

Database System Implementation

Project -1: Heap Data Base File Implementation

Project Members:

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Instructions to Run Code:

Change the path specified in the main.cc file and test.cc and Gtest.cc file to the current working directory.

```
$ make main
```

```
$ ./main
```

Instruction to run test Queries:

```
$make main
```

```
$make test.out
```

```
$/Test.out
```

Instructions to run GTests:

```
$ make main
```

```
$ make GTest.out
```

```
$/GTest.out
```

Method Description of HeapImplementation Class:

A DBFile instance is created in the DBFile.cc class and all of the following methods are implemented in the HeapImplementation Class.

void MoveFirst ()

This method checks whether the current page pointer points to the first record in the file. If it doesn't due to record retrievals, the function makes the pointer point to the first record of the file.

void Add (Record &rec)

This method takes the input record and puts it into the file.

int GetNext (Record &fetchMe)

The method gets the next record from the file which means the next of the record to which the pointer is currently pointing to and returns this record to the user and increments the pointer. This method returns an integer value which is zero in case when the function does not return any valid record which usually happens after the last record of the file has been returned.

int GetNext (Record &fetchMe, CNF &applyMe, Record &literal)

This method accepts CNF as a selection parameter and returns the next record which satisfies this parameter. A literal record is also created after parse tree for the CNF is processed and is used to check the selection parameter.

int Create (char *f_path, f_Type my_Type, void *startup)

This method creates a file with the name which is passed as first parameter in the DB and of the type passed as the second parameter (type may be heap, sorted or a tree). It returns 1 if success and 0 on failure.

int Open (char *f_path)

This method looks for a file with the name passed as a parameter in the Dbfile and opens this file. It returns value 1 on success and zero on failure.

int Close ()

This method just closes the file and returns 1 on success and 0 on failure.

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

This method loads the bulk amount of data from the data file whose name is the parameter passed to the method and it appends the additional data to this by fetching from the Record.h using the method SuckNextRecord().

Screenshots of the output:

Query1: for 10MB data
(r_name = 'EUROPE')

```
srinadhk7373@Srinadh-ubuntu: ~/Desktop/DBI/P1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location:  catalog
tpch files dir:    /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
1

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

DBFile will be created at region.tbl
tpch file will be loaded from /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/region.tbl
Total Records: 5
No of Pages: 1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location:  catalog
tpch files dir:    /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
3

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

Filter with CNF for : region
Enter CNF predicate (when done press ctrl-D):
(r_name = 'EUROPE')
Heap Type of File Opened Successfully
r_regionkey: [3], r_name: [EUROPE], r_comment: [ly final courts cajole furiously final excuse]
selected 1 recs
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$
```

Query 1: for 1 GB data (r_name = 'EUROPE')

```
srinadhk7373@Srinadh-ubuntu: ~/Desktop/DBI/P1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
1

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

DBFile will be created at region.tbl
tpch file will be loaded from /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/region.tbl
Total Records: 5
No of Pages: 1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
3

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

Filter with CNF for : region
Enter CNF predicate (when done press ctrl-D):
(r_name = 'EUROPE')
Heap Type of File Opened Successfully
r_regionkey: [3], r_name: [EUROPE], r_comment: [ly final courts cajole furiously final excuse]
selected 1 rows
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$
```

Query 2 : for 10 MB data (r_name < 'middle east') AND (r_regionkey > 1)

```
srinadhk7373@Srinadh-ubuntu: ~/Desktop/DBI/P1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location:      catalog
tpch files dir:        /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
3

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

Filter with CNF for : region
Enter CNF predicate (when done press ctrl-D):
(r_name < 'middle east') AND
(r_regionkey > 1)
Heap Type of File Opened Successfully
r_regionkey: [2], r_name: [ASIA], r_comment: [ges. thinly even pinto beans ca]
r_regionkey: [3], r_name: [EUROPE], r_comment: [ly final courts cajole furiously final excuse]
r_regionkey: [4], r_name: [MIDDLE EAST], r_comment: [uickly special accounts cajole carefully blithely close requests. carefully final asymptotes haggle furiously]
Selected 3 recs
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$
```

Query 2: for 1GB data
(r_name < 'middle east') AND (r_regionkey > 1)

```
srinadhk7373@Srinadh-ubuntu: ~/Desktop/DBI/P1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location:      catalog
tpch files dir:        /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
1

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

DBFile will be created at region.tbl
tpch file will be loaded from /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/region.tbl
Total Records: 5
No of Pages: 1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location:      catalog
tpch files dir:        /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
3

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

Filter with CNF for : region
Enter CNF predicate (when done press ctrl-D):
(r_name < 'middle east') AND
(r_regionkey > 1)
Heap Type of File Opened Successfully
r_regionkey: [2], r_name: [ASIA], r_comment: [ges. thinly even pinto beans ca]
r_regionkey: [3], r_name: [EUROPE], r_comment: [ly final courts cajole furiously final excuse]
r_regionkey: [4], r_name: [MIDDLE EAST], r_comment: [uickly special accounts cajole carefully blithely close requests. carefully final asymptotes haggle furiously]
Selected 3 recs
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$
```

Query 3: for 10 MB data
(n_regionkey = 3) AND (n_nationkey > 10) AND (n_name > 'japan')

```
srinadhk7373@Srinadh-ubuntu: ~/Desktop/DBI/P1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
1

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

DBFile will be created at nation.tbl
tpch file will be loaded from /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/nation.tbl
Total Records: 25
No of Pages: 1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
3

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

Filter with CNF for : nation
Enter CNF predicate (when done press ctrl-D):
(n_regionkey = 3) AND
(n_nationkey > 10) AND
(n_name > 'japan')
Heap Type of File Opened Successfully
selected 0 recs
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$
```

Query 3: for 1 GB data
(n_regionkey = 3) AND (n_nationkey > 10) AND (n_name > 'japan')

```
srinadhk7373@Srinadh-ubuntu: ~/Desktop/DBI/P1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
1

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

DBFile will be created at nation.tbl
tpch file will be loaded from /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/nation.tbl
Total Records: 25
No of Pages: 1
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/git/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
3

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

Filter with CNF for : nation
Enter CNF predicate (when done press ctrl-D):
(n_nationkey > 10) AND
(n_name > 'JAPAN')
Heap Type of File Opened Successfully
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 account]
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]
selected 3 recs
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$
```

Query 11: for 10MB data
(l_shipdate > '1994-01-01') AND

(l_shipdate < '1994-01-07') AND
(l_discount > 0.05) AND
(l_discount < 0.06) AND

(l_quantity = 4)

```
srinadhk7373@Srinadh-ubuntu: ~/Desktop/DBI/P1
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/glt/tpch-dbggen/
heap files dir:

select test:
  1. load file
  2. scan
  3. scan & filter
  1

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

DBFile will be created at lineitem.bin
tpch file will be loaded from /home/srinadhk7373/Desktop/DBI/P1/glt/tpch-dbggen/lineitem.tbl
10000
20000
30000
40000
50000
60000
Total Records: 60175
No of Pages: 99
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/glt/tpch-dbggen/
heap files dir:

select test:
  1. load file
  2. scan
  3. scan & filter
  3

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

Filter with CNF for : lineitem
Enter CNF predicate (when done press ctrl-D):
(l_shipdate > '1994-01-01') AND
(l_shipdate < '1994-01-07') AND
(l_discount > 0.05) AND
(l_discount < 0.06) AND
(l_quantity = 4.0)
Heap Type of File Opened Successfully
selected 0 recs
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$
```

Query 11: for 1 GB data

(l_shipdate > '1994-01-01') AND
(l_shipdate < '1994-01-07') AND
(l_discount > 0.05) AND
(l_discount < 0.06) AND
(l_quantity = 4)

```

srinadhk7373@Srinadh-ubuntu: ~/Desktop/OBI/P1
srinadhk7373@Srinadh-ubuntu:~/Desktop/OBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
Catalog location:      catalog
tpch files dir:        /home/srinadhk7373/Desktop/OBI/P1/glt/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
3

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

Filter with CNF for : lineitem
Enter CNF predicate (when done press ctrl-D):
(l_shipdate > '1994-01-01') AND
(l_shipdate < '1994-01-07') AND
(l_discount > 0.05) AND
(l_discount < 0.06) AND
(l_quantity = 4.0)
Heap Type of File Opened Successfully
selected 0 recs
srinadhk7373@Srinadh-ubuntu:~/Desktop/OBI/P1$

```

Query 12: for 10MB data

```

(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)

```

srlnadhk7373@srlnadh-ubuntu: ~/Desktop/DB1/P1

srlnadhk7373@srlnadh-ubuntu: ~/Desktop/DB1/P1\$./test.out

**** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT ****

catalog location: catalog
tpch files dir: /home/srlnadhk7373/Desktop/DB1/P1/glt/tpch-dbg/en/
heap files dir:

select test:

1. load file
2. scan
3. scan & filter
- 3

select table:

1. nation
2. region
3. customer
4. part
5. partsupp
6. orders
7. llnetnm

Filter with CNF for : llnetnm

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_linstatus = 'F') AND

(l_tax < 0.07)

Heap Type of File Opened Successfully

```
l_orderkey: [132], l_partkey: [181], l_supplykey: [63], l_linenumber: [4], l_quantity: [23], l_extendedprice: [27169.4], l_discount: [0.1], l_tax: [0], l_returnflag: [A], l_linstatus: [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: [164], l_partkey: [185], l_supplykey: [38], l_linenumber: [2], l_quantity: [24], l_extendedprice: [26044.3], l_discount: [0.05], l_tax: [0.05], l_returnflag: [R], l_linstatus: [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: [1266], l_supplykey: [68], l_linenumber: [3], l_quantity: [38], l_extendedprice: [43976.5], l_discount: [0.03], l_tax: [0.06], l_returnflag: [R], l_linstatus: [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: [1089], l_supplykey: [90], l_linenumber: [0], l_quantity: [27], l_extendedprice: [26732.2], l_discount: [0.1], l_tax: [0.04], l_returnflag: [R], l_linstatus: [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: [opers wake carefully a]
l_orderkey: [226], l_partkey: [407], l_supplykey: [95], l_linenumber: [4], l_quantity: [45], l_extendedprice: [58833], l_discount: [0.1], l_tax: [0.02], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1993-04-17], l_commitdate: [1993-05-27], l_receiptdate: [1993-05-11], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [carefully pending pl]
l_orderkey: [258], l_partkey: [1465], l_supplykey: [6], l_linenumber: [0], l_quantity: [36], l_extendedprice: [49192.6], l_discount: [0.09], l_tax: [0.04], l_returnflag: [A], l_linstatus: [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 f]
l_orderkey: [261], l_partkey: [1740], l_supplykey: [25], l_linenumber: [3], l_quantity: