CRTJRN      JRN(&DBLIB/&JRNNAME) +
                           JRNRCV(&JRNLIB/&JRNRCVNAME) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*SYSTEM) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1 +
                           &RCVSIZOUT2 &RCVSIZOUT3) TEXT('TPCC +
                           Journal (Split DB)')
        CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
        IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO CRTJRNSYSM)
       ENDDO     /* end else */
     ENDDO  /* end  IF COND(&MNGRCV *EQ '*SYSTEM') THEN(DO) */
     ELSE DO
       IF COND(&NUMPARTS *EQ 1) THEN(DO)
              CRTJRN      JRN(&DBLIB/TPCCJRN) +
                           JRNRCV(&JRNLIB/TPCCJRNRCV) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*USER) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1 +
                           &RCVSIZOUT2 &RCVSIZOUT3) TEXT('TPCC Journal')
       ENDDO
       ELSE DO
             CHGVAR VAR(&CURRPART) VALUE(1)
CRTJRNUSRM: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
             CHGVAR VAR(%SST(&JRNNAME 8 2)) VALUE(&CURRPARTC)
             CHGVAR VAR(%SST(&JRNRCVNAME 5 2)) VALUE(&CURRPARTC)
              CRTJRN      JRN(&DBLIB/&JRNNAME) +
                           JRNRCV(&JRNLIB/&JRNRCVNAME) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*USER) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1 +
                           &RCVSIZOUT2 &RCVSIZOUT3) TEXT('TPCC +
                           Journal (Split DB)')
        CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
        IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO CRTJRNUSRM)
       ENDDO  /* else */
     ENDDO  /* end of else system manage */
     GOTO EXIT
     ENDDO
     IF COND(%SST(&RCVSIZOUT2 1 1) *EQ '*') THEN( +
     DO)
     IF COND(&MNGRCV *EQ '*SYSTEM') THEN(DO)
       IF COND(&NUMPARTS *EQ 1) THEN(DO)
              CRTJRN      JRN(&DBLIB/TPCCJRN) +
                           JRNRCV(&JRNLIB/TPCCJRNRCV) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*SYSTEM) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1 +
                           &RCVSIZOUT2) TEXT('TPCC Journal')
       ENDDO
       ELSE DO
             CHGVAR VAR(&CURRPART) VALUE(1)
CRTJRNSYS2: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
             CHGVAR VAR(%SST(&JRNNAME 8 2)) VALUE(&CURRPARTC)
             CHGVAR VAR(%SST(&JRNRCVNAME 5 2)) VALUE(&CURRPARTC)
              CRTJRN      JRN(&DBLIB/&JRNNAME) +
                           JRNRCV(&JRNLIB/&JRNRCVNAME) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*SYSTEM) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1 +
                           &RCVSIZOUT2) TEXT('TPCC +
                           Journal (Split DB)')
        CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
        IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO CRTJRNSYS2)
       ENDDO /* end else */
     ENDDO  /* end IF COND(&MNGRCV *EQ '*SYSTEM') THEN(DO) */
     ELSE DO
       IF COND(&NUMPARTS *EQ 1) THEN(DO)
              CRTJRN      JRN(&DBLIB/TPCCJRN) +
                           JRNRCV(&JRNLIB/TPCCJRNRCV) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*SYSTEM) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1 +
                           &RCVSIZOUT2) TEXT('TPCC Journal')
       ENDDO
       ELSE DO
             CHGVAR VAR(&CURRPART) VALUE(1)
CRTJRNUSR2: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
             CHGVAR VAR(%SST(&JRNNAME 8 2)) VALUE(&CURRPARTC)
             CHGVAR VAR(%SST(&JRNRCVNAME 5 2)) VALUE(&CURRPARTC)
              CRTJRN      JRN(&DBLIB/&JRNNAME) +
                           JRNRCV(&JRNLIB/&JRNRCVNAME) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*USER) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1 +
                           &RCVSIZOUT2) TEXT('TPCC +
                           Journal  (Split  DB)')
        CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
        IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO CRTJRNUSR2)
       ENDDO /* else */
     ENDDO   /* elseIF COND(&MNGRCV *EQ '*SYSTEM') THEN(DO) */
     GOTO EXIT
     ENDDO  /* end of rcvsizout2 set */
     /* last case only rcvsizout1 has data */
     IF COND(&MNGRCV *EQ '*SYSTEM') THEN(DO)
       IF COND(&NUMPARTS *EQ 1) THEN(DO)
              CRTJRN      JRN(&DBLIB/TPCCJRN) +
                           JRNRCV(&JRNLIB/TPCCJRNRCV) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*SYSTEM) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1) +
                           TEXT('TPCC Journal')
       ENDDO
       ELSE DO
             CHGVAR VAR(&CURRPART) VALUE(1)
CRTJRNSYS1: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
             CHGVAR VAR(%SST(&JRNNAME 8 2)) VALUE(&CURRPARTC)
             CHGVAR VAR(%SST(&JRNRCVNAME 5 2)) VALUE(&CURRPARTC)
              CRTJRN      JRN(&DBLIB/&JRNNAME) +
                           JRNRCV(&JRNLIB/&JRNRCVNAME) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*SYSTEM) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1) +
                           TEXT('TPCC +
                           Journal (Split DB)')
        CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
        IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO CRTJRNSYS1)
       ENDDO /* end of else */
     ENDDO /* end of IF COND(&MNGRCV *EQ '*SYSTEM') THEN(DO) */
     ELSE DO
       IF COND(&NUMPARTS *EQ 1) THEN(DO)
              CRTJRN      JRN(&DBLIB/TPCCJRN) +
                           JRNRCV(&JRNLIB/TPCCJRNRCV) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*USER) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1) +
                           TEXT('TPCC Journal')
       ENDDO
       ELSE DO
             CHGVAR VAR(&CURRPART) VALUE(1)
CRTJRNUSR1: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
             CHGVAR VAR(%SST(&JRNNAME 8 2)) VALUE(&CURRPARTC)
             CHGVAR VAR(%SST(&JRNRCVNAME 5 2)) VALUE(&CURRPARTC)
              CRTJRN      JRN(&DBLIB/&JRNNAME) +
                           JRNRCV(&JRNLIB/&JRNRCVNAME) ASP(&DBASP) +
                           MSGQ(&DBLIB/TPCCJRNMSG) MNGRCV(*USER) +
                           DLTRCV(*NO) RCVSIZOPT(&RCVSIZOUT1) +
                           TEXT('TPCC +
                           Journal (Split DB)')
        CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
        IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO CRTJRNUSR1)
       ENDDO /* end else */
     ENDDO /* end else IF COND(&MNGRCV *EQ '*SYSTEM') THEN(DO) */
EXIT:

     /*********************************************************/
     /*                                                       */
     /*  Update the database data arars with the new Journal  */
     /*  information.                                         */
     /*                                                       */
     /*                                                       */
     /*                                                       */
     /*********************************************************/

     CHKOBJ     OBJ(&DBLIB/TPCCJRNLIB) OBJTYPE(*DTAARA)
     MONMSG     MSGID(CPF9801) EXEC(CRTDTAARA +
                DTAARA(&DBLIB/TPCCJRNLIB) TYPE(*CHAR) +
                LEN(10))
     CHGDTAARA  &DBLIB/TPCCJRNLIB  VALUE(&JRNLIB)
     CHKOBJ     OBJ(&DBLIB/TPCCMNGRCV) OBJTYPE(*DTAARA)
     MONMSG     MSGID(CPF9801) EXEC(CRTDTAARA +
                DTAARA(&DBLIB/TPCCMNGRCV) TYPE(*CHAR) +
                LEN(10))
     CHGDTAARA  DTAARA(&DBLIB/TPCCMNGRCV) VALUE(&MNGRCV)
             CHKOBJ     OBJ(&DBLIB/TPCCRCVSIZ) OBJTYPE(*DTAARA)
             MONMSG     MSGID(CPF9801) EXEC(CRTDTAARA +
                          DTAARA(&DBLIB/TPCCRCVSIZ) TYPE(*CHAR) +
                          LEN(10) TEXT('TPCC Journal receiver size +
                          option'))
             CHGDTAARA  DTAARA(&DBLIB/TPCCRCVSIZ) VALUE(&RCVSIZOUT1)
             CHKOBJ     OBJ(&DBLIB/TPCCRCVTRH) OBJTYPE(*DTAARA)
             MONMSG     MSGID(CPF9801) EXEC(CRTDTAARA +
                          DTAARA(&DBLIB/TPCCRCVTRH) TYPE(*DEC) +
                          LEN(10) TEXT('Journal receiver threshold'))
             CHGDTAARA  DTAARA(&DBLIB/TPCCRCVTRH) VALUE(&THRESHOLD)

     DLTMSGQ MSGQ(&DBLIB/TPCCJRNMSG)
       MONMSG CPF0000

         /*-----------------------------------------------------------------*/
     SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                     MSGDTA('CRTTPCCJRN completed successfully!') MSGTYPE(*COMP)
        GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                MSGDTA('CRTTPCCJRN failed!') MSGTYPE(*ESCAPE)
ENDPGM: ENDPGM
```

C.22 CRTWHFILE.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: CRTWHFILE                                              */
/*                                                                 */
/* Purpose: Create and fill the Warehouse file.                    */
/*                                                                 */
/* Parms: Database library name                                    */
/*        File name                                                */
/*        Starting warehouse id  (null terminated)                 */
/*        Number of warehouses   (null terminated)                 */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &WHFILE &STRWH &NUMWH &RECOMPILE)

   DCL &DBLIB      TYPE(*CHAR) LEN(10)
   DCL &WHFILE     TYPE(*CHAR) LEN(10)
   DCL &STRWH      TYPE(*DEC)  LEN(6)
   DCL &NUMWH      TYPE(*DEC)  LEN(6)
   DCL &RECOMPILE  TYPE(*CHAR) LEN(1)

   DCL &STRWHC     TYPE(*CHAR) LEN(6)
   DCL &NUMWHC     TYPE(*CHAR) LEN(6)
   DCL &STRWHNULL  TYPE(*CHAR) LEN(7)
   DCL &NUMWHNULL  TYPE(*CHAR) LEN(7)
   DCL &NULLCH     TYPE(*CHAR) LEN(1) VALUE(X'00')

   DCL &WHFILEDEF  TYPE(*CHAR) LEN(10) VALUE(WRHS)

   DCL &NUM1       TYPE(*DEC)  LEN(6 0)
```

```
   DCL &NUM2       TYPE(*DEC)  LEN(6 0)

   DCL &PGMLIB     TYPE(*CHAR) LEN(10)
   DCL &MSGQ       TYPE(*CHAR) LEN(10) VALUE(TPCCMSG)

   DCL &MDATA      TYPE(*CHAR) LEN(49) +
           VALUE('CRTWHFILE program is filling the WRHS  db file...')

         MONMSG MSGID(CPF0000 MCH0000) EXEC(GOTO ERREXIT)

         /* Other pgms will be called from library we are running in.  */
         RTVOBJD OBJ(CRTWHFILE) OBJTYPE(*PGM) RTNLIB(&PGMLIB)

         /*--------------------------------------------------*/
         /* Create the WRHS file and programs.               */
         /*--------------------------------------------------*/
         CHGVAR VAR(%SST(&MDATA 34 5)) VALUE(&WHFILE)
         SNDPGMMSG MSGID(CPF9897) MSGDTA(&MDATA) +
                   MSGF(QSYS/QCPFMSG) TOPGMQ(*EXT) MSGTYPE(*STATUS)
         SNDPGMMSG MSGID(CPF9897) MSGDTA(&MDATA) +
                   MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) TOMSGQ(&DBLIB/&MSGQ)

         DLTF &DBLIB/&WHFILE
           MONMSG MSGID(CPF2105) EXEC(RCVMSG RMV(*YES))

             CRTPF      FILE(&DBLIB/&WHFILE) SRCMBR(WRHS) +
                          SIZE(*NOMAX) WAITRCD(2) LVLCHK(*NO)

         IF (&RECOMPILE *EQ 'Y') THEN(DO)

            OVRDBF FILE(&WHFILEDEF) TOFILE(&DBLIB/&WHFILE)

            CRTCMOD &PGMLIB/FILLWH

            CRTPGM PGM(&PGMLIB/FILLWH) +
                   MODULE(&PGMLIB/FILLWH &PGMLIB/COMMONTPCC &PGMLIB/TPCCSPACE) +
                   ENTMOD(&PGMLIB/FILLWH) BNDSRVPGM(TPCCTOOLS/TPCCTOOLS)

            DLTOVR FILE(&WHFILEDEF)
         ENDDO

         CHGVAR &STRWHC     VALUE(&STRWH)
         CHGVAR &STRWHNULL  VALUE(&STRWHC *CAT &NULLCH)
         CHGVAR &NUMWHC     VALUE(&NUMWH)
         CHGVAR &NUMWHNULL  VALUE(&NUMWHC *CAT &NULLCH)

         CALL &PGMLIB/FILLWH PARM(&DBLIB &WHFILE &STRWHNULL &NUMWHNULL)

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('CRTWHFILE program completed successfully!') +
                   TOMSGQ(&DBLIB/TPCCMSG)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRTWHFILE failed!') MSGTYPE(*ESCAPE)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('CRTWHFILE failed!') TOMSGQ(&DBLIB/&MSGQ)
ENDPGM: ENDPGM
```

C.23 CSTMRVIEW.CL:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* NAME: CSTMRVIEW                                                   */
/*                                                                   */
/* PURPOSE: create logical views                                     */
/*                                                                   */
/*-------------------------------------------------------------------*/
PGM PARM(&DBLIB &NUMPARTS)

   DCL &DBLIB    TYPE(*CHAR) LEN(10)
   DCL &NUMPARTS TYPE(*CHAR) LEN(2)

   DCL &FILE1    TYPE(*CHAR) LEN(10)
   DCL &FILE2    TYPE(*CHAR) LEN(10)
   DCL &FILE3    TYPE(*CHAR) LEN(10)

   IF COND(&NUMPARTS *EQ '01') THEN(DO)
      CHGVAR &FILE1 VALUE(CSTMRLFCRT)
      CHGVAR &FILE2 VALUE(CSTMRLFNAM)
      CHGVAR &FILE3 VALUE(CSTMR)
   ENDDO
   ELSE DO
      CHGVAR &FILE1 VALUE(CSTMRCRT)
      CHGVAR &FILE2 VALUE(CSTMRNAM)
      CHGVAR &FILE3 VALUE(CSTMR000)
      CHGVAR %SST(&FILE1 9 2) VALUE(&NUMPARTS)
      CHGVAR %SST(&FILE2 9 2) VALUE(&NUMPARTS)
      CHGVAR %SST(&FILE3 9 2) VALUE(&NUMPARTS)
   ENDDO

   /* CREATE THE LAST/FIRST NAME VIEW OVER CSTMRPF.  */
   CHKOBJ OBJ(&DBLIB/CSTMRLFCRT) OBJTYPE(*FILE)
     MONMSG CPF9801 EXEC(CRTLF FILE(&DBLIB/CSTMRLFCRT) SRCMBR(&FILE1) +
                               WAITRCD(2) LVLCHK(*NO))

   /* CREATE THE VIEW FOR ACCESS BY LAST NAME.  */
   CHKOBJ OBJ(&DBLIB/CSTMRLFNAM) OBJTYPE(*FILE)
     MONMSG CPF9801 EXEC(CRTLF FILE(&DBLIB/CSTMRLFNAM) SRCMBR(&FILE2) +
                               WAITRCD(2) LVLCHK(*NO))

   /* CREATE THE UNIQUE VIEW FOR CSTMRPF.  */
   CHKOBJ OBJ(&DBLIB/CSTMR) OBJTYPE(*FILE)
     MONMSG CPF9801 EXEC(CRTLF FILE(&DBLIB/CSTMR) SRCMBR(&FILE3) +
                               WAITRCD(2) LVLCHK(*NO))

   SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
             MSGDTA('CSTMRVIEW completed successfully!') MSGTYPE(*COMP)
ENDPGM
```

C.24 FILCUSFILE.CL:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* NAME: FILCUSFILE                                                  */
/*                                                                   */
/* PURPOSE: fill the following Database files:                       */
/*          - CSTMRPF or for split  DB: CSTMRPF01 to CSTMRPF32       */
/*-------------------------------------------------------------------*/
PGM PARM(&DBLIB &DBFILE &STRWH &NUMWHS &RECOMPILE)

         DCL &DBLIB       TYPE(*CHAR) LEN(10)
         DCL &DBFILE      TYPE(*CHAR) LEN(10)
         DCL &STRWH       TYPE(*DEC)  LEN(6 0)
         DCL &NUMWHS      TYPE(*DEC)  LEN(6 0)
         DCL &RECOMPILE  TYPE(*CHAR) LEN(1)

         DCL &NUM1       TYPE(*DEC)  LEN(6 0)
         DCL &NUM2       TYPE(*DEC)  LEN(6 0)

         DCL &STRWHC     TYPE(*CHAR) LEN(6)
         DCL &NUMWHSC    TYPE(*CHAR) LEN(6)
         DCL &STRWHNULL  TYPE(*CHAR) LEN(7)
         DCL &NUMWHSNULL TYPE(*CHAR) LEN(7)
         DCL &NULLCH     TYPE(*CHAR) LEN(1)  VALUE(X'00')

         DCL &PGMLIB     TYPE(*CHAR) LEN(10)
         DCL &MSGQ       TYPE(*CHAR) LEN(10) VALUE(TPCCMSG)
         DCL &CSTMRSRC   TYPE(*CHAR) LEN(10) VALUE(CSTMRPF)
         DCL &STOCKSRC   TYPE(*CHAR) LEN(10) VALUE(STOCKPF)
         DCL &STOCKFILE  TYPE(*CHAR) LEN(10) VALUE(STOCKPF)

         DCL &MDATA      TYPE(*CHAR) LEN(44) +
                          VALUE('FILCUSFILE: filling the           db file...')

         /*-------------------------------------------------------*/
         MONMSG MSGID(CPF0000 MCH0000) EXEC(GOTO ERREXIT)


         RTVOBJD OBJ(FILCUSFILE) OBJTYPE(*PGM) RTNLIB(&PGMLIB)
           MONMSG CPF9811 EXEC(DO)
             SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
                       MSGDTA('Add the library with FILCUSFILE pgm to lib list!')
             GOTO ERREXIT
           ENDDO

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) TOPGMQ(*EXT) +
                   MSGDTA('FILCUSFILE program starting...') MSGTYPE(*STATUS)

         CRTMSGQ MSGQ(&DBLIB/&MSGQ)
           MONMSG CPF2112 EXEC(RCVMSG RMV(*YES))

         CALL TPCCTOOLS/SETTOOLIBL

         ADDLIBLE &DBLIB
           MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))

         /*-----------------------------------------------------------*/
         IF (&RECOMPILE *EQ 'Y') THEN(DO)

            OVRDBF &CSTMRSRC TOFILE(&DBLIB/&DBFILE) OVRSCOPE(*JOB)
              MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))

            CRTCMOD &PGMLIB/FILLCUS

            CRTPGM  &PGMLIB/FILLCUS +
                    MODULE(&PGMLIB/FILLCUS &PGMLIB/COMMONTPCC +
                           &PGMLIB/TPCCSPACE) +
                    ENTMOD(&PGMLIB/FILLCUS) BNDSRVPGM(TPCCTOOLS/TPCCTOOLS)

            DLTOVR FILE(&CSTMRSRC) LVL(*JOB)
         ENDDO

         CHGVAR VAR(%SST(&MDATA 25 9)) VALUE(&DBFILE)
         SNDPGMMSG MSGID(CPF9897) MSGDTA(&MDATA) +
                   MSGF(QSYS/QCPFMSG) TOPGMQ(*EXT) MSGTYPE(*STATUS)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA(&MDATA) TOMSGQ(&DBLIB/&MSGQ)

         CHGVAR &NUMWHSC    VALUE(&NUMWHS)
         CHGVAR &NUMWHSNULL VALUE(&NUMWHSC *CAT &NULLCH)
         CHGVAR &STRWHC     VALUE(&STRWH)
         CHGVAR &STRWHNULL  VALUE(&STRWHC *CAT &NULLCH)

      /*  WRKSYSSTS OUTPUT(*PRINT) RESET(*YES)  */

         CALL &PGMLIB/MASTCUSSTK PARM(&DBLIB &STRWHNULL &NUMWHSNULL &DBFILE)

      /*  WRKSYSSTS OUTPUT(*PRINT) RESET(*NO)   */

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('FILCUSFILE program completed successfully!')
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('FILCUSFILE program completed successfully!')  +
                   TOMSGQ(&DBLIB/&MSGQ)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('FILCUSFILE failed!') MSGTYPE(*ESCAPE)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('FILCUSFILE failed!') TOMSGQ(&DBLIB/&MSGQ)
ENDPGM: ENDPGM
```

C.25 FILLCUS.C:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* File name: FILLCUS                                                */
/*                                                                   */
/* Purpose: Fill the Customer file.                                  */
/*                                                                   */
/*          NOTE: The logic is the same as in the  FILLSTOCK file.   */
/*                                                                   */
/* PARMS: database library name                                      */
/*        fill_Q name                                                */
/*        write_Q name                                               */
/*        Fill space name                                            */
/*        file id                                                    */
/*        instance number                                            */
/*        starting warehouse number                                  */
/*        number of warehouses                                       */
/*        our job number in the scheme of things                     */
/*        total number of jobs to fill data                          */
/*                                                                   */
/*-------------------------------------------------------------------*/
  /*-----------------------------------------------------------------*/
  /* Includes.                                                       */
  /*-----------------------------------------------------------------*/
  #include <stdlib.h>
  #include <errno.h>
  #include <recio.h>
  #include <string.h>
  #include <xxfdbk.h>
  #include <milib.h>
  #include <micomput.h>
  #include <decimal.h>
  #include <qusptrus.h>
  #include <qwtchgjb.h>
  #include <mih/cpybytes.h>
  #include <mih/cpyblap.h>
  #include <mih/triml.h>
  #include <mih/mattod.h>
  #include <qsysinc/mih/enq>
  #include <qsysinc/mih/deq>
  #include <qsysinc/mih/rslvsp>
  #include <os4msg.h>
  #include <filldata.h>
  #include <commontpcc.h>
  #include <tpccspace.h>

  /*-----------------------------------------------------------------*/
  /* MAPINC generates structures for the database file.              */
  /*-----------------------------------------------------------------*/
  #pragma mapinc("cstmrpf","*libl/cstmrpf(*all)","both",  "d _P",,"tpcc")
  #include "cstmrpf"

  /*-----------------------------------------------------------------*/
  /* Defines                                                         */
  /*-----------------------------------------------------------------*/
  #define DBLIB_PARM           1
  #define FILL_Q_PARM          2
  #define WRITE_Q_PARM         3
  #define FILL_SPACE_PARM      4
  #define FILE_ID_PARM         5
  #define INST_NUMBER_PARM     6
  #define STRWH_PARM           7
  #define NUMWH_PARM           8
  #define JOB_NUMBER_PARM      9
  #define NUMBER_JOBS_PARM    10

  /*-----------------------------------------------------------------*/
  /* Global declares                                                 */
  /*-----------------------------------------------------------------*/
  int    file_id;
  int    inst_number;

  char   dblib[11];
  char   msgtxt[100];
  char   msgq_gl[20];
```

```
  char   pgmname_gl[11];
  char   pgmlib_gl[11];

  _SYSPTR  write_Q_ptr = NULL;
  _ENQ_Msg_Prefix_T  ENQ_msg_prefix;


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: error_cleanup                                           */
/*                                                                   */
/*-------------------------------------------------------------------*/
void error_cleanup(void)
{
    char  Q_msg_text[MSG_LENGTH];

    add_error_jobs(dblib, file_id, inst_number);
    if (NULL != write_Q_ptr)
    {
       sprintf(Q_msg_text, "Q");          /* Quit. */
       enq(write_Q_ptr, &ENQ_msg_prefix, Q_msg_text);
    }

    sprintf(msgtxt, "%s program failed!", pgmname_gl);
    QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
    return;
} /* End: error_cleanup() */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: fill_customer                                           */
/*                                                                   */
/*-------------------------------------------------------------------*/
void fill_customer(unsigned long record_number,
                   unsigned long num_record_per_IO_block,
                   unsigned long max_record,
                   char *data_space, int StartWH, int NumWH)
{
   int  Cid, wid, Dist;
   int  iX;
   int  index;

   unsigned long record_count;   /* Number of records filled in block. */
   unsigned long current_record; /* Current record being processed. */

   char tstr[21];
   char chNumStr[11] = "0123456789";

   tpcc_CSRCD_both_t *CustRec;
   _MI_Time CurrTime;        /* Current time from MATTOD.  */

   /*-------------------------------------------------------------------*/
   /* Start executable code.                                            */
   /*-------------------------------------------------------------------*/
   current_record = record_number;  /* Find the current record */
   record_count = 0;
   while ((record_count < num_record_per_IO_block)  &&
          (current_record <= max_record))
   {
        index = record_count * sizeof(tpcc_CSRCD_both_t); /* Get the position */
        CustRec = (tpcc_CSRCD_both_t *)&data_space[index];
        wid = ((current_record -1) % NumWH) + 1;
        CustRec->CWID  = wid + StartWH;/* note StartWH starts at 0       */
        CustRec->CDID  = Dist = (((current_record -1) / NumWH)% 10) + 1;
        CustRec->CID   = Cid = ((current_record -1) /(10 * NumWH)) + 1;

        /* Build cfirst */
        memset(CustRec->CFIRST, ' ', 16);
        if ((1 == wid) && (1 == Dist) && (Cid==1))
        {
           sprintf(CustRec->CFIRST, "C_load = %d", 7);
           CustRec->CFIRST[strlen(CustRec->CFIRST)]  = ' ';/* put in space */
        } else {
          iX = RANDOM(0,99);
          strncpy(CustRec->CFIRST, szFName[iX], strlen(szFName[iX]));
        }

        /* Build cinit. */
        strncpy(CustRec->CINIT, "OE", 2);

        /* Build clast */
        if (Cid < 1001)
        {
           CreateCust_lastname((Cid-1), tstr);
        } else {
           CreateCust_lastname((NEW_RAND(255,  0, 999)), tstr);
        }
        cpyblap(CustRec->CLAST, 16, tstr, strlen(tstr), ' ');

        CreateStrPad(10, 20, CustRec->CADDR1);
        CreateStrPad(10, 20, CustRec->CADDR2);

        /* build city */
        iX = RANDOM(0,99);
        cpyblap(CustRec->CCITY, 20, CITY_ARR[iX], strlen(CITY_ARR[iX]), ' ');

        /* build state */
        strncpy(CustRec->CSTATE, state_arr[iX], 2);

        /* build zip code */
        CREATE_ZIP(CustRec->CZIP);

        /* build phone # */
        for (iX = 0; iX < 16; ++iX)
        {
           CustRec->CPHONE[iX] = chNumStr[(RANDOM(0,9))];
        }

        /* Build credit limit */
        CustRec->CCRDLM = 50000.00;

        /* Build credit status */
        if ((RANDOM(0,9)) > 0)
        {
           CustRec->CCREDT[0] = 'G';
        } else {
           CustRec->CCREDT[0] = 'B';
        }
        CustRec->CCREDT[1] = 'C';
        /* build Cust balance */
        CustRec->CBAL = -10.00;
        /* build Cust YTD payments */
        CustRec->CYTD = 10.00;
        /* build Cust pay count & delivery count */
        CustRec->CPAYCNT = 1;
        CustRec->CDELCNT = 0;

        /* build Cust Discount */
        CustRec->CDCT = ((RANDOM(0,5000)) / 10000.00);

        /* Build Cust Data */
        CreateStrPad(300, 500, CustRec->CDATA);

        /* Build Cust Date & Time */
        mattod(CurrTime);
        CurrTime[7] = BASE_TIME;
        memcpy(CustRec->CLTOD, CurrTime, sizeof(_MI_Time));

        ++record_count;
        ++current_record;
   } /* end of while loop. */

   return;

} /* end of fill_customer */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: main                                                    */
/*                                                                   */
/*-------------------------------------------------------------------*/
int main(int argc, char **argv)
{
   short    block, job_number;
   int      StartWH;
   int      NumWH;
   int      number_jobs, number_blocks_per_job;
   error_structure errCode;
   unsigned int lib_len;

   char   *slash_pos;

   char    fill_space[21];
   char   *fill_space_ptr;   /* Always points to start of fill space.  */
   char   *fill_space_ptr2;  /* Points to different blocks with space. */

   char    fill_Q[11];
   char    write_Q[11];
   _SYSPTR fill_Q_ptr;

   unsigned long rec_number;        /* Relative record number.      */
   unsigned long num_record_per_IO_block;
   unsigned long record_skip_size;
   unsigned long last_record = 0;

   char  Q_msg_text[MSG_LENGTH];
   _DEQ_Msg_Prefix_T DEQ_msg_prefix;

   struct {
           Qus_Job_Change_Information_t jci;
           Qus_JOBC0100_t x;
           int  priority;
   } chgI;

   ExcData_t volatile exD = {0 ,"*HANDLE   "};

   /*-------------------------------------------------------------------*/
   /* Start executable code.                                            */
   /*-------------------------------------------------------------------*/

   /*-------------------------------------------------------------------*/
   /* Set up the exception handler.  Handle all escapes &  FC excps.    */
   /* Branch to: ERR when an error occurs.                              */
   /*-------------------------------------------------------------------*/
   #pragma exception_handler \
      (ERR, 0, 0, _C2_MH_ESCAPE | _C2_MH_FUNCTION_CHECK, _CTLA_HANDLE)

   errCode.bytes_prov = 0;

   /*-------------------------------------------------------------------*/
   /* Get the library name that we are running in.                      */
   /*-------------------------------------------------------------------*/
   slash_pos = strchr(argv[0], '/');
   lib_len   = slash_pos - argv[0];
   _CPYBYTES(pgmlib_gl, argv[0], lib_len);
   pgmlib_gl[lib_len] = '\0';

   ++slash_pos;   /* Skip the '/' that follows the  pgmlib field. */
   _CPYBYTES(pgmname_gl, slash_pos, 10);
   pgmname_gl[triml(pgmname_gl, ' ')] = '\0';

   /*-------------------------------------------------------------------*/
   /* TPCC message queue to send our build messages to.                 */
   /*-------------------------------------------------------------------*/
   _CPYBYTES(msgq_gl, BLD_MSGQ_NAME_10, 10);
   _CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);

   dblib[10] = '\0';
   _CPYBYTES(dblib, argv[DBLIB_PARM], 10);
   dblib[triml(dblib, ' ')] = '\0';

   _CPYBYTES(fill_space, argv[FILL_SPACE_PARM], 10);
   _CPYBYTES(fill_space+10, argv[DBLIB_PARM], 10);

   job_number = atoi(argv[JOB_NUMBER_PARM]);

   /*-------------------------------------------------------------------*/
   sprintf(msgtxt, "FILLCUS: filling user space %.10s in library %s...",
           fill_space, dblib);
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq_gl, 1, NULL);


   StartWH = atoi(argv[STRWH_PARM]) - 1;
   inst_number = atoi(argv[INST_NUMBER_PARM]);
   /*-------------------------------------------------------------------*/
   /* Calculate the number of records and the starting record.          */
   /* Number of records is the  (io block size) / record size.          */
   /*-------------------------------------------------------------------*/
   NumWH   = atoi(argv[NUMWH_PARM]);
   file_id = atoi(argv[FILE_ID_PARM]);   /* Customer or Stock file? */

   num_record_per_IO_block = IO_BLOCK_SIZE / sizeof(tpcc_CSRCD_both_t);
   last_record = NumWH * MAX_DISTRICTS * CUSTPERDIST;

   /*-------------------------------------------------------------------*/
   /* Set Queuing values.                                               */
   /*-------------------------------------------------------------------*/
   DEQ_msg_prefix.Wait_Forever = 1;      /* Wait forever.             */
   ENQ_msg_prefix.Msg_Len = MSG_LENGTH;

   fill_Q[10] = '\0';
   _CPYBYTES(fill_Q,  argv[FILL_Q_PARM],  10);
   fill_Q[triml(fill_Q, ' ')] = '\0';
   write_Q[10] = '\0';
   _CPYBYTES(write_Q, argv[WRITE_Q_PARM], 10);
   write_Q[triml(write_Q, ' ')] = '\0';

   if (NULL == (fill_Q_ptr = rslvsp(_Usrq, fill_Q, dblib, _AUTH_ALL)))
   {
      sprintf(msgtxt, "Cound not resolve to user queue, %s, in library %s.",
              fill_Q, dblib);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      error_cleanup();
      return(-1);
   }
   if (NULL == (write_Q_ptr = rslvsp(_Usrq, write_Q, dblib, _AUTH_ALL)))
   {
      sprintf(msgtxt, "Cound not resolve to user queue, %s, in library %s.",
              write_Q, dblib);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      error_cleanup();
      return(-1);
   }

   QUSPTRUS(fill_space, &fill_space_ptr, &errCode); /* Get the ptr */
   fill_space_ptr2 = fill_space_ptr;

   /* Set up random number generator */
   srand(get_seed());

   /*-------------------------------------------------------------------*/
   /* Find the starting record number.                                  */
   /*-------------------------------------------------------------------*/
   number_jobs = atoi(argv[NUMBER_JOBS_PARM]);
   rec_number = (job_number * num_record_per_IO_block) + 1;
   record_skip_size = num_record_per_IO_block * number_jobs;

   block = 1;
   IO_BLOCKS_PER_JOB(number_blocks_per_job,  num_record_per_IO_block,
                     last_record, number_jobs)

   /*-------------------------------------------------------------------*/
   /* Change our job priority so we run a little slower than the        */
   /* master job that called us.                                        */
   /*-------------------------------------------------------------------*/
   chgI.jci.Number_Fields_Enterd = 1;
```

```
   chgI.x.Length_Field_Info_ = sizeof(Qus_JOBC0100_t) + sizeof(int);
   chgI.x.Key_Field          = 1802;
   chgI.x.Type_Of_Data       = 'B';
   _CPYBYTES(chgI.x.Reserved, "   ", 3);
   chgI.x.Length_Data        = 4;
   chgI.priority = 50;

   QWTCHGJB("*                        ", "                ",
            "JOBC0100", &chgI, &errCode);

   if (errCode.bytes_avail > 0)
   {
      sprintf(msgtxt, "Unable to change FILLCUS job's priority.");
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
   }

   /*-----------------------------------------------------------------*/
   while (rec_number <= last_record)
   {
      /*-----------------------------------------------------------------*/
      /* Wait until the storage area is available for us to fill.      */
      /*-----------------------------------------------------------------*/
      deq(&DEQ_msg_prefix, Q_msg_text, fill_Q_ptr);

      if ('Q' == Q_msg_text[0])
      {
         add_successful_jobs(dblib, file_id, inst_number);
         sprintf(msgtxt,
                 "Ending Fill job. 'Quit' message received on user queue.");
         Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq_gl,1,NULL);
         return;
      }

      /*-----------------------------------*/
      /* Start filling...                  */
      /*-----------------------------------*/
      fill_customer(rec_number, num_record_per_IO_block, last_record,
                    fill_space_ptr2, StartWH, NumWH);

      sprintf(Q_msg_text, "%02d", block);          /* Convert to char. */
      enq(write_Q_ptr, &ENQ_msg_prefix, Q_msg_text);

      if (block == number_blocks_per_job)
      {
         block = 1;
         fill_space_ptr2 = fill_space_ptr;   /* Reset to beginning of space.*/
      } else {
         ++block;
         fill_space_ptr2 = fill_space_ptr2 + IO_BLOCK_SIZE;

      }
      rec_number += record_skip_size;

   } /* End: while < last record. */

   add_successful_jobs(dblib, file_id, inst_number);

   sprintf(msgtxt,
           "FILLCUS: job number %d successfully filled user space %.10s.",
           job_number, fill_space);
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, msgq_gl, 1, NULL);
   QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, CS_CTLBDY, 1);
   return;

   #pragma disable_handler

   /*-----------------------------------------------------------------*/
   /* Any exceptions causes us to branch here.                        */
   /*-----------------------------------------------------------------*/
   ERR:
       error_cleanup();
       return(-1);

} /* end of main */
```

C.26 FILLDATA.H:

```
#ifndef _FILLDATA_H
 #define _FILLDATA_H
/*** START HEADER FILE SPECIFICATIONS ********************************/
/*                                                                   */
/* Header file name: FILLDATA                                        */
/*                                                                   */
/* Purpose: data used to fill Customer and History files.            */
/*                                                                   */
/*** END HEADER FILE SPECIFICATIONS **********************************/

  #define CITY_LENGTH  20
  #define STATE_LENGTH  2

  /*-----------------------------------------------------------------*/
  /* There are 100 names.                                            */
  /*-----------------------------------------------------------------*/
  char *szFName[] = {
      "FrankGifford    ",  "FranTarkenton   ",   "GailStormyNight ",
      "JohnWayne       ",  "JaneSeeDickRun  ",   "JeannieWithLight",
      "DavesNotHere    ",  "MaryMartin      ",   "JefferyTheWaiter",
      "CarriePromQueen ",  "StephanKing     ",   "KaraKing        ",
      "AnnieOakley     ",  "BillClements    ",   "FannyFarmer     ",
      "AllanLuden      ",  "BerniceLattitude",   "MelindaFisher   ",
      "ElaineBoosler   ",  "FrankieAvalon   ",   "Francine        ",
      "GaleGordon      ",  "JohnBoyWalton   ",   "JeanneCRiley    ",
      "DavidBowie      ",  "KuklaFranOllie  ",   "PhillipOfWales  ",
      "KerryCWilliams  ",  "Stephanie       ",   "AnnaSueBrighton ",
      "BillyBob        ",  "FayDunawayWith  ",   "PamelaSueMartin ",
      "AlanAlda        ",  "BernardPFife    ",   "LindaDayGeorge  ",
      "RobertConrad    ",  "Franklin        ",   "FrancisTheMule  ",
      "GayleMcDonald   ",  "JanMurray       ",   "JoanneCassidy   ",
      "MarkTheSpot     ",  "Geoffrey        ",   "PhyllisDiller   ",
      "DoogieHowser    ",  "Anastasia       ",   "AlvinChipmunk   ",
      "AlexPKeaton     ",  "BelindaMcWilliam",   "EllynBurnstyne  ",
      "JayePMorgan     ",  "JoeFromKokomo   ",   "JoeyHeatherton  ",
      "Gilligan        ",  "TheSkipper2     ",   "CarryBishop     ",
      "BenjaminFranklin",  "AbrahamLincoln  ",   "GeorgeWBush     ",
      "VincentPrice    ",  "PotsieWeber     ",   "RichieCunningham",
      "Alexander       ",  "PeterTheGreater ",   "MickeyMouse     ",
      "DonaldDuck      ",  "BabyHuey        ",   "CrystalGayle    ",
      "SnidelyWhiplash ",  "HastaLaVista    ",   "GeorgeWashington",
      "KareemAbdulJabar",  "WhitneyHouston  ",   "BobSmith        ",
      "PerryMason      ",  "PaulDrake       ",   "DellaMainStreet ",
      "MissPiggy       ",  "TheCookieMonster",   "KermitTheFrog   ",
      "BluesBrothers   ",  "BeaverCleaver   ",   "Anriqueta       ",
      "Crenshaw        ",  "AndyTaylor      ",   "ClaytonWilliams ",
      "BillClinton     ",  "Elizabeth       ",   "MichaelJordan   ",
      "PaulRevere      ",  "JohnGlenn       ",   "WashingtonCarver",
      "DanJohnson      ",  "BubbaTexan      ",   "GGordonLiddy    ",
      "ScottSimpson    ",  "BenKnight       ",
      "NolanRyan       ",  "AlbertEinstein  " };

  /*-----------------------------------------------------------------*/
  /* There are 100 cities.                                           */
  /*-----------------------------------------------------------------*/
  char *CITY_ARR[] = {
      "Saint_Paul          ",  "Saint_Louis         ",
      "Concord_Grapes      ",  "Trenton_New_Jersey  ",
      "Bismark_Doughnut    ",  "Cheyenne_Wyoming    ",
      "Juneau_Alaska       ",  "Honolulu_Hawaii     ",
      "Phoenix_The_Big_Bird",  "Topeka_Kansas       ",
      "Montgomery          ",  "Elmwood_Illinois    ",
      "Madison_Dolly       ",  "Lansing_Michigan    ",
      "Frankfurt_Germany   ",  "Des_Moines_Iowa     ",
      "Byron_Minnesota     ",  "Pierre_South_Dakota ",
      "Dover_Cliffs        ",  "Helena_Montana      ",
      "San_Antonio         ",  "Saint_Petersburg    ",
      "Caribu_Maine        ",  "Sault_Saint_Marie   ",
      "Los_Angeles         ",  "Minneapolis_St_Paul ",
      "Dallas_Fort_Worth   ",  "Kalamazoo_Michigan  ",
      "The_Land_Of_Oz      ",  "Lexington_Kentucky  ",
      "Washington          ",  "District_Of_Columbia",
      "New_Orleans         ",  "Boise_Idaho         ",
      "Kensington_Maryland ",  "Denver_Colorado     ",
      "Blue_Mountain       ",  "Riverside_Ca        ",
      "New_York_City       ",  "Nashville_Tennessee ",
      "MayBerry_RFD        ",  "Berkeley_California ",
      "Maryville_Missouri  ",  "San_Francisco       ",
      "Indianapolis        ",  "Saint_Joseph_Mo     ",
      "Rochester_Minnesota ",  "Fort_Worth          ",
      "Holland_Michigan    ",  "South_Orange_NJ     ",
      "Stillwater          ",  "Eugene_Oregon       ",
      "Alexandria_Virginia ",  "Salt_Lake_City      ",
      "Manitowoc_Wisconsin ",  "Philadelphia        ",
      "Sioux_Falls         ",  "West_Lafayette      ",
      "New_Brunswick_NJ    ",  "Rochester_New_York  ",
      "Oakland_Ca          ",  "Las_Vegas_Nevada    ",
      "Birmingham_Alabama  ",  "Arkadelphia_Arkansas",
      "San_Juan_Puerto_Rico",  "Omaha_Nebraska      ",
      "Walla_Walla         ",  "Baraboo_Wisconsin   ",
      "Atlanta_Georgia     ",  "Grand_Forks_ND      ",
      "Tempe_Arizona       ",  "Knoxville_Tn        ",
      "Fort_Leavenworth    ",  "Boston_Massachusetts",
      "Danville_Virginia   ",  "Baltimore_Maryland  ",
      "New_Haven_Ct        ",  "Claremont_California",
      "Otsego_Michigan     ",  "Providence          ",
      "Jacksonville        ",  "Columbia_SC         ",
      "London_England      ",  "Paris_France        ",
      "Chicago_Illinois    ",  "Albuquerque         ",
      "Raleigh_NC          ",  "Kansas_City_Missouri",
      "Tacoma_Washington   ",  "Oronoco_Mn          ",
      "Charleston_WV       ",  "Newark_Delaware     ",
      "Burlington_Vermont  ",  "Damariscotta_Maine  ",
      "Colorado_Springs_Co ",  "Nacogdoches_Texas   ",
      "Barbourville_Ky     ",  "Boca_Raton_Fl       ",
      "Mary_Of_The_Woods   ",  "Heston_And_Isleworth" };

  /*-----------------------------------------------------------------*/
  /*  There are 100 states.                                          */
  /*-----------------------------------------------------------------*/
  char *state_arr[] = {
      "AL", "AK", "AR", "AZ", "CA", "CO", "CT", "DE", "FL", "GA",
      "HI", "ID", "IL", "IN", "IA", "KS", "KY", "LA", "ME", "MD",
      "MA", "MI", "MN", "MS", "MO", "MT", "NE", "NV", "NH", "NM",
      "NJ", "NY", "NC", "ND", "OH", "OK", "OR", "PA", "RI", "SC",
      "SD", "TN", "TX", "UT", "VT", "VA", "WA", "WV", "WI", "WY",
      "AC", "AG", "AI", "AM", "AP", "AV", "AW", "CN", "CS", "DI",
      "DM", "DN", "DS", "ED", "EM", "EN", "HN", "HO", "IH", "IM",
      "IR", "IW", "JN", "KA", "KO", "LF", "LI", "NI", "NT", "NZ",
      "OC", "OM", "ON", "PR", "RA", "RO", "SK", "SM", "TC", "TM",
      "TY", "TV", "VI", "VN", "VW", "XT", "YK", "YN", "YW", "ZA" };

  /*-----------------------------------------------------------------*/
  /* There are 3 sets of characters that are concatenated            */
  /* to make the district information fields for Stock.              */
  /* Also used by FILLORD file.                                      */
  /*-----------------------------------------------------------------*/
  char *DistInf1[] = {
        "abcdefghijk", "nowisthetim", "thisiswhere",
        "whatdoyouno", "notmuchthen", "whydoyouask",
        "Idonotknow_", "sowhereisit", "inthecities", "andthetowns"};

  char *DistInf2[] = {
        "01", "02", "03", "04", "05", "06", "07", "08", "09", "10"};

  char *DistInf3[] = {
        "mnopqrstuvw", "whydidyoudo", "interactive",
        "batchwork__", "systemview_", "performance",
        "Ineverwork_", "Ialwaysplay", "nexttolast_", "nowthefinal"};

/* ---------------------> End of FILLDATA.H <---------------------  */
#endif
```

C.27 FILLDIST.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Name: FILLDIST                                                  */
/*                                                                 */
/* Purpose: fill the district file.                                */
/*                                                                 */
/*-----------------------------------------------------------------*/

  #include <stdlib.h>
  #include <string.h>
  #include <decimal.h>
  #include <micomput.h>
  #include <milib.h>
  #include <recio.h>
  #include <time.h>
  #include <mih/cpyblap.h>
  #include <os4msg.h>
  #include <commontpcc.h>
  #include <filldata.h>

  /*-----------------------------------------------------------------*/
  /* Defines                                                         */
  /*-----------------------------------------------------------------*/
  #define DBLIB_PARM          1
  #define DISTFILE_PARM       2
  #define STRWH_PARM          3
  #define NUMWH_PARM          4

  /* MAPINC generates structures for the database files          */
  #pragma mapinc("dstrct","*LIBL/dstrct(*all)","both","d  _P",,"tpcc")
  #include "dstrct"


/*-----------------------------------------------------------------*/
/*                                                                 */
/* Name: main                                                      */
/*                                                                 */
/*-----------------------------------------------------------------*/
 int main(int argc, char **argv)
 {
   short int strWH, endWH, curWH, iDist;
   int  iX;

   char  dblib[11];
   char  distfile[11];
   char msgtxt[50];
   char  msgq_gl[20];

   char currwhs[5];
   char curdist[3];
   char daddr[21];
   char tempstr[13];
   char tstr[5];

   _RFILE *Dist_File;
   tpcc_DSRCD_both_t DRec;

   time_t ltime;


   /* Set up random number generator */
   time(&ltime);
   srand(ltime);          /* seed the random num generator */

   dblib[10] = '\0';
   _CPYBYTES(dblib, argv[DBLIB_PARM], 10);
   dblib[triml(dblib, ' ')] = '\0';

   distfile[10] = '\0';
   _CPYBYTES(distfile, argv[DISTFILE_PARM], 10);
```

```
   distfile[triml(distfile, ' ')] = '\0';

   strWH = atoi(argv[STRWH_PARM]);
   endWH = (atoi(argv[NUMWH_PARM]))  + strWH;

   /* TPCC message queue to send our build messages to.  */
   _CPYBYTES(msgq_gl, "TPCCMSG   ", 10);
   _CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);


   if (NULL == (Dist_File = _Ropen(distfile, "rr+")))
   {
      sprintf(msgtxt, "Open of file, %s, failed!", distfile);
      Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   for (curWH = strWH; curWH < endWH; ++curWH)
   {
       for (iDist = 1; iDist <= 10; ++iDist)
       {
           DRec.DWID = curWH;
           DRec.DID = iDist;
           sprintf(curwhs,  "%04d", curWH);
           sprintf(curdist, "%02d", iDist);

           /* build dname */
           strcpy(tempstr, "D");
           strcat(tempstr, curwhs);
           strcat(tempstr, curdist);
           CreateStr(1, 4, tstr);
           strcat(tempstr, tstr);
           cpyblap(DRec.DNAME, 10, tempstr, strlen(tempstr), ' ');

           /* build address1 */
           strcpy(daddr, curdist);
           sprintf(tstr, "%03d", (RANDOM(1,999)));
           strcat(daddr, tstr);
           strcat(daddr, " Ave.");
           CreateStr(1, 10, tempstr);
           strcat(daddr, tempstr);
           cpyblap(DRec.DADDR1, 20, daddr, strlen(daddr), ' ');

           /* build address2 */
           strcpy(daddr, "Bldg ");
           strcat(daddr, curdist);
           strcat(daddr, " ");
           CreateStr(1, 12, tempstr);
           strcat(daddr, tempstr);
           cpyblap(DRec.DADDR2, 20, daddr, strlen(daddr), ' ');

           /* build city */
           iX = RANDOM(0,99);
           strncpy(DRec.DCITY,  CITY_ARR[iX], CITY_LENGTH);
           strncpy(DRec.DSTATE, state_arr[iX], STATE_LENGTH);

           CREATE_ZIP(DRec.DZIP);

           DRec.DTAX = (RANDOM(0,2000)) / 10000.0;

           DRec.DYTD = 30000.00;
           DRec.DNXTOR = 3001;     /* Next order id */

           _Rwrite(Dist_File, (void *)&DRec, sizeof(DRec));
       }
   }

   _Rclose(Dist_File);
   return(0);

 } /* end of main() */
```

C.28 FILLHIST.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* File name: FILLHIST                                             */
/*                                                                 */
/* Purpose: This program fills the history file.                   */
/*                                                                 */
/*-----------------------------------------------------------------*/
  /*---------------------------------------------------------------*/
  /* Includes.                                                     */
  /*---------------------------------------------------------------*/
  #include <stdlib.h>
  #include <recio.h>
  #include <string.h>
  #include <xxfdbk.h>
  #include <mih/cpybytes.h>
  #include <mih/cpyblap.h>
  #include <mih/triml.h>
  #include <mih/mattod.h>
  #include <errno.h>
  #include <unistd.h>          /* Has unlink()  */
  #include <sys/stat.h>        /* Has lstat()   */
  #include <decimal.h>         /* Used by hstry include file. */
  #include <qcmdexc.h>
  #include <commontpcc.h>
  #include <tpccspace.h>
  #include <os4msg.h>
  #include <os4wait.h>

  /* MAPINC generates structures for the database file.          */
  #pragma mapinc("hstry","*libl/hstry(*all)","both",  "d _P",,"tpcc")
  #include "hstry"

  /*---------------------------------------------------------------*/
  /* Defines                                                       */
  /*---------------------------------------------------------------*/
  #define DBLIB_PARM  1
  #define DBFILE_PARM 2
  #define STRWH_PARM  3
  #define WH_PARM     4
  #define LEVEL_PARM  5
  #define INST_PARM   6
  #define TOTAL_PARM  6

  #define WH_PARM_LEN    6

  /*---------------------------------------------------------------*/
  /* globals                                                       */
  /*---------------------------------------------------------------*/
  char pgmlib_gl[11];
  char pgmname_gl[11];
  char msgq_gl[20];
  char msgtxt[110];


/*-----------------------------------------------------------------*/
/*                                                                 */
/* Function: multi_jobs                                            */
/*                                                                 */
/* Purpose:                                                        */
/*                                                                 */
/* Return: -1 = error                                              */
/*         Any other value is number of jobs spawned.              */
/*                                                                 */
/*-----------------------------------------------------------------*/
int multi_jobs(char *dblib, char *dbfile, int str_wh, int total_whs,
               int jobs_alloc, int inst_num)
{
   int          rc, times;
   int          num_jobs;
   int          num_wh;
   int          wh_per_job;
   int          have_extra;     /* # of jobs with extra warehouse.  */
   int          lp;                     /* loop counter             */
   unsigned int plen;

   char         job_num[4] = "    ";
   char         dblib_pad[10];
   char         dbfile_pad[10];
   char         work_path[22];
   char         hard_path[41];
   struct stat  checker;

   /*-----------------------------------------------------------------*/
   /* Determine how many jobs to spawn.                               */
   /*-----------------------------------------------------------------*/
   if (jobs_alloc < total_whs)
   {
      num_jobs = jobs_alloc;             /* Use all jobs available. */
   } else {
      num_jobs = total_whs;
   }

   wh_per_job = total_whs / num_jobs;
   have_extra = total_whs % num_jobs;

   if (0 == have_extra)
   {
      num_wh = wh_per_job;
   } else {
      /* Do an extra warehouse for this job. */
      num_wh = wh_per_job + 1;
   }

   /*-----------------------------------------------------------------*/
   /* Save job info so Master control can see and we can use later.  */
   /*-----------------------------------------------------------------*/
   if (0 != set_plan_to_start(dblib, HISTORY_JOBS, inst_num, num_jobs))
   {
      sprintf(msgtxt,
              "FILLHIST can't set number of jobs (%d) it plans to spawn!", 1);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   sprintf(msgtxt,"FILLHIST plans to spawn %d jobs to fill the %s file.",
           num_jobs, dbfile);
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq_gl, 1, NULL);

   cpyblap(dblib_pad,  10, dblib,  strlen(dblib),  ' ');
   cpyblap(dbfile_pad, 10, dbfile, strlen(dbfile), ' ');

   sprintf(hard_path,"/QSYS.LIB/%s.LIB/%s.PGM",  pgmlib_gl, pgmname_gl);

   sprintf(work_path, "/%s/%0.7s", pgmlib_gl, pgmname_gl);
   plen = strlen(work_path);

   rc = 0;
   /*-----------------------------------------------------------------*/
   /* Set parms for the spawn.                                        */
   /*-----------------------------------------------------------------*/
   for (lp=1; ((lp <= num_jobs) && (-1 != rc)); lp++)
   {
      /* Set job name number. */
      sprintf(&work_path[plen],"%03d",  lp); /* Add job number. */
      sprintf(job_num,"%03d", lp);

      if (lstat(work_path, &checker) == 0)  /* If the link exists  */
      {
         /* Unlink the symblic link.                                 */
         /* (it may be to another library so it should be removed.   */
         if (-1 == unlink(work_path))
         {
            char msgid[8];
            /* Send the errno message text message. */
            sprintf(msgid, "CPE%d", errno);
            QsendMsg(IBM_MSG_FILE, msgid, "", DIAG_MSG, CS_CUR_PGM, 1);

            sprintf(msgtxt,"Could NOT unlink path: '%s'", work_path);
            QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
         }
      } /* End: link exists. */


      if (0 == symlink(hard_path, work_path))
      {
          /*-------------------------------------------------------*/
          /* Spawn the job!                                        */
          /*-------------------------------------------------------*/
          rc = spawn_FILL_job(dblib_pad, dbfile_pad, HISTORY_JOBS, inst_num,
                              str_wh, num_wh, NULL, work_path, job_num);

          str_wh = str_wh + num_wh;   /* Next starting warehouse id.*/
          if (lp == have_extra)
          {
             --num_wh;       /* Start doing 1 less warehouse.  */
          }
      } else {
         /*-----------------------*/
         /* symlink not created.  */
         /*-----------------------*/
         char msgid[8];
         /* Send the errno message text message. */
         sprintf(msgid, "CPE%d", errno);
         QsendMsg(IBM_MSG_FILE, msgid, "", DIAG_MSG, CS_CTLBDY, 1);

         sprintf(msgtxt,"Could NOT create a symbolic link '%s' to %s",
                 work_path, hard_path);
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM,1);
         rc = -1;  /* Exit from loop. */
      }
    } /* end: 'for' loop. */

   if (0 == rc)
      rc = num_jobs;
   return(rc);

} /* multi_jobs() */


/*-----------------------------------------------------------------*/
/*                                                                 */
/* Function: main                                                  */
/*                                                                 */
/*-----------------------------------------------------------------*/
int main(int argc, char **argv)
{
  int   rc = 0;
  int   times;
  int   num_spawned;
  int   inst_number;
  int   max_allocated;
  int   hist_ovr_size;/* over ride size */
  int   Cid;
  short Dist;
  short wid;
  short StrWH, EndWH, numWH;

  unsigned int lib_len;
  char  *slash_pos;

  _MI_Time CurrTime;        /* Current time from MATTOD.  */

  char  call_level[3];
  char  job_name[11] = "          ";
  char  dbfile[11];
  char  dblib[11];
  char  lib_file[17];
  char  cmd[90];
  tpcc_HSRCD_both_t HstRec;
  _RFILE            *Hstry_File;
```

```
ExcData_t volatile exD = {0 ,"*HANDLE   "};


/*-----------------------------------------------------------------*/
if (argc < TOTAL_PARM)
{
   sprintf(msgtxt, "%s program expected %s parms, received %d parm",
                   pgmname_gl, (TOTAL_PARM - 1), (argc-1));
   QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
   exit;
}

/*-----------------------------------------------------------------*/
/* Get the library name that we are running in now.                */
/*-----------------------------------------------------------------*/
slash_pos = strchr(argv[0], '/');
lib_len   = slash_pos - argv[0];
_CPYBYTES(pgmlib_gl, argv[0], lib_len);
pgmlib_gl[lib_len] = '\0';

++slash_pos;   /* Skip the '/'  */
_CPYBYTES(pgmname_gl, slash_pos, 10);
pgmname_gl[triml(pgmname_gl, ' ')] = '\0';

dblib[10] = '\0';
_CPYBYTES(dblib, argv[DBLIB_PARM], 10);
dblib[triml(dblib, ' ')] = '\0';

dbfile[10] = '\0';
_CPYBYTES(dbfile, argv[DBFILE_PARM], 10);
dbfile[triml(dbfile, ' ')] = '\0';

/* TPCC message queue to send our build messages to.  */
_CPYBYTES(msgq_gl, "TPCCMSG   ", 10);
_CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);

/* Set library/file name to open and use. */
sprintf(lib_file, "%s/%s", dblib, dbfile);

StrWH = atoi(argv[STRWH_PARM]);
numWH = atoi(argv[WH_PARM]);

call_level[3] = '\0';
_CPYBYTES(call_level, argv[LEVEL_PARM], 3);
call_level[triml(call_level, ' ')] = '\0';

sprintf(job_name, "%0.7s%03s", pgmname_gl, call_level);
if (0 == strncmp(call_level, "000", 3))
{
   if (1 == StrWH)
   {
      inst_number = 0;
   } else {
      inst_number = 1;  /* split warehouse high group   */
   }

   /*-----------------------------------------------------------------*/
   /* Get max number of jobs we can use.                              */
   /*-----------------------------------------------------------------*/
   max_allocated = get_maxjobs_available(dblib,HISTORY_JOBS,inst_number);

   if ((1 < max_allocated)  &&  (1 < numWH))
   {
      /*-----------------------------------------------------------*/
      /* Spawn extra jobs to speed things up...                    */
      /*-----------------------------------------------------------*/
      num_spawned = multi_jobs(dblib, dbfile, StrWH, numWH,
                               max_allocated, inst_number);

      /*-----------------------------------------------------------*/
      /* If 1 job failed to spawn, then don't wait on other spawned   */
      /* jobs to complete.                                         */
      /*-----------------------------------------------------------*/
       if (-1 == num_spawned)
       {
           sprintf(msgtxt, "%s job failed!", job_name);
           QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
           return(-1);
       }
      /*-----------------------------------------------------------*/
      /* All spawned successfully, wait on them to finish.         */
      /*-----------------------------------------------------------*/
       rc = wait_on_spawned_jobs(dblib,HISTORY_JOBS,inst_number,num_spawned);
   } /* end: allocated jobs > 1 and warehouses > 1   */
   else {
      /*-----------------------------------------------------------*/
      /* Note: we don't have to query the available jobs, as we are    */
      /*       not starting another job.                           */
      /*-----------------------------------------------------------*/

      /*-----------------------------------------------------------*/
      /* Only up the count when we are called from CL program.        */
      /* When spawned, our caller has already upped the count.        */
      /*-----------------------------------------------------------*/
      /*-----------------------------------------------------------*/
      /* Save job info so Master control can see and use later.   */
      /*-----------------------------------------------------------*/
      if (0 != set_plan_to_start(dblib, HISTORY_JOBS, inst_number, 1 ))
      {
          sprintf(msgtxt,
                 "I can't set number of %s jobs (%d) I plan to start!",
                 get_DB_filename(HISTORY_JOBS), 1);
          Qsendmsg_MQ(IBM_MSG_FILE,"CPF9897",msgtxt,DIAG_MSG,msgq_gl  ,1,NULL);
          QsendMsg(IBM_MSG_FILE,"CPF9897",msgtxt,ESCAPE_MSG,CS_CTLBDY,1);
          return(-1);
      }

      times = 0;
      while ((0 != add_started_jobs(dblib, HISTORY_JOBS, inst_number))
             && (-1 != rc))
      {
         /*-----------------------------------------------------*/
         /* wait and try again...                               */
         /*-----------------------------------------------------*/
          tpcc_Wait(3, 0, NULL, NULL);     /* Wait 3 seconds.      */

          ++times;
          if (100 == times)       /* Total of 5 minutes wait time. */
          {
              sprintf(msgtxt,
                     "I can't add to the number of %s jobs I am starting!",
                     get_DB_filename(HISTORY_JOBS));
           Qsendmsg_MQ(IBM_MSG_FILE,"CPF9897",msgtxt,DIAG_MSG,msgq_gl,1,NULL);
              QsendMsg(IBM_MSG_FILE,"CPF9897",msgtxt,DIAG_MSG,CS_PGMBDY,1);
              return(-1);
          }
      }/* end of while((0!=add_started_jobs(dblib,HISTORY_JOBS,inst_number))*/
   } /* end of else */
} /* end of if  (0 == strncmp(call_level, "000", 3))                 */
else
{
  inst_number = atoi(argv[INST_PARM]);/* get the parameter           */
}

if (0 != strncmp(call_level, "000", 3)) /* if action reqired        */
{
   /*-----------------------------------------------------------------*/
   /* Now that I have updated the # jobs started counter, use an     */
   /* exception handler to update space upon an error.                */
   /*-----------------------------------------------------------------*/
   #pragma exception_handler \
    (EXCP_HND, 0, 0, _C2_MH_ESCAPE | _C2_MH_FUNCTION_CHECK, _CTLA_HANDLE)
   hist_ovr_size = IO_BLOCK_SIZE / sizeof(tpcc_HSRCD_both_t);
   sprintf(cmd,
           "OVRDBF FILE(%s) TOFILE(%s/%s) SEQONLY(*YES %d) OVRSCOPE(*JOB)",
           dbfile, dblib, dbfile, hist_ovr_size);

   /* printf ( "Override %s\n", cmd ); */
   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler

   if (0 != exD.error)
   {
      sprintf(msgtxt, "%s program failed!", pgmname_gl);
     Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   Hstry_File = _Ropen(dbfile, "ar,arrseq=Y,blkrcd=Y,riofb=N");

   if (NULL == Hstry_File)
   {
      sprintf(msgtxt, "Failed to open file: %s.", dbfile);
      Qsendmsg_MQ(NULL, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   EndWH = StrWH + numWH;
   sprintf(msgtxt,
           "%s is starting to fill %s file from warehouse %d to %d.",
           job_name, dbfile, StrWH, (EndWH - 1));
   Qsendmsg_MQ(NULL, "CPF9897", msgtxt, INFO_MSG, msgq_gl, 1, NULL);

   for (Cid = 1; Cid <= CUSTPERDIST; Cid++)
   {
/*-----------------------------------------------------------------------*/
/*     if (0 == (Cid % 1000))                                            */
/*     {                                                                 */
/*        sprintf(msgtxt, "%s starting on customer %d...", job_name, Cid); */
/*        Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, msgq_gl,  */
/*                    1, NULL);                                            */
/*     }                                                                 */
/*-----------------------------------------------------------------------*/
       for (wid = StrWH; wid < EndWH; wid++)
       {
          for (Dist = 1; Dist <= 10; Dist++)
          {
              HstRec.HCWID = wid;
              HstRec.HWID  = wid;
              HstRec.HDID  = Dist;
              HstRec.HCDID = Dist;
              HstRec.HCID  = Cid;

              HstRec.HAMT = 10.00;

              CreateStrPad(12, 24, HstRec.HDATA);

              /* Build Hist Date & Time.  */
              mattod(CurrTime);
              CurrTime[7] = BASE_TIME;       /* set the base time */
              memcpy(HstRec.HTOD, CurrTime, sizeof(_MI_Time));

              _Rwrite(Hstry_File, (void *)&HstRec, sizeof(HstRec));
          }
       }
   }
   _Rclose(Hstry_File);

   /* Disable the EXCP_HND handler. */
   #pragma disable_handler
   /*-----------------------------------------------------------*/
   /* Send message now so it appears in outq before our caller's */
   /* completion message.                                       */
   /*-----------------------------------------------------------*/
   sprintf(msgtxt,
           "%s successfully completed filling warehouse %d to %d.",
            job_name, StrWH, (StrWH+(numWH-1)));
   Qsendmsg_MQ(NULL, "CPF9897", msgtxt, COMP_MSG, msgq_gl, 1, NULL);

   times = 0;
   while ((0 != add_successful_jobs(dblib, HISTORY_JOBS, inst_number))
          && (-1 != rc))
   {
      /*-----------------------------------------------------*/
      /* Wait and try again...                               */
      /*-----------------------------------------------------*/
      tpcc_Wait(3, 0, NULL, NULL);     /* Wait 3 seconds.      */

      ++times;
      if (100 == times)       /* Total of 5 minutes wait time. */
      {
         sprintf(msgtxt,"I can't set completed jobs value!");
         Qsendmsg_MQ(NULL, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
         return(-1);
      }
   }
} /* end of if (0 != strncmp(call_level, "000", 3))  */

if (0 == rc)
{
   /* If we have NOT already sent a completion msg...  */
   if (0 == strncmp(call_level, "000", 3))
   {
      sprintf(msgtxt,
              "%s program successfully completed filling warehouse %d to %d.",
               pgmname_gl, StrWH, (StrWH+(numWH-1)));
      Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, msgq_gl, 1,NULL);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, CS_CTLBDY, 1);
   }
   return(0);
} else {
   sprintf(msgtxt, "%s program failed!", pgmname_gl);
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
   QsendMsg(IBM_MSG_FILE,"CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
   return(-1);
}


/*-----------------------------------------------------------------*/
/* Handle unexpected errors.                                       */
/*-----------------------------------------------------------------*/
EXCP_HND:
   rc = 0;
   times = 0;
   while ((0 != add_error_jobs(dblib, HISTORY_JOBS, inst_number))
          && (-1 != rc))
   {
      /*-----------------------------------------------------*/
      /* Wait and try again...                               */
      /*-----------------------------------------------------*/
      tpcc_Wait(3, 0, NULL, NULL);     /* Wait 3 seconds.      */

      ++times;
      if (100 == times)       /* Total of 5 minutes wait time. */
      {
         sprintf(msgtxt,"I can't set 'error' jobs value for %s!",
                 get_DB_filename(HISTORY_JOBS));
         Qsendmsg_MQ(NULL, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
         return(-1);
      }
   }

   sprintf(msgtxt, "%s program failed!", pgmname_gl);
   Qsendmsg_MQ(NULL, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
   QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
   return(-1);

} /* end of main */
```

C.29 FILLITEM.C:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* File name: FILLITEM                                               */
/*                                                                   */
/* Purpose: This program fills the ITEM file.                        */
/*                                                                   */
/* PARMS: Database library name                                      */
/*                                                                   */
/*-------------------------------------------------------------------*/
  /*-----------------------------------------------------------------*/
  /* Includes.                                                       */
  /*-----------------------------------------------------------------*/
  #include <stdlib.h>
  #include <recio.h>
  #include <string.h>
  #include <xxfdbk.h>
  #include <decimal.h>
  #include <mih/cpybytes.h>
  #include <mih/cpyblap.h>
  #include <mih/triml.h>
  #include <qcmdexc.h>
  #include <os4msg.h>
  #include <commontpcc.h>

  /*-----------------------------------------------------------------*/
  /* Defines                                                         */
  /*-----------------------------------------------------------------*/
  #define DBLIB_PARM   1
  #define DBFILE_PARM  2
  #define MAXITEMS     100000

  /* MAPINC generates structures for the database files          */
  #pragma mapinc("item","*LIBL/item(*all)","both","d _P",,"tpcc")
  #include "item"

  /*-----------------------------------------------------------------*/
  /* globals                                                         */
  /*-----------------------------------------------------------------*/
  char msgtxt[100];
  char msgq_gl[20];

  _RFILE *Item_File;


  /* There are 100 entries, each of length 24  */
  char *ItemNameStr[]  = {
   "Ball_Point_Pen          ",   "Sailboat_Fuel_Tank      ",
   "Flowers_(Poppies)       ",   "VCR_Road_Warrior_Game   ",
   "Bird_House_Plans        ",   "Pushbutton_Telephone    ",
   "Surgical_Gloves         ",   "1_Gallon_Distilled_Water",
   "Black_Labrador_Puppies  ",   "Plain_Pockets_Pants     ",
   "Electric_Plane          ",   "Childs_Car_Seat         ",
   "Gray_Hooded_Sweatshirts ",   "Lone_Ranger_Costume     ",
   "Jiffy_Pain_Pills        ",   "Devil's_Food_Cake       ",
   "Full_Length_Fox_Fur     ",   "AM_FM_Stereo_Car_Radio  ",
   "Cheddar_Cheese_Ball     ",   "Elephant_Ear_Mushroom   ",
   "White_Traffic_Lane_Paint",   "Plastic_Garbage_Pail    ",
   "Four_Blade_Ceiling_Fans ",   "Doll_House_Furniture    ",
   "Apple_Core_Remover      ",   "Cola_Twelve_Pack        ",
   "Italian_Food_Cook_Book  ",   "Wool_Toe_Socks          ",
   "Feel_Good_Vitamins      ",   "100'_Rubber_Garden_Hose ",
   "Orange_Golf_Balls       ",   "Snorkle_And_Fins_Set    ",
   "IBM_Facsimile_Machine   ",   "5_lb._Bag_Flour         ",
   "Fleece_Lined_Wool_Gloves",   "Bermuda_Grass_Seed      ",
   "Front_And_Rear_Floor_Mat",   "Waiter_Costume          ",
   "Magical_Mystery_Maze    ",   "Red_Safety_Flares       ",
   "Silver_Push_Pins        ",   "QuartzDigital_Wristwatch",
   "10_lb_Test_Fishing_Line ",   "Blue_Pile_Carpeting     ",
   "Red_Brick_House         ",   "Bear_Claw_Doughnuts     ",
   "AS/400_Advanced_Series  ",   "12_Inch_Wooden_Ruler    ",
   "Square_Plastic_Calendar ",   "Twelve_Num_Two_Pencils  ",
   "Pad_Yellow_Legal_Paper  ",   "Change_Machine          ",
   "Street_Hockey_Balls     ",   "Half_Inch_3_Ring_Binders",
   "Sporting_Good_Catalog   ",   "Ten_Gallon_Hats         ",
   "Promotion_Notification  ",   "32_Gal._Keg_Beer        ",
   "Business_Cards          ",   "Pebble_Beach_Poster     ",
   "Texas_Residence_Forms   ",   "COBOL_Programmers_Guide ",
   "25_Inch_Color_TVs       ",   "Black_Magic_Marker      ",
   "Telephone_Books         ",   "Riding_Lawnmower        ",
   "$7500_Gift_Certificate  ",   "Compact_Disc_Player     ",
   "Four_Drawer_Cabinets    ",   "Dry-Erase_Markers       ",
   "Multi-System_Paper      ",   "Message_Waiting_Light   ",
   "Automotive_Care_Manuals ",   "Carton_Ceiling_Tiles    ",
   "12_Ounce_Styrofoam_Cup  ",   "Phone_Calling_Card      ",
   "Inflatable_Globe        ",   "Walnut_Magazine_Rack    ",
   "Over_Under_Shotgun      ",   "While_You_Were_Gone_Memo",
   "Three_Tea_Bags          ",   "Bowling_Pin_Spotter     ",
   "Golf_Club_Cleaner       ",   "Staple_Removers         ",
   "Downtown_Parking_Permit ",   "Sliding_Glass_Door_Locks",
   "Floral_Pattern_Lampshade",   "Junior_College_Books    ",
   "Two_Wheel_Bike          ",   "Zoo_Season_Pass         ",
   "Baseball_Tickets        ",   "Four_Person_Tent        ",
   "Cross_Country_Ski_Set   ",   "Motorcycle_Sidecars     ",
   "Fireplace_Tools         ",   "Radio_Controlled_Plane  ",
   "Oak_Wall_Clock          ",   "Rubber_Baby_Buggy_Wheel ",
   "Anti_Static_Strap       ",   "Old_Wooden_Toothpicks   " };


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: main                                                    */
/*                                                                   */
/*-------------------------------------------------------------------*/
 int main(int argc, char** argv)
 {
   int i;
   tpcc_ITRCD_both_t ItemRec;

   char dbfile[11];
   char dblib[11];
   char cmd[100];

   ExcData_t volatile exD = {0 ,"*HANDLE   "};

   /* Parse the input parms */
   dblib[10] = '\0';
   _CPYBYTES(dblib, argv[DBLIB_PARM], 10);
   dblib[triml(dblib, ' ')] = '\0';

   dbfile[10] = '\0';
   _CPYBYTES(dbfile, argv[DBFILE_PARM], 10);
   dbfile[triml(dbfile, ' ')] = '\0';

   /* TPCC message queue to send our build messages to.  */
   _CPYBYTES(msgq_gl, "TPCCMSG    ", 10);
   _CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);

   sprintf(msgtxt, "FILLITEM program filling the %s  db file...", dbfile);
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
   QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, STATUS_MSG, CS_EXT_MSGQ, 1);

   /* Do the overrides */
   sprintf(cmd,
           "OVRDBF FILE(%s) TOFILE(%s/%s) SEQONLY(*YES 15000) OVRSCOPE(*JOB)",
           dbfile, dblib, dbfile);

   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler

   if (0 != exD.error)
   {
      sprintf(msgtxt, "OVRDBF command in FILLITEM program failed!");
      Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   if (NULL == (Item_File = _Ropen(dbfile, "rr+")))
   {
      sprintf(msgtxt, "Open of file, %s, failed!", dbfile);
      Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   for (i=1; i <= MAXITEMS; i++)
   {
      ItemRec.IID = i;
      ItemRec.IMAGEID = RANDOM(1,10000);

      _CPYBYTES(ItemRec.INAME, ItemNameStr[RANDOM(0,99)], 24);

      ItemRec.IPRICE = (decimal(5,2)) ((RANDOM(100,10000)) / 100.00);

      /* Build IDATA random string 26 to 50 chars  */
      CreateStrPad_extra(26, 50, ItemRec.IDATA, "ORIGINAL");

      _Rwrite(Item_File, (void *)&ItemRec, sizeof(ItemRec));

   } /* end of for */

   _Rclose(Item_File);

   sprintf(msgtxt, "FILLITEM completed filling the %s file in library %s",
           dbfile, dblib);
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, msgq_gl, 1, NULL);
   QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, CS_CTLBDY, 1);

 } /* end of main */
```

C.30 FILLORD.C:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* File name: FILLORD                                                */
/*                                                                   */
/* Purpose: This program fills the neword, orders, and ordlin files.*/
/*                                                                   */
/*          It will create an an order record, selecting the         */
/*          customer for that order at random (each customer will    */
/*          one and only one order but which order that will be is   */
/*          determined with random numbers).                         */
/*                                                                   */
/* The next thing done is only done for orders between 2,101 and     */
/* 3000 for each district, this is the creation of a  neworder       */
/* record. The orderline records for that order are created last,    */
/* the number of lines for the  order is between 5 and 15, selected  */
/* at random.                                                        */
/*-------------------------------------------------------------------*/

  /*-----------------------------------------------------------------*/
  /* Includes.                                                       */
  /*-----------------------------------------------------------------*/
  #include <stdlib.h>
  #include <errno.h>
  #include <recio.h>
  #include <string.h>
  #include <xxfdbk.h>
  #include <milib.h>
  #include <micomput.h>
  #include <decimal.h>
  #include <time.h>
  #include <xxcvt.h>
  #include <except.h>
  #include <QSYSINC/MIH/MATTOD>/* time of day mi time */
  #include <QSYSINC/MIH/CMPSWP>
  #include <QSYSINC/MIH/WAITTIME>
  #include <qcmdexc.h>
  #include <mih/triml.h>
  #include <filldata.h>
  #include <tpccspace.h>
  #include <commontpcc.h>
  #include <os4msg.h>

  /* MAPINC generates structures for the database files          */
  #pragma mapinc("newordpf","*libl/newordpf(*all)","both  key","d _P",,"tpcc")
  #include "newordpf"
  #pragma mapinc("orderspf","*libl/orderspf(*all)","both  key", "d _P",,"tpcc")
  #include "orderspf"
  #pragma mapinc("ordlinpf","*libl/ordlinpf(*all)","both  key","d _P",,"tpcc")
  #include "ordlinpf"

  /*-----------------------------------------------------------------*/
  /* Defines                                                         */
  /*-----------------------------------------------------------------*/
  #define ACTIVE_WAREHOUSES  100
  #define MAX_WHRS_SIZE      15000

  #define STRWH_PARM        1
  #define NUMWH_PARM        2
  #define INST_VALUE_PARM   3
  #define JOB_INDEX_PARM    4
  #define DBLIB_PARM        5
  #define PARM_ORDERS_FILE  6
  #define PARM_ORDLIN_FILE  7
  #define PARM_NEWORD_FILE  8

  /*-----------------------------------------------------------------*/
  /* globals                                                         */
  /*-----------------------------------------------------------------*/
  int strWH_gl;         /* Starting warehouse from parameter input.  */
  short customer[ACTIVE_WAREHOUSES][10][3000];/* array of customer numbers */
  short offset_table[MAX_WHRS_SIZE];/* table of offsets for warehouses.  */
  char  offset_active = 'N';

  _RFILE *NewOrder_File, *Orders_File, *OrderLine_File;

  tpcc_ORRCD_both_t OrderRec;
  tpcc_OLRCD_both_t OrdlnRec;
  tpcc_NORCD_both_t NewordRec;

  static _MI_Time CurrTime;
  static char CarrStr[3];
  static unsigned long int rand_next = 1;

  char msgtxt[133];
  char msgq_gl[20];

  /* There are 10 entries of length 24 each   */
  char  *DIST_INFO[] =
      {"Info for District Num 00",
       "Info for District Num 01",
       "Info for District Num 02",
       "Info for District Num 03",
       "Info for District Num 04",
       "Info for District Num 05",
       "Info for District Num 06",
       "Info for District Num 07",
       "Info for District Num 08",
       "Info for District Num 09",
       "Info for District Num 10" };

 char *CarId[] = {"00","01", "02", "03", "04", "05",
                  "06", "07", "08", "09", "10" };


/*******************************************************************/
/*   L o a d O r d e r s                                           */
/*       Create & write orders and Orderline rec.                  */
/*                                                                 */
/*  PARMS: curWH   => current warehouse id                         */
/*         curDist => current district id                          */
/*         curOid  => current Order id                             */
```

```
/*****************************************************************/
void LoadOrders(int curWH, int curDist, int curOid)
{
   decimal(7,2) d;
   short int oln,curoln;
   char StockDist[25];

   int warehouse_index;    /* index into offset table.         */
   short order_point;      /* index of the order number point. */
   int warehouse_point;    /* actual index into the table.     */


   OrderRec.OID  = OrdlnRec.OLOID = curOid;
   OrderRec.OWID = OrdlnRec.OLWID = curWH;
   OrderRec.ODID = OrdlnRec.OLDID = curDist;

   /* Generate a random customer id.   */
   warehouse_index = curWH - strWH_gl;
   order_point = (offset_table[warehouse_index] + curOid - 1) % ORDERSPERDIST;
   /* Set index into table. Use table size.*/
   warehouse_point = warehouse_index % ACTIVE_WAREHOUSES;
   OrderRec.OCID = customer[warehouse_point][curDist - 1][order_point];

   mattod(CurrTime);
   CurrTime[7] = BASE_TIME;
   memcpy(OrderRec.OENTTOD, CurrTime, sizeof(_MI_Time));

   if(curOid < 2101)
   {
      strncpy(OrderRec.OCARID, CarId[RANDOM(1, 10)],strlen(CarId[0]));
   } else {
     memset(OrderRec.OCARID,'\0', strlen(OrderRec.OCARID));
   }
   OrderRec.OLINES = RANDOM(5, 15);
   curoln = OrderRec.OLINES;
   OrderRec.OLOCAL = 1;
   _Rwrite(Orders_File,(void *)&OrderRec, sizeof(OrderRec));

   /* load order line records                                  */
   for (oln = 1; oln <= curoln; ++oln)
   {
       OrdlnRec.OLOID = curOid;
       OrdlnRec.OLNBR = oln;
       while((OrdlnRec.OLIID = MaxRand(&rand_next))==0);
       OrdlnRec.OLSPWH = curWH;
       OrdlnRec.OLQTY = 5;
       if (curOid < 2101)
       {
          memcpy(OrdlnRec.OLDLVTOD, OrderRec.OENTTOD,sizeof(OrderRec.OENTTOD));
          OrdlnRec.OLAMNT = 0.00;
       } else {
         memcpy(OrdlnRec.OLDLVTOD, "00000000", 8);
         d = MaxRand(&rand_next) / 100;
         OrdlnRec.OLAMNT = d;
       }
       memcpy(StockDist, DistInf1[RANDOM(0, 9)], 11);
       memcpy((void *)&StockDist[11], DistInf2[curDist-1],2);
       memcpy((void *)&StockDist[13], DistInf3[RANDOM(0, 9)],11);
       strncpy(OrdlnRec.OLDSTI, StockDist, 24);

       _Rwrite(OrderLine_File,(void *)&OrdlnRec, sizeof(OrdlnRec));
   } /* End of order line loop  */

   return;
} /* End of LoadOrders  */


/*****************************************************************/
/*                                                               */
/* Function: load_customer                                       */
/*                                                               */
/*   Build the array for OCIDs.                                  */
/*   Generates a unique random customer id and builds an array.  */
/*                                                               */
/*****************************************************************/
void load_customer(int EndWH)
{
   int i,j,k,l, temp;

   if (EndWH > ACTIVE_WAREHOUSES)
   {
       for (i=0; i < EndWH; ++i)
       {
          /* Load the offset table with the starting point for customer.  */
          offset_table[i] =  RANDOM(0,(ORDERSPERDIST-1));
       }
       EndWH = ACTIVE_WAREHOUSES;
       offset_active = 'Y';        /* Set the flag if required. */
   } else {
       for (i=0; i < EndWH; ++i)
       {
           /* load the offset table */
           offset_table[i] = 0; /* set the starting point for customer */
       }
       offset_active = 'N';
   }

   for (i=0; i < EndWH; ++i)     /* go through the warehouse numbers */
   {
      /* set up the array for storing the order number  */
      for (j=0; j < 10; ++j)
      {
         for (k=0; k < ORDERSPERDIST; ++k)
         {
            customer[i][j][k] = k+1; /* setup the values                */
         } /* end of initialize customer id.  */

         for (k=0; k < ORDERSPERDIST; ++k)
         {
             /* Get the swap point. */
             RANDOM2(k, (ORDERSPERDIST-1), l)
             temp = customer[i][j][l];/* get the value to be swapped */
             customer[i][j][l] = customer[i][j][k]; /* swap part one */
             customer[i][j][k] = temp;            /* swap part two */
         }
      }
   }
   return;
 } /* End of load_customer */


/*---------------------------------------------------------------*/
/*                                                               */
/* Function: load_files                                          */
/*                                                               */
/*---------------------------------------------------------------*/
int load_files(int EndWH, int CurOid)
{
  short int wid, dist;

  for (wid = strWH_gl; wid < EndWH; ++wid)
  {
      for (dist = 1; dist <= 10; ++dist)
      {
          LoadOrders(wid, dist, CurOid);

          if (CurOid >= 2101)
          {
             /* Load New Order record. */
             NewordRec.NOWID = wid;
             NewordRec.NODID = dist;
             NewordRec.NOOID = CurOid;
             _Rwrite(NewOrder_File,(void *)&NewordRec, sizeof(NewordRec));
          }
      }
  }
  return(0);
}/* end of load files */
```

```
/*---------------------------------------------------------------*/
/*                                                               */
/* Function: main                                                */
/*                                                               */
/*---------------------------------------------------------------*/
 int main(int argc, char ** argv)
 {
    unsigned int lib_len;
    char  *slash_pos;

    char  pgmname[11];
    char  pgmlib[11];
    char  job_index[3];
    char  job_name[11] = "          ";
    char cmd[120];/* override commands */
    char dblib_null[11];
    char dblib_space[11];
    char orders_file[11];
    char ordlin_file[11];
    char neword_file[11];
    int loopX;
    int inst_num = 0;     /* the space instance number */
    int ordlin_ovr_size;  /* override size for order line file.  */
    int orders_ovr_size;  /* override size for orders file.      */
    int neword_ovr_size;  /* override size for new orders file. */
    int numWH;
    unsigned long int this_seed;
    ExcData_t volatile exD = {0 ,"*HANDLE   "};

    /*****************************************************************/
    /* Wait time variables  (key think time waits)                   */
    /*****************************************************************/
    _MI_Time  time_to_wait;                /* The amount of time to wait  */
    int hours     = 0,                     /* Time components used to    */
        minutes   = 0,                     /* create an _MI_Time value   */
        seconds   = 0,                     /* that can be passed to the  */
        hundredths = 0;                    /* 'waittime' function        */
    short wait_option = _WAIT_NORMAL;      /* wait time options          */
                                           /* format an mitime value     */
                                           /* representing the wait time  */


   /* Parse the input parms */
   _CPYBYTES(dblib_space, argv[DBLIB_PARM], 10);
   _CPYBYTES(dblib_null,  argv[DBLIB_PARM], 10);
   dblib_null[10] = '\0';
   dblib_null[triml(dblib_null, ' ')] = '\0';
   dblib_space[10] = '\0';

   /* TPCC message queue to send our build messages to.  */
   _CPYBYTES(msgq_gl, "TPCCMSG   ", 10);
   _CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);

   strWH_gl = atoi(argv[STRWH_PARM]);
   numWH    = atoi(argv[NUMWH_PARM]);
   numWH = strWH_gl + numWH;

   /*-------------------------------------------------------------*/
   /* Get the library name that we are running in now.            */
   /*-------------------------------------------------------------*/
   slash_pos = strchr(argv[0], '/');
   lib_len   = slash_pos - argv[0];
   _CPYBYTES(pgmlib, argv[0], lib_len);
   pgmlib[lib_len] = '\0';

   ++slash_pos;   /* Skip the '/'  */
   _CPYBYTES(pgmname, slash_pos, 10);
   pgmname[triml(pgmname, ' ')] = '\0';

   job_index[3] = '\0';
   _CPYBYTES(job_index, argv[JOB_INDEX_PARM], 3);
   job_index[triml(job_index, ' ')] = '\0';
   sprintf(job_name, "%0.7s%03s", pgmname, job_index);

   strncpy(orders_file, argv[PARM_ORDERS_FILE], 11);
   strncpy(ordlin_file, argv[PARM_ORDLIN_FILE], 11);
   strncpy(neword_file, argv[PARM_NEWORD_FILE], 11);

   inst_num = atoi(argv[INST_VALUE_PARM]);

   /*-------------------------------------------------------------*/
   /* Send a STARTING message...                                  */
   /*-------------------------------------------------------------*/
   while (0 != add_started_jobs(dblib_space, ORDER_JOBS, inst_num))
   {
      sprintf(msgtxt, "Error when calling add_started_jobs().");
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   sprintf(msgtxt,
         "%s is starting to fill the  ORDERs files from warehouse %d to %d.",
         job_name, strWH_gl, (numWH-1));
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
   QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, STATUS_MSG, CS_EXT_MSGQ, 1);

   ordlin_ovr_size = IO_BLOCK_SIZE / sizeof(tpcc_OLRCD_both_t);
   orders_ovr_size = IO_BLOCK_SIZE / sizeof(tpcc_ORRCD_both_t);
   neword_ovr_size = IO_BLOCK_SIZE / sizeof(tpcc_NORCD_both_t);

   sprintf(cmd,"OVRDBF FILE(%s) TOFILE(%s/%s) SEQONLY(*YES %d) OVRSCOPE(*JOB)",
           neword_file, dblib_null, neword_file, neword_ovr_size);
   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler
   if (0 != exD.error)
   {
      sprintf(msgtxt, "Override of Newordpf failed");
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   sprintf(cmd,"OVRDBF FILE(%s) TOFILE(%s/%s) SEQONLY(*YES %d) OVRSCOPE(*JOB)",
           orders_file, dblib_null, orders_file, orders_ovr_size );
   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler

   if (0 != exD.error)
   {
      sprintf(msgtxt, "Override of ORDERSPF failed.");
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   sprintf(cmd,"OVRDBF FILE(%s) TOFILE(%s/%s) SEQONLY(*YES %d) OVRSCOPE(*JOB)",
           ordlin_file, dblib_null, ordlin_file, ordlin_ovr_size );
   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler

   if (0 != exD.error)
   {
      sprintf(msgtxt, "Override of ORDLINPF failed.");
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   if ((Orders_File = _Ropen(orders_file,
        "ar,arrseq=Y,blkrcd=Y,riofb=N")) == NULL)
   {
      sprintf(msgtxt, "Open of ORDERSPF file failed.");
      add_error_jobs(dblib_space, ORDER_JOBS, inst_num);
      QsendMsg(IBM_MSG_FILE,"CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   if ((OrderLine_File = _Ropen(ordlin_file,
```

```
        "ar,arrseq=Y,blkrcd=Y,riofb=N"))  == NULL)
    {
       sprintf(msgtxt, "Open of ORDLIN file %s failed.", ordlin_file );
       add_error_jobs ( dblib_space, ORDER_JOBS, inst_num );
       QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
       return(-1);
    }

    if ((NewOrder_File = _Ropen(neword_file,
        "ar,arrseq=Y,blkrcd=Y,riofb=N"))  == NULL)
    {
       sprintf(msgtxt, "Open file %s failed\n", neword_file);
       add_error_jobs(dblib_space, ORDER_JOBS, inst_num);
       QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
       return(-1);
    }

    /* Set up random number generator */
    this_seed = get_seed();             /* get the seed value */
    srand(this_seed);                   /* set the seed       */
    rand_next = (unsigned long int)this_seed;

    load_customer(numWH);

    for (loopX = 1; loopX <= ORDERSPERDIST; ++loopX)
    {
       load_files(numWH, loopX);
    }

    _Rclose(Orders_File);
    _Rclose(OrderLine_File);
    _Rclose(NewOrder_File);
    add_successful_jobs(dblib_space, ORDER_JOBS, inst_num);

    /*-----------------------------------------------------------------*/
    /* Send an ENDING message...                                       */
    /*-----------------------------------------------------------------*/
    sprintf(msgtxt, "%s job has completed successfully.", job_name);
    Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, msgq_gl, 1, NULL);
    QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, STATUS_MSG, CS_EXT_MSGQ, 1);

    return(0);

 } /* end of main */
```

C.31 FILLPARTS.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* Program: FILLPARTS                                              */
/*                                                                 */
/* Purpose: Fill the files that make up a Split database.          */
/*     using any number of partitions 1 to 32                      */
/* Parms: Where to put pgm objects                                 */
/*        Database library name                                    */
/*        Number of warehouses                                     */
/*                                                                 */
/*  Build files and index mixed                                    */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &DBASP &NUMWHS &NUMPARTS &TEMPSTG)

   DCL &DBLIB      TYPE(*CHAR) LEN(10)
   DCL &DBASPCN    TYPE(*CHAR) LEN(3) /* DB ASP number w/null   */
   DCL &DBASPC     TYPE(*CHAR) LEN(2) /* DB ASP number w/null   */
   DCL &DBASP      TYPE(*DEC)  LEN(2 0)/* DB ASP number         */
   DCL &NUMWHS     TYPE(*DEC)  LEN(6 0)
   DCL &NUMWHSC    TYPE(*CHAR) LEN(6)
   DCL &TEMPSTG    TYPE(*CHAR) LEN(7)

    DCL &NUMPARTS TYPE(*DEC)  LEN(2 0)
    DCL &NUMPARTSC TYPE(*CHAR)  LEN(2)

   DCL &STRWH      TYPE(*DEC)  LEN(6 0) VALUE(1)
   DCL &NEXTSTR    TYPE(*DEC)  LEN(6 0)
   DCL &PARTSIZE   TYPE(*DEC)  LEN(6 0)
   DCL &LASTSIZE   TYPE(*DEC)  LEN(6 0)

   DCL &STRWHC     TYPE(*CHAR) LEN(6)
   DCL &NUMWHSC    TYPE(*CHAR) LEN(6)
   DCL &NUMWHSCN   TYPE(*CHAR) LEN(7)

   DCL &DLVRYSIZ   TYPE(*DEC)  LEN(10 0)
   DCL &PGMLIB     TYPE(*CHAR) LEN(10)
   DCL &MSGQ       TYPE(*CHAR) LEN(10) VALUE(INDEXMSGQ)
   DCL &GENMSGQ    TYPE(*CHAR) LEN(10) VALUE(TPCCMSG)

   DCL &RTNTYPE  TYPE(*CHAR) LEN(2)
   DCL &FUNCTION   TYPE(*CHAR) LEN(3)
   DCL &NULL       TYPE(*CHAR) LEN(1) VALUE(X'00')
   DCL &RECMPFLAG  TYPE(*CHAR) LEN(1) VALUE(Y)
   DCL &TAG        TYPE(*CHAR) LEN(2)
   DCL &CURRPART   TYPE(*DEC)  LEN(2)
   /*-----------------------------------------------------------------*/
   /* File name varables one per file                                 */
   /*-----------------------------------------------------------------*/
   DCL &CSTMRNAM       TYPE(*CHAR) LEN(10)
   DCL &DSTRCTNAM      TYPE(*CHAR) LEN(10)
   DCL &HSTRYNAM       TYPE(*CHAR) LEN(10)
   DCL &NEWORDNAM      TYPE(*CHAR) LEN(10)
   DCL &ORDLINNAM      TYPE(*CHAR) LEN(10)
   DCL &ORDNAM         TYPE(*CHAR) LEN(10)
   DCL &STOCKNAM       TYPE(*CHAR) LEN(10)
   DCL &WRHSNAM        TYPE(*CHAR) LEN(10)


         MONMSG MSGID(CPF0000 MCH0000 CZM0000) EXEC(GOTO ERREXIT)


         /* Other pgms will be called from library we are running in.  */
         IF COND(&NUMPARTS *GT &NUMWHS) THEN( +
         DO)
            SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*ESCAPE) +
            MSGDTA('Number of warehouses must be greater or equal +
            to the number of partitions.')
            GOTO ERREXIT
         ENDDO
         RTVOBJD OBJ(FILLPARTS) OBJTYPE(*PGM) RTNLIB(&PGMLIB)

         CD DIR(/)   /* go to the base directory */
         MKDIR DIR(&PGMLIB)  /* Create the directory needed for spawning */
           MONMSG CPFA0A0 EXEC(RCVMSG RMV(*YES))

         ADDLIBLE &DBLIB
           MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))

         CALL TPCCTOOLS/SETTOOLIBL
         CALL &PGMLIB/SETBLDLIBL

         /*-----------------------------------------------------------------*/
         SNDPGMMSG MSGID(CPF9897) +
                   MSGDTA('FILLPARTS: creating initial DB files...') +
                   MSGF(QSYS/QCPFMSG) TOPGMQ(*EXT) MSGTYPE(*STATUS)

         CRTPF FILE(&DBLIB/AREFFIL)
           MONMSG MSGID(CPF2103 CPF7302) EXEC(RCVMSG RMV(*YES))

         CHGVAR &STRWHC   VALUE(&STRWH)
         CHGVAR &NUMWHSC  VALUE(&NUMWHS)
         CHGVAR &NUMWHSCN VALUE(&NUMWHSC *CAT &NULL)

         CRTBLDSPCE DBLIB(&DBLIB) STRWH(&STRWHC) WHS(&NUMWHSC) SPLITDB(Y)

         CHGVAR &PARTSIZE  VALUE(&NUMWHS / &NUMPARTS)
         CHGVAR &LASTSIZE  VALUE(&NUMWHS - ((&NUMPARTS - 1)* &PARTSIZE))
         CHGVAR &NEXTSTR   VALUE(&STRWH + &PARTSIZE)

         /* MSGQ for Send and Receive messages for index builds  */
         CRTMSGQ MSGQ(&DBLIB/&MSGQ)
           MONMSG CPF2112 EXEC(CLRMSGQ MSGQ(&DBLIB/&MSGQ))
          /*-----------------------------------------------------*/
          /* Fill the ORDERs, NEWORDs, ORDLINs files.        */
          /*-----------------------------------------------------*/

          IF COND(&NUMPARTS *EQ 1) THEN( +
          CRTORDFILE DBLIB(&DBLIB) ORDNAM(ORDERSPF) +
                     ORDLINNAM(ORDLINPF) NEWORDNAM(NEWORDPF) +
                     STRWH(&STRWH) WHS(&NUMWHS) RECOMPILE(Y))
          ELSE       CMD(   +
          DO)
               CHGVAR VAR(&CURRPART) VALUE(1)
ORDLOOP:       CHGVAR VAR(&TAG) VALUE(&CURRPART)
               CHGVAR VAR(&ORDNAM) VALUE( 'ORDERSPF' *TCAT &TAG)
               CHGVAR VAR(&ORDLINNAM) VALUE( 'ORDLINPF' *TCAT &TAG)
               CHGVAR VAR(&NEWORDNAM) VALUE( 'NEWORDPF' *TCAT &TAG)
               IF (&CURRPART *NE &NUMPARTS)  THEN( +
                  CRTORDFILE DBLIB(&DBLIB) ORDNAM(&ORDNAM) +
                     ORDLINNAM(&ORDLINNAM) NEWORDNAM(&NEWORDNAM) +
                     STRWH(&STRWH) WHS(&PARTSIZE) RECOMPILE(&RECMPFLAG))
               ELSE CMD( +
                  CRTORDFILE DBLIB(&DBLIB) ORDNAM(&ORDNAM) +
                     ORDLINNAM(&ORDLINNAM) NEWORDNAM(&NEWORDNAM) +
                     STRWH(&STRWH) WHS(&LASTSIZE) RECOMPILE(&RECMPFLAG))
               CHGVAR VAR(&RECMPFLAG) VALUE('N')
               CHGVAR VAR(&STRWH)     VALUE(&STRWH + &PARTSIZE)
               CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
               IF         COND(&CURRPART *LE &NUMPARTS) THEN(GOTO +
                           CMDLBL(ORDLOOP))
          ENDDO

         CHGVAR VAR(&NUMPARTSC) VALUE(&NUMPARTS)

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('INDEXBUILD: submitting jobs to build indexes...') +
                   TOPGMQ(*EXT) MSGTYPE(*STATUS)

         CHGVAR   VAR(&DBASPC) VALUE(&DBASP)
         CHGVAR   VAR(&NUMWHSC) VALUE(&NUMWHSC)
         SBMJOB CMD(CRTDBIX  IX(*ORDLIN) DBLIB(&DBLIB) DBASP(&DBASPC)  +
                TEMPSTG(&TEMPSTG) NUMP(&NUMPARTS) WHS(&NUMWHSC))     +
                JOB(ORDLININDX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)


          /*-----------------------------------------------------*/
          /* Fill the STOCK  and custmer files.              */
          /*-----------------------------------------------------*/
          CHGVAR VAR(&STRWH) VALUE(1)
          CHGVAR VAR(&RECMPFLAG) VALUE('Y')
          CRTPF      FILE(&DBLIB/STOCKPF) SRCMBR(STOCKPF) +
                     SIZE(*NOMAX) WAITRCD(2) SHARE(*NO)  +
                     REUSEDLT(*NO) LVLCHK(*NO)

          CRTPF &DBLIB/CSTMRPF SRCMBR(CSTMRPF)  SIZE(*NOMAX)  +
                WAITRCD(2)  SHARE(*NO)  REUSEDLT(*NO)  LVLCHK(*NO)

          CRTCMOD  &PGMLIB/MASTCUSSTK
          CRTPGM      PGM(&PGMLIB/MASTCUSSTK)  +
                      MODULE(&PGMLIB/MASTCUSSTK  +
                      &PGMLIB/COMMONTPCC  &PGMLIB/TPCCSPACE)  +
                      ENTMOD(&PGMLIB/MASTCUSSTK)  +
                      BNDSRVPGM(TPCCTOOLS/TPCCTOOLS  QSYS/QDBRUNHA)

          IF COND(&NUMPARTS *NE 1) THEN( +
          DO)
             DLTF FILE(STOCKPF)
            DLTF FILE(CSTMRPF)
           /* CREATE The PYSICAL FILES */
               CHGVAR VAR(&CURRPART) VALUE(1)
STOCKLOOP:     CHGVAR VAR(&TAG) VALUE(&CURRPART)
               CHGVAR VAR(&STOCKNAM) VALUE( 'STOCKPF' *TCAT &TAG)
               CHGVAR VAR(&CSTMRNAM) VALUE( 'CSTMRPF' *TCAT &TAG)
               CRTPF      FILE(&DBLIB/&STOCKNAM)  SRCMBR(STOCKPF)  +
                          SIZE(*NOMAX)  WAITRCD(2)  SHARE(*NO)  +
                          REUSEDLT(*NO)  LVLCHK(*NO)

               CRTPF  &DBLIB/&CSTMRNAM SRCMBR(CSTMRPF)  SIZE(*NOMAX)  +
                WAITRCD(2)  SHARE(*NO)  REUSEDLT(*NO)  LVLCHK(*NO)

               CHGVAR     VAR(&CURRPART)  VALUE(&CURRPART + 1)
               IF         COND(&CURRPART *LE &NUMPARTS)  THEN(GOTO +
                         CMDLBL(STOCKLOOP))
          ENDDO

          CALL PGM(&PGMLIB/CRTSTOCKLF)  PARM(&DBLIB +
                                 &NUMPARTSC)
          CALL PGM(&PGMLIB/CSTMRVIEW)  PARM(&DBLIB +
                                 &NUMPARTSC)
          CRTHASH DBLIB(&DBLIB)  WHS(&NUMWHSC)  PFILE(STOCKPF)  +
               LFILE(STOCK)  CREATE('Y')

          CRTHASH  DBLIB(&DBLIB)  WHS(&NUMWHSC)  PFILE(CSTMRPF)  +
                 LFILE(CSTMR)  CREATE('N')

          IF COND(&NUMPARTS *EQ 1) THEN( +
          FILSTKFILE DBLIB(&DBLIB) FILE(STOCKPF)  STRWH(&STRWH)  +
                     WHS(&NUMWHS)  RECOMPILE(Y))
          ELSE       CMD(   +
          DO)
               CHGVAR VAR(&CURRPART) VALUE(1)
FSTOCKLOOP:     CHGVAR VAR(&TAG) VALUE(&CURRPART)
               CHGVAR  VAR(&STOCKNAM)  VALUE( 'STOCKPF' *TCAT &TAG)
               IF  (&CURRPART *NE &NUMPARTS)   THEN( +
                  FILSTKFILE  DBLIB(&DBLIB)  FILE(&STOCKNAM)  STRWH(&STRWH)  +
                   WHS(&PARTSIZE)  RECOMPILE(&RECMPFLAG))
               ELSE CMD( +
                  FILSTKFILE DBLIB(&DBLIB)  FILE(&STOCKNAM)  STRWH(&STRWH)  +
                    WHS(&LASTSIZE)  RECOMPILE(&RECMPFLAG))
               CHGVAR VAR(&RECMPFLAG)  VALUE('N')
               CHGVAR VAR(&STRWH)     VALUE(&STRWH + &PARTSIZE)
               CHGVAR VAR(&CURRPART)  VALUE(&CURRPART + 1)
               IF         COND(&CURRPART *LE &NUMPARTS)  THEN(GOTO +
                           CMDLBL(FSTOCKLOOP))
          ENDDO


          /*-----------------------------------------------------*/
          /* Fill the CUSTOMER files.                        */
          /*-----------------------------------------------------*/

          CHGVAR VAR(&STRWH)  VALUE(1)
          CHGVAR VAR(&RECMPFLAG)  VALUE('Y')
          IF COND(&NUMPARTS *EQ 1) THEN( +
             FILCUSFILE  DBLIB(&DBLIB)  FILE(CSTMRPF)  STRWH(&STRWH)  +
                    WHS(&NUMWHS)  RECOMPILE(Y))
          ELSE       CMD(   +
          DO)
               CHGVAR VAR(&CURRPART)  VALUE(1)
CSMRLOOP:      CHGVAR VAR(&TAG)  VALUE(&CURRPART)
               CHGVAR  VAR(&CSTMRNAM)  VALUE( 'CSTMRPF'  *TCAT  &TAG)
               IF  (&CURRPART  *NE  &NUMPARTS)   THEN( +
               FILCUSFILE  DBLIB(&DBLIB)  FILE(&CSTMRNAM)  STRWH(&STRWH)  +
                   WHS(&PARTSIZE)  RECOMPILE(&RECMPFLAG))
               ELSE CMD( +
               FILCUSFILE  DBLIB(&DBLIB)  FILE(&CSTMRNAM)  STRWH(&STRWH)  +
                    WHS(&LASTSIZE)  RECOMPILE(&RECMPFLAG))
               CHGVAR VAR(&RECMPFLAG)  VALUE('N')
               CHGVAR VAR(&STRWH)     VALUE(&STRWH + &PARTSIZE)
               CHGVAR VAR(&CURRPART)  VALUE(&CURRPART + 1)
               IF         COND(&CURRPART  *LE  &NUMPARTS)  THEN(GOTO +
                           CMDLBL(CSMRLOOP))
          ENDDO

          /*-----------------------------------------------------*/
          /* Fill the HISTORY files.                         */
          /*-----------------------------------------------------*/
```

```
         CHGVAR VAR(&STRWH) VALUE(1)
         CHGVAR VAR(&RECMPFLAG) VALUE('Y')
         IF COND(&NUMPARTS *EQ 1) THEN( +
            CRTHISFILE DBLIB(&DBLIB) FILE(HSTRY) STRWH(&STRWH) +
                  WHS(&NUMWHS) RECOMPILE(Y))
         ELSE       CMD(   +
         DO)
               CHGVAR VAR(&CURRPART) VALUE(1)
HSTRYLOOP:     CHGVAR VAR(&TAG) VALUE(&CURRPART)
               CHGVAR VAR(&HSTRYNAM) VALUE( 'HSTRY' *TCAT &TAG)
               IF (&CURRPART *NE &NUMPARTS)  THEN( +
               CRTHISFILE DBLIB(&DBLIB) FILE(&HSTRYNAM) STRWH(&STRWH) +
                    WHS(&PARTSIZE) RECOMPILE(&RECMPFLAG))
               ELSE CMD( +
               CRTHISFILE DBLIB(&DBLIB) FILE(&HSTRYNAM) STRWH(&STRWH) +
                    WHS(&LASTSIZE) RECOMPILE(&RECMPFLAG))
               CHGVAR VAR(&RECMPFLAG) VALUE('N')
               CHGVAR VAR(&STRWH)     VALUE(&STRWH + &PARTSIZE)
               CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
               IF          COND(&CURRPART *LE &NUMPARTS) THEN(GOTO +
                            CMDLBL(HSTRYLOOP))
         ENDDO

         /*-----------------------------------------------------------*/
         /* Create the ITEM files and program.                        */
         /*-----------------------------------------------------------*/
         CALL PGM(&PGMLIB/CRTITEM) PARM(&DBLIB &NUMPARTS)


         /*-----------------------------------------------------------*/
         /* Create the WRHS files and programs.                       */
         /*-----------------------------------------------------------*/
         CHGVAR VAR(&STRWH) VALUE(1)
         CHGVAR VAR(&RECMPFLAG) VALUE('Y')
         IF COND(&NUMPARTS *EQ 1) THEN( +
            CRTWHFILE DBLIB(&DBLIB) FILE(WRHS) STRWH(&STRWH) +
                  WHS(&NUMWHS) RECOMPILE(Y))
         ELSE       CMD(   +
         DO)
               CHGVAR VAR(&CURRPART) VALUE(1)
WRHSLOOP:      CHGVAR VAR(&TAG) VALUE(&CURRPART)
               CHGVAR VAR(&WRHSNAM) VALUE( 'WRHS' *TCAT &TAG)
               IF (&CURRPART *NE &NUMPARTS)  THEN( +
               CRTWHFILE DBLIB(&DBLIB) FILE(&WRHSNAM) STRWH(&STRWH) +
                    WHS(&PARTSIZE) RECOMPILE(&RECMPFLAG))
               ELSE CMD( +
               CRTWHFILE DBLIB(&DBLIB) FILE(&WRHSNAM) STRWH(&STRWH) +
                    WHS(&LASTSIZE) RECOMPILE(&RECMPFLAG))
               CHGVAR VAR(&RECMPFLAG) VALUE('N')
               CHGVAR VAR(&STRWH)     VALUE(&STRWH + &PARTSIZE)
               CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
               IF          COND(&CURRPART *LE &NUMPARTS) THEN(GOTO +
                            CMDLBL(WRHSLOOP))
         ENDDO

         /*-----------------------------------------------------------*/
         /* Create the DISTRICT part 1 file and programs.             */
         /*-----------------------------------------------------------*/

         CHGVAR VAR(&STRWH) VALUE(1)
         CHGVAR VAR(&RECMPFLAG) VALUE('Y')
         IF COND(&NUMPARTS *EQ 1) THEN( +
            CRTDIST DBLIB(&DBLIB) FILE(DSTRCT) STRWH(&STRWH) +
                  WHS(&NUMWHS) RECOMPILE(Y))
         ELSE       CMD(   +
         DO)
               CHGVAR VAR(&CURRPART) VALUE(1)
DISTLOOP:      CHGVAR VAR(&TAG) VALUE(&CURRPART)
               CHGVAR VAR(&DSTRCTNAM) VALUE( 'DSTRCT' *TCAT &TAG)
               IF (&CURRPART *NE &NUMPARTS)  THEN( +
                  CRTDIST DBLIB(&DBLIB) FILE(&DSTRCTNAM) STRWH(&STRWH) +
                    WHS(&PARTSIZE) RECOMPILE(&RECMPFLAG))
               ELSE CMD( +
                  CRTDIST DBLIB(&DBLIB) FILE(&DSTRCTNAM) STRWH(&STRWH) +
                    WHS(&LASTSIZE) RECOMPILE(&RECMPFLAG))
               CHGVAR VAR(&RECMPFLAG) VALUE('N')
               CHGVAR VAR(&STRWH)     VALUE(&STRWH + &PARTSIZE)
               CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
               IF          COND(&CURRPART *LE &NUMPARTS) THEN(GOTO +
                            CMDLBL(DISTLOOP))
         ENDDO

         /*-----------------------------------------------------*/
         /* Create delivery log and delivery log a              */
         /*-----------------------------------------------------*/
         CHGVAR VAR(&DLVRYSIZ) VALUE(&NUMWHS * 1000)
         CRTPF FILE(&DBLIB/DLVRYLOG) SIZE(&DLVRYSIZ 10000 10000) +
               ALLOCATE(*YES) WAITRCD(*NOMAX) SHARE(*YES) LVLCHK(*NO)

         CRTPF FILE(&DBLIB/DLVRYLOGA) SIZE(*NOMAX) WAITRCD(*NOMAX) +
               SHARE(*YES) LVLCHK(*NO)

         CRTPRTF FILE(&DBLIB/DBUGPRT)  LVLCHK(*NO)
         CRTPRTF FILE(&DBLIB/DBUGPRT2) LVLCHK(*NO)

          SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
             MSGDTA('INDEXBUILD: waiting for ordline inxex to complete...') +
                   TOPGMQ(*EXT) MSGTYPE(*STATUS)
          RCVMSG MSGQ(&DBLIB/&MSGQ) MSGTYPE(*ANY) WAIT(*MAX) RTNTYPE(&RTNTYPE)
          IF COND((&RTNTYPE = '15') | (&RTNTYPE = '17')) THEN(DO)
             SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
         MSGDTA('Error with submitted INDEXBUILD job.  See appropriate joblog!')
            GOTO ERREXIT
          ENDDO


         /*-----------------------------------------------------*/
         /* Build  ORDERS and NEWORD indexs                     */
         /*-----------------------------------------------------*/

      SBMJOB CMD(CRTDBIX  IX(*ORDERS) DBLIB(&DBLIB) DBASP(&DBASPC)  +
                TEMPSTG(&TEMPSTG) NUMP(&NUMPARTS) WHS(&NUMWHSC)   +
             JOB(ORDERSINDX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)

      SBMJOB CMD(CRTDBIX  IX(*NEWORD) DBLIB(&DBLIB) DBASP(&DBASPC)  +
                TEMPSTG(&TEMPSTG) NUMP(&NUMPARTS) WHS(&NUMWHSC)   +
             JOB(NEWORDINDX) JOBQ(&PGMLIB/TPCBLDJOBQ) MSGQ(&DBLIB/&MSGQ)


        /*-------------------------------------------------------------------*/
        /* WAIT FOR COMPLETION OF SUBMITTED JOBS.                            */
        /*                                                                   */
        /* Send a status msg to the screen and also one to the joblog...     */
        /*-------------------------------------------------------------------*/

        IF COND(&NUMPARTS *GT 1) THEN(DO)

           CALL CRTINDEX PARM('HSTRY ' &DBLIB &DBASPCN  +
                             &NUMWHSCN &NUMPARTSC &TEMPSTG)

           CALL CRTINDEX PARM('WRHS  ' &DBLIB &DBASPCN  +
                             &NUMWHSCN &NUMPARTSC &TEMPSTG)

           CALL CRTINDEX PARM('DSTRCT' &DBLIB &DBASPCN  +
                              &NUMWHSCN &NUMPARTSC &TEMPSTG)


        ENDDO


        SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
             MSGDTA('INDEXBUILD: waiting for 5 submitted jobs to complete...') +
                   TOPGMQ(*EXT) MSGTYPE(*STATUS)
        RCVMSG MSGQ(&DBLIB/&MSGQ) MSGTYPE(*ANY) WAIT(*MAX) RTNTYPE(&RTNTYPE)
        IF COND((&RTNTYPE = '15') | (&RTNTYPE = '17')) THEN(DO)
           SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
         MSGDTA('Error with submitted INDEXBUILD job.  See appropriate joblog!')
           GOTO ERREXIT
        ENDDO

        SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
             MSGDTA('INDEXBUILD: waiting for 4 submitted jobs to complete...') +
                   TOPGMQ(*EXT) MSGTYPE(*STATUS)
        RCVMSG MSGQ(&DBLIB/&MSGQ) MSGTYPE(*ANY) WAIT(*MAX) RTNTYPE(&RTNTYPE)
        IF COND((&RTNTYPE = '15') | (&RTNTYPE = '17')) THEN(DO)
           SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
         MSGDTA('Error with submitted INDEXBUILD job.  See appropriate joblog!')
           GOTO ERREXIT
        ENDDO

        SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
             MSGDTA('INDEXBUILD: waiting for 3 submitted jobs to complete...') +
                   TOPGMQ(*EXT) MSGTYPE(*STATUS)
        RCVMSG MSGQ(&DBLIB/&MSGQ) MSGTYPE(*ANY) WAIT(*MAX) RTNTYPE(&RTNTYPE)
        IF COND((&RTNTYPE = '15') | (&RTNTYPE = '17')) THEN(DO)
           SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
         MSGDTA('Error with submitted INDEXBUILD job.  See appropriate joblog!')
           GOTO ERREXIT
        ENDDO

        SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
             MSGDTA('INDEXBUILD: waiting for 2 submitted jobs to complete...') +
                   TOPGMQ(*EXT) MSGTYPE(*STATUS)
        RCVMSG MSGQ(&DBLIB/&MSGQ) MSGTYPE(*ANY) WAIT(*MAX) RTNTYPE(&RTNTYPE)
        IF COND((&RTNTYPE = '15') | (&RTNTYPE = '17')) THEN(DO)
           SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
         MSGDTA('Error with submitted INDEXBUILD job.  See appropriate joblog!')
           GOTO ERREXIT
        ENDDO

        SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
             MSGDTA('INDEXBUILD: waiting for 1 submitted jobs to complete...') +
                   TOPGMQ(*EXT) MSGTYPE(*STATUS)
        RCVMSG MSGQ(&DBLIB/&MSGQ) MSGTYPE(*ANY) WAIT(*MAX) RTNTYPE(&RTNTYPE)
        IF COND((&RTNTYPE = '15') | (&RTNTYPE = '17')) THEN(DO)
           SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
         MSGDTA('Error with submitted INDEXBUILD job.  See appropriate joblog!')

           GOTO ERREXIT
         ENDDO

         DLTMSGQ MSGQ(&DBLIB/&MSGQ)
           MONMSG CPF0000


         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('FILLPARTS program completed successfully!')
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('FILLPARTS program completed successfully!') +
                   TOMSGQ(&DBLIB/&GENMSGQ)

         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('FILLPARTS failed!') TOMSGQ(&DBLIB/&GENMSGQ)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('FILLPARTS failed!') MSGTYPE(*ESCAPE)
ENDPGM: ENDPGM
```

C.32 FILLSTOCK.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* File name: FILLSTOCK                                            */
/*                                                                 */
/* Purpose: Fill the STOCK file.                                   */
/*                                                                 */
/*          NOTE: The logic is the same as in  FILLCUS c file.     */
/*                                                                 */
/* PARMS: database library name                                    */
/*        fill_Q name                                              */
/*        write_Q name                                             */
/*        Fill space name                                          */
/*        file id                                                  */
/*        instance number                                          */
/*        starting warehouse number                                */
/*        number of warehouses                                     */
/*        our job number in the scheme of things                   */
/*        total number of jobs to fill data                        */
/*                                                                 */
/*-----------------------------------------------------------------*/
  /*---------------------------------------------------------------*/
  /* Includes.                                                     */
  /*---------------------------------------------------------------*/
  #include <stdlib.h>
  #include <errno.h>
  #include <recio.h>
  #include <string.h>
  #include <xxfdbk.h>
  #include <milib.h>
  #include <micomput.h>
  #include <decimal.h>
  #include <qusptrus.h>
  #include <qwtchgjb.h>
  #include <mih/cpybytes.h>
  #include <mih/cpyblap.h>
  #include <mih/triml.h>
  #include <mih/mattod.h>
  #include <qsysinc/mih/enq>
  #include <qsysinc/mih/deq>
  #include <qsysinc/mih/rslvsp>
  #include <os4msg.h>
  #include <filldata.h>
  #include <commontpcc.h>
  #include <tpccspace.h>

  /*---------------------------------------------------------------*/
  /* MAPINC generates structures for the database file.            */
  /*---------------------------------------------------------------*/
  #pragma mapinc("stockpf","*LIBL/stockpf(*all)","both",  "d _P",,"tpcc")
  #include "stockpf"

  /*---------------------------------------------------------------*/
  /* Defines                                                       */
  /*---------------------------------------------------------------*/
  #define DBLIB_PARM          1
  #define FILL_Q_PARM         2
  #define WRITE_Q_PARM        3
  #define FILL_SPACE_PARM     4
  #define FILE_ID_PARM        5
  #define INST_NUMBER_PARM    6
  #define STRWH_PARM          7
  #define NUMWH_PARM          8
  #define JOB_NUMBER_PARM     9
  #define NUMBER_JOBS_PARM   10

  /*---------------------------------------------------------------*/
  /* Global declares                                               */
  /*---------------------------------------------------------------*/
  int    file_id;
  int    inst_number;

  char   dblib[11];
  char   msgtxt[100];
  char   msgq_gl[20];
  char   pgmname_gl[11];
  char   pgmlib_gl[11];

  _SYSPTR  write_Q_ptr = NULL;
  _ENQ_Msg_Prefix_T  ENQ_msg_prefix;


/*-----------------------------------------------------------------*/
/*                                                                 */
/* Function: error_cleanup                                         */
```

```
/*                                                                    */
/*--------------------------------------------------------------------*/
void error_cleanup(void)
{
    char  Q_msg_text[MSG_LENGTH];

    add_error_jobs(dblib, file_id, inst_number);
    if (NULL != write_Q_ptr)
    {
       sprintf(Q_msg_text, "Q");          /* Quit. */
       enq(write_Q_ptr, &ENQ_msg_prefix, Q_msg_text);
    }

    sprintf(msgtxt, "%s program failed!", pgmname_gl);
    QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
    return;
} /* End: error_cleanup() */


/*--------------------------------------------------------------------*/
/*                                                                    */
/* Function: fill_stock                                               */
/*                                                                    */
/* Note: DistInf fields are declared in the FILLSTOCK H file.         */
/*                                                                    */
/*--------------------------------------------------------------------*/
void fill_stock(unsigned long record_number,
                unsigned long num_record_per_IO_block,
                unsigned long max_record,
                char *data_space, int StartWH, int NumWH)
{
   unsigned long record_count;          /* Records filled in block.  */
   unsigned long current_record;
   tpcc_STRCD_both_t *StkRec;


   /*-----------------------------------------------------------------*/
   /* Start executable code.                                          */
   /*-----------------------------------------------------------------*/
   record_count = 0;
   current_record = record_number;
   while ((record_count < num_record_per_IO_block)  &&
          (current_record <= max_record))
   {
      StkRec = (tpcc_STRCD_both_t *)
                  &data_space[(record_count * sizeof(tpcc_STRCD_both_t))];

      /*--------------------------------------------------------------*/
      /*                                                              */
      /* Fill stock record.                                           */
      /* Changed for uses with database version 3.4                   */
      /* The order is STIDD as the first key and STWID as the         */
      /* second key.                                                  */
      /*                                                              */
      /*--------------------------------------------------------------*/
      StkRec->STWID = ((current_record - 1) % NumWH) + 1 + StartWH;
      StkRec->STIID = ((current_record - 1) / NumWH) + 1;
      StkRec->STQTY = RANDOM(10,100);

      /*---------------------------------*/
      /* Create STDInn (district info) */
      /*---------------------------------*/
      memcpy(StkRec->STDI01, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI01)+11, DistInf2[0], 2);
      memcpy((StkRec->STDI01)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI02, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI02)+11, DistInf2[1], 2);
      memcpy((StkRec->STDI02)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI03, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI03)+11, DistInf2[2], 2);
      memcpy((StkRec->STDI03)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI04, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI04)+11, DistInf2[3], 2);
      memcpy((StkRec->STDI04)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI05, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI05)+11, DistInf2[4], 2);
      memcpy((StkRec->STDI05)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI06, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI06)+11, DistInf2[5], 2);
      memcpy((StkRec->STDI06)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI07, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI07)+11, DistInf2[6], 2);
      memcpy((StkRec->STDI07)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI08, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI08)+11, DistInf2[7], 2);
      memcpy((StkRec->STDI08)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI09, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI09)+11, DistInf2[8], 2);
      memcpy((StkRec->STDI09)+13, DistInf3[RANDOM(0, 9)], 11);

      memcpy(StkRec->STDI10, DistInf1[RANDOM(0, 9)], 11);
      memcpy((StkRec->STDI10)+11, DistInf2[9], 2);
      memcpy((StkRec->STDI10)+13, DistInf3[RANDOM(0, 9)], 11);

      /*-----------------------------------------------*/
      /* Create STDATA random string 26 to 50 chars  */
      /*-----------------------------------------------*/
      CreateStrPad_extra(26, 50, StkRec->STDATA, "ORIGINAL");

      StkRec->STYTD = 0;
      StkRec->STORDRS = 0;
      StkRec->STREMORD = 0;

      /*--------------------------------------------------------------*/
      ++record_count;
      ++current_record;
   }
   return;

} /* end of fill_stock */


/*--------------------------------------------------------------------*/
/*                                                                    */
/* Function: main                                                     */
/*                                                                    */
/*--------------------------------------------------------------------*/
int main(int argc, char **argv)
{
   short    block, job_number;
   int      StartWH;
   int      NumWH;
   int      number_jobs, number_blocks_per_job;
   error_structure errCode;
   unsigned int lib_len;

   char   *slash_pos;

   char    fill_space[21];
   char   *fill_space_ptr;   /* Always points to start of fill space.  */
   char   *fill_space_ptr2;  /* Points to different blocks with space. */

   char    fill_Q[11];
   char    write_Q[11];
   _SYSPTR fill_Q_ptr;

   unsigned long rec_number;        /* Relative record number.      */
   unsigned long num_record_per_IO_block;
   unsigned long record_skip_size;
   unsigned long last_record = 0;

   char  Q_msg_text[MSG_LENGTH];
   _DEQ_Msg_Prefix_T DEQ_msg_prefix;

   struct {
           Qus_Job_Change_Information_t jci;
           Qus_JOBC0100_t x;
           int  priority;
   } chgI;

   ExcData_t volatile exD = {0 ,"*HANDLE   "};

   /*-----------------------------------------------------------------*/
   /* Start executable code.                                          */
   /*-----------------------------------------------------------------*/

   /*-----------------------------------------------------------------*/
   /* Set up the exception handler.  Handle all escapes &  FC excps.  */
   /* Branch to: ERR when an error occurs.                            */
   /*-----------------------------------------------------------------*/
   #pragma exception_handler \
      (ERR, 0, 0, _C2_MH_ESCAPE | _C2_MH_FUNCTION_CHECK, _CTLA_HANDLE)

   errCode.bytes_prov = 0;

   /*-----------------------------------------------------------------*/
   /* Get the library name that we are running in.                    */
   /*-----------------------------------------------------------------*/
   slash_pos = strchr(argv[0], '/');
   lib_len   = slash_pos - argv[0];
   _CPYBYTES(pgmlib_gl, argv[0], lib_len);
   pgmlib_gl[lib_len] = '\0';

   ++slash_pos;   /* Skip the '/' that follows the pgmlib field. */
   _CPYBYTES(pgmname_gl, slash_pos, 10);
   pgmname_gl[triml(pgmname_gl, ' ')] = '\0';

   /*-----------------------------------------------------------------*/
   /* TPCC message queue to send our build messages to.               */
   /*-----------------------------------------------------------------*/
   _CPYBYTES(msgq_gl, BLD_MSGQ_NAME_10, 10);
   _CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);

   dblib[10] = '\0';
   _CPYBYTES(dblib, argv[DBLIB_PARM], 10);
   dblib[triml(dblib, ' ')] = '\0';

   _CPYBYTES(fill_space, argv[FILL_SPACE_PARM], 10);
   _CPYBYTES(fill_space+10, argv[DBLIB_PARM], 10);

   job_number = atoi(argv[JOB_NUMBER_PARM]);

   /*-----------------------------------------------------------------*/
   sprintf(msgtxt, "FILLSTOCK: filling user space %.10s in library %s...",
           fill_space, dblib);
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq_gl, 1, NULL);


   StartWH = atoi(argv[STRWH_PARM]) - 1;
   inst_number = atoi(argv[INST_NUMBER_PARM]);
   /*-----------------------------------------------------------------*/
   /* Calculate the number of records and the starting record.        */
   /* Number of records is the  (io block size) / record size.        */
   /*-----------------------------------------------------------------*/
   NumWH   = atoi(argv[NUMWH_PARM]);
   file_id = atoi(argv[FILE_ID_PARM]);   /* Customer or Stock file? */

   num_record_per_IO_block = IO_BLOCK_SIZE / sizeof(tpcc_STRCD_both_t);
   last_record = NumWH * MAXITEMS;

   /*-----------------------------------------------------------------*/
   /* Set Queuing values.                                             */
   /*-----------------------------------------------------------------*/
   DEQ_msg_prefix.Wait_Forever = 1;      /* Wait forever.             */
   ENQ_msg_prefix.Msg_Len = MSG_LENGTH;

   fill_Q[10] = '\0';
   _CPYBYTES(fill_Q,  argv[FILL_Q_PARM],  10);
   fill_Q[triml(fill_Q, ' ')] = '\0';
   write_Q[10] = '\0';
   _CPYBYTES(write_Q, argv[WRITE_Q_PARM], 10);
   write_Q[triml(write_Q, ' ')] = '\0';

   if (NULL == (fill_Q_ptr = rslvsp(_Usrq, fill_Q, dblib, _AUTH_ALL)))
   {
      sprintf(msgtxt, "Cound not resolve to user queue, %s, in library %s.",
              fill_Q, dblib);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      error_cleanup();
      return(-1);
   }
   if (NULL == (write_Q_ptr = rslvsp(_Usrq, write_Q, dblib, _AUTH_ALL)))
   {
      sprintf(msgtxt, "Cound not resolve to user queue, %s, in library %s.",
              write_Q, dblib);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      error_cleanup();
      return(-1);
   }

   QUSPTRUS(fill_space, &fill_space_ptr, &errCode); /* Get the ptr */
   fill_space_ptr2 = fill_space_ptr;

   /* Set up random number generator */
   srand(get_seed());

   /*-----------------------------------------------------------------*/
   /* Find the starting record number.                                */
   /*-----------------------------------------------------------------*/
   number_jobs = atoi(argv[NUMBER_JOBS_PARM]);
   rec_number = (job_number * num_record_per_IO_block) + 1;
   record_skip_size = num_record_per_IO_block * number_jobs;

   block = 1;
   IO_BLOCKS_PER_JOB(number_blocks_per_job, num_record_per_IO_block,
                     last_record, number_jobs)

   /*-----------------------------------------------------------------*/
   /* Change our job priority so we run a little slower than the      */
   /* master job that called us.                                      */
   /*-----------------------------------------------------------------*/
   chgI.jci.Number_Fields_Enterd = 1;
   chgI.x.Length_Field_Info_ = sizeof(Qus_JOBC0100_t) + sizeof(int);
   chgI.x.Key_Field          = 1802;
   chgI.x.Type_Of_Data       = 'B';
   _CPYBYTES(chgI.x.Reserved, "   ", 3);
   chgI.x.Length_Data        = 4;
   chgI.priority = 50;

   QWTCHGJB("*                          ", "                  ",
            "JOBC0100", &chgI, &errCode);

   if (errCode.bytes_avail > 0)
   {
      sprintf(msgtxt, "Unable to change FILLSTOCK job's priority.");
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
   }

   /*-----------------------------------------------------------------*/
   while (rec_number <= last_record)
   {
      /*-----------------------------------------------------------------*/
      /* Wait until the storage area is available for us to fill.      */
      /*-----------------------------------------------------------------*/
      deq(&DEQ_msg_prefix, Q_msg_text, fill_Q_ptr);

      if ('Q' == Q_msg_text[0])
      {
         add_successful_jobs(dblib, file_id, inst_number);
         sprintf(msgtxt,
```

```
                "Ending Fill job. 'Quit' message received on user queue.");
          Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq_gl,1,NULL);
          return;
       }

       /*-----------------------------------*/
       /* Start filling...                  */
       /*-----------------------------------*/
       fill_stock(rec_number, num_record_per_IO_block, last_record,
                  fill_space_ptr2, StartWH, NumWH);

       sprintf(Q_msg_text, "%02d", block);          /* Convert to char. */
       enq(write_Q_ptr, &ENQ_msg_prefix, Q_msg_text);

       if (block == number_blocks_per_job)
       {
          block = 1;
          fill_space_ptr2 = fill_space_ptr;   /* Reset to beginning of space.*/
       } else {
          ++block;
          fill_space_ptr2 = fill_space_ptr2 + IO_BLOCK_SIZE;

       }
       rec_number += record_skip_size;

    } /* End: while < last record. */

    add_successful_jobs(dblib, file_id, inst_number);

    sprintf(msgtxt,
            "FILLSTOCK: job number %d successfully filled user space %.10s.",
            job_number, fill_space);
    Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, msgq_gl, 1, NULL);
    QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, COMP_MSG, CS_CTLBDY, 1);
    return;

    #pragma disable_handler

    /*-------------------------------------------------------------------*/
    /* Any exceptions causes us to branch here.                          */
    /*-------------------------------------------------------------------*/
    ERR:
        error_cleanup();
        return(-1);

} /* end of main */
```

C.33 FILLWH.C:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* Name: FILLWH                                                      */
/*                                                                   */
/* Purpose: fill the warehouse file.                                 */
/*                                                                   */
/*-------------------------------------------------------------------*/

  #include <stdlib.h>
  #include <string.h>
  #include <decimal.h>             /* Used by the wrhs include. */
  #include <milib.h>
  #include <micomput.h>
  #include <recio.h>
  #include <time.h>
  #include <mih/cpyblap.h>
  #include <os4msg.h>
  #include <commontpcc.h>
  #include <filldata.h>

  /*-----------------------------------------------------------------*/
  /* Defines                                                         */
  /*-----------------------------------------------------------------*/
  #define DBLIB_PARM    1
  #define WHFILE_PARM   2
  #define STRWH_PARM    3
  #define NUMWH_PARM    4

  /* MAPINC generates structures for the database files          */
  #pragma mapinc("wrhs","*LIBL/wrhs(*all)","both", "d _P",,"tpcc")
  #include "wrhs"


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Name: main                                                        */
/*                                                                   */
/*-------------------------------------------------------------------*/
 int main(int argc, char **argv)
 {
   short int strWH, endWH, curWH;
   int  iX;

   char dblib[11];
   char whfile[11];
   char msgtxt[50];
   char msgq_gl[20];
   char tempstr[40];

   char curwhs[5];
   char waddr1[21];
   char waddr2[21];

   time_t ltime;
   _RFILE *WH_File;

   tpcc_WRRCD_both_t WRec;


   /* Set up random number generator */
   time(&ltime);
   srand(ltime);          /* seed the random num generator */

   dblib[10] = '\0';
   _CPYBYTES(dblib, argv[DBLIB_PARM], 10);
   dblib[triml(dblib, ' ')] = '\0';

   whfile[10] = '\0';
   _CPYBYTES(whfile, argv[WHFILE_PARM], 10);
   whfile[triml(whfile, ' ')] = '\0';

   strWH = atoi(argv[STRWH_PARM]);
   endWH = (atoi(argv[NUMWH_PARM])) + strWH;


   /* TPCC message queue to send our build messages to.  */
   _CPYBYTES(msgq_gl, "TPCCMSG   ", 10);
   _CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);


   if (NULL == (WH_File = _Ropen(whfile, "rr+")))
   {
      sprintf(msgtxt, "Open of file, %s, failed!", whfile);
      Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   for (curWH = strWH; curWH < endWH; ++curWH)
   {
      WRec.WID = curWH;
      sprintf(curwhs, "%04d", curWH);

      /* build wname */
      CreateStr(1, 5, tempstr);
      strcat(tempstr, curwhs);
      strcat(tempstr, "W");
      cpyblap(WRec.WNAME, 10, tempstr, strlen(tempstr), ' ');

      /* build address1 */
      CreateStr(1, 10, waddr1);
      sprintf(tempstr, "1%s Ave.%s", curwhs, waddr1);
      cpyblap(WRec.WADDR1, 20, tempstr, strlen(tempstr), ' ');

      /* build address2 */
      strcpy(tempstr, "Bldg 1");
      strcat(tempstr, curwhs);
      CreateStr(1, 10, waddr2);
      strcat(tempstr, waddr2);
      cpyblap(WRec.WADDR2, 20, tempstr, strlen(tempstr), ' ');

      /* build city */
      iX = RANDOM(0,99);
      strncpy(WRec.WCITY,  CITY_ARR[iX], CITY_LENGTH);
      strncpy(WRec.WSTATE, state_arr[iX], STATE_LENGTH);

      CREATE_ZIP(WRec.WZIP);

      WRec.WTAX = (RANDOM(0,2000)) / 10000.0;
      WRec.WYTD = 300000.00;

      _Rwrite(WH_File,(void *)&WRec, sizeof(WRec));
   }

   _Rclose(WH_File);
   return(0);

 } /* end of main() */
```

C.34 FILSTKFILE.CL:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* NAME: FILSTKFILE                                                  */
/*                                                                   */
/* PURPOSE: fill the following Database files:                       */
/*          - STOCKPF or for split DB: STOCKPF)1 to STOCKPF32        */
/*-------------------------------------------------------------------*/
PGM PARM(&DBLIB &DBFILE &STRWH &NUMWHS &RECOMPILE)

         DCL &DBLIB      TYPE(*CHAR) LEN(10)
         DCL &DBFILE     TYPE(*CHAR) LEN(10)
         DCL &STRWH      TYPE(*DEC)  LEN(6 0)
         DCL &NUMWHS     TYPE(*DEC)  LEN(6 0)
         DCL &RECOMPILE  TYPE(*CHAR) LEN(1)

         DCL &NUM1       TYPE(*DEC)  LEN(6 0)
         DCL &NUM2       TYPE(*DEC)  LEN(6 0)

         DCL &STRWHC     TYPE(*CHAR) LEN(6)
         DCL &NUMWHSC    TYPE(*CHAR) LEN(6)
         DCL &STRWHNULL  TYPE(*CHAR) LEN(7)
         DCL &NUMWHSNULL TYPE(*CHAR) LEN(7)
         DCL &NULLCH     TYPE(*CHAR) LEN(1)  VALUE(X'00')

         DCL &PGMLIB     TYPE(*CHAR) LEN(10)
         DCL &MSGQ       TYPE(*CHAR) LEN(10) VALUE(TPCCMSG)
         DCL &STOCKSRC   TYPE(*CHAR) LEN(10) VALUE(STOCKPF)

         DCL &MDATA      TYPE(*CHAR) LEN(42) +
                         VALUE('CRTSTOCK: filling the            db file...')

         /*-----------------------------------------------------------*/
         MONMSG MSGID(CPF0000 MCH0000) EXEC(GOTO ERREXIT)


         RTVOBJD OBJ(FILSTKFILE) OBJTYPE(*PGM) RTNLIB(&PGMLIB)
           MONMSG CPF9811 EXEC(DO)
             SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*DIAG) +
                       MSGDTA('Add the library with CRTSTOCK pgm to lib list!')
             GOTO ERREXIT
          ENDDO

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) TOPGMQ(*EXT) +
                   MSGDTA('CRTSTOCK program starting...') MSGTYPE(*STATUS)

         CRTMSGQ MSGQ(&DBLIB/&MSGQ)
           MONMSG CPF2112 EXEC(RCVMSG RMV(*YES))

         CALL TPCCTOOLS/SETTOOLIBL

         ADDLIBLE &DBLIB
           MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))

         /*-----------------------------------------------------------*/
         IF (&RECOMPILE *EQ 'Y') THEN(DO)

            OVRDBF &STOCKSRC TOFILE(&DBLIB/&DBFILE) OVRSCOPE(*JOB)
              MONMSG CPF2103 EXEC(RCVMSG RMV(*YES))

            CRTCMOD &PGMLIB/FILLSTOCK

            CRTPGM  &PGMLIB/FILLSTOCK +
                    MODULE(&PGMLIB/FILLSTOCK &PGMLIB/COMMONTPCC +
                           &PGMLIB/TPCCSPACE) +
                    ENTMOD(&PGMLIB/FILLSTOCK) BNDSRVPGM(TPCCTOOLS/TPCCTOOLS)

            DLTOVR FILE(&STOCKSRC) LVL(*JOB)
         ENDDO

         CHGVAR VAR(%SST(&MDATA 23 9)) VALUE(&DBFILE)
         SNDPGMMSG MSGID(CPF9897) MSGDTA(&MDATA) +
                   MSGF(QSYS/QCPFMSG) TOPGMQ(*EXT) MSGTYPE(*STATUS)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA(&MDATA) TOMSGQ(&DBLIB/&MSGQ)

         CHGVAR &NUMWHSC    VALUE(&NUMWHS)
         CHGVAR &NUMWHSNULL VALUE(&NUMWHSC *CAT &NULLCH)
         CHGVAR &STRWHC     VALUE(&STRWH)
         CHGVAR &STRWHNULL  VALUE(&STRWHC *CAT &NULLCH)

      /*  WRKSYSSTS OUTPUT(*PRINT) RESET(*YES)  */

         CALL &PGMLIB/MASTCUSSTK PARM(&DBLIB &STRWHNULL &NUMWHSNULL &DBFILE)

      /*  WRKSYSSTS OUTPUT(*PRINT) RESET(*NO)   */

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('CRTSTOCK program completed successfully!')
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*COMP) +
                   MSGDTA('CRTSTOCK program completed successfully!')  +
                   TOMSGQ(&DBLIB/&MSGQ)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRTSTOCK failed!') MSGTYPE(*ESCAPE)
         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
                   MSGDTA('CRTSTOCK failed!') TOMSGQ(&DBLIB/&MSGQ)
ENDPGM: ENDPGM
```

C.35 MASTCUSSTK.C:

```
/*-------------------------------------------------------------------*/
/*                                                                   */
/* File name: MASTCUSSTK                                             */
/*                                                                   */
/* Purpose: This program spawns jobs to fill the following files:    */
/*            - customer                                             */
/*            - stock                                                */
/*                                                                   */
```

```
/* PARMS: database library name                                        */
/*        starting warehouse number                                    */
/*        number of warehouses                                         */
/*        number of jobs we can start                                  */
/*        name of file to fill                                         */
/*                                                                     */
/*---------------------------------------------------------------------*/
  /*-------------------------------------------------------------------*/
  /* Includes.                                                         */
  /*-------------------------------------------------------------------*/
  #include <stdlib.h>                /* Malloc declares.  */
  #include <errno.h>
  #include <string.h>
  #include <recio.h>
  #include <xxfdbk.h>
  #include <unistd.h>
  #include <milib.h>
  #include <decimal.h>
  #include <qcmdexc.h>
  #include <sys/stat.h>
  #include <qusrcrtus.h>
  #include <qusdltus.h>
  #include <qusptrus.h>
  #include <qusrcrtuq.h>
  #include <qusdltuq.h>
  #include <qusrjobi.h>
  #include <qwtchgjb.h>
  #include <mih/cpybytes.h>
  #include <mih/cpyblap.h>
  #include <mih/trimi.h>
  #include <qsysinc/mih/rslvsp>
  #include <qsysinc/mih/deq>
  #include <qsysinc/mih/enq>
  #include <spawn.h>
  #include <qp0wpid.h>
  #include <commontpcc.h>
  #include <tpccspace.h>
  #include <filldata.h>
  #include <os4msg.h>
  #include <os4wait.h>


  /*-------------------------------------------------------------------*/
  /* MAPINC generates structures for the database file.                */
  /*-------------------------------------------------------------------*/
  #pragma mapinc("cstmrpf","*libl/cstmrpf(*all)","both",  "d _P",,"tpcc")
  #include "cstmrpf"
  #pragma mapinc("stockpf","*LIBL/stockpf(*all)","both",  "d _P",,"tpcc")
  #include "stockpf"

  /*-------------------------------------------------------------------*/
  /* Defines                                                           */
  /*-------------------------------------------------------------------*/
  #define DBLIB_PARM          1
  #define START_WH_PARM       2
  #define PARM_NUM_WHS        3
  #define PARM_FILE_NAME      4

  #define CUSTOMER_SPAWN_PGM        "FILLCUS"
  #define CUSTOMER_NAME_PART_STRING "FILLCUS"
  #define STOCK_SPAWN_PGM           "FILLSTOCK"
  #define STOCK_NAME_PART_STRING    "FILLSTK"

  #define SET_FILL_QUEUE_NAME(q_name, job_num) \
  { \
     sprintf(name_temp, "FIL%s%01d%03d", name_tag, inst_number, job_num); \
     _CPYBYTES(q_name, name_temp, 10); \
 }

  #define SET_WRITE_QUEUE_NAME(q_name, job_num) \
  { \
     sprintf(name_temp, "WRI%s%01d%03d", name_tag, inst_number, job_num); \
     _CPYBYTES(q_name, name_temp, 10); \
 }

  #define SET_SPACE_NAME(spc_name, job_num) \
  { \
     sprintf(name_temp, "%03d", job_num);   \
     _CPYBYTES((spc_name)+7, name_temp, 3); \
 }

typedef _Packed struct key_struct {
                  char name[10];
                  long value;
           } key_values_structure[5];

  /*-------------------------------------------------------------------*/
  /* Global declares                                                   */
  /*-------------------------------------------------------------------*/
  int    number_jobs = MAX_JOBS;
  int    inst_number;           /* instance number for the jobs
                                   when the database is split.       */
  char   ovr_flag = 'N';
  char   pgmlib_gl[11];
  char   pgmname_gl[11];
  char   dblib[11];
  char   queue_name[20];
  char   name_tag[4];           /* Part of queue or space name.      */
  char   fill_space_name[20];
  char   name_temp[11];
  char   msgtxt[130];
  char   msgq_gl[20];

  char    *IO_space[MAX_JOBS];
  char    insert = '5';/* value used for an insert using qdbrunha */
  char    hash_name[10];
  long    key_count;/* the key count used for call to qdbrunha         */
  long    ret_data;/* return data from call to qdbrunha                 */
  tpcc_CSRCD_both_t  * cstmr_data_ptr;
  /* pointer to the customer file data, used for referance by qdbrunha */
  tpcc_STRCD_both_t * stock_data_ptr;/*pointer to the stock file data*/

  key_values_structure key_values;/* keys for the hash function */

  _SYSPTR  fill_Q_ptr[MAX_JOBS];
  _SYSPTR  write_Q_ptr[MAX_JOBS];

  char  Q_msg_text[MSG_LENGTH];
  _ENQ_Msg_Prefix_T ENQ_msg_prefix;

  _RFILE  *DB_File = NULL;

   struct {
           Qus_Job_Change_Information_t jci;
           Qus_JOBC0100_t x;
           int  priority;
   } chgI;

  Qwc_JOBI0100_t jobI;

  error_structure errCode;

void qdbrunha(char * hash_name,char function,long key_count,
              key_values_structure key_values,char * returned_data,
              long * ret_data);

/*---------------------------------------------------------------------*/
/*                                                                     */
/* Function: dlt_usrQ                                                  */
/*                                                                     */
/*---------------------------------------------------------------------*/
void dlt_usrQ(void)
{
   int  i, objname_number;

   errCode.bytes_prov = 16;

   for (i = 0; i < number_jobs; ++i)
   {
      objname_number = i + 1;

      if (NULL != fill_Q_ptr[i])
      {
         SET_FILL_QUEUE_NAME(queue_name, objname_number)
         QUSDLTUQ(queue_name, &errCode);
         if (errCode.bytes_avail > 0)
         {
            sprintf(msgtxt,"Error deleting user queue %10s.  Error id = %.07s",
                    queue_name, errCode.except_id);
            QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
         }
         fill_Q_ptr[i] = NULL;
      }

      if (NULL != write_Q_ptr[i])
      {
         SET_WRITE_QUEUE_NAME(queue_name, objname_number)
         QUSDLTUQ(queue_name, &errCode);
         if (errCode.bytes_avail > 0)
         {
            sprintf(msgtxt,"Error deleting user queue %10s.  Error id = %.07s",
                    queue_name, errCode.except_id);
            QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
         }
         write_Q_ptr[i] = NULL;
      }
   }
   return;
} /* end: dlt_usrQ() */


/*---------------------------------------------------------------------*/
/*                                                                     */
/* Function: free_spaces                                               */
/*                                                                     */
/*---------------------------------------------------------------------*/
void free_spaces(void)
{
   int  i;

   errCode.bytes_prov = 16;

   for (i = 0; i < number_jobs; ++i)
   {
      if (NULL != IO_space[i])
      {
         SET_SPACE_NAME(fill_space_name, (i+1))
         QUSDLTUS(fill_space_name, &errCode);
         if (errCode.bytes_avail > 0)
         {
            sprintf(msgtxt,
               "Error deleting temporary fill space '%.20s'.  Error id = %.07s",
                    fill_space_name, errCode.except_id);
            QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
         }
         IO_space[i] = NULL;
      }
   }
   return;
} /* end: free_spaces() */


/*---------------------------------------------------------------------*/
/*                                                                     */
/* Function: send_FINAL_ERROR_MSG                                      */
/*                                                                     */
/* Purpose: send the correct final escape message.                     */
/*                                                                     */
/*---------------------------------------------------------------------*/
void send_FINAL_ERROR_MSG(char *msg_txt)
{
   int  i;

   /* Send the error message in the msgtext variable as a DIAG. */
   QsendMsg(IBM_MSG_FILE, "CPF9897", msg_txt, DIAG_MSG,CS_CUR_PGM,1);

   /* Now cleanup - delete objects.                                  */
   sprintf(Q_msg_text, "Q");  /* Quit. */
   for (i = 0; i < number_jobs; ++i)
   {
      if (NULL != fill_Q_ptr[i])
      {
         sprintf(msgtxt, "%s: (ENQ)  ERROR!  Sending Quit to fill job %d...",
                 pgmname_gl, i);
         Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq_gl,
                     1, NULL);
         enq(fill_Q_ptr[i], &ENQ_msg_prefix, Q_msg_text);
      }
   }

   if (NULL != DB_File)
   {
      _Rclose(DB_File);
   }
   dlt_usrQ();
   free_spaces();

   /* Change our job's priority back to the original value.  */
   if (jobI.Run_Priority > 0)
   {
      chgI.priority = jobI.Run_Priority;
      QWTCHGJB("                          ", "                    ",
               "JOBC0100", &chgI, &errCode);

      if (errCode.bytes_avail > 0)
      {
         sprintf(msgtxt,
                 "Unable to change our job's priority back to original value.");
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      }
   }

   sprintf(msgtxt, "%s program failed!", pgmname_gl);
   QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
   return;

} /* send_FINAL_ERROR_MSG() */


/*---------------------------------------------------------------------*/
/*                                                                     */
/* Function: spawn_CS_fill_job                                         */
/*                                                                     */
/* Purpose: spawn the customer and stock jobs                          */
/*                                                                     */
/*---------------------------------------------------------------------*/
int spawn_CS_fill_job(char *dblib, int file_id, char *strWH, char *numWH,
                      int job_number, char *work_path)
{
   int           rc, times, objname_number;
   int           fd_count = 0;
   pid_t         pid;
   inheritance_t inherit;
   char         *env_arg[1];
   char         *wp_arg[11];

   char          ch_job_num[8];
   char          ch_max_jobs[8];
   char          ch_file_id[4];
   char          ch_inst_num[3];
   char          write_queue[10];  /* No need to send the dblib with q name. */

   /*-------------------------------------------------------------------*/
   /* See if there is an available job for us to use.                   */
   /*-------------------------------------------------------------------*/
   times = 0;
   while ((0 == get_available_jobs(dblib)) && (-1 != rc))
   {
```

```
      /*-----------------------------------------------------------*/
      /* Wait and try again...                                     */
      /*-----------------------------------------------------------*/
      tpcc_Wait(5, 0, NULL, NULL);     /* Wait 5 seconds.      */

      ++times;
      if (2880 == times)  /* wait for 4 hours for an available job.  */
      {
         sprintf(msgtxt,
                 "No available %s jobs. Tired of waiting for one. Quitting!",
                 get_DB_filename(file_id));
         send_FINAL_ERROR_MSG(msgtxt);
      }
   }

   /*-----------------------------------------------------------------*/
   sprintf(ch_job_num, "%03d", job_number);   /* convert to char. */
   sprintf(ch_max_jobs,"%03d", number_jobs);  /* convert to char. */
   sprintf(ch_file_id, "%03d", file_id);      /* convert to char. */
   sprintf(ch_inst_num,"%03d", inst_number);  /* convert to char. */

   /* We want names to start with 1 and not 0 for ascetic reasons.  */
   objname_number = job_number + 1;
   SET_SPACE_NAME(fill_space_name,   objname_number)
   SET_FILL_QUEUE_NAME(queue_name,   objname_number)
   SET_WRITE_QUEUE_NAME(write_queue, objname_number)

   /*-----------------------------------------------------------------*/
   /* Set parms for the spawn.                                        */
   /*-----------------------------------------------------------------*/
   wp_arg[0]  = "dummy";
   wp_arg[1]  = dblib;
   wp_arg[2]  = queue_name;
   wp_arg[3]  = write_queue;
   wp_arg[4]  = fill_space_name;
   wp_arg[5]  = ch_file_id;
   wp_arg[6]  = ch_inst_num;
   wp_arg[7]  = strWH;
   wp_arg[8]  = numWH;
   wp_arg[9]  = ch_job_num;
   wp_arg[10] = ch_max_jobs;
   wp_arg[11] = NULL;        /* terminate the array. */

   env_arg[0] = NULL;
   inherit.flags = 0;
   inherit.pgroup = SPAWN_NEWPGROUP;

   times = 0;
   while ((0 != add_started_jobs(dblib, file_id, inst_number)) && (-1 != rc))
   {
      /*-----------------------------------------------------------*/
      /* wait and try again...                                     */
      /*-----------------------------------------------------------*/
      tpcc_Wait(3, 0, NULL, NULL);     /* Wait 3 seconds.      */

      ++times;
      if (100 == times)       /* Total of 5 minutes wait time.  */
      {
         sprintf(msgtxt,"I can't add to the number of %s jobs I am starting!",
                 get_DB_filename(file_id));
         send_FINAL_ERROR_MSG(msgtxt);
      }
   }

   /*-----------------------------------------------------------------*/
   pid = spawn(work_path, fd_count, NULL, &inherit,
               (char **)(&wp_arg), (char **)(&env_arg));

   if (pid < 0)
   {
      rc = 0;
      times = 0;
      while ((0 != add_error_jobs(dblib, file_id, inst_number)) && (-1 != rc))
      {
         /*-----------------------------------------------------------*/
         /* Wait and try again...                                     */
         /*-----------------------------------------------------------*/
         tpcc_Wait(3, 0, NULL, NULL);       /* Wait 3 seconds.      */

         ++times;
         if (100 == times)          /* Total of 5 minutes wait time.  */
         {
            sprintf(msgtxt, "I can't set 'error' jobs value for %s files!",
                    get_DB_filename(file_id));
            QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG,CS_CUR_PGM,1);
         }
      }
      sprintf(msgtxt, "Link '%s' not spawned. Process id = %d",  work_path, pid);
      send_FINAL_ERROR_MSG(msgtxt);
   }
   return(0);

} /* End of: spawn_CS_fill_job()  */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: write_IO                                                */
/*                                                                   */
/*-------------------------------------------------------------------*/
int write_IO(size_t record_size, unsigned long last_record,
             unsigned long number_records_per_IO_block,
             int num_blocks_per_job)
{
   short         block, job;
   int           block_size;
   unsigned long rec;                   /* Record loop index.          */
   unsigned long current_record = 1;
   char         *out_rec;

  _DEQ_Msg_Prefix_T DEQ_msg_prefix;

   /*-----------------------------------------------------------------*/
   DEQ_msg_prefix.Wait_Forever = 1;      /* Wait forever.             */

   while (current_record <= last_record)
   {
      for (block = 0;
           (block < num_blocks_per_job) && (current_record <= last_record);
           ++block)
      {
         block_size = IO_BLOCK_SIZE * block;
         for (job = 0;
              (job < number_jobs) && (current_record <= last_record);
               ++job)
         {
              deq(&DEQ_msg_prefix, Q_msg_text, write_Q_ptr[job]);

              if ('Q' == Q_msg_text[0])
              {
                 sprintf(msgtxt,
                    "Ending Master job. 'Quit' message received on user queue.");
                 send_FINAL_ERROR_MSG(msgtxt);
              }
 /*-----------------------------------------------------------------------*/
 /*           sprintf(msgtxt,                                             */
 /*                "%s: writing - file '   ', job %d, block %d, record  %d...",*/
 /*                     pgmname_gl, job, block+1, current_record);        */
 /*           Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq_gl, */
 /*                       1, NULL);                                       */
 /*-----------------------------------------------------------------------*/
              for (rec = 0;
                   (rec < number_records_per_IO_block)  &&
                   (current_record <= last_record);
                   ++rec)
              {
                  /* Get the record position in fill array.  */
                  /* User the qdbrunha to do the writting   */
                  out_rec = IO_space[job] + block_size + (rec * record_size);
                  if ( hash_name[0] == 'C' )
                  {
                     cstmr_data_ptr = ( tpcc_CSRCD_both_t *)out_rec;
                     key_values[0].value = cstmr_data_ptr->CID;
                     /* get cid */
                     key_values[1].value = cstmr_data_ptr->CDID;
                     /* get cdid */
                     key_values[2].value = cstmr_data_ptr->CWID;
                     /* get cwid */
                  }
                  else
                  {
                     /* the file is a stock file process as a stock record  */
                     stock_data_ptr=(tpcc_STRCD_both_t *) out_rec;
                     key_values[0].value = stock_data_ptr->STIID;
                     /* get the item id */
                     key_values[1].value = stock_data_ptr->STWID;
                     /* get the stock warehouse id  */
                  }
                  qdbrunha ( hash_name, insert, key_count, key_values,
                             (char*) out_rec, &ret_data );
         /*       _Rwrite(DB_File, (void *)out_rec, record_size); */
                  ++current_record;
              }
              /*-----------------------------------------------------------*/
              /* Let Fill job know it can fill the next block of data.     */
              /*-----------------------------------------------------------*/
              if (current_record <= last_record)
                 sprintf(Q_msg_text, "%02d", block); /* Convert to char. */
              else
                 sprintf(Q_msg_text, "Q");     /* Quit. */

              enq(fill_Q_ptr[job], &ENQ_msg_prefix, Q_msg_text);

         } /* End: job loop. */
      } /* End: block loop. */
   } /* End: while loop. */
   return(0);

} /* End of: write_IO() */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: un_link                                                 */
/*                                                                   */
/*-------------------------------------------------------------------*/
void un_link(char *name_part)
{
   int   jj;
   char  work_path[22];
   char *WorkPathEnd;        /* pointer to end of the working path.  */

   sprintf(work_path, "/%s/%s", pgmlib_gl, name_part);
   WorkPathEnd = &work_path[strlen(work_path)];

   for (jj = 0; jj < number_jobs; ++jj)
   {
      sprintf(WorkPathEnd, "%03d", (jj+1));
      if (-1 == unlink(work_path))
      {
     sprintf(msgtxt, "FYI: could NOT unlink the symbolic link  %s\n", work_path);
        QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      }
   }
   return;

} /* End of: un_link() */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: build_link                                              */
/*                                                                   */
/*-------------------------------------------------------------------*/
int build_link(char *hard_path, char *work_path)
{
   struct stat checker;

   if (lstat(work_path, &checker) == 0)  /* If the link exists     */
   {
      /* Unlink the symblic link.                                   */
      /* (it may be to another program so it should be removed.     */
      if (-1 == unlink(work_path))
      {
         sprintf(msgtxt, "Could NOT unlink the symbolic link %s\n", work_path);
         send_FINAL_ERROR_MSG(msgtxt);
      }
   } /* End: link exists. */

   if (0 != symlink(hard_path, work_path))
   {
      /* symlink not created. */
      sprintf(msgtxt, "Could NOT create a symbolic link '%s' to '%s'",
              work_path, hard_path);
      send_FINAL_ERROR_MSG(msgtxt);
   }
   return(0);

} /* End of: build_link() */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: crt_queues                                              */
/*                                                                   */
/*-------------------------------------------------------------------*/
void crt_queues(void)
{
   /*-----------------------------------------------------------------*/
   /*  User queue values.                                             */
   /*-----------------------------------------------------------------*/
   int   job, objname_number;
   int   initial_msgs;                /* Number of user queue msgs.  */
   int   addl_msgs;                   /* additional number of msgs.  */

   char  just_name[11];

   char  authority[10] = "*ALL      ";
   char  replace[10]   = "*YES      ";
   char  description[50] = "TPCC user queue for job            ";

   char type[] = "F";                 /* First in first out.         */

   /*-----------------------------------------------------------------*/
   errCode.bytes_prov = 16;
   initial_msgs = (number_jobs * NUM_IO_BLOCKS); /* All we should need. */
   addl_msgs    = (MAX_JOBS * NUM_IO_BLOCKS) - initial_msgs;

   cpyblap(queue_name+10, 10, dblib, strlen(dblib), ' ');

   /*-----------------------------------------------------------------*/
   /* Create the message queues for the files.                        */
   /* Msg queue names will be FILCUS0001 and FILSTK0001 and so on.    */
   /* Msg queue names will be WRICUS0001 and WRISTK0001 and so on.    */
   /*-----------------------------------------------------------------*/
   for (job = 0; job < number_jobs; ++job)
   {
      objname_number = job + 1;   /* So names start with 1 and not 0.  */
      SET_FILL_QUEUE_NAME(queue_name, objname_number)

      QUSCRTUQ(queue_name, "TPCCMSG   ", type, 0, MSG_LENGTH, initial_msgs,
               addl_msgs, authority, description, replace, &errCode);
      if (errCode.bytes_avail > 0)
      {
         if (0 != memcmp(errCode.except_id, "CPF9870", 7))
         {
          sprintf(msgtxt,"Error creating fill queue '%.20s'.  Error id = %.07s",
                  queue_name, errCode.except_id);
```

```
            send_FINAL_ERROR_MSG(msgtxt);
         }
      }
      /*-----------------------------------------------------------------*/
      /* Get pointer to the user queue.                                  */
      /*-----------------------------------------------------------------*/
      _CPYBYTES(just_name, queue_name, 10);
      just_name[10] = '\0';
      if (NULL == (fill_Q_ptr[job] = rslvsp(_Usrq, just_name, dblib,_AUTH_ALL)))
      {
         sprintf(msgtxt, "Cound not resolve to user queue: %s.",  queue_name);
         send_FINAL_ERROR_MSG(msgtxt);
      }

      /*-----------------------------------------------------------------*/
      SET_WRITE_QUEUE_NAME(queue_name, objname_number)

      QUSCRTUQ(queue_name, "TPCCMSG   ", type, 0, MSG_LENGTH, initial_msgs,
               addl_msgs, authority, description, replace, &errCode);
      if (errCode.bytes_avail > 0)
      {
         if (0 != memcmp(errCode.except_id, "CPF9870", 7))
         {
         sprintf(msgtxt,"Error creating write queue '%.20s'.  Error id = %.07s",
                  queue_name, errCode.except_id);
            send_FINAL_ERROR_MSG(msgtxt);
         }
      }
      /*-----------------------------------------------------------------*/
      /* Get pointer to the user queue.                                  */
      /*-----------------------------------------------------------------*/
      _CPYBYTES(just_name, queue_name, 10);
      just_name[10] = '\0';
      if (NULL == (write_Q_ptr[job] = rslvsp(_Usrq, just_name,dblib,_AUTH_ALL)))
      {
         sprintf(msgtxt, "Cound not resolve to user queue: %s.",  queue_name);
         send_FINAL_ERROR_MSG(msgtxt);
      }
   }
   return;

} /* End of: crt_queues() */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: crt_spaces                                              */
/*                                                                   */
/*-------------------------------------------------------------------*/
void crt_spaces(void)
{
   int  job;
   char init_char;
   char replace[10] = "*YES      ";
   char public_auth[10] = "*ALL      ";
   char text_descript[50];

   cpyblap(text_descript, 50, "Space to temporarily hold fill data.",
                   strlen("Space to temporarily hold fill data."), ' ');
   errCode.bytes_prov = 16;
   init_char = 0;

   sprintf(fill_space_name, "FIL%s%01d", name_tag, inst_number);
   cpyblap(fill_space_name+10, 10, dblib, strlen(dblib), ' ');

   for (job = 0; job < number_jobs; ++job)
   {
       /*-----------------------------------------------------------------*/
       /* Space names will be FILCUS0001 and FILSTK0001, etc.             */
       /*-----------------------------------------------------------------*/
       SET_SPACE_NAME(fill_space_name,  (job+1))

       QUSCRTUS(fill_space_name, "PF        ", (IO_BLOCK_SIZE * NUM_IO_BLOCKS),
                &init_char, public_auth, text_descript, replace, &errCode);
       if (errCode.bytes_avail > 0)
       {
          sprintf(msgtxt, "Error creating data space '%.20s'.  Error id = %.07s",
                   fill_space_name, errCode.except_id);
          send_FINAL_ERROR_MSG(msgtxt);
       }

       QUSPTRUS(fill_space_name, &IO_space[job], &errCode); /* Get the ptr */
       if (errCode.bytes_avail > 0)
       {
          sprintf(msgtxt,
                  "Error getting data space '%.20s' pointer.  Error id = %.07s",
                   fill_space_name, errCode.except_id);
          send_FINAL_ERROR_MSG(msgtxt);
       }
   }
   return;

} /* End of: crt_spaces() */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: main                                                    */
/*                                                                   */
/*-------------------------------------------------------------------*/
int main(int argc, char **argv)
{
   int   rc;
   unsigned int lib_len;
   short     i;                    /* Loop control.                    */
   int       job;
   int       error_count;
   int       length;               /* string length of work_path.      */
   int       file_id;
   int       times;
   int       number_blocks_per_job;
   unsigned long number_records_per_IO_block;

   char *slash_pos;

   char *WorkPathEnd;      /* pointer to the end of the working path.    */
   char  work_path[22];    /* path name for the link used as job name.  */
   char  name_part[8];     /* job name string      */
   char  file_name[11];
   char  hard_path[41];
   char  pgm_to_spawn[11];
   char  cmd[100];

   size_t record_size;
   unsigned long last_record;

   ExcData_t volatile exD = {0 ,"*HANDLE   "};

   /*-----------------------------------------------------------------*/
   /* Start of code.                                                  */
   /*-----------------------------------------------------------------*/
   jobI.Run_Priority = 0;   /* Initialize in case we have an error.  */

   /*-----------------------------------------------------------------*/
   /* Get the library name that we are running in.                    */
   /*-----------------------------------------------------------------*/
   slash_pos = strchr(argv[0], '/');
   lib_len   = slash_pos - argv[0];
   _CPYBYTES(pgmlib_gl, argv[0], lib_len);
   pgmlib_gl[lib_len] = '\0';

   ++slash_pos;    /* Skip the '/' that follows the pgmlib field. */
   _CPYBYTES(pgmname_gl, slash_pos, 10);
   pgmname_gl[triml(pgmname_gl, ' ')] = '\0';

   /* TPCC message queue to send our build messages to.  */
   _CPYBYTES(msgq_gl, BLD_MSGQ_NAME_10, 10);
   _CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);

   /*-----------------------------------------------------------------*/
   if (1 == atoi(argv[START_WH_PARM]))
     inst_number = 0;        /* normal or low split. */
   else
     inst_number = 1;        /* high split           */

   /*-----------------------------------------------------------------*/
   /* Initialize in case we have an error.  That way we won't try to  */
   /* destroy non-existant spaces and user queues.                    */
   /*-----------------------------------------------------------------*/
   for (job = 0; job < number_jobs; ++job)
   {
       IO_space[job] = NULL;
       fill_Q_ptr[job] = NULL;
       write_Q_ptr[job] = NULL;
   }

   /*-----------------------------------------------------------------*/
   /* Get the file name and related parameters.                       */
   /*-----------------------------------------------------------------*/
   dblib[10] = '\0';
   _CPYBYTES(dblib, argv[DBLIB_PARM], 10);
   dblib[triml(dblib, ' ')] = '\0';

   file_name[10] = '\0';
   _CPYBYTES(file_name, argv[PARM_FILE_NAME], 10);
   file_name[triml(file_name, ' ')] = '\0';

   switch(file_name[0])
   {
      case 'C':
               file_id = CUSTOMER_JOBS;
               sprintf(name_tag, "CUS");
               sprintf(pgm_to_spawn, CUSTOMER_SPAWN_PGM);
               sprintf(name_part, CUSTOMER_NAME_PART_STRING);
               record_size = CUSTOMER_RECORD_SIZE;
               last_record =
                           MAX_DISTRICTS * CUSTPERDIST * atoi(argv[PARM_NUM_WHS]);
           number_jobs = get_maxjobs_available(dblib,CUSTOMER_JOBS,inst_number);
               /* insert information for hash                              */
               memcpy( hash_name, "CSTMR      ", 10);/* insert the hash name */
               key_count = 3;/* customer has three keys                    */
      break;
      case 'S':
               file_id = STOCK_JOBS;
               sprintf(name_tag, "STK");
               sprintf(pgm_to_spawn, STOCK_SPAWN_PGM);
               sprintf(name_part, STOCK_NAME_PART_STRING);
               record_size = STOCK_RECORD_SIZE;
               last_record = MAXITEMS * atoi(argv[PARM_NUM_WHS]);
            number_jobs = get_maxjobs_available(dblib,  STOCK_JOBS, inst_number);
               /* Insert information for hash                              */
               memcpy( hash_name, "STOCK      ", 10);/* insert the hash name */
               key_count = 2;/* stock has two keys                         */
      break;
      default:
               sprintf(msgtxt, "Unknown file name: '%s'", file_name);
               send_FINAL_ERROR_MSG(msgtxt);
      break;
   } /* end of switch */

   /*-----------------------------------------------------------------*/
   /* Error getting job number from space?                            */
   /*-----------------------------------------------------------------*/
   if (-1 == number_jobs)
   {
      sprintf(msgtxt, "ERROR retreiving the 'max jobs available' value for %s.",
              get_DB_filename(file_id));
      send_FINAL_ERROR_MSG(msgtxt);
   }

   /*-----------------------------------------------------------------*/
   /* Save job info so Master control can see and we can use later.  */
   /*-----------------------------------------------------------------*/
   if (0 != set_plan_to_start(dblib, file_id, inst_number, number_jobs))
   {
      sprintf(msgtxt, "I can't set number of jobs (%d) I plan to spawn!",
                      number_jobs);
      send_FINAL_ERROR_MSG(msgtxt);
   }
   sprintf(msgtxt,"I plan to spawn %d jobs to fill the %s file.",
           number_jobs, get_DB_filename(file_id));
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG, msgq_gl, 1, NULL);

   /*-----------------------------------------------------------------*/
   crt_spaces();
   crt_queues();

   /*-----------------------------------------------------------------*/
   /* One time setup for job spawn.                                   */
   /*-----------------------------------------------------------------*/
   sprintf(hard_path,"/QSYS.LIB/%s.LIB/%s.PGM", pgmlib_gl, pgm_to_spawn);
   sprintf(work_path, "/%s/%s", pgmlib_gl, name_part);
   length = strlen(work_path);
   WorkPathEnd = &work_path[length];

   /*-----------------------------------------------------------------*/
   /* One time setup for job queueing.                                */
   /*-----------------------------------------------------------------*/
   ENQ_msg_prefix.Msg_len = MSG_LENGTH;

   number_records_per_IO_block = IO_BLOCK_SIZE / record_size;


   IO_BLOCKS_PER_JOB(number_blocks_per_job,  number_records_per_IO_block,
                     last_record, number_jobs)

   /*-----------------------------------------------------------------*/
   /*                                                                 */
   /* Start the LOOP to fill jobs...                                  */
   /*                                                                 */
   /*-----------------------------------------------------------------*/
   for (job = 0; job < number_jobs; ++job)
   {
      times = 0;
      while (0 == (rc = get_available_jobs(dblib)))
      {
         sprintf(msgtxt, "%s:  no jobs available.  Waiting...",  pgmname_gl);
         Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, INFO_MSG,msgq_gl,  1,NULL);
         /*-----------------------------------------------------------*/
         /* Wait and try again...                                     */
         /*-----------------------------------------------------------*/
         tpcc_Wait(5, 0, NULL, NULL);     /* Wait 5 seconds.      */

         ++times;
         if (2880 == times)  /* wait for 4 hours for an available job.  */
         {
             sprintf(msgtxt,
                "%s: no available %s jobs. Tired of waiting for one. Quitting!",
                     pgmname_gl, get_DB_filename(file_id));
             send_FINAL_ERROR_MSG(msgtxt);
         }
      }
      if (-1 == rc)
      {
         sprintf(msgtxt,
                 "Error getting an available job for filling the %s file.",
                     get_DB_filename(file_id));
         send_FINAL_ERROR_MSG(msgtxt);
      }

      /*-----------------------------------------------------------*/
      /* Tell spawned job he can starting immediately filling data.   */
      /* The method is to enqueue the data blck number.               */
      /* We don't need a number as all we need are a number of  msgs, */
      /* but having a number may make debugging easier...             */
      /*-----------------------------------------------------------*/
      for (i = 1; i <= number_blocks_per_job; ++i)
      {
```

```
         sprintf(Q_msg_text, "%02d", i);  /* Convert from short to char. */
         enq(fill_Q_ptr[job], &ENQ_msg_prefix, Q_msg_text);
      }

      /*-----------------------------------------------------------------*/
      /* Spawn the jobs to fill the file.                                */
      /* (Add 1 to job number so the numbers range from 1 to n and       */
      /*  0 to n).                                                       */
      /*-----------------------------------------------------------------*/
      sprintf(WorkPathEnd, "%03d", (job+1));
      build_link(hard_path, work_path);

      spawn_CS_fill_job(argv[DBLIB_PARM], file_id, argv[START_WH_PARM],
                        argv[PARM_NUM_WHS], job, work_path);

   } /* End: loop to start fill jobs. */


   /*-----------------------------------------------------------------*/
   /* Now that the jobs have been spawned, change our priority to a   */
   /* value that ensures we will have a higher priority than our      */
   /* spawned jobs.   Note: we wait until now as the spawned jobs are */
   /* spawned with the same priority as this job when they are        */
   /* spawned.                                                        */
   /*-----------------------------------------------------------------*/

   /*-----------------------------------------------------------------*/
   /* Get current job's run priority.                                 */
   /*-----------------------------------------------------------------*/
   QUSRJOBI(&jobI, sizeof(jobI), "JOBI0100",
            "*                          ","                  ",   &errCode);

   if (errCode.bytes_avail > 0)
   {
      sprintf(msgtxt, "Unable to retreive our job's priority.");
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
   } else {
      /*-----------------------------------------------------------------*/
      /* Change our job priority so we run a a higher  priotity (faster). */
      /*-----------------------------------------------------------------*/
      chgI.jci.Number_Fields_Enterd = 1;
      chgI.x.Length_Field_Info_  = sizeof(Qus_JOBC0100_t)  + sizeof(int);
      chgI.x.Key_Field           = 1802;
      chgI.x.Type_Of_Data        = 'B';
      _CPYBYTES(chgI.x.Reserved, "   ", 3);
      chgI.x.Length_Data         = 4;
      chgI.priority = 10;

      QWTCHGJB("*                          ", "                  ",
               "JOBC0100", &chgI, &errCode);

      if (errCode.bytes_avail > 0)
      {
         sprintf(msgtxt, "Unable to change our job's priority.");
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      }
   } /* We were able to retreive our job's priority. */


   /*-----------------------------------------------------------------*/
   /* Setup Override of DB file while we wait for all jobs to start.  */
   /*-----------------------------------------------------------------*/
   sprintf(cmd,
           "OVRDBF FILE(%s) TOFILE(%s/%s) SEQONLY(*YES %lu) OVRSCOPE(*JOB)",
           file_name, dblib, file_name, number_records_per_IO_block);

   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler

   if (0 != exD.error)
   {
      sprintf(msgtxt, "Override of file '%s' failed.", file_name);
      send_FINAL_ERROR_MSG(msgtxt);
   }
   ovr_flag = 'Y';

   /*-----------------------------------------------------------------*/
   /* Now OPEN the DB file.                                           */
   /*-----------------------------------------------------------------*/
   if (NULL == (DB_File = _Ropen(file_name, "ar,arrseq=Y,blkrcd=Y,riofb=N")))
   {
      sprintf(msgtxt, "Open of %s with override %s/%s failed.",
              file_name, dblib, file_name);
      send_FINAL_ERROR_MSG(msgtxt);
   }

   /*-----------------------------------------------------------------*/
   /* Check that no jobs failed.                                      */
   /*-----------------------------------------------------------------*/
   if (0 < get_error_jobs(dblib, file_id, inst_number))
   {
      sprintf(msgtxt, "The number of Fill jobs in error > 0.  Check  joblogs.");
      send_FINAL_ERROR_MSG(msgtxt);
   }

   /*-----------------------------------------------------------------*/
   /* Now that all the jobs have been spawned, start writing data     */
   /* that they have filled in the temporary space, to the permanent  */
   /* data base file.                                                 */
   /*-----------------------------------------------------------------*/
   write_IO(record_size, last_record, number_records_per_IO_block,
            number_blocks_per_job);

   /*-----------------------------------------------------------------*/
   /* Cleanup!                                                        */
   /*-----------------------------------------------------------------*/
   _Rclose(DB_File);
   dlt_usrQ();
   free_spaces();
   un_link(name_part);

   sprintf(cmd, "DLTOVR FILE(%s) LVL(*JOB)", file_name);

   #pragma exception_handler(QexcepHdlr, exD, 0, _C2_MH_ESCAPE)
   QCMDEXC(cmd, strlen(cmd));
   #pragma disable_handler

   if (jobI.Run_Priority > 0)
   {
      chgI.priority = jobI.Run_Priority;

      QWTCHGJB("*                          ", "                  ",
               "JOBC0100", &chgI, &errCode);

      if (errCode.bytes_avail > 0)
      {
         sprintf(msgtxt,
                 "Unable to change our job's priority back to original value.");
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      }
   }

   return;
} /* End: main() */
```

C.36 MASTORD.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* FILE: MASTORD                                                   */
/*                                                                 */
/* PURPOSE: control program to spawns jobs to fill the  neword,    */
/*          orders, and ordlin files.                              */
/*          It fills them all simultaneously.                      */
/*                                                                 */
/*-----------------------------------------------------------------*/
  #include <stdio.h>
  #include <stdlib.h>
  #include <errno.h>
  #include <string.h>
  #include <qusrtvus.h>
  #include <qusptrus.h>
  #include <qusrcrtus.h>
  #include <qusgen.h>
  #include <xxcvt.h>
  #include <time.h>

  /*-----------------------------------------------------------*/
  /* Spawn declares                                            */
  /*-----------------------------------------------------------*/
  #include <spawn.h>
  #include <sys/stat.h>
  #include <qp0wpid.h>
  #include <unistd.h>
  #include <mih/cpybytes.h>
  #include <mih/triml.h>
  #include <QSYSINC/MIH/CMPSWP>
  #include <QSYSINC/MIH/WAITTIME>
  #include <tpccspace.h>
  #include <os4msg.h>
  #include <os4wait.h>

  /*-----------------------------------------------------------*/
  #define DBLIB_PARM        1
  #define PARM_ORDERS_NAME  2
  #define PARM_ORDLIN_NAME  3
  #define PARM_NEWORD_NAME  4
  #define STRWH_PARM        5
  #define NUMWH_PARM        6

  #define SPAWN_PGM        "FILLORD"

  /*-----------------------------------------------------------*/
  /* Globals                                                   */
  /*-----------------------------------------------------------*/
  char pgmlib_gl[11];
  char pgmname_gl[11];
  char msgtxt[133];
  char msgq_gl[20];
  char dblib[11];


/*-----------------------------------------------------------------*/
int start_tasks(int *num_jobs, int jobs_alloc, int str_wh, int total_whs,
                int inst_num, char *dblib,
                char *orders_file, char *ordlin_file, char *neword_file)
{
   int          wh_per_job, have_extra, num_wh;
   int          lp;                          /* for loop counter. */
   unsigned int plen;
   char         job_num[4] = "    ";

   inheritance_t inherit;
   int           fd_count = 0;
   char         *env_arg[1];
   char         *wp_arg[10];
   char          work_path[22];
   char          hard_path[41];
   char          str_string[8];
   char          num_string[8];
   char          number_string[8];
   char          instance_string[3];
   pid_t         pid;
   struct stat   checker;              /* used to unlink path          */

   /*-----------------------------------------------------------*/
   /* Start executable code.                                    */
   /*-----------------------------------------------------------*/
   if (jobs_alloc < total_whs)
   {
      *num_jobs = jobs_alloc;      /* Use all jobs available. */
   } else {
      *num_jobs = total_whs;
   }
   wh_per_job = total_whs / (*num_jobs);
   have_extra = total_whs % (*num_jobs);

   if (0 == have_extra)
   {
      num_wh = wh_per_job;
   } else {
      /* Do an extra warehouse for this job. */
      num_wh = wh_per_job + 1;
   }

   /*-----------------------------------------------------------*/
   /* Save job info so Master control can see and we can use later.  */
   /*-----------------------------------------------------------*/
   if (0 != set_plan_to_start(dblib, ORDER_JOBS, inst_num, *num_jobs))
   {
      sprintf(msgtxt,"I can't set number of jobs (%d) I plan to spawn!", 1);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
      return(-1);
   }

   sprintf(msgtxt,"MASTORD: I plan to spawn %d jobs to fill the %s files.",
           *num_jobs, get_DB_filename(ORDER_JOBS));
   Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);


   sprintf(hard_path,"/QSYS.LIB/%s.LIB/%s.PGM",  pgmlib_gl, SPAWN_PGM);

   sprintf(work_path, "/%s/%s", pgmlib_gl, SPAWN_PGM);
   plen = strlen(work_path);

   /*-----------------------------------------------------------*/
   /* Set parms for the spawn.                                  */
   /*-----------------------------------------------------------*/
   for (lp = 1; lp <= *num_jobs; ++lp)
   {
       /* Set job name number. */
       sprintf(&work_path[plen],"%03d",  lp); /* Add the job number.*/
       sprintf(job_num,"%03d",  lp);

       if (lstat(work_path, &checker) == 0)  /* If the link exists */
       {
           /* Unlink the symblic link.                          */
           /* (it may be to another program so it should be removed.  */
           if (-1 == unlink(work_path))
           {
              char msgid[8];
              /* Send the errno message text message. */
              sprintf(msgid, "CPE%d", errno);
              QsendMsg(IBM_MSG_FILE, msgid, "", DIAG_MSG, CS_CTLBDY, 1);

             sprintf(msgtxt,"Could NOT unlink path: '%s'", work_path);
             QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY,1);
             return (-1);/* abort the operation */
           }
       } /* End: link exists. */

       if (0 != symlink(hard_path, work_path))
       {
          char msgid[8];
          /* Send the errno message text message. */
          sprintf(msgid, "CPE%d", errno);
          QsendMsg(IBM_MSG_FILE, msgid, "", DIAG_MSG, CS_CTLBDY, 1);

          sprintf(msgtxt, "Could NOT create a symbolic link '%s' to '%s'",
                  work_path, hard_path);
          QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY,1);
          return(-1);
       }
```

```
    /*-----------------------------------------------------------------*/
    /* Spawn the job.                                                  */
    /*-----------------------------------------------------------------*/
    wp_arg[0] = "dummy";
    sprintf(str_string,    "%05d", str_wh);
    sprintf(num_string,    "%05d", num_wh);
    sprintf(instance_string, "%d", inst_num);

    wp_arg[1] = str_string;
    wp_arg[2] = num_string;
    wp_arg[3] = instance_string;
    wp_arg[4] = job_num;
    wp_arg[5] = dblib;
    wp_arg[6] = orders_file;
    wp_arg[7] = ordlin_file;
    wp_arg[8] = neword_file;
    wp_arg[9] = NULL;

    env_arg[0] = NULL;
    inherit.flags = 0;
    inherit.pgroup = SPAWN_NEWPGROUP;

    pid = spawn(work_path, fd_count, NULL, &inherit,
                (char **)(&wp_arg), (char **)(&env_arg));
    if (pid < 0)
    {
       sprintf (msgtxt, "Spawn %d failed!\n", lp);
       QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY,1);
       return(-1);
    }

    /*-----------------------------------------------------------------*/
    str_wh = str_wh + num_wh;   /* Next starting warehouse id.*/
    if (lp == have_extra)
    {
       --num_wh;        /* Start doing 1 less warehouse. */
    }
  } /* end: for loop  */

  return(0);

} /* end: start_tasks() */


/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: main                                                    */
/*                                                                   */
/*-------------------------------------------------------------------*/
int main(int argc, char **argv)
{
    int  strWH, numWHs;
    int  number_jobs;
    int  max_allocated;
    int  InstNum;          /* Instance number used in split data base */
    int  time_passed;           /* time out counter for wait loops */

    unsigned int lib_len;
    char  *slash_pos;

    /*****************************************************************/
    /* Wait time variables  (key think time waits)                   */
    /*****************************************************************/
    _MI_Time  time_to_wait;            /* The amount of time to wait */
    int hours  = 0,                    /* Time components used to    */
        minutes    = 0,                /* create an _MI_Time value   */
        seconds    = 1,                /* that can be passed to the  */
        hundredths = 0;                /* 'waittime' function        */
    short wait_option = _WAIT_NORMAL;  /* wait time options          */
                                       /* format an mitime value     */
                                       /* representing the wait time */

    /*-----------------------------------------------------------------*/
    /* Get the library name that we are running in now.                */
    /*-----------------------------------------------------------------*/
    slash_pos = strchr(argv[0], '/');
    lib_len   = slash_pos - argv[0];
    _CPYBYTES(pgmlib_gl, argv[0], lib_len);
    pgmlib_gl[lib_len] = '\0';

    ++slash_pos;   /* Skip the '/'  */
    _CPYBYTES(pgmname_gl, slash_pos, 10);
    pgmname_gl[triml(pgmname_gl, ' ')] = '\0';

    dblib[10] = '\0';
    _CPYBYTES(dblib, argv[DBLIB_PARM], 10);
    dblib[triml(dblib, ' ')] = '\0';

    /* TPCC message queue to send our build messages to. */
    _CPYBYTES(msgq_gl, "TPCCMSG   ", 10);
    _CPYBYTES(&(msgq_gl[10]), argv[DBLIB_PARM], 10);

    strWH  = atoi(argv[STRWH_PARM]);
    numWHs = atoi(argv[NUMWH_PARM]);
    if (1 == strWH)
      InstNum = 0;    /* low split or normal */
    else
      InstNum = 1;    /* high split section */

    /*-----------------------------------------------------------------*/
    /* Get max number of jobs we can use.                              */
    /*-----------------------------------------------------------------*/
    max_allocated = get_maxjobs_available(dblib, ORDER_JOBS, InstNum);

    if (max_allocated < 1)
    {
       sprintf(msgtxt, "We were allocated only %d jobs. This is not enough!",
                max_allocated);
       Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
       QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
       return(-1);
    }

    if (start_tasks(&number_jobs, max_allocated, strWH, numWHs,
                    InstNum, argv[DBLIB_PARM], argv[PARM_ORDERS_NAME],
                    argv[PARM_ORDLIN_NAME], argv[PARM_NEWORD_NAME]) != 0)
    {
       sprintf(msgtxt, "Error was detected while trying to start tasks\n");
       Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, msgq_gl, 1, NULL);
       QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
       return(-1);
    }

    mitime(&time_to_wait, hours, minutes, seconds, hundredths);
    time_passed = 0;
    while ((get_started_jobs(dblib, ORDER_JOBS, InstNum) +
            get_successful_jobs(dblib, ORDER_JOBS, InstNum)) < number_jobs)
    {
        waittime(&time_to_wait, wait_option);
        if (time_passed > 70)
        {
           sprintf(msgtxt, "Error only %d of %d tasks started.\n",
                   get_started_jobs(dblib, ORDER_JOBS, InstNum ) +
                   get_successful_jobs(dblib, ORDER_JOBS, InstNum),
                   number_jobs);
           Qsendmsg_MQ(IBM_MSG_FILE, "CPF9897", msgtxt,DIAG_MSG,msgq_gl,1,NULL);
           QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, ESCAPE_MSG, CS_CTLBDY, 1);
           return(-1);
        }
        ++time_passed;
    }
    time_passed = 0;
    while ((get_started_jobs(dblib, ORDER_JOBS, InstNum)) > 0)
    {
        waittime(&time_to_wait, wait_option);
        ++time_passed;
        if ((time_passed % 5) == 0)
        {
           get_successful_jobs(dblib, ORDER_JOBS, InstNum);
        }
    } /* wait for the files to be built. */

    return(0);
} /* end of main */
```

C.37 CRTSTOCKLF.CL:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* NAME: CRTSTOCKLF                                                */
/*                                                                 */
/* PURPOSE: create the stock logical view.                         */
/*                                                                 */
/*          Note that Split DB file names have source members with */
/*          the number number of partitiions in the last two       */
/*          characters of the name.                                */
/*                                                                 */
/*-----------------------------------------------------------------*/
PGM PARM(&DBLIB &NUMPARTS)

   DCL &FILE       TYPE(*CHAR) LEN(10) VALUE(STOCK)
   DCL &DBLIB      TYPE(*CHAR) LEN(10)
   DCL &NUMPARTS   TYPE(*CHAR) LEN(2)

   DCL &FILESRCLF  TYPE(*CHAR) LEN(10) VALUE(STOCK)

         /*-----------------------------------------------------*/
         MONMSG (CPF7302 CPF0001) EXEC(GOTO ERREXIT)
         IF COND(&NUMPARTS *GT '01') THEN( +
         DO)
           CHGVAR %SST(&FILESRCLF 6 3) VALUE('000')
           CHGVAR %SST(&FILESRCLF 9 2) VALUE(&NUMPARTS)
         ENDDO
         /* Create PARTIAL key view. */
         CHKOBJ OBJ(&DBLIB/&FILE) OBJTYPE(*FILE)
           MONMSG CPF9801 EXEC(CRTLF FILE(&DBLIB/&FILE) SRCMBR(&FILESRCLF) +
                                     WAITRCD(2) LVLCHK(*NO))

         SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRT1VIEW completed successfully!') MSGTYPE(*COMP)
         GOTO ENDPGM

ERREXIT: SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
                   MSGDTA('CRT1VIEW failed!') MSGTYPE(*ESCAPE)
ENDPGM: ENDPGM
```

C.38 STRTPCCJRN.CL:

```
/*****************************************************************/
/*                                                               */
/* Name: STRTPCCJRN                                              */
/*                                                               */
/* FUNCTION: start journaling for the TPCC workload.             */
/*                                                               */
/* INPUT: DBLIB = where files are located.                       */
/*        Creating a Split Database?                             */
/*                                                               */
/* OUTPUT:  JOURNALING STARTED FOR ALL TPCC FILES.               */
/*                                                               */
/*****************************************************************/
PGM PARM(&DBLIB)

     DCL &DBLIB     TYPE(*CHAR) LEN(10)
     DCL &NUMPARTS  TYPE(*DEC)  LEN(2 0)
     DCL &JRNNAME   TYPE(*CHAR) LEN(10)
     DCL &CURRPART  TYPE(*DEC)  LEN(2 0)
     DCL &CURRPARTC TYPE(*CHAR) LEN(2)
     DCL &FILENAME  TYPE(*CHAR) LEN(10)

     MONMSG MSGID(CPF7030 CPF9812)

     SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) MSGTYPE(*INFO) +
               MSGDTA('STRTPCCJRN: starting journaling of DB files...')

            RTVMBRD    FILE(&DBLIB/WRHS) NBRDTAMBRS(&NUMPARTS)
     IF COND(&NUMPARTS *EQ 1) THEN(DO)
       STRJRNPF FILE(&DBLIB/CSTMRPF) +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       STRJRNPF FILE(&DBLIB/DSTRCT)  +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       STRJRNPF FILE(&DBLIB/HSTRY)   +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       STRJRNPF FILE(&DBLIB/ITEM)    +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       STRJRNPF FILE(&DBLIB/NEWORDPF) +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       STRJRNPF FILE(&DBLIB/ORDERSPF) +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       STRJRNPF FILE(&DBLIB/ORDLINPF) +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       STRJRNPF FILE(&DBLIB/STOCKPF) +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       STRJRNPF FILE(&DBLIB/WRHS) +
                JRN(&DBLIB/TPCCJRN) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
     ENDDO
     ELSE DO
       /*-----------------------------------------------------------*/
       /* Split Database                                            */
       /*-----------------------------------------------------------*/
       CHGVAR VAR(&CURRPART) VALUE(1)
STRLOOP: CHGVAR VAR(&CURRPARTC) VALUE(&CURRPART)
       CHGVAR VAR(&JRNNAME)  VALUE(TPCCJRN *TCAT &CURRPARTC)
       CHGVAR VAR(&FILENAME) VALUE(CSTMRPF *TCAT &CURRPARTC)
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       CHGVAR VAR(&FILENAME) VALUE(DSTRCT *TCAT &CURRPARTC)
  /*   STRJRNPF FILE(&DBLIB/DSTRCT1)  +  */
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
  /*   STRJRNPF FILE(&DBLIB/HSTRY1)   +  */
       CHGVAR VAR(&FILENAME) VALUE(HSTRY *TCAT &CURRPARTC)
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
  /*   STRJRNPF FILE(&DBLIB/ITEM1)    +   */
       CHGVAR VAR(&FILENAME) VALUE(ITEM *TCAT &CURRPARTC)
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
  /*   STRJRNPF FILE(&DBLIB/NEWORDPF1) +  */
       CHGVAR VAR(&FILENAME) VALUE(NEWORDPF *TCAT &CURRPARTC)
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
  /*   STRJRNPF FILE(&DBLIB/ORDERSPF1) +  */
       CHGVAR VAR(&FILENAME) VALUE(ORDERSPF *TCAT &CURRPARTC)
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
  /*   STRJRNPF FILE(&DBLIB/ORDLINPF1) +  */
       CHGVAR VAR(&FILENAME) VALUE(ORDLINPF *TCAT &CURRPARTC)
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
  /*   STRJRNPF FILE(&DBLIB/STOCKPF1) +   */
       CHGVAR VAR(&FILENAME) VALUE(STOCKPF *TCAT &CURRPARTC)
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
  /*   STRJRNPF FILE(&DBLIB/WRHS1) +      */
       CHGVAR VAR(&FILENAME) VALUE(WRHS *TCAT &CURRPARTC)
       STRJRNPF FILE(&DBLIB/&FILENAME) +
                JRN(&DBLIB/&JRNNAME) IMAGES(*BOTH) OMTJRNE(*OPNCLO)
       CHGVAR VAR(&CURRPART) VALUE(&CURRPART + 1)
       IF COND(&CURRPART *LE &NUMPARTS) THEN(GOTO STRLOOP)

     ENDDO  /* end of the else section */
```

```
     /*-----------------------------------------------------------------*/
     SNDPGMMSG MSGID(CPF9897) MSGF(QSYS/QCPFMSG) +
               MSGDTA('STRTPCCJRN completed successfully!') MSGTYPE(*COMP)
 ENDPGM
```

C.39 TPCCSPACE.C:

```
/*-----------------------------------------------------------------*/
/*                                                                 */
/* File name: TPCCSPACE                                            */
/*                                                                 */
/* Purpose: Functions for working with TPCC Build space.           */
/*                                                                 */
/*-----------------------------------------------------------------*/

  /*-----------------------------------------------------------------*/
  /* Start include files.                                            */
  /*-----------------------------------------------------------------*/
  #include <stdio.h>
  #include <stdlib.h>
  #include <string.h>
  #include <qusrtvus.h>
  #include <qusptrus.h>
  #include <qusgen.h>
  #include <QSYSINC/MIH/CMPSWP>
  #include <mih/cpybytes.h>
  #include <mih/cpyblap.h>
  #include <os4msg.h>
  #include <commontpcc.h>
  #include <tpccspace.h>
  #include <tpccspacei.h>

  /* Global values used for all calls */
  control_space *control_ptr;
  char space_active = 'N';      /* space access flag. */

  int setup_space(char *dblib);
  job_data *get_job_ptr(int TypeID, int InsNo);
  int *get_item_ptr(int InfoType, job_data *job_ptr);


/*-----------------------------------------------------------------*/
int dec_space_item(int *item)
{
   int test_value;/* used in compare and swap                          */
   int new_value; /* used in compare and swap                          */
   int check;     /* used in compare and swap                          */
   do
   {
      test_value = *item; /* get old value */
      new_value = test_value - 1;/* decrement counter must be positive        */
      if (new_value < 0)
      {
          check = -1;   /* error flag path */
          return(-1);   /* the value is too low */
      }
      check = _CMPSWP( &test_value, item ,new_value);                 ;
                                                  /*update task count          */
   } while(check == 0);
   return 0;
}


/*-----------------------------------------------------------------*/
int inc_space_item(int *item)
{
   int test_value;    /* used in compare and swap. */
   int new_value;     /* used in compare and swap. */
   int check;         /* used in compare and swap. */
   do
   {
      test_value = *item; /* get old task count value                    */
      new_value = test_value + 1;/* increment task counter               */
      check = _CMPSWP( &test_value, item ,new_value);  /*update task count. */
   } while (check == 0);
   return(0);
}


/*-----------------------------------------------------------------*/
int chg_space_item(int *item, int input_value)
{
   int test_value;    /* used in compare and swap. */
   int new_value;     /* used in compare and swap. */
   int check;         /* used in compare and swap. */
   if (*item != input_value)
   {
      do
      {
         test_value = *item; /* get old task count value */
         check = _CMPSWP( &test_value, item, input_value);
                                                  /* update task count */
      } while (check == 0);
      return(0);
   } else {
      return(1); /* the value was not changed */
   }
} /* end of procedure */


/*-----------------------------------------------------------------*/
int dec_available_count ( void )
{
   return(dec_space_item(&control_ptr->available_jobs));
}


/*-----------------------------------------------------------------*/
int inc_available_count(void)
{
   if (control_ptr->max_jobs > control_ptr->available_jobs)
   {
      return(inc_space_item (&control_ptr->available_jobs));
   } else {
      char msgtxt[100];
      sprintf(msgtxt,
        "Error: attempted to increment the number of jobs larger then  max of %d",
              control_ptr->max_jobs);
      QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
      return(-1);
   }
}

/*-----------------------------------------------------------------*/
int  get_available_jobs(char *dblib)
{
    if (space_active == 'N')
    {
       if (setup_space(dblib) != 0)
       {
          return (-1);
       }
    }
    return control_ptr->available_jobs;
}


/*-----------------------------------------------------------------*/
int  get_number_instances(char *dblib)
{
    if ( space_active == 'N')/* check space flag. */
    {
       if (setup_space(dblib) != 0)
       {
           return (-1);
       }
    }
    return control_ptr->max_instance;
}

/*-----------------------------------------------------------------*/
char get_split(char *dblib)
{
    if (space_active == 'N')
    {
       if (setup_space(dblib) != 0)
       {
           return('U');
       }
    }
    if (control_ptr-> max_instance > 1)
    {
       return 'Y';
    } else {
       return 'N';
    }
}

/*-----------------------------------------------------------------*/
int  get_starting_wh(char *dblib, int InstNum)
{
    if (space_active == 'N')  /* check space flag. */
    {
       if (setup_space(dblib) != 0)
       {
           return(-1);
       }
    }
    if ((InstNum<0)||(InstNum>=control_ptr->max_instance))
    {
        char msg_txt[120];
        sprintf(msg_txt, "An instance number of %d is out of range 0 - %d",
                  InstNum, control_ptr->max_instance -1);
        QsendMsg(IBM_MSG_FILE, "CPF9897", msg_txt, DIAG_MSG, CS_CUR_PGM, 1);
        return -1;  /* if the instance is out of range */
    }

    return control_ptr->working[InstNum].start_whs;
}


/*-----------------------------------------------------------------*/
int get_number_whs(char *dblib, int InstNum)
{
    if (space_active == 'N')   /* check space flag.  */
    {
       if (setup_space(dblib) != 0)
       {
           return(-1);
       }
    }
    if ((InstNum<0)||(InstNum>=control_ptr->max_instance))
    {
        char msg_txt[120];/* diagnotic message text */
        sprintf ( msg_txt, "An instance number of %d is out of range 0 - %d",
                  InstNum, control_ptr->max_instance - 1 );
        QsendMsg(IBM_MSG_FILE, "CPF9897", msg_txt, DIAG_MSG, CS_CUR_PGM, 1);
        return -1;/* if the instance is out of range */
    }

    return control_ptr->working[InstNum].number_whs;
}

/*-----------------------------------------------------------------*/
int get_number_of_cpus(char *dblib)
{
    if ( space_active == 'N')/* check space flag                          */
    {
       if ( setup_space( dblib ) != 0 )
       {
           return (-1);
       }
    }
    return control_ptr->actual_cpu_cnt;
}

/*-----------------------------------------------------------------*/
int *get_item_ptr(int InfoType, job_data *jobs_ptr)
{
    switch(InfoType)
    {
       case MAX_JOBS_ALLOWED:
           return ( &jobs_ptr-> max_allowed );
        break;
       case JOBS_PLANNED:
          return ( &jobs_ptr->planned );
        break;
       case JOBS_RUNNING:
          return ( &jobs_ptr->running);
         break;
       case JOBS_COMPLETED:
          return ( &jobs_ptr->completed);
         break;
       case JOBS_ERROR:
          return ( &jobs_ptr->error);
         break;
       default:
          return (NULL);
        break;
     } /* end of the switch */
  }

  /* Get a pointer to the job data.                  */
  job_data *get_job_ptr(int TypeID, int InstNum)
  {
    if ((InstNum<0)||(InstNum>=control_ptr->max_instance))
    {
        char msg_txt[120];/* diagnotic message text */
        sprintf ( msg_txt, "An instance number of %d is out of range 0 - %d",
                  InstNum, control_ptr->max_instance - 1 );
        QsendMsg(IBM_MSG_FILE, "CPF9897", msg_txt, DIAG_MSG, CS_CUR_PGM, 1);
        return NULL;/* if the instance is out of range */
    }
    switch (TypeID)
    {
       case ORDER_JOBS:
           return( &control_ptr->working[InstNum].orders );
        break;
       case STOCK_JOBS:
           return( &control_ptr->working[InstNum].stock );
         break;
       case HISTORY_JOBS:
           return( &control_ptr->working[InstNum].history );
         break;
       case CUSTOMER_JOBS:
           return( &control_ptr->working[InstNum].customer );
         break;
       default:
           return (NULL);
        break;
    }/* end of the switch */
}

/* Return the value of the task count                  */
int GetJobInfo(char *dblib, int TypeID, int InstNum, int InfoType)
{
    int rv;/* return value                                              */
    int * item_ptr;/* pointer to the requested item                     */
    job_data * jobs_ptr;/* pointer to the data block                   */
    if ( space_active == 'N')/* check space flag                       */
    {
       if ( setup_space( dblib ) != 0 )
       {
           return (-1);
       }
```

```
    }
    if (NULL==( jobs_ptr = get_job_ptr ( TypeID, InstNum)))
      return (-1);
    else
    {
      if ( NULL == (item_ptr = get_item_ptr ( InfoType, jobs_ptr )))
      {
         return (-1);/* flag an error */
      }
      else
      {
         return (*item_ptr);/* return the value */
      }
    }
}

/* Return the value of the task count                    */
int IncJobInfo(char *dblib, int TypeID, int InstNum, int InfoType)
{
    int rv;/* return value                                                  */
    int * item_ptr;/* pointer to the item in the space                      */
    job_data * task_ptr;/* pointer to the data block                        */
    if ( space_active == 'N')/* check space flag                            */
    {
       if ( setup_space( dblib ) != 0 )
       {
          return (-1);
       }
    }
    if (NULL==( task_ptr = get_job_ptr ( TypeID, InstNum)))
      return (-1);
    else
    {
      if ( NULL == (item_ptr = get_item_ptr ( InfoType, task_ptr )))
      {
         return (-1);/* flag an error                                      */
      }
      else
      {
         return (inc_space_item(item_ptr));/* return the value             */
      }
    }
}

int DecJobInfo(char *dblib, int TypeID, int InstNum, int InfoType)
{
    int rv;/* return value                                                   */
    int * item_ptr;     /* pointer to the data item                        */
    job_data * task_ptr;/* pointer to the data block                       */
    if ( space_active == 'N')/* check space flag                           */
    {
       if ( setup_space( dblib ) != 0 )
       {
          return (-1);
       }
    }
    if (NULL == (task_ptr = get_job_ptr ( TypeID, InstNum)))
      return (-1);
    else
    {
      if (NULL == (item_ptr = get_item_ptr ( InfoType, task_ptr)))
      {
         return (-1);/* flag an error                                      */
      }
    }
    return (dec_space_item(item_ptr));/* return the value                 */
}

int setup_space(char *dblib)
{
     error_structure err;
     char space_name[21];/* user space name                                 */
     char test_lib[11];/* test library name */
     int length;/* string length */
     Qus_Generic_Header_0100_t *  space; /* user space header               */
     _CPYBYTES( test_lib, dblib, 10 );
     test_lib[10] = '\0';/* terminate the string */
     _CPYBYTES( space_name, USERSPACE, 10 );
     cpyblap( &space_name[10], 10, test_lib, strlen(test_lib), ' ' );
      /* get the user space name                                            */
     space_name[20]='\0';/* terminate the space name                       */
    err.bytes_prov = 16;/* set the number of bytes and error reporting mode  */
    QUSPTRUS(space_name,&space,  &err);/* get the pointer                   */
    if (err.bytes_avail != 0 )
    {
       return(-1);
    }
    control_ptr = (control_space *)space->User_Area;/* get the address      */
    space_active = 'Y';/* set the flag to the active state                  */
    return(0);
}

int get_maxjobs_available(char *dblib, int fileID, int InstNum)
{
   return( GetJobInfo ( dblib, fileID, InstNum, MAX_JOBS_ALLOWED ));
}

int get_started_jobs ( char *dblib, int fileID, int InstNum )
{
   return( GetJobInfo ( dblib, fileID, InstNum, JOBS_RUNNING ));
}

int add_started_jobs ( char *dblib, int fileID, int InstNum )
{
     int test_value;/* used to check setup space */
     test_value = get_available_jobs( dblib );
     if ( test_value == -1 )/* error detected */
     {
        return (-1);
     }
     if ( dec_available_count() != 0 )
     {
        return (-1);
     }
     if( IncJobInfo ( dblib, fileID, InstNum, JOBS_RUNNING ) == -1)
     {
         inc_available_count ();/* update available */
         return (-1);
     }
     else
     {
         return (0);
     }
}

int get_successful_jobs(char *dblib, int fileID, int InstNum)
{
   return( GetJobInfo(dblib, fileID, InstNum, JOBS_COMPLETED));
}

int add_successful_jobs(char *dblib, int fileID, int InstNum)
{
     if ((IncJobInfo(dblib, fileID, InstNum, JOBS_COMPLETED))== -1)
     {
        return -1;
     }
     DecJobInfo(dblib, fileID, InstNum, JOBS_RUNNING);
     return(inc_available_count());
}

int get_error_jobs(char *dblib, int fileID, int InstNum)
{
   return(GetJobInfo(dblib, fileID, InstNum, JOBS_ERROR));
}

int add_error_jobs(char *dblib, int fileID, int InstNum)
{
     if(( IncJobInfo(dblib, fileID, InstNum, JOBS_ERROR))== -1)
     {
        return -1;
     }
     return ( inc_available_count ());
}

int get_plan_to_start(char *dblib, int fileID, int InstNum)
{
   return(GetJobInfo(dblib, fileID, InstNum, JOBS_PLANNED));
}

int set_plan_to_start(char *dblib, int fileID, int InstNum, int set_value)
{
      job_data *jobs_ptr; /* pointer to the job data block. */

      if (space_active == 'N')
      {
          if (setup_space(dblib) != 0)
          {
             return(-1);
          }
      }
      jobs_ptr = get_job_ptr( fileID, InstNum);
      if ((jobs_ptr != NULL )&&(jobs_ptr->max_allowed >= set_value))
      {
          chg_space_item(&jobs_ptr->planned, set_value);
          return(0);
      } else {
          char msg_txt[120];/* output message for diagnostic */
          char *file_name;

          if (jobs_ptr != NULL)
          {
             if ((file_name = get_DB_filename(fileID)) != NULL)
                 sprintf(msg_txt,
  "max_allowed (%d) for %s jobs is too low for 'planned to start' field of %d",
                         jobs_ptr->max_allowed, file_name, set_value);
             else
                 sprintf(msg_txt, "FileID %d is invalid", fileID);
          } else {
             sprintf(msg_txt, "Job pointer not found", fileID);
          }
          QsendMsg(IBM_MSG_FILE,"CPF9897",msg_txt,DIAG_MSG,CS_CUR_PGM,1);
          return(-1);
      }
}


int add_plan_to_start(char *dblib, int fileID, int InstNum)
{
     int current_value;/* test value for the nuber planned */
     int max_value;/* max for this item                    */
     current_value = GetJobInfo ( dblib, fileID, InstNum, JOBS_PLANNED );
     max_value = GetJobInfo ( dblib, fileID, InstNum, MAX_JOBS_ALLOWED );
     if (current_value < max_value)
     {
        return(IncJobInfo(dblib, fileID, InstNum, JOBS_PLANNED));
     } else {
        return(-1);
     }
}

int remove_plan_to_start(char *dblib, int fileID, int InstNum)
{
   return(DecJobInfo(dblib, fileID, InstNum, JOBS_PLANNED));
}

/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: get_DB_filename                                         */
/*                                                                   */
/* Purpose: convert file id value used to access space into a file   */
/*          name.                                                    */
/*                                                                   */
/*-------------------------------------------------------------------*/
char *get_DB_filename(int file_id)
{
   switch (file_id)
   {
      case ORDER_JOBS:
      {
         return("ORDER");
         break;
      }
      case STOCK_JOBS:
      {
         return("STOCK");
         break;
      }
      case HISTORY_JOBS:
      {
         return("HISTORY");
         break;
      }
      case CUSTOMER_JOBS:
      {
         return("CUSTOMER");
         break;
      }
      default:
      {
         char msgtxt[30];
         sprintf(msgtxt, "Unknown file id of %d", file_id);
         QsendMsg(IBM_MSG_FILE, "CPF9897", msgtxt, DIAG_MSG, CS_CUR_PGM, 1);
         return(NULL);
      }
   } /* end: switch */
   return(NULL);

} /* end: get_DB_filename() */
```

C.40 TPCCSPACE.H:

```
#ifndef _TPCCSPACE_H
  #define _TPCCSPACE_H
/*******************************************************************/
/*                                                                 */
/* Header file name: TPCCSPACE                                     */
/*                                                                 */
/* Purpose: common functions                                       */
/*                                                                 */
/*******************************************************************/

  /*-----------------------------------------------------------------*/
  /* DEFINES                                                         */
  /*-----------------------------------------------------------------*/

  /* Define the job info types uses as the fileID */
  /* Note: new file types need to be updated in get_DB_filename() */
  #define ORDER_JOBS      0
  #define STOCK_JOBS      1
  #define HISTORY_JOBS    2
  #define CUSTOMER_JOBS   3

