COP 6726: DATABASE SYSTEM IMPLEMENTATION
Assignment 2.2: Sorted File Implementation

Group Info:

	Name	UFID
1.	**Manishkumar Chopra**	**1796-7121**
2.	**Neel Manish Rami**	**7712-3151**

I. INTRODUCTION

In this assignment, we have implemented the Sorted File. The job of the Sorted File class within the database system is to store in a sorted order wherein the sort order is provided by the user and retrieve records from the disk. We have also written unit test cases using google test unit testing library for every function which we have implemented in DBFile Class.

II. ASSUMPTIONS

A. gcc (or clang) must be installed together with “bison” and “flex” on the machine on which the project will be tested.
B. Google Test Unit Testing Library should also be installed and compiled on the machine on which the project will be tested.
C. Google Test Unit Testing Library is not installed on CISE Thunder Server so the gTest command won’t run on thunder.

III. FILE STRUCTURE

A. bin/ : Contains object(.o) files.
B. src/: Contains .cc and .h files.
C. table_files/: Contains .tbl files which were generated using tpch data generator.
D. gtest/: Google Test Unit testing library.
E. catalog: Catalog file for the schema of .tbl files
F. MakeFile: Make File.

IV. CODE EXPLANATION

Private Data Structures used in DBFile Class:-

1. **File* mySFFile:** Sorted File Class is built on top of File Class.
2. **Page* mySFPage:** Sorted File Class is built on top of Page Class.
3. **Pipe* mySFInputPipe:** This variable is used to insert records into the Input Pipe.
4. **Pipe* mySFInputPipe:** This variable is used to remove records from the Output Pipe.
5. **Mode myMode:** This variable is an enum which has 2 values. One is Read and other is Write
6. **SortInfo* mySFSortInfo:**
7. **BigQ* mySFBigQ:** An instance of BigQ which was implemented during the previous project.
8. **OrderMaker* mySFOrderMaker:**
9. **bool queryFlag:** This variable is used when 2nd version of GetNext is called repeatedly.
10. **bool sortOrderFlag:** This variable is used when 2nd version of GetNext is called repeatedly.

Public Functions used in DBFile Class:-

1. **void Add (Record &addMe);**

   This function is used to add records to the file. In the case of the sorted file that has been implemented in this assignment, this function first sees whether it is read or write mode. If it is in read mode, mySFBiQ variable is re-initialized and the record is then inserted into the Input Pipe.

2. **int Create (char *name, fType myType, void *startup);**

   This function is used to create the file. Also along with creating the file, we are also creating metadata file for each .tbl file. MetaData File description is written in the code file.

3. **int Open (char *name);**

   This function is used to open a file that has already been created and also being closed.

4. **int Close();**

   This function simply closes the file. But before closing the file, merge operation is performed.

5. **void Load (Schema &mySchema, char *loadMe);**

   This function bulk loads the records from the file into the Input Record. After all the records have been inserted into Input Pipe, they are removed from the Output Pipe and then they are inserted into the page and these pages are added into the Sorted File.

6. **int GetNext (Record &fetchMe);**

   This function simply gets the next record from the file and returns it to the user.

7. **int GetNext (Record &fetchMe, CNF &applyMe, Record &literal);**

   This function accepts a selection predicate and returns the next record in the file which is accepted by the selection predicate.

8. **void MoveFirst ()**

   This function forces some pointer to correspond to the first record in the file.

9. **void Merge ()**

   This function merges records from input pipe with the records from the sorted file. We also first change its mode to read and shutdown the pipe. Then, we merge records from the pipe and sorted file.

V. COMMANDS TO RUN THE PROGRAM

To compile the given test driver, type
make test.out

To run the test driver, type
./test.out
and then follow the on-screen instructions. For scan and filter operation, write any CNF which has been given in the result section below. After writing the CNF, press ENTER and then press Ctrl+D.

The thunder server at cise.ufl.edu doesn't have Google Test installed so you might have to download it.

To compile Google Test, type
make gTest21

To run the unit tests, type
cd bin
./gTestProj21

The unit tests should run and you should be able to see the test results.

VI. RESULTS

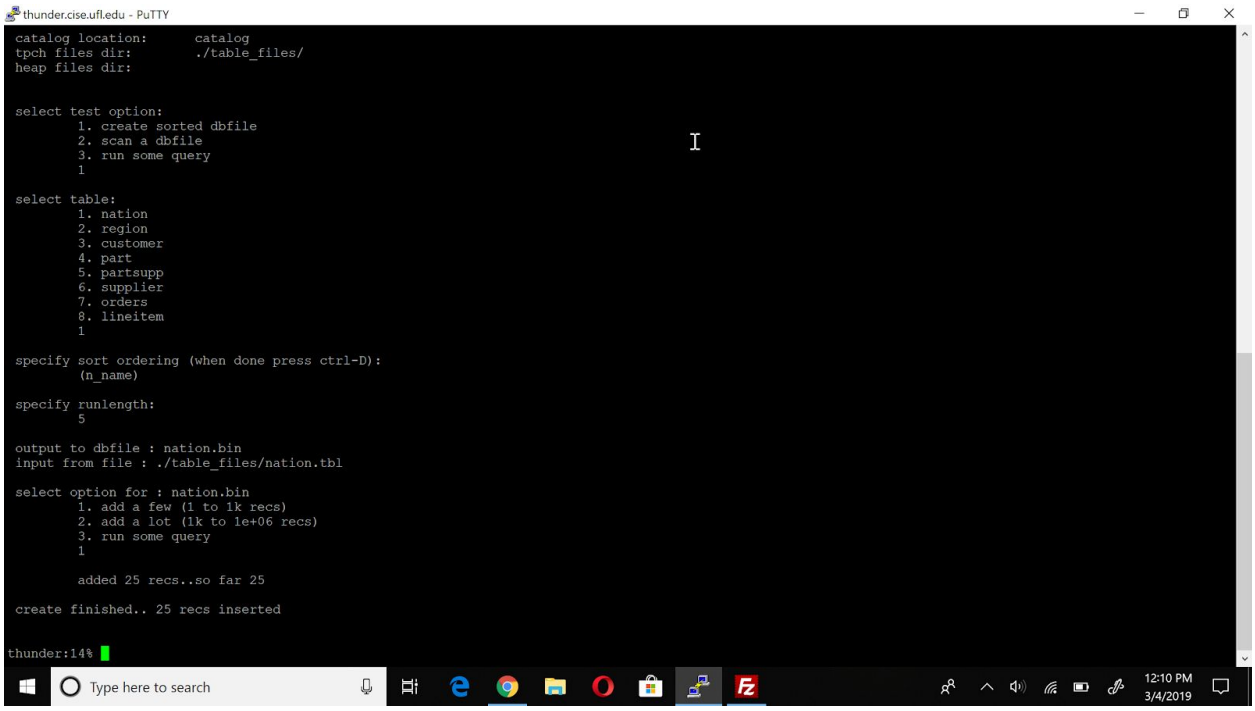
We ran our program on 1 set of data which was generated by tpch data generator. That set of data is 10M.

A. 10M Data

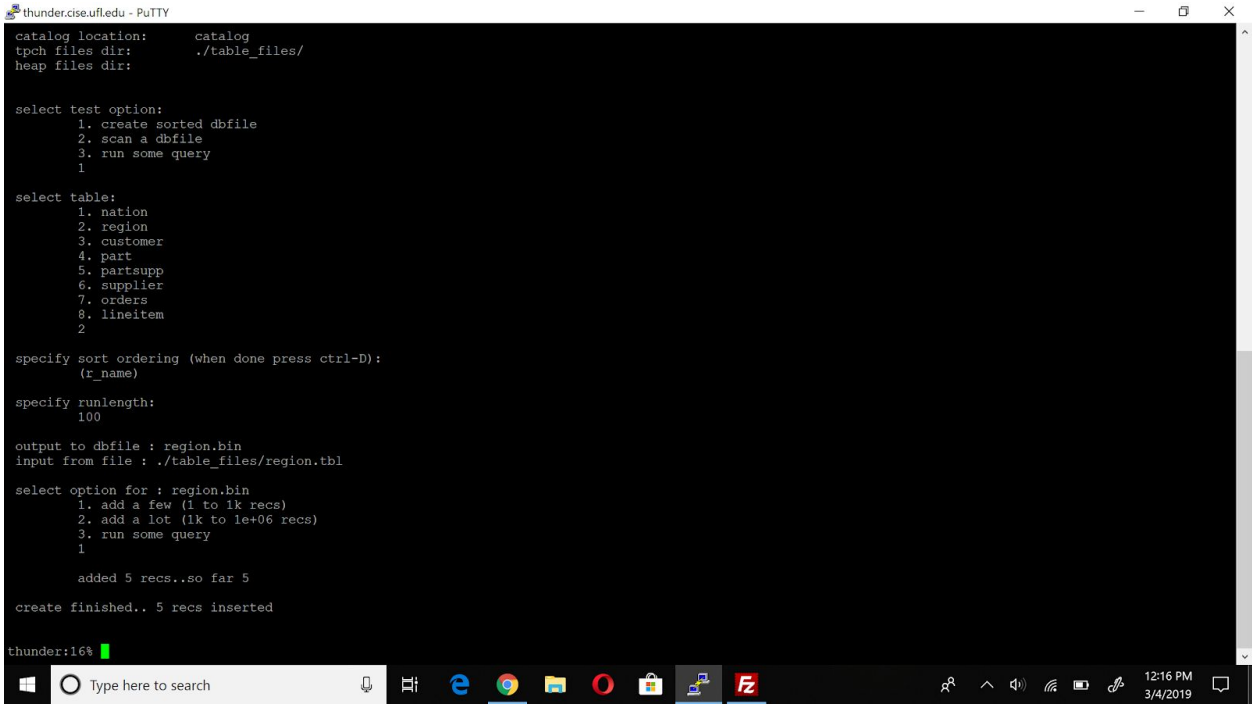
We verified those results by inserting this 10M data into MariaDB and writing SQL queries in MariaDB.

Query Type A : Creating Sorted File

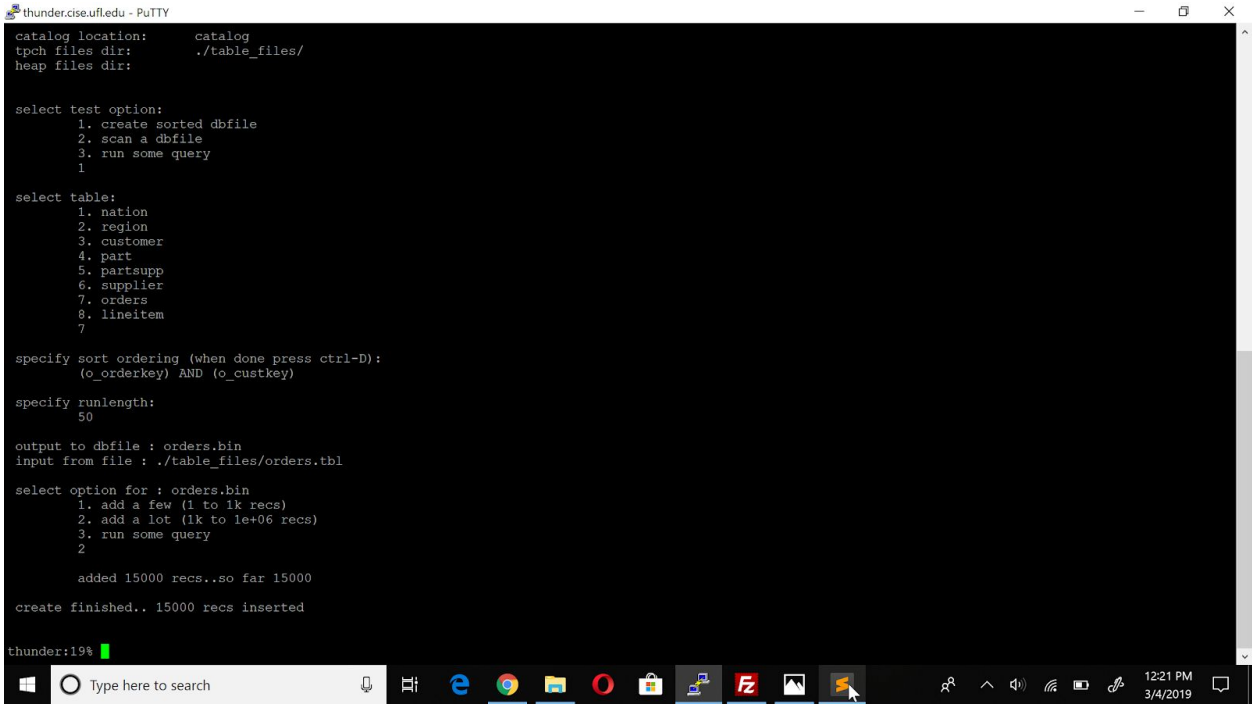
1. nation.tbl



2. region.tbl

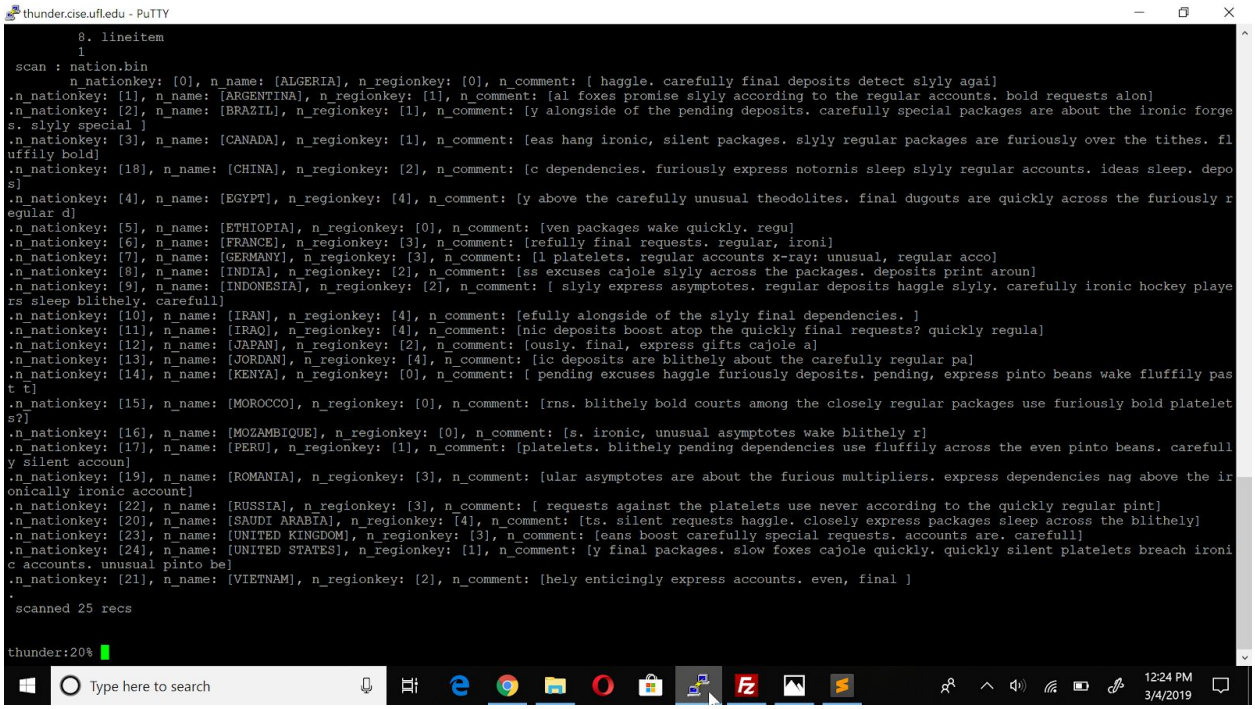


3. orders.tbl

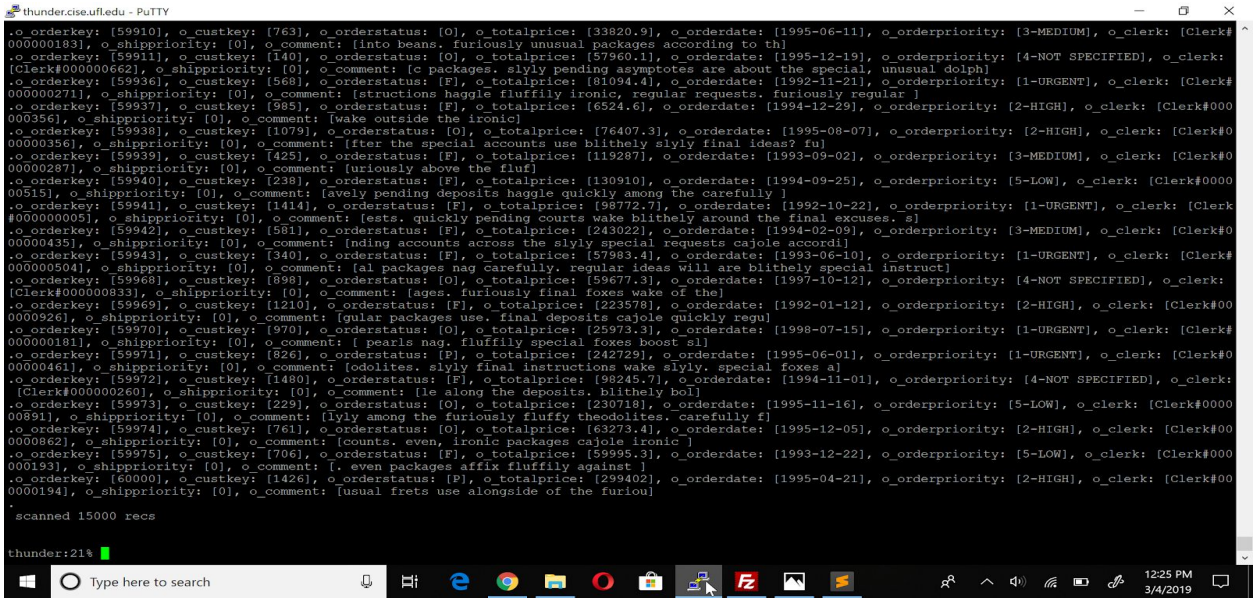


Query Type B (Scanning a Sorted File)

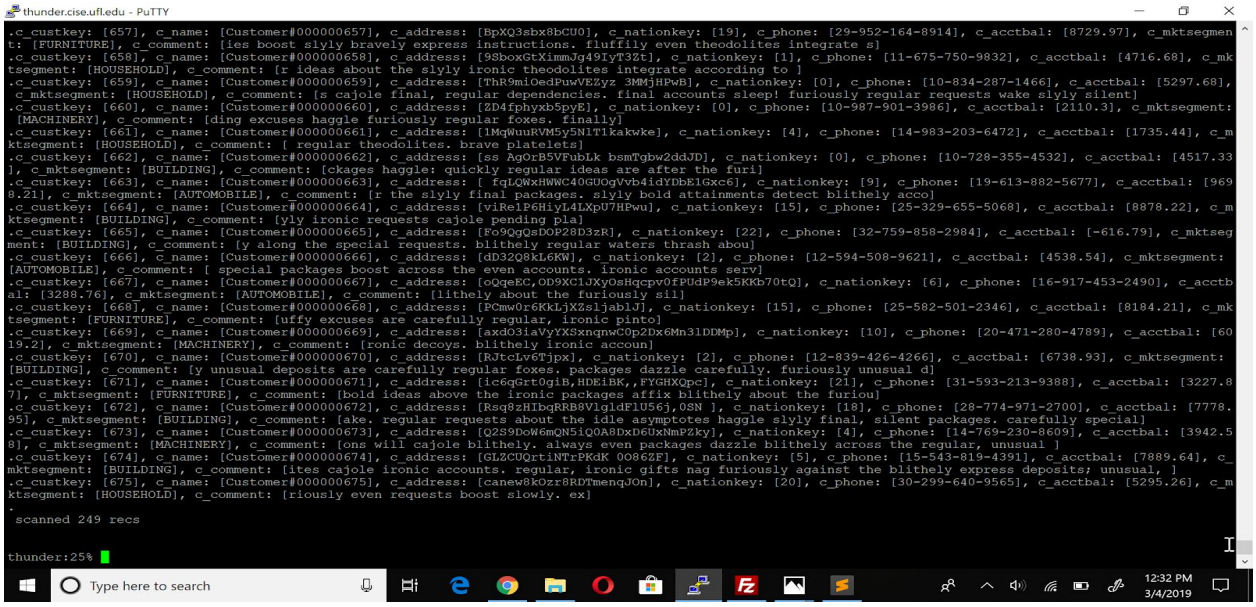
1. nation.tbl



2. orders.tbl



3. Customer.tbl



Query Type C (Extracting Records based on user provided CNF)

Query 1 (r_name = 'EUROPE')

```
thunder:17% ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
 catalog location:      catalog
 tpch files dir:        ./table_files/
 heap files dir:


 select test option:
        1. create sorted dbfile
        2. scan a dbfile
        3. run some query
        3

 select table:
        1. nation
        2. region
        3. customer
        4. part
        5. partsupp
        6. supplier
        7. orders
        8. lineitem
        2

 enter CNF predicate (when done press ctrl-D):
       (r_name = 'EUROPE')
       r_regionkey: [3], r_name: [EUROPE], r_comment: [ly final courts cajole furiously final excuse]

 query over region.bin returned 1 recs


thunder:18%
```

Query 2 (r_name = ‘MIDDLE EAST’) AND (r_regionkey > 1)

```
thunder:4% ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
 catalog location:      catalog
 tpch files dir:        ./table_files/
 heap files dir:


 select test option:
        1. create sorted dbfile
        2. scan a dbfile
        3. run some query
        3

 select table:
        1. nation
        2. region
        3. customer
        4. part
        5. partsupp
        6. supplier
        7. orders
        8. lineitem
        2

 enter CNF predicate (when done press ctrl-D):
       (r_name = 'MIDDLE EAST') AND (r_regionkey> 1)
       r_regionkey: [4], r_name: [MIDDLE EAST], r_comment: [uickly special accounts cajole carefully blithely close requests. carefully final asymptotes haggle furiousl]

 query over region.bin returned 1 recs
```

Query 3 (n_regionkey = 3) AND (n_nationkey > 10) AND (n_name > 'JAPAN')

```
thunder:7% ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
 catalog location:      catalog
 tpch files dir:        ./table_files/
 heap files dir:


 select test option:
        1. create sorted dbfile
        2. scan a dbfile
        3. run some query
        3

 select table:
        1. nation
        2. region
        3. customer
        4. part
        5. partsupp
        6. supplier
        7. orders
        8. lineitem
        1

 enter CNF predicate (when done press ctrl-D):
       (n_regionkey = 3) AND (n_nationkey > 10) AND (n_name > 'JAPAN')
       n_nationkey: [19], n_name: [ROMANIA], n_regionkey: [3], n_comment: [ular asymptotes are about the furious multipliers. express dependencies nag above the ironically ironic accoun
t]
n_nationkey: [22], n_name: [RUSSIA], n_regionkey: [3], n_comment: [ requests against the platelets use never according to the quickly regular pint]
n_nationkey: [23], n_name: [UNITED KINGDOM], n_regionkey: [3], n_comment: [eans boost carefully special requests. accounts are. carefull]

 query over nation.bin returned 3 recs
```

Query 4 (c_nationkey = 23) AND (c_mktsegment = 'FURNITURE') AND (c_acctbal > 1000.00) AND (c_acctbal < 8000.00)

```
thunder:11% ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
 catalog location:      catalog
 tpch files dir:        ./table_files/
 heap files dir:


 select test option:
        1. create sorted dbfile
        2. scan a dbfile
        3. run some query
        3

 select table:
        1. nation
        2. region
        3. customer
        4. part
        5. partsupp
        6. supplier
        7. orders
        8. lineitem
        3

 enter CNF predicate (when done press ctrl-D):
       (c_nationkey = 23) AND (c_mktsegment = 'FURNITURE') AND (c_acctbal > 1000.00) AND (c_acctbal < 8000.00)
       c_custkey: [87], c_name: [Customer#000000087], c_address: [hgGhHVSWQl 6jZ6Ev], c_nationkey: [23], c_phone: [33-869-884-7053], c_acctbal: [6327.54], c_mktsegment: [FURNITURE], c_c
omment: [hely ironic requests integrate according to the ironic accounts. slyly regular pla]
c_custkey: [174], c_name: [Customer#000000174], c_address: [R5 fCPMSeDXtUpp5Ax], c_nationkey: [23], c_phone: [33-845-455-8799], c_acctbal: [1944.73], c_mktsegment: [FURNITURE], c_comment
: [oldly even requests haggle quickly blithely ironic accounts. idly final foxes doze slyly pending dep]
c_custkey: [338], c_name: [Customer#000000338], c_address: [ aiYAeWgI0okGSJv7OgvKqMvPLhxF3blT8josX], c_nationkey: [23], c_phone: [33-302-620-7535], c_acctbal: [4092.49], c_mktsegment: [F
URNITURE], c_comment: [ckages nag blithely regular requests: carefully final packages between the slyly regular instructions sleep ]
c_custkey: [415], c_name: [Customer#000000415], c_address: [334jCRiUb,gx3], c_nationkey: [23], c_phone: [33-346-876-2972], c_acctbal: [2317.93], c_mktsegment: [FURNITURE], c_comment: [eg
ular deposits. blithely ironic inst]
c_custkey: [794], c_name: [Customer#000000794], c_address: [RMY8 LyGnJ67NGc5cxPYiIDSF], c_nationkey: [23], c_phone: [33-633-470-5945], c_acctbal: [1709.5], c_mktsegment: [FURNITURE], c_c
omment: [gular patterns cajole slyly blithely final ideas? furiously unusual courts wake among ]
c_custkey: [982], c_name: [Customer#000000982], c_address: [EN9aD5Xgh2q], c_nationkey: [23], c_phone: [33-460-986-9418], c_acctbal: [1437.55], c_mktsegment: [FURNITURE], c_comment: [lith
ely express requests along the carefully pendi]
c_custkey: [1117], c_name: [Customer#000001117], c_address: [80NfzBRWj5tUUaRdnsFE7Eg], c_nationkey: [23], c_phone: [33-461-439-5684], c_acctbal: [2829.07], c_mktsegment: [FURNITURE], c_c
omment: [ ironic deposits need to haggle furiously. furiously bold deposits use among the carefully ironic]
c_custkey: [1227], c_name: [Customer#000001227], c_address: [GiT5IrOJ1zJTZErbFt1Jy6Gj], c_nationkey: [23], c_phone: [33-468-642-3107], c_acctbal: [3335.72], c_mktsegment: [FURNITURE], c_
comment: [fily atop the bold, unusual theo]
c_custkey: [1391], c_name: [Customer#000001391], c_address: [7MqN5yFijW6Yua7lVU6i7QMjjiyJ2KTZEaQ], c_nationkey: [23], c_phone: [33-558-545-3053], c_acctbal: [5510.28], c_mktsegment: [FUR
NITURE], c_comment: [ges haggle slyly across the carefully pending accounts. slyly regular accounts should sleep. slyly express packages]

 query over customer.bin returned 9 recs


thunder:12%
```

Query 5 (p_brand = 'Brand#13') AND (p_retailprice > 500.00) AND (p_retailprice < 930.00) AND (p_size > 28) AND (p_size < 1000000)

```
thunder:15% ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
 catalog location:      catalog
 tpch files dir:        ./table_files/
 heap files dir:


 select test option:
        1. create sorted dbfile
        2. scan a dbfile
        3. run some query
        3

 select table:
        1. nation
        2. region
        3. customer
        4. part
        5. partsupp
        6. supplier
        7. orders
        8. lineitem
        4

 enter CNF predicate (when done press ctrl-D):
       (p_brand = 'Brand#13') AND (p_retailprice > 500.00) AND (p_retailprice < 930.00) AND (p_size > 28) AND (p_size < 1000000)
       p_partkey: [1022], p_name: [olive smoke blue dim ghost], p_mfgr: [Manufacturer#1], p_brand: [Brand#13], p_type: [SMALL BURNISHED COPPER], p_size: [33], p_container: [WRAP CAN], p
_retailprice: [923.02], p_comment: [sly quickly ]

 query over part.bin returned 1 recs


thunder:16%
```

Query 6 (ps_supplycost > 999.00)

```
thunder:18% ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
 catalog location:      catalog
 tpch files dir:        ./table_files/
 heap files dir:


 select test option:
        1. create sorted dbfile
        2. scan a dbfile
        3. run some query
        3

 select table:
        1. nation
        2. region
        3. customer
        4. part
        5. partsupp
        6. supplier
        7. orders
        8. lineitem
        5

 enter CNF predicate (when done press ctrl-D):
       (ps_supplycost > 999.00)
       ps_partkey: [1667], ps_suppkey: [91], ps_availqty: [5303], ps_supplycost: [999.36], ps_comment: [instructions. slyly even accounts across the bold ideas hag]
ps_partkey: [857], ps_suppkey: [57], ps_availqty: [9270], ps_supplycost: [999.64], ps_comment: [furiously pending pinto beans. special, bold instructions wake regularly. blith]
ps_partkey: [914], ps_suppkey: [83], ps_availqty: [4678], ps_supplycost: [999.65], ps_comment: [lyly alongside of the furiously quiet instructions. slyly final account]
ps_partkey: [768], ps_suppkey: [1], ps_availqty: [2578], ps_supplycost: [999.77], ps_comment: [ep carefully between the quickly special deposits. quickly regular platelets use slyly thin
ly ironic excuses. quickly regular ideas poach. ideas haggle across the car]
ps_partkey: [238], ps_suppkey: [66], ps_availqty: [1615], ps_supplycost: [999.92], ps_comment: [riously ironic foxes detect fluffily across the regular packages]
ps_partkey: [1793], ps_suppkey: [36], ps_availqty: [5136], ps_supplycost: [999.92], ps_comment: [lets grow carefully. slyly silent ideas about the foxes nag blithely ironi]
ps_partkey: [160], ps_suppkey: [87], ps_availqty: [8324], ps_supplycost: [999.93], ps_comment: [ly final instructions. closely final deposits nag furiously alongside of the furiously dog
ged theodolites. blithely unusual theodolites are furi]
ps_partkey: [1218], ps_suppkey: [19], ps_availqty: [6915], ps_supplycost: [999.95], ps_comment: [fluffily unusual packages doubt even, regular requests. ironic requests detect carefully
blithely silen]
ps_partkey: [1628], ps_suppkey: [70], ps_availqty: [1761], ps_supplycost: [999.95], ps_comment: [lyly about the permanently ironic instructions. carefully ironic pinto beans]
ps_partkey: [1385], ps_suppkey: [24], ps_availqty: [2120], ps_supplycost: [999.97], ps_comment: [ts haggle blithely about the pending, regular ideas! e]
ps_partkey: [1213], ps_suppkey: [51], ps_availqty: [5070], ps_supplycost: [999.99], ps_comment: [ ironic, special deposits. carefully final deposits haggle fluffily. furiously final foxe
s use furiously furiously ironic accounts. package]

 query over partsupp.bin returned 11 recs
```

Query 7 (ps_availqty < 10) AND (ps_supplycost > 100.00) AND (ps_suppkey < 300)

```
thunder:19% ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
 catalog location:      catalog
 tpch files dir:        ./table_files/
 heap files dir:


 select test option:
        1. create sorted dbfile
        2. scan a dbfile
        3. run some query
        3

 select table:
        1. nation
        2. region
        3. customer
        4. part
        5. partsupp
        6. supplier
        7. orders
        8. lineitem
        5

 enter CNF predicate (when done press ctrl-D):
       (ps_availqty < 10)  AND (ps_supplycost > 100.00) AND (ps_suppkey < 300)
       ps_partkey: [977], ps_suppkey: [78], ps_availqty: [8], ps_supplycost: [102.28], ps_comment: [ regular excuses. quickly ironic courts are busily. theodolites haggle carefully slyl
y final accounts. regular, special asymptotes haggle along the furiousl]
ps_partkey: [744], ps_suppkey: [45], ps_availqty: [4], ps_supplycost: [698.75], ps_comment: [express packages try to use above the even excuses. furiously regular deposits above the sile
n]
ps_partkey: [1427], ps_suppkey: [28], ps_availqty: [3], ps_supplycost: [746.8], ps_comment: [lyly unusual deposits. regular deposits cajole slyly about the blithely special warthogs. fur
iously regular dolphins integrate across the bold requests. quickly regular ]
ps_partkey: [1452], ps_suppkey: [31], ps_availqty: [6], ps_supplycost: [969.62], ps_comment: [gle blithely furiously final deposits. carefully ironic packages wake. final asymptotes ar]

 query over partsupp.bin returned 4 recs


thunder:20%
```

Query 8

(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)

```
thunder:25% ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
 catalog location:      catalog
 tpch files dir:        ./table_files/
 heap files dir:


 select test option:
        1. create sorted dbfile
        2. scan a dbfile
        3. run some query
        3

 select table:
        1. nation
        2. region
        3. customer
        4. part
        5. partsupp
        6. supplier
        7. orders
        8. lineitem
        8

 enter CNF predicate (when done press ctrl-D):
       (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)
        l_orderkey: [801], l_partkey: [947], l_suppkey: [16], l_linenumber: [2], l_quantity: [21], l_extendedprice: [38806.7], l_discount: [0.05], l_tax: [0.02], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1992-03-14], l_commitdate: [1992-04-01], l_receiptdate: [1992-04-05], l_shipinstruct: [COLLECT COD], l_shipmode: [AIR], l_comment: [wake silently furiously idle deposits. ]
l_orderkey: [322], l_partkey: [1833], l_suppkey: [77], l_linenumber: [4], l_quantity: [10], l_extendedprice: [17348.3], l_discount: [0.06], l_tax: [0.03], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1992-04-12], l_commitdate: [1992-05-13], l_receiptdate: [1992-04-14], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [ deposits grow slyly according to th]
l_orderkey: [322], l_partkey: [334], l_suppkey: [91], l_linenumber: [6], l_quantity: [3], l_extendedprice: [3702.99], l_discount: [0.08], l_tax: [0.05], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1992-07-03], l_commitdate: [1992-05-10], l_receiptdate: [1992-07-28], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [ending, ironic deposits along the blith]
l_orderkey: [549], l_partkey: [653], l_suppkey: [54], l_linenumber: [3], l_quantity: [36], l_extendedprice: [55931.4], l_discount: [0.08], l_tax: [0.04], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1992-09-11], l_commitdate: [1992-10-11], l_receiptdate: [1992-09-12], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [ts against the ironic, even theodolites eng]
l_orderkey: [933], l_partkey: [992], l_suppkey: [27], l_linenumber: [3], l_quantity: [26], l_extendedprice: [49217.7], l_discount: [0.05], l_tax: [0], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1992-11-09], l_commitdate: [1992-11-03], l_receiptdate: [1992-11-16], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [ the deposits affix slyly after t]
l_orderkey: [164], l_partkey: [1256], l_suppkey: [68], l_linenumber: [3], l_quantity: [38], l_extendedprice: [43975.5], l_discount: [0.03], l_tax: [0.06], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1992-12-04], l_commitdate: [1992-11-23], l_receiptdate: [1993-01-02], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [counts cajole fluffily regular packages. b]
l_orderkey: [164], l_partkey: [185], l_suppkey: [38], l_linenumber: [2], l_quantity: [24], l_extendedprice: [26044.3], l_discount: [0.05], l_tax: [0.05], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1992-12-22], l_commitdate: [1992-11-27], l_receiptdate: [1993-01-06], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [side of the slyly unusual theodolites. f]
l_orderkey: [164], l_partkey: [1089], l_suppkey: [90], l_linenumber: [6], l_quantity: [27], l_extendedprice: [26732.2], l_discount: [0.1], l_tax: [0.04], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1992-12-23], l_commitdate: [1993-01-16], l_receiptdate: [1993-01-10], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [ayers wake carefully a]
l_orderkey: [481], l_partkey: [207], l_suppkey: [8], l_linenumber: [2], l_quantity: [19], l_extendedprice: [21036.8], l_discount: [0.08], l_tax: [0.01], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1993-01-09], l_commitdate: [1992-11-27], l_receiptdate: [1993-01-14], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [p blithely after t]
l_orderkey: [481], l_partkey: [1120], l_suppkey: [93], l_linenumber: [5], l_quantity: [31], l_extendedprice: [31654.7], l_discount: [0.05], l_tax: [0.01], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1993-01-15], l_commitdate: [1992-12-31], l_receiptdate: [1993-01-21], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [usly final packages believe. quick]
```

