Database System Implementation

Project 1 - Implementation of Heap File

***Developed by* –**

Ghodkari Chowdary, Raghunatha Rao - UFID: 6218-1051
Mullapudi, Aseesh - UFID: 9175-1971

Aim of this project is to implement a Heap file.

We have completed the DBFile class by writing the required functions. The job of the DBFile within the system is to store and retrieve records from the disk.

Implementation Details:

We have created the following private fields in the DBFile.h

File *fileBuffer; // a file instance

Page *writeBuffer; // a page buffer to write records

Page *readBuffer; // a page buffer to read records

bool isEmptyWriteBuffer; // to check if the writeBuffer is empty

bool endoffile; // to check of end of file has been reached

int pageIdx; // to track page index in File

Method Definitions:

- ***DBFile::DBFile ()***

  Constructor used to create instances of the File and page buffers. End of file flag is off and isEmptyWriteBuffer is true

- ***int DBFile::Create (const char *f_path, fType f_type, void *startup)***

  This method takes input f_path, f_type and creates a bin file. It also creates a metadata file which stores the required the file type.

- ***void DBFile::Load (Schema &f_schema, const char *loadpath)***

  This method takes schema, loadpath as input and loads the records from the dataset into the bin file

- ***int DBFile::Open (const char *f_path)***

  This method takes the f_path as input and points to the bin file

- ***void DBFile::MoveFirst ()***

This method points to the first record in the Heap File using readBuffer

- ***void DBFile::Add (Record &rec)***

  This method is used to add the records to the DBFile. The records are first added to the writeBuffer and whenever the writeBuffer is full we are adding the Page to the File. This writeBuffer is emptied and used again for storing records

- ***int DBFile::GetNext (Record &fetchme)***

  This method returns the record from the DBFile instance using readBuffer

- ***int DBFile::GetNext (Record &fetchme, CNF &cnf, Record &literal)***

  This method returns the record from the DBFile if it matches the filter CNF using readBuffer

- ***int DBFile::Close ()***

  It checks whether writeBuffer is empty to add the last page to file and then deletes all the file and page instances

File ***gtest.cc*** written to unit test the Create, Open and Close functions of the DBFile

Instructions to run code:

1) ***Compile and run code main.cc:***

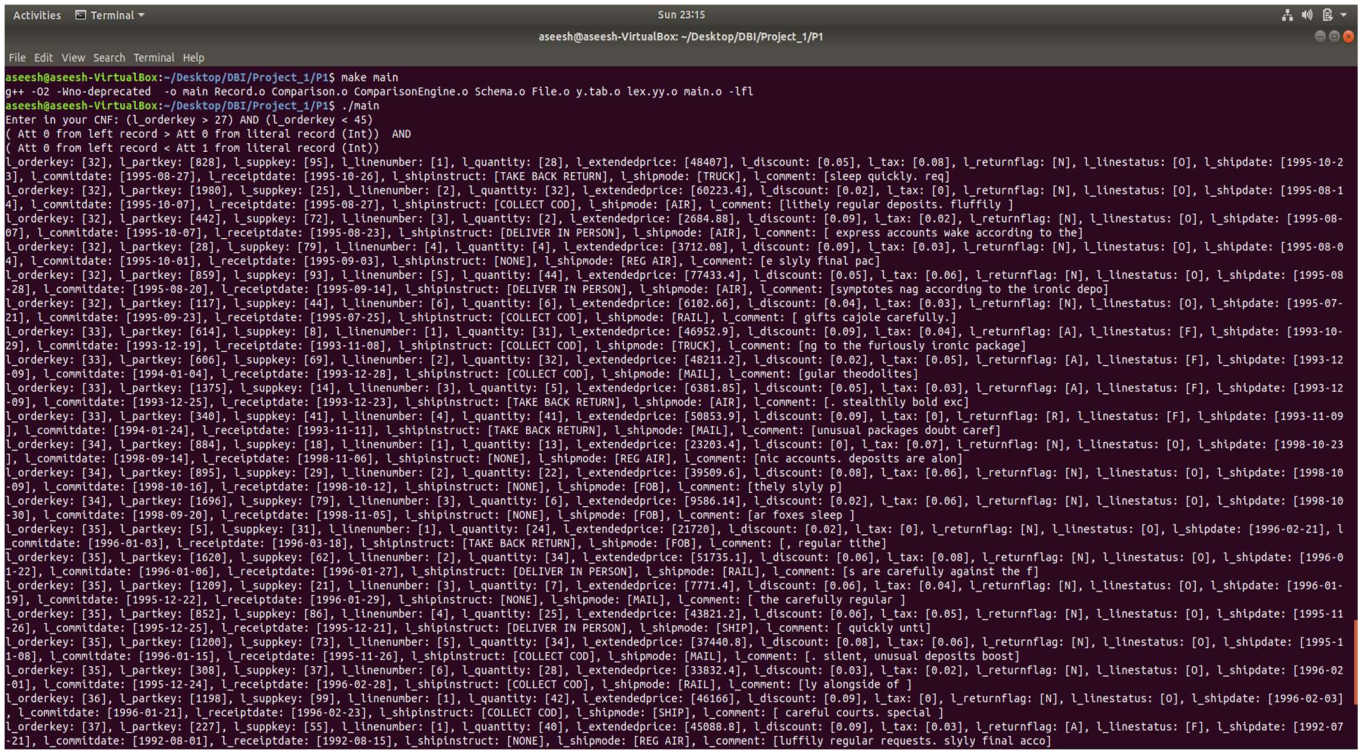
   1. make main
   2. ./main

   Enter the CNF on the console

   E.g. (l_orderkey > 27) AND (l_orderkey < 45)

   Press Enter and then Ctrl + D

   Output is printed on the Console (**Screenshot of ./main is on the next page**)



2) Compile and run code test.cc:

Ensure that the tpch_dir has the correct path to data generated by the tpch-dbgen so that project has access to datasets.

Ensure there is Catalog file in the root folder as well

1. make
2. ./test.out

Queries used for testing on 1GB tpch-dbgen files are below:

(q1) select * from region where r_name='EUROPE';

(q2) select * from region where r_name < 'middle east' and r_regionkey > 1;

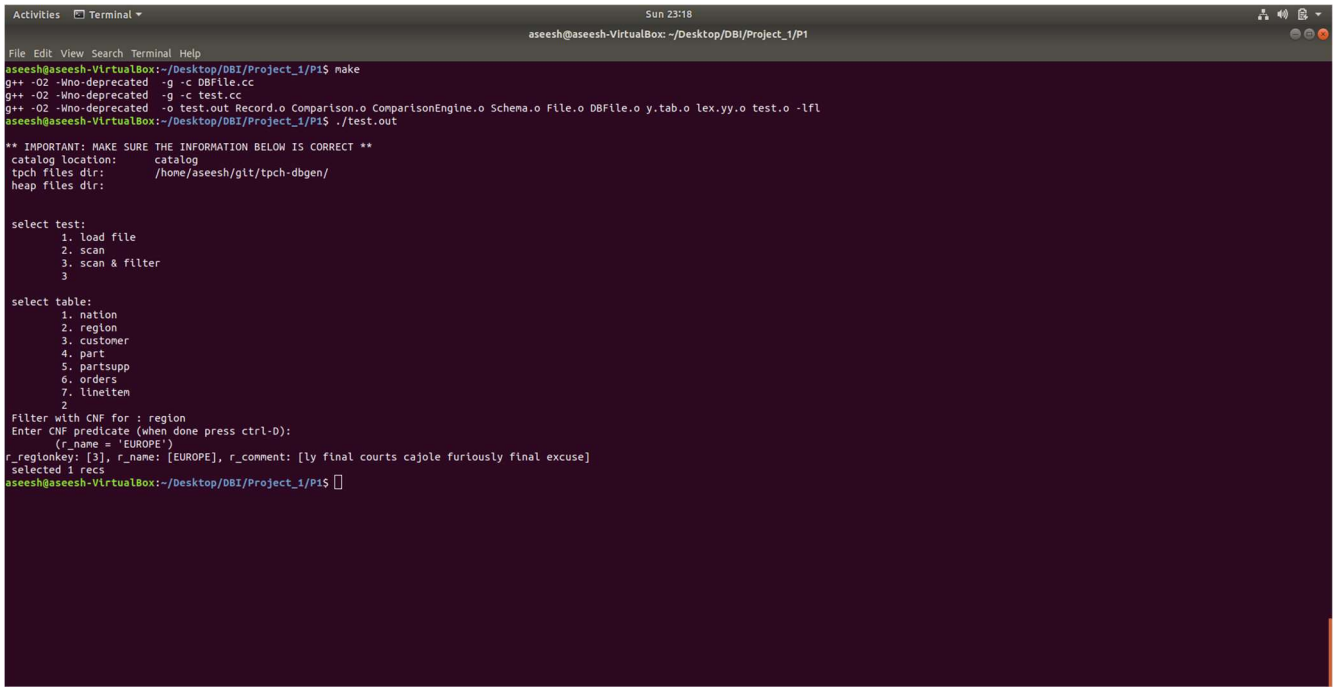
(q3) select * from nation where n_regionkey = 3 and n_nationkey > 10 and n_name > 'japan';

(q11) select * from lineitem where l_shipdate > '1994-01-01' and l_shipdate < '1994-01-04' and l_discount > 0.05 and l_discount < 0.06 and l_quantity = 4.0;

(q12) select * from lineitem where l_orderkey > 100 and l_orderkey < 1000 and l_partkey > 100 and l_partkey < 5000 and l_shipmode='AIR' and l_linestatus='F' and l_tax < '0.07';

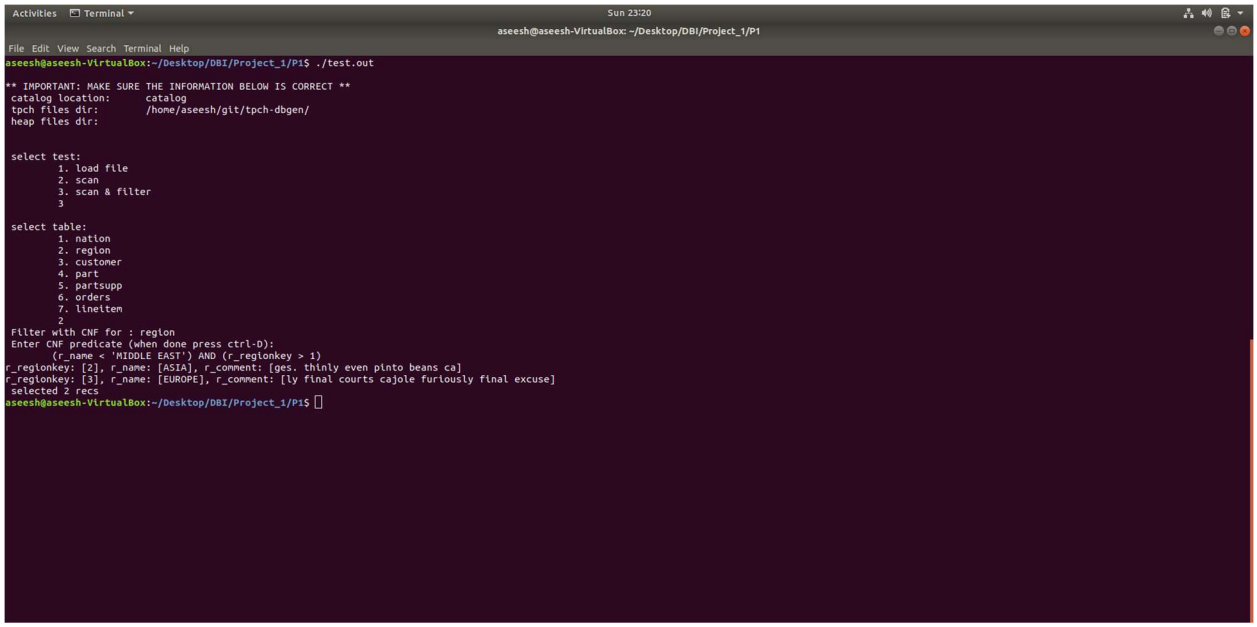
Ouput screenshots of the above mentioned queries:

(q1) select * from region where r_name='EUROPE';



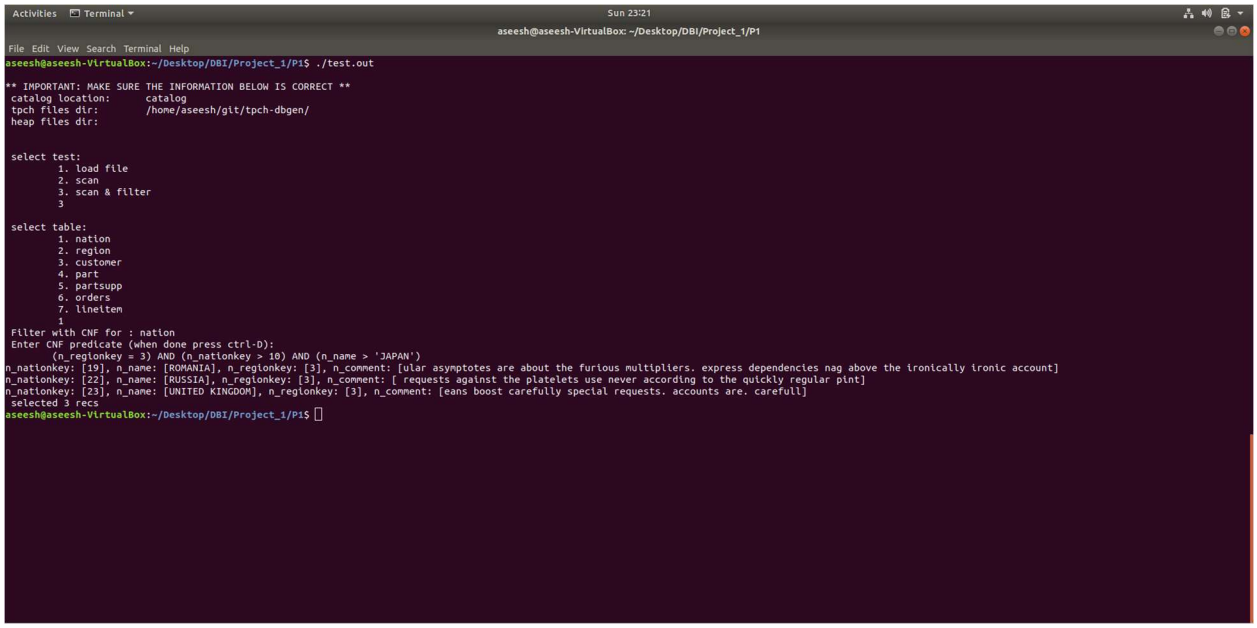
There is only one record matching the above-mentioned query in the database.

(q2) select * from region where r_name < 'middle east' and r_regionkey > 1;



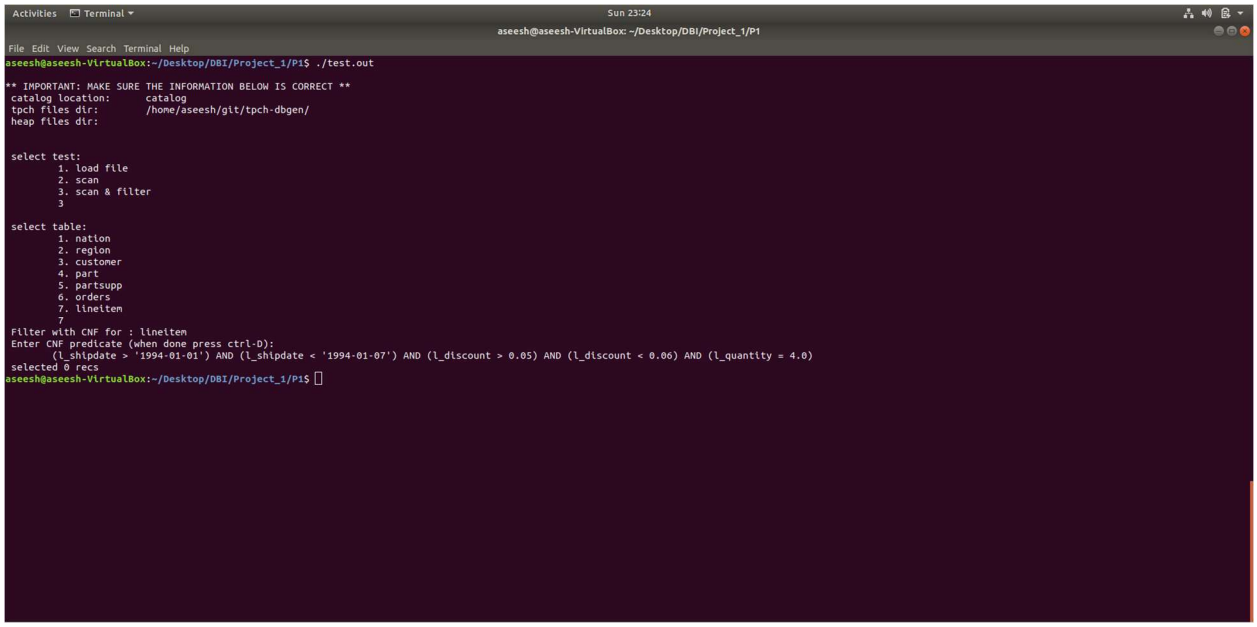
There are two records matching the above-mentioned query in the database.

(q3) select * from nation where n_regionkey = 3 and n_nationkey > 10 and n_name > 'japan';



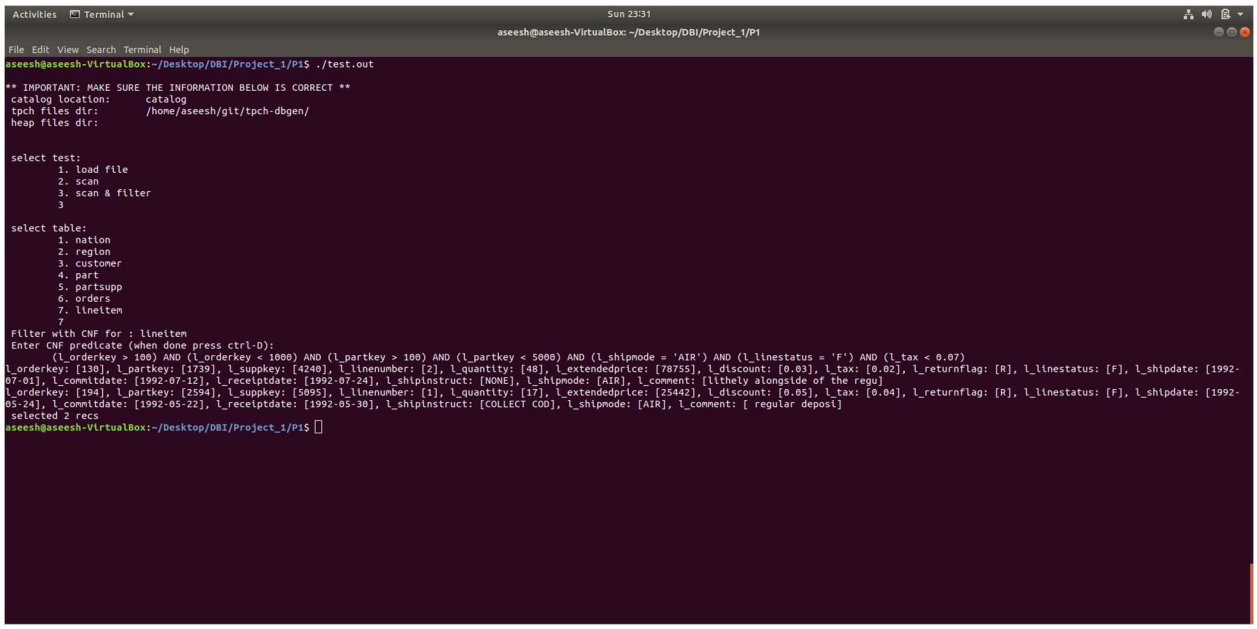
There are 3 records matching the above-mentioned query in the database.

(q11) select * from lineitem where l_shipdate > '1994-01-01' and l_shipdate < '1994-01-04' and l_discount > 0.05 and l_discount < 0.06 and l_quantity = 4.0;



There are zero records that corresponds to the above-mentioned query in the database.

(q12) select * from lineitem where l_orderkey > 100 and l_orderkey < 1000 and l_partkey > 100 and l_partkey < 5000 and l_shipmode='AIR' and l_linestatus='F' and l_tax < '0.07';



There are two records that match the above-mentioned query in the database.