  /*-----------------------------------------------------------------*/
  /* Prototypes                                                      */
  /*-----------------------------------------------------------------*/
  int  get_available_jobs(char *dblib);
  int  get_number_of_cpus(char *dblib);
  int  get_number_instances(char *dblib);

  int  get_starting_wh(char *dblib, int InstNo);
  int  get_number_whs (char *dblib, int InstNo);

  int  get_maxjobs_available(char *dblib, int fileID, int InstNo);

  int  get_started_jobs(char *dblib, int fileID, int InstNo);
```

```
  int  add_started_jobs(char *dblib, int fileID, int InstNo);

  int  get_successful_jobs(char *dblib, int fileID, int InstNo);
  int  add_successful_jobs(char *dblib, int fileID, int InstNo);

  int  get_error_jobs(char *dblib, int fileID, int InstNo);
  int  add_error_jobs(char *dblib, int fileID, int InstNo);

  int  get_plan_to_start(char *dblib, int fileID, int InstNo);
  int  set_plan_to_start(char *dblib, int fileID, int InstNo, int set_value);
  int  add_plan_to_start(char *dblib, int fileID, int InstNo);
  int  remove_plan_to_start(char *dblib, int fileID, int InstNo);

  char get_split(char *dblib);

/*-------------------------------------------------------------------*/
/*                                                                   */
/* Function: get_DB_filename                                         */
/*                                                                   */
/* Purpose: convert file id used to access space into a file name.   */
/*                                                                   */
/* Return: file name                                                 */
/*                                                                   */
/*-------------------------------------------------------------------*/
 char *get_DB_filename(int file_id);

/* ---------------------> End of TPCCSPACE.H <--------------------- */
#endif
```

C.41 TPCCSPACEI.H:

```
#ifndef _TPCCSPACEI_H
#define _TPCCSPACEI_H
/*******************************************************************/
/*                                                                 */
/* Header file name: TPCCSPACEI                                    */
/*                                                                 */
/* Purpose: common space functions                                 */
/*                                                                 */
/*******************************************************************/

  /*-----------------------------------------------------------------*/
  /* DEFINES                                                         */
  /*-----------------------------------------------------------------*/
  #define USERSPACE   "TPCCDBJOBS"

  #define MAX_JOBS_ALLOWED 10
  #define JOBS_PLANNED     11
  #define JOBS_RUNNING     12
  #define JOBS_COMPLETED   13
  #define JOBS_ERROR       14
  #define SPLIT_SIZE        2

  /* space data defintion */
  typedef struct
  {
        int max_allowed; /* maximum number of jobs allowed limit value.     */
        int planned;     /* number of jobs planned.                         */
        int running;     /* number of task currrently running               */
        int completed;   /* number of tasks that have completed successfuly.*/
        int error;       /* count of jobs that ended with an error          */
  } job_data;

  typedef struct
  {
        int start_whs;        /* starting warehouse for this instance   */
        int number_whs;       /* number of warehouses in this instance.*/
        job_data orders;      /* data for the orders tasks              */
        job_data stock;       /* number of stock task running           */
        job_data customer;    /* number of customer task running        */
        job_data history;     /* number of history tasks running        */
   } instance_data;

  typedef struct
  {
      int max_jobs;       /* limit value  set at the start    */
      int available_jobs; /* number of avaliable processors   */
      int actual_cpu_cnt; /* number of cpus avaliable         */
      int max_instance;   /* maximum number of instances      */
      instance_data working[SPLIT_SIZE];
  } control_space;

/* ---------------------> End of TPCCSPACEI.H <--------------------- */
#endif
```

Appendix D. Application Source Code

Program Flow.

CLIENT:

D.1 COMMON.C:

```
#define _COMMON_C
#include "Common.h"

/* Establish a listening port */
int Listen(int port) {
  struct sockaddr_in    sin;
  int                   sd, on=1;

  /* Get a socket descriptor */
  if ((sd=socket(AF_INET,SOCK_STREAM,0))<0)  {
    perror("socket() failed");
    exit(-1);
  }

  /* Allow socket descriptor to be reuseable */
  if (setsockopt(
                 sd,
                 SOL_SOCKET,
                 SO_REUSEADDR,
                 (char *)&on,
                 sizeof(on)
                 )<0) {
    perror("setsockopt() failed");
    close(sd);
    exit(-1);
  }

  /* bind to an address */
  memset(&sin, 0x00, sizeof(struct sockaddr_in));
  sin.sin_family        =AF_INET;
  sin.sin_port          =htons(port);
  sin.sin_addr.s_addr   =htonl(INADDR_ANY);

  if(bind(sd,(struct sockaddr *)&sin,sizeof(sin))<0)  {
    perror("bind() failed");
    close(sd);
    exit(-1);
  }

  if(listen(sd,500)<0)  {
    perror("listen() failed");
    close(sd);
    exit(-1);
  }

  return sd;
}


/* Establish connection to specified address  */
int Connect(int ipAddr, int port) {
  struct sockaddr_in    sin;
  int                   sd;

  /* Get a socket descriptor */
  if ((sd=socket(AF_INET,SOCK_STREAM,0))<0)  {
    perror("socket() failed");
    exit(-1);
  }

  memset(&sin, 0x00, sizeof(struct sockaddr_in));
  sin.sin_family        =AF_INET;
  sin.sin_port          =htons(port);
  sin.sin_addr.s_addr   =htonl(ipAddr);

  if(connect(sd,(struct sockaddr *)&sin,sizeof(sin))<0)  {
    perror("connect() failed");
    close(sd);
    exit(-1);
  }

  return sd;
}

/* Establish a listening port */
int Bind(int ipAddr, int port) {
  struct sockaddr_in    sin;
  int                   sd, on=1;

  /* Get a socket descriptor */
  if ((sd=socket(AF_INET,SOCK_STREAM,0))<0)  {
    perror("socket() failed");
    exit(-1);
  }

  /* Allow socket descriptor to be reuseable */
  if (setsockopt(
                 sd,
                 SOL_SOCKET,
                 SO_REUSEADDR,
                 (char *)&on,
                 sizeof(on)
                 )<0) {
    perror("setsockopt() failed");
    close(sd);
    exit(-1);
  }

  /* bind to an address */
  memset(&sin, 0x00, sizeof(struct sockaddr_in));
  sin.sin_family        =AF_INET;
  sin.sin_port          =htons(port);
  sin.sin_addr.s_addr   =htonl(ipAddr);

  if(bind(sd,(struct sockaddr *)&sin,sizeof(sin))<0)  {
    perror("bind() failed");
    close(sd);
    exit(-1);
  }

  return sd;
}
/* Establish connection to specified address  */
int bConnect(int sd, int ipAddr, int port) {
  struct sockaddr_in    sin;


  memset(&sin, 0x00, sizeof(struct sockaddr_in));
  sin.sin_family        =AF_INET;
  sin.sin_port          =htons(port);
  sin.sin_addr.s_addr   =htonl(ipAddr);

  if(connect(sd,(struct sockaddr *)&sin,sizeof(sin))<0)  {
      perror("connect() failed");
      close(sd);
      exit(-1);
    }

    return sd;
  }
```

D.2 COMMON.H:

```
#ifndef _COMMON_H
#define _COMMON_H

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <spawn.h>
#include <qp0z1170.h>
#include <sys/shm.h>
#include <sys/stat.h>
#include <sys/wait.h>
#include <mih/mattod>
#include <sys/types.h>
#include <sys/socket.h>
#include <sys/msg.h>
#include <netinet/in.h>
#include <errno.h>
#include <unistd.h>
#include <iconv.h>
#include <sys/uio.h>
#include <decimal.h>
#include <qp0wpid.h>
#include <qwcrdtaa.h>
#include <atmi.h>       /* TUXEDO Header File */
#include <userlog.h>    /* TUXEDO Header File */


#define FromEBCDIC      "IBMCCSID000000000000\0\0\0\0\0\0\0\0\0\0\0\0"
#define ToIA5           "IBMCCSID00850\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0"
#define ToEBCDIC        "IBMCCSID00000\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0"
#define FromIA5         "IBMCCSID008500000000\0\0\0\0\0\0\0\0\0\0\0\0"
#define BufferSize 3078
#define BufferRecvSize 1400
#define WarehouseFieldSize 5
#define DistrictFieldSize  2
#define SPACE    " "
#define binToIA5(b,s)           \
{                               \
int _b=(b);                     \
char *_s=(s);                   \
do                              \
{*_s=ZERO+(_b%10);              \
_b/=10;                         \
--_s;                           \
}                               \
while(_b>0);                    \
}

#ifndef _COMMON_C

#pragma convert(819)
const char BLANK      =' ';
const char ZERO       ='0';
const char period     ='.';
const char parameter  ='=';
const char delimiter  ='?';
const char date_marker = '@';
const char ampersand  ='&';
const char termid[]   = "TERMID=";/* terminal ID string */

const char HEADER[]=
  "HTTP/2.0 200 DOCUMENT FOLLOWS\r\n"
  "MIME-VERSION: 2.0\r\n"
  "SERVER: TPC-C-SERVER 2.0\r\n"
  "DATE: MONDAY, 15-FEB-99 09:30:37 GMT\r\n"
  "CONTENT-TYPE: TEXT/HTML\r\n"
  "CONTENT-LENGTH:   ?   \r\n"
  "LAST-MODIFIED: MONDAY, 15-FEB-99 09:30:37    GMT\r\n"
  "CONNECTION: KEEP-ALIVE\r\n\r\n";

const char EXITHEADER[]=
  "HTTP/2.0 200 DOCUMENT FOLLOWS\r\n"
  "MIME-VERSION: 2.0\r\n"
  "SERVER: TPC-C-SERVER 2.0\r\n"
  "DATE: MONDAY, 15-FEB-99 09:30:37  GMT\r\n"
  "CONTENT-TYPE: TEXT/HTML\r\n"
  "CONTENT-LENGTH:   ?   \r\n"
  "LAST-MODIFIED: MONDAY, 15-FEB-99 09:30:37    GMT\r\n";

const char ERRORHEADER[]=
  "HTTP/1.0 404 DOCUMENT FOLLOWS\r\n"
  "MIME-VERSION: 1.0\r\n"
  "SERVER: TPC-C-SERVER 1.0\r\n"
  "DATE: MONDAY, 15-FEB-99 09:30:37 GMT\r\n"
  "CONTENT-TYPE: TEXT/HTML\r\n"
  "CONTENT-LENGTH:   ?    \r\n"
  "LAST-MODIFIED: MONDAY, 15-FEB-99 09:30:37 GMT\r\n";

#pragma convert(0)

enum Forms {
  WELCOME,
  MENU,
  NEW_ORDER,
  PAYMENT,
  DELIVERY,
  ORDER_STATUS,
  STOCK_LEVEL,
  INPUT_ERROR,
  NOT_FOUND_ERROR,
  EXIT,
  NUM_FORMS
};

enum Transaction {
  NEW_ORDER_TRAN,
  PAYMENT_TRAN,
  DELIVERY_TRAN,
  ORDER_STATUS_TRAN,
  STOCK_LEVEL_TRAN,
  NUM_TRANS
};

typedef struct Config {
  struct {
    int         size;
    char        *addr;
    char        *hiddenWid;
    char        *hiddenDid;
    char        *wid;
    char        *date_location;
  } form[NUM_FORMS];

} Config_t;

typedef _Packed struct {
       short olspwh;
       int    oliid;
       decimal(3,0) olqty;
} line_item;

typedef _Packed struct {
      char txn_type;
      char jobname[10];
      short cwid;
      short cdid;
      int   cid;
      decimal(3,0) number_of_items;
      line_item input_line[15];/* neworder data */
}new_order_input;/* output to database server */


typedef _Packed struct {
     short output_stqty;
     char  output_borg;
     char output_item_name[24];
     decimal (5,2)output_item_price;
```

```
     decimal (7,2)output_olamnt;
}output_line_item;


typedef _Packed struct {
     char neword_result;
     char oenttm[6];/* zoned amount */
     char clast[16];/*customer last name */
     char ccredt[2];
     decimal (5,2) cdct;
     int oid;/* order id */
     decimal (5,2) wtax;
     decimal (5,2) dtax;
     decimal (11,2) totamt;
     output_line_item output_line[16];
}new_order_output;/* output from database server */


typedef _Packed struct {
     new_order_input *new_inp;
     new_order_output *new_out;
     char execution_status[24];
}new_order_display;/* output from database server */



typedef _Packed struct {
      char txn_type;
      char jobname[10];
      char payment_type;
      short did;
      short wid;
      int cid;
      short cdid;
      short cwid;
      decimal ( 7, 2) amount;
      char clast[16];/* customer last name */
      char filler[155];
} payment_input;/* data sent to the database server */


typedef _Packed struct {
       char output_fmt_num[2];
       char time_of_day[8];/* time of day data                    */
       char time_filler[6];/* time filler                         */
       char waddr1[20];
       char waddr2[20];
       char wcity[20];
       char wstate[2];
       char wzip[9];
       char daddr1[20];
       char daddr2[20];
       char dcity[20];
       char dstate[2];
       char dzip[9];
       int  cid;
       char cfirst[16];
       char cinit[2];
       char clast[16];
       char cldate[8]; /* custormer last data date?               */
       char caddr1[20];
       char ccredt[2];
       char caddr2[20];
       decimal(5,2) cdct;
       char ccity[20];
       char cstate[2];
       char czip[9];
       char cphone[16];
       decimal (13,2) cbal;
       decimal (13,2) ccrdlm;
       char cdat1[50];
       char cdat2[50];
       char cdat3[50];
       char cdat4[50];
} payment_output;/* data returned from the database server */


typedef _Packed struct {
       payment_input *pay_inp;
       payment_output *pay_out;
} payment_display;  /* data returned from the database server */


typedef _Packed struct {
      char txn_type;
      char jobname[10];
      char ordsts_type;
      int cid;
      short did;
      short wid;
      char clast[16];
      char filler[165];
} order_status_input;/* data sent to database server              */


typedef _Packed struct {

     short do_olspwh;
     int   do_oliid;
     short do_olqty;/* is this correct ?? */
     decimal(7,2) do_olamnt;
     char do_oldlvl[8];/* zoned data from database server        */

} order_status_line_item;/* subarray of order status             */

typedef _Packed struct {


     char ordsts_fmt_num[2];
     int  ocid;
     char cfirst[16];
     char cinit[2];
     char clast[16];
     decimal(13,2) cbal;
     int oid;
     char oettod[8];/* time of day must be converted              */
     char oettm[6];/* blank field                                  */
     char ocarid[2];
     short olnenbr;
     order_status_line_item olineinfo[15];
} order_status_output;/* data returned from the database server */


typedef _Packed struct {
     order_status_input *ordsts_inp;
     order_status_output *ordsts_out;
} order_status_display;/* data displayed */



typedef _Packed struct {
      char txn_type;
      char jobname[10];
      short      wid;
      char      carrier[2];
      char      time[8];/* data is not send to delivery */
 }dlv_input;/* to the server */


 /* delivery does not have return from the database server  */


typedef _Packed struct {
      char txn_type;
      char jobname[10];
      short wid;
      short did;
      short threshold;
      short  blwstk;
} stock_input;


typedef _Packed struct {
    char filler[2];
    short blwstk;
} stock_output;


typedef _Packed struct {
    stock_input *stk_inp;
    stock_output *stk_out;
} stock_display;

  typedef struct {
    int bytes_prov;
    int bytes_avail;
    char except_id[7];
    char reserved[1];
    char except_data[50];
  } error_code;/* error code structure used by QUSPTRUS */


 typedef _Packed struct {
   int bytes_aval;
   int bytes_returned;
   char type_return[10];
   char lib[10];
   int length_value;
   int number_dec_pos;
   char data_block[200];
   } data_area_data;


  char clnt_dtaara[21] = "CLIENT_IP TPCCINFO  ";
  char srvr_dtaara[21] = "SERVER_IP TPCCINFO  ";
  char modn_dtaara[21] = "MODNUMBER TPCCINFO  ";


extern int Listen(int port);
extern int Connect(int ipAddr, int port);
extern int Bind(int ipAddr, int port);

#endif



#endif /* _COMMON_H */
```

D.3 DELVRYSRV.C:

```
#include "common.h"

/* tpsvrinit is executed when a server is booted, before it begins
   processing requests.  It is not necessary to have this function.
   Also available is tpsvrdone (not used in this example), which is
   called at server shutdown time.
*/


   static int sd, sd2, addr=0, length, port=7000;
   int rc=670, remain=0;
   static  pid_t                    pid;
   error_code err_code;
   data_area_data data_area_input;
   int mod_number=0;
   char clnt_ip1[13], clnt_ip2[13];
   char srvr_ip1[13], srvr_ip2[13];

tpsvrinit(int argc, char *argv[])
{
        /* Some compilers warn if argc and argv aren't used. */
        argc = argc;
        argv = argv;

        /* userlog writes to the central TUXEDO message log  */
        userlog("Welcome to the tpcc server");
   err_code.bytes_prov = 0;
   QWCRDTAA ( &data_area_input, 46, modn_dtaara, 1, 1, &err_code );
   mod_number = atoi(data_area_input.data_block);
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 1, 11, &err_code );
   memcpy( clnt_ip1, &data_area_input.data_block, 11 );
   clnt_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 13, 11, &err_code );
   memcpy( clnt_ip2, &data_area_input.data_block, 11 );
   clnt_ip2[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 1, 11, &err_code );
   memcpy( srvr_ip1, &data_area_input.data_block, 11 );
   srvr_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 13, 11, &err_code );
   memcpy( srvr_ip2, &data_area_input.data_block, 11 );
   srvr_ip2[12] = '\0';

   pid = getpid();
   remain = pid % mod_number;
   if(remain == 0) {
      addr=inet_addr(clnt_ip1);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip1);
      sd2=bConnect(sd,addr,port);
    }
   else {
      addr=inet_addr(clnt_ip2);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip2);
      sd2=bConnect(sd,addr,port);
    }
        return(0);
}

/* This function performs the actual service requested by the client.
   Its argument is a structure containing among other things a pointer
   to the data buffer, and the length of the data buffer.
*/


     /*       DELIVERY      */

DELIVRY(TPSVCINFO *rqst)
{

    if(send(sd, rqst->data, 230, 0)<0) {
      perror("\nsend() failed");
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }
    for(remain=1; remain<= 10000; remain++);
    /* Return the transformed buffer to the  requestor. */
    tpreturn(TPSUCCESS, 0, rqst->data, rc, 0);
}
```

D.4 FORMCHILDS.C:

```
#include "Common.h"

 char FrmServerPath[]="/usr/bin/FormServer";
```

```
void main(int argc, char *argv[]) {
  struct inheritance     spw_inherit;
  char                   *childArgv[5], shmid_s[20];
  char                   *dumy=NULL;
  int                    sd, shmid;
  pid_t                  child;
  struct sockaddr_in     sin;
  int numjobs, i , length;
  char numjobs_s[5];
  char cmd[50];
shmid = atoi(argv[1]);
numjobs = atoi(argv[2]);
memcpy(cmd,"DLYJOB DLY(300)", 17);
cmd[49] = '\0';
/* system(cmd); */

  sprintf(shmid_s,"%i",shmid);
  sprintf(numjobs_s,"%i",numjobs);
  childArgv[0]=shmid_s;
  childArgv[1]=shmid_s;
  childArgv[2]=numjobs_s;
  childArgv[3]=NULL;

   memset(&spw_inherit,0x00,sizeof(spw_inherit));

   length=sizeof(sin);

   for(i=1; i<=numjobs; i++) {

   if(child=(spawn(
                   FrmServerPath,
                   1,
                   &sd,
                   &spw_inherit,
                   childArgv,
                   &dumy
                   ))<0) {
      perror("spawn() failed");
      close(sd);
      exit(-1);
    }

  }
}
```

D.5 FORMPARENT.C:

```
#include "Common.h"

char FrmChildPath[]="/usr/bin/FormChilds";
static int numformchilds=4;

#pragma convert(819)

const char *FORM[NUM_FORMS]={

"<HTML>"
  "<HEAD><TITLE>Welcome To TPC-C</TITLE></HEAD><BODY><center><h2>"
  "Please Identify your Warehouse and District for this  session.<BR>"
  "</h2></center><FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"1\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"-2\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"0\">"
  "Warehouse ID <INPUT NAME=\"w_id\" SIZE=5 MAXLENGTH=5><BR>"
  "District ID <INPUT NAME=\"d_id\" SIZE=2 MAXLENGTH=2><BR>"
  "<HR>"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Submit\">"
  "</FORM><BODY>"
  "</HTML>",

"<HTML><HEAD><TITLE>TPC-C Main Menu</TITLE></HEAD><BODY>"
"<center><h2>Select Desired Transaction.</h2></center><BR><HR>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"2\">"
"<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"?    \">"
"<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"? \">"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
"</FORM></BODY>"
"</HTML>",


"<HTML><HEAD><TITLE>TPC-C New Order</TITLE></HEAD>"
"<body>"
"<center><h1>TPC-C New Order</h1></center>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"PI\" VALUE=\"\">"
"<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"ERROR\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"3\">"
"<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"?     \">"
"<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=? >"
"<pre>"
"Warehouse: ?     "
"District: <input name=\"D_ID\" size=2 MAXLENGTH=2>"
"<br>Customer: <input name=\"C_ID\" size=4 MAXLENGTH=4>"
"</pre>"
"<p>"
"<table>"
"<tr>"
"<th>Supp_w</th>"
"<th>Item_Id</th>"
"<th>Qty</th>"
"<th>Item Name</th>"
"<th>Stock</th>"
"<th>B/G</th>"
"<th>Price</th>"
"<th>Amount</th>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S00\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I00\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q00\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S01\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I01\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q01\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S02\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I02\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q02\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S03\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I03\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q03\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S04\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I04\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q04\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S05\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I05\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q05\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S06\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I06\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q06\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S07\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I07\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q07\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S08\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I08\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q08\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S09\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I09\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q09\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S10\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I10\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q10\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S11\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I11\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q11\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S12\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I12\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q12\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S13\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I13\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q13\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
```

```
"</td>"
"</tr>"
"<tr>"
"<td>"
"<input name=\"S14\" SIZE=5 MAXLENGTH=5>"
"</td>"
"<td>"
"<input name=\"I14\" size=6 MAXLENGTH=6>"
"</td>"
"<td>"
"<input name=\"Q14\" size=2 MAXLENGTH=2>"
"</td>"
"<td colspan=5>"
"</td>"
"</tr>"
"</table>"
"<p>"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Process\">"
"</form>"
"</body>"
"</HTML>",

"<HTML><HEAD><TITLE>TPC-C Payment</TITLE></HEAD>"
"<body>"
"<center><h1>TPC-C Payment</h1></center>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"PI*\" VALUE=\"\">"
"<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"ERROR\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"4\">"
"<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"?     \">"
"<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"? \">"
"<pre>"
"Date: @                        <br><br>"
"Warehouse: ?            "
"District: <input name=\"D_ID\" size=2 MAXLENGTH=2><br>"
"Customer: <input name=\"C_ID\" size=4 MAXLENGTH=4>  "
"Cust-Warehouse: <input name=\"C_W_ID\" SIZE=5 MAXLENGTH=5>  "
"Cust-District: <input name=\"C_D_ID\" size=2 MAXLENGTH=2><br>"
"Name:    <input name=\"LNAME\" size=16 MAXLENGTH=16 >     Since:<br>"
"                               Credit:<br>"
"                               Disc:<br>"
"                               Phone:<br><br>"
"Amount Paid:      $<input name=\"PAID\" size=7 MAXLENGTH=7>"
"     New Cust Balance:<br>"
"Credit Limit:<br><br>"
"Cust-Data:<br><br><br><br>"
"</pre>"
"<p>"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Process\">"
"</form>"
"</body>"
"</HTML>",

"<HTML><HEAD><TITLE>TPC-C Delivery</TITLE></HEAD>"
"<body>"
"<center><h1>TPC-C Delivery</h1></center>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"PI*\" VALUE=\"\">"
"<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"ERROR\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"5\">"
"<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"?     \">"
"<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"? \">"
"<pre>"
"Warehouse: ?            "
"<br>                    "
"<br>Carrier Number: <INPUT TYPE=TEXT SIZE=2 MAXLENGTH=2 NAME=\"CARRIER\">"
"<br>                    "
"<br>Execution Status:"
"</pre>"
"<p>"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Process\">"
"</form>"
"</body>"
"</HTML>",

"<HTML><HEAD><TITLE>TPC-C Order-Status</TITLE></HEAD>"
"<body>"
"<center><h1>TPC-C Order-Status</h1></center>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"PI*\" VALUE=\"\">"
"<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"ERROR\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"6\">"
"<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"?     \">"
"<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"? \">"
"<pre>"
"Warehouse: ?            "
"District: <input name=\"D_ID\" size=2 MAXLENGTH=2><br>"
"Customer: <input name=\"C_ID\" size=4 MAXLENGTH=4>"
"Name: <input name=\"LNAME\" size =16 MAXLENGTH=16><br>"
"Cust-Balance: <br><br>"
"Order-Number:    "
"Entry-Date:   "
"Carrier-Number: <br>"
"</pre>"
"<p>"
"<table>"
"<tr>"
"<th>Supply_W</th>"
"<th>Item_Id</th>"
"<th>Qty</th>"
"<th>Amount</th>"
"<th>Delivery-Date</th>"
"</tr>"
"</table>"
"<p>"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Process\">"
"</form>"
"</body>"
"</HTML>",

"<HTML><HEAD><TITLE>TPC-C Stock Level</TITLE></HEAD>"
"<body>"
"<center><h1>TPC-C Stock Level</h1></center>"
"<FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"PI*\" VALUE=\"\">"
"<INPUT TYPE=\"hidden\" NAME=\"STATUSID\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"ERROR\" VALUE=\"0\">"
"<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"7\">"
"<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"?     \">"
"<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"? \">"
"<pre>"
"Warehouse: ?            "
"<br>                    "
"<br>Stock Level Threshold: \
<INPUT TYPE=TEXT SIZE=2 MAXLENGTH=2 NAME=\"THRESHOLD\">"
"<br>                    "
"<br>Low Stock:"
"</pre>"
"<p>"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Process\">"
"</form>"
"</body>"
"</HTML>",

"<HTML>"
"<HEAD><TITLE>Welcome To TPC-C</TITLE></HEAD><BODY><center><h2>"
"The Warehouse and District you entered are not valid.  Please try  again.<BR>"
"</h2></center><FORM ACTION=\"tpcc.dll\" METHOD=\"GET\">"
"<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"1\">"
"<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"-2\">"
"<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"0\">"
"Warehouse ID <INPUT NAME=\"w_id\" SIZE=5 MAXLENGTH=5><BR>"
"District ID <INPUT NAME=\"d_id\" SIZE=2 MAXLENGTH=2><BR>"
"<HR>"
"<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Submit\">"
"</FORM></BODY>"
"</HTML>",

"<HTML>"
"<HEAD><TITLE>TPC-C data not found error</TITLE></HEAD><BODY>"
"<center><H2>TPC-C Benchmark application data not found.</h2><BR>"
"<H3>ERROR 404</h3></center><BR>"
"</BODY>"
"</HTML>",

"<HTML>"
"<HEAD><TITLE>TPC-C application exit </TITLE></HEAD><BODY>"
"<center><H2>TPC-C Benchmark application has ended.</h2><BR>"
"<H3>GOOD-BYE!</h2></center><BR>"
"</BODY>"
"</HTML>"
};
#pragma convert(0)

#define NUM_SVRS 5


void main(int argc, char *argv[]) {
  struct inheritance    spw_inherit;
  char                  *childArgv[4], shmid_s[20];
  char                  *dumy=NULL, *base;
  char                  buffer[BufferSize];
  char             warehouse[WarehouseFieldSize], district[DistrictFieldSize];
  char                  *hiddenWid, *hiddenDid, *contLen;
  int                   status, sd, shmid;
  int                   formPort=80;
  int                   header_size; /* header size          */
  int                   content_size;/* size of the contents */
  int                   i, j, length;
  Config_t              *config;
  pid_t                 child;
  struct                sockaddr_in    sin;
  int                   numusers=0, numchildjobs=0;
  char                  numchildjobs_s[5];
  int                   addr=0;
  char                  ip_addr[12];
  memcpy(ip_addr, argv[1], 11);
  ip_addr[11] = '\0';
  numusers = atoi(argv[2]);
  Qp0zInitEnv();

  /* Determine amount of shared memory required  */
    length=sizeof(Config_t)
      +((NUM_TRANS+2)*strlen(HEADER))
      +16; /* Slop */

    for(i=0;i<NUM_FORMS;++i)  length+=strlen(FORM[i]);

    if((shmid=shmget(
                                IPC_PRIVATE,
                                length,
                                S_IRUSR|S_IWUSR
                                )<0) {
              perror("\nshmget() failed");
              exit(1);
    }

    if((config=shmat(
                                shmid,
                                NULL,
                                0
                                ))==NULL) {
              perror("\nshmat() failed");
              exit(1);
    }


    sprintf(shmid_s,"%i",shmid);
    childArgv[0]=shmid_s;
    childArgv[1]=shmid_s;
    childArgv[3]=NULL;

    base=(char *)config+sizeof(Config_t);


  /* Create operation forms and spawn the jobs      */

    for(i=0;i<NUM_FORMS;++i)  {
              if ( i!= NOT_FOUND_ERROR )
              {
                  if ( i != EXIT )
                  {
                            sprintf(base,"%s%s",HEADER,FORM[i]);
                            header_size = strlen( HEADER );
                  }
                  else
                  {
                            sprintf(base,"%s%s",EXITHEADER,FORM[i]);
                            header_size = strlen( EXITHEADER );
                  }
              }
              else
              {
                  sprintf(base,"%s%s",ERRORHEADER,FORM[i]);
                  header_size = strlen( ERRORHEADER );
              }

    /* Locate areas containing content length, and hidden  w_id/d_id */

              contLen=strchr(base,delimiter);

              if (( i!= WELCOME )&&(i!= NOT_FOUND_ERROR)&&(i!=INPUT_ERROR)&&
                  ( i != MENU )&&( i != EXIT ))
              {
                  config->form[i].hiddenWid=strchr(contLen+1,delimiter);
                  config->form[i].hiddenDid=strchr(config->form[i].hiddenWid+1,delimiter);
                  config->form[i].wid=strchr(config->form[i].hiddenDid+1,delimiter);
              }
              else
              {
                  if ( i != MENU )
                  {
                            contLen=strchr(base,delimiter);
                            config->form[i].hiddenWid=NULL;
                            config->form[i].hiddenDid=NULL;
                            config->form[i].wid=NULL;
                  }
                  else /* the menu form */
                  {
                            contLen=strchr(base,delimiter);/*  first ? */
                            config->form[i].hiddenWid=strchr(contLen+1,delimiter);/*  next
?*/
                            config->form[i].hiddenDid=
                              strchr(config->form[i].hiddenWid+1,delimiter);
                            config->form[i].wid=NULL;
                     /* next ? in the form */
                      }
              }
              config->form[i].addr=base;
              config->form[i].size=strlen(config->form[i].addr);
              content_size = config->form[i].size- header_size;

    /* Poke in the content length */
              binToIA5(content_size,contLen);
              config->form[i].date_location=strchr(base,date_marker);
              base=base+config->form[i].size;
    } /* end of the form generating section  */

    addr=inet_addr(ip_addr);
    sd=Bind(addr, formPort);

    if((listen(sd,500))<0)  {
      perror("listen() failed");
      close(sd);
```

```
      exit(-1);
    }

    memset(&spw_inherit,0x00,sizeof(spw_inherit));

    length=sizeof(sin);

    numchildjobs = numusers / numformchilds;

    if (( numchildjobs == 0) || ( numchildjobs < 4)) {
                 numformchilds=1;
                 numchildjobs=1;
    }

    sprintf(numchildjobs_s, "%i", numchildjobs);

    childArgv[2]=numchildjobs_s;

    for(i=1; i<=numformchilds; i++) {

              if(child=(spawn(
                                          FrmChildPath,
                                          1,
                                          &sd,
                                          &spw_inherit,
                                          childArgv,
                                          &dumy
                                          ))<0) {
                   perror("spawn() failed");
     close(sd);
                   exit(-1);
              }

    }


    shmdt(config);
    return;
}
```

D.6 FORMSERVER.C:

```
#include "Common.h"
#include "atmi.h"
#include "uunix.h"

#define DATA_ERROR 30
#define SIGNON_ERROR 31
/*********************************************************************/
/*                                                                   */
/* External functions                                                */
/* External functions must be linked in                              */
/*                                                                   */
/*********************************************************************/
int scan_new_order(char * input, new_order_input * output);
int scan_payment(char * input, payment_input * output);
int scan_order_status(char * input, order_status_input * output);
int scan_delivery(char * input, dlv_input * output);
int scan_stock_level(char * input, stock_input * output);
int getdttmstr(char * timein, char* timestamp, char type);

#pragma convert(819)

 const char DASH='-';          /* dash for the time                          */
 const char COLON=':';         /* get the colon in asci for the time         */
 const char NINE='9';          /* Ascii character nine for scaning input     */
 const char ONE='1';           /* For the form numbers                       */
 const char ASCI_3 = '3';      /* For the form numbers                       */
 const char INPUT_BLANK = '+';/* blank inserted character from brawser      */
 const char ASCI_C = 'C';        /* ASCII C used in CMD                      */
 const char ASCI_N = 'N';        /* ASCII N for the new order transaction    */
 const char ASCI_P = 'P';        /* ASCII P for the payment transcation      */
 const char ASCI_O = 'O';        /* ASCII O for the order status transaction */
 const char ASCI_D = 'D';        /* ASCII D for the delivery transaction     */
 const char ASCI_S = 'S';        /* ASCII S for the stock level transaction  */
 const char ASCI_E = 'E';        /* ASCII E for the exit action selection    */
 const char ASCI_F = 'F';        /* ASCII E for the exit action selection    */
 const char ASCI_W = 'W';        /* ASCII W for the welcome screen           */
 const char ASCI_w = 'w';        /* ASCII w for the welcome screen           */

 const char GET_STRING[]="GET /";/* GET for form action                      */
 const char TEST_DATA[]= "tpcc.dll?";/* First part of the input              */
 const char WELCOME_DATA[]="welcome.html "; /* welcome string              */
 const char STATUSID[]= "STATUSID=";     /* Status ID text                   */
 const char COMMNAD[] = "CMD=";          /* Command string                   */
 const char TERMID[]  = "TERMID=";       /* Terminal ID text                 */
 const char SYNCID[]  = "SYNCID=";       /* Sync ID text                     */
 const char ERROR[]   = "ERROR=";        /* Error text part of the data      */
 char FORMID[]        = "FORMID=";       /* Form ID text                     */
 char WAREHOUSEID[]   = "w_id=";         /* warehouse number text            */
 char DISTRICTID[]    = "d_id=";         /* district number                  */
 char CMDSTRING[]     = "CMD=..";        /* command for start                */


#pragma convert(0)

  char          *date_loc;/* pointer to insert the date and time  */
  char warehouse[WarehouseFieldSize], district[DistrictFieldSize];
  char          *writePtr;
  Config_t *config;
  int           writeLen;
  int           form_number;/* results form ID */
  char          *hiddenWid, *hiddenDid;
  char          *wid;/* warehouse insert location */
  char          cl_time[27]; /* converted output return                */

  iconv_t         toEBCDIC, toIA5;
  char            scratchBuffer[BufferSize];
  char            buffer[BufferSize];

  new_order_display       nd;
  payment_display         pd;
  order_status_display    od;
  dlv_input              *di;
  stock_display           s_d;
  struct sockaddr_in    sin;

/*===================================================================*/
/*  Internal procedures                                              */
/*                                                                   */
/*===================================================================*/
int set_error_report( int status);
char scan_strings ( char ** input_string, char * output_loc, int size,
                    char   terminator );
char parse_input ( char * input, char ** new_location );

void process_normal  ( char * temp );
void process_exit    ( char * temp );
void process_start   ( void );
void display_error   ( void );
void copy_date       ( void );
void initTux         ( void );
void process_input   ( char * data_input );
int postResult(void *res_buf, char* warehouse, char * district, int form,
               char *scratchBuffer );

void main(int argc, char *argv[]) {
  int  sd, sd2, i, j, length, termId=0;
  char *temp;
  char          *contLen, *base, *actionLoc;
  char          *new_ptr;/* location of the data after parsing    */
  char          data_error;/* data error flag                      */
  int           contentLen;
  char          cmd[20];
```

```
  for(i=0; i < BufferSize; i++) buffer[i] = '\0';
  for(i=0; i < WarehouseFieldSize; i++) warehouse[i] = '\0';
  for(i=0; i < DistrictFieldSize; i++) district[i] = '\0';
  /* Get access to shared memory */
  if((config=shmat(
                   atoi(argv[1]),
                   NULL,
                   0
                  ))==NULL) {
    perror("shmat() failed");
    close(0);
    exit(-1);
  }


    length=sizeof(sin);
    if((sd2=accept(sd,(struct sockaddr *)&sin,&length))<0) {
      perror("accept() failed");
      close(sd);
      exit(-1);
    }


      initTux(); /* setup the tuxedo functions and buffers */
      for(;;) {
        warehouse[0]=0x20;
        warehouse[1]=0x20;
        warehouse[2]=0x20;
        warehouse[3]=0x20;
        warehouse[4]=0x20;
        *((short *)district) =0x2020;    /* Prime district identifier   */


      if((length=recv(sd2,buffer,BufferRecvSize,0))<1)  {
        perror("recv() failed");
        close(sd2);
        close(sd);
        exit(-1);
      }
      else {
               buffer[length]='\0';

      temp = buffer;/* set up input pointer                          */
      data_error = parse_input( temp, &new_ptr );
      if ( data_error == 'N' )/* if the input data is valid  */
      {
         temp = new_ptr;/* go to the start of command */
         if (( *temp == ASCI_F )||   /* if the data is FORMID=        */
             ( *temp == ASCI_S )    /* if the data is STATUSID=      */
         {
             process_normal( temp );
             if (( form_number != NOT_FOUND_ERROR )&&
                ( form_number != WELCOME )&&
                ( form_number != INPUT_ERROR )&&
                ( form_number != EXIT ))
             {
             /* Poke the warehouse id and district id in the form  */
                for(i=0;i<WarehouseFieldSize;++i)
                {
                    hiddenWid[i]=warehouse[i];
                }
                if ( form_number != MENU )
                {
                   for(i=0;i<WarehouseFieldSize;++i)
                   {
                      wid[i]=warehouse[i];
                   }
                }
                for(i=0;i<DistrictFieldSize;++i)
                {
                   hiddenDid[i]=district[i];
                }
             } /* end of form_number test */
         }    /* end of if ASCI_F */
         else
         {
             if (*temp == ASCI_C )/* text CMD=Begin */
             {
                 process_start ( );
             }
             else
             {
                 if (*temp == ASCI_P )/* if transaction_input_form */
                 {
                    process_input ( temp );/* process input data */
                 }
                 else
                 {
                    display_error ();
                 }
             }
         }
      } /* end of if data_error == 'N' ) */
      else /* data error not equal N */
      {
         if ( data_error == 'W' )/* welcome screen */
              /* send the signon screen           */
         {
             process_start (  );
         }
         else
         {
             display_error ();
         }
      }
      if(writeLen==0) printf("writelen is zero\n");
      if(write(sd2,writePtr,writeLen)<0)
      {
        perror("write() failed");
        break;/* error management for write error  */
      }
      if (( form_number == EXIT )|(form_number == NOT_FOUND_ERROR))
        break; /* exit the receive loop */
    } /* end of the recv else statment */
  } /* end of for loop */
  close(sd2);

  /* Free Buffers & Detach from System/T */
  tpterm();
  shmdt(config);
  iconv_close(toIA5);
  iconv_close(toEBCDIC);
  close(sd);
  exit(0);
}
void process_start ( void )
{
      writePtr=config->form[WELCOME].addr;
      writeLen=config->form[WELCOME].size;
}
void display_error ( void )
{
      form_number = NOT_FOUND_ERROR;
      writePtr=config->form[NOT_FOUND_ERROR].addr;
      writeLen=config->form[NOT_FOUND_ERROR].size;
}
void process_normal ( char * temp )
{
  char form_selector;
  char * marker;                  /* Location of the formid string    */
  char          input_error='Y'; /* input error flag */
  char          input_error_1='Y';/* scan warehouse input error flag  */
  char          input_error_2='Y';/* scan district input error flag   */
  int           i;

   /* Find the text string FORMID= and then get the form number         */
   if((marker=strstr(temp,FORMID))!=NULL)
   {
       /* advance pointer to the end of the formid string */
```

```
    temp = marker + strlen(FORMID);
    form_number = *temp - ONE;/* get the form number                then  */
 }
 else/* FORMID not found */
 {
    form_number = NOT_FOUND_ERROR;/* set form number to error form */
    i = form_number;/* set form index */
    /* setup error form and return */
    writePtr=config->form[i].addr;
    writeLen=config->form[i].size;
    hiddenWid=config->form[i].hiddenWid;/*  set the warehouse field */
    hiddenDid=config->form[i].hiddenDid;/*  set the district field  */
    wid=config->form[i].wid;            /* set the warehouse field */
    return;
 }
/* check the form number */
if ( form_number == WELCOME )/* welcome form */
{
   /* check for the warehouse id  text                          */
   if((marker=strstr(temp,WAREHOUSEID))!=NULL)
   {
       temp=marker+strlen(WAREHOUSEID)-1;/*  go just to the = sign */
       input_error = 'Y';
       /* scan for warehouse ID */
       input_error_1 = scan_strings(&temp,warehouse,5,ampersand);
       {
         if((temp=strchr(temp,parameter))!=NULL)
         /* advance pointer to start of district data  */
         {
                        /* scan for district ID */
             input_error_2=scan_strings(&temp,district,3,ampersand);
         }
       }
       if (( input_error_1 == 'N' )&&(input_error_2 == 'N'))
        input_error = 'N';/* set the input error flag  */
       if ( input_error == 'N')  /* district and warehouse are correct  */
       {
           form_number = MENU;/* set up the menu display */
           i = form_number;/* set form index */
           /* setup menu form and return */
           writePtr=config->form[i].addr;
           writeLen=config->form[i].size;
           hiddenWid=config->form[i].hiddenWid;/*  set the warehouse field  */
           hiddenDid=config->form[i].hiddenDid;/*  set the district field   */
       }
       else
       {
           form_number = INPUT_ERROR;
           /* setup input error screen form and return  */
           i = form_number;
       } /* end of inner else */
   }
   else /* warehouse id not found */
   {
       form_number = NOT_FOUND_ERROR;/* set form number to error screen  */
       i = form_number;
   }
   writePtr=config->form[i].addr;
   writeLen=config->form[i].size;
   hiddenWid=config->form[i].hiddenWid;
   hiddenDid=config->form[i].hiddenDid;
   wid=config->form[i].wid;            /* set the warehouse field */
} /* end of check for Welcome FORM   */

else  /* The form is a memu selection        */
{
  /* check for the TERMID text                          */
  if((marker=strstr(temp,TERMID))!=NULL)
  {
     temp = marker + strlen(TERMID);/* advance the pointer */
     for(
          i=0;
           temp[i]&&temp[i]!=INPUT_BLANK&&temp[i]!=ampersand&&
             (i<WarehouseFieldSize);
          ++i
            )
         warehouse[i]=temp[i];
     /* check SYNCID text */
     if((marker=strstr(temp,SYNCID))!=NULL)
     {
         temp = marker + strlen(SYNCID);/* go to the syncid string */
         /* advance pointer to syncid                          */
         for(
             i=0;
             temp[i]&&temp[i]!=INPUT_BLANK&&temp[i]!=ampersand&&
               (i<DistrictFieldSize);
             ++i
               )
           district[i]=temp[i];
         /* check for the &CMD=.. text */
         if((marker=strstr(temp,CMDSTRING))!=NULL)
         {
             /* advance the pointer to the end of the command string    */
             temp = marker + strlen(CMDSTRING);
             form_selector = *temp;
             /* form_selector is the first character of the command     */
         }
         else
         {
          form_selector = ASCI_N;/* default to new order */
         }
         /* check the form number */
         if ( form_selector == ASCI_N )
              i= NEW_ORDER;/* set up the new order form              */
         else
         {
            if ( form_selector == ASCI_P )
            {
               i= PAYMENT;
               date_loc=config->form[i].date_location;
               copy_date();
            }
            else
            {
               if ( form_selector == ASCI_O )
                  i= ORDER_STATUS;
               else
               {
                  if ( form_selector == ASCI_D )
                     i= DELIVERY;
                  else
                  {
                      if ( form_selector == ASCI_S )
                         i=  STOCK_LEVEL;
                      else
                      {
                          if ( form_selector == ASCI_E )
                              i = EXIT;
                          else
                              i = NEW_ORDER;  /* send new order  */
                      }/* end else if ( form_selector == ASCI_S ) */
                  }    /* end else if ( form_selector == ASCI_D ) */
               }       /* end else if ( form_selector == ASCI_O ) */
           }           /* end else if ( form_selector == ASCI_P ) */
         }             /* end else if ( form_selector == ASCI_N ) */
         form_number = i; /* set the form number */
         writePtr=config->form[i].addr;
         writeLen=config->form[i].size;
         /* Set local ptrs to hidden vars */
         hiddenWid=config->form[i].hiddenWid;
         hiddenDid=config->form[i].hiddenDid;
         wid=config->form[i].wid;   /* set the warehouse field */
     } /* end of if SYNCID found */
     else
     {
       form_number = NOT_FOUND_ERROR; /* set the form number */
       writePtr=config->form[NOT_FOUND_ERROR].addr;
       writeLen=config->form[NOT_FOUND_ERROR].size;
     }
     }   /* end of if TERMID found */
     else
     {
         form_number = NOT_FOUND_ERROR; /* set the form number */
         writePtr=config->form[NOT_FOUND_ERROR].addr;
         writeLen=config->form[NOT_FOUND_ERROR].size;
     }
 }        /* end of else form id not equal WELCOME form        */
}


void copy_date(void)
                /* Poke date into form when required  */
{
  int i;/* for loop counter */
  _MI_Time      time_of_day; /* time of day  */
  mattod( time_of_day );/* get the time of day */
  time_of_day[7]='B';
  getdtmstr  ( time_of_day, cl_time, 'm' );/* get time string */
  cl_time[19] = '\0'; /* terminate the string */
  for(i=0;i<19;++i) {
    switch ( cl_time[i] )
    {
            case '-':
                  date_loc[i] = DASH;
                break;
            case ':':
                  date_loc[i] = COLON;
                break;
            case ' ':
                  date_loc[i] = BLANK;
                break;
            default:
                  date_loc[i]=(cl_time[i]-'0')+ZERO;
                break;
         } /* end of switch */
     } /* end of for loop */
}/* end of copy date  */

/*****************************************/
/* checks if the input data is valid     */
/*****************************************/
char parse_input ( char * input, char ** new_ptr )
{
   int index;
   int test_string_size; /* set longer then max string */
   char * test_string;/* string to test                  */
   char * data_string;/* pointer to new test string     */
   char mode = 'N';
   int normal_len;
   int welcome_len;
   normal_len = strlen( TEST_DATA )-1;/* index of length */
   welcome_len = strlen ( WELCOME_DATA )-1;/* inedx of length */
   for(index=0;index<5;index++)
   {
      if ( input[index] != GET_STRING[index] )
      {
           *new_ptr = NULL;/* set a null pointer for return  */
          return ('Y');
      }
   }
   if ( input[5] == TEST_DATA[0] )
   {
      test_string = (unsigned char *)&TEST_DATA[0];
      test_string_size = strlen (TEST_DATA);
      mode = 'N';/* set the processing mode */
   }
   else
   {
       if ( input[5] == WELCOME_DATA[0] )
       {
          test_string =(unsigned char *)&WELCOME_DATA[0];
          test_string_size = strlen (WELCOME_DATA);
          mode =  'W';/* set the processing mode  */
       }
       else
       {
           *new_ptr = NULL;/* set a null pointer for return  */
           return ('Y');
       }
   }
   data_string =(unsigned char *)&input[5];   /* get starting point      */
   for(index=1;index<test_string_size;index++)/*  index 0 has ben tested  */
   {
      if ( data_string[index]  != test_string[index] )
      {
             *new_ptr = NULL;/* set a null pointer for return  */
             return ('Y');  /* error detected */
      }
   }  /* end of the for loop                        */
   *new_ptr = data_string + test_string_size;
   return (mode);
}


/*****************************************/
/* checks if the input data is numeric    */
/*****************************************/
char scan_strings ( char ** current_ptr, char * output_loc, int size,
                    char terminator )
{
   int blank_count=0;/* blank character counter */
   char * start_ptr;/* pointer to the active string start            */
   char * output_ptr; /* pointer to current string location          */
   int  scan_count;            /* for loop counter                   */
   char scan_error='N';        /* scan error flag                    */
   start_ptr = *current_ptr+1;/* set the starting postion pointer    */
   output_ptr = output_loc;/* saved location                         */
   for( scan_count = 0;scan_count<size; scan_count++)
   {
     *current_ptr=*current_ptr+1;/*  next character point       */
     if ((((**current_ptr) >= ZERO)&&((**current_ptr)<= NINE))
     {
         if( blank_count == 0 )      /* not after a trailing blank */
         {
                  *output_ptr = **current_ptr; /* save the data              */
                  output_ptr  =  output_ptr+1;/* go to the next location     */
         }
         else
         {
                  scan_error = 'Y';/* this is an input error  */
                  scan_count = size;/* you are done scanning  */
          }
     }
     else /* end of if numeric */
     {
       if ( (**current_ptr) == terminator )
       {
          scan_count = size;/* you are done scanning */
          if ((*current_ptr)==start_ptr)/*  no character were processed        */
          {
             scan_error = 'Y';
          }
       }
       else/* character is not a terminater */
       {
          if ( (**current_ptr)  == INPUT_BLANK )/* check for blanks */
          {
             if ((*current_ptr)==start_ptr)    /* leading blank             */
             {
                start_ptr = start_ptr+1;       /* skip this character       */
             }
             else
             {
                blank_count=blank_count+1;   /* count the traling input blank */
             }
          }
```

```
          else
          {
             scan_error = 'Y';/* this is an input error */
             scan_count = size;/* you are done scanning */
          }
       }
      }/* end of else not numeric */
     }/* end of the for loop */
     if ((*current_ptr)==start_ptr)   /* blank input   */
     {
          scan_error = 'Y';
     }
     return scan_error;
}


/*********************************************/
/* Initialize the environment including tuxedo */
/*********************************************/
void initTux          ( void )
{
  toIA5=iconv_open(ToIA5,FromEBCDIC);
  if(toIA5.return_value<0){
    perror("\niconv_open() failed");
    exit(1);
  }

  toEBCDIC=iconv_open(ToEBCDIC,FromIA5);
  if(toEBCDIC.return_value<0){
    perror("\niconv_open() failed");
    exit(1);
  }

  /* set up the tuxedo environment   */
  putenv("TUXDIR=/qopensys/tuxsdk");
  putenv("APPDIR=/home/tpcckvclnt");
  putenv("TUXCONFIG=/home/tpcckvclnt/tuxconfig");


       /* Attach to System/T as a Client Process */
       if (tpinit((TPINIT *) NULL) == -1) {
              (void) fprintf(stderr, "Tpinit failed\n");
              exit(1);
       }

   /* allocate space for buffers       */

   if((nd.new_inp=(new_order_input *)tpalloc("CARRAY", NULL, 670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for newordi\n" );
                    exit(1);
                  }
   if((pd.pay_inp= (payment_input *) tpalloc("CARRAY", NULL, 670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for paymnti\n" );
                    exit(1);
                  }
   if((di= (dlv_input *) tpalloc("CARRAY", NULL, 670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for delvryi\n" );
                    exit(1);
                  }
 if((od.ordsts_inp=(order_status_input *)tpalloc("CARRAY", NULL, 670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for ordstsi\n" );
                    exit(1);
                  }
   if((s_d.stk_inp= (stock_input *) tpalloc("CARRAY", NULL, 670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for stklvli\n" );
                    exit(1);
                  }


   if((nd.new_out= (new_order_output *) tpalloc("CARRAY", NULL, 670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for newordo\n" );
                    exit(1);
                  }
   if((pd.pay_out= (payment_output *) tpalloc("CARRAY", NULL, 670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for paymnto\n" );
                    exit(1);
                  }
   if((od.ordsts_out=(order_status_output *)tpalloc("CARRAY",NULL,670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for ordstso\n" );
                    exit(1);
                  }
   if((s_d.stk_out= (stock_output *) tpalloc("CARRAY", NULL, 670))==NULL) {
                    (void) fprintf(stderr, "Can't allocate buffer for stklvlo\n" );
                    exit(1);
                  }
}



/*********************************************/
/* Processes the transaction input data          */
/*********************************************/

void process_input  ( char * input_buffer )
{
  int              formId;/* form ID from the input */
  int              formIdPost;/* modified form input */
  int             i, j;
  int             contentSize;
  unsigned char *fromPtr, *toPtr;
  Config_t      *config;
  int            count;
  int             counter;/* for loop counter */
  char            *work;/* buffer to get the warehouse number */
  unsigned int  length, inSize, outSize;
  char            argument[BufferSize];/* location after converting */
  char            *temp, *inStr;
  long            send_len = 670, *recv_len;
  int             ret;
  _MI_Time        time_of_day;    /* time of day */
  char            cmd[20];


  recv_len = &send_len;
  /* Find the form id number and save as the  FormId */
  if ((work=strstr(input_buffer, FORMID))==NULL)
  {
        printf("\nMissing FORMID");
        formId = NUM_FORMS;
  }
  else
  {
     work = work + sizeof(FORMID) -1;
     formId = *work - ONE;/* get the form id number */
  }
  /* Find start of argument area */
  if((inStr=strstr(input_buffer,TERMID))==NULL)
     printf("\nMissing TERMID");
  else if((temp=strchr(inStr,BLANK))==NULL)/*  locate next blank */
     printf("\nMissing Blank");
  else {
      inSize=outSize=(temp-inStr);
      temp=argument;
      temp[inSize]=0;         /* Insert string terminator */

      /* Convert arguments to EBCDIC */
          if(iconv(toEBCDIC,&inStr,&inSize,&temp,&outSize)<0){
            perror("\niconv() failed");
            exit(1);
          }
      formIdPost = formId;
      work = argument + sizeof(termid) -1;
  memset ( warehouse, '\0', WarehouseFieldSize + 1 );
  for ( counter=0;(counter<WarehouseFieldSize)&&
        (work[counter]!='&')&&
        (work[counter]!='+');
        counter++)
      warehouse[counter]  = work[ counter ];
  if ((work = strstr( work, "SYNCID=" ))==NULL )
  {
     printf ( "District not found\n" );
  }
  else
  {
     memset ( district, '\0', DistrictFieldSize + 1 );
     work = work + 7;
  for ( counter=0;(counter<DistrictFieldSize)&&
        (work[counter]!='&')&&
        (work[counter]!='+');
         counter++)
     district[counter] = work[ counter ];
  }

  /* process transaction based on type     */
  switch(formId) {
    case NEW_ORDER:

   count = scan_new_order( argument, nd.new_inp);
 if ( count == 0 )/* new order data valid */
 {
                  ret=tpcall("NEWORDER",(char *)nd.new_inp,send_len,
                (char **) &nd.new_out, (long *) recv_len, TPNOTIME);

                  if(ret == -1) {
                      (void) fprintf(stderr, "Can't send request to NEWORDER \n" );
                      (void) fprintf(stderr, "Tperrno = %d, ret=%d\n", tperrno,ret);
                      tpterm();
                      exit(1);
                  }
                }
 else    /*  invalid new order data     */
               formIdPost = set_error_report( count );

                  /* Respond to the client */
                      postResult(&nd, warehouse, district, formIdPost, scratchBuffer);

    break;

    case PAYMENT:
          count = scan_payment ( argument, pd.pay_inp );
          if(count == 0) /* payment data valid */
          {

                  ret=tpcall("PAYMNT",(char *)pd.pay_inp,send_len,
              (char **) &pd.pay_out, (long *) recv_len, TPNOTIME);

  if(ret == -1) {
    (void) fprintf(stderr, "Can't send request to service PAYMENT\n");
    (void) fprintf(stderr, "Tperrno = %d\n", tperrno);
    tpterm();
    exit(1);
  }
  }        /* payment data invalid */
   else       formIdPost = set_error_report( count );
          /* Respond to the client */
                      postResult(&pd, warehouse, district, formIdPost, scratchBuffer);

      break;

    case ORDER_STATUS:
          count=scan_order_status ( argument, od.ordsts_inp );
          if (count == 0) {  /* order status data valid */

                  ret=tpcall("ORDSTS",(char *)od.ordsts_inp,send_len,
              (char **) &od.ordsts_out, (long *) recv_len, TPNOTIME);


  if(ret == -1) {
    (void) fprintf(stderr, "Can't send request to service ORDSTS\n");
    (void) fprintf(stderr, "Tperrno = %d\n", tperrno);
    tpterm();
    exit(1);
  }
    }           /* order status data invalid */
       else       formIdPost = set_error_report( count );
                      postResult(&od, warehouse, district, formIdPost, scratchBuffer);

      break;

    case DELIVERY:
          count= scan_delivery( argument, di );
          if (count == 0) {    /* delivery data valid */
             /* do a get time here */
             mattod ( time_of_day );
             time_of_day[7]= 'B'; /* set ending flag */
             getdtmstr (time_of_day, di->time, 'h');

                  ret=tpacall("DELIVRY",(char *)di,send_len, TPNOREPLY);

  if(ret == -1) {
    (void) fprintf(stderr, "Can't send request to service DELIVERY\n");
    (void) fprintf(stderr, "Tperrno = %d\n", tperrno);
    tpterm();
    exit(1);
  }
          }             /* delivery data invalid */
          else        formIdPost = set_error_report( count );
                      postResult(di, warehouse, district, formIdPost, scratchBuffer);
      break;

    case STOCK_LEVEL:
          count= scan_stock_level ( argument, s_d.stk_inp );
          if (count == 0) {  /* stock level data valid */

                  ret=tpcall("STKLVL",(char *)s_d.stk_inp, send_len,
              (char **) &s_d.stk_out, (long *) recv_len, TPNOTIME);


  if(ret == -1) {
    (void) fprintf(stderr, "Can't send request to service STKLVL\n");
    (void) fprintf(stderr, "Tperrno = %d\n", tperrno);
    tpterm();
    exit(1);
  }
}
        /* stock level  data invalid */
      else       formIdPost = set_error_report( count );
                      postResult(&s_d, warehouse, district, formIdPost, scratchBuffer);
      break;

    case NUM_FORMS:    /* invalid form number  */
       formIdPost = SIGNON_ERROR;
                      postResult(&nd, warehouse, district, formIdPost, scratchBuffer);
      break;

    default:      /* return an error if no match above */
      printf("Invalid form ID = %d", formId);
      return;

  }/* end of switch */
  inSize = outSize = contentSize = strlen(scratchBuffer);

  /* Copy header into output buffer */
  sprintf(buffer,"%s",HEADER);
  length = strlen(buffer);

  /* Convert EBCDIC result to ASCII */
  toPtr = buffer + length;
  length += inSize;
  fromPtr = scratchBuffer;

  if(iconv(toIA5,&fromPtr,&inSize,&toPtr,&outSize)<0){
    perror("\niconv() failed");
    exit(1);
  }

  /* Poke in response length */
  binToIA5(contentSize,strchr(buffer,delimiter));
```

```
  writePtr = buffer;/* set up the output function */
  writeLen = length;/* set the output length   */
  }
}

int set_error_report( int status )
{
  if ( status == 100 )
  {
      return SIGNON_ERROR;
  }
  else
  {
      return DATA_ERROR;
  }
}
```

D.7 GETDTTMSTR.C:

```
/*****************************************************************************/
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <stddef.h>
#include <math.h>
#include <ctype.h>
#include <decimal.h>
#include <recio.h>
#include <errno.h>
#include <time.h>
#include <xxfdbk.h>
#include <xxcvt.h>
#include <micomput.h>
#include <QSYSINC/MIH/MIDTTM>
#include <qwcrsval.h>
#include <qsysinc/mih/cvtch>
/*****************************************************************/
/* Function Prototypes                                           */
/*****************************************************************/
void MI_Template (_INST_Template_T1 **, _DDAT_T **, _DDAT_T **, char );

/*****************************************************************/
/* Date and time coversion pointers                              */
/*****************************************************************/
 _INST_Template_T1 *inst_t1;          /* MI template         */
 _DDAT_T   *ddat_t1 , *ddat_t2 ;      /* DDAT pointers       */
 /* Internal format for end of Gregorian timeline: Jan. 1,  0001  */
 #define GREGORIAN_TIMELINE_START 1721424
 /* Internal format for end of Gregorian timeline: Jan. 1, 10000  */
 #define GREGORIAN_TIMELINE_END   5373485
 typedef struct {                     /*  rtn error code structure */
   int bytes_prov;
   int bytes_avail;
   char except_id[7];
   char reserved[1];
   char except_data[50];
  } error_code;/* error code structure used by QUSPTRUS */
/*****************************************************************/
/*        Start                                                  */
/*****************************************************************/
getdttmstr(char * timein, char* timestamp, char type)
{

 char tmstamp[27];
 static char first = 'Y';

 if ( timein[7] == '0' )
 {
 switch ( type )
 {
    case 'd':
       memset ( timestamp, '0', 8 );/* set the null date */
    break;
    case 't':
       memset ( timestamp, '0', 6 );/* set the null date */
    break;
    case 'h':
       memset ( timestamp, '0', 8 );/* set the null date */
    break;
    case 'b':
       memset ( timestamp, '0', 14 );/* set the null date */
    break;
    case 'l':
       memcpy( &timestamp[0],/* copy hour min sec */
       "0000-00-00.00.00.00.000000\0", 27 );
    break;
    case 'm':
       memcpy( &timestamp[0],/* copy hour min sec */
       "0000-00-00 00:00:00.000000\0", 27 );/* set null string */
    break;
    case 'n':
       memcpy( &timestamp[0],/* copy hour min sec */
       "0000/00/00 00:00:00.000000\0", 27 );/* set null string */
    break;
    default:
    break;
   } /* end of switch */
 }
 else
 {
 MI_Template(&inst_t1,&ddat_t1,&ddat_t2,  'P');
 timein[7] = 0;/* clear the era flag */
 cvtts(tmstamp, timein, inst_t1);

 switch ( type )
 {
    case 'd':
       memcpy( &timestamp[4],  &tmstamp[0],  4 ); /* copy the year */
       memcpy( &timestamp[0],  &tmstamp[5],  2 ); /* copy month    */
       memcpy( &timestamp[2],  &tmstamp[8],  2 ); /* copy day      */
    break;
    case 't':
    case 'h':
       memcpy( &timestamp[0],  &tmstamp[11], 2 ); /* copy hour     */
       memcpy( &timestamp[2],  &tmstamp[14], 2 );/* copy minuites */
       memcpy( &timestamp[4],  &tmstamp[17], 2 ); /* copy secound  */
       if ( type == 'h')
       memcpy( &timestamp[6],  &tmstamp[20], 2 ); /* copy secound  */
    break;
    case 'b':
       memcpy( &timestamp[4],  &tmstamp[0],  4 ); /* copy the year */
       memcpy( &timestamp[0],  &tmstamp[5],  2 ); /* copy month    */
       memcpy( &timestamp[2],  &tmstamp[8],  2 ); /* copy days     */
       memcpy( &timestamp[8],  &tmstamp[11], 2 ); /* copy hour     */
       memcpy( &timestamp[10], &tmstamp[14], 2 );/* copy minuites */
       memcpy( &timestamp[12], &tmstamp[17], 2 ); /* copy secound  */
    break;
    case 'l':
       memcpy( &timestamp[0],  &tmstamp[0],  27 );/* copy hour min sec */
    break;
    case 'm':
    case 'n':
       memcpy(&timestamp[0],&tmstamp[5],2);        /* get month    */
       memcpy(&timestamp[3],&tmstamp[8],2);        /* get day      */
       memcpy(&timestamp[6],&tmstamp[0],4);        /* get year     */
       memcpy(&timestamp[11],&tmstamp[11],2);      /* get hours    */
       memcpy(&timestamp[14],&tmstamp[14],2);      /* get minutes  */
       memcpy(&timestamp[17],&tmstamp[17],2);      /* get seconds  */
       timestamp[10] = ' ';/* set the time seperator */
       timestamp[13] = ':';/* set the time seperator */
       timestamp[16] = ':';/* set the time seperator */
       if ( type == 'n' )
       {
         timestamp[2] = '/';/* set the date seperator */
         timestamp[5] = '/';/* set the date seperator */
       }
       else
       {
         timestamp[2] = '-';/* set the date seperator */
         timestamp[5] = '-';/* set the date seperator */
       }
    break;
    default:
    break;
 } /* end of switch */
 } /* end of else   */
}
void makemitime ( char * date, char *time, char * flag,
                  char * output )
{
  char working[27];/* the working 26 character data input  */
  char cvt_type = 'I';
  char impl_time[9] = {0x7D,0x66,0x27,0x9F,0xE4,0xF5,0x00,0x00};
 char tmstamp1[27] = "1998-07-24-13.16.55.000000";

  /* format   YYYY-MM-DDHH.MI.SS.999999   */
 /* location  012345678901234567890123456789012345  */
 /* tens      0         1         2         3    */
  memcpy ( &working[0], &date[4], 4); /* get the year */
  memcpy ( &working[5], &date[0], 2); /* get the month */
  memcpy ( &working[8], &date[2], 2); /* get the day   */
  memcpy ( &working[11], &time[0], 2); /* get the hour  */
  memcpy ( &working[14], &time[2], 2); /* get the minite */
  memcpy ( &working[17], &time[4], 2); /* get the secound */
  working[4] = '-'; /* set the dashes */
  working[7] = '-'; /* set the dashes */
  working[10] = '-'; /* set the dashes */
  working[13] = '.'; /* set the time seperator */
  working[16] = '.';/* set the porid */
  working[19] = '.';/* set the porid */
  working[26] = '\0';/* terminate the string */
  if ( flag[0] == 'H' )
  {
       memset ( &working[20], '9', 6 );/* set the value to the maximume */
  }
  else
  {
       memset ( &working[20], '0', 6 );/* set the value to the minimume */
  }
    MI_Template(&inst_t1,&ddat_t1,&ddat_t2,  cvt_type);
    /* printf ( "The time  stamp was %s\n", tmstamp1 ); */
       printf ( "The time is          %s\n", working );
    cvtts( output, working, inst_t1);
}
 /******************** MI_Template ********************************/
 /* Function: MI_Template                                         */
 /*                                                               */
 /* Description: Allocate and fill in MI instruction template used  */
 /*              in date and time conversions.                    */
 /*                                                               */
 /*****************************************************************/
void  MI_Template(_INST_Template_T1 **inst_t, _DDAT_T **ddat1,
              _DDAT_T **ddat2, char cvt_type)
{
 static char first = 'Y';
 /*****************************************************************/
 /* Date and Time conversion  (mi template)                       */
 /*****************************************************************/
  _Era_Table_T     *era_t1,   *era_t2; /* Era table pointers        */
  _Calendar_Table_T  *cal_t1,  *cal_t2; /* Calendar table pointers   */

 int                DDAT_Length, Calendar_Offset;
 int                DDAT_Size, Template_Size;
 int                DDAT_Offset1, DDAT_Offset2;
 char               inbuffer[80];     /* buffer for input century   */
 char               value[1][10]={"QCENTURY  "};
 int                offset, offset_2;/* offest to century */
 int                * offset_ptr;
  error_code err_code;/* error code varable */
 /*****************************************************************/
 if (first == 'Y')              /* First call ?                  */
 {                              /* Yes, allocate template etc.   */
    first ='N';

 DDAT_Length = sizeof(_DDAT_T)+2*(sizeof(_Calendar_Table_T))
              -sizeof(short) + sizeof(_Era_Table_T)-1;

 Calendar_Offset = offsetof(_DDAT_T, Tables)+sizeof(_Era_Table_T);

 DDAT_Size = 2*DDAT_Length +
            2*(sizeof(int)) + /* DDAT_Offset  */
            10 +              /* reserved4    */
            sizeof(short) +   /* Num_DDATS    */
            sizeof(int);      /* DDAT_Size    */
                              /* DDAT offset  */

 Template_Size = 2*DDAT_Length+offsetof(_INST_Template_T1,DDAT)
                + sizeof(int);
                              /* DDAT1 offset */
 DDAT_Offset1  = (offsetof(_INST_Template_T1,DDAT)  -
                 offsetof(_INST_Template_T1,DDAT_Size))  + sizeof(int);
                              /* DDAT2 offset */

 DDAT_Offset2  = (offsetof(_INST_Template_T1,DDAT)  -
                 offsetof(_INST_Template_T1,DDAT_Size))+sizeof(int)+DDAT_Length;

    *inst_t        = (_INST_Template_T1 *)malloc(Template_Size);

 /* Fill in Instruction Template */


 memset(*inst_t,'\0', sizeof(_INST_Template_T1));
 (* inst_t)->Template_Size= Template_Size; /* Instruction template size  */
 (* inst_t)->DDAT_1       = 1;               /* Operand 1 DDAT       */
 (* inst_t)->DDAT_2       = 2;               /* Operand 2 DDAT       */
 (* inst_t)->reserved1[0] = 0;               /* set reserved1        */
 (* inst_t)->reserved1[1] = 0;               /* set reserved1        */
 (* inst_t)->Length_1     = 26;              /* Result timestamp     */
 (* inst_t)->Length_2     = 8;               /* input mitime         */
 (* inst_t)->reserved2[0] = 0;               /* set reserved2        */
 (* inst_t)->reserved2[1] = 0;               /* set reserved2        */
 (* inst_t)->DDAT_Size       = DDAT_Size;    /* Size of DDAT list    */
 (* inst_t)->Num_DDATs       = 2;            /* Number of DDATs      */
 memset (( inst_t)->reserved3, 0, 22 );/* set the reserved values   */
 memset (( inst_t)->reserved4, 0, 10 );/* set the reserved values   */
 (* inst_t)->DDAT_Offset1[0]  = DDAT_Offset1; /* DDAT offset1        */
 *(( inst_t)->DDAT_Offset+1)= DDAT_Offset2; /* DDAT offset2          */

 *ddat1   = (_DDAT_T *)&(( inst_t)->DDAT_Offset+2);
 era_t1 = (_Era_Table_T *)&(( ddat1)->Tables); /* set era table ptr */
 cal_t1   = (_Calendar_Table_T *)((char *)*ddat1 + Calendar_Offset);
 *ddat2   = (_DDAT_T *)((char *)*ddat1 + DDAT_Length);
 era_t2    = (_Era_Table_T *)&(( ddat2)->Tables);
 cal_t2    = (_Calendar_Table_T *)((char *)*ddat2 + Calendar_Offset);

 /* Fill in DDAT1 */

 (* ddat1)->DDAT_Length = DDAT_Length;      /* Set DDAT length       */
 (* ddat1)->Format_Code =_SAA_TIMESTAMP; /* Set result format code      */
 (* ddat1)->Hour_Zone = 24;             /* set target hours            */
 (* ddat1)->Min_Zone  = 60;             /* set target minutes          */
 (* ddat1)->Calendar_Offset=Calendar_Offset;/*  Calendar offset         */
    memset (( ddat1)->reserved, 0, 6 );/* set the reserved values   */
 /* Fill in Era Table for DDAT1 */

    era_t1->Num_Elems = 1;               /* Set number of era elements  */
    era_t1->Element[0].Origin_Date = GREGORIAN_TIMELINE_START;
    era_t1->Element[0].Era_Name[0]= 'A'; /* Set era name, to ....       */
    era_t1->Element[0].Era_Name[1]= 'D'; /* AD                          */
    memset (era_t1->Element[0].reserved, 0, 12 );/* set the reserved v alues */


 /* Fill in Calendar Table for DDAT1 */
```

```
   cal_t1->Num_Elems = 2;              /* Set Calendar elements       */
   cal_t1->Element->Effect_Date     = GREGORIAN_TIMELINE_START;
   cal_t1->Element->Type            = 0x0001; /* Set element type      */
   memset(cal_t1->Element->reserved,'\0',10);  /* Initialize reserved   */
    (cal_t1->Element+1)->Effect_Date = GREGORIAN_TIMELINE_END;
    (cal_t1->Element+1)->Type  = 0;
   memset((cal_t1->Element+1)->reserved,'\0',10);

 /* Fill in DDAT2 */

 (* ddat2)->DDAT_Length = DDAT_Length;     /* Set DDAT length        */
 (* ddat2)->Format_Code =_IMPI_CLOCK; /* Set source format code      */
 (* ddat2)->Hour_Zone = 24;           /* set target hours            */
 (* ddat2)->Min_Zone  = 60;           /* set target minutes          */
 err_code.bytes_prov = 0;            /* set error reporting mode    */
 QWCRSVAL ( inbuffer, 80, 1, value, &err_code );
                                     /* the current century         */
 offset_ptr = (int *)&inbuffer[4];/* get the offset */
 offset = *offset_ptr;/* get the offset value */
 offset_2 = offset + 16;/* get the true offset */
 /* if ( inbuffer[offset_2]=='1' )          */
 /* (* ddat2)->Cur_Century = 1;   set target current century  */
 /* else */
    (* ddat2)->Cur_Century = 0;  /* set target current century  */
 (* ddat2)->Century_Div = 0;          /* set target centry devision  */
 (* ddat2)->Calendar_Offset=Calendar_Offset;/* Calendar offset       */
 (* ddat2)->Calendar_Offset = Calendar_Offset;
 memset ((* ddat2)->reserved, 0, 6 );/* set the reserved values   */

 /* Fill in Era Table for DDAT2 */

    era_t2->Num_Elems = 1;
    era_t2->Element[0].Origin_Date   = GREGORIAN_TIMELINE_START;
    era_t2->Element[0].Era_Name[0]   = 'A';
    era_t2->Element[0].Era_Name[1]   = 'D';
    memset (era_t2->Element[0].reserved, 0, 12 );/* set the reserved v alues */

 /* Fill in Calendar Table for DDAT2 */

    cal_t2->Num_Elems                = 2;
    cal_t2->Element->Effect_Date     = GREGORIAN_TIMELINE_START;
    cal_t2->Element->Type            = 0x0001;
    memset(cal_t2->Element->reserved,'\0',10);
    (cal_t2->Element+1)->Effect_Date = GREGORIAN_TIMELINE_END;
    (cal_t2->Element+1)->Type        = 0;
    memset((cal_t2->Element+1)->reserved,'\0',10);
}/* end of if (first) */
if (cvt_type == 'I')                        /* converting to mitime ?  */
{                                           /* Yes, then ....          */
   (* ddat1)->Format_Code =_IMPI_CLOCK;     /* Set source format code  */
   (* ddat2)->Format_Code =_SAA_TIMESTAMP;  /* Set source format code  */
   (* inst_t)->Length_1     = 8;            /* Result timestamp        */
   (* inst_t)->Length_2     = 26;           /* input mitime            */
}
else
{
   (* ddat1)->Format_Code =_SAA_TIMESTAMP;  /* Set source format code  */
   (* ddat2)->Format_Code =_IMPI_CLOCK;     /* Set source format code  */
   (* inst_t)->Length_1     = 26;           /* Result timestamp        */
   (* inst_t)->Length_2     = 8;            /* input mitime            */
}
}/* end of proceedure */
```

D.8 IMPORT.H:

```
/*********************************************************************/
/* Defines for parameters passed to DBLOAD                           */
/*********************************************************************/
#define FROMFILE      1
#define TOFILE        2
#define TOFILENAME    3
#define TOLIB         4
#define FROMRCD       5
#define TORCD         6
#define MTASK         7
#define TASKNBR       8
#define NBRTASKS      9
#define FTYPE        10
#define STR_DELIMIT  11
#define DELIMIT      12
#define ROW          13
#define DATFMT       14
#define DATSEP       15
#define TIMFMT       16
#define TIMSEP       17
#define DECMPT       18
/*********************************************************************/
/* Miscellaneous Defines                                             */
/*********************************************************************/
#define FALSE      0
#define TRUE     !FALSE
#define AS400   /* AS400    */
/*************************/
/* MoveField type codes  */
/*************************/
#define CHAR_GRAPH     0x00
#define VAR_CHAR_GRAPH 0x01
#define INTEGER        0x02
#define SMALLINT       0x03
#define FLOAT          0x04
#define PACKED         0x05
#define ZONED          0x06
#define DATE           0x07
#define TIME           0x08
#define TIMESTAMP      0x09
#define NUMARIC_CHAR   0x0A
/*************************/
/* Date and Time defines */
/*************************/
#define USA            0x00
#define ISO            0x01
#define EUR            0x02
#define JIS            0x03
#define MDY            0x04
#define DMY            0x05
#define YMD            0x06
#define JUL            0x07
#define HMS            0x08
#define SAA            0x09
/*********************************************************************/
/* ERRORS                                                            */
/*********************************************************************/
#define  OPEN_IMPORT         1
#define  OPEN_DBFILE         2
#define  COL_DEL_NOT_FOUND   3
#define  COLUMNS_ERROR       4
#define  FIELD_LENGTH        5
#define  STRING_DELIMIT      6
#define  NULL_ERROR          7
#define  MEM_ERROR           8
#define  MISSING_STR_DELIMIT 9
#define  STR_RECORD         10
#define  END_RECORD         11
#define  OPEN_HDRFILE       12
#define  TSKS_ERROR         13
#define  NUMERIC_ERROR      14
#define  DECIMAL_ERROR      15
#define  WRITE_ERROR        16
/*********************************************************************/
/* Common structure                                                  */
/*********************************************************************/
 typedef struct
 {
 char * colptr;                  /* Data ptr - import file records   */
 char  * inptr;                  /* Field ptr - import file records  */
 char  * outptr;                 /* Output buffer pointer            */
 char  * outstart;               /* Pointer to start of output buffer*/
 char  * decptr;                 /* Decimal point pointer            */
 char  * transptr;               /* Pointer to transaction input     */
 int   ix;                       /* Loop index                       */
 decimal(3,0) new_count;         /* New order line numbers           */
 short buflen;                   /* Import input buffer length       */
 short columnCnt;                /* Number of output columns allowed */
 short fldcnt;                   /* Current number of fields found   */
 short fldlen;                   /* Length of current input field    */
 short Blankcnt;                 /* Trailing blank count (numeric)   */
 char col_delimit;               /* Column delimiter                 */
 char row_delimit;               /* Row delimiter                    */
 char decmpt;                    /* decimal point                    */

 struct
 {
 unsigned Data  : 1;             /* Numeric field data flag          */
 } Numeric;

 char header;                    /* Looking at header data           */
 char end_trans;                 /* processing end of new_order      */
 char tran_type;                 /* transaction type flag            */
 char last_name;                 /* set when last anme was detected  */
 char cust_number;               /* set when a customer number used  */
 char tran_error;                /* transaction error flag           */
 char sign_on_error;             /* sign on sreen error              */
 } ImportParms;

/*********************************************************************/
/* Output record column descriptions                                 */
/*********************************************************************/
 typedef struct
 {
  unsigned char  fldtype;        /* Field data type                  */
  unsigned char  MoveField_code; /* Branch code for MoveField rtn    */
  int            fldlen;         /* Field length                     */
  short          precision;      /* Precision for decimal fields     */
  short          scale;          /* Scale for decimal fields         */
  short          left;           /* Data length left of decimalpoint */
  short          offset;         /* Offset to this field from start  */
                                 /* offset from ip->outstart         */
  unsigned char  number_chk;     /* Validity check flag              */
  unsigned char  skip;           /* skip saving this item            */
 } column_info;
column_info *ci;                 /* Current column_info ptr          */
column_info *ci_str;             /* Pointer to start of column_info  */
/*********************************************************************/
/* Function Prototypes           ***                                 */
/*********************************************************************/
void ImportFields(ImportParms * );
void ColRowDelimiter(ImportParms *);
void MoveField(ImportParms *);
void do_new_order(ImportParms * ip);
void do_payment(ImportParms * ip);
void do_order_status(ImportParms * ip);
void check_input_string(ImportParms * ip);/* check the input string   */
```

D.9 NEWORDSRV.C:

```
#include "common.h"

/* tpsvrinit is executed when a server is booted, before it begins
   processing requests.  It is not necessary to have this function.
   Also available is tpsvrdone (not used in this example), which is
   called at server shutdown time.
*/


   static int sd, sd2, addr=0, length, port=4000;
   static  pid_t                        pid;
   int rc=670, remain=0;
   error_code err_code;
   data_area data data_area_input;
   int mod_number=0;
   char clnt_ip1[13], clnt_ip2[13];
   char srvr_ip1[13], srvr_ip2[13];
   char cmd[40] = "DLYJOB DLY(3600)";

tpsvrinit(int argc, char *argv[])
{
        /* Some compilers warn if argc and argv aren't used. */
        argc = argc;
        argv = argv;

        /* userlog writes to the central TUXEDO message log  */
        userlog("Welcome to the tpcc server");
   err_code.bytes_prov = 0;
   QWCRDTAA ( &data_area_input, 46, modn_dtaara, 1, 1, &err_code );
   mod_number = atoi(data_area_input.data_block);
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 1, 11, &err_code );
   memcpy( clnt_ip1, &data_area_input.data_block, 11 );
   clnt_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 13, 11, &err_code );
   memcpy( clnt_ip2, &data_area_input.data_block, 11 );
   clnt_ip2[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 1, 11, &err_code );
   memcpy( srvr_ip1, &data_area_input.data_block, 11 );
   srvr_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 13, 11, &err_code );
   memcpy( srvr_ip2, &data_area_input.data_block, 11 );
   srvr_ip2[12] = '\0';

    pid = getpid();
   remain = pid % mod_number;
   if(remain == 0) {
      addr=inet_addr(clnt_ip1);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip1);
      sd2=bConnect(sd,addr,port);
    }
   else {
      addr=inet_addr(clnt_ip2);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip2);
      sd2=bConnect(sd,addr,port);
    }
        return(0);
}

/* This function performs the actual service requested by the client.
   Its argument is a structure containing among other things a pointer
   to the data buffer, and the length of the data buffer.
*/


     /*       NEW ORDER      */

NEWORDER(TPSVCINFO *rqst)
{


    if(send(sd, rqst->data, 230, 0)<0) {
      perror("\nsend() failed");
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }

    memset(rqst->data, 'V', 670);

    rc=recv(sd, rqst->data, 670,0);

    if(rc<=0) {
      perror("\nrecv[0]() failed");
```

```
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }


    /* Return the transformed buffer to the  requestor. */
    tpreturn(TPSUCCESS, 0, rqst->data, rc, 0);
}
```

D.10 ORDSTSSRV.C:

```
#include "common.h"

/* tpsvrinit is executed when a server is booted, before it begins
   processing requests.  It is not necessary to have this function.
   Also available is tpsvrdone (not used in this example), which is
   called at server shutdown time.
*/


   static int sd, sd2, addr=0, length, port=6000;
   static  pid_t                          pid;
   int rc=670, remain=0;
   error_code err_code;
   data_area_data data_area_input;
   int mod_number=0;
   char clnt_ip1[13], clnt_ip2[13];
   char srvr_ip1[13], srvr_ip2[13];
   char cmd[40] = "DLYJOB DLY(3600)";


tpsvrinit(int argc, char *argv[])
{
        /* Some compilers warn if argc and argv aren't used. */
        argc = argc;
        argv = argv;

        /* userlog writes to the central TUXEDO message log  */
        userlog("Welcome to the tpcc server");
   err_code.bytes_prov = 0;
   QWCRDTAA ( &data_area_input, 46, modn_dtaara, 1, 1, &err_code );
   mod_number = atoi(data_area_input.data_block);
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 1, 11, &err_code );
   memcpy( clnt_ip1, &data_area_input.data_block, 11 );
   clnt_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 13, 11, &err_code );
   memcpy( clnt_ip2, &data_area_input.data_block, 11 );
   clnt_ip2[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 1, 11, &err_code );
   memcpy( srvr_ip1, &data_area_input.data_block, 11 );
   srvr_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 13, 11, &err_code );
   memcpy( srvr_ip2, &data_area_input.data_block, 11 );
   srvr_ip2[12] = '\0';

    pid = getpid();
   remain = pid % mod_number;
   if(remain == 0) {
      addr=inet_addr(clnt_ip1);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip1);
      sd2=bConnect(sd,addr,port);
    }
   else {
      addr=inet_addr(clnt_ip2);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip2);
      sd2=bConnect(sd,addr,port);
    }
        return(0);
}

/* This function performs the actual service requested by the client.
   Its argument is a structure containing among other things a pointer
   to the data buffer, and the length of the data buffer.
*/


     /*     ORDER STATUS     */

ORDSTS(TPSVCINFO *rqst)
{


    if(send(sd, rqst->data, 230, 0)<0) {
      perror("\nsend() failed");
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }

    memset(rqst->data, 'V', 670);

    rc=recv(sd, rqst->data, 670,0);

    if(rc<=0) {
      perror("\nrecv[0]() failed");
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }


    /* Return the transformed buffer to the  requestor. */
    tpreturn(TPSUCCESS, 0, rqst->data, rc, 0);
}
```

D.11 PAYMNTSRV.C:

```
#include "common.h"

/* tpsvrinit is executed when a server is booted, before it begins
   processing requests.  It is not necessary to have this function.
   Also available is tpsvrdone (not used in this example), which is
   called at server shutdown time.
*/


   static int sd, sd2, addr=0, length, port=5000;
   static  pid_t                          pid;
   int rc=670, remain=0;
   error_code err_code;
   data_area_data data_area_input;
   int mod_number=0;
   char clnt_ip1[13], clnt_ip2[13];
   char srvr_ip1[13], srvr_ip2[13];
   char cmd[40] = "DLYJOB DLY(3600)";

tpsvrinit(int argc, char *argv[])
{
        /* Some compilers warn if argc and argv aren't used. */
        argc = argc;
        argv = argv;

        /* userlog writes to the central TUXEDO message log  */
        userlog("Welcome to the tpcc server");
   err_code.bytes_prov = 0;
   QWCRDTAA ( &data_area_input, 46, modn_dtaara, 1, 1, &err_code );
   mod_number  = atoi(data_area_input.data_block);
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 1, 11, &err_code );
   memcpy( clnt_ip1, &data_area_input.data_block, 11 );
   clnt_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 13, 11, &err_code );
   memcpy( clnt_ip2, &data_area_input.data_block, 11 );
   clnt_ip2[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 1, 11, &err_code );
   memcpy( srvr_ip1, &data_area_input.data_block, 11 );
   srvr_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 13, 11, &err_code );
   memcpy( srvr_ip2, &data_area_input.data_block, 11 );
   srvr_ip2[12] = '\0';

    pid = getpid();
   remain = pid % mod_number;
   if(remain == 0) {
      addr=inet_addr(clnt_ip1);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip1);
      sd2=bConnect(sd,addr,port);
    }
   else {
      addr=inet_addr(clnt_ip2);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip2);
      sd2=bConnect(sd,addr,port);
    }
        return(0);
}

/* This function performs the actual service requested by the client.
   Its argument is a structure containing among other things a pointer
   to the data buffer, and the length of the data buffer.
*/


     /*     PAYMENT          */

PAYMNT(TPSVCINFO *rqst)
{


    if(send(sd, rqst->data, 230, 0)<0) {
      perror("\nsend() failed");
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }

    memset(rqst->data, 'V', 670);

    rc=recv(sd, rqst->data, 670,0);

    if(rc<=0) {
      perror("\nrecv[0]() failed");
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }

    /* Return the transformed buffer to the  requestor. */
    tpreturn(TPSUCCESS, 0, rqst->data, rc, 0);
}
```

D.12 POSTRESULT.C:

```
#include "Common.h"

#define DATA_ERROR 30
#define SIGNON_ERROR 31
/*********************************************************************/
/*                                                                   */
/*       External functions                                          */
/*                                                                   */
/*********************************************************************/
int getdttmstr(char * timein, char* timestamp, char type);

/*==================================================================*/
/*  Internal procedures                                             */
/*                                                                  */
/*==================================================================*/


char *newOrderResult = {
  "<html>"
    "<head>"
    "<title>TPC-C New Order</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"3\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C New Order</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d District: %2.2d"
    "                    "
    "Date: %s<br>"
    "Customer:  %4.4d  Name: %15s%c  Credit: %c%c    Disc: %5.2D(5,2)<br>"
    "Order Number: %8d  Number of Lines: %2D(3,0)        W_tax: %4.2D(5,2)"
    "  D_tax:  %4.2D(5,2)<br><br>"
    "<p>"
    "<table>"
    "<tr>"
    "<th>Supp_w  </th>"
    "<th>Item_Id  </th>"
    "<th Colspan=75>Item Name                  </th>"
    /*   1234567890123456789012345 */
    "                    "
    "<th>              </th>"
    "<th>Qty  </th>"
    "<th>Stock  </th>"
    "<th>B/G  </th>"
    "<th Colspan=35>Price    </th>"
    "<th>Amount</th>"
    "</tr>"
    "</table>"
};

char *newOrderError = {
  "<html>"
    "<head>"
    "<title>TPC-C New Order Error</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"3\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C New Order Error</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d District: %2.2d"
    "                    "
    "Date: %s<br>"
    "Customer:  %4.4d  <br>"
    "<p>"
    "<table>"
    "<tr>"
    "<th>Supp_w  </th>"
    "<th>Item_Id  </th>"
    "<th>              </th>"
    "<th>Qty  </th>"
    "</tr>"
    "</table>"
};

char *newOrderTail = {
  "Execution Status: %24s            Total:  $%8.2D(11,2)<br>"
  "<br><br>"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
```

```
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *paymentResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Payment</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"4\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Payment</h1></center>"
    "<pre>"
    "Date: %s<br><br>"
    "<br>Warehouse: %5.5d                          District: %2.2d"
    "<br>%19s%c              /* wrhs address 1  */
    "                   "    /* gap   */
    "    %19s%c              /* dstrct address 1  */
    "<br>%19s%c              /* wrhs address 2  */
    "                   "    /* gap   */
    "    %19s%c              /* dstrct address 2  */
    "<br>%19s%c              /* wrhs city        */
    "    %c%c               /* wrhs state two characters  */
    "    %8s%c               /* wrhs zip         */
    "    %19s%c              /* dstrct city       */
    "    %c%c               /* dstrct state two characters */
    "    %8s%c               /* dstrct zip        */
    "<br>                                                                  "
    "<br>Customer: %4.4d  Cust-Warehouse: %5.5d  Cust-District: %2.2d"
    "<br>Name: %15s%c %c%c %15s%c      Since:  %9s "
    "<br>      %19s%c                  Credit: %c%c "
    "<br>      %19s%c                  %Disc: %2.2D(5,2)"
    "<br>      %19s%c  %c%c %10s%c   Phone: %17s%c"
    "<br>"
    "<br>Amount Paid:   $%6.2D(7,2)  New Cust-Balance: $%8.2D(13,2)"
    "<br>Credit Limit:  $%10.2D(13,2) "
    "<br>"
    "<br>Cust-data: %49s%c"
    "<br>           %49s%c"
    "<br>           %49s%c"
    "<br>           %49s%c"
    "<br><br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *paymentError = {
  "<html>"
    "<head>"
    "<title>TPC-C Payment Error</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"4\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Invalid payment data</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d                          District: %2.2d"
    "<br>Customer:  %4.4d   Customer-Warhouse %4.4d  Customer-District: %2.2d"
    "<br>Name:    %15s%c  Type: %c"
    "Amount Paid: %9D(7,2)"
    "<br><br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *ordstsResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Order-Status</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"5\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Order-Status</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d      District: %2.2d"
    "<br>Customer: %4.4d  "
    "    Name: %15s%c"
    "    %c%c %15s%c"
    "<br>Cust-Balance: $%7.2D(13,2)"
    "<br>                   "    /* gap   */
    "<br>Order-Number: %8.2d"
    "    Entry-Date: %s"
    "    Carrier-Number: %c%c"
    "<br><br>"
    "<table>"
    "<tr>"
    "<th>Supp-w  </th>"
    "<th>Item-Id  </th>"
    "<th>Qty     </th>"
    "<th>Amount</th>"
    "<th>Delivery-Date</th>"
    "</tr>"
    "</table>"
    "<br><br>"
};

char *ordstsTail = {
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *ordstsError = {
  "<html>"
    "<head>"
    "<title>TPC-C Order-Status Error</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"5\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Invalid order status data</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d                          District: %2.2d"
    "<br>Customer:  %4.4d"
    "<br>Name:   %15s%c Type: %c"
    "<br><br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *deliveryResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Delivery</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"6\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Delivery</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d"
    "<br>                  "
    "<br>Carrier Number: %c%c"
    "<br>                  "
    "<br>Execution Status: Delivery has been queued"
    "<br><br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *stklvlResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Stock Level</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"7\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1>TPC-C Stock Level</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d      District: %2.2d"
    "<br>                  "
    "<br>Stock Level Threshold: %2.2d"
    "<br>                  "
    "<br>Low Stock: %3.3d<br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *signonResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Sign On Error in CGI</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"1\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"-2\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"0\">"
    "<h1>TPC-C Sign error detected!</h1>"
    "<center><h2>Please sign on again</h2></center>"
    "<center><h2>the signon inforation has been lost.</h2></center>"
    "Warehouse ID <INPUT NAME=\"w_id\" SIZE=5 MAXLENGTH=5><BR>"
    "District ID <INPUT NAME=\"d_id\" SIZE=2 MAXLENGTH=2><BR>"
    "<HR>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Submit\">"
    "</body>"
    "</HTML>"
};

char *stklvlError = {
  "<html>"
    "<head>"
    "<title>TPC-C Stock Level Error</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"7\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1>TPC-C Stock Level Error</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d      District: %2.2d"
    "<br>                  "
    "<br>Stock Level Threshold: %2.2d"
    "<br>                  "
    "<br>Invalid stock level input<br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *dataErrorResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Data Error in CGI</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"2\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<h1>TPC-C Data entry error detected!</h1>"
    "<center><h2>Please select a tranaction from the menu</h2></center>"
    "<center><h2>or select Back and correct the data</h2></center>"
    "<br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</body>"
    "</HTML>"
};


int postResult(void *res_buf, char * warehouse, char * district,
               int formIDPost, char * scratchBuffer )
{
  int           i;
```

```
unsigned char *toPtr;/* storeage location                    */
char          wzip_tag;/* ending character for warehouse zip   */
char          dzip_tag;/* ending character for district zip    */
char          czip_tag;/* ending character for customer zip    */
char          clast_tag;/* ending of customers last name       */
char          cfirst_tag;/* ending of customers first name     */
char          waddress1_tag;/* ending of warehouse address one */
char          waddress2_tag;/* ending of warehouse address two */
char          daddress1_tag;/* ending of district address one  */
char          daddress2_tag;/* ending of district address two  */
char          wcity_tag;/* ending of warehouse city            */
char          dcity_tag;/* ending of district city             */
char          cphone_tag;/* ending of customers last name      */
char          caddress1_tag;/* ending for customer address 1   */
char          caddress2_tag;/* ending for customer address 1   */
char          ccity_tag;/* ending for customer city            */
char          cdata1_tag;/* ending for customer data 1         */
char          cdata2_tag;/* ending for customer data 2         */
char          cdata3_tag;/* ending for customer data 3         */
char          cdata4_tag;/* ending for customer data 4         */
char          item_name_tag;/* last character of the item name */
char          dlv_time[27];/* time string used for convertion       */
char          time[27];    /* converted output return 27 characters */
char          cl_time[27]; /* converted output return               */
_MI_Time      time_of_day; /* time of dat for new order transaction */
char          cmd[20];
char          trcoffcmd[40];
new_order_display      *t;
payment_display        *p;
order_status_display   *o;
dlv_input              *d;
stock_display          *s;

#pragma exception_handler(ME,0,0,_C2_ALL,_CTLA_HANDLE,"MCH1202")

switch(formIdPost) {
  case NEW_ORDER:
  t = ( new_order_display *) res_buf;
  /* conver ordttm to date */
  /* getdtmstr( time, t->new_out->oenttm,   ) */
  mattod ( time_of_day);
  time_of_day[7] = 'B';/* set the period flag  */
  getdtmstr ( time_of_day, time, 'm' );
  /* returns a 27 character null terminated string  */
  /* remove the mirosecound */
  time[19] = '\0'; /* terminate the string */
  if (t->new_out->neword_result == 'G')
  {
    clast_tag = t->new_out->clast[15];/* get last character */
    t->new_out->clast[15]= '\0';/* terminate string */
    sprintf(scratchBuffer,newOrderResult,
            warehouse,
            district,
            t->new_inp->cwid,
            t->new_inp->cdid,
            time,
            t->new_inp->cid,
            t->new_out->clast, clast_tag,
            t->new_out->ccredt[0],
            t->new_out->ccredt[1],
            t->new_out->cdct,
            t->new_out->oid,
            t->new_inp->number_of_items,
            t->new_out->wtax,
            t->new_out->dtax
            );

      toPtr = scratchBuffer + strlen(scratchBuffer);
      for (i=0; i<t->new_inp->number_of_items; ++i){
      item_name_tag = t->new_out->output_line[i].output_item_name[23];
      t->new_out->output_line[i].output_item_name[23]='\0';/* terminate */
      sprintf(toPtr,
      "%5d %6d   %23s%c %3D(3,0)  %3d   %c   $%6.2D(5,2)  $%7.2D(7    ,2)<br>",
              t->new_inp->input_line[i].olspwh,
              t->new_inp->input_line[i].oliid,
              t->new_out->output_line[i].output_item_name,  item_name_tag,
              t->new_inp->input_line[i].olqty,
              t->new_out->output_line[i].output_stqty,
              t->new_out->output_line[i].output_borg,
              t->new_out->output_line[i].output_item_price,
              t->new_out->output_line[i].output_olamnt);
        toPtr += strlen(toPtr);
      }
      t->execution_status[0] = '\0';/* make blank */
    }
    else
    {
          sprintf(scratchBuffer,newOrderError,
            warehouse,
            district,
             t->new_inp->cwid,
             t->new_inp->cdid,
             time,
             t->new_inp->cid
            );

       toPtr = scratchBuffer + strlen(scratchBuffer);
       for (i=0; i<t->new_inp->number_of_items; ++i){
           sprintf(toPtr,
                " %5d  %6d  %3D(3,0)<br>",
                t->new_inp->input_line[i].olspwh,
                t->new_inp->input_line[i].oliid,
                t->new_inp->input_line[i].olqty );
           toPtr += strlen(toPtr);
       }
    t->new_out->totamt = 0.0;
    if (t->new_out->neword_result == 'I')
        strcpy( t->execution_status, "INVALID INPUT");/* set to ID    */
    else
        strcpy( t->execution_status, "Item number is not valid ");

 } /* end of the else */

    sprintf(toPtr,newOrderTail,
            t->execution_status,
            t->new_out->totamt);

    break;

  case PAYMENT:
  p = ( payment_display *) res_buf;
    /* terminate output strings */
    if(( p->pay_out->output_fmt_num[0] != '7' )||
       ( p->pay_out->output_fmt_num[1] != '7' ))
    {
         waddress1_tag = p->pay_out->waddr1[19];
         daddress1_tag = p->pay_out->daddr1[19];
         waddress2_tag = p->pay_out->waddr2[19];
         daddress2_tag = p->pay_out->daddr2[19];
         wcity_tag     = p->pay_out->wcity[19];
         dcity_tag     = p->pay_out->dcity[19];
         clast_tag     = p->pay_out->clast[15];
         cfirst_tag    = p->pay_out->cfirst[15];
         caddress1_tag = p->pay_out->caddr1[19];
         caddress2_tag = p->pay_out->caddr2[19];
         ccity_tag     = p->pay_out->ccity[19];
         cphone_tag    = p->pay_out->cphone[15];
         cdata1_tag    = p->pay_out->cdat1[49];
         cdata2_tag    = p->pay_out->cdat2[49];
         cdata3_tag    = p->pay_out->cdat3[49];
         cdata4_tag    = p->pay_out->cdat4[49];
         p->pay_out->waddr1[19]='\0';
         p->pay_out->daddr1[19]='\0';
         p->pay_out->waddr2[19]='\0';
         p->pay_out->daddr2[19]='\0';
         p->pay_out->wcity[19]='\0';
         p->pay_out->dcity[19]='\0';
         p->pay_out->clast[15]='\0';
         p->pay_out->cfirst[15]='\0';
         p->pay_out->caddr1[19]='\0';
         p->pay_out->caddr2[19]='\0';
         p->pay_out->ccity[19]='\0';
         p->pay_out->cphone[15]='\0';
         p->pay_out->cdat1[49]='\0';
         p->pay_out->cdat2[49]='\0';
         p->pay_out->cdat3[49]='\0';
         p->pay_out->cdat4[49]='\0';
         wzip_tag = p->pay_out->wzip[8];/* copy zip */
         dzip_tag = p->pay_out->dzip[8];/* copy zip */
         czip_tag = p->pay_out->czip[8];/* copy zip */
         p->pay_out->wzip[8] = '\0';/* terminate warehouse zip */
         p->pay_out->dzip[8] = '\0';/* terminate district zip  */
         p->pay_out->czip[8] = '\0';/* terminate customer zip  */
         /* convert time to string    */
         /* inputs                    */
         /* p->pay_out->cldate,       */
         getdttmstr ( p->pay_out->cldate, cl_time, 'm' );
         /* returns a 27 character null terminated string  */
         /* remove the mirosecound */
         cl_time[19] = '\0'; /* terminate the string */
         /* p->pay_out->time_of_day,  */
         /* output cldate and time    */
         getdttmstr ( p->pay_out->time_of_day, time, 'm' );
         /* returns a 27 character null terminated string  */
         /* remove the mirosecound */
         time[19] = '\0'; /* terminate the string */
         sprintf(scratchBuffer,paymentResult,
            warehouse,
            district,
            time,
            p->pay_inp->wid,
            p->pay_inp->did,
            p->pay_out->waddr1, waddress1_tag,
            p->pay_out->daddr1, daddress1_tag,
            p->pay_out->waddr2, waddress2_tag,
            p->pay_out->daddr2, daddress2_tag,
            p->pay_out->wcity,  wcity_tag,
            p->pay_out->wstate[0],
            p->pay_out->wstate[1],
            p->pay_out->wzip, wzip_tag,
            p->pay_out->dcity, dcity_tag,
            p->pay_out->dstate[0],
            p->pay_out->dstate[1],
            p->pay_out->dzip,  dzip_tag,
            p->pay_out->cid,
            p->pay_inp->cwid,
            p->pay_inp->cdid,
            p->pay_out->clast, clast_tag,
            p->pay_out->cinit[0],
            p->pay_out->cinit[1],
            p->pay_out->cfirst, cfirst_tag,
            cl_time,
            p->pay_out->caddr1, caddress1_tag,
            p->pay_out->ccredt[0],
            p->pay_out->ccredt[1],
            p->pay_out->caddr2, caddress2_tag,
            p->pay_out->cdct,
            p->pay_out->ccity, ccity_tag,
            p->pay_out->cstate[0],
            p->pay_out->cstate[1],
            p->pay_out->czip, czip_tag,
            p->pay_out->cphone, cphone_tag,
            p->pay_inp->amount,
            p->pay_out->cbal,
            p->pay_out->ccrdlm,
            p->pay_out->cdat1, cdata1_tag,
            p->pay_out->cdat2, cdata2_tag,
            p->pay_out->cdat3, cdata3_tag,
            p->pay_out->cdat4, cdata4_tag
            );
    }
    else
    {
       clast_tag = p->pay_inp->clast[15];
       p->pay_inp->clast[15]  = '\0';
       sprintf(scratchBuffer,paymentError,
            warehouse,
            district,
               p->pay_inp->wid,
               p->pay_inp->did,
               p->pay_inp->cid,
               p->pay_inp->cwid,
               p->pay_inp->cdid,
               p->pay_inp->clast, clast_tag,
               p->pay_inp->payment_type,
               p->pay_inp->amount );
    }
    break;

  case ORDER_STATUS:
  o = ( order_status_display *) res_buf;
  if (( o->ordsts_out->ordsts_fmt_num[0]!='6')||
      ( o->ordsts_out->ordsts_fmt_num[1]!='2'))
  {
  /* convert time       o->ordsts_out->oettod,           */
  /* output is in time                                   */
    getdttmstr ( o->ordsts_out->oettod, time, 'm' );
    /* returns a 27 character null terminated string  */
    /* remove the mirosecound */
    time[19] = '\0'; /* terminate the string */
  /* set temination for the customer first and last name  */
    clast_tag = o->ordsts_out->clast[15];
    cfirst_tag = o->ordsts_out->cfirst[15];
    o->ordsts_out->clast[15]  = '\0';
    o->ordsts_out->cfirst[15]  = '\0';
    if ( o->ordsts_out->ocarid[0] == '\0' )
      o->ordsts_out->ocarid[0]  = ' ';
    if ( o->ordsts_out->ocarid[1] == '\0' )
      o->ordsts_out->ocarid[1]  = ' ';
    sprintf(scratchBuffer,ordstsResult,
            warehouse,
            district,
            o->ordsts_inp->wid,
            o->ordsts_inp->did,
            o->ordsts_out->ocid,
            o->ordsts_out->clast, clast_tag,
            o->ordsts_out->cinit[0],
            o->ordsts_out->cinit[1],
            o->ordsts_out->cfirst, cfirst_tag,
            o->ordsts_out->cbal,
            o->ordsts_out->oid,
            time, /* o->ordsts_out->oenttm, */
            o->ordsts_out->ocarid[0],
            o->ordsts_out->ocarid[1]
            );

    toPtr = scratchBuffer + strlen(scratchBuffer);
    for (i=0; i<o->ordsts_out->olnenbr; ++i){
    /* conver orderline deliver time to time of day  */
    /*                                               */
    /* o->ordsts_out->olineinfo[i].do_oldlvl         */
    /* output as dlv_time  char 15 output array      */
    /*  conver dlv_time to date time string          */
    getdttmstr ( o->ordsts_out->olineinfo[i].do_oldlvl, dlv_time, 'm' );
    /* returns a 27 character null terminated string  */
    /* remove the mirosecound */
    dlv_time[19] = '\0'; /* terminate the string  */
      sprintf(toPtr," %5d     %6d %2s %2d %6.2D(7,2)  %14s<br>",
              o->ordsts_out->olineinfo[i].do_olspwh,
              o->ordsts_out->olineinfo[i].do_oliid,
              SPACE,
              o->ordsts_out->olineinfo[i].do_olqty,
              o->ordsts_out->olineinfo[i].do_olamnt,
              dlv_time );
      toPtr += strlen(toPtr);
    }

    sprintf(toPtr,ordstsTail);
```

```
      }
      else
      {
          clast_tag = o->ordsts_inp->clast[15];
          o->ordsts_inp->clast[15] = '\0';
          sprintf(scratchBuffer,ordstsError,
                  warehouse,
                  district,
                  o->ordsts_inp->wid,
                  o->ordsts_inp->did,
                  o->ordsts_inp->cid,
                  o->ordsts_inp->clast, clast_tag,
                  o->ordsts_inp->ordsts_type );
      }

      break;

    case DELIVERY:
    d = ( dlv_input *) res_buf;
      sprintf(scratchBuffer,deliveryResult,
              warehouse,
              district,
              d->wid,
              d->carrier[0],
              d->carrier[1]
              );
      break;

    case STOCK_LEVEL:
    s = ( stock_display *) res_buf;
    if ( s->stk_out->result!='I')
    {
      sprintf(scratchBuffer,stklvlResult,
              warehouse,
              district,
              s->stk_inp->wid,
              s->stk_inp->did,
              s->stk_inp->threshold,
              s->stk_out->blwstk
              );
      }
      else
      {
      sprintf(scratchBuffer,stklvlError,
              warehouse,
              district,
              s->stk_inp->wid,
              s->stk_inp->did,
              s->stk_inp->threshold
              );
      }
      break;

    case SIGNON_ERROR:
      sprintf(scratchBuffer,signonResult );
      break;

    case DATA_ERROR:
      sprintf(scratchBuffer,dataErrorResult,
              warehouse, district );
      break;

    default:
      printf("postResult: Invalid form ID = %d", formIdPost );
      return (-1);
      break;
  } /* end of switch */


 #pragma disable_handler

  return 0;
     ME:
   memcpy(trcoffcmd, "TRCINT SET(*HOLD) TRCTBL(TPCCTRC)", 40);
   trcoffcmd[40] = '\0';
              system(trcoffcmd);
              memcpy(cmd,"DLYJOB DLY(3600)", 20);
              cmd[20] = '\0';
              system(cmd);
}
```

D.13 SCANINPUT.C:

```
#include "Common.h"

#define DATA_ERROR 30
#define SIGNON_ERROR 31
/*********************************************************************/
/*                                                                   */
/*       External functions                                          */
/*                                                                   */
/*********************************************************************/
int getdttmstr(char * timein, char* timestamp, char type);

/*==================================================================*/
/*  Internal procedures                                             */
/*                                                                  */
/*==================================================================*/



char *newOrderResult = {
  "<html>"
    "<head>"
    "<title>TPC-C New Order</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"3\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C New Order</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d District: %2.2d"
    "                                    "
    "Date: %s<br>"
    "Customer:  %4.4d  Name: %15s%c  Credit: %c%c    Disc: %5.2D(5,2)<br>"
    "Order Number: %8d  Number of Lines: %2D(3,0)        W_tax: %4.2D(5,2)"
    "    D_tax:  %4.2D(5,2)<br><br>"
    "<p>"
    "<table>"
    "<tr>"
    "<th>Supp_w  </th>"
    "<th>Item_Id  </th>"
    "<th Colspan=75>Item Name                    </th>"
    /*   123456789012345678901234 5 */
    "                                                  "
    "<th>             </th>"
    "<th>Qty  </th>"
    "<th>Stock  </th>"
    "<th>B/G  </th>"
    "<th Colspan=35>Price    </th>"
    "<th>Amount</th>"
    "</tr>"
    "</table>"
};

char *newOrderError = {
  "<html>"
    "<head>"
    "<title>TPC-C New Order Error</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"3\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C New Order Error</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d District: %2.2d"
    "                                    "
    "Date: %s<br>"
    "Customer:  %4.4d  <br>"
    "<p>"
    "<table>"
    "<tr>"
    "<th>Supp_w  </th>"
    "<th>Item_Id  </th>"
    "<th>             </th>"
    "<th>Qty  </th>"
    "</tr>"
    "</table>"
};

char *newOrderTail = {
  "Execution Status: %24s            Total:  $%8.2D(11,2)<br>"
  "<br><br>"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
  "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *paymentResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Payment</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"4\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Payment</h1></center>"
    "<pre>"
    "Date: %s<br><br>"
    "<br>Warehouse: %5.5d                          District: %2.2d"
    "<br>%19s%c"             /* wrhs address 1  */
    "                    "    /* gap   */
    "    %19s%c"             /* dstrct address 1  */
    "<br>%19s%c"             /* wrhs address 2  */
    "                    "    /* gap   */
    "    %19s%c"             /* dstrct address 2  */
    "<br>%19s%c"             /* wrhs city        */
    "    %c%c"              /* wrhs state two characters  */
    "    %8s%c"              /* wrhs zip         */
    "    %19s%c"             /* dstrct city      */
    "    %c%c"              /* dstrct state two characters */
    "    %8s%c"              /* dstrct zip       */
    "<br>                                                    "
    "<br>Customer: %4.4d  Cust-Warehouse: %5.5d  Cust-District: %2.2d"
    "<br>Name: %15s%c %c%c %15s%c      Since:  %9s "
    "<br>      %19s%c                  Credit: %c%c  "
    "<br>      %19s%c                  %Disc: %2.2D(5,2)"
    "<br>      %19s%c  %c%c %10s%c   Phone: %17s%c"
    "<br>"
    "<br>Amount Paid:   $%6.2D(7,2)  New Cust-Balance: $%8.2D(13,2)"
    "<br>Credit Limit:  $%10.2D(13,2) "
    "<br>"
    "<br>Cust-data: %49s%c"
    "<br>           %49s%c"
    "<br>           %49s%c"
    "<br>           %49s%c"
    "<br><br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *paymentError = {
  "<html>"
    "<head>"
    "<title>TPC-C Payment Error</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"4\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Invalid payment data</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d                          District: %2.2d"
    "<br>Customer:  %4.4d   Customer-Warhouse %4.4d  Customer-District: %2.2d"
    "<br>Name:   %15s%c  Type: %c"
    "Amount Paid: %9D(7,2)"
    "<br><br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *ordstsResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Order-Status</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"5\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Order-Status</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d      District: %2.2d"
    "<br>Customer: %4.4d  "
    "    Name: %15s%c"
    "    %c%c %15s%c"
    "<br>Cust-Balance: $%7.2D(13,2)"
    "<br>                    "    /* gap   */
    "<br>Order-Number: %8.2d"
    "    Entry-Date: %s"
    "    Carrier-Number: %c%c"
    "<br><br>"
    "<table>"
    "<tr>"
    "<th>Supp-w  </th>"
    "<th>Item-Id  </th>"
    "<th>Qty     </th>"
    "<th>Amount</th>"
    "<th>Delivery-Date</th>"
    "</tr>"
    "</table>"
    "<br><br>"
};

char *ordstsTail = {
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
```

```
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *ordstsError = {
  "<html>"
    "<head>"
    "<title>TPC-C Order-Status Error</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"5\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Invalid order status data</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d                                  District: %2.2d"
    "<br>Customer:  %4.4d"
    "<br>Name:    %15s%c Type: %c"
    "<br><br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};


char *deliveryResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Delivery</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"6\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1> TPC-C Delivery</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d"
    "<br>                  "
    "<br>Carrier Number: %c%c"
    "<br>                  "
    "<br>Execution Status: Delivery has been queued"
    "<br><br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *stklvlResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Stock Level</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"7\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1>TPC-C Stock Level</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d      District: %2.2d"
    "<br>                  "
    "<br>Stock Level Threshold: %2.2d"
    "<br>                  "
    "<br>Low Stock: %3.3d<br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *signonResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Sign On Error in CGI</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"1\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"-2\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"0\">"
    "<h1>TPC-C Sign error detected!</h1>"
    "<center><h2>Please sign on again</h2></center>"
    "<center><h2>the signon inforation has been lost.</h2></center>"
    "Warehouse ID <INPUT NAME=\"w_id\" SIZE=5 MAXLENGTH=5><BR>"
    "District ID <INPUT NAME=\"d_id\" SIZE=2 MAXLENGTH=2><BR>"
    "<HR>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"Submit\">"
    "</body>"
    "</HTML>"
};

char *stklvlError = {
  "<html>"
    "<head>"
    "<title>TPC-C Stock Level Error</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"7\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<center><h1>TPC-C Stock Level Error</h1></center>"
    "<pre>"
    "<br>Warehouse: %5.5d      District: %2.2d"
    "<br>                  "
    "<br>Stock Level Threshold: %2.2d"
    "<br>                  "
    "<br>Invalid stock level input<br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</pre>"
    "</body>"
    "</HTML>"
};

char *dataErrorResult = {
  "<html>"
    "<head>"
    "<title>TPC-C Data Error in CGI</title>"
    "</head>"
    "<body>"
    "<FORM ACTION=tpcc.dll METHOD=\"GET\">"
  "<INPUT TYPE=\"hidden\" NAME=\"FORMID\" VALUE=\"2\">"
  "<INPUT TYPE=\"hidden\" NAME=\"TERMID\" VALUE=\"%s\">"
  "<INPUT TYPE=\"hidden\" NAME=\"SYNCID\" VALUE=\"%s\">"
    "<h1>TPC-C Data entry error detected!</h1>"
    "<center><h2>Please select a tranaction from the menu</h2></center>"
    "<center><h2>or select Back and correct the data</h2></center>"
    "<br>"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..NewOrder..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Payment..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Delivery..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Order-Status..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Stock-Level..\">"
    "<INPUT TYPE=\"submit\" NAME=\"CMD\" VALUE=\"..Exit..\">"
    "</body>"
    "</HTML>"
};


int postResult(void *res_buf, char * warehouse, char * district,
               int formIdPost, char * scratchBuffer )
{
  int           i;
  unsigned char *toPtr;/* storeage location                      */
  char          wzip_tag;/* ending character for warehouse zip   */
  char          dzip_tag;/* ending character for district zip    */
  char          czip_tag;/* ending character for customer zip    */
  char          clast_tag;/* ending of customers last name       */
  char          cfirst_tag;/* ending of customers first name     */
  char          waddress1_tag;/* ending of warehouse address one */
  char          waddress2_tag;/* ending of warehouse address two */
  char          daddress1_tag;/* ending of district address one  */
  char          daddress2_tag;/* ending of district address two  */
  char          wcity_tag;/* ending of warehouse city            */
  char          dcity_tag;/* ending of district city             */
  char          cphone_tag;/* ending of customers last name      */
  char          caddress1_tag;/* ending for customer address 1   */
  char          caddress2_tag;/* ending for customer address 1   */
  char          ccity_tag;/* ending for customer city            */
  char          cdata1_tag;/* ending for customer data 1         */
  char          cdata2_tag;/* ending for customer data 2         */
  char          cdata3_tag;/* ending for customer data 3         */
  char          cdata4_tag;/* ending for customer data 4         */
  char          item_name_tag;/* last character of the item name */
  char          dlv_time[27];;/* time string used for convertion       */
  char          time[27];     /* converted output return 27 characters */
  char          cl_time[27]; /* converted output return              */
  _MI_Time      time_of_day; /* time of dat for new order transaction */
  char          cmd[20];
  char          trcoffcmd[40];
  new_order_display       *t;
  payment_display         *p;
  order_status_display    *o;
  dlv_input               *d;
  stock_display           *s;

  #pragma exception_handler(ME,0,0,_C2_ALL,_CTLA_HANDLE,"MCH1202")

  switch(formIdPost) {
    case NEW_ORDER:
    t = ( new_order_display *) res_buf;
    /* conver ordttm to date */
    /* getdtmstr( time, t->new_out->oenttm,   ) */
    mattod ( time_of_day);
    time_of_day[7] = 'B';/* set the period flag  */
    getdttmstr ( time_of_day, time, 'm' );
    /* returns a 27 character null terminated string  */
    /* remove the mirosecound */
    time[19] = '\0'; /* terminate the string */
    if (t->new_out->neword_result == 'G')
    {
      clast_tag = t->new_out->clast[15];/* get last character */
      t->new_out->clast[15]= '\0';/* terminate string */
      sprintf(scratchBuffer,newOrderResult,
              warehouse,
              district,
              t->new_inp->cwid,
              t->new_inp->cdid,
              time,
              t->new_inp->cid,
              t->new_out->clast, clast_tag,
              t->new_out->ccredt[0],
              t->new_out->ccredt[1],
              t->new_out->cdct,
              t->new_out->oid,
              t->new_inp->number_of_items,
              t->new_out->wtax,
              t->new_out->dtax
              );

        toPtr = scratchBuffer + strlen(scratchBuffer);
        for (i=0; i<t->new_inp->number_of_items; ++i){
        item_name_tag = t->new_out->output_line[i].output_item_name[23];
        t->new_out->output_line[i].output_item_name[23]='\0';/*  terminate */
        sprintf(toPtr,
        "%5d %6d   %23s%c %3D(3,0)  %3d   %c   $%6.2D(5,2)  $%7.2D(7    ,2)<br>",
                t->new_inp->input_line[i].olspwh,
                t->new_inp->input_line[i].oliid,
                t->new_out->output_line[i].output_item_name,  item_name_tag,
                t->new_inp->input_line[i].olqty,
                t->new_out->output_line[i].output_stqty,
                t->new_out->output_line[i].output_borg,
                t->new_out->output_line[i].output_item_price,
                t->new_out->output_line[i].output_olamnt);
          toPtr += strlen(toPtr);
        }
        t->execution_status[0] = '\0';/* make blank */
      }
      else
      {
            sprintf(scratchBuffer,newOrderError,
              warehouse,
              district,
               t->new_inp->cwid,
               t->new_inp->cdid,
               time,
               t->new_inp->cid
              );


        toPtr = scratchBuffer + strlen(scratchBuffer);
        for (i=0; i<t->new_inp->number_of_items; ++i){
           sprintf(toPtr,
               " %5d  %6d  %3D(3,0)<br>",
               t->new_inp->input_line[i].olspwh,
               t->new_inp->input_line[i].oliid,
               t->new_inp->input_line[i].olqty );
          toPtr += strlen(toPtr);
        }
      t->new_out->totamt = 0.0;
      if (t->new_out->neword_result == 'I')
          strcpy( t->execution_status, "INVALID INPUT");/* set to ID    */
      else
          strcpy( t->execution_status, "Item number is not valid ");

  } /* end of the else */

      sprintf(toPtr,newOrderTail,
              t->execution_status,
              t->new_out->totamt);

      break;

    case PAYMENT:
    p = ( payment_display *) res_buf;
      /* terminate output strings */
      if(( p->pay_out->output_fmt_num[0] != '7' )||
         ( p->pay_out->output_fmt_num[1] != '7' ))
```

```
  {
       waddress1_tag = p->pay_out->waddr1[19];
       daddress1_tag = p->pay_out->daddr1[19];
       waddress2_tag = p->pay_out->waddr2[19];
       daddress2_tag = p->pay_out->daddr2[19];
       wcity_tag     = p->pay_out->wcity[19];
       dcity_tag     = p->pay_out->dcity[19];
       clast_tag     = p->pay_out->clast[15];
       cfirst_tag    = p->pay_out->cfirst[15];
       caddress1_tag = p->pay_out->caddr1[19];
       caddress2_tag = p->pay_out->caddr2[19];
       ccity_tag     = p->pay_out->ccity[19];
       cphone_tag    = p->pay_out->cphone[15];
       cdata1_tag    = p->pay_out->cdat1[49];
       cdata2_tag    = p->pay_out->cdat2[49];
       cdata3_tag    = p->pay_out->cdat3[49];
       cdata4_tag    = p->pay_out->cdat4[49];
       p->pay_out->waddr1[19]='\0';
       p->pay_out->daddr1[19]='\0';
       p->pay_out->waddr2[19]='\0';
       p->pay_out->daddr2[19]='\0';
       p->pay_out->wcity[19]='\0';
       p->pay_out->dcity[19]='\0';
       p->pay_out->clast[15]='\0';
       p->pay_out->cfirst[15]='\0';
       p->pay_out->caddr1[19]='\0';
       p->pay_out->caddr2[19]='\0';
       p->pay_out->ccity[19]='\0';
       p->pay_out->cphone[15]='\0';
       p->pay_out->cdat1[49]='\0';
       p->pay_out->cdat2[49]='\0';
       p->pay_out->cdat3[49]='\0';
       p->pay_out->cdat4[49]='\0';
       wzip_tag = p->pay_out->wzip[8];/* copy zip */
       dzip_tag = p->pay_out->dzip[8];/* copy zip */
       czip_tag = p->pay_out->czip[8];/* copy zip */
       p->pay_out->wzip[8] = '\0';/* terminate warehouse zip */
       p->pay_out->dzip[8] = '\0';/* terminate district zip  */
       p->pay_out->czip[8] = '\0';/* terminate customer zip  */
       /* convert time to string   */
       /* inputs                   */
       /* p->pay_out->cldate,       */
       getdttmstr ( p->pay_out->cldate, cl_time, 'm' );
       /* returns a 27 character null terminated string */
       /* remove the mirosecound */
       cl_time[19] = '\0'; /* terminate the string */
       /* p->pay_out->time_of_day,  */
       /* output cldate and time   */
       getdttmstr ( p->pay_out->time_of_day, time, 'm' );
       /* returns a 27 character null terminated string */
       /* remove the mirosecound */
       time[19] = '\0'; /* terminate the string */
       sprintf(scratchBuffer,paymentResult,
          warehouse,
          district,
          time,
          p->pay_inp->wid,
          p->pay_inp->did,
          p->pay_out->waddr1, waddress1_tag,
          p->pay_out->daddr1, daddress1_tag,
          p->pay_out->waddr2, waddress2_tag,
          p->pay_out->daddr2, daddress2_tag,
          p->pay_out->wcity,  wcity_tag,
          p->pay_out->wstate[0],
          p->pay_out->wstate[1],
          p->pay_out->wzip, wzip_tag,
          p->pay_out->dcity, dcity_tag,
          p->pay_out->dstate[0],
          p->pay_out->dstate[1],
          p->pay_out->dzip,  dzip_tag,
          p->pay_out->cid,
          p->pay_inp->cwid,
          p->pay_inp->cdid,
          p->pay_out->clast, clast_tag,
          p->pay_out->cinit[0],
          p->pay_out->cinit[1],
          p->pay_out->cfirst, cfirst_tag,
          cl_time,
          p->pay_out->caddr1, caddress1_tag,
          p->pay_out->ccredt[0],
          p->pay_out->ccredt[1],
          p->pay_out->caddr2, caddress2_tag,
          p->pay_out->cdct,
          p->pay_out->ccity, ccity_tag,
          p->pay_out->cstate[0],
          p->pay_out->cstate[1],
          p->pay_out->czip, czip_tag,
          p->pay_out->cphone, cphone_tag,
          p->pay_inp->amount,
          p->pay_out->cbal,
          p->pay_out->ccrdlm,
          p->pay_out->cdat1, cdata1_tag,
          p->pay_out->cdat2, cdata2_tag,
          p->pay_out->cdat3, cdata3_tag,
          p->pay_out->cdat4, cdata4_tag
          );
  }
  else
  {
     clast_tag = p->pay_inp->clast[15];
     p->pay_inp->clast[15] = '\0';
     sprintf(scratchBuffer,paymentError,
          warehouse,
          district,
             p->pay_inp->wid,
             p->pay_inp->did,
             p->pay_inp->cid,
             p->pay_inp->cwid,
             p->pay_inp->cdid,
             p->pay_inp->clast, clast_tag,
             p->pay_inp->payment_type,
             p->pay_inp->amount );
  }
  break;

case ORDER_STATUS:
o = ( order_status_display *) res_buf;
if (( o->ordsts_out->ordsts_fmt_num[0]!='6')||
    ( o->ordsts_out->ordsts_fmt_num[1]!='2'))
{
/* convert time       o->ordsts_out->oettod,           */
/* output is in time                                   */
  getdttmstr ( o->ordsts_out->oettod, time, 'm' );
  /* returns a 27 character null terminated string */
  /* remove the mirosecound */
  time[19] = '\0'; /* terminate the string */
/* set temination for the customer first and last name */
  clast_tag = o->ordsts_out->clast[15];
  cfirst_tag = o->ordsts_out->cfirst[15];
  o->ordsts_out->clast[15] = '\0';
  o->ordsts_out->cfirst[15] = '\0';
  if ( o->ordsts_out->ocarid[0] == '\0' )
    o->ordsts_out->ocarid[0] = ' ';
  if ( o->ordsts_out->ocarid[1] == '\0' )
    o->ordsts_out->ocarid[1] = ' ';
  sprintf(scratchBuffer,ordstsResult,
          warehouse,
          district,
          o->ordsts_inp->wid,
          o->ordsts_inp->did,
          o->ordsts_out->ocid,
          o->ordsts_out->clast, clast_tag,
          o->ordsts_out->cinit[0],
          o->ordsts_out->cinit[1],
          o->ordsts_out->cfirst, cfirst_tag,
          o->ordsts_out->cbal,
          o->ordsts_out->oid,
          time, /* o->ordsts_out->oettm, */
          o->ordsts_out->ocarid[0],
          o->ordsts_out->ocarid[1]
          );

     toPtr = scratchBuffer + strlen(scratchBuffer);
     for (i=0; i<o->ordsts_out->olnenbr; ++i){
     /* conver orderline deliver time to time of day */
     /*                                              */
     /* o->ordsts_out->olineinfo[i].do_oldlvl        */
     /* output as dlv_time  char 15 output array     */
     /*  conver dlv_time to date time string         */
     getdttmstr ( o->ordsts_out->olineinfo[i].do_oldlvl, dlv_time, 'm' );
     /* returns a 27 character null terminated string */
     /* remove the mirosecound */
     dlv_time[19] = '\0'; /* terminate the string */
       sprintf(toPtr," %5d    %6d %2s %2d %6.2D(7,2) %14s<br>",
               o->ordsts_out->olineinfo[i].do_olspwh,
               o->ordsts_out->olineinfo[i].do_oliid,
               SPACE,
               o->ordsts_out->olineinfo[i].do_olqty,
               o->ordsts_out->olineinfo[i].do_olamnt,
               dlv_time );
       toPtr += strlen(toPtr);
     }

     sprintf(toPtr,ordstsTail);
     }
     else
     {
        clast_tag = o->ordsts_inp->clast[15];
        o->ordsts_inp->clast[15] = '\0';
        sprintf(scratchBuffer,ordstsError,
                warehouse,
                district,
                o->ordsts_inp->wid,
                o->ordsts_inp->did,
                o->ordsts_inp->cid,
                o->ordsts_inp->clast, clast_tag,
                o->ordsts_inp->ordsts_type );
     }

     break;

    case DELIVERY:
    d = ( dlv_input *) res_buf;
      sprintf(scratchBuffer,deliveryResult,
              warehouse,
              district,
              d->wid,
              d->carrier[0],
              d->carrier[1]
              );
      break;

    case STOCK_LEVEL:
    s = ( stock_display *) res_buf;
    if ( s->stk_out->result!='I')
    {
      sprintf(scratchBuffer,stklvlResult,
              warehouse,
              district,
              s->stk_inp->wid,
              s->stk_inp->did,
              s->stk_inp->threshold,
              s->stk_out->blwstk
              );
      }
      else
      {
      sprintf(scratchBuffer,stklvlError,
              warehouse,
              district,
              s->stk_inp->wid,
              s->stk_inp->did,
              s->stk_inp->threshold
              );
      }
      break;

    case SIGNON_ERROR:
      sprintf(scratchBuffer,signonResult );
      break;

    case DATA_ERROR:
      sprintf(scratchBuffer,dataErrorResult,
              warehouse, district );
      break;

    default:
      printf("postResult: Invalid form ID = %d", formIdPost );
      return (-1);
      break;
  } /* end of switch */


 #pragma disable_handler

  return 0;
     ME:
   memcpy(trcoffcmd, "TRCINT SET(*HOLD) TRCTBL(TPCCTRC)", 40);
   trcoffcmd[40] = '\0';
              system(trcoffcmd);
              memcpy(cmd,"DLYJOB DLY(3600)", 20);
              cmd[20] = '\0';
              system(cmd);



}
```

D.14 STKLVLSRV.C:

```
#include "common.h"

/* tpsvrinit is executed when a server is booted, before it begins
   processing requests.  It is not necessary to have this function.
   Also available is tpsvrdone (not used in this example), which is
   called at server shutdown time.
*/


   static int sd, sd2, addr=0, length, port=8000;
   static  pid_t                        pid;
   int rc=670, remain=0;
   error_code err_code;
   data_area_data data_area_input;
   int mod_number=0;
   char clnt_ip1[13], clnt_ip2[13];
   char srvr_ip1[13], srvr_ip2[13];

tpsvrinit(int argc, char *argv[])
{
        /* Some compilers warn if argc and argv aren't used. */
        argc = argc;
        argv = argv;

        /* userlog writes to the central TUXEDO message log  */
        userlog("Welcome to the tpcc server");
   err_code.bytes_prov = 0;
   QWCRDTAA ( &data_area_input, 46, modn_dtaara, 1, 1, &err_code );
   mod_number = atoi(data_area_input.data_block);
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 1, 11, &err_code );
   memcpy( clnt_ip1, &data_area_input.data_block, 11 );
   clnt_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, clnt_dtaara, 13, 11, &err_code );
   memcpy( clnt_ip2, &data_area_input.data_block, 11 );
```

```
   clnt_ip2[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 1, 11, &err_code );
   memcpy( srvr_ip1, &data_area_input.data_block, 11 );
   srvr_ip1[12] = '\0';
   QWCRDTAA ( &data_area_input, 48, srvr_dtaara, 13, 11, &err_code );
   memcpy( srvr_ip2, &data_area_input.data_block, 11 );
   srvr_ip2[12] = '\0';

    pid = getpid();
   remain = pid % mod_number;
   if(remain == 0) {
      addr=inet_addr(clnt_ip1);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip1);
      sd2=bConnect(sd,addr,port);
    }
   else {
      addr=inet_addr(clnt_ip2);
      sd=Bind(addr, pid);
      addr=inet_addr(srvr_ip2);
      sd2=bConnect(sd,addr,port);
    }
        return(0);
}

/* This function performs the actual service requested by the client.
   Its argument is a structure containing among other things a pointer
   to the data buffer, and the length of the data buffer.
*/


     /*     STOCK LEVEL     */

STKLVL(TPSVCINFO *rqst)
{


    if(send(sd, rqst->data, 230, 0)<0) {
      perror("\nsend() failed");
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }

    memset(rqst->data, 'V', 670);

    rc=recv(sd, rqst->data, 670,0);

    if(rc<=0) {
      perror("\nrecv[0]() failed");
      tpreturn(TPFAIL, 0, rqst->data, 0L, 0);
    }

    /* Return the transformed buffer to the  requestor. */
    tpreturn(TPSUCCESS, 0, rqst->data, rc, 0);
}
```

D.15 TUXCONFIG File:

```
#ident  "@(#)apps:simpapp/ubbsimple     60.3"

#Skeleton UBBCONFIG file for the TUXEDO Simple Application.
#Replace the <bracketed> items with the appropriate values.

*RESOURCES
IPCKEY                  123235

DOMAINID                tpccapp
MASTER                  CLIENT10
MAXACCESSERS            9600
MAXSERVERS              300
MAXSERVICES             300
MODEL                   SHM
LDBAL                   Y
SCANUNIT                60
SANITYSCAN              60
BLOCKTIME               60
BBLQUERY                60
DBBLWAIT                1

*MACHINES
"CLIENT10.RCHLAND.IBM.COM"
                        LMID=CLIENT10
                        APPDIR="/home/tpcckvclnt"
                        TUXCONFIG="/home/tpcckvclnt/tuxconfig"
                        TUXDIR="/qopensys/tuxsdk"
SPINCOUNT=2000

*GROUPS
DEFAULT:                LMID=CLIENT10
srvr1                   GRPNO=1
srvr2                   GRPNO=11
srvr3                   GRPNO=21
srvr4                   GRPNO=31
srvr5                   GRPNO=41
srvr6                   GRPNO=51
srvr7                   GRPNO=61

*SERVERS
DEFAULT:                REPLYQ=Y
newordsrv               SRVGRP=srvr1 SRVID=1    MIN=72
paymntsrv               SRVGRP=srvr2 SRVID=101  MIN=54
ordstssrv               SRVGRP=srvr3 SRVID=201  MIN=18
delvrysrv               SRVGRP=srvr4 SRVID=301  MIN=18 RQADDR=dlq1
delvrysrv               SRVGRP=srvr5 SRVID=351  MIN=18 RQADDR=dlq2
stklvlsrv               SRVGRP=srvr6 SRVID=401  MIN=72

*SERVICES
DEFAULT:
NEWORDER
PAYMNT
DELIVRY
STKLVL
ORDSTS
```

SERVER:

D.16 COMMON.H:

```
#ifndef _COMMON_H
#define _COMMON_H

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <spawn.h>
#include <qp0z1170.h>
#include <sys/shm.h>
#include <sys/stat.h>
#include <sys/wait.h>
#include <mih/mattod>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <sys/msg.h>
#include <netinet/in.h>
#include <errno.h>
#include <unistd.h>
#include <iconv.h>
#include <sys/uio.h>
#include <decimal.h>
#ifdef SEMAPHORE
typedef struct Semaphore {
  _Mutex_T        xMutex;
  _Mutex_Lock_T xTemplate;
  int             xCount, xSleep;
} Semaphore_t;
#endif
#define BufferSize 3078
#define MAX_CONN  32

char *DLVRYMOD(short *, char *);
char *NEWORDMOD(short *, char *, char *);
char *ORDSTSMOD(short *, char *, char *);
char *PAYMENTMOD(short *, char *, char *);
char *STKLVLMOD(short *, char *, char *);

extern int Listen(int port);
extern int Connect(int ipAddr, int port);
extern int Bind(int ipAddr, int port);
static short  first_time=2;/* first time the operation runs  */

#endif /* _COMMON_H */
```

D.17 DELIVERY.CBL:

```
      PROCESS NOTRUNC NORANGE.
      IDENTIFICATION DIVISION.
        PROGRAM-ID. DLVRYMOD.
        AUTHOR. TPCC.
        INSTALLATION. IBM-ROCHESTER.
        DATE-WRITTEN.
        DATE-COMPILED.
      ENVIRONMENT DIVISION.
      CONFIGURATION SECTION.
        SOURCE-COMPUTER.  IBM-AS400.
     *  SOURCE-COMPUTER.  IBM-AS400 WITH DEBUGGING MODE.
        OBJECT-COMPUTER.  IBM-AS400.
      INPUT-OUTPUT SECTION.
      FILE-CONTROL.
          SELECT NEWORD
                 ASSIGN TO DATABASE-NEWORDLF
                 ORGANIZATION IS INDEXED
                 ACCESS MODE IS DYNAMIC
                 RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                 WITH DUPLICATES
                 FILE STATUS IS  NEWORD-FILE-STATUS.
          SELECT DISTRICT-FILE
                ASSIGN TO  DATABASE-DSTRCT
                ORGANIZATION IS INDEXED
                ACCESS MODE IS RANDOM
                RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                WITH DUPLICATES
                FILE STATUS IS DISTRICT-FILE-STATUS.
          SELECT ORDERS
                 ASSIGN TO DATABASE-ORDERSLF
                 ORGANIZATION IS INDEXED
                 ACCESS MODE IS RANDOM
                 RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                 WITH DUPLICATES.
          SELECT ORDERLINE
                 ASSIGN TO DATABASE-ORDLINLF
                 ORGANIZATION IS INDEXED
                 ACCESS MODE IS DYNAMIC
                 RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                 WITH DUPLICATES.
          SELECT  DLVRYLOG
                 ASSIGN TO DATABASE-DLVRYLOG
                 ORGANIZATION IS SEQUENTIAL.
D           SELECT ISO-IFILE
D                ASSIGN TO DATABASE-ISOIFILE
D                ORGANIZATION IS SEQUENTIAL
D                ACCESS IS SEQUENTIAL.
D           SELECT DBUG-FILE
D                ASSIGN TO  FORMATFILE-DBUGPRT2
D                ORGANIZATION IS SEQUENTIAL
D                ACCESS IS SEQUENTIAL.
       I-O-CONTROL.
           COMMITMENT CONTROL FOR ORDERS ORDERLINE
                                   DISTRICT-FILE NEWORD.

       DATA DIVISION.
       FILE SECTION.
       FD  NEWORD
           LABEL RECORDS ARE STANDARD
           DATA RECORD IS NEWORD-RECORD.
       01  NEWORD-RECORD.
           COPY DDS-NORCD OF NEWORDLF.
       FD DISTRICT-FILE
             LABEL RECORDS ARE STANDARD.
       01 DISTRICT-RECORD.
            COPY DDS-DSRCD OF DSTRCT.
       FD  ORDERS
           LABEL RECORDS ARE STANDARD
           DATA RECORD IS ORDERS-RECORD.
       01  ORDERS-RECORD.
           COPY DDS-ORRCD OF ORDERSLF.
       FD  ORDERLINE
           LABEL RECORDS ARE STANDARD.
       01  ORDERLINE-RECORD.
           COPY DDS-OLRCD OF ORDLINLF.
       FD  DLVRYLOG
           LABEL RECORDS ARE STANDARD
           DATA RECORD IS DLVRYLOG-RECORD.
       01  DLVRYLOG-RECORD.
           COPY DDS-LGRCD OF DLVRYLOG.
           05 LOG-REDEF REDEFINES LGRCD.
               06        TIMEB    PIC S9(8).
               06        TIMEA    PIC S9(8).
               06        UNDEL    PIC S9.
               06        WID      PIC S9(4) COMP-4.

      DFD  DBUG-FILE
      D    LABEL RECORDS ARE STANDARD
      D    DATA RECORD IS DBUG-REC2.
      D   01  DBUGPRT-REC2.
      D    COPY DDS-DBUGRCD2 OF DBUGPRT2.
      D       05  DBUG-REC2 REDEFINES DBUGRCD2-O.
      D           06  DEBUG-DATA.
      D               07  ISONUMBER              PIC 99.
      D               07  TXTDATA                PIC X(40).
      D               07  WID                    PIC S9(4).
      D               07  DID                    PIC S9(2).
      D               07  TIME-DATE.
      D                   08  DATE6              PIC S9(8).
      D                   08  TIME6              PIC S9(6).
      D               07  CID                    PIC S9(4).
      D               07  CWID                   PIC S9(4).
      D               07  CDID                   PIC S9(2).
      D               07  CBAL                   PIC S9(11)V99.
      D               07  PAYMNT                 PIC S9(7)V99.
      DFD  ISO-IFILE
      D    LABEL RECORDS ARE STANDARD.
      D01  ISOIFILE-RECORD.
      D    COPY DDS-ISOIRCD OF ISOIFILE.
      D    05 ISO-IREC REDEFINES ISOIRCD.
      D      06 ISOINUM PIC S9(4) COMP-4.



       WORKING-STORAGE SECTION.

       01 CSTMR-RECORD.
              05  CUST-KEY.
```

```
            06 CID     PIC S9(9) COMP-4.
            06 CDID    PIC S9(4) COMP-4.
            06 CWID    PIC S9(4) COMP-4.
            06 CUST-INFO.
               08 CFIRST  PIC X(16).
               08 CINIT   PIC X(02).
               08 CLAST   PIC X(16).
               08 CLDATE  PIC S9(8).
               08 CADDR1  PIC X(20).
               08 CCREDT  PIC X(02).
               08 CADDR2  PIC X(20).
               08 CDCT    PIC S9V9999 COMP-3.
               08 CCITY   PIC X(20).
               08 CSTATE  PIC X(02).
               08 CZIP    PIC X(9).
               08 CPHONE  PIC X(16).
               08 CBAL     PIC S9(11)V99 COMP-3.
               08 CCRDLM   PIC S9(11)V99 COMP-3.
               08 CYTD     PIC S9(11)V99 COMP-3.
               08 CPAYCNT  PIC S9(3)     COMP-3.
               08 CDELCNT  PIC S9(3)     COMP-3.
               08 CDATA    PIC X(500).


 01 CSTMR-KEY.
   03 CSTMR-KEY-DATA OCCURS 5 TIMES.
      05  KNAM   PIC X(10).
      05  KVAL   PIC S9(9) COMP-4.

 01 CSTMR-HASH-PTR   USAGE POINTER.

 01 CSTMR-HASH-NAME  PIC X(10).
 01 FUNCT            PIC X(1).
 01 KEYS             PIC S9(9) COMP-4.
 01 RET-CODE         PIC S9(9) COMP-4.

 01  RET-CODE-PTR    USAGE POINTER.
 01  CSTMR-DEF-PTR   USAGE POINTER.
 01  CSTMR-KEY-PTR   USAGE POINTER.

D01  CBAL2              PIC S9(11)V99 COMP-3.
D01  ISOVALUE           PIC S999 COMP-3 VALUE 0.

 01 UPDATER               PIC X(1) VALUE "3".
 01 FETCHR                PIC X(1) VALUE "1".
 01 FETCHUPDATE           PIC X(1) VALUE "2".

 01 CUST-KEYS             pic 9(1) comp-4 vALUE 3.


  01   TRANSACTION-INPUT.
         06     TXN-TYPE            PIC X.
         06     JOBNAME             PIC X(10).
         06    CLIENT-INPUT         PIC X(202).
         06 DLVRY-I REDEFINES CLIENT-INPUT.
           08 WID                   PIC S9(4) COMP-4.
           08 CARRIER               PIC XX.
           08 D-TIME-OF-DAY         PIC X(8).
 01  TIME-OF-DAY          PIC X(8).
 01  TIME-PTR          USAGE POINTER.

D  01 TIME-OF-DAY-STRING PIC X(14).
D   01 TORD   PIC X(1) VALUE "b".


 01 DQDATA-FRM-CLNT.
    05 DQDATA-WHS  PIC S9(4) COMP-4.
    05 DQDATA-CARR PIC X(2).
    05 DQDATA-BTIM PIC S9(8).
    05 DQDATA-fill PIC S9(6).

D  01 TESTNUM                  PIC 99 VALUE 1.

 01 OLINES-LEFT  PIC S9(2) COMP-4.

 77  ORDAMT PIC 9(9)V99.

 01  FILE-STATUS-ERROR-CDS.
    05  NEWORD-FILE-STATUS     PIC X(2) VALUE "00".
    05  DISTRICT-FILE-STATUS    PIC X(2) VALUE "00".
 01  ORDERS-DELIVERED-TABLE.
       10 ORDER-LINE OCCURS 10 TIMES.
         15 ELEMENT-DISTRICT     PIC S99.
         15 ELEMENT-ORDER        PIC S9(6).
 77  WHS   PIC X(4).

 LINKAGE SECTION.
   01  FIRST-TIME PIC S9(4) COMP-4.
   01  INP-TRAN PIC X(230).

 PROCEDURE DIVISION USING FIRST-TIME  INP-TRAN.

 DELIVERY-PROGRAM.
     IF FIRST-TIME > 0
       PERFORM SET-UP-ROUTINE.
 PROCESS-DELIVERY.

     MOVE  INP-TRAN TO  TRANSACTION-INPUT.

     MOVE  DLVRY-I TO DQDATA-FRM-CLNT.

     MOVE  D-TIME-OF-DAY OF DLVRY-I TO
                       LOGTIMEB OF DLVRYLOG-RECORD.

D    READ ISO-IFILE.
D    MOVE ISOINUM TO ISONUMBER, ISOVALUE.
     MOVE   0 TO NODID.
     MOVE   0 TO NOOID.
     MOVE "0" TO UNDELDST.
     MOVE DQDATA-WHS TO NOWID, OWID, OLWID,  CWID OF CSTMR-RECORD.
     MOVE  DQDATA-WHS TO DWID.

     IF DQDATA-CARR = "99" THEN
       STOP RUN.

     MOVE DQDATA-CARR TO OCARID.
     CALL "gettime" USING BY VALUE TIME-PTR.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D    MOVE "DEL PRE-READ  " TO TXTDATA.
D    MOVE 1 TO CDID OF DBUG-REC2.
D    MOVE DQDATA-WHS TO CWID OF DBUG-REC2.
D    MOVE 0 TO CID OF DBUG-REC2.
D    MOVE 1 TO DID OF DBUG-REC2.
D    MOVE 0 TO PAYMNT OF DBUG-REC2.
D    MOVE DQDATA-WHS TO WID OF DBUG-REC2.
D      MOVE "b" TO TORD.
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD.
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC2.
D    MOVE 0 TO CBAL OF DBUG-REC2.
D    WRITE DBUGPRT-REC2 FORMAT IS "DBUGRCD2".
  RE-DO-DLVRY.
      PERFORM 10 TIMES

        MOVE 0 TO ORDAMT
        ADD 1 TO NODID
        READ NEWORD
        IF NEWORD-FILE-STATUS = "23"
           MOVE NODID TO DID OF DISTRICT-RECORD
           MOVE "00" TO NEWORD-FILE-STATUS
           READ DISTRICT-FILE
           IF DISTRICT-FILE-STATUS NOT EQUAL "00"
                   ROLLBACK
                   GOBACK
           END-IF
           READ NEWORD
           END-IF
D       IF NEWORD-FILE-STATUS = "23"
D          CALL "gettime" USING BY VALUE TIME-PTR
D      MOVE "b" TO TORD
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC2
D         MOVE NODID TO DID OF  DBUG-REC2
D         MOVE "DEL NO  NEWORDER" TO TXTDATA
D         WRITE  DBUGPRT-REC2 FORMAT IS "DBUGRCD2"
D         CALL "delayme"
D         READ NEWORD
D         CALL "gettime" USING BY VALUE TIME-PTR
D      MOVE "b" TO TORD
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC2
D         MOVE "DEL NO  NEWORD2" TO TXTDATA
D         WRITE  DBUGPRT-REC2 FORMAT IS "DBUGRCD2"
D         END-IF
           IF NEWORD-FILE-STATUS = "23"
             MOVE "00" TO NEWORD-FILE-STATUS
             MOVE "1" TO UNDELDST
           ELSE
             MOVE NODID TO ODID, OLDID, CDID OF  CSTMR-RECORD
             MOVE NOOID TO OID, OLOID

             READ ORDERS
             MOVE DQDATA-CARR TO OCARID
             REWRITE ORDERS-RECORD

             READ ORDERLINE
             MOVE TIME-OF-DAY TO  OLDLVTOD
             REWRITE  ORDERLINE-RECORD
             ADD OLAMNT TO ORDAMT

             SUBTRACT 1 FROM  OLINES GIVING OLINES-LEFT

             PERFORM OLINES-LEFT TIMES
                  READ ORDERLINE NEXT
                  MOVE TIME-OF-DAY TO  OLDLVTOD
                  REWRITE  ORDERLINE-RECORD
                  ADD OLAMNT TO ORDAMT
             END-PERFORM


           MOVE OCID TO CID OF CSTMR-RECORD
           MOVE CID  OF CSTMR-RECORD TO KVAL OF CSTMR-KEY-DATA(1)
           MOVE CDID OF CSTMR-RECORD TO KVAL OF CSTMR-KEY-DATA(2)
           MOVE CWID OF CSTMR-RECORD TO KVAL OF CSTMR-KEY-DATA(3)

              CALL "qdbrunha" USING BY VALUE
              CSTMR-HASH-PTR FETCHUPDATE CUST-KEYS CSTMR-KEY-PTR
                      CSTMR-DEF-PTR RET-CODE-PTR
                 IF RET-CODE > 0
                     IF RET-CODE = 812
                        ROLLBACK
                        MOVE   0 TO NODID
                        GO TO  RE-DO-DLVRY
                     ELSE
                        IF RET-CODE = 100
                           ROLLBACK
                           GO TO MORE-ACTION
                        ELSE
                           ROLLBACK
                           GO TO PROGRAM-END
                        END-IF
                     END-IF
                 END-IF
              ADD ORDAMT TO CBAL OF CSTMR-RECORD
              ADD 1 TO  CDELCNT

              CALL "qdbrunha" USING BY VALUE
                   CSTMR-HASH-PTR UPDATER CUST-KEYS CSTMR-KEY-PTR
                      CSTMR-DEF-PTR RET-CODE-PTR

                 IF RET-CODE > 0
                     IF RET-CODE = 812
                        ROLLBACK
                        MOVE   0 TO NODID
                        GO TO  RE-DO-DLVRY
                     ELSE
                        IF RET-CODE = 100
                           ROLLBACK
                           GO TO MORE-ACTION
                        ELSE
                           ROLLBACK
                           GO TO PROGRAM-END
                        END-IF
                     END-IF
                 END-IF

              DELETE NEWORD
              MOVE OID  OF ORDERS-RECORD
                      TO  ELEMENT-ORDER(NODID)

         END-IF
      END-PERFORM.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D    IF ISOVALUE = 8 THEN GO TO DBG-SKP1.
D    IF ISOVALUE = 6 THEN
D       MOVE "DEL PRE-ROLLBK" TO TXTDATA
D    ELSE IF ISOVALUE = 5 THEN
D       MOVE "DEL PRE-COMMIT" TO  TXTDATA.
D    MOVE 1 TO CDID OF  DBUG-REC2.
D    MOVE  DQDATA-WHS  TO CWID OF DBUG-REC2.
D    MOVE 1 TO DID OF  DBUG-REC2.
D    MOVE  DQDATA-WHS  TO WID OF DBUG-REC2.
D    WRITE  DBUGPRT-REC2  FORMAT IS "DBUGRCD2".
D    CALL "delayme".
D         CALL "gettime" USING BY VALUE TIME-PTR
D      MOVE "b" TO TORD.
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD.
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC2.
D    IF  ISOVALUE = 6 THEN
D     ROLLBACK.
DDBG-SKP1.
          COMMIT.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D    IF ISOVALUE = 8 THEN GO TO DBG-SKP2.
D    IF ISOVALUE = 6 THEN
D       MOVE "DEL POST-ROLLBK" TO TXTDATA
D    ELSE IF ISOVALUE = 5 THEN
D       MOVE "DEL POST-COMMIT" TO  TXTDATA.
D    MOVE 1 TO CDID OF  DBUG-REC2.
D    MOVE  DQDATA-WHS  TO CWID OF DBUG-REC2.
D    MOVE 1 TO DID OF  DBUG-REC2.
D    MOVE 0 TO PAYMNT OF DBUG-REC2.
D    MOVE  DQDATA-WHS  TO WID OF DBUG-REC2.
D    MOVE  CBAL2 TO CBAL OF DBUG-REC2.
D    CALL "gettime" USING BY VALUE TIME-PTR.
D      MOVE "b" TO TORD.
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD.
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC2.
D    WRITE DBUGPRT-REC2  FORMAT IS "DBUGRCD2".
DDBG-SKP2.
     MOVE  DQDATA-WHS  TO WH OF DLVRYLOG-RECORD.
     CALL "gettime" USING BY VALUE TIME-PTR.
     MOVE TIME-OF-DAY TO  LOGTIMEA.
     WRITE  DLVRYLOG-RECORD.
```

```
      MORE-ACTION.
          GOBACK.

      SET-UP-ROUTINE.

              PERFORM CLOSE-ROUTINE.
              OPEN EXTEND DLVRYLOG.
              OPEN I-O ORDERLINE.
              OPEN I-O ORDERS.
              OPEN I-O DISTRICT-FILE.
              OPEN I-O NEWORD.
      D       OPEN OUTPUT DBUG-FILE.
      D       OPEN INPUT ISO-IFILE.

              MOVE "CSTMR"  TO CSTMR-HASH-NAME.
              MOVE "CID"    TO KNAM OF CSTMR-KEY-DATA(1).
              MOVE "CDID"   TO KNAM OF CSTMR-KEY-DATA(2).
              MOVE "CWID"   TO KNAM OF CSTMR-KEY-DATA(3).

              SET CSTMR-HASH-PTR TO ADDRESS OF CSTMR-HASH-NAME.
              SET RET-CODE-PTR   TO ADDRESS OF RET-CODE.
              SET CSTMR-DEF-PTR  TO ADDRESS OF CSTMR-RECORD.
              SET CSTMR-KEY-PTR  TO ADDRESS OF CSTMR-KEY.
              SET TIME-PTR       TO ADDRESS OF TIME-OF-DAY.

      CLOSE-ROUTINE.
              CLOSE NEWORD
              CLOSE DISTRICT-FILE
              CLOSE ORDERS
              CLOSE ORDERLINE
              CLOSE DLVRYLOG.
      D       CLOSE DBUG-FILE.
      D       CLOSE ISO-IFILE.
       PROGRAM-END.
          STOP RUN.
```

D.18 DLVRSRVR.C:

```
#include <Common.h>
#include <qsoasync.h>
#include <stdio.h>

main(int argc, char **argv)
{
  int           sd;/* the input socket that is doing the listen              */
  int           snd_len=670, rcv_len=230, port, rc;
  int           sd_arr[MAX_CONN];/* the indexes for accepts and use          */
  int           num_conn;/* the number of connections */
  int           accept_index;/* accept index goes from 0 to num_conn - 1     */
  int           retry_count;/* nuber of retries attempted                     */
  char          rcv_buf[MAX_CONN] [BufferSize];/* one per connection */
  struct sockaddr_in    sin;
  int           length;
    Qso_OverlappedIO_t        status;
    char                      buffer[256];

    memset(&status,0,sizeof(status));
    status.bufferLength=rcv_len;
    status.postFlag=1;                        /* Always post to I/O completion port
   */
    status.fillBuffer=1;      /* Fill buffer.                                     */
    /* get the number of connections                                          */
    num_conn = atoi(argv[1]);
/*  printf("The number of delivert connections is %d\n", num_conn ); */
    /* num_conn = 2;*//* test action */

    if((port=QsoCreateIOCompletionPort())<0)  {
      perror("\nQsoCreateIOCompletionPort()  failed");
      exit(-1);
    }

     length=sizeof(sin);
     for( accept_index=0;accept_index<num_conn;accept_index++)
     {
           if((sd_arr[accept_index]=accept(sd,
              (struct sockaddr *)&sin,&length))<0)
           {
               perror("accept() in DLVSRVR failed");
               close(sd);
               exit(-1);
           }
           status.descriptorHandle=(void*)sd_arr[accept_index];
           status.buffer=rcv_buf[accept_index];
           if(QsoStartRecv(sd_arr[accept_index],port,&status)<0)  {
                           perror("\nQsoStartRecv()  failed");
                           exit(-1);
           }

     }/* end of connect loop */
     do
     {
          if(QsoWaitForIOCompletion(port,&status,0)<0)
          {
                           perror("\nQsoWaitForIoCompletion()  failed");
                           exit(-1);
          }

          if(status.returnValue<=0)  {
                           printf("\nRecv()  failed, errno=%d",status.errnoValue);
                           exit(-1);
          }

       if(status.operationCompleted!=QSOSTARTRECV)  {
                      printf("\nUnexpected  completion=%d",status.operationCompleted);
                          exit(-1);
       }

       system("STRCMTCTL  LCKLVL(*ALL)");
       system("CHGJOB RUNPTY(34)");
       system("OVRDBF FILE(NEWORDLF) TOFILE(NEWORDLF) NBRRCDS(10)");
       system("OVRDBF FILE(ORDLINLF) TOFILE(ORDLINLF) NBRRCDS(120)");
       DLVRYMOD(&first_time, status.buffer);/* first transaction */
       first_time--;
       if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)  {
                           perror("\nQsoStartRecv()  failed");
                           exit(-1);
        }
     }
     while ( first_time > 0 );
     for(;;) {

        if(QsoWaitForIOCompletion(port,&status,0)<0)  {
                                  perror("\nQsoWaitForIoCompletion()  failed");
                                  exit(-1);
        }
        if(status.returnValue<=0)  {
                          printf("\nRecv()  failed, errno=%d",status.errnoValue);
                          exit(-1);
        }
        if(status.operationCompleted!=QSOSTARTRECV)  {
                      printf("\nUnexpected  completion=%d",status.operationCompleted);
                          exit(-1);
        }
        DLVRYMOD(&first_time, status.buffer);/* normal transaction */

        if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)  {
                           perror("\nQsoStartRecv()  failed");
                           exit(-1);
         }
   }  /* for loop  */
  return 0;
}
```

D.19 GETTIME.C:

```
/*****************************************************************/
/*                                                               */
/* OCO Source Materials                                          */
/*                                                               */
/* The Source code for this program is not published or otherwise  */
/* divested of its trade secrets, irrespective of what has been    */
/* deposited with the U.S. Copyright office                      */
/*                                                               */
/* TPCCCLIENT LIBRARY                                            */
/*  (C) Copyright IBM Corp. 1997,1998                            */
/*                                                               */
/*****************************************************************/

#pragma comment (copyright, \
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#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <leawi.h>
#include <QSYSINC/MIH/MATTOD>
#include <qwcrdtaa.h>
#define BASE_OFFSET 4503599627.370496
#define OFFSET     10914267600.0 /* set to a fixed value */
/* Define the time range flag */
#define HIGH_FLAG 'B'
/* #include <CEEDATM> */
struct dateTime |
   _MI_Time returnTimestamp;
 };
void gettime(struct dateTime * new_date_time)
{
   mattod(new_date_time->returnTimestamp);/* get the time of day */
   new_date_time->returnTimestamp[7] = HIGH_FLAG;/* set the high flag */
}

void gettime_string(char * timein, char* timestamp )
{
  double converted = 0;/* the output value */
  double seconds;/* number of seconds in floting point since 14 October 1582 */
  double scale=0;/* scae factor from MI_Time to seconds */
  double second = 16000000;/* number of MI units in one second */
  double offset=/*number of seconds from MI_base to seconds base */
         OFFSET;
         /* note this has a one hour offset for daylight time  */
         /* base date is Aug 23, 1928 noon */
         /* the daylight time offset gives 1:00 PM time  */
  double base =1;/* the base for the value used */
  double Base_sec = 0;/* the base for the value used */
  char picture[] = "Mmm DD, YYYY HH:MI:SS AP.";/* timestamp defintion */

  _FEEDBACK fb;/* feedback value */
  int count;/* loop counter */
  char high_flag;
  high_flag = timein[7];/* get the high byte flag */
  if ( high_flag != 'B' )
  {
    if (( high_flag == 'A' )&(( timein[0]&&0xF0 )> 0x70))
    /* first part of the A date range this section is smaller then  */
    /* the base section                                             */
    {
       offset = OFFSET - BASE_OFFSET; /* next lower range */
    }
    else
    {
       if (( high_flag == 'C' )&(( timein[0]&&0xF0 )< 0x80))
    /* second part of the C date range this section is larger then  */
       {
         offset = OFFSET + BASE_OFFSET; /* next higher range */
       }
    }
  }
  for ( count = 0; count <7; count++ )
  {
     converted = converted +  ((timein[6-count]&255)  * base);
     base = base * 256;
  }
  /* printf ("second is %f\n", second ); */
  seconds = (converted/second) + offset;
  memset (timestamp, ' ', 27 );/* reset time stamp */
  CEEDATM ( &seconds,&picture[0],timestamp,&fb);/*  convert to timestamp */
  timestamp[26] = '\0';/* terminate the time stamp */
}
void printtime(char * timein )
{
  char time_stamp[27];/* storage for text */
  gettime_string(timein, time_stamp );/* get the time stamp */
  printf ( "TIME: %s\n", time_stamp );/* print output */


}
```

D.20 NEWORDER.CBL:

```
      PROCESS NOTRUNC NORANGE.
      IDENTIFICATION DIVISION.
        PROGRAM-ID. NEWORDMOD.
        AUTHOR. TPCC.
        INSTALLATION. IBM-ROCHESTER.
        DATE-WRITTEN.
        DATE-COMPILED.
     ***************************************************************
     *
     *  PART NAME: NEWORDER
     *
     ***************************************************************
      ENVIRONMENT DIVISION.
      CONFIGURATION SECTION.
        SOURCE-COMPUTER.  IBM-AS400.
     *  SOURCE-COMPUTER.  IBM-AS400 WITH DEBUGGING MODE.
        OBJECT-COMPUTER.  IBM-AS400.
        INPUT-OUTPUT SECTION.
        FILE-CONTROL.
            SELECT WAREHOUSE-FILE ASSIGN TO  DATABASE-WRHS
                 ORGANIZATION IS INDEXED
                 ACCESS MODE IS RANDOM
                 RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                 WITH DUPLICATES
                 FILE STATUS IS WAREHOUSE-FILE-STATUS.
            SELECT DISTRICT-FILE ASSIGN TO  DATABASE-DSTRCT
                 ORGANIZATION IS INDEXED
                 ACCESS MODE IS RANDOM
                 RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                 WITH DUPLICATES
                 FILE STATUS IS DISTRICT-FILE-STATUS.
            SELECT ITEM-FILE ASSIGN TO DATABASE-ITEM
                 ORGANIZATION IS INDEXED
                 ACCESS MODE IS RANDOM
                 RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                 WITH DUPLICATES
                 FILE STATUS IS ITEM-FILE-STATUS.
            SELECT NEWORDER-FILE ASSIGN TO DATABASE-NEWORD
                 ORGANIZATION IS SEQUENTIAL
```

```
            FILE STATUS IS NEWORDER-FILE-STATUS.
        SELECT ORDERS-FILE ASSIGN TO DATABASE-ORDERSLF
            ORGANIZATION IS SEQUENTIAL.
        SELECT ORDERLINE-FILE ASSIGN TO DATABASE-ORDLIN
            ACCESS MODE IS SEQUENTIAL.
D       SELECT DBUG-FILE
D           ASSIGN TO FORMATFILE-DBUGPRT
D           ORGANIZATION IS SEQUENTIAL
D           ACCESS IS SEQUENTIAL.
D       SELECT DBUG-FILE2
D           ASSIGN TO FORMATFILE-DBUGPRT2
D           ORGANIZATION IS SEQUENTIAL
D           ACCESS IS SEQUENTIAL.
D       SELECT ISO-IFILE
D           ASSIGN TO DATABASE-ISOIFILE
D           ORGANIZATION IS SEQUENTIAL
D           ACCESS IS SEQUENTIAL.

    I-O-CONTROL.
       COMMITMENT CONTROL FOR WAREHOUSE-FILE
       COMMITMENT CONTROL FOR DISTRICT-FILE
       COMMITMENT CONTROL FOR ITEM-FILE
       COMMITMENT CONTROL FOR NEWORDER-FILE
       COMMITMENT CONTROL FOR ORDERS-FILE
       COMMITMENT CONTROL FOR ORDERLINE-FILE.
    DATA DIVISION.
    FILE SECTION.


    FD WAREHOUSE-FILE
       LABEL RECORDS ARE STANDARD.
     01 WAREHOUSE-REC.
          COPY DDS-WRRCD OF WRHS.
          05 WRHS-INFO REDEFINES WRRCD.
             06 FILLER                PIC X(12).
             06 WH-ADDRESS.
                08 WADDR1             PIC X(20).
                08 WADDR2             PIC X(20).
                08 CITYW              PIC X(20).
                08 STATEW             PIC X(2).
                08 ZIPW               PIC X(10).
    FD DISTRICT-FILE
       LABEL RECORDS ARE STANDARD.
     01 DISTRICT-REC.
       COPY DDS-DSRCD OF DSTRCT.
        05  DISTRICT-INFO REDEFINES  DSRCD.
            06 DIST-KEY.
               08 DID                 PIC S9(4) COMP-4.
               08 DWID                PIC S9(4) COMP-4.
            06 FILLER               PIC X(10).
            06 DIST-ADDRESS.
               08 DADDR1              PIC X(20).
               08 DADDR2              PIC X(20).
               08 CITY                PIC X(20).
               08 STATE               PIC X(2).
               08 ZIP                 PIC X(10).
    FD ITEM-FILE
       LABEL RECORDS ARE STANDARD.
     01 ITEM-REC.
       COPY DDS-ITRCD OF ITEM.
       05 ITEM-DEF REDEFINES ITRCD.
           06 ID-IID              PIC S9(9) COMP-4.
           06 ID-IMID             PIC S9(9) COMP-4.
           06 ITEM-INFO.
              08 ID-INAME         PIC X(24).
              08 ID-IPRICE        PIC S9(3)V99 COMP-3.
           06 ID-IDATA            PIC X(50).
    FD NEWORDER-FILE
       LABEL RECORDS ARE STANDARD.
     01 NEWORDER-REC.
       COPY DDS-NORCD OF NEWORD.
    FD ORDERS-FILE
       LABEL RECORDS ARE STANDARD.
     01 ORDERS-REC.
       COPY DDS-ORRCD OF ORDERSLF.
    FD ORDERLINE-FILE
       LABEL RECORDS ARE STANDARD.
     01 ORDERLINE-REC.
       COPY DDS-OLRCD OF ORDLIN.
       05 ORDERLIN-INPUT REDEFINES OLRCD.
          07 ORDER-KEY.
             08 OLOID                 PIC S9(9) COMP-4.
             08 OLDID                 PIC S9(4) COMP-4.
             08 OLWID                 PIC S9(4) COMP-4.
             08 OLNBR                 PIC S9(3) COMP-3.
          07 OL-INPUT.
             08 OL-INPUT-OLSPWH       PIC S9(4) COMP-4.
             08 OL-INPUT-OLIID        PIC S9(9) COMP-4.
             08 OL-INPUT-QTY          PIC S9(3) COMP-3.
          07 FILLER                   PIC X(4).
          07 OLTIME-OF-DAY            PIC X(8).
          07 TIME-FILLER              PIC X(6).
DFD  DBUG-FILE
D    LABEL RECORDS ARE STANDARD
D    DATA RECORD IS DBUG-REC.
D   01  DBUGPRT-REC.
D    COPY DDS-DBUGRCD OF DBUGPRT.
D       05  DBUG-REC REDEFINES DBUGRCD-O.
D           06  DEBUG-DATA.
D               07  ISONUM                 PIC XX.
D               07  TXTDATA                PIC X(40).
D               07  WID                    PIC S9(4).
D               07  DID                    PIC S9(2).
D               07  TIME-DATE.
D                   08  DATE6              PIC S9(8).
D                   08  TIME6              PIC S9(6).
D               07  CID                    PIC S9(4).
D               07  OID                    PIC S9(8).
D               07  DEBUG-ITEM-INFO OCCURS 15 TIMES.
D                 08 DEBUG-OLSPWH          PIC S9(4).
D                 08 DEBUG-OLIID           PIC S9(6).
D                 08 DEBUG-OLQTY           PIC S9(3).
D                 08 DEBUG-IPRICE          PIC S9(5)V9(2).
DFD  DBUG-FILE2
D    LABEL RECORDS ARE STANDARD
D    DATA RECORD IS DBUG-REC2.
D   01  DBUGPRT-REC2.
D    COPY DDS-DBUGRCD2 OF DBUGPRT2.
D       05  DBUG-REC2 REDEFINES DBUGRCD2-O.
D           06  DEBUG-DATA.
D               07  ISONUM                 PIC XX.
D               07  TXTDATA                PIC X(40).
D               07  WID                    PIC S9(4).
D               07  DID                    PIC S9(2).
D               07  TIME-DATE.
D                   08  DATE6              PIC S9(8).
D                   08  TIME6              PIC S9(6).
D               07  CID                    PIC S9(4).
D               07  CWID                   PIC S9(4).
D               07  CDID                   PIC S9(2).
D               07  CBAL                   PIC S9(11)V99.
D               07  PAYMNT                 PIC S9(7)V99.
DFD  ISO-IFILE
D    LABEL RECORDS ARE STANDARD.
D01  ISOIFILE-RECORD.
D    COPY DDS-ISOIRCD OF ISOIFILE.
D    05 ISO-IREC REDEFINES ISOIRCD.
D      06 ISOINUM PIC S9(4) COMP-4.


  WORKING-STORAGE SECTION.

   01  TRAN-OUTPUT.
    05 TRAN-OUT PIC X(670).

    05 NEWORD-O REDEFINES TRAN-OUT.
         06    NEWORD-RESULT         PIC X.
         06    OENTTM                PIC S9(6).
         06    CLAST                 PIC X(16).
         06    CCREDT                PIC X(2).
         06    CDCT                  PIC S999V99 COMP-3.
         06    OID                   PIC S9(9) COMP-4.
         06    WTAX                  PIC S9V9999 COMP-3.
         06    DTAX                  PIC S9V9999 COMP-3.
         06    TOTAMT                PIC S9(9)V9(2) COMP-3.
         06  OUTPUT-TABLE.
           10 OUTPUT-LINE OCCURS  15 TIMES.
              15 OUTPUT-STQTY        PIC S9(4) COMP-4.
              15 OUTPUT-BORG         PIC  X(1).
              15 OUTPUT-ITEM-INFO.
                20 OUTPUT-INAME        PIC X(24).
                20 OUTPUT-IPRICE       PIC S9(3)V9(2) COMP-3.
              15 OUTPUT-OLAMNT        PIC S9(5)V9(2) COMP-3.
         06   OENTTOD                 PIC X(8).


01 STOCK-KEY-PTR USAGE POINTER.
01 CSTMR-KEY-PTR USAGE POINTER.

01 STOCK-KEY.
  03 STOCK-KEY-DATA OCCURS 5 TIMES.
     05  KNAM   PIC X(10).
     05  KVAL   PIC S9(9) COMP-4.

01 CSTMR-KEY.
  03 CSTMR-KEY-DATA OCCURS 5 TIMES.
     05  KNAM   PIC X(10).
     05  KVAL   PIC S9(9) COMP-4.

01 STOCK-HASH-NAME  PIC X(10).
01 CSTMR-HASH-NAME  PIC X(10).

01 STOCK-HASH-PTR   USAGE POINTER.
01 CSTMR-HASH-PTR   USAGE POINTER.

01 FUNCT            PIC X(1).
01 KEYS             PIC S9(9) COMP-4.
01 RET-CODE         PIC S9(9) COMP-4.

01  RET-CODE-PTR    USAGE POINTER.

01  STOCK-DEF-PTR   USAGE POINTER.
01  CSTMR-DEF-PTR   USAGE POINTER.

01 UPDATER                PIC X(1) VALUE "3".
01 FETCHR                 PIC X(1) VALUE "1".
01 FETCHUPDATE            PIC X(1) VALUE "2".

01 CUST-KEYS              PIC 9(1) comp-4 VALUE 3.
01 STOCK-KEYS             PIC 9(1) comp-4 VALUE 2.


01 CUSTOMER-REC.
        05  CUST-KEY.
            06 CID     PIC S9(9) COMP-4.
            06 CDID    PIC S9(4) COMP-4.
            06 CWID    PIC S9(4) COMP-4.
            06 CUST-INFO.
               08 CFIRST  PIC X(16).
               08 CINIT   PIC X(02).
               08 CLAST   PIC X(16).
               08 CLDATE  PIC S9(8).
               08 CADDR1  PIC X(20).
               08 CCREDT  PIC X(02).
               08 CADDR2  PIC X(20).
               08 CDCT    PIC S9V9999 COMP-3.
               08 CCITY   PIC X(20).
               08 CSTATE  PIC X(02).
               08 CZIP    PIC X(9).
               08 CPHONE  PIC X(16).
               08 CBAL     PIC S9(11)V99 COMP-3.
               08 CCRDLM   PIC S9(11)V99 COMP-3.
               08 CYTD     PIC S9(11)V99 COMP-3.
               08 CPAYCNT  PIC S9(3)     COMP-3.
               08 CDELCNT  PIC S9(3)     COMP-3.
               08 CDATA    PIC X(500).

   01 STOCK-REC.
     05  STOCK-DEF.
         06  STOCK-IN.
             08 STIID1          PIC S9(9) COMP-4.
             08 STWID1          PIC S9(4) COMP-4.
             08 STQTY           PIC S9(3) COMP-3.
         06  DIST-INFO  OCCURS 10 TIMES.
             07  DIST-IN       PIC X(24).
         06 STYTD          PIC S9(9) COMP-4.
         06 STORDRS        PIC S9(3) COMP-3.
         06 STREMORD       PIC S9(3) COMP-3.
         06 STDATA         PIC X(50).


 01   TRANSACTION-INPUT.
        06    TXN-TYPE           PIC X.
        06    JOBNAME            PIC X(10).
        06    CLIENT-INPUT       PIC X(202).
        06 NEWORD-I REDEFINES CLIENT-INPUT.
           08 CWID                 PIC S9(4) COMP-4.
           08 CDID                 PIC S9(4) COMP-4.
           08 CID                  PIC S9(9) COMP-4.
           08 NUMBER-OF-ITEMS      PIC 9(3) COMP-3.
           08 INPUT-LINE OCCURS 15 TIMES.
              10 OLSPWH            PIC S9(4) COMP-4.
              10 OLIID             PIC S9(9) COMP-4.
              10 OLQTY             PIC S9(3) COMP-3.


01 INPUT-ROW.
     05 STOCK-KEY-INPUT.
            10 OLIID             PIC S9(9) COMP-4.
            10 OLSPWH            PIC S9(4) COMP-4.
     05 OLQTY             PIC S9(3) COMP-3.


  01 ROLL-BACK-REQUIRED       PIC X(1) VALUE '0'.
  01 CONTR-1                  PIC S99 COMP-4.

D 01 TESTNUM                  PIC 99 VALUE 1.
D 01 J                        PIC S999 COMP-3.

  01 DATETIME-INIT.
     05 TPCDATE-INIT          PIC X(8) VALUE "00000000".
  01 DATETIME-CHARINIT REDEFINES DATETIME-INIT PIC X(8).

  01 TIME-OF-DAY PIC X(8).

D 01 TIME-OF-DAY-STRING  PIC X(14).

D   01 TORD   PIC X(1) VALUE "b".

  01 ERROR-HDLNG-PARAMETERS.
      05  NEWORDER-FILE-STATUS       PIC X(2) VALUE "00".
      05  ITEM-FILE-STATUS           PIC X(2) VALUE "00".
      05  DISTRICT-FILE-STATUS       PIC X(2) VALUE "00".
      05  WAREHOUSE-FILE-STATUS      PIC X(2) VALUE "00".
      05  ORDLIN-FILE-STATUS         PIC X(2) VALUE "00".

  01 I        PIC S9(3) COMP-3.

LINKAGE SECTION.
  01  FIRST-TIME PIC S9(4) COMP-4.
  01  INP-TRAN PIC X(230).
  01  OUT-TRAN PIC X(670).

PROCEDURE DIVISION USING FIRST-TIME  INP-TRAN OUT-TRAN.

DECLARATIVES.
```

```
 HANDLE-ERROR SECTION.


 I-O-ERROR-PARA.


 END DECLARATIVES.


   MAIN-LINE-ROUTINE.

       IF FIRST-TIME > 0
       PERFORM SET-UP-ROUTINE.

       MOVE INP-TRAN TO TRANSACTION-INPUT.

D    READ ISO-IFILE.
D    MOVE ISOINUM TO TESTNUM, ISONUM of DBUG-REC, ISONUM OF
D    DBUG-REC2.


 NEW-ORDER-TRANSACTION.

     CALL "gettime" USING TIME-OF-DAY.

     MOVE CWID of NEWORD-I to CWID OF CUSTOMER-REC
                          WID OF  WAREHOUSE-REC
                         DWID OF  DSRCD
                        NOWID OF  NEWORDER-REC
                         OWID OF  ORDERS-REC.

     MOVE CDID OF NEWORD-I TO
                           CDID OF  CUSTOMER-REC
                            DID OF  DSRCD
                         NODID OF  NEWORDER-REC
                          ODID OF  ORDERS-REC.

     MOVE   TIME-OF-DAY TO  OENTTOD OF ORDERS-REC.
     MOVE   TIME-OF-DAY TO  OENTTOD OF NEWORD-O.


     MOVE CID OF NEWORD-I TO CID OF CUSTOMER-REC
                              OCID OF ORDERS-REC.

     MOVE NUMBER-OF-ITEMS TO  OLINES OF ORDERS-REC.
     MOVE 1 TO OLOCAL OF ORDERS-REC.

     MOVE 0 TO TOTAMT.

 RE-DO-NEWORD.


* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D    MOVE "NEW ORDER PRE-READ  " TO  TXTDATA OF DBUG-REC.
D    MOVE 9999 TO OID OF DBUG-REC.
D    PERFORM GET-ISOLATION-DATA-1.
D    WRITE DBUGPRT-REC FORMAT IS "DBUGRCD".


     MOVE CID  OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(1)
     MOVE CDID OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(2)
     MOVE CWID OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(3)

      CALL "qdbrunha" USING BY VALUE
             CSTMR-HASH-PTR FETCHUPDATE CUST-KEYS CSTMR-KEY-PTR
             CSTMR-DEF-PTR RET-CODE-PTR

     IF RET-CODE > 0
           IF RET-CODE = 100
                MOVE "2" TO ROLL-BACK-REQUIRED
                GO TO ROLLBACK-PARA
           ELSE
               IF  RET-CODE = 812
                   ROLLBACK
                   GO TO  RE-DO-NEWORD
               ELSE
                   ROLLBACK
                   GO TO PROGRAM-END
               END-IF
           END-IF

     ELSE


     READ DISTRICT-FILE
     END-READ
         IF DISTRICT-FILE-STATUS NOT EQUAL "00"
           IF DISTRICT-FILE-STATUS EQUAL "9D"
                ROLLBACK
                GO TO RE-DO-NEWORD
           ELSE
                MOVE "2" TO ROLL-BACK-REQUIRED
                GO TO ROLLBACK-PARA
           END-IF
         ELSE
     MOVE DNXTOR OF DISTRICT-REC   TO OID OF ORDERS-REC
                                      NOOID OF NEWORDER-REC

     PERFORM VARYING I FROM 1 BY 1 UNTIL I > NUMBER-OF-ITEMS
           MOVE OLSPWH OF INPUT-LINE(I)  TO OLSPWH OF INPUT-ROW
           MOVE OLIID  OF INPUT-LINE(I)  TO OLIID  OF INPUT-ROW
           MOVE OLQTY  OF INPUT-LINE(I)  TO OLQTY  OF INPUT-ROW
           MOVE OLIID OF INPUT-ROW TO IID OF ITEM-REC


     READ ITEM-FILE
     IF ITEM-FILE-STATUS NOT EQUAL "00"

          MOVE "1" TO ROLL-BACK-REQUIRED
                GO TO ROLLBACK-PARA

     ELSE

                MOVE ITEM-INFO TO   OUTPUT-ITEM-INFO(I)

                MOVE ZERO TO  CONTR-1

                INSPECT  IDATA OF ITEM-REC
                TALLYING  CONTR-1 FOR ALL "ORIGINAL"

                MOVE STOCK-KEY-INPUT TO STOCK-IN

     MOVE STWID1              TO KVAL OF STOCK-KEY-DATA(2)
     MOVE STIID1              TO KVAL OF STOCK-KEY-DATA(1)

     CALL "qdbrunha" USING BY VALUE
            STOCK-HASH-PTR FETCHUPDATE STOCK-KEYS STOCK-KEY-PTR
            STOCK-DEF-PTR RET-CODE-PTR

           IF RET-CODE > 0
            IF RET-CODE = 100
                 MOVE "2" TO ROLL-BACK-REQUIRED
                 GO TO ROLLBACK-PARA
            ELSE
                IF RET-CODE = 812
                    ROLLBACK
                    GO TO  RE-DO-NEWORD
                ELSE
                    ROLLBACK
                    GO TO PROGRAM-END
                END-IF
             END-IF
            ELSE
```

```
* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D              IF TESTNUM = 7 THEN
D                IF I = 1 THEN
D                  CALL "delayme"
D                END-IF
D              END-IF


                SUBTRACT  OLQTY OF INPUT-ROW
                                FROM  STQTY OF STOCK-REC
                IF STQTY OF STOCK-REC < 10 THEN
                    ADD 91 TO  STQTY OF STOCK-REC
                END-IF


                IF  (OLSPWH OF INPUT-ROW NOT EQUAL CWID OF
                                              NEWORD-I)
                     MOVE 0 TO  OLOCAL   OF ORDERS-REC
                     ADD  1 TO  STREMORD OF STOCK-REC
                END-IF

                ADD 1              TO  STORDRS OF STOCK-REC
                ADD  OLQTY OF INPUT-ROW TO STYTD OF STOCK-REC

       CALL "qdbrunha" USING BY VALUE
              STOCK-HASH-PTR UPDATER STOCK-KEYS STOCK-KEY-PTR
              STOCK-DEF-PTR RET-CODE-PTR
              IF RET-CODE > 0 THEN
                 IF RET-CODE = 1 THEN
                    ROLLBACK
                    GO TO PROGRAM-END
                 END-IF
                 IF RET-CODE = 2 THEN
                     ROLLBACK
                 END-IF
              END-IF
              IF CONTR-1 > ZERO THEN
                   MOVE ZERO TO  CONTR-1
                   INSPECT  STDATA OF STOCK-REC
                   TALLYING  CONTR-1 FOR ALL "ORIGINAL"
              END-IF

              IF CONTR-1 > ZERO
                 THEN MOVE "B" TO  OUTPUT-BORG(I)
                 ELSE MOVE "G" TO  OUTPUT-BORG(I)
              END-IF

              MULTIPLY  OLQTY OF INPUT-ROW BY  IPRICE
                   GIVING  OUTPUT-OLAMNT(I)

              ADD  OUTPUT-OLAMNT(I)  TO TOTAMT

              MOVE  NORCD             TO ORDER-KEY
              MOVE I                  TO  OLNBR OF OLRCD
                                           OF  ORDERLINE-REC
              MOVE INPUT-ROW    TO  OL-INPUT
              MOVE OLIID  OF INPUT-ROW TO OL-INPUT-OLIID
              MOVE OLSPWH OF INPUT-ROW TO OL-INPUT-OLSPWH
              MOVE OLQTY  OF INPUT-ROW TO OL-INPUT-QTY
              MOVE  OUTPUT-OLAMNT(I)  TO OLAMNT OF OLRCD
                                           OF  ORDERLINE-REC
              MOVE  DIST-INFO(CDID OF NEWORD-I)
                                     TO  OLDSTI OF OLRCD
                                           OF  ORDERLINE-REC

              MOVE  DATETIME-CHARINIT  TO OLTIME-OF-DAY
              WRITE  ORDERLINE-REC
              MOVE  STQTY OF STOCK-REC TO OUTPUT-STQTY(I)
            END-IF
            END-IF
       END-PERFORM
       END-IF
      END-IF.

D    MOVE  OID OF ORDERS-REC TO OID OF DBUG-REC.

     ADD 1 TO  DNXTOR OF DISTRICT-REC.

     REWRITE  DISTRICT-REC.

     WRITE  ORDERS-REC.

     WRITE NEWORDER-REC.

 READ-WAREHOUSE.
     READ WAREHOUSE-FILE.
         IF WAREHOUSE-FILE-STATUS NOT EQUAL "00"
           IF WAREHOUSE-FILE-STATUS EQUAL "9D"
                GO TO READ-WAREHOUSE
           ELSE
                MOVE "2" TO ROLL-BACK-REQUIRED
           END-IF
         END-IF.

 ROLLBACK-PARA.
     IF ROLL-BACK-REQUIRED NOT EQUAL "0"
     THEN
* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D         MOVE "NEW ORDER  PRE-RBACK  " TO TXTDATA OF DBUG-REC
D         PERFORM GET-ISOLATION-DATA-1
D         WRITE  DBUGPRT-REC FORMAT IS "DBUGRCD"
D         CALL "delayme"

         ROLLBACK
* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D         MOVE "NEW ORDER  POST-RBACK" TO TXTDATA OF DBUG-REC
D         PERFORM GET-ISOLATION-DATA-2
D         WRITE  DBUGPRT-REC FORMAT IS "DBUGRCD"
D         CLOSE  DBUG-FILE
D         OPEN OUTPUT  DBUG-FILE


         MOVE CLAST OF CUSTOMER-REC
                         TO CLAST OF NEWORD-O
         MOVE CCREDT  OF CUSTOMER-REC
                         TO CCREDT OF NEWORD-O
         MOVE OID OF ORDERS-REC
                        TO OID OF NEWORD-O
       IF ROLL-BACK-REQUIRED = "1"
         MOVE "R" TO NEWORD-RESULT of NEWORD-O
       ELSE IF ROLL-BACK-REQUIRED = "2"
         MOVE "I" TO NEWORD-RESULT of NEWORD-O
       END-IF
       END-IF
         MOVE "0" TO ROLL-BACK-REQUIRED
         GO TO RETURN-DATA
     ELSE
* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D         MOVE "NEW ORDER PRE-COMMIT" TO  TXTDATA OF DBUG-REC
D         PERFORM GET-ISOLATION-DATA-1
D         WRITE  DBUGPRT-REC FORMAT IS "DBUGRCD"
D         CALL "delayme"



          COMMIT.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D         MOVE "NEW ORDER  POST-COMIT" TO TXTDATA OF DBUG-REC.
```

```
D         PERFORM GET-ISOLATION-DATA-2.
D         WRITE  DBUGFRT-REC FORMAT IS "DBUGRCD".
D         CLOSE  DBUG-FILE.
D         OPEN OUTPUT DBUG-FILE.

     MOVE "G" TO NEWORD-RESULT of NEWORD-O
     MOVE CLAST OF CUSTOMER-REC
           TO CLAST OF NEWORD-O
     MOVE CCREDT OF CUSTOMER-REC
           TO CCREDT OF NEWORD-O
     MOVE CDCT of CUSTOMER-REC TO CDCT OF NEWORD-O
     MOVE WTAX of WAREHOUSE-REC TO WTAX OF NEWORD-O
     MOVE DTAX of DISTRICT-REC TO DTAX OF NEWORD-O
     MOVE OID OF ORDERS-REC TO
              OID OF NEWORD-O.

     GO TO RETURN-DATA.

 NEW-ORDER-TRANSACTION-EXIT.

     EXIT.


D GET-ISOLATION-DATA-1.
D       MOVE CDID OF NEWORD-I TO DID OF DBUG-REC
D       MOVE CID OF NEWORD-I TO CID OF DBUG-REC
D       MOVE cwid of NEWORD-I TO WID OF DBUG-REC
D       CALL "gettime" USING TIME-OF-DAY
D       MOVE "b" TO TORD
D       CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D       TORD
D       MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC
D       MOVE TESTNUM TO ISONUM OF DBUG-REC
D       PERFORM VARYING J FROM 1 BY 1 UNTIL J = 16
D         MOVE OLSPWH OF INPUT-LINE(J) TO DEBUG-OLSPWH(J)
D         MOVE OLIID OF INPUT-LINE(J) TO DEBUG-OLIID(J)
D         MOVE OLQTY OF INPUT-LINE(J) TO DEBUG-OLQTY(J)
D         MOVE 0 TO DEBUG-IPRICE(J)
D       END-PERFORM.


D GET-ISOLATION-DATA-2.
D       MOVE OID OF ORDERS-REC TO OID OF DBUG-REC.
D       MOVE CDID OF NEWORD-I TO DID OF DBUG-REC
D       MOVE CID OF NEWORD-I TO CID OF DBUG-REC
D       MOVE cwid of NEWORD-I TO WID OF DBUG-REC
D       CALL "gettime" USING TIME-OF-DAY
D       MOVE "b" TO TORD
D       CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D       TORD
D       MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC
D       MOVE TESTNUM TO ISONUM OF DBUG-REC
D       PERFORM VARYING J FROM 1 BY 1 UNTIL J = 16
D         MOVE OLSPWH OF INPUT-LINE(J) TO DEBUG-OLSPWH(J)
D         MOVE OLIID OF INPUT-LINE(J) TO DEBUG-OLIID(J)
D         MOVE OLQTY OF INPUT-LINE(J) TO DEBUG-OLQTY(J)
D         IF OLIID OF INPUT-LINE(J) <= 100000
D         MOVE OUTPUT-IPRICE(J) TO DEBUG-IPRICE(J)
D         ELSE
D         MOVE 0 TO DEBUG-IPRICE(J)
D         END-IF
D       END-PERFORM.

 OPEN-ROUTINE.
*OPEN FILES
     PERFORM CLOSE-ROUTINE.
     OPEN  I-O   WAREHOUSE-FILE.
     OPEN EXTEND NEWORDER-FILE.
     OPEN EXTEND ORDERS-FILE.
     OPEN EXTEND ORDERLINE-FILE.
     OPEN INPUT  ITEM-FILE.
     OPEN  I-O   DISTRICT-FILE.
D    OPEN INPUT  ISO-IFILE.
D    OPEN OUTPUT DBUG-FILE.
D    OPEN OUTPUT DBUG-FILE2.

 CLOSE-ROUTINE.
*CLOSE FILES
     CLOSE DISTRICT-FILE.
     CLOSE WAREHOUSE-FILE.
     CLOSE ITEM-FILE.
     CLOSE ORDERLINE-FILE.
     CLOSE ORDERS-FILE.
     CLOSE NEWORDER-FILE.
D    CLOSE ISO-IFILE.
D    CLOSE DBUG-FILE.
D    CLOSE DBUG-FILE2.

 SET-UP-ROUTINE.

     CALL "gettime" USING TIME-OF-DAY.
     PERFORM OPEN-ROUTINE.

     MOVE "STOCK"            TO STOCK-HASH-NAME.
     MOVE "STIID"            TO KNAM OF STOCK-KEY-DATA(1).
     MOVE "STWID"            TO KNAM OF STOCK-KEY-DATA(2).

     SET STOCK-HASH-PTR TO ADDRESS OF STOCK-HASH-NAME.
     SET RET-CODE-PTR  TO ADDRESS OF RET-CODE.
     SET STOCK-DEF-PTR TO ADDRESS OF STOCK-DEF.
     SET STOCK-KEY-PTR TO ADDRESS OF STOCK-KEY.

     MOVE "CSTMR"            TO  CSTMR-HASH-NAME.
     MOVE "CIID"             TO  KNAM OF CSTMR-KEY-DATA(1).
     MOVE "CDID"             TO  KNAM OF CSTMR-KEY-DATA(2).
     MOVE "CWID"             TO  KNAM OF CSTMR-KEY-DATA(3).

     SET CSTMR-HASH-PTR TO ADDRESS OF CSTMR-HASH-NAME.
     SET RET-CODE-PTR    TO ADDRESS OF  RET-CODE.
     SET CSTMR-DEF-PTR  TO ADDRESS OF CUSTOMER-REC.
     SET CSTMR-KEY-PTR  TO ADDRESS OF CSTMR-KEY.

     MOVE SPACES TO OCARID   OF ORDERS-REC.
     MOVE ZEROES TO OLDLVTOD OF ORDERLINE-REC.
 RETURN-DATA.
        MOVE NEWORD-O TO OUT-TRAN.
        GOBACK.
 PROGRAM-END.
     STOP RUN.
```

D.21 NEWSRVR.C:

```
#include <Common.h>
#include <qsoasync.h>
#include <stdio.h>



main(int argc, char **argv)
{
  int           sd, snd_len=670, rcv_len=230, port, rc;
  int           sd_arr[MAX_CONN];/* the indexes for accepts and use          */
  int           num_conn;/* the number of connections */
  int           accept_index;/* accept index goes from 0 to num_conn - 1     */
  int           retry_count;/* nuber of retries attempted */
  char          rcv_buf[MAX_CONN] [BufferSize];/* one per connection */
  char          snd_buf[BufferSize];
  char          start_error;/* start transaction error flag       */
  char          cmd[120];/* command holder                          */
  struct sockaddr_in    sin;
  int           length;
    Qso_OverlappedIO_t        status;
    char                      buffer[256];

    memset(&status,0,sizeof(status));
    status.bufferLength=rcv_len;
    status.postFlag=1;                          /* Always post to I/O completion port */
    status.fillBuffer=1;       /* Fill buffer. */
    /* get the number of connections                                          */
    num_conn = atoi(argv[1]);
    sd = atoi(argv[2]);/* get the socket number */
    /* num_conn = 2; */// test action */

    if((port=QsoCreateIOCompletionPort())<0) {
      perror("\nQsoCreateIOCompletionPort() failed");
      exit(-1);
    }

     length=sizeof(sin);

     for( accept_index=0;accept_index<num_conn;accept_index++)
     {
          if((sd_arr[accept_index]=accept(sd,
             (struct sockaddr *)&sin,&length))<0)
          {
              perror("accept() in NEWSRVR failed\n");
              printf("Input socket is %d\n", sd );
              close(sd);
              exit(-1);
          }
          status.descriptorHandle=(void*)sd_arr[accept_index];
          status.buffer=rcv_buf[accept_index];
          if(QsoStartRecv(sd_arr[accept_index],port,&status)<0)  {
                           perror("\nQsoStartRecv() failed");
                           exit(-1);
          }

     }/* end of connect loop */
     system("STRCMTCTL  LCKLVL(*ALL)");
     system("CHGJOB RUNPTY(16)");
     do
     {
         if(QsoWaitForIOCompletion(port,&status,0)<0)
         {
                           perror("\nQsoWaitForIoCompletion() failed");
                           exit(-1);
         }

         if(status.returnValue<=0)  {
                           printf("\nRecv() failed, errno=%d",status.errnoValue);
                           exit(-1);
         }

         if(status.operationCompleted!=QSOSTARTRECV)  {
                      printf("\nUnexpected completion=%d",status.operationCompleted);
                           exit(-1);
         }

         NEWORDMOD(&first_time, status.buffer, snd_buf);
         if ( snd_buf[0] == 'G' )/* check the NEWORD-RESULT */
         {
           first_time--;
         }
         if(send((int)status.descriptorHandle,snd_buf,snd_len,0)<0)
         {
            if (( errno != EPIPE )&&( errno != EUNKNOWN ))
            {
                perror("\nsend(2) failed");
                exit(-1);
            }
         }

         if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)
         {
                             perror("\nQsoStartRecv() failed");
                             exit(-1);
         }

     } while(first_time > 0);

    for(;;) {

         if(QsoWaitForIOCompletion(port,&status,0)<0)
         {
                                   perror("\nQsoWaitForIoCompletion() failed");
                                   exit(-1);
         }

         if(status.returnValue<=0)
         {
                           printf("\nRecv() failed, errno=%d",status.errnoValue);
                           exit(-1);
         }

         if(status.operationCompleted!=QSOSTARTRECV)  {
                      printf("\nUnexpected completion=%d", status.operationCompleted);
                           exit(-1);
         }

         NEWORDMOD(&first_time, status.buffer, snd_buf);

         if(send((int) status.descriptorHandle,snd_buf,snd_len,0)<0)
         {
            if (( errno != EPIPE )&&( errno != EUNKNOWN ))
            {
                perror("\nsend(2) failed");
                exit(-1);
            }
         }
         if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)
         {
                          perror("\nQsoStartRecv() failed");
                          exit(-1);
         }



   }  /* for loop  */
   return 0;
}
```

D.22 ORDSRVR.C:

```
#include <Common.h>
#include <qsoasync.h>
#include <stdio.h>


void main(int argc, char **argv)
{
  int           sd, snd_len=670, rcv_len=230, port, rc;
  int           sd_arr[MAX_CONN];/* the indexes for accepts and use          */
  int           num_conn;/* the number of connections */
  int           accept_index;/* accept index goes from 0 to num_conn - 1     */
  int           retry_count;/* nuber of retries attempted */
  char          rcv_buf[MAX_CONN] [BufferSize];/* one per connection */
  char          snd_buf[BufferSize];
  struct sockaddr_in    sin;
  int           length;
    Qso_OverlappedIO_t        status;
    char                      buffer[256];

    memset(&status,0,sizeof(status));
    status.bufferLength=rcv_len;
    status.postFlag=1;                          /* Always post to I/O completion port */
    status.fillBuffer=1;       /* Fill buffer. */
    /* get the number of connections                                          */
    num_conn = atoi(argv[1]);
    /* num_conn = 2;*//* test action  */
```

```
    if((port=QsoCreateIOCompletionPort())<0)  {
      perror("\nQsoCreateIOCompletionPort()  failed");
      exit(-1);
    }

    length=sizeof(sin);

    for( accept_index=0;accept_index<num_conn;accept_index++)
    {
          if((sd_arr[accept_index]=accept(sd,
             (struct sockaddr *)&sin,&length))<0)
          {
               perror("accept() in DLVSRVR failed");
               close(sd);
               exit(-1);
          }
          status.descriptorHandle=(void*)sd_arr[accept_index];
          status.buffer=rcv_buf[accept_index];
          if(QsoStartRecv(sd_arr[accept_index],port,&status)<0)  {
                            perror("\nQsoStartRecv()  failed");
                            exit(-1);
          }

    }/* end of connect loop  */
    system("STRCMTCTL  LCKLVL(*ALL)");
    system("CHGJOB RUNPTY(18)");
    system("OVRDBF FILE(ORDLINLF) TOFILE(*FILE) NBRRCDS(15)");
    do
    {
        if(QsoWaitForIOCompletion(port,&status,0)<0)
        {
                          perror("\nQsoWaitForIoCompletion()  failed");
                          exit(-1);
        }

        if(status.returnValue<=0)
        {
                            printf("\nRecv()  failed, errno=%d",status.errnoValue);
                            exit(-1);
        }

        if(status.operationCompleted!=QSOSTARTRECV)
        {
                          printf("\nUnexpected  completion=%d",status.operationCompleted);
                          exit(-1);
        }

        ORDSTSMOD(&first_time, status.buffer, snd_buf);
        if (( snd_buf[0] != '6' )||/* check the ORDSTS-FMT-NUM */
           (( snd_buf[0] == '6' )&&( snd_buf[1] != '2' )))
        {
            first_time--;
        }
        if(send((int) status.descriptorHandle,snd_buf,snd_len,0)<0)
        {
            if (( errno != EPIPE )&&( errno != EUNKNOWN ))
            {
              perror("\nsend(1) failed");
              exit(-1);
            }

        }

        if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)
        {
                          perror("\nQsoStartRecv()  failed");
                          exit(-1);
        }


    } while ( first_time > 0 );

    for(;;) {



         if(QsoWaitForIOCompletion(port,&status,0)<0)  {
                                   perror("\nQsoWaitForIoCompletion()  failed");
                                   exit(-1);
         }

         if(status.returnValue<=0)  {
                                printf("\nRecv()  failed, errno=%d",status.errnoValue);
                                exit(-1);
         }

         if(status.operationCompleted!=QSOSTARTRECV)  {
                        printf("\nUnexpected  completion=%d",status.operationCompleted);
                            exit(-1);
         }

         ORDSTSMOD(&first_time, status.buffer, snd_buf);

         if(send((int) status.descriptorHandle,snd_buf,snd_len,0)<0)
         {
            if (( errno != EPIPE )&&( errno != EUNKNOWN ))
            {
              perror("\nsend(2) failed");
              exit(-1);
            }
         }

         if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)
         {
                            perror("\nQsoStartRecv()  failed");
                            exit(-1);
         }


      }  /* for loop  */
}
```

D.23 ORDSTS.CBL:

```
       PROCESS NOTRUNC NORANGE.
       IDENTIFICATION DIVISION.
         PROGRAM-ID. ORDSTSMOD.
         AUTHOR. TPCC.
         INSTALLATION. IBM-ROCHESTER.
         DATE-WRITTEN.
         DATE-COMPILED.
      ****************************************************************
      *
      *  PART NAME: ORDERSTATUS
      *
      ****************************************************************
       ENVIRONMENT DIVISION.
       CONFIGURATION SECTION.
         SOURCE-COMPUTER.  IBM-AS400.
      *  SOURCE-COMPUTER.  IBM-AS400 WITH DEBUGGING MODE.
         OBJECT-COMPUTER.  IBM-AS400.
         INPUT-OUTPUT SECTION.
         FILE-CONTROL.
             SELECT ORDERS-VIEW ASSIGN TO DATABASE-ORDERS
                  ORGANIZATION IS INDEXED
                  ACCESS MODE IS DYNAMIC
                  RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                  WITH DUPLICATES.
             SELECT ORDERLINE-VIEW ASSIGN TO DATABASE-ORDLINLF
                  ORGANIZATION IS INDEXED
                  ACCESS MODE IS DYNAMIC
                  RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                  WITH DUPLICATES.
      D      SELECT DBUG-FILE
      D           ASSIGN TO FORMATFILE-DBUGPRT
      D           ORGANIZATION IS SEQUENTIAL
      D           ACCESS IS SEQUENTIAL.
      D      SELECT ISO-IFILE
      D           ASSIGN TO DATABASE-ISOIFILE
      D           ORGANIZATION IS SEQUENTIAL
      D           ACCESS IS SEQUENTIAL.

      I-O-CONTROL.
         COMMITMENT CONTROL FOR ORDERS-VIEW
         COMMITMENT CONTROL FOR  ORDERLINE-VIEW.
      DATA DIVISION.
      FILE SECTION.


      FD ORDERS-VIEW
         LABEL RECORDS ARE STANDARD.
       01 ORDERS-VIEW-REC.
         COPY DDS-ORRCD OF ORDERS.
      FD ORDERLINE-VIEW
         LABEL RECORDS ARE STANDARD.
       01 ORDERLINE-VIEW-REC.
         COPY DDS-OLRCD OF ORDLINLF.
         05 OL-STATUS-OUTPUT REDEFINES OLRCD.
            08 FILLER            PIC X(10).
            08 OL-INFO.
               10 OL-INFO-OLSPWH        PIC S9(4) COMP-4.
               10 OL-INFO-OLIID         PIC S9(9) COMP-4.
               10 OL-INFO-OLQTY         PIC S9(3) COMP-3.
               10 OL-INFO-OLAMNT        PIC S9(5)V9(2) COMP-3.
               10 OL-INFO-OLDLVTOD      PIC X(8).
DFD  DBUG-FILE
D    LABEL RECORDS ARE STANDARD
D    DATA RECORD IS DBUG-REC.
D   01  DBUGPRT-REC.
D    COPY DDS-DBUGRCD OF DBUGPRT.
D       05  DBUG-REC REDEFINES DBUGRCD-O.
D           06  DEBUG-DATA.
D               07  ISONUM                 PIC XX.
D               07  TXTDATA                PIC X(40).
D               07  WID                    PIC S9(4).
D               07  DID                    PIC S9(2).
D               07  TIME-DATE.
D                   08  DATE6              PIC S9(8).
D                   08  TIME6              PIC S9(6).
D               07  CID                    PIC S9(4).
D               07  OID                    PIC S9(8).
D               07  DEBUG-ITEM-INFO OCCURS 15 TIMES.
D                 08  DEBUG-OLSPWH         PIC S9(4).
D                 08  DEBUG-OLIID          PIC S9(6).
D                 08  DEBUG-OLQTY          PIC S9(3).
D                 08  DEBUG-IPRICE         PIC S9(5)V9(2).
DFD  ISO-IFILE
D    LABEL RECORDS ARE STANDARD.
D01  ISOIFILE-RECORD.
D    COPY DDS-ISOIRCD OF ISOIFILE.
D    05 ISO-IREC REDEFINES ISOIRCD.
D      06 ISOINUM PIC S9(4) COMP-4.


  WORKING-STORAGE SECTION.

   01  TRAN-OUTPUT.
    05 TRAN-OUT PIC X(670).


    05  ORDSTS-O REDEFINES TRAN-OUT.
        06 ORDSTS-FMT-NUM        PIC XX.
        06 OCID                  PIC S9(9) COMP-4.
        06 CUSTINFO.
           08 CFIRST                PIC X(16).
           08 CINIT                 PIC X(2).
           08 CLAST                 PIC X(16).
        06 CBAL                  PIC S9(11)V9(2)  COMP-3.
        06 ORDERINFO.
           08 OID                   PIC S9(9) COMP-4.
           08 ODT.
              10 OENTTOD               PIC X(8).
              10 OENTTM                PIC 9(6).
           08 OCARID                PIC X(2).
           08 OLINENBR              PIC S9(4) COMP-4.
        06 OLINEINFO OCCURS 15 TIMES.
          07 DO-OLSPWH            PIC S9(4) COMP-4.
          07 DO-OLIID             PIC S9(9) COMP-4.
          07 DO-OLQTY             PIC S9(3) COMP-3.
          07 DO-OLAMNT            PIC S9(5)V9(2) COMP-3.
          07 DO-OLDLVTOD          PIC X(8).

01 CSTMR-KEY-PTR USAGE POINTER.


01 CSTMR-KEY.
  03 CSTMR-KEY-DATA OCCURS 5 TIMES.
     05  KNAM    PIC X(10).
     05  KVAL    PIC S9(9) COMP-4.

01 CSTMR-HASH-NAME  PIC X(10).

01 CSTMR-HASH-PTR   USAGE POINTER.

01 FUNCT            PIC X(1).
01 KEYS             PIC S9(9) COMP-4.
01 RET-CODE          PIC S9(9) COMP-4.

01  RET-CODE-PTR    USAGE POINTER.

01  CSTMR-DEF-PTR   USAGE POINTER.

01 FETCHR                 PIC X(1) VALUE "1".

01 CUST-KEYS              PIC 9(1) comp-4 VALUE 3.


01 CUSTOMER-REC.
        05  CUST-KEY.
            06 CID      PIC S9(9) COMP-4.
            06 CDID     PIC S9(4) COMP-4.
            06 CWID     PIC S9(4) COMP-4.
            06 CUST-INFO.
               08 CFIRST  PIC X(16).
               08 CINIT   PIC X(02).
               08 CLAST   PIC X(16).
               08 CLDATE  PIC S9(8).
               08 CADDR1  PIC X(20).
               08 CCREDT  PIC X(02).
               08 CADDR2  PIC X(20).
               08 CDCT    PIC S9V9999 COMP-3.
               08 CCITY   PIC X(20).
               08 CSTATE  PIC X(02).
               08 CZIP    PIC X(9).
               08 CPHONE  PIC X(16).
               08 CBAL     PIC S9(11)V99 COMP-3.
               08 CCRDLM   PIC S9(11)V99 COMP-3.
               08 CYTD     PIC S9(11)V99 COMP-3.
               08 CPAYCNT  PIC S9(3)     COMP-3.
               08 CDELCNT  PIC S9(3)     COMP-3.
               08 CDATA    PIC X(500).

 01   TRANSACTION-INPUT.
        06    TXN-TYPE           PIC X.
        06    JOBNAME            PIC X(10).
        06    CLIENT-INPUT       PIC X(202).
        06 ORDSTS-I REDEFINES CLIENT-INPUT.
          08 ORDSTS-TYPE         PIC X.
          08 ORD-CUST-KEY.
           09 CID                PIC S9(9) COMP-4.
           09 DID                PIC S9(4) COMP-4.
           09 WID                PIC S9(4) COMP-4.
          08 CLAST               PIC X(16).
          08 FILLER              PIC X(165).
```

```
  01 CWIDR    PIC S9(4) COMP-4.
  01 CDIDR    PIC S9(4) COMP-4.
  01 CLASTR   PIC X(16).
  01 CLASTK   PIC X(16).
  01 CUSTREL      PIC 9(9) COMP-4.



D  01 TESTNUM                   PIC 99 VALUE 1.
D  01 J                         PIC S999 COMP-3.

   01 TIME-OF-DAY  PIC X(8).

D  01 TIME-OF-DAY-STRING  PIC X(14).

D   01 TORD   PIC X(1) VALUE "b".

    01 CNTR                       PIC 99.
    01 CUST-INDEX   PIC S9(4)  USAGE BINARY.
    01 CUSTR-INDEX   PIC S9(4)  USAGE BINARY.
    01 CUSTOMER-ARRAY.
       03  CUSTOMER-ARRAY-ELEMENT   OCCURS 100 TIMES.
           05 CID      PIC S9(9) COMP-4.
           05 CDID     PIC S9(4) COMP-4.
           05 CWID     PIC S9(4) COMP-4.
   01 TEMP-DATA2        PIC X(468).

   01 HOST-DATA.
       03  HOST-ARRAY-ELEMENT   OCCURS 100 TIMES.
           05 CID    PIC S9(9) COMP-4.

   01 ERROR-HDLNG-PARAMETERS.
       05  NEWORDER-FILE-STATUS            PIC X(2).

   01 I        PIC S999 BINARY.

 01  TOO-MANY.
      05 TOO-MANY-1.
         06 TOO-MANY-CID     PIC S9(9) COMP-4.
         06 TOO-MANY-DID     PIC S9(4) COMP-4.
         06 TOO-MANY-WID     PIC S9(4) COMP-4.
      06 TOO-MANY-CLAST      PIC X(16).


     EXEC SQL
       INCLUDE  SQLCA
     END-EXEC.


*  SQL ERROR/WARNING Messages  *

     EXEC SQL
       WHENEVER  SQLERROR CONTINUE
     END-EXEC.

     EXEC SQL
       WHENEVER  SQLWARNING CONTINUE
     END-EXEC.

  01 XX  PIC S9(2) COMP-4.

 LINKAGE SECTION.
   01  FIRST-TIME  PIC S9(4) COMP-4.
   01  INP-TRAN PIC X(230).
   01  OUT-TRAN PIC X(670).

 PROCEDURE DIVISION USING FIRST-TIME  INP-TRAN OUT-TRAN.

 DECLARATIVES.

 HANDLE-ERROR SECTION.


 I-O-ERROR-PARA.


 END DECLARATIVES.


   MAIN-LINE-ROUTINE.

       IF FIRST-TIME > 0
       PERFORM SET-UP-ROUTINE.

       MOVE INP-TRAN TO TRANSACTION-INPUT.

D    READ ISO-IFILE.
D    MOVE ISOINUM TO TESTNUM, ISONUM of DBUG-REC.

 ORDER-STATUS-TRANSACTION.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D    MOVE "ORDER STATUS PRE-READ  " TO  TXTDATA OF DBUG-REC.
D    MOVE 0 TO OID OF DBUG-REC
D    PERFORM GET-ISOLATION-DATA-3.
D    WRITE DBUGPRT-REC FORMAT IS "DBUGRCD".

     MOVE WID OF ORDSTS-I TO OWID OF ORDERS-VIEW-REC.
     MOVE DID OF ORDSTS-I TO ODID OF ORDERS-VIEW-REC.
     MOVE ORD-CUST-KEY OF ORDSTS-I TO CUST-KEY OF CUSTOMER-REC.
 ORDER-STATUS-READS.
     IF ORDSTS-TYPE = "C" THEN
        PERFORM CUSTOMER-BY-NUMBER
     ELSE
        MOVE CLAST OF ORDSTS-I TO CLASTK
        MOVE WID OF ORDSTS-I TO CWID OF CUSTOMER-REC
        MOVE DID OF ORDSTS-I TO CDID OF CUSTOMER-REC
        PERFORM CUSTOMER-BY-NAME THROUGH
             CUSTOMER-BY-NAME-EXIT
     END-IF.
     MOVE CID OF CUSTOMER-REC TO OCID OF ORDERS-VIEW-REC
                                 OCID OF ORDSTS-O.
     MOVE 999999 TO OID OF ORDERS-VIEW-REC.

     START ORDERS-VIEW KEY NOT < EXTERNALLY-DESCRIBED-KEY
     INVALID KEY
               MOVE "62" TO ORDSTS-FMT-NUM
               GO TO ORDER-STATUS-TRANSACTION-EXIT.
     READ ORDERS-VIEW PRIOR
D              IF TESTNUM = 9 THEN
D                  CALL "delayme"
D                  READ ORDERS-VIEW
D              END-IF

     MOVE OWID OF ORDERS-VIEW-REC TO
             OLWID OF ORDERLINE-VIEW-REC.
     MOVE ODID OF ORDERS-VIEW-REC TO
             OLDID OF ORDERLINE-VIEW-REC.
     MOVE OID OF ORDERS-VIEW-REC TO
             OLOID OF ORDERLINE-VIEW-REC OID OF ORDSTS-O.
     MOVE 1 TO OLNBR OF ORDERLINE-VIEW-REC.
     MOVE OLINES OF ORDERS-VIEW-REC TO
             OLINENBR OF ORDSTS-O.
     MOVE OCARID OF ORDERS-VIEW-REC TO
             OCARID OF ORDSTS-O.
     MOVE OENTTOD OF ORDERS-VIEW-REC TO
             OENTTOD OF ORDSTS-O.

     READ ORDERLINE-VIEW
     MOVE OL-INFO TO OLINEINFO(1)

     PERFORM varying I
             from 2 by 1 until I >  OLINES OF ORDERS-VIEW-REC

         READ ORDERLINE-VIEW NEXT

         MOVE OL-INFO TO OLINEINFO(I)

     END-PERFORM.

       MOVE I TO ORDSTS-FMT-NUM.
D      MOVE OID OF ORRCD OF ORDERS-VIEW-REC TO OID OF DBUG-REC.
     COMMIT.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D    MOVE "ORDER STATUS POST-COMMIT " TO  TXTDATA OF DBUG-REC.
*    MOVE 0 TO OID OF DBUG-REC
D    PERFORM GET-ISOLATION-DATA-4.
D    WRITE DBUGPRT-REC FORMAT IS "DBUGRCD".
D    CLOSE DBUG-FILE.
D    OPEN OUTPUT DBUG-FILE.


     MOVE CBAL OF CUSTOMER-REC TO CBAL OF ORDSTS-O.
     MOVE CFIRST OF CUSTOMER-REC TO CFIRST OF ORDSTS-O.
     MOVE CINIT OF CUSTOMER-REC TO CINIT OF ORDSTS-O.
     MOVE CLAST OF CUSTOMER-REC TO CLAST OF ORDSTS-O.

     MOVE ORDSTS-O TO OUT-TRAN.
     GOBACK.
 ORDER-STATUS-TRANSACTION-EXIT.
     MOVE ORDSTS-O TO OUT-TRAN.
     GOBACK.

 CUSTOMER-BY-NUMBER.
         MOVE CID  OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(1)
         MOVE CDID OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(2)
         MOVE CWID OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(3)

         CALL "qdbrunha" USING BY VALUE
               CSTMR-HASH-PTR FETCHR CUST-KEYS
               CSTMR-KEY-PTR CSTMR-DEF-PTR RET-CODE-PTR

         IF RET-CODE > 0
           IF RET-CODE = 100
                 MOVE "62" TO  ORDSTS-FMT-NUM
                 ROLLBACK
                 GO TO ORDER-STATUS-TRANSACTION-EXIT
           ELSE
              IF RET-CODE = 812
                     ROLLBACK
                     GO TO ORDER-STATUS-TRANSACTION
              ELSE
                     ROLLBACK
                     GO TO PROGRAM-END
              END-IF
           END-IF
         END-IF.

 CUSTOMER-BY-NAME.

      MOVE CWID OF CUSTOMER-REC TO CWIDR.
      MOVE CDID OF CUSTOMER-REC TO CDIDR.
      MOVE CLASTK                  TO CLASTR.

      EXEC SQL DECLARE C1 CURSOR FOR
      SELECT CID
      FROM CSTMRLFCRT
      WHERE CLAST = :CLASTR AND CDID = :CDIDR AND
      CWID = :CWIDR
      END-EXEC.

      EXEC SQL OPEN C1
      END-EXEC.

      EXEC SQL FETCH C1 FOR 100 ROWS INTO :HOST-ARRAY-ELEMENT
      END-EXEC.
      MOVE SQLERRD OF SQLCA(3)  TO XX.

      EXEC SQL CLOSE C1
      END-EXEC.

      IF XX = 0
          MOVE "62" TO  ORDSTS-FMT-NUM
          ROLLBACK
          GO TO ORDER-STATUS-TRANSACTION-EXIT
      END-IF

      IF XX = 100
          CALL "TOOMANY" USING CWIDR, CDIDR, CLASTR, CUSTREL
      ELSE
          COMPUTE  CUST-INDEX = (XX + 1) / 2.
          MOVE  HOST-ARRAY-ELEMENT(CUST-INDEX)  TO
          CID  OF CUSTOMER-REC.
          PERFORM CUSTOMER-BY-NUMBER.

 CUSTOMER-BY-NAME-EXIT.


D GET-ISOLATION-DATA-3.
D      MOVE DID OF ORDSTS-I TO DID OF DBUG-REC
D      MOVE CID OF ORDSTS-I TO CID OF DBUG-REC
D      MOVE WID of ORDSTS-I TO WID OF DBUG-REC
D      CALL "gettime" USING TIME-OF-DAY
D      MOVE "b" TO TORD
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC
D      MOVE TESTNUM TO ISONUM OF DBUG-REC
D      PERFORM VARYING J FROM 1 BY 1 UNTIL J = 16
D        MOVE 0 TO DEBUG-OLSPWH(J)
D        MOVE 0 TO DEBUG-OLIID(J)
D        MOVE 0 TO DEBUG-OLQTY(J)
D        MOVE 0 TO DEBUG-IPRICE(J)
D      END-PERFORM.


D GET-ISOLATION-DATA-4.
D      MOVE DID OF ORDSTS-I TO DID OF DBUG-REC
D      MOVE CID OF ORDSTS-I TO CID OF DBUG-REC
D      MOVE WID of ORDSTS-I TO WID OF DBUG-REC
D      CALL "gettime" USING TIME-OF-DAY
D      MOVE "b" TO TORD
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC
D      MOVE TESTNUM TO ISONUM OF DBUG-REC
D      PERFORM VARYING J FROM 1 BY 1 UNTIL J >
D                          OLINES OF ORDERS-VIEW-REC
D        MOVE DO-OLSPWH(J)  TO DEBUG-OLSPWH(J)
D        MOVE DO-OLIID(J)  TO DEBUG-OLIID(J)
D        MOVE DO-OLQTY(J)  TO DEBUG-OLQTY(J)
D        MOVE 0 TO DEBUG-IPRICE(J)
D      END-PERFORM.



 SET-UP-ROUTINE.

     CALL "gettime" USING TIME-OF-DAY.


*OPEN FILES
     PERFORM CLOSE-ROUTINE.
     OPEN INPUT
                 ORDERLINE-VIEW
                 ORDERS-VIEW.
D    OPEN INPUT  ISO-IFILE.
D    OPEN OUTPUT DBUG-FILE.


     MOVE "CSTMR"           TO CSTMR-HASH-NAME.
```

```
     MOVE "CID"             TO KNAM OF CSTMR-KEY-DATA(1).
     MOVE "CDID"            TO KNAM OF CSTMR-KEY-DATA(2).
     MOVE "CWID"            TO KNAM OF CSTMR-KEY-DATA(3).

     SET CSTMR-HASH-PTR TO ADDRESS OF CSTMR-HASH-NAME.
     SET RET-CODE-PTR   TO ADDRESS OF RET-CODE.
     SET CSTMR-DEF-PTR  TO ADDRESS OF CUSTOMER-REC.
     SET CSTMR-KEY-PTR  TO ADDRESS OF CSTMR-KEY.

 CLOSE-ROUTINE.
     CLOSE       ORDERLINE-VIEW.
     CLOSE       ORDERS-VIEW.
D    CLOSE       ISO-IFILE.
D    CLOSE       DBUG-FILE.
 PROGRAM-END.
     STOP RUN.
```

D.24 PAYMENT.CBL:

```
 PROCESS NOTRUNC NORANGE.
 IDENTIFICATION DIVISION.
   PROGRAM-ID. PAYMENTMOD.
   AUTHOR. TPCC.
   INSTALLATION. IBM-ROCHESTER.
   DATE-WRITTEN.
   DATE-COMPILED.
*****************************************************************
*
*  PART NAME: PAYMENT
*
*****************************************************************
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
   SOURCE-COMPUTER. IBM-AS400.
*  SOURCE-COMPUTER. IBM-AS400 WITH DEBUGGING MODE.
   OBJECT-COMPUTER. IBM-AS400.
   INPUT-OUTPUT SECTION.
   FILE-CONTROL.
       SELECT WAREHOUSE-FILE ASSIGN TO  DATABASE-WRHS
            ORGANIZATION IS INDEXED
            ACCESS MODE IS RANDOM
            RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
            WITH DUPLICATES
            FILE STATUS IS WAREHOUSE-FILE-STATUS.
       SELECT DISTRICT-FILE ASSIGN TO  DATABASE-DSTRCT
            ORGANIZATION IS INDEXED
            ACCESS MODE IS RANDOM
            RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
            WITH DUPLICATES
            FILE STATUS IS DISTRICT-FILE-STATUS.
       SELECT HISTORY-FILE ASSIGN TO  DATABASE-HSTRY
            ORGANIZATION IS SEQUENTIAL.
D      SELECT DBUG-FILE2
D           ASSIGN TO FORMATFILE-DBUGPRT2
D           ORGANIZATION IS SEQUENTIAL
D           ACCESS IS SEQUENTIAL.
D      SELECT ISO-IFILE
D           ASSIGN TO DATABASE-ISOIFILE
D           ORGANIZATION IS SEQUENTIAL
D           ACCESS IS SEQUENTIAL.

   I-O-CONTROL.
      COMMITMENT CONTROL FOR WAREHOUSE-FILE
      COMMITMENT CONTROL FOR DISTRICT-FILE
      COMMITMENT CONTROL FOR HISTORY-FILE.
   DATA DIVISION.
   FILE SECTION.


   FD WAREHOUSE-FILE
      LABEL RECORDS ARE STANDARD.
    01 WAREHOUSE-REC.
         COPY DDS-WRRCD OF WRHS.
         05 WRHS-INFO REDEFINES WRRCD.
            06 FILLER                PIC X(12).
            06 WH-ADDRESS.
               08 WADDR1             PIC X(20).
               08 WADDR2             PIC X(20).
               08 CITYW              PIC X(20).
               08 STATEW             PIC X(2).
               08 ZIPW               PIC X(10).
   FD DISTRICT-FILE
      LABEL RECORDS ARE STANDARD.
    01 DISTRICT-REC.
      COPY DDS-DSRCD OF DSTRCT.
       05  DISTRICT-INFO REDEFINES  DSRCD.
           06 DIST-KEY.
              08 DID                 PIC S9(4) COMP-4.
              08 DWID                PIC S9(4) COMP-4.
           06 FILLER               PIC X(10).
           06 DIST-ADDRESS.
              08 DADDR1              PIC X(20).
              08 DADDR2              PIC X(20).
              08 CITY                PIC X(20).
              08 STATE               PIC X(2).
              08 ZIP                 PIC X(10).
 FD  HISTORY-FILE
     LABEL RECORDS ARE STANDARD
     DATA RECORD IS HISTORY-REC.
    01  HISTORY-REC.
     COPY DDS-HSRCD OF HSTRY.
       05 HIST-INFO REDEFINES HSRCD.
          07 HISTORY-DATA.
            09 PAY-DIST-KEY.
             10 DID                 PIC S9(4) COMP-4.
             10 WID                 PIC S9(4) COMP-4.
            09 PAY-CUST-KEY.
             10 CID                 PIC S9(9) COMP-4.
             10 CDID                PIC S9(4) COMP-4.
             10 CWID                PIC S9(4) COMP-4.
          07 DATE-TIME.
            09 HTOD                 PIC X(8).
          07 AMOUNT               PIC S9(5)V99 COMP-3.
          07 HDATA.
            09 WNAME                PIC X(10).
            09 FILLER               PIC XXXX.
            09 DNAME                PIC X(10).
DFD  DBUG-FILE2
D    LABEL RECORDS ARE STANDARD
D    DATA RECORD IS  DBUG-REC2.
D   01  DBUGPRT-REC2.
D    COPY DDS-DBUGRCD2 OF DBUGPRT2.
D       05  DBUG-REC2 REDEFINES DBUGRCD2-O.
D           06  DEBUG-DATA.
D               07  ISONUM                  PIC XX.
D               07  TXTDATA                 PIC X(40).
D               07  WID                     PIC S9(4).
D               07  DID                     PIC S9(2).
D               07  TIME-DATE.
D                   08  DATE6               PIC S9(8).
D                   08  TIME6               PIC S9(6).
D               07  CID                     PIC S9(4).
D               07  CWID                    PIC S9(4).
D               07  CDID                    PIC S9(2).
D               07  CBAL                    PIC S9(11)V99.
D               07  PAYMNT                  PIC S9(7)V99.
DFD  ISO-IFILE
D    LABEL RECORDS ARE STANDARD.
D01  ISOIFILE-RECORD.
D    COPY DDS-ISOIRCD OF ISOIFILE.
D    05 ISO-IREC REDEFINES ISOIRCD.
D      06 ISOINUM PIC S9(4) COMP-4.


  WORKING-STORAGE SECTION.
```

```
  01  TRAN-OUTPUT.
   05 TRAN-OUT PIC X(670).


     05 PAYMNT-O REDEFINES TRAN-OUT.
        06 OUTPUT-FMT-NUM-3      PIC XX.
+                                   17 = bad credit
+                                   18 = no cid or  clast
+                                   19 = good credit
+                                   88 = bad last name
        06 HDT.
          08 HOTOD    PIC X(8).
          08 HTIME    pic 9(6).
        06 WH-DATA.
          08 WADDR1   PIC X(20).
          08 WADDR2   PIC X(20).
          08 WCITY    PIC X(20).
          08 WSTATE   PIC X(02).
          08 WZIP     PIC X(9).
        06 DST-DATA.
          08 DADDR1   PIC X(20).
          08 DADDR2   PIC X(20).
          08 DCITY    PIC X(20).
          08 DSTATE   PIC X(02).
          08 DZIP     PIC X(9).
        06 CID          PIC S9(9) COMP-4.
        06 PAYMENT-CUST-INFO.
          08 CFIRST   PIC X(16).
          08 CINIT    PIC X(02).
          08 CLAST    PIC X(16).
          08 CLDATE   PIC S9(8).
          08 CADDR1   PIC X(20).
          08 CCREDT   PIC X(02).
          08 CADDR2   PIC X(20).
          08 CDCT     PIC S999V99 COMP-3.
          08 CCITY    PIC X(20).
          08 CSTATE   PIC X(02).
          08 CZIP     PIC X(9).
          08 CPHONE   PIC X(16).
          08 CBAL     PIC S9(11)V9(2) COMP-3.
          08 CCRDLM   PIC S9(11)V9(2) COMP-3.
        06 MISC-CDATA.
          08  CDAT1    PIC X(50).
          08  CDAT2    PIC X(50).
          08  CDAT3    PIC X(50).
          08  CDAT4    PIC X(50).


 01 CSTMR-KEY-PTR USAGE POINTER.

 01 CSTMR-KEY.
   03 CSTMR-KEY-DATA OCCURS 5 TIMES.
      05  KNAM    PIC X(10).
      05  KVAL    PIC S9(9) COMP-4.

 01 CSTMR-HASH-NAME  PIC X(10).

 01 CSTMR-HASH-PTR   USAGE POINTER.

 01 FUNCT            PIC X(1).
 01 KEYS             PIC S9(9) COMP-4.
 01 RET-CODE         PIC S9(9) COMP-4.

 01  RET-CODE-PTR    USAGE POINTER.

 01  CSTMR-DEF-PTR   USAGE POINTER.

 01 UPDATER                PIC X(1) VALUE "3".
 01 FETCHR                 PIC X(1) VALUE "1".
 01 FETCHUPDATE            PIC X(1) VALUE "2".

 01 CUST-KEYS              PIC 9(1) comp-4 VALUE 3.

 01 CMNF-INDIC-AREA.
    03 CMNF-INDIC      PIC 1 OCCURS 99 TIMES
                      INDICATOR 1.

 01 CUSTOMER-REC.
        05  CUST-KEY.
            06 CID     PIC S9(9) COMP-4.
            06 CDID    PIC S9(4) COMP-4.
            06 CWID    PIC S9(4) COMP-4.
            06 CUST-INFO.
               08 CFIRST  PIC X(16).
               08 CINIT   PIC X(02).
               08 CLAST   PIC X(16).
               08 CLDATE  PIC S9(8).
               08 CADDR1  PIC X(20).
               08 CCREDT  PIC X(02).
               08 CADDR2  PIC X(20).
               08 CDCT    PIC S9V9999 COMP-3.
               08 CCITY   PIC X(20).
               08 CSTATE  PIC X(02).
               08 CZIP    PIC X(9).
               08 CPHONE  PIC X(16).
               08 CBAL     PIC S9(11)V99 COMP-3.
               08 CCRDLM   PIC S9(11)V99 COMP-3.
               08 CYTD     PIC S9(11)V99 COMP-3.
               08 CPAYCNT  PIC S9(3)     COMP-3.
               08 CDELCNT  PIC S9(3)     COMP-3.
               08 CDATA    PIC X(500).

  01   TRANSACTION-INPUT.
         06    TXN-TYPE           PIC X.
         06    JOBNAME            PIC X(10).
         06    CLIENT-INPUT       PIC X(202).
         06 NEWORD-I REDEFINES CLIENT-INPUT.
           08 CWID                 PIC S9(4) COMP-4.
           08 CDID                 PIC S9(4) COMP-4.
           08 CID                  PIC S9(9) COMP-4.
           08 NUMBER-OF-ITEMS      PIC 9(3) COMP-3.
           08 INPUT-LINE OCCURS 15 TIMES.
             10 OLSPWH             PIC S9(4) COMP-4.
             10 OLIID              PIC S9(9) COMP-4.
             10 OLQTY              PIC S9(3) COMP-3.
         06 PAYMENT-I REDEFINES CLIENT-INPUT.
           08 PAYMENT-TYPE         PIC X.
+                                  Payment type = C if by CID
+                                  Payment type = L if by  CLAST
           08 HISTORY-DATA.
            09 PAY-DIST-KEY.
             10 DID                 PIC S9(4) COMP-4.
             10 WID                 PIC S9(4) COMP-4.
            09 PAY-CUST-KEY.
             10 CID                 PIC S9(9) COMP-4.
             10 CDID                PIC S9(4) COMP-4.
             10 CWID                PIC S9(4) COMP-4.
           08 AMOUNT               PIC S9(5)V99 COMP-3.
           08 CLAST                PIC X(16).
           08 FILLER               PIC X(155).
         06 ORDSTS-I REDEFINES CLIENT-INPUT.
           08 ORDSTS-TYPE          PIC X.
           08 ORD-CUST-KEY.
            09 CID                 PIC S9(9) COMP-4.
            09 DID                 PIC S9(4) COMP-4.
            09 WID                 PIC S9(4) COMP-4.
           08 CLAST                PIC X(16).
           08 FILLER               PIC X(165).
         06 STKLVL-I REDEFINES CLIENT-INPUT.
           08 WID                  PIC S9(4) COMP-4.
           08 DID                  PIC S9(4) COMP-4.
           08 THRESHOLD            PIC S9(4) COMP-4.
           08 BLWSTK               PIC S9(4) COMP-4.
         06 DLVRY-I REDEFINES CLIENT-INPUT.
           08 WID                  PIC S9(4) COMP-4.
           08 CARRIER              PIC XX.
           08 D-DATE               PIC 9(8).
           08 D-TIME               PIC 9(8).
```

```
 01 CWIDR    PIC S9(4) COMP-4.
 01 CDIDR    PIC S9(4) COMP-4.
 01 CLASTR   PIC X(16).
 01 CLASTK   PIC X(16).
 01 CUSTREL      PIC 9(9) COMP-4.


01  CHAR-HIST-DATA.
    05 DID                    PIC S99.
    05 WID                    PIC S9(4).
    05 CID                    PIC S9(6).
    05 CDID                   PIC S99.
    05 CWID                   PIC S9(4).
    05 AMOUNT                 PIC S9(5)V99.


  01 ROLL-BACK-REQUIRED   PIC X(1).
  01 CONTR-1                  PIC S99 COMP-4.


  01 DATEINT.
     06  YY                   PIC 9(2).
     06  MMDD                 PIC 9(4).

  01 DATETIME-INIT.
     05 TPCDATE-INIT          PIC X(8) VALUE "00000000".
  01 DATETIME-CHARINIT REDEFINES DATETIME-INIT PIC X(8).
  01 TIME-OF-DAY  PIC X(8).

   01 CNTR                     PIC 99.
   01 CUST-INDEX   PIC S9(4)  USAGE BINARY.
   01 CUSTR-INDEX   PIC S9(4)  USAGE BINARY.
   01 CUSTOMER-ARRAY.
      03  CUSTOMER-ARRAY-ELEMENT   OCCURS 100 TIMES.
          05 CID       PIC S9(9) COMP-4.
          05 CDID      PIC S9(4) COMP-4.
          05 CWID      PIC S9(4) COMP-4.
  01 TEMP-DATA2        PIC X(468).

  01 HOST-DATA.
      03  HOST-ARRAY-ELEMENT   OCCURS 100 TIMES.
          05 CID    PIC S9(9) COMP-4.

  01 ERROR-HDLNG-PARAMETERS.
      05  DISTRICT-FILE-STATUS            PIC X(2).
      05  WAREHOUSE-FILE-STATUS           PIC X(2).


  01 I          PIC S999 BINARY.
D 01 TESTNUM                  PIC 99 VALUE 1.
D 01 J                        PIC S999 COMP-3.
D 01 TIME-OF-DAY-STRING  PIC X(14).
D  01 TORD   PIC X(1) VALUE "b".



     EXEC SQL
       INCLUDE  SQLCA
     END-EXEC.


*  SQL ERROR/WARNING Messages  *

     EXEC SQL
       WHENEVER  SQLERROR CONTINUE
     END-EXEC.

     EXEC SQL
       WHENEVER  SQLWARNING CONTINUE
     END-EXEC.

 01 XX  PIC S9(2) COMP-4.

LINKAGE SECTION.
  01  FIRST-TIME  PIC S9(4) COMP-4.
  01  INP-TRAN PIC X(230).
  01  OUT-TRAN PIC X(670).

PROCEDURE DIVISION USING FIRST-TIME  INP-TRAN OUT-TRAN.

DECLARATIVES.

HANDLE-ERROR SECTION.


I-O-ERROR-PARA.

END DECLARATIVES.


  MAIN-LINE-ROUTINE.

      IF FIRST-TIME > 0
      PERFORM SET-UP-ROUTINE.

      MOVE  INP-TRAN TO TRANSACTION-INPUT.

D    READ  ISO-IFILE.
D    MOVE  ISOINUM TO TESTNUM, ISONUM OF DBUG-REC2.


PAYMENT-TRANSACTION.

     MOVE HISTORY-DATA OF PAYMENT-I TO HISTORY-DATA OF  HIST-INFO.
     MOVE AMOUNT OF PAYMENT-I TO AMOUNT OF  HIST-INFO.

     CALL "gettime" USING TIME-OF-DAY.

     MOVE  TIME-OF-DAY TO DATE-TIME OF  HIST-INFO, HDT.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D    MOVE "PAY PRE-READ  " TO  TXTDATA OF DBUG-REC2.
D    MOVE CDID OF  CUSTOMER-REC TO CDID OF  DBUG-REC2.
D    MOVE CWID OF CUSTOMER-REC TO CWID OF DBUG-REC2.
D    MOVE CID OF PAYMENT-I TO CID OF  DBUG-REC2.
D    MOVE CDID OF  CUSTOMER-REC TO DID OF DBUG-REC2.
D    MOVE AMOUNT OF PAYMENT-I TO
D           PAYMNT OF DBUG-REC2.
D    MOVE WID OF PAYMENT-I TO WID OF  DBUG-REC2.
D    MOVE 0 TO CBAL OF DBUG-REC2.
D      MOVE "b" TO TORD.
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD.
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC2.
D    WRITE  DBUGPRT-REC2  FORMAT IS "DBUGRCD2".


     IF PAYMENT-TYPE EQUAL "C"
     MOVE  PAY-CUST-KEY OF PAYMENT-I TO CUST-KEY
           OF  CUSTOMER-REC
         PERFORM CUSTOMER-BY-NUMBER
     ELSE
     MOVE CWID OF PAYMENT-I TO CWID OF CUSTOMER-REC
     MOVE CDID OF PAYMENT-I TO CDID OF  CUSTOMER-REC
     MOVE CLAST OF PAYMENT-I TO CLASTK


          PERFORM CUSTOMER-BY-NAME  THRU CUSTOMER-BY-NAME-EXIT.

D    MOVE CBAL OF CUSTOMER-REC TO CBAL OF DBUG-REC2.
     SUBTRACT AMOUNT OF PAYMENT-I
              FROM CBAL OF CUSTOMER-REC.

     ADD AMOUNT OF PAYMENT-I
         TO CYTD OF CUSTOMER-REC.

     ADD 1 TO CPAYCNT OF CUSTOMER-REC.
     MOVE CUST-INFO TO PAYMENT-CUST-INFO.
     MOVE CBAL OF CUSTOMER-REC TO CBAL OF PAYMNT-O.
     MOVE CCRDLM OF CUSTOMER-REC
         TO CCRDLM OF PAYMNT-O.
     MULTIPLY CDCT OF CUSTOMER-REC BY 100 GIVING
         CDCT OF PAYMNT-O.

     MOVE SPACES                    TO MISC-CDATA.
     IF CCREDT OF CUSTOMER-REC = "BC" THEN
       MOVE CDATA OF CUSTOMER-REC (1:468)
           TO TEMP-DATA2
       MOVE TEMP-DATA2
           TO CDATA OF CUSTOMER-REC (32:468)

       MOVE DID OF HISTORY-DATA OF  HIST-INFO
                                   TO DID OF  CHAR-HIST-DATA
       MOVE WID OF HISTORY-DATA OF  HIST-INFO
                                   TO WID OF  CHAR-HIST-DATA
       MOVE CID OF HISTORY-DATA OF  HIST-INFO
                                   TO CID OF  CHAR-HIST-DATA
       MOVE CDID OF HISTORY-DATA OF  HIST-INFO
                                   TO CDID OF  CHAR-HIST-DATA
       MOVE CWID OF HISTORY-DATA OF  HIST-INFO
                                   TO  CWID OF CHAR-HIST-DATA
       MOVE AMOUNT OF  HIST-INFO
                                   TO AMOUNT OF  CHAR-HIST-DATA
       MOVE CHAR-HIST-DATA TO CDATA OF CUSTOMER-REC(1:31)
       MOVE CDATA OF CUSTOMER-REC TO MISC-CDATA
     END-IF.
     CALL "qdbrunha" USING BY VALUE
           CSTMR-HASH-PTR UPDATER CUST-KEYS CSTMR-KEY-PTR
           CSTMR-DEF-PTR RET-CODE-PTR
         IF RET-CODE > 0
           IF RET-CODE = 100
                MOVE "77" TO  OUTPUT-FMT-NUM-3
                ROLLBACK
                GO TO PAYMENT-TRANSACTION-EXIT
           ELSE
           IF RET-CODE = 812
                      ROLLBACK
                      GO TO PAYMENT-TRANSACTION
           ELSE
                      ROLLBACK
                      GO TO PROGRAM-END
           END-IF
           END-IF
         END-IF.
     MOVE  PAY-DIST-KEY OF PAYMENT-I TO DIST-KEY.

READ-DSTRCT.
     READ DISTRICT-FILE.
         IF DISTRICT-FILE-STATUS NOT EQUAL "00"
           IF DISTRICT-FILE-STATUS EQUAL "9D"
                GO TO READ-DSTRCT
           ELSE
                MOVE "77" TO  OUTPUT-FMT-NUM-3
                ROLLBACK
                GO TO PAYMENT-TRANSACTION-EXIT
            END-IF
         END-IF.

     ADD AMOUNT OF PAYMENT-I
         TO DYTD OF DISTRICT-REC.

     REWRITE  DISTRICT-REC.

     MOVE WID OF PAYMENT-I TO WID OF  WAREHOUSE-REC.


     READ WAREHOUSE-FILE.
         IF WAREHOUSE-FILE-STATUS NOT EQUAL "00"
           IF WAREHOUSE-FILE-STATUS EQUAL "9D"
                ROLLBACK
                GO TO PAYMENT-TRANSACTION
           ELSE
                MOVE "77" TO  OUTPUT-FMT-NUM-3
                ROLLBACK
                GO TO PAYMENT-TRANSACTION-EXIT
            END-IF
         END-IF.

     ADD AMOUNT OF PAYMENT-I
         TO WYTD OF  WAREHOUSE-REC.

     REWRITE  WAREHOUSE-REC.

     MOVE CID OF  CUSTOMER-REC TO
              CID OF  HISTORY-REC.
     MOVE  WNAME OF WAREHOUSE-REC TO
              WNAME OF HDATA OF HIST-INFO.
     MOVE  DNAME OF DISTRICT-REC TO
              DNAME OF HDATA OF HIST-INFO.

     WRITE  HISTORY-REC.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D    MOVE "PAY PRE-COMMIT" TO  TXTDATA OF DBUG-REC2.
D    MOVE CDID OF  CUSTOMER-REC TO CDID OF  DBUG-REC2.
D    MOVE CWID OF CUSTOMER-REC TO CWID OF DBUG-REC2.
D    MOVE CID OF PAYMENT-I TO CID OF  DBUG-REC2.
D    MOVE CDID OF  CUSTOMER-REC TO DID OF DBUG-REC2.
D    MOVE WID OF PAYMENT-I TO WID OF  DBUG-REC2.
*    MOVE AMOUNT OF PAYMENT-I TO
*           PAYMNT OF DBUG-REC2.
D      CALL "gettime" USING TIME-OF-DAY.
D      MOVE "b" TO TORD.
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD.
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC2.
D    WRITE  DBUGPRT-REC2  FORMAT IS "DBUGRCD2".
D                   CALL "delayme".

*********  For Atomicity Rollback case ********
D    IF TESTNUM EQUAL "20"
D    ROLLBACK
D    GO TO PAY-POST-COMMIT
D    END-IF.

     COMMIT.

* THE FOLLOWING CODE WILL ONLY BE INCLUDED WHEN THE
* FLAG IS SET AND IS FOR ISOLATION TEST USE
*
D PAY-POST-COMMIT.
D    MOVE "PAY POST-COMMIT" TO  TXTDATA OF DBUG-REC2.
D    MOVE CDID OF  CUSTOMER-REC TO CDID OF  DBUG-REC2.
D    MOVE CWID OF CUSTOMER-REC TO CWID OF DBUG-REC2.
D    MOVE CID OF PAYMENT-I TO CID OF  DBUG-REC2.
D    MOVE CDID OF  CUSTOMER-REC TO DID OF DBUG-REC2.
*    MOVE AMOUNT OF PAYMENT-I TO
*           PAYMNT OF DBUG-REC2.
D    MOVE WID OF PAYMENT-I TO WID OF  DBUG-REC2.
D    MOVE CBAL OF CUSTOMER-REC TO CBAL OF DBUG-REC2.
D      CALL "gettime" USING TIME-OF-DAY.
D      MOVE "b" TO TORD.
D      CALL "getdttmstr" USING TIME-OF-DAY, TIME-OF-DAY-STRING,
D      TORD.
D      MOVE TIME-OF-DAY-STRING TO TIME-DATE OF  DBUG-REC2.
D    WRITE  DBUGPRT-REC2  FORMAT IS "DBUGRCD2".


     MOVE  DIST-ADDRESS TO DST-DATA.
     MOVE  WH-ADDRESS TO WH-DATA.
     MOVE CID OF  CUSTOMER-REC TO CID OF PAYMNT-O.
```

```
        IF CCREDT OF CUSTOMER-REC = "BC"
        THEN MOVE "17" TO OUTPUT-FMT-NUM-3
        ELSE MOVE "19" TO OUTPUT-FMT-NUM-3
        END-IF.

    PAYMENT-TRANSACTION-EXIT.
        MOVE PAYMNT-O TO OUT-TRAN.
        GOBACK.

    CUSTOMER-BY-NUMBER.
            MOVE CID  OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(1)
            MOVE CDID OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(2)
            MOVE CWID OF CUSTOMER-REC TO KVAL OF CSTMR-KEY-DATA(3)

            CALL "qdbrunha" USING BY VALUE
                  CSTMR-HASH-PTR FETCHUPDATE CUST-KEYS
                  CSTMR-KEY-PTR CSTMR-DEF-PTR RET-CODE-PTR

            IF RET-CODE > 0
              IF RET-CODE = 100
                    MOVE "77" TO OUTPUT-FMT-NUM-3
                    ROLLBACK
                    GO TO PAYMENT-TRANSACTION-EXIT
              ELSE
                    IF RET-CODE = 812
                         ROLLBACK
                         GO TO PAYMENT-TRANSACTION
                    ELSE
                         ROLLBACK
                         GO TO PROGRAM-END
                    END-IF
               END-IF
             END-IF.

    CUSTOMER-BY-NAME.

          MOVE CWID OF CUSTOMER-REC TO CWIDR.
          MOVE CDID OF CUSTOMER-REC TO CDIDR.
          MOVE CLASTK                TO CLASTR.

          EXEC SQL DECLARE C1 CURSOR FOR
          SELECT CID
          FROM CSTMRLFCRT
          WHERE CLAST = :CLASTR AND CDID = :CDIDR AND
          CWID = :CWIDR
          END-EXEC.

          EXEC SQL OPEN C1
          END-EXEC.

          EXEC SQL FETCH C1 FOR 100 ROWS INTO :HOST-ARRAY-ELEMENT
          END-EXEC.
          MOVE SQLERRD OF SQLCA(3) TO XX.

          EXEC SQL CLOSE C1
          END-EXEC.

          IF XX = 0
              MOVE "77" TO OUTPUT-FMT-NUM-3
              ROLLBACK
              GO TO PAYMENT-TRANSACTION-EXIT
          END-IF

          IF XX = 100
              CALL "TOOMANY" USING CWIDR, CDIDR, CLASTR, CUSTREL
          ELSE
              COMPUTE CUST-INDEX = (XX + 1) / 2.
              MOVE HOST-ARRAY-ELEMENT(CUST-INDEX)  TO
              CID  OF CUSTOMER-REC.
          PERFORM CUSTOMER-BY-NUMBER.

    CUSTOMER-BY-NAME-EXIT.

    SET-UP-ROUTINE.

        CALL "gettime" USING TIME-OF-DAY.


        PERFORM OPEN-ROUTINE.

        MOVE "CSTMR"            TO CSTMR-HASH-NAME.

        SET CSTMR-HASH-PTR TO ADDRESS OF CSTMR-HASH-NAME.
        SET RET-CODE-PTR   TO ADDRESS OF RET-CODE.
        SET CSTMR-DEF-PTR  TO ADDRESS OF CUSTOMER-REC.
        SET CSTMR-KEY-PTR  TO ADDRESS OF CSTMR-KEY.

        MOVE SPACES TO HDATA OF HIST-INFO.
     OPEN-ROUTINE.
    *OPEN FILES
         PERFORM CLOSE-ROUTINE.
         OPEN EXTEND HISTORY-FILE.
         OPEN  I-O   WAREHOUSE-FILE.
         OPEN  I-O   DISTRICT-FILE.
    D    OPEN INPUT  ISO-IFILE.
    D    OPEN OUTPUT DBUG-FILE2.
     CLOSE-ROUTINE.
    *CLOSE FILES
         CLOSE DISTRICT-FILE.
         CLOSE WAREHOUSE-FILE.
         CLOSE HISTORY-FILE.
    D    CLOSE ISO-IFILE.
    D    CLOSE DBUG-FILE2.
      PROGRAM-END.
         STOP RUN.
```

D.25 PAYSRVR.C:

```
#include <Common.h>
#include <qsoasync.h>
#include <stdio.h>

char *PAYMENTMOD(short *, char *, char *);
#define MAX_CONN  32

main(int argc, char **argv)
{
  int           sd, snd_len=670, rcv_len=230, port, rc;
  int           sd_arr[MAX_CONN];/* the indexes for accepts and use          */
  int           num_conn;/* the number of connections */
  int           accept_index;/* accept index goes from 0 to num_conn - 1     */
  char          rcv_buf[MAX_CONN] [BufferSize];/* one per connection */
  char          snd_buf[BufferSize];
  char          cmd[120];/* command holder                    */
  struct sockaddr_in    sin;
  int           length;
    Qso_OverlappedIO_t        status;
    char                      buffer[256];

    memset(&status,0,sizeof(status));
    status.bufferLength=rcv_len;
    status.postFlag=1;                        /* Always post to I/O completion port */
    status.fillBuffer=1;      /* Fill buffer. */
    /* get the number of connections                                          */
    num_conn = atoi(argv[1]);
    /* num_conn = 2;*//* test action */

    if((port=QsoCreateIOCompletionPort())<0)  {
      perror("\nQsoCreateIOCompletionPort()  failed");
      exit(-1);
    }

     length=sizeof(sin);

     for( accept_index=0;accept_index<num_conn;accept_index++)
     {
         if((sd_arr[accept_index]=accept(sd,
            (struct sockaddr *)&sin,&length))<0)
         {
             perror("accept() in DLVSRVR failed");
             close(sd);
             exit(-1);
         }
         status.descriptorHandle=(void*)sd_arr[accept_index];
         status.buffer=rcv_buf[accept_index];
         if(QsoStartRecv(sd_arr[accept_index],port,&status)<0)  {
                          perror("\nQsoStartRecv()  failed");
                          exit(-1);
         }

    }/* end of connect loop */
    system("STRCMTCTL  LCKLVL(*ALL)");
    system("CHGJOB RUNPTY(16)");
    do
    {
        if(QsoWaitForIOCompletion(port,&status,0)<0)
        {
                          perror("\nQsoWaitForIoCompletion()  failed");
                          exit(-1);
        }

        if(status.returnValue<=0)  {
                          printf("\nRecv()  failed, errno=%d",status.errnoValue);
                          exit(-1);
        }

        if(status.operationCompleted!=QSOSTARTRECV)  {
                     printf("\nUnexpected  completion=%d",status.operationCompleted);
                          exit(-1);
        }
        PAYMENTMOD(&first_time, status.buffer, snd_buf);
        if (( snd_buf[0] != '7' )||((snd_buf[0]== '7')&&
            (snd_buf[1]!= '7')))
        {
          first_time--;
        }
        if(send((int)status.descriptorHandle,snd_buf,snd_len,0)<0)
        {
           if (( errno != EPIPE )&&( errno != EUNKNOWN ))
           {
              perror("\nsend(1)  failed");
              exit(-1);
           }
        }

        if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)
        {
                           perror("\nQsoStartRecv()  failed");
                           exit(-1);
        }

    } while(first_time> 0 );

    for(;;)
    {

        if(QsoWaitForIOCompletion(port,&status,0)<0)  {
                                  perror("\nQsoWaitForIoCompletion()  failed");
                                  exit(-1);
        }

        if(status.returnValue<=0)  {
                                 printf("\nRecv()  failed, errno=%d",status.errnoValue);
                                 exit(-1);
        }

        if(status.operationCompleted!=QSOSTARTRECV)  {
                     printf("\nUnexpected  completion=%d",status.operationCompleted);
                          exit(-1);
        }

        PAYMENTMOD(&first_time, status.buffer, snd_buf);

        if(send((int) status.descriptorHandle,snd_buf,snd_len,0)<0)
        {
           if (( errno != EPIPE )&&( errno != EUNKNOWN ))
           {
             perror("\nsend(2)  failed");
             exit(-1);
           }
        }

        if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)
        {

                          perror("\nQsoStartRecv()  failed");
                          exit(-1);
        }

    }  /* for loop  */
  return 0;
}
```

D.26 STKLVL.CBL:

```
     PROCESS NOTRUNC NORANGE.
     IDENTIFICATION DIVISION.

       PROGRAM-ID. STKLVLMOD.
       AUTHOR. TPCC.
       INSTALLATION. IBM-ROCHESTER.
       DATE-WRITTEN.
       DATE-COMPILED.
     ENVIRONMENT DIVISION.
     CONFIGURATION SECTION.
       SOURCE-COMPUTER. IBM-AS400.
       OBJECT-COMPUTER. IBM-AS400.
       INPUT-OUTPUT SECTION.
       FILE-CONTROL.
         SELECT DSTRCT
                ASSIGN TO DATABASE-DSTRCT
                ORGANIZATION IS INDEXED
                ACCESS MODE IS RANDOM
                RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                WITH DUPLICATES
                FILE STATUS IS DISTRICT-FILE-STATUS.
         SELECT ORDERLINE
                ASSIGN TO DATABASE-ORDLINLF
                ORGANIZATION IS INDEXED
                ACCESS MODE IS DYNAMIC
                FILE STATUS IS ORDERLINE-FILE-STATUS
                RECORD KEY IS EXTERNALLY-DESCRIBED-KEY
                WITH DUPLICATES.
       I-O-CONTROL.
         COMMITMENT CONTROL FOR DSTRCT ORDERLINE.

       DATA DIVISION.
       FILE SECTION.
     FD  DSTRCT
         LABEL RECORDS ARE STANDARD
         DATA RECORD IS DSTRCT-RECORD.
     01  DSTRCT-RECORD.
         COPY DDS-DSRCD OF DSTRCT.
     FD  ORDERLINE
         LABEL RECORDS ARE STANDARD
         DATA RECORD IS ORDERLINE-RECORD.
     01  ORDERLINE-RECORD.
         COPY DDS-OLRCD OF ORDLINLF.

    **************************
     WORKING-STORAGE SECTION.
    **************************
```

```
  01  TRAN-OUTPUT.
   05 TRAN-OUT PIC X(670).
  05 STKLVL-O REDEFINES TRAN-OUT.
      06 RESULT                    PIC X(1).
      06 FILLER                    PIC X(1).
      06 BLWSTK                    PIC S9(2) COMP-4.

   01 STOCK-REC.
     05  STOCK-DEF.
         06  STOCK-IN.
             08 STIID           PIC S9(9) COMP-4.
             08 STWID           PIC S9(4) COMP-4.
         06  STQTY          PIC S9(3) COMP-3.
         06  DIST-INFO  OCCURS 10 TIMES.
             07  DIST-IN        PIC X(24).
         06 STYTD           PIC S9(9) COMP-4.
         06 STORDRS         PIC S9(3) COMP-3.
         06 STREMORD        PIC S9(3) COMP-3.
         06 STDATA          PIC X(50).

01 STOCK-KEY.
  03 STOCK-KEY-DATA OCCURS 5 TIMES.
      05  KNAM   PIC X(10).
      05  KVAL   PIC S9(9) COMP-4.

01 STOCK-HASH-PTR   USAGE POINTER.

01 STOCK-HASH-NAME  PIC X(10).
01 FUNCT            PIC X(1).
01 KEYS             PIC S9(9) COMP-4.
01 RET-CODE         PIC S9(9) COMP-4.

01  RET-CODE-PTR    USAGE POINTER.
01  STOCK-DEF-PTR   USAGE POINTER.
01 STOCK-KEY-PTR USAGE POINTER.


01 UPDATER                PIC X(1) VALUE "3".
01 FETCHR                 PIC X(1) VALUE "1".
01 FETCHUPDATE            PIC X(1) VALUE "2".

01 STOCK-KEYS             PIC 9(1) COMP-4 VALUE 2.


 01   TRANSACTION-INPUT.
        06    TXN-TYPE            PIC X.
        06    JOBNAME             PIC X(10).
        06    CLIENT-INPUT        PIC X(202).
        06 STKLVL-I REDEFINES CLIENT-INPUT.
          08 WID                  PIC S9(4) COMP-4.
          08 DID                  PIC S9(4) COMP-4.
          08 THRESHOLD            PIC S9(4) COMP-4.
          08 BLWSTK               PIC S9(4) COMP-4.

01  ITEM-TABLE.
    05  ITEM-TABLE-ELEMENT OCCURS 300 TIMES.
        07  ITEM-TABLE-KEY.
            09  ITEM-TABLE-IID       PIC S9(6).

77  DISTRICT-FILE-STATUS      PIC X(2).
77  ORDERLINE-FILE-STATUS     PIC X(2).

01  NUMBER-OF-ITEMS           PIC S9(5) COMP-4.

77 DUPS               PIC S9(5) COMP-4.
77 HIORDER            PIC S9(9) COMP-4.
77 LOORDER            PIC S9(9) COMP-4.
77 IN-LOOP             PIC S9(5) COMP-4.
77 OUT-LOOP            PIC S9(5) COMP-4.

******************
 LINKAGE SECTION.
******************
   01  FIRST-TIME PIC S9(4) COMP-4.
   01  INP-TRAN PIC X(230).
   01  OUT-TRAN PIC X(670).

 PROCEDURE DIVISION USING FIRST-TIME  INP-TRAN OUT-TRAN.

********************
 START-OF-PROGRAM.
********************

 STOCK-WATCH-PROGRAM.

       IF FIRST-TIME > 0
       PERFORM SET-UP-ROUTINE.

     MOVE INP-TRAN TO TRANSACTION-INPUT.

     MOVE WID OF STKLVL-I TO DWID, OLWID, STWID.

     MOVE DID OF STKLVL-I TO DID OF DSRCD, OLDID.

 READ-DSTRCT.
     READ DSTRCT.
       IF DISTRICT-FILE-STATUS NOT EQUAL "00"
             IF DISTRICT-FILE-STATUS EQUAL "9D"
                GO TO READ-DSTRCT
             ELSE
                   ROLLBACK
                   MOVE "1" TO RESULT OF  STKLVL-O
                   MOVE STKLVL-O to OUT-TRAN
                   GOBACK
             END-IF
       END-IF.

*  Select all Detail Order Lines for the Last 20 Orders
*  that are below the threshold and also match a unique
*  stock item.

     SUBTRACT 1  FROM DNXTOR GIVING HIORDER.
     SUBTRACT 20 FROM DNXTOR GIVING LOORDER.
 READ-ORDERLINE-FILE.

     MOVE LOORDER  TO OLOID OF ORDERLINE-RECORD.

     MOVE 0 TO NUMBER-OF-ITEMS.

     READ ORDERLINE.

     MOVE OLIID TO STIID.

     MOVE WID OF STKLVL-I    TO KVAL OF STOCK-KEY-DATA(2)
     MOVE STIID              TO KVAL OF STOCK-KEY-DATA(1)

      CALL "qdbrunha" USING BY VALUE
            STOCK-HASH-PTR FETCHR STOCK-KEYS STOCK-KEY-PTR
            STOCK-DEF-PTR RET-CODE-PTR
      IF RET-CODE > 0 THEN
          IF RET-CODE = 1 THEN
             GO TO END-PGM
          END-IF
          IF RET-CODE = 2 THEN
             GO TO END-PGM
          END-IF
      END-IF
     IF STQTY IS LESS THAN THRESHOLD
         ADD 1 TO NUMBER-OF-ITEMS
         MOVE STIID TO ITEM-TABLE-IID(NUMBER-OF-ITEMS)
     END-IF.

 READ-ORDERLINE-FILE-NEXT.

     READ ORDERLINE NEXT AT END GO TO SORT-ITEM-TABLE
     END-READ

     IF OLDID NOT EQUAL TO DID OF  STKLVL-I
        GO TO SORT-ITEM-TABLE
     END-IF

     IF (OLOID > HIORDER) THEN GO TO SORT-ITEM-TABLE
        ELSE
          MOVE OLIID TO STIID

     MOVE WID OF STKLVL-I    TO KVAL OF STOCK-KEY-DATA(2)
     MOVE STIID              TO KVAL OF STOCK-KEY-DATA(1)

      CALL "qdbrunha" USING BY VALUE
            STOCK-HASH-PTR FETCHR STOCK-KEYS STOCK-KEY-PTR
            STOCK-DEF-PTR RET-CODE-PTR
      IF RET-CODE > 0 THEN
          IF RET-CODE = 1 THEN
             GO TO END-PGM
          END-IF
          IF RET-CODE = 2 THEN
             GO TO END-PGM
          END-IF
      END-IF
          IF STQTY IS LESS THAN THRESHOLD
            ADD 1 TO NUMBER-OF-ITEMS
            MOVE STIID TO ITEM-TABLE-IID(NUMBER-OF-ITEMS)
          END-IF
     END-IF

     GO TO READ-ORDERLINE-FILE-NEXT.

 SORT-ITEM-TABLE.
       COMMIT

     PERFORM DISTINCT-SORT.

 DISPLAY-ANSWER.

     MOVE "G" TO RESULT OF  STKLVL-O
     MOVE STKLVL-O to OUT-TRAN.

     GOBACK.


 DISTINCT-SORT.
     IF NUMBER-OF-ITEMS > 0
       MOVE 1 TO BLWSTK OF STKLVL-O
       PERFORM VARYING OUT-LOOP FROM 2 BY 1 UNTIL OUT-LOOP
                IS GREATER THAN NUMBER-OF-ITEMS
         MOVE 0 TO DUPS
         PERFORM VARYING IN-LOOP FROM 1 BY 1 UNTIL IN-LOOP
             IS EQUAL TO OUT-LOOP
            IF ITEM-TABLE-ELEMENT(IN-LOOP)  =
              ITEM-TABLE-ELEMENT(OUT-LOOP)
              ADD 1 TO  DUPS
              END-IF
            END-PERFORM
         IF DUPS = 0
            ADD 1 TO BLWSTK OF STKLVL-O
            END-IF
       END-PERFORM
       ELSE MOVE 0 TO BLWSTK OF STKLVL-O.
     MOVE "G" TO RESULT OF  STKLVL-O
     MOVE STKLVL-O to OUT-TRAN.

     GOBACK.

 SET-UP-ROUTINE.

        CLOSE DSTRCT
              ORDERLINE.

        OPEN INPUT ORDERLINE
             INPUT DSTRCT.


     MOVE "STOCK"            TO STOCK-HASH-NAME.
     MOVE "STWID"            TO KNAM OF STOCK-KEY-DATA(2).
     MOVE "STIID"            TO KNAM OF STOCK-KEY-DATA(1).

     SET STOCK-HASH-PTR  TO ADDRESS OF STOCK-HASH-NAME.
     SET RET-CODE-PTR    TO ADDRESS OF RET-CODE.
     SET STOCK-DEF-PTR   TO ADDRESS OF STOCK-REC.
     SET STOCK-KEY-PTR   TO ADDRESS OF STOCK-KEY.

 END-PGM.
     STOP RUN.
```

D.27 STKSRVR.C:

```
#include <Common.h>
#include <qsoasync.h>
#include <stdio.h>

main(int argc, char **argv)
{
  int           sd, snd_len=670, rcv_len=230, port, rc;
  int           sd_arr[MAX_CONN];/* the indexes for accepts and use          */
  int           num_conn;/* the number of connections */
  int           accept_index;/* accept index goes from 0 to num_conn - 1     */
  char          rcv_buf[MAX_CONN] [BufferSize];/* one per connection */
  char          snd_buf[BufferSize];
  struct sockaddr_in    sin;
  int           length;
    Qso_OverlappedIO_t        status;
    char                      buffer[256];

    memset(&status,0,sizeof(status));
    status.bufferLength=rcv_len;
    status.postFlag=1;                          /* Always post to I/O completion port */
    status.fillBuffer=1;       /* Fill buffer. */
    /* get the number of connections                                            */
    num_conn = atoi(argv[1]);

    if((port=QsoCreateIOCompletionPort())<0) {
      perror("\nQsoCreateIOCompletionPort()  failed");
      exit(-1);
    }

     length=sizeof(sin);

     for( accept_index=0;accept_index<num_conn;accept_index++)
     {
          if((sd_arr[accept_index]=accept(sd,
             (struct sockaddr *)&sin,&length))<0)
          {
              perror("accept() in DLVSRVR failed");
              close(sd);
              exit(-1);
          }
          status.descriptorHandle=(void*)sd_arr[accept_index];
          status.buffer=rcv_buf[accept_index];
          if(QsoStartRecv(sd_arr[accept_index],port,&status)<0)  {
                            perror("\nQsoStartRecv()  failed");
                           exit(-1);
          }

     }/* end of connect loop */
     system("STRCMTCTL  LCKLVL(*CS)");
     system("CHGJOB RUNPTY(20)");
     system("OVRDBF FILE(ORDLINLF) TOFILE(ORDLINLF) NBRRCDS(16)");
     do
     {
        if(QsoWaitForIOCompletion(port,&status,0)<0)
        {
                           perror("\nQsoWaitForIoCompletion()  failed");
                           exit(-1);
        }
```

```
        if(status.returnValue<=0)
        {
                        printf("\nRecv() failed, errno=%d",status.errnoValue);
                        exit(-1);
        }

        if(status.operationCompleted!=QSOSTARTRECV)
        {
                        printf("\nUnexpected completion=%d", status.operationCompleted);
                        exit(-1);
        }
        STKLVLMOD(&first_time, status.buffer, snd_buf);
        if ( snd_buf[0] == 'G' )/* check the NEWORD-RESULT */
        {
            first_time--;
        }
        if(send((int)status.descriptorHandle,snd_buf,snd_len,0)<0)
        {
            if (( errno != EPIPE )&&( errno != EUNKNOWN ))
            {
               perror("\nsend(1) failed");
               exit(-1);
            }
        }

        if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)
        {
                          perror("\nQsoStartRecv() failed");
                          exit(-1);
        }

     } while(first_time > 0);

     for(;;) {

              if(QsoWaitForIOCompletion(port,&status,0)<0)  {
                                  perror("\nQsoWaitForIoCompletion() failed");
                                  exit(-1);
              }

              if(status.returnValue<=0)  {
                              printf("\nRecv() failed, errno=%d",status.errnoValue);
                              exit(-1);
               }

    if(status.operationCompleted!=QSOSTARTRECV)  {
                      printf("\nUnexpected completion=%d",status.operationCompleted);
                      exit(-1);
    }

          STKLVLMOD(&first_time, status.buffer, snd_buf);
          if(send((int) status.descriptorHandle,snd_buf,snd_len,0)<0)
          {
            if (( errno != EPIPE )&&( errno != EUNKNOWN ))
            {
              perror("\nsend(2) failed");
              exit(-1);
            }
          }

          if(QsoStartRecv((int)status.descriptorHandle,port,&status)<0)
          {
                          perror("\nQsoStartRecv() failed");
                          exit(-1);
          }


   }  /* for loop  */
  return 0;
}
```

D.28 TOOMANY.CBL:

```
      PROCESS NOTRUNC NORANGE.
      IDENTIFICATION DIVISION.

     *  TOOMANY Program
     *
     *     Files Accessed:   - CSTMR     (Read)
     *     Views Used:       - CSTMRLFNAM (C1 - SQL)

        PROGRAM-ID. TOOMANY.
        AUTHOR. DEPT-53G.
        INSTALLATION. IBM-ROCHESTER.
        DATE-WRITTEN. 09-03-95.
        DATE-COMPILED. 12-14-92.
      ENVIRONMENT DIVISION.
      CONFIGURATION SECTION.
        SOURCE-COMPUTER. IBM-AS400.
     ** SOURCE-COMPUTER. IBM-AS400. WITH DEBUGGING MODE.
        OBJECT-COMPUTER. IBM-AS400.

      DATA DIVISION.

     ***************************
      WORKING-STORAGE SECTION.
     ***************************
      01 HOST-VARIABLES.
         05 VWID                      PIC S9(4) COMP-4.
         05 VDID                      PIC S9(2) COMP-4.
         05 VCID                      PIC S9(6) COMP-4.
         05 VCLAST                    PIC X(16).
         05 VCFIRST                   PIC X(16).
         05 VCOUNT                    PIC S9(4) COMP-4.
      01 I                            PIC S9(4) COMP-4.

     ****************
     *  SQL INCLUDE  *
     ****************
          EXEC SQL
            INCLUDE SQLCA
          END-EXEC.

     *********************************
     *  SQL ERROR/WARNING Messages  *
     *********************************
          EXEC SQL
            WHENEVER SQLERROR CONTINUE
          END-EXEC.

          EXEC SQL
            WHENEVER SQLWARNING CONTINUE
          END-EXEC.

     *******************
      LINKAGE SECTION.
     *******************
      01 FULL-KEY.
         05 PART-KEY.
           06 CID       PIC S9(6) COMP-4.
           06 DSTRCT    PIC S9(2) COMP-4.
           06 WRHS      PIC S9(4) COMP-4.
         05 CLAST     PIC X(16).
      PROCEDURE DIVISION USING FULL-KEY.

     *******************
      START-OF-PROGRAM.
     *******************
          MOVE WRHS TO VWID.
          MOVE DSTRCT TO VDID.
          MOVE CLAST TO VCLAST.

          EXIT.

          EXEC SQL
            SELECT  COUNT(*)
            INTO    :VCOUNT
            FROM    CSTMRLFCRT
            WHERE   (CWID = :VWID AND CDID = :VDID
                     AND CLAST = :VCLAST)
          END-EXEC.

          COMPUTE VCOUNT = 10 * VCOUNT + 1.
          COMPUTE VCOUNT = VCOUNT / 20.

          EXEC SQL
            DECLARE C_BY_NAME CURSOR FOR
            SELECT CWID, CDID, CID, CLAST, CFIRST
            FROM CSTMRLFCRT
            WHERE CWID = :VWID AND CDID = :VDID
            AND CLAST = :VCLAST
            ORDER BY CWID, CDID, CLAST, CFIRST
          END-EXEC.

          EXEC SQL
            OPEN C_BY_NAME
          END-EXEC.

          PERFORM VARYING I FROM 1 BY 1 UNTIL I >  VCOUNT

          EXEC SQL
            FETCH C_BY_NAME INTO :VWID, :VDID, :VCID,
                                 :VCLAST, :VCFIRST
          END-EXEC

          END-PERFORM.

          MOVE VCID TO CID.

          EXIT.
```

D.29 TPCCUSER.H:

```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include <decimal.h>
#include <qusrmbrd.h>
#include <qusrjobi.h>
#pragma mapinc("wrhs","*LIBL/WRHS01(*ALL)","both","d _P",,"tpcc")
#pragma mapinc("dstrct","*LIBL/DSTRCT01(*ALL)","both","d _P",,"tpcc")
#pragma mapinc("hstry","*LIBL/HSTRY01(*ALL)","both","d _P",,"tpcc")
#pragma mapinc("ordlin","*LIBL/ORDLINPF01(*ALL)","both","d _P",,"tpcc")
#pragma mapinc("orders","*LIBL/ORDERSPF01(*ALL)","both","d _P",,"tpcc")
#pragma mapinc("neword","*LIBL/NEWORDPF01(*ALL)","both","d _P",,"tpcc")
#pragma mapinc("cstmr","*LIBL/CSTMRPF01(*ALL)","both","d _P",,"tpcc")
#pragma mapinc("stock","*LIBL/STOCKPF01(*ALL)","both","d _P",,"tpcc")

   typedef struct {     /* space rtn error code structure */
      int bytes_prov;
      int bytes_avail;
      char except_id[7];
      char reserved[1];
      char except_data[50];
    } error_code;
  /* Format name and data space number structure  */
    typedef _Packed struct {
                            short ds_num;
                            long  zero1;
                            long  zero2;
                          } Format_Name;
```

Appendix E. RTE Scripts

E.1 RTE Parameters

```
RTE RUN-PROFILE (TO BE SENT TO AUDITOR)
-----------------------------------

Customer Lastname Constant = 117

Transaction Weights
-------------------
Payment: 0.000000
Order Status: 0.000000
Delivery: 0.000000
Stock Level: 0.000000

DELAY CONSTANTS
-----------
Menu Delay= 0.100000
Response Delay= 0.100000

Think Times
---------------
NEW ORDER: 12.020000
PAYMENT: 12.020000
ORDER STATUS: 10.020000
DELIVERY: 5.020000
STOCK LEVEL: 5.020000

SLAVE #0
-------
RTE MACHINE: slave1
CONNECTS TO CLIENT: 8.5.8.10
# OF USERS: 1000

SLAVE #1
-------
RTE MACHINE: slave2
CONNECTS TO CLIENT: 8.5.8.10
# OF USERS: 1000

SLAVE #2
-------
RTE MACHINE: slave3
CONNECTS TO CLIENT: 8.5.8.10
# OF USERS: 1000

SLAVE #3
-------
RTE MACHINE: slave4
CONNECTS TO CLIENT: 8.5.8.10
# OF USERS: 1000

SLAVE #4
-------
RTE MACHINE: slave5
CONNECTS TO CLIENT: 8.5.8.10
# OF USERS: 1000

SLAVE #5
-------
RTE MACHINE: slave6
CONNECTS TO CLIENT: 8.5.8.10
# OF USERS: 1000

SLAVE #6
-------
RTE MACHINE: slave7
CONNECTS TO CLIENT: 8.5.8.10
# OF USERS: 1000

SLAVE #7
-------
RTE MACHINE: slave8
CONNECTS TO CLIENT: 8.5.8.10
# OF USERS: 1000

SLAVE #8
-------
RTE MACHINE: slave9
CONNECTS TO CLIENT: 8.5.7.11
# OF USERS: 1000

SLAVE #9
-------
RTE MACHINE: slave10
CONNECTS TO CLIENT: 8.5.7.11
# OF USERS: 1000

SLAVE #10
-------
RTE MACHINE: slave11
CONNECTS TO CLIENT: 8.5.7.11
# OF USERS: 1000

SLAVE #11
-------
RTE MACHINE: slave12
CONNECTS TO CLIENT: 8.5.7.11
# OF USERS: 1000

SLAVE #12
-------
RTE MACHINE: slave13
CONNECTS TO CLIENT: 8.5.7.11
# OF USERS: 1000

SLAVE #13
-------
RTE MACHINE: slave14
CONNECTS TO CLIENT: 8.5.7.11
# OF USERS: 1000

SLAVE #14
-------
RTE MACHINE: slave15
CONNECTS TO CLIENT: 8.5.7.11
# OF USERS: 1000

SLAVE #15
-------
RTE MACHINE: slave16
CONNECTS TO CLIENT: 8.5.7.11
# OF USERS: 1000

SLAVE #16
-------
RTE MACHINE: slave17
CONNECTS TO CLIENT: 8.5.6.12
# OF USERS: 1000

SLAVE #17
-------
RTE MACHINE: slave18
CONNECTS TO CLIENT: 8.5.6.12
# OF USERS: 1000

SLAVE #18
-------
RTE MACHINE: slave19
CONNECTS TO CLIENT: 8.5.6.12
# OF USERS: 1000

SLAVE #19
-------
RTE MACHINE: slave20
CONNECTS TO CLIENT: 8.5.6.12
# OF USERS: 1000

SLAVE #20
-------
RTE MACHINE: slave21
CONNECTS TO CLIENT: 8.5.6.12
# OF USERS: 1000

SLAVE #21
-------
RTE MACHINE: slave22
CONNECTS TO CLIENT: 8.5.6.12
# OF USERS: 1000

SLAVE #22
-------
RTE MACHINE: slave23
CONNECTS TO CLIENT: 8.5.6.12
# OF USERS: 1000

SLAVE #23
-------
RTE MACHINE: slave24
CONNECTS TO CLIENT: 8.5.6.12
# OF USERS: 1000

SLAVE #24
-------
RTE MACHINE: slave25
CONNECTS TO CLIENT: 8.5.8.13
# OF USERS: 1000

SLAVE #25
-------
RTE MACHINE: slave26
CONNECTS TO CLIENT: 8.5.8.13
# OF USERS: 1000

SLAVE #26
-------
RTE MACHINE: slave27
CONNECTS TO CLIENT: 8.5.8.13
# OF USERS: 1000

SLAVE #27
-------
RTE MACHINE: slave28
CONNECTS TO CLIENT: 8.5.8.13
# OF USERS: 1000

SLAVE #28
-------
RTE MACHINE: slave29
CONNECTS TO CLIENT: 8.5.8.13
# OF USERS: 1000

SLAVE #29
-------
RTE MACHINE: slave30
CONNECTS TO CLIENT: 8.5.8.13
# OF USERS: 1000

SLAVE #30
-------
RTE MACHINE: slave31
CONNECTS TO CLIENT: 8.5.8.13
# OF USERS: 1000

SLAVE #31
-------
RTE MACHINE: slave32
CONNECTS TO CLIENT: 8.5.8.13
# OF USERS: 1000

SLAVE #32
-------
RTE MACHINE: slave33
CONNECTS TO CLIENT: 8.5.7.14
# OF USERS: 1000

SLAVE #33
-------
RTE MACHINE: slave34
CONNECTS TO CLIENT: 8.5.7.14
# OF USERS: 1000

SLAVE #34
-------
RTE MACHINE: slave35
CONNECTS TO CLIENT: 8.5.7.14
# OF USERS: 1000

SLAVE #35
-------
RTE MACHINE: slave36
CONNECTS TO CLIENT: 8.5.7.14
# OF USERS: 1000

SLAVE #36
-------
RTE MACHINE: slave37
CONNECTS TO CLIENT: 8.5.7.14
# OF USERS: 1000

SLAVE #37
-------
RTE MACHINE: slave38
CONNECTS TO CLIENT: 8.5.7.14
# OF USERS: 1000

SLAVE #38
-------
RTE MACHINE: slave39
CONNECTS TO CLIENT: 8.5.7.14
# OF USERS: 1000

SLAVE #39
-------
RTE MACHINE: slave40
CONNECTS TO CLIENT: 8.5.7.14
# OF USERS: 1000

SLAVE #40
-------
RTE MACHINE: slave41
CONNECTS TO CLIENT: 8.5.6.15
# OF USERS: 1000

SLAVE #41
-------
RTE MACHINE: slave42
CONNECTS TO CLIENT: 8.5.6.15
# OF USERS: 1000
```

```
SLAVE #42
-------
RTE MACHINE: slave43
CONNECTS TO CLIENT: 8.5.6.15
# OF USERS: 1000

SLAVE #43
-------
RTE MACHINE: slave44
CONNECTS TO CLIENT: 8.5.6.15
# OF USERS: 1000

SLAVE #44
-------
RTE MACHINE: slave45
CONNECTS TO CLIENT: 8.5.6.15
# OF USERS: 1000

SLAVE #45
-------
RTE MACHINE: slave46
CONNECTS TO CLIENT: 8.5.6.15
# OF USERS: 1000

SLAVE #46
-------
RTE MACHINE: slave47
CONNECTS TO CLIENT: 8.5.6.15
# OF USERS: 1000

SLAVE #47
-------
RTE MACHINE: slave48
CONNECTS TO CLIENT: 8.5.6.15
# OF USERS: 1000

SLAVE #48
-------
RTE MACHINE: slave49
CONNECTS TO CLIENT: 8.5.8.16
# OF USERS: 1000

SLAVE #49
-------
RTE MACHINE: slave50
CONNECTS TO CLIENT: 8.5.8.16
# OF USERS: 1000

SLAVE #50
-------
RTE MACHINE: slave51
CONNECTS TO CLIENT: 8.5.8.16
# OF USERS: 1000

SLAVE #51
-------
RTE MACHINE: slave52
CONNECTS TO CLIENT: 8.5.8.16
# OF USERS: 1000

SLAVE #52
-------
RTE MACHINE: slave53
CONNECTS TO CLIENT: 8.5.8.16
# OF USERS: 1000

SLAVE #53
-------
RTE MACHINE: slave54
CONNECTS TO CLIENT: 8.5.8.16
# OF USERS: 1000

SLAVE #54
-------
RTE MACHINE: slave55
CONNECTS TO CLIENT: 8.5.8.16
# OF USERS: 1000

SLAVE #55
-------
RTE MACHINE: slave56
CONNECTS TO CLIENT: 8.5.8.16
# OF USERS: 1000

SLAVE #56
-------
RTE MACHINE: slave57
CONNECTS TO CLIENT: 8.5.7.17
# OF USERS: 1000

SLAVE #57
-------
RTE MACHINE: slave58
CONNECTS TO CLIENT: 8.5.7.17
# OF USERS: 1000

SLAVE #58
-------
RTE MACHINE: slave59
CONNECTS TO CLIENT: 8.5.7.17
# OF USERS: 1000

SLAVE #59
-------
RTE MACHINE: slave60
CONNECTS TO CLIENT: 8.5.7.17
# OF USERS: 1000

SLAVE #60
-------
RTE MACHINE: slave61
CONNECTS TO CLIENT: 8.5.7.17
# OF USERS: 1000

SLAVE #61
-------
RTE MACHINE: slave62
CONNECTS TO CLIENT: 8.5.6.18
# OF USERS: 1000

SLAVE #62
-------
RTE MACHINE: slave63
CONNECTS TO CLIENT: 8.5.6.18
# OF USERS: 1000

SLAVE #63
-------
RTE MACHINE: slave64
CONNECTS TO CLIENT: 8.5.6.18
# OF USERS: 1000

SLAVE #64
-------
RTE MACHINE: slave65
CONNECTS TO CLIENT: 8.5.6.18
# OF USERS: 1000

SLAVE #65
-------
RTE MACHINE: slave66
CONNECTS TO CLIENT: 8.5.6.18
# OF USERS: 1000

SLAVE #66
-------
RTE MACHINE: slave67
CONNECTS TO CLIENT: 8.5.6.18
# OF USERS: 1000

SLAVE #67
-------
RTE MACHINE: slave68
CONNECTS TO CLIENT: 8.5.6.18
# OF USERS: 1000

SLAVE #68
-------
RTE MACHINE: slave69
CONNECTS TO CLIENT: 8.5.6.18
# OF USERS: 1000

SLAVE #69
-------
RTE MACHINE: slave70
CONNECTS TO CLIENT: 8.5.8.19
# OF USERS: 1000

SLAVE #70
-------
RTE MACHINE: slave71
CONNECTS TO CLIENT: 8.5.8.19
# OF USERS: 1000

SLAVE #71
-------
RTE MACHINE: slave72
CONNECTS TO CLIENT: 8.5.8.19
# OF USERS: 1000

SLAVE #72
-------
RTE MACHINE: slave73
CONNECTS TO CLIENT: 8.5.8.19
# OF USERS: 1000

SLAVE #73
-------
RTE MACHINE: slave74
CONNECTS TO CLIENT: 8.5.8.19
# OF USERS: 1000

SLAVE #74
-------
RTE MACHINE: slave75
CONNECTS TO CLIENT: 8.5.8.19
# OF USERS: 1000

SLAVE #75
-------
RTE MACHINE: slave76
CONNECTS TO CLIENT: 8.5.8.19
# OF USERS: 1000

SLAVE #76
-------
RTE MACHINE: slave77
CONNECTS TO CLIENT: 8.5.8.19
# OF USERS: 1000

SLAVE #77
-------
RTE MACHINE: slave78
CONNECTS TO CLIENT: 8.5.7.20
# OF USERS: 1000

SLAVE #78
-------
RTE MACHINE: slave79
CONNECTS TO CLIENT: 8.5.7.20
# OF USERS: 1000

SLAVE #79
-------
RTE MACHINE: slave80
CONNECTS TO CLIENT: 8.5.7.20
# OF USERS: 1000

SLAVE #80
-------
RTE MACHINE: slave81
CONNECTS TO CLIENT: 8.5.7.20
# OF USERS: 1000

SLAVE #81
-------
RTE MACHINE: slave82
CONNECTS TO CLIENT: 8.5.7.20
# OF USERS: 1000

SLAVE #82
-------
RTE MACHINE: slave83
CONNECTS TO CLIENT: 8.5.7.20
# OF USERS: 1000

SLAVE #83
-------
RTE MACHINE: slave84
CONNECTS TO CLIENT: 8.5.7.20
# OF USERS: 1000

SLAVE #84
-------
RTE MACHINE: slave85
CONNECTS TO CLIENT: 8.5.7.20
# OF USERS: 1000

SLAVE #85
-------
RTE MACHINE: slave86
CONNECTS TO CLIENT: 8.5.6.21
# OF USERS: 1000

SLAVE #86
-------
RTE MACHINE: slave87
CONNECTS TO CLIENT: 8.5.6.21
# OF USERS: 1000

SLAVE #87
-------
RTE MACHINE: slave88
CONNECTS TO CLIENT: 8.5.6.21
# OF USERS: 1000

SLAVE #88
-------
RTE MACHINE: slave89
CONNECTS TO CLIENT: 8.5.6.21
# OF USERS: 1000

SLAVE #89
-------
RTE MACHINE: slave90
CONNECTS TO CLIENT: 8.5.6.21
# OF USERS: 1000

SLAVE #90
-------
RTE MACHINE: slave91
CONNECTS TO CLIENT: 8.5.6.21
# OF USERS: 1000

SLAVE #91
-------
RTE MACHINE: slave92
CONNECTS TO CLIENT: 8.5.6.21
```

```
# OF USERS: 1000

SLAVE #92
-------
RTE MACHINE: slave93
CONNECTS TO CLIENT: 8.5.6.21
# OF USERS: 1000

SLAVE #93
-------
RTE MACHINE: slave94
CONNECTS TO CLIENT: 8.5.8.22
# OF USERS: 1000

SLAVE #94
-------
RTE MACHINE: slave95
CONNECTS TO CLIENT: 8.5.8.22
# OF USERS: 1000

SLAVE #95
-------
RTE MACHINE: slave96
CONNECTS TO CLIENT: 8.5.8.22
# OF USERS: 1000

SLAVE #96
-------
RTE MACHINE: slave97
CONNECTS TO CLIENT: 8.5.8.22
# OF USERS: 1000

SLAVE #97
-------
RTE MACHINE: slave98
CONNECTS TO CLIENT: 8.5.8.22
# OF USERS: 1000

SLAVE #98
-------
RTE MACHINE: slave99
CONNECTS TO CLIENT: 8.5.8.22
# OF USERS: 1000

SLAVE #99
-------
RTE MACHINE: slave100
CONNECTS TO CLIENT: 8.5.8.22
# OF USERS: 1000

SLAVE #100
-------
RTE MACHINE: slave101
CONNECTS TO CLIENT: 8.5.8.22
# OF USERS: 1000

SLAVE #101
-------
RTE MACHINE: slave102
CONNECTS TO CLIENT: 8.5.7.26
# OF USERS: 1000

SLAVE #102
-------
RTE MACHINE: slave103
CONNECTS TO CLIENT: 8.5.7.26
# OF USERS: 1000

SLAVE #103
-------
RTE MACHINE: slave104
CONNECTS TO CLIENT: 8.5.7.26
# OF USERS: 1000

SLAVE #104
-------
RTE MACHINE: slave105
CONNECTS TO CLIENT: 8.5.7.26
# OF USERS: 1000

SLAVE #105
-------
RTE MACHINE: slave106
CONNECTS TO CLIENT: 8.5.7.26
# OF USERS: 1000

SLAVE #106
-------
RTE MACHINE: slave107
CONNECTS TO CLIENT: 8.5.7.26
# OF USERS: 1000

SLAVE #107
-------
RTE MACHINE: slave108
CONNECTS TO CLIENT: 8.5.7.26
# OF USERS: 1000

SLAVE #108
-------
RTE MACHINE: slave109
CONNECTS TO CLIENT: 8.5.7.26
# OF USERS: 1000

SLAVE #109
-------
RTE MACHINE: slave110
CONNECTS TO CLIENT: 8.5.6.24
# OF USERS: 1000

SLAVE #110
-------
RTE MACHINE: slave111
CONNECTS TO CLIENT: 8.5.6.24
# OF USERS: 1000

SLAVE #111
-------
RTE MACHINE: slave112
CONNECTS TO CLIENT: 8.5.6.24
# OF USERS: 1000

SLAVE #112
-------
RTE MACHINE: slave113
CONNECTS TO CLIENT: 8.5.6.24
# OF USERS: 1000

SLAVE #113
-------
RTE MACHINE: slave114
CONNECTS TO CLIENT: 8.5.6.24
# OF USERS: 1000

SLAVE #114
-------
RTE MACHINE: slave115
CONNECTS TO CLIENT: 8.5.6.24
# OF USERS: 1000

SLAVE #115
-------
RTE MACHINE: slave116
CONNECTS TO CLIENT: 8.5.6.24
# OF USERS: 1000

SLAVE #116
-------
RTE MACHINE: slave117
CONNECTS TO CLIENT: 8.5.6.24
# OF USERS: 1000

SLAVE #117
-------
RTE MACHINE: slave118
CONNECTS TO CLIENT: 8.5.8.25
# OF USERS: 1000

SLAVE #118
-------
RTE MACHINE: slave119
CONNECTS TO CLIENT: 8.5.8.25
# OF USERS: 1000

SLAVE #119
-------
RTE MACHINE: slave120
CONNECTS TO CLIENT: 8.5.8.25
# OF USERS: 1000

SLAVE #120
-------
RTE MACHINE: slave121
CONNECTS TO CLIENT: 8.5.8.25
# OF USERS: 1000
```

E.2 TRANSACTIONS.H

```
#include "Random.h"
#include "SharedMem.h"
#include "User_tpc.h"

#include "ClientSocket.h"

struct UserInfo {
                int UserNum;
                int Warehouse;
                int District;
                int StatusID;
                int Error;
                int FormID;
                int TermID;
                int SyncID;
//              int Version;
                ClientSocket socket;
                struct drand48_data seedbuf;
        struct timeb t1;
        struct timeb t2;

                TransData tdata;
};


long NURand(int A, int x, int y, long cval, struct drand48_data* seed);
void getname(char* lastname, struct drand48_data* seed);
int Delivery(UserInfo *Info);
int NewOrder(UserInfo *Info);
int OrderStatus(UserInfo *Info);
int Payment(UserInfo *Info);
int StockLevel(UserInfo *Info);
```

E.3 TRANSACTIONS.C

```
//-----------------------------------------------------------------
//  MODULE NAME:              transactions.C
//
//
//  DESCRIPTION: This file contains  "user_transaction" which selects
//               and executes each  TPC-C transaction.  Each of these
//               routines generate the data for the  TPC-C transaction,
//               formats it into appropriate HTML strings, transmits it
//               to the web client interface, receives, validates,
//               records the output, and collects  timestamps during
//               key points in the transaction.
//
//  FUNCTIONS: NURand
//                            getname
//                            Delivery
//                            NewOrder
//                            OrderStatus
//                            Payment
//                            StockLevel
//
//   (C) COPYRIGHT International Business Machines Corp. 1997
//   All Rights Reserved
//   Licensed Materials - Property of IBM
//
//  MODIFCATION HISTORY:
//
//  Date     By        Description
//  -------  --------  ---------------------------------------------
//  2/17/97  T.Thomas  Initial version for NT
//
//             8/02/99         C. Floyd  Overhaul of code in preparation for  TPCC Version 4.
//
//
//-----------------------------------------------------------------
/*****************************************************************************/
/***                    TPCC FILE FOR ALL USERS                            ***/
/*****************************************************************************/

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

#include "iostream.h"

#include "memory.h"
#include "Transactions.h"
#include "Sleep.h"

extern SharedMem *pSHM;

/*-----------------------------------------------------------------------*/
/* NURand()                                                              */
/*                                                                       */
/* A: 255 for C_LAST, 1023 for C_ID, 8191 for  OL_I_ID                   */
/* x: 0 for C_LAST, 1 for C_ID and OL_I_ID                               */
/* y: 999 for C_LAST, 3000 for C_ID, 100000 for  OL_I_ID                 */
/*                                                                       */
/* The "uniform()" function has range of the absolute value of the       */
/* difference between the 1st and 2nd  parms up to a maximum of 2147483647.*/
/*-----------------------------------------------------------------------*/
long NURand(int A, int x, int y, long cval,struct drand48_data* seed)
{
                return ((((long) uniform(0L, (long)A, seed) |
                                (long) uniform((long)x, (long)y, seed)) + cval) % (y - x + 1))
+ x;
}

/*-------------------------------------------------------*/
/* getname()                                             */
/*                                                       */
/* Generates a random number from 0 to 999 inclusive.    */
/* A random name is generated by associating a random    */
/* string with each digit of the generated number.       */
/* Three strings are concatenated to generate  "lastname".*/
/*-------------------------------------------------------*/
void getname(char* lastname, struct drand48_data* seed)
```

```
{
    char *last_name_parts[] =
    {
                "BAR",
                "OUGHT",
                "ABLE",
                "PRI",
                "PRES",
                "ESE",
                "ANTI",
                "CALLY",
                "ATION",
                "EING"
    };

    int                         random_num;

    // Generate a random number between 0 and 999 inclusive.
    random_num = NURand(255, 0, 999, pSHM->LASTC, seed);

    // Use the first digit as an index into the  last_name_parts array.
    // Then throw away the high order digit.
    strcpy(lastname, last_name_parts[random_num / 100]);
    random_num %= 100;

    // Use the 10s digit as an index into the  last_name_parts array.
    // Then throw away the 10s digit.
    strcat(lastname, last_name_parts[random_num / 10]);
    random_num %= 10;

    // Finally use the last digit as an index into the  last_name_parts array.
    strcat(lastname, last_name_parts[random_num]);
}


/*************************************************************************/
/*                        Delivery Transaction                           */
/*************************************************************************/

int Delivery(UserInfo *Info)
{
    char Result[4096];
    char Request[256];
    char theUrl[128];
    char* pStr;

    char buf[4097];
    buf[sizeof(buf)-1] = 0;

    int        bytes, totalBytes;
    unsigned int t1, t2;
    int                         status;
    int                         carrier;


    // Identify the transaction ID and state (for debug).
    pSHM->User[Info->UserNum].transaction_ID = Delivery_ID;
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State0;

    // Build Url to request Delivery Menu

    // Locally mark the beginning of this routine by getting
    // the time relative to when RTE was started.
//    cout << "(Transactions.C) Delivery() invoked by " << Info->UserNum << endl;
    t1 = pSHM->timestamp();

    // Create a buffer of
    // o "GET %s HTTP/2.0\r\nAccept: */* HTTP/2.0\r\nConnection: Keep-Alive\r\n\r\n"
    // o "/tpcc.dll?FORMID=%d&TERMID=%d&SYNCID=%d&CMD=%s"
    // o 2
    // o Info->TermID,
    // o Info->SyncID,
    // o "..Delivery.."
    // and send it on the socket.
    sprintf(theUrl,
                    MAIN_MENU_FMT,
                    MAIN_MENU_FORM_ID,
                    Info->TermID,
                    Info->SyncID,
                    "..Delivery..");
    sprintf(Request, GET_REQUEST, theUrl);
    if (Info->socket.write(Request)  < 0)
    {
                perror ("(Transactions.C) Delivery() failure on write to socket due to: ");
                return 30;
    }

    // Iteratively read up to 4096 bytes from the socket until we find  "</HTML>".
    // Identify the transaction state and byte count (for debug).
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State1;
    pSHM->User[Info->UserNum].transaction_bytes  = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
                if ((bytes = Info->socket.read(buf,  sizeof(buf)-1))  < 0) return 40;
                pSHM->User[Info->UserNum].transaction_bytes  = totalBytes + bytes;
                if ((totalBytes + bytes) > sizeof(Result))  return 50;
                memcpy(&Result[totalBytes], buf, bytes);
                if (strstr(Result, "</HTML>")) break;
                totalBytes += bytes;
    }
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State2;

    // If the Result buffer does not contain  "TPC-C Delivery", return.
    if (strstr(Result, DELIVERY_EXPECT_STRING)  == NULL)
    {
                cout << "(Transaction.C) Delivery() received the following string: "
                  << Result << endl;
                return 3;
    }

    // Sleep for the number of seconds specified for the DELIVERY option.
    Sleep(pSHM->menu[DELIVERY]*1000.0);
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State3;

    // After the socket read-wait and the sleep, locally mark the end of
    // Menu response time and the beginning of keying time.
    t2 = pSHM->timestamp();

    // Subtract the time that the last transaction was finished from
    // the time at the beginning of this routine to produce
    // the number of milliseconds of think time.
    Info->tdata.think_ms  = t1 - Info->tdata.trans_finish_ms;

    // Copy the transaction data into the shared memory's output buffer  (finished_trans),
    // but exclude initial transaction value and other non-transaction types.
    if ((Info->tdata.trans_type  > 0)  && (Info->tdata.trans_type  < MAX_TRAN_TYPE))
                pSHM->transaction_done(&Info->tdata);

    // Calculate the time (in milliseconds) from the beginning of this routine
    // to (essentially) right now.
    Info->tdata.menu_ms  = t2 - t1;

    // Re-initialize the "status".
    Info->tdata.status = 0;

    // Begin Key Time

    // Calculate data for delivery input screen by
    // producing a random number between 1 and 10, inclusive.
    // i.e. Carrier # is 1 - 10.
    carrier = (char)uniform(1L, 10L,&Info->seedbuf);

    //Build Url to fill in Delivery form.
    // o "/tpcc.dll?PI*=&FORMID=%d&TERMID=%d&SYNCID=%d"
    // o 5
    // o Info->TermID,
    // o Info->SyncID,
    // o "&OCD*=%d&CMD=Process" where %d is 1 - 10.
    sprintf(theUrl,
                    MAIN_FORM_FMT,
                    DELIVERY_FORM_ID,
                    Info->TermID,
                    Info->SyncID);
    sprintf(theUrl+strlen(theUrl),  "&OCD*=%d&CMD=Process", carrier);

    // Fill in additional data
    Info->tdata.trans_type  = DELIVERY;
    Info->tdata.data = 0;
    Info->tdata.wh = Info->Warehouse;
    Info->tdata.w_d_id = Info->District;
    Info->tdata.d_id = 0;
    Info->tdata.c_id = 0;
    Info->tdata.o_id = 0;
    Info->tdata.orders = 0;
    Info->tdata.remote = 0;

    // Mark End of Keying time and beginning of delivery response time.
    // Determine how long to sleep to meet minimum keying time requirement
    // and take a short nap.
    // DELIVERY_KEYING_TIME = 2000 milliseconds
    // We are subtracting from  DELIVERY_KEYING_TIME the variable time
    // that it took us to get from the last sleep to here.
    // Identify the transaction state (for debug).
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State4;
    unsigned int wait_time = DELIVERY_KEYING_TIME + t2 - pSHM->timestamp();
    if (wait_time > 0)
              Sleep((unsigned int)wait_time);

    // Determine the time at the beginning of the delivery response time.
    // Determine from that the amount of time past since the prior sleep.
    Info->tdata.trans_start_ms  = pSHM->timestamp();
    Info->tdata.key_ms  = Info->tdata.trans_start_ms  - t2;


    sprintf(Request, GET_REQUEST, theUrl);
    if (Info->socket.write(Request)  < 0)
    {
              perror ("(Transactions.C) Delivery() failure on write to socket due to: ");
              return 31;
    }

    // Iteratively read up to 4096 bytes from the socket until we find  "</HTML>".
    // Identify the transaction state and byte count (for debug).
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State5;
    pSHM->User[Info->UserNum].transaction_bytes  = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
              if ((bytes = Info->socket.read(buf,  sizeof(buf)-1))  < 0) return 41;
              pSHM->User[Info->UserNum].transaction_bytes  = totalBytes + bytes;
              if ((totalBytes + bytes) > sizeof(Result))  return 51;
              memcpy(&Result[totalBytes], buf, bytes);
              if (strstr(Result, "</HTML>")) break;
              totalBytes += bytes;
    }
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State6;

    // Search the Result string for  "TPC-C Delivery".
    if (strstr(Result, DELIVERY_EXPECT_STRING)  == NULL)
    {
              cout << "(Transaction.C) Delivery() received the following string: "
                << Result << endl;
              return 5;
    }

    // Scan Result string for  "NAME=\"STATUSID\" VALUE=\""
    // and then point past it.
    // If the value at this location is >0,
    // use it as a status and copy the transaction data into
    // the shared memory's output buffer  (finished_trans).
    if (pStr = strstr(Result, STATUS_ID_STRING))
    {
              pStr += strlen(STATUS_ID_STRING);
              if ((status = atoi(pStr))  > 0 )
              {
                  Info->tdata.status = status;
                  pSHM->transaction_done(&Info->tdata);
              }
    }

    // Transaction response time includes delay to display data on screen.
    // Identify the transaction state (for debug).
    Sleep(pSHM->response[DELIVERY]*1000.0);
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State7;

    // Mark End of Transaction response time, begin Think time
    Info->tdata.trans_finish_ms  = pSHM->timestamp();
    Info->tdata.trans_ms  = Info->tdata.trans_finish_ms  - Info->tdata.trans_start_ms;

    double think_time = neg_exp_4(pSHM->think[DELIVERY],&Info->seedbuf);
    if ((think_time*1000.0)  > 0){
              Sleep((unsigned)(think_time*1000.0));
    }

    return 1;
}


/*************************************************************************/
/***                     New Order Transaction                         ***/
/*************************************************************************/
int NewOrder(UserInfo *Info)
{

    char Result[4096];
    char theUrl[1024];
    char Request[256];

    char buf[4097];
    buf[sizeof(buf)-1] = 0;

    neword_struct             neworder;

    int        RBtrans, remoteflag, i;
    int        t1, t2;
    int        status;
    int        whses;
    int low_whse = 1;
    int        rollback = 0;

    int        bytes, totalBytes;
    char* pStr;

    // Identify the transaction ID and state (for debug).
    pSHM->User[Info->UserNum].transaction_ID  = NewOrder_ID;
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State0;

    // Start NewOrder Menu Response Time

    // Locally mark the beginning of this routine by getting
    // the time relative to when RTE was started.
//    cout << "(Transactions.C) NewOrder() invoked  by " << Info->UserNum << endl;
    t1 = pSHM->timestamp();

    // Build Url to Request NewOrder Menu
    // Create a buffer of
    // o "GET %s HTTP/2.0\r\nAccept: */* HTTP/2.0\r\nConnection: Keep-Alive\r\n\r\n"
    // o "/tpcc.dll?FORMID=%d&TERMID=%d&SYNCID=%d&CMD=%s"
    // o 2
    // o Info->TermID,
    // o Info->SyncID,
    // o "..NewOrder.."
    // and send it on the socket.
    sprintf(theUrl,
                    MAIN_MENU_FMT,
```

```
                    MAIN_MENU_FORM_ID,
                    Info->TermID,
                    Info->SyncID,
                    "..NewOrder..");
    sprintf(Request, GET_REQUEST, theUrl);
    if (Info->socket.write(Request) < 0)
    {
              perror ("(Transactions.C) NewOrder() failure on write to socket due to: ");
              return 32;
    }

    // Iteratively read up to 4096 bytes from the socket until we find "</HTML>".
    // Identify the transaction state and byte count (for debug).
    pSHM->User[Info->UserNum].transaction_state = Transaction_State1;
    pSHM->User[Info->UserNum].transaction_bytes = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
              if ((bytes = Info->socket.read(buf, sizeof(buf)-1)) < 0) return 42;
              pSHM->User[Info->UserNum].transaction_bytes = totalBytes + bytes;
              if ((totalBytes + bytes) > sizeof(Result)) return 52;
              memcpy(&Result[totalBytes], buf, bytes);
              if (strstr(Result, "</HTML>")) break;
              totalBytes += bytes;
    }
    pSHM->User[Info->UserNum].transaction_state = Transaction_State2;

  /*  cout << "(Transaction.C) NewOrder() received the following string of length: "
                << totalBytes << endl;  */


    // If the Result buffer does not contain "TPC-C New Order", return.
    if (strstr(Result, NEW_ORDER_EXPECT_STRING) == 0)
    {
              cout << "(Transaction.C) NewOrder() received the following string: "
                << Result << endl;
              return 7;
    }

    // Sleep for the number of seconds specified for the NEWORDER option.
    Sleep(pSHM->menu[NEWORDER]*1000.0);
    pSHM->User[Info->UserNum].transaction_state = Transaction_State3;

    // Mark End of Menu response time, beginning of keying time
    // After the socket read-wait and the sleep, locally mark the end of
    // Menu response time and the beginning of keying time.
    t2 = pSHM->timestamp();


    // Subtract the time that the last transaction was finished from
    // the time at the beginning of this routine to produce
    // the number of milliseconds of think time.
    Info->tdata.think_ms = t1 - Info->tdata.trans_finish_ms;

    // Copy the transaction data into the shared memory's output buffer (finished_trans),
    // but exclude initial transaction value and other non-transaction types.
    if ((Info->tdata.trans_type > 0) && (Info->tdata.trans_type < MAX_TRAN_TYPE))
              pSHM->transaction_done(&Info->tdata);

    // Calculate the time (in milliseconds) from the beginning of this routine
    // to (essentially) right now.
    Info->tdata.menu_ms = t2 - t1;

    // Re-initialize the "status".
    Info->tdata.status = 0;

    // If the Result string contains "NAME=\"STATUSID\" VALUE=\"",
    // and if the value after this string is >0,
    // use it as a status and copy the transaction data into
    // the shared memory's output buffer (finished_trans).
    if (pStr = strstr(Result, STATUS_ID_STRING))
    {
              pStr += strlen(STATUS_ID_STRING);
              if ((status = atoi(pStr)) > 0 )
              {
                  Info->tdata.status = status;
                  pSHM->transaction_done(&Info->tdata);
              }
    }

    // Reinitialize portions of the TransData.
    Info->tdata.data = 0;
    Info->tdata.orders = 0;
    Info->tdata.remote = 0;

    // Indicate that we want a ROLLBACK TRANSACTION for 1% of NewOrders.
    RBtrans = 0;
    if (uniform(1L, 5000L, &Info->seedbuf) <= 50)
    {
              RBtrans = 1;
              Info->tdata.data |= ROLLBACK;
    }

    // Generate a random District number between 1 and 10, inclusive.
    neworder.did = uniform(1L, 10L,&Info->seedbuf);

    // Generate a random Customer number less than 3000.
    neworder.cid = NURand(1023, 1, 3000, CUSTC , &Info->seedbuf);

    //Build Url to fill into NewOrder form.
    // o "/tpcc.dll?PI*=&FORMID=%d&TERMID=%d&SYNCID=%d"
    // o 3
    // o Info->TermID,
    // o Info->SyncID,
    // o "&DID*=%d" where %d is 1 - 10.
    // o "&CID*=%d" where %d is 1 - 2999.
    sprintf(theUrl,
                    MAIN_FORM_FMT,
                    NEW_ORDER_FORM_ID,
                    Info->TermID,
                    Info->SyncID);
    sprintf(theUrl+strlen(theUrl),"&DID*=%d", neworder.did);
    sprintf(theUrl+strlen(theUrl),"&CID*=%d", neworder.cid);

    remoteflag = 0;                         // for remote orders
    neworder.olremote = 0;    // find total number of remote order-lines

    whses = pSHM->End_WH;

    // Generate a random number between 5 and 15, inclusive,
    // as a loop counter.
    neworder.nloop = uniform(5L, 15L,&Info->seedbuf);
    for (i = 0; i < neworder.nloop; i++)
    {
              neworder.item[i].olswid = Info->Warehouse;
              if (whses > 1 && (uniform(0.0, 100.0,&Info->seedbuf) < 1.0)) {
                  while (neworder.item[i].olswid == Info->Warehouse)
                  {
                            neworder.item[i].olswid =
                              (long) uniform((long) low_whse, (long)whses,&Info->seedbuf);
                  }
//                printf("*** Remote NEWORDER *** Local W_ID: %d, Remote W_ID:
%d\n",Info->Warehouse,neworder.item[i].olswid);

                  neworder.olremote++;      // find total number of remote order-lines //
                  Info->tdata.remote++;
                  remoteflag = 1;
              }
              sprintf(theUrl+strlen(theUrl),"&SP%02d*=%d", i, neworder.item[i].olswid);

              Info->tdata.orders++;

              // If last iteration of loop and a RollBack transaction.
              if (neworder.nloop == i+1 && RBtrans)
                  neworder.item[i].oliid = 999999;
              else
              {
                  // Item value less than 100,000.
                  neworder.item[i].oliid = NURand(8191, 1, 100000, ITEMC,&Info->seedbuf);
              }

              sprintf(theUrl+strlen(theUrl),"&IID%02d*=%d", i, neworder.item[i].oliid);

              // Quantity is a random value between 1 and 10, inclusive.
              neworder.item[i].olquantity = uniform(1L, 10L,&Info->seedbuf);

              sprintf(theUrl+strlen(theUrl),"&Qty%02d*=%d",  i, neworder.item[i].olquantity);

    }         // end of for nloop

    // If this is a remote order, ...
    if (remoteflag == 1)
              neworder.oremote = 1;
    else
              neworder.oremote = 0;

    // Complete the URL by specifiying remaining Supplier Warhouse #,
    // Item Id and Quantity fields as null.
    for( ; i<15; i++) {
              sprintf(theUrl+strlen(theUrl),"&SP%02d*=&IID%02d*=&Qty%02d*=",  i, i, i);
    }
    sprintf(theUrl+strlen(theUrl),"&CMD=Process");

    // Fill in additional data
    Info->tdata.trans_type = NEWORDER;
    Info->tdata.wh = Info->Warehouse;
    Info->tdata.w_d_id = Info->District;
    Info->tdata.d_id = (char)neworder.did;
    Info->tdata.c_id = (unsigned short)neworder.cid;

    // Determine how long to sleep to meet minimum Keying time requirement and
    // take a short nap.
    // Mark End of Keying time and beginning of delivery response time.
    // Determine how long to sleep to meet minimum keying time requirement
    // and take a short nap.
    // NEW_ORDER_KEYING_TIME = 18000 milliseconds
    // We are subtracting from NEW_ORDER_KEYING_TIME the variable time
    // that it took us to get from the last sleep to here.
    unsigned int wait_time = NEW_ORDER_KEYING_TIME + t2 - pSHM->timestamp();
    if (wait_time > 0)
              Sleep((unsigned int)wait_time);
    pSHM->User[Info->UserNum].transaction_state = Transaction_State4;

    // Log Key Time
    // Determine the time at the beginning of the delivery response time.
    // Determine from that the amount of time past since the prior sleep.
    Info->tdata.trans_start_ms = pSHM->timestamp();
    Info->tdata.key_ms = Info->tdata.trans_start_ms - t2;

    sprintf(Request, GET_REQUEST, theUrl);
    if (Info->socket.write(Request) < 0)
    {
              perror ("(Transactions.C) NewOrder() failure on write to socket due to: ");
              return 33;
    }

    // Iteratively read up to 4096 bytes from the socket until we find "</HTML>".
    pSHM->User[Info->UserNum].transaction_state = Transaction_State5;
    pSHM->User[Info->UserNum].transaction_bytes = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
              if ((bytes = Info->socket.read(buf, sizeof(buf)-1)) < 0) return 43;
              pSHM->User[Info->UserNum].transaction_bytes = totalBytes + bytes;
              if ((totalBytes + bytes) > sizeof(Result)) return 53;
              memcpy(&Result[totalBytes], buf, bytes);
              if (strstr(Result, "</HTML>")) break;
              totalBytes += bytes;
    }
    pSHM->User[Info->UserNum].transaction_state = Transaction_State6;

    // Search the Result string for "TPC-C New Order".
    if (strstr(Result, NEW_ORDER_EXPECT_STRING) == 0)
    {
              cout << "(Transaction.C) NewOrder() received the following string: "
                << Result << endl;
              return 9;
    }

    // Transaction response time includes delay to display data on screen.
    Sleep(pSHM->response[NEWORDER]*1000.0);
    pSHM->User[Info->UserNum].transaction_state = Transaction_State7;

    // Mark End of NewOrder response time, beginning of Think Time
    Info->tdata.trans_finish_ms = pSHM->timestamp();
    Info->tdata.trans_ms = Info->tdata.trans_finish_ms - Info->tdata.trans_start_ms;

    if (pStr = strstr(Result, STATUS_ID_STRING))
    {
              pStr += strlen(STATUS_ID_STRING);
              status = atoi(pStr);

              if (status > 0 )
              {
                  Info->tdata.status = status;

                  if (pStr = strstr(Result,ORDER_NUMBER_STRING))
                  {
                            pStr += strlen(ORDER_NUMBER_STRING);
                            neworder.oid = atoi(pStr);
                            if (pStr = strstr(Result,ROLLBACK_MSG_STRING)){
                                neworder.rollback = 1;
                                if ( neworder.item[neworder.nloop-1].oliid != 999999 ) {
                                }
                            }
                  }
                  else
                  {
                            neworder.oid = -1;
                            neworder.invalid = 1;
                            pSHM->transaction_done(&Info->tdata);
                            return 22;
                  }
              }
              // routine will work for TPCCKIT version 3.002
              else
              {
                  if (!(pStr = strstr(Result,ORDER_NUMBER_STRING)))
                            neworder.oid = -1;
                  else
                  {
                            pStr += strlen(ORDER_NUMBER_STRING);
                            neworder.oid = atoi(pStr);

                            if (pStr = strstr(Result, ROLLBACK_MSG_STRING)) {
                                neworder.rollback = 1;
                                if ( neworder.item[neworder.nloop-1].oliid != 999999 ) {
                                }
                            }
                  }
              }
    }
    Info->tdata.o_id = (unsigned short)neworder.oid;


    double think_time = neg_exp_4(pSHM->think[NEWORDER],&Info->seedbuf);
    if ((think_time*1000.0) > 0){
              Sleep((unsigned)(think_time*1000.0));
    }

    return 1;
}


/*********************************************************************/
/***                    Order Status                                 ***/
```

```
/*********************************************************************/
int OrderStatus(UserInfo *Info)
{
    char Result[4096];
    char theUrl[1024];
    char Request[256];
    char * pStr;

    char buf[4097];
    buf[sizeof(buf)-1] = 0;

    ordstat_struct            ordstat;

    int        t1, t2;
    int        status;
    int        bytes, totalBytes;

    // Identify the transaction ID and state (for debug).
    pSHM->User[Info->UserNum].transaction_ID = OrderStatus_ID;
    pSHM->User[Info->UserNum].transaction_state = Transaction_State0;

    // Build Url to request Order Status Input screen

    // Locally mark the beginning of this routine by getting
    // the time relative to when RTE was started.
//    cout << "(Transactions.C) OrderStatus() invoked  by " << Info->UserNum << endl;
    t1 = pSHM->timestamp();

    // Create a buffer of
    // o "GET %s HTTP/2.0\r\nAccept: */* HTTP/2.0\r\nConnection: Keep-Alive\r\n\r\n"
    // o "/tpcc.dll?FORMID=%d&TERMID=%d&SYNCID=%d&CMD=%s"
    // o 2
    // o Info->TermID,
    // o Info->SyncID,
    // o "..Order-Status.."
    // and send it on the socket.
    sprintf(theUrl,
                    MAIN_MENU_FMT,
                    MAIN_MENU_FORM_ID,
                    Info->TermID,
                    Info->SyncID,
                    "..Order-Status..");
    sprintf(Request,GET_REQUEST, theUrl);
    if (Info->socket.write(Request) < 0)
    {
            perror ("(Transactions.C) OrderStatus() failure on write to socket due to: ");
            return 34;
    }

    // Iteratively read up to 4096 bytes from the socket until we find "</HTML>".
    pSHM->User[Info->UserNum].transaction_state = Transaction_State1;
    pSHM->User[Info->UserNum].transaction_bytes = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
            if ((bytes = Info->socket.read(buf, sizeof(buf)-1)) < 0) return 44;
            pSHM->User[Info->UserNum].transaction_bytes = totalBytes + bytes;
            if ((totalBytes + bytes) > sizeof(Result)) return 54;
            memcpy(&Result[totalBytes], buf, bytes);
            if (strstr(Result, "</HTML>")) break;
            totalBytes += bytes;
    }
    pSHM->User[Info->UserNum].transaction_state = Transaction_State2;

    // If the Result buffer does not contain "TPC-C Order-Status", return.
    if (strstr(Result, ORDER_STATUS_EXPECT_STRING) == 0)
    {
            cout << "(Transaction.C) OrderStatus() received the following string:\n "
              << Result << endl;
            return 11;
    }

    // Sleep for the number of seconds specified for the ORDSTAT option.
    Sleep(pSHM->menu[ORDSTAT]*1000.0);
    pSHM->User[Info->UserNum].transaction_state = Transaction_State3;

    // After the socket read-wait and the sleep, locally mark the end of
    // Menu response time and the beginning of keying time.
    t2 = pSHM->timestamp();

    // Subtract the time that the last transaction was finished from
    // the time at the beginning of this routine to produce
    // the number of milliseconds of think time.
    Info->tdata.think_ms = t1 - Info->tdata.trans_finish_ms;

    // Copy the transaction data into the shared memory's output buffer (finished_trans),
    // but exclude initial transaction value and other non-transaction types.
    if ((Info->tdata.trans_type > 0) && (Info->tdata.trans_type < MAX_TRAN_TYPE))
            pSHM->transaction_done(&Info->tdata);

    // Calculate the time (in milliseconds) from the beginning of this routine
    // to (essentially) right now.
    Info->tdata.menu_ms = t2 - t1;

    // Re-initialize the "status".
    Info->tdata.status = 0;

    // Scan Result string for "NAME=\"STATUSID\" VALUE=\""
    // and then point past it.
    // If the value at this location is >0,
    // use it as a status and copy the transaction data into
    // the shared memory's output buffer (finished_trans).

    if (pStr = strstr(Result, STATUS_ID_STRING))
    {
            pStr += strlen(STATUS_ID_STRING);
            if ((status = atoi(pStr)) > 0 )
            {
                Info->tdata.status = status;
                pSHM->transaction_done(&Info->tdata);
            }
    }

    Info->tdata.trans_type = ORDSTAT;
    Info->tdata.data = 0;
    Info->tdata.d_id = 0;
    Info->tdata.orders = 0;
    Info->tdata.remote = 0;
    Info->tdata.o_id = 0;

    // Set District number per a random number between 1 and 10, inclusively.
    ordstat.did = uniform(1L, 10L, &Info->seedbuf);

    //Build Url to fill in OrderStatus form
    // o "/tpcc.dll?PI*=&FORMID=%d&TERMID=%d&SYNCID=%d"
    // o 6
    // o Info->TermID,
    // o Info->SyncID,
    // o "&DID*=%d" where %d is 1 - 10.
    sprintf(theUrl,
                    MAIN_FORM_FMT,
                    ORDER_STATUS_FORM_ID,
                    Info->TermID,
                    Info->SyncID);
    sprintf(theUrl+strlen(theUrl), "&DID*=%d", ordstat.did);

    // For 60% of the transactions, ...
    if (uniform(1L, 100L, &Info->seedbuf) <= 60)
    {
            // Glom onto a 3-part randomly generated customer last name and
            // update the buffer.
            char getnameBuf[20];
            getname(getnameBuf, &Info->seedbuf);
            strcpy(ordstat.clast, getnameBuf);
            sprintf(theUrl+strlen(theUrl), "&CID*=&CLT*=%s", ordstat.clast);
            ordstat.byname = 1;
            ordstat.cid = 0;
            Info->tdata.data |= BY_NAME;
    }
    else // For the remaining 40% of transactions....
    {
            // Generate a Customer ID less than or equal to 3000 and
            // update the buffer.
            ordstat.cid = NURand(1023, 1, 3000, CUSTC, &Info->seedbuf);
#ifdef AUDIT_TRANS
            if (dnum == OS_DNUM) ordstat.cid = AUDIT_C_ID;
#endif
            sprintf(theUrl+strlen(theUrl), "&CID*=%d&CLT*=", ordstat.cid);
            ordstat.byname = 0;
            ordstat.clast[0] = (char) NULL;
    }
    strcat(theUrl,"&CMD=Process");

    // Fill in additional data
    Info->tdata.wh = Info->Warehouse;
    Info->tdata.w_d_id = Info->District;
    Info->tdata.c_id = (unsigned short)ordstat.cid;

    // Determine how long to sleep to meet minimum Keying time requirement and
    // take a short nap
    unsigned int wait_time = ORDER_STATUS_KEYING_TIME + t2 - pSHM->timestamp();
    if (wait_time > 0)
            Sleep((unsigned int)wait_time);
    pSHM->User[Info->UserNum].transaction_state = Transaction_State4;

    // Mark End of keying time, beginning of OrderStatus response time.
    Info->tdata.trans_start_ms = pSHM->timestamp();
    Info->tdata.key_ms = Info->tdata.trans_start_ms - t2;

    sprintf(Request, GET_REQUEST, theUrl);
    if (Info->socket.write(Request) < 0)
    {
            perror ("(Transactions.C) OrderStatus() failure on write to socket due to: ");
            return 35;
    }

    // Iteratively read up to 4096 bytes from the socket until we find "</HTML>".
    pSHM->User[Info->UserNum].transaction_state = Transaction_State5;
    pSHM->User[Info->UserNum].transaction_bytes = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
            if ((bytes = Info->socket.read(buf, sizeof(buf)-1)) < 0) return 45;
            pSHM->User[Info->UserNum].transaction_bytes = totalBytes + bytes;
            if ((totalBytes + bytes) > sizeof(Result)) return 55;
            memcpy(&Result[totalBytes], buf, bytes);
            if (strstr(Result, "</HTML>")) break;
            totalBytes += bytes;
    }
    pSHM->User[Info->UserNum].transaction_state = Transaction_State6;

    // Search the Result string for "TPC-C Order-Status".
    if (strstr(Result,ORDER_STATUS_EXPECT_STRING) == 0)
    {
            cout << "(Transaction.C) OrderStatus() received the following string: "
              << Result << endl;
            return 13;
    }

    // Transaction response time includes delay to display data on screen.
    Sleep(pSHM->response[ORDSTAT]*1000.0);
    pSHM->User[Info->UserNum].transaction_state = Transaction_State7;

    // Mark End of OrderStatus response time, beginning of Think Time
    Info->tdata.trans_finish_ms = pSHM->timestamp();
    Info->tdata.trans_ms = Info->tdata.trans_finish_ms - Info->tdata.trans_start_ms;

    // Scan Result string for "NAME=\"STATUSID\" VALUE=\""
    // and then point past it.
    // If the value at this location is >0,
    // use it as a status and copy the transaction data into
    // the shared memory's output buffer (finished_trans).
    if (pStr = strstr(Result, STATUS_ID_STRING))
    {
            pStr += strlen(STATUS_ID_STRING);
            if ((status = atoi(pStr)) > 0 )
            {
                Info->tdata.status = status;
                pSHM->transaction_done(&Info->tdata);
            }
    }

    double think_time = neg_exp_4(pSHM->think[ORDSTAT],&Info->seedbuf);
    if ((think_time*1000.0) > 0){
            Sleep((unsigned)(think_time*1000.0));
    }

    return 1;
}


/*********************************************************************/
/***                    Payment                                    ***/
/*********************************************************************/
int Payment(UserInfo *Info)
{
    char Result[4096];
    char theUrl[1024];
    char Request[256];
    char* pStr;

    char buf[4097];
    buf[sizeof(buf)-1] = 0;

    payment_struct            payment;

    int dollars, cents;
    int        bytes, totalBytes;
    int        t1, t2;
    int        status;
    int        whses, low_whse = 1;

    // Identify the transaction ID and state (for debug).
    pSHM->User[Info->UserNum].transaction_ID = Payment_ID;
    pSHM->User[Info->UserNum].transaction_state = Transaction_State0;

    // Start Payment Menu Response Time

    // Locally mark the beginning of this routine by getting
    // the time relative to when RTE was started.
//    cout << "(Transactions.C) Payment() invoked  by " << Info->UserNum << endl;
    t1 = pSHM->timestamp();

    // Create a buffer of
    // o "GET %s HTTP/2.0\r\nAccept: */* HTTP/2.0\r\nConnection: Keep-Alive\r\n\r\n"
    // o "/tpcc.dll?FORMID=%d&TERMID=%d&SYNCID=%d&CMD=%s"
    // o 2
    // o Info->TermID,
    // o Info->SyncID,
    // o "..Payment.."
    // and send it on the socket.
    sprintf(theUrl,
                    MAIN_MENU_FMT,
                    MAIN_MENU_FORM_ID,
                    Info->TermID,
                    Info->SyncID,
                    "..Payment..");
    sprintf(Request, GET_REQUEST, theUrl);
    if ((Info->socket.write(Request)) < 0)
    {
            perror ("(Transactions.C) Payment() failure on write to socket due to: ");
            return 36;
    }

    // Iteratively read up to 4096 bytes from the socket until we find "</HTML>".
    pSHM->User[Info->UserNum].transaction_state = Transaction_State1;
```

```
    pSHM->User[Info->UserNum].transaction_bytes  = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
               if ((bytes = Info->socket.read(buf, sizeof(buf)-1)) < 0) return 46;
               pSHM->User[Info->UserNum].transaction_bytes  = totalBytes + bytes;
               if ((totalBytes + bytes) > sizeof(Result)) return 56;
               memcpy(&Result[totalBytes], buf, bytes);
               if (strstr(Result, "</HTML>")) break;
               totalBytes += bytes;
    }
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State2;

    // If the Result buffer does not contain  "TPC-C Payment", return.
    if (strstr(Result, PAYMENT_EXPECT_STRING)  == 0)
    {
               cout << "(Transaction.C) Payment() received the following string: "
                    << Result << endl;
               return 15;
    }

    // Sleep for the number of seconds specified for the PAYMENT option.
    Sleep(pSHM->menu[PAYMENT]*1000.0);
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State3;

    // After the socket read-wait and the sleep, locally mark the end of
    // Menu response time and the beginning of keying time.
    t2 = pSHM->timestamp();


    // Subtract the time that the last transaction was finished from
    // the time at the beginning of this routine to produce
    // the number of milliseconds of think time.
    Info->tdata.think_ms  = t1 - Info->tdata.trans_finish_ms;

    // Copy the transaction data into the shared memory's output buffer  (finished_trans),
    // but exclude initial transaction value and other non-transaction types.
    if (Info->tdata.trans_type  > 0 && Info->tdata.trans_type  < MAX_TRAN_TYPE)
               pSHM->transaction_done(&Info->tdata);

    // Calculate the time (in milliseconds) from the beginning of this routine
    // to (essentially) right now.
    Info->tdata.menu_ms  = t2 - t1;

    // Re-initialize the "status".
    Info->tdata.status  = 0;

    // Scan Result string for  "NAME=\"STATUSID\" VALUE=\""
    // and then point past it.
    // If the value at this location is >0,
    // use it as a status and copy the transaction data into
    // the shared memory's output buffer  (finished_trans).
    if (pStr = strstr(Result, STATUS_ID_STRING))
    {
               pStr += strlen(STATUS_ID_STRING);
               if ((status = atoi(pStr))  > 0 )
               {
                    Info->tdata.status  = status;
                    pSHM->transaction_done(&Info->tdata);
               }
    }

    Info->tdata.trans_type  = PAYMENT;
    Info->tdata.data  = 0;
    Info->tdata.orders  = 0;
    Info->tdata.remote  = 0;
    Info->tdata.c_id  = 0;
    Info->tdata.o_id  = 0;

    // Set the District number per a random number between 1 and 10, inclusively.
    payment.did = uniform(1L, 10L, &Info->seedbuf);

    //Build Url to fill in Payment form.
    // o "/tpcc.dll?PI*=&FORMID=%d&TERMID=%d&SYNCID=%d"
    // o 4
    // o Info->TermID  (originally from AS/400 at  login)
    // o Info->SyncID  (originally from AS/400 at  login)
    // o "&DID*=%d" where %d is 1 - 10.
    sprintf(theUrl,
                    MAIN_FORM_FMT,
                    PAYMENT_FORM_ID,
                    Info->TermID,
                    Info->SyncID);
    sprintf(theUrl+strlen(theUrl),  "&DID*=%d", payment.did);

    // For 60% of the transactions, ...
    if (uniform(1L, 100L, &Info->seedbuf)  <= 60)
    {
               // Randomly generate a 3-part Customer name.
               char getnameBuf[20];
               getname(getnameBuf,  &Info->seedbuf);
               strcpy(payment.clast, getnameBuf);
               payment.byname = 1;
               payment.cid = 0;
               Info->tdata.data  |= BY_NAME;
    }
    else
    {          // For the remaining 40%, ...
               // Choose a Customer ID between 1 and 3000.
               payment.cid = NURand(1023, 1, 3000, CUSTC, &Info->seedbuf);
#ifdef AUDIT_TRANS
               if (dnum == PAY_DNUM)
                    payment.cid = AUDIT_C_ID;
#endif
               payment.byname = 0;
               payment.clast[0]  = (char) NULL;
    }


    // For 85% of the transactions OR
    // if there are fewer than 2 warehouses,
    // use the one warehouse in  Info->Warehouse.
    whses = pSHM->End_WH;
    // cout << "total warehouses = " << whses << " hom whs = " << Info->Warehouse << endl;
    if (whses < 2 || uniform(1L, 100L,&Info->seedbuf)  <= 85)
    {
               payment.cwid = Info->Warehouse;
               payment.cdid = payment.did;
               payment.remote  = 0;
    }
    else
    {          // For the remaining 15 % of transactions,
               // randomly choose a warehouse ID other than the one in  Info->Warehouse.
               while (1)
               {
                    payment.cwid = (long)uniform((long)low_whse,  (long)whses, &Info->seedbuf);
                    if (payment.cwid != Info->Warehouse)  break;
               }

               payment.remote = 1;
               payment.cdid = uniform(1L, 10L,&Info->seedbuf);              // district 1 to 10
               Info->tdata.data  |= REMOTE;

    // cout << "seed = " << &Info->seedbuf << " rem dst = " << payment.cdid << endl;
    // cout << "hom whs = " << Info->Warehouse << " rem whs = " << payment.cwid << endl;
    // cout << "cid = " << payment.cid << " clast = " << payment.clast << endl;

    }

    if (payment.byname)
    {
               sprintf(theUrl+strlen(theUrl),
                              "&CID*=&CWI*=%d&CDI*=%d&CLT*=%s",
                              payment.cwid, payment.cdid, payment.clast);
    }
    else
    {
               sprintf(theUrl+strlen(theUrl),
                              "&CID*=%d&CWI*=%d&CDI*=%d&CLT*=",
                              payment.cid, payment.cwid, payment.cdid);
    }

    // Set a dollar amount between 1 and 5000, inclusive, and
    // a cents amount between 0 and 99, inclusive.
    dollars = uniform(1L, 5000L,  &Info->seedbuf);
    if (dollars == 5000)
               cents = 0;
    else
               cents = uniform(0L, 99L,&Info->seedbuf);
    payment.amount = ((double) dollars) + ((double) cents) / 100.0;
    sprintf(theUrl+strlen(theUrl),
                    "&HAM*=%d.%02d",
                    dollars,
                    cents);
    strcat(theUrl, "&CMD=Process");

    // Fill in additional data
    Info->tdata.wh = Info->Warehouse;
    Info->tdata.w_d_id = Info->District;
    Info->tdata.d_id = (char)payment.cdid;
    Info->tdata.c_id = (unsigned short)payment.cid;

    // Determine how long to sleep to meet minimum Keying time requirement and
    // take a short nap
    unsigned int wait_time = PAYMENT_KEYING_TIME + t2 - pSHM->timestamp();
    if (wait_time > 0)
               Sleep((unsigned int)wait_time);
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State4;

    // Mark End of keying time, beginning of Payment response time
    Info->tdata.trans_start_ms  = pSHM->timestamp();
    Info->tdata.key_ms  = Info->tdata.trans_start_ms  - t2;

    sprintf(Request, GET_REQUEST, theUrl);
    if ((Info->socket.write(Request))  < 0)
    {
               perror ("(Transactions.C) Payment() failure on write to socket due to: ");
               return 37;
    }

    // Iteratively read up to 4096 bytes from the socket until we find  "</HTML>".
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State5;
    pSHM->User[Info->UserNum].transaction_bytes  = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
               if ((bytes = Info->socket.read(buf, sizeof(buf)-1)) < 0) return 47;
               pSHM->User[Info->UserNum].transaction_bytes  = totalBytes + bytes;
               if ((totalBytes + bytes) > sizeof(Result)) return 57;
               memcpy(&Result[totalBytes], buf, bytes);
               if (strstr(Result, "</HTML>")) break;
               totalBytes += bytes;
    }
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State6;

    // If the Result string does not contain  "TPC-C Payment", return.
    if (strstr(Result, PAYMENT_EXPECT_STRING)  == 0) return 17;

    // Sleep for the number of seconds specified for the PAYMENT option.
    Sleep(pSHM->response[PAYMENT]*1000.0);
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State7;

    // Mark End of Payment response time, beginning of Think Time
    Info->tdata.trans_finish_ms  = pSHM->timestamp();
    Info->tdata.trans_ms  = Info->tdata.trans_finish_ms  - Info->tdata.trans_start_ms;

    // Scan Result string for  "NAME=\"STATUSID\" VALUE=\""
    // and then point past it.
    // If the value at this location is >0,
    // use it as a status and copy the transaction data into
    // the shared memory's output buffer  (finished_trans).
    if (pStr = strstr(Result, STATUS_ID_STRING))
    {
               pStr += strlen(STATUS_ID_STRING);
               if ((status = atoi(pStr))  > 0 )
               {
                    Info->tdata.status  = status;
                    pSHM->transaction_done(&Info->tdata);
               }
    }

    double think_time = neg_exp_4(pSHM->think[PAYMENT],&Info->seedbuf);
    if ((think_time*1000.0)  > 0){
               Sleep((unsigned)(think_time*1000.0));
    }
    return 1;
}


/*********************************************************************/
/***                    Stock Level                                  ***/
/*********************************************************************/
int StockLevel(UserInfo *Info)
{
    char Result[4096];
    char theUrl[1024];
    char Request[256];
    char* pStr;

    char buf[4097];
    buf[sizeof(buf)-1]  = 0;

    stocklev_struct           stocklevel;

    int        bytes, totalBytes;
    int        t1, t2;
    int        status;

    // Identify the transaction ID and state (for debug).
    pSHM->User[Info->UserNum].transaction_ID  = StockLevel_ID;
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State0;

    // Locally mark the beginning of this routine by getting
    // the time relative to when RTE was started.
//    cout << "(Transactions.C) StockLevel() invoked  by " << Info->UserNum << endl;
    t1 = pSHM->timestamp();

    // Create a buffer of
    // o "GET %s HTTP/2.0\r\nAccept:  */* HTTP/2.0\r\nConnection: Keep-Alive\r\n\r\n"
    // o "/tpcc.dll?FORMID=%d&TERMID=%d&SYNCID=%d&CMD=%s"
    // o 2
    // o Info->TermID,
    // o Info->SyncID,
    // o "..Stock-Level.."
    // and send it on the socket.
    sprintf(theUrl,
                    MAIN_MENU_FMT,
                    MAIN_MENU_FORM_ID,
                    Info->TermID,
                    Info->SyncID,
                    "..Stock-Level..");
    sprintf(Request,GET_REQUEST, theUrl);
    if ((Info->socket.write(Request))  < 0)
    {
               perror ("(Transactions.C) StockLevel() failure on write to socket due to: ");
               return 38;
    }

    // Iteratively read up to 4096 bytes from the socket until we find  "</HTML>".
    pSHM->User[Info->UserNum].transaction_state  = Transaction_State1;
    pSHM->User[Info->UserNum].transaction_bytes  = 0;
    totalBytes = 0;
    memset(Result, 0, sizeof(Result));
    while(totalBytes < sizeof(Result))
    {
               if ((bytes = Info->socket.read(buf, sizeof(buf)-1)) < 0) return 48;
```

```
            pSHM->User[Info->UserNum].transaction_bytes  = totalBytes + bytes;
            if ((totalBytes + bytes) > sizeof(Result)) return 58;
            memcpy(&Result[totalBytes], buf, bytes);
            if (strstr(Result, "</HTML>")) break;
            totalBytes += bytes;
}
pSHM->User[Info->UserNum].transaction_state  = Transaction_State2;

// If the Result buffer does not contain  "TPC-C Stock Level", return.
if (strstr(Result, STOCK_LEVEL_EXPECT_STRING)  == 0)
{
            cout << "(Transaction.C) StockLevel() received the following string: "
              << Result << endl;
            return 19;
}


// Sleep for the number of seconds specified for the  STOCKLEV option.
Sleep(pSHM->menu[STOCKLEV]*1000.0);
pSHM->User[Info->UserNum].transaction_state  = Transaction_State3;

// After the socket read-wait and the sleep, locally mark the end of
// Menu response time and the beginning of keying time.
t2 = pSHM->timestamp();

// Subtract the time that the last transaction was finished from
// the time at the beginning of this routine to produce
// the number of milliseconds of think time.
Info->tdata.think_ms  = t1 - Info->tdata.trans_finish_ms;

// Copy the transaction data into the shared memory's output buffer  (finished_trans),
// but exclude initial transaction value and other non-transaction types.
if (Info->tdata.trans_type  > 0 && Info->tdata.trans_type  < MAX_TRAN_TYPE)
            pSHM->transaction_done(&Info->tdata);

// Calculate the time (in milliseconds) from the beginning of this routine
// to (essentially) right now.
Info->tdata.menu_ms  = t2 - t1;

// Re-initialize the "status".
Info->tdata.status  = 0;

// Scan Result string for  "NAME=\"STATUSID\" VALUE=\""
// and then point past it.
// If the value at this location is >0,
// use it as a status and copy the transaction data into
// the shared memory's output buffer  (finished_trans).
if (pStr  = strstr(Result, STATUS_ID_STRING))
{
            pStr += strlen(STATUS_ID_STRING);
            if ((status  = atoi(pStr))  > 0 )
            {
                Info->tdata.status  = status;
                pSHM->transaction_done(&Info->tdata);
            }
}

// Generate a random threshold value between 10 and 20, inclusively.
stocklevel.threshold  = uniform(10L, 20L,&Info->seedbuf);

//Build Url to fill in Stock-Level form.
// o "/tpcc.dll?PI*=&FORMID=%d&TERMID=%d&SYNCID=%d"
// o 7
// o Info->TermID (originally from AS/400 at  login)
// o Info->SyncID (originally from AS/400 at  login)
// o "&TT*=%d" where %d is 10 - 20.
// o "&CMD=Process"
sprintf(theUrl,
                MAIN_FORM_FMT,
                STOCK_LEVEL_FORM_ID,
                Info->TermID,
                Info->SyncID);
sprintf(theUrl+strlen(theUrl),  "&TT*=%d", stocklevel.threshold);
strcat(theUrl, "&CMD=Process");

// Fill in additional data
Info->tdata.trans_type  = STOCKLEV;
Info->tdata.data  = 0;
Info->tdata.orders  = 0;
Info->tdata.remote  = 0;
Info->tdata.c_id  = 0;
Info->tdata.o_id  = 0;
Info->tdata.wh  = Info->Warehouse;
Info->tdata.d_id  = Info->District;

// Determine how long to sleep to meet minimum Keying time requirement and
// take a short nap
unsigned int wait_time  = STOCK_LEVEL_KEYING_TIME  + t2 - pSHM->timestamp();
if (wait_time  > 0)
            Sleep((unsigned int)wait_time);
pSHM->User[Info->UserNum].transaction_state  = Transaction_State4;

// Mark End of keying time, beginning of Stock-Level response time
Info->tdata.trans_start_ms  = pSHM->timestamp();
Info->tdata.key_ms  = Info->tdata.trans_start_ms  - t2;

// Send the Stock-Level form on the socket.
sprintf(Request, GET_REQUEST, theUrl);
if ((Info->socket.write(Request))  < 0)
{
            perror ("(Transactions.C) StockLevel() failure on write to socket due to: ");
            return 39;
}

// Iteratively read up to 4096 bytes from the socket until we find  "</HTML>".
pSHM->User[Info->UserNum].transaction_state  = Transaction_State5;
pSHM->User[Info->UserNum].transaction_bytes  = 0;
totalBytes  = 0;
memset(Result, 0, sizeof(Result));
while(totalBytes < sizeof(Result))
{
            if ((bytes  = Info->socket.read(buf, sizeof(buf)-1))  < 0) return 49;
            pSHM->User[Info->UserNum].transaction_bytes  = totalBytes + bytes;
            if ((totalBytes + bytes) > sizeof(Result)) return 59;
            memcpy(&Result[totalBytes], buf, bytes);
            if (strstr(Result, "</HTML>")) break;
            totalBytes += bytes;
}
pSHM->User[Info->UserNum].transaction_state  = Transaction_State6;

// If the Result buffer does not contain  "TPC-C Stock Level", return.
if (strstr(Result, STOCK_LEVEL_EXPECT_STRING)  == 0)
{
            cout << "(Transaction.C) StockLevel() received the following string: "
              << Result << endl;
            return 21;
}

// Transaction response time includes delay to display data on screen.
Sleep(pSHM->response[STOCKLEV]*1000.0);
pSHM->User[Info->UserNum].transaction_state  = Transaction_State7;

// Mark End of Stock-Level response time, beginning of Think Time
Info->tdata.trans_finish_ms  = pSHM->timestamp();
Info->tdata.trans_ms  = Info->tdata.trans_finish_ms  - Info->tdata.trans_start_ms;


// Scan Result string for  "NAME=\"STATUSID\" VALUE=\""
// and then point past it.
// If the value at this location is >0,
// use it as a status and copy the transaction data into
// the shared memory's output buffer  (finished_trans).
if (pStr  = strstr(Result, STATUS_ID_STRING))
{
            pStr += strlen(STATUS_ID_STRING);
            if ((status  = atoi(pStr))  > 0 )
            {
                Info->tdata.status  = status;
                pSHM->transaction_done(&Info->tdata);
            }
}

double think_time  = neg_exp_4(pSHM->think[STOCKLEV],&Info->seedbuf);
if ((think_time*1000.0)  > 0){
            Sleep((unsigned)(think_time*1000.0));
}

return 1;
}
```

Appendix F. 180-Day DASD Requirements

The appendix documents the information required to calculate the 180-Day DASD requirements for the TPC Benchmark C measurements on the IBM @server iSeries 400 Model 840-2420 system. Also included is the calculation used to determine the amount of DASD required for the 8 hours of journal space.

Section "IBM @server iSeries 400 Model 840-2420 -- 180-Day DASD Requirements" shows the values in the calculation of the 180-Day Space. Also used were the formulas provided in Clause 4.2.3 of the TPC Benchmark C Standard Specification. These formulas are:

Daily-Growth	=	{dynamic-space/(W*62.5)} *tpmC
Daily-Spread	=	MAX (0, Free-Space - 1.5*Daily-Growth)
180-Day-Space	=	Static-Space + 180*(Daily-Growth+Daily-Spread)

F.1 IBM @server iSeries 400 Model 840-2420 -- 180-Day DASD Requirements

Static Files	Number of Warehouses	12200		tpmC	152346	
File name	Customer	District	Item	New Order	Stock	Warehouse
Number of Records	366000000	122000	100000	39600000	1220000000	12100
Data Space	244490420224	12599296	9445376	1207877632	374541230080	1196032
Index Space	11050446848	2105344	1843200	2004901888	38053912576	229376
Add'l Index	25718587392			12288		
Add'l Index	16384					

Dynamic Files			
File name	History	Orderline	Orders
Initial Records	366000000	3660140702	366000000
Size Per Record	49.0016641166	75.7402476648	26.0009640801
Initial Data Space	17934609067	277219963258	9516352853
Initial Index Space	24576	98620739584	12024115200
Add'l Index		16384	12172947456
Add'l Index			
Configured Space	21521530880	332651167744	11419623424
Free Space	3586921813	55431204486	1903270571

Static Space	854767383757
Dynamic Space	304670925178
Free Space	60921396870
Daily Growth	60872651498
Daily Spread	0
180 Day Space	11811844653371
System Software	1941358080
SubTotal	11813786011451
Journal Space	1055366564646
Total DASD Required	12869152576097
DASD Priced	12990690623488
Difference	121538047391

F.2 IBM @server iSeries 400 Model 840-2420 -- Journal DASD Requirements

To determine the amount of DASD required for the 8 hours of journal, a series of tests were run for an extended period. Through these tests it was determined that an average of 6,927,432 bytes of DASD are required per tpmC.

Appendix G. Third Party Quotes

THE ECOMMERCE TRANSACTION PLATFORM

March 19, 2001

Mr. Douglas D. Jans
IBM Bldg. 006-2
3605 Highway 52 North
Rochester, MN 55901
Phone: 507 253-6717
FAX: 507 253-7743

Dear Mr. Jans:

Per your request I am enclosing the pricing information regarding TUXEDO that you requested. This pricing applies to Tuxedo 6.4, 6.5 and 7.1. Please note that Tuxedo 7.1 is our most recent version of Tuxedo but that 6.4, 6.5 and 7.1 releases are generally available. Core functionality services pricing is appropriate for your activities. As per the table below, server systems are classified in one of 5 tiers based on CPU type and capacity. *This quote is valid for 90 days from the date of issue of this letter*.

Tuxedo Core Functionality Services (CFS) Program Product Pricing and Description

TUX-CFS provides a basic level of middleware support for distributed computing, and is best used by organizations with substantial resources and knowledge for advanced distributed computing implementations.

TUX-CFS prices are server only and are based on the overall performance characteristics of the server and uses the same five-tier computer classification as TUXEDO 6.4, Tuxedo 6.5, and Tuxedo 7.1. Prices range from $3,000 for Tier 1 to $250,000 for Tier 5. Under this pricing option EVERY system running TUX-CFS at the user site must have a TUXEDO license installed and pay the appropriate per server license fees.

Very Truly Yours,

Robert J. Gieringer

Robert J. Gieringer
Worldwide Pricing Manager

BEA Tux/CFS Unlimited User License Fees Per Server

Unlimited User License fees per server	Number of Users	Dollar Amount	Maintenance (5 x 8) per year	Maintenance (7 x 24) per year
Tier 1 -- PC Servers with 1 or 2 CPUs, entry level RISC Uni-processor workstations and servers	Unlimited	$3,000.00	$480.00	$690.00
Tier 2 - PC Servers with 3 or 4 CPUs, Midrange RISC Uni-processor servers and workstations with up to 2 CPUs	Unlimited	$12,000.00	$1,920.00	$2,760.00
Tier 3 - Midrange Multiprocessors, up to 8 CPUs per system capacity	Unlimited	$30,000.00	$4,800.00	$6,900.00
Tier 4 - Large (more than 8, less than 32 CPUs)	Unlimited	$100,000.00	$16,000.00	$23,000.00
Tier 5 - Massively Parallel Systems, > 32 processors	Unlimited	$250,000.00	$40,000.00	$57,500.00

	Tier 1	*Tier 2*	*Tier 3*	*Tier 3*	*Tier 4*	*Tier 5*
Platform	***Class 2***	***Class 3***	***Class 4***	***Class 5***	***Class 6***	***Class 7***
IBM AS400	*Model 170 (All except 2388)* *Model 270 (1 way – 2248,2250, 2252)*	Models 20s, 30s, 40s, 200, 300, 400, 600, S10, 150 170 - 2388 150 all models *Model 270 (2 Way)*	Models 310, 320, 500, 510, 520, 620, S20, 50s Model 530, 640, S30, S40, 53s 720 all models	730 all models 740-2069 s40-sb1-2 310 s40-sb1-2 311	Model 650 740-2070	

Appendix H. Auditor Letter

INFO SIZING

TPC TRANSACTION PROCESSING PERFORMANCE COUNCIL CERTIFIED AUDITOR

Test Sponsor: Douglas D. Jans
Development Programmer Manager
IBM Corp Dept 53QA
3605 Highway 52 N.
Rochester, MN 55901

March 19, 2001

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

Platform: **IBM eServer iSeries 400 Model 840-2420 c/s**
DataBase Manager: **DB2 for AS/400 Version 4 Release 5**
Operating System: **OS/400 Version 4 Release 5**
Transaction Manager: **BEA Tuxedo Version 6.4**

The results were:

CPU's Speed	Memory	Disks	NewOrder 90% Response Time	**tpmC**
Server: IBM eServer iSeries 400 Model 840-2420				
24 x Power PC 2420 (500 MHz)	128 GB Main 8 MB cache/cpu	769 x 17.6 GB	0.5 Seconds	**152,346.25**
Sixteen (16) Clients: IBM eServer iSeries 400 Model 270-2252 (Specification for each)				
1 x Power PC 2252 (450 MHz)	8 GB Main 2 MB cache/cpu	6 x 8.6 GB	n/a	n/a

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

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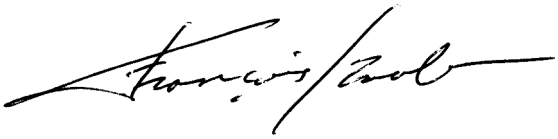
- The transactions were correctly implemented
- The database records were the proper size
- The database was properly scaled and populated
- The ACID properties were met
- Input data was generated according to the specified percentages
- The transaction cycle times included the required keying and think times
- The reported response times were correctly measured.
- At least 90% of all delivery transactions met the 80 Second completion time limit
- All 90% response times were under the specified maximums
- The measurement interval was representative of steady state conditions
- The reported measurement interval was 20 minutes
- At least 5 file synchronization cycles occurred during the measurement interval
- Measurement repeatability was verified
- The 180 day storage requirement was correctly computed
- The system pricing was verified for major components and maintenance

Additional Audit Notes:

This benchmark was originally conducted in September 2000 under the TPC-C Version 3. It is now upgraded to TPC-C Version 5 in accordance with the rules defined by the TPC.

Respectfully Yours,



François Raab
President

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