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l_orderkey: [738], l_partkey: [1749], l_suppkey: [34], l_linenumber: [5], l_quantity: [30], l_extendedprice: [49522.2], l_discount: [0.02], l_tax: [0], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1993-06-12], l_commitdate: [1993-05-29], l_receiptdate: [1993-06-25], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [ecial instructions haggle blithely regula]
l_orderkey: [132], l_partkey: [281], l_suppkey: [63], l_linenumber: [4], l_quantity: [23], l_extendedprice: [27169.4], l_discount: [0.1], l_tax: [0], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1993-06-16], l_commitdate: [1993-08-27], l_receiptdate: [1993-06-23], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [refully blithely bold acco]
l_orderkey: [738], l_partkey: [1871], l_suppkey: [72], l_linenumber: [2], l_quantity: [4], l_extendedprice: [7091.48], l_discount: [0], l_tax: [0.03], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1993-06-20], l_commitdate: [1993-04-08], l_receiptdate: [1993-07-09], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [ar packages. fluffily bo]
l_orderkey: [261], l_partkey: [1740], l_suppkey: [25], l_linenumber: [3], l_quantity: [28], l_extendedprice: [45968.7], l_discount: [0.08], l_tax: [0.03], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1993-07-24], l_commitdate: [1993-08-20], l_receiptdate: [1993-08-05], l_shipinstruct: [COLLECT COD], l_shipmode: [AIR], l_comment: [ironic packages nag slyly. carefully fin]
l_orderkey: [294], l_partkey: [597], l_suppkey: [88], l_linenumber: [1], l_quantity: [31], l_extendedprice: [46425.3], l_discount: [0], l_tax: [0.01], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1993-08-06], l_commitdate: [1993-08-19], l_receiptdate: [1993-08-13], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [le fluffily along the quick]
l_orderkey: [769], l_partkey: [1751], l_suppkey: [94], l_linenumber: [1], l_quantity: [36], l_extendedprice: [59499], l_discount: [0.02], l_tax: [0.02], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1993-10-01], l_commitdate: [1993-08-07], l_receiptdate: [1993-10-15], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [es. furiously iro]
l_orderkey: [261], l_partkey: [970], l_suppkey: [5], l_linenumber: [6], l_quantity: [20], l_extendedprice: [37419.4], l_discount: [0.06], l_tax: [0.06], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1993-10-15], l_commitdate: [1993-09-05], l_receiptdate: [1993-11-07], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [ing to the special, ironic deposi]
l_orderkey: [416], l_partkey: [1742], l_suppkey: [85], l_linenumber: [3], l_quantity: [25], l_extendedprice: [41093.5], l_discount: [0.07], l_tax: [0.01], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1993-10-16], l_commitdate: [1993-12-03], l_receiptdate: [1993-10-29], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [ses boost after the bold requests.]
l_orderkey: [258], l_partkey: [1465], l_suppkey: [5], l_linenumber: [6], l_quantity: [36], l_extendedprice: [49192.6], l_discount: [0.09], l_tax: [0.04], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1994-01-11], l_commitdate: [1994-03-04], l_receiptdate: [1994-01-18], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [nic asymptotes. slyly silent r]
l_orderkey: [677], l_partkey: [1497], l_suppkey: [15], l_linenumber: [5], l_quantity: [25], l_extendedprice: [34962.2], l_discount: [0], l_tax: [0.05], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1994-03-12], l_commitdate: [1994-02-02], l_receiptdate: [1994-03-28], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [ packages integrate blithely]
l_orderkey: [353], l_partkey: [1194], l_suppkey: [67], l_linenumber: [1], l_quantity: [41], l_extendedprice: [44902.8], l_discount: [0], l_tax: [0.06], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1994-03-25], l_commitdate: [1994-03-31], l_receiptdate: [1994-03-30], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [refully final theodoli]
l_orderkey: [548], l_partkey: [568], l_suppkey: [59], l_linenumber: [4], l_quantity: [21], l_extendedprice: [30839.8], l_discount: [0.08], l_tax: [0.03], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1994-10-27], l_commitdate: [1994-12-04], l_receiptdate: [1994-11-21], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [ engage quickly. regular theo]
l_orderkey: [295], l_partkey: [914], l_suppkey: [17], l_linenumber: [2], l_quantity: [26], l_extendedprice: [47187.7], l_discount: [0.04], l_tax: [0.03], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1994-12-13], l_commitdate: [1994-11-30], l_receiptdate: [1995-01-06], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [ts above the slyly regular requests x-ray q]
l_orderkey: [960], l_partkey: [1070], l_suppkey: [6], l_linenumber: [1], l_quantity: [1], l_extendedprice: [971.07], l_discount: [0.07], l_tax: [0], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1994-12-24], l_commitdate: [1994-10-26], l_receiptdate: [1995-01-20], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [y ironic packages. quickly even ]
l_orderkey: [742], l_partkey: [1919], l_suppkey: [64], l_linenumber: [4], l_quantity: [16], l_extendedprice: [29134.6], l_discount: [0.01], l_tax: [0.05], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1995-01-15], l_commitdate: [1995-02-25], l_receiptdate: [1995-01-24], l_shipinstruct: [COLLECT COD], l_shipmode: [AIR], l_comment: [eodolites haggle carefully regul]
l_orderkey: [802], l_partkey: [1328], l_suppkey: [29], l_linenumber: [2], l_quantity: [34], l_extendedprice: [41796.9], l_discount: [0.08], l_tax: [0.06], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1995-03-01], l_commitdate: [1995-03-15], l_receiptdate: [1995-03-12], l_shipinstruct: [COLLECT COD], l_shipmode: [AIR], l_comment: [instructions cajole carefully. quietl]
l_orderkey: [450], l_partkey: [781], l_suppkey: [82], l_linenumber: [5], l_quantity: [2], l_extendedprice: [3363.56], l_discount: [0.09], l_tax: [0], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1995-03-11], l_commitdate: [1995-05-21], l_receiptdate: [1995-03-16], l_shipinstruct: [COLLECT COD], l_shipmode: [AIR], l_comment: [y even pinto beans; qui]
l_orderkey: [930], l_partkey: [173], l_suppkey: [52], l_linenumber: [2], l_quantity: [47], l_extendedprice: [50439], l_discount: [0.08], l_tax: [0], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1995-03-20], l_commitdate: [1995-02-04], l_receiptdate: [1995-04-04], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [ackages. fluffily e]
l_orderkey: [577], l_partkey: [259], l_suppkey: [14], l_linenumber: [1], l_quantity: [25], l_extendedprice: [28981.2], l_discount: [0.06], l_tax: [0.01], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1995-04-09], l_commitdate: [1995-02-20], l_receiptdate: [1995-05-09], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [ve slyly of the frets. careful]
l_orderkey: [928], l_partkey: [104], l_suppkey: [31], l_linenumber: [7], l_quantity: [11], l_extendedprice: [11045.1], l_discount: [0], l_tax: [0.01], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1995-04-29], l_commitdate: [1995-04-16], l_receiptdate: [1995-04-30], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [longside of]
l_orderkey: [327], l_partkey: [418], l_suppkey: [48], l_linenumber: [2], l_quantity: [9], l_extendedprice: [11865.7], l_discount: [0.09], l_tax: [0.05], l_returnflag: [A], l_linestatus: [F], l_shipdate: [1995-05-24], l_commitdate: [1995-07-11], l_receiptdate: [1995-06-05], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [ asymptotes are fu]

 query over lineitem.bin returned 35 recs
```

Google Test Results:

```
neel@nrami:~/Desktop/DBI/Projects/Project2.1/bin$ ./gTestProj21
[==========] Running 7 tests from 7 test cases.
[----------] Global test environment set-up.
[----------] 1 test from SFCreateTest
[ RUN      ] SFCreateTest.SubTest1
[       OK ] SFCreateTest.SubTest1 (0 ms)
[----------] 1 test from SFCreateTest (1 ms total)

[----------] 1 test from SFOpenTest
[ RUN      ] SFOpenTest.SubTest1
[       OK ] SFOpenTest.SubTest1 (34 ms)
[----------] 1 test from SFOpenTest (34 ms total)

[----------] 1 test from SFMoveFirstTest
[ RUN      ] SFMoveFirstTest.SubTest1
[       OK ] SFMoveFirstTest.SubTest1 (3 ms)
[----------] 1 test from SFMoveFirstTest (3 ms total)

[----------] 1 test from SFAddTest
[ RUN      ] SFAddTest.SubTest1
[       OK ] SFAddTest.SubTest1 (2 ms)
[----------] 1 test from SFAddTest (2 ms total)

[----------] 1 test from SFLoadTest
[ RUN      ] SFLoadTest.SubTest1
[       OK ] SFLoadTest.SubTest1 (2 ms)
[----------] 1 test from SFLoadTest (2 ms total)

[----------] 1 test from GetNext1Test
[ RUN      ] GetNext1Test.SubTest1
[       OK ] GetNext1Test.SubTest1 (2 ms)
[----------] 1 test from GetNext1Test (2 ms total)

[----------] 1 test from GetNext2Test
[ RUN      ] GetNext2Test.SubTest1
[       OK ] GetNext2Test.SubTest1 (2 ms)
[----------] 1 test from GetNext2Test (2 ms total)

[----------] Global test environment tear-down
[==========] 7 tests from 7 test cases ran. (47 ms total)
[  PASSED  ] 7 tests.
neel@nrami:~/Desktop/DBI/Projects/Project2.1/bin$
```