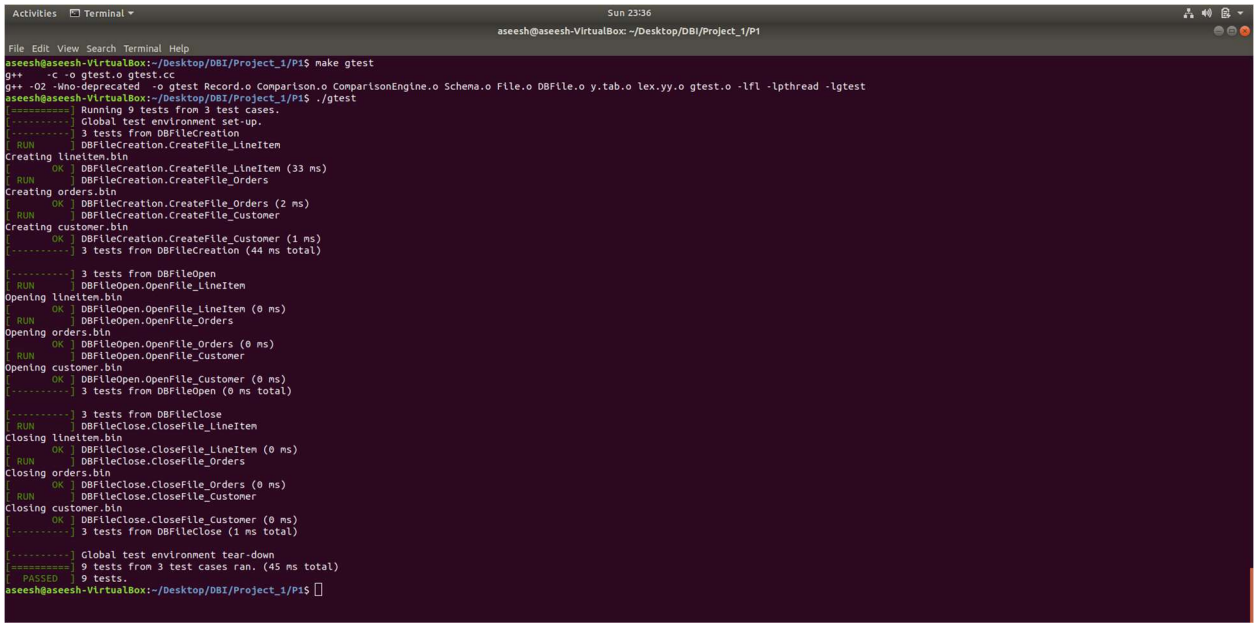
3) Instructions to run gtests:

File gtest.cc contains the test cases for the Open, Create and Close methods of DBFile.
There are a total of 9 test cases testing the functionality of the above mentioned methods on 3 tables lineitem, orders, customer. Therefore, each table has 3 methods (Create, Open, Close) that are tested.

Compile and run code gtest.cc:

1. make gtest
2. ./gtest

The screenshot of ./gtest is present on the next page


Activities
Terminal
Sun 23:36
aseesh@aseesh-VirtualBox: ~/Desktop/DBI/Project_1/P1
File Edit View Search Terminal Help
aseesh@aseesh-VirtualBox:~/Desktop/DBI/Project_1/P1$ make gtest
g++ -c -o gtest.o gtest.cc
g++ -O2 -Wno-deprecated -o gtest Record.o Comparison.o ComparisonEngine.o Schema.o File.o DBFile.o y.tab.o lex.yy.o gtest.o -lfl -lpthread -lgtest
aseesh@aseesh-VirtualBox:~/Desktop/DBI/Project_1/P1$ ./gtest
[==========] Running 9 tests from 3 test cases.
[----------] Global test environment set-up.
[----------] 3 tests from DBFileCreation
[RUN] DBFileCreation.CreateFile_LineItem
Creating lineitem.bin
[OK] DBFileCreation.CreateFile_LineItem (33 ms)
[RUN] DBFileCreation.CreateFile_Orders
Creating orders.bin
[OK] DBFileCreation.CreateFile_Orders (2 ms)
[RUN] DBFileCreation.CreateFile_Customer
Creating customer.bin
[OK] DBFileCreation.CreateFile_Customer (1 ms)
[----------] 3 tests from DBFileCreation (44 ms total)
[----------] 3 tests from DBFileOpen
[RUN] DBFileOpen.OpenFile_LineItem
Opening lineitem.bin
[OK] DBFileOpen.OpenFile_LineItem (0 ms)
[RUN] DBFileOpen.OpenFile_Orders
Opening orders.bin
[OK] DBFileOpen.OpenFile_Orders (0 ms)
[RUN] DBFileOpen.OpenFile_Customer
Opening customer.bin
[OK] DBFileOpen.OpenFile_Customer (0 ms)
[----------] 3 tests from DBFileOpen (0 ms total)
[----------] 3 tests from DBFileClose
[RUN] DBFileClose.CloseFile_LineItem
Closing lineitem.bin
[OK] DBFileClose.CloseFile_LineItem (0 ms)
[RUN] DBFileClose.CloseFile_Orders
Closing orders.bin
[OK] DBFileClose.CloseFile_Orders (0 ms)
[RUN] DBFileClose.CloseFile_Customer
Closing customer.bin
[OK] DBFileClose.CloseFile_Customer (0 ms)
[----------] 3 tests from DBFileClose (1 ms total)
[----------] Global test environment tear-down
[==========] 9 tests from 3 test cases ran. (45 ms total)
[PASSED] 9 tests.
aseesh@aseesh-VirtualBox:~/Desktop/DBI/Project_1/P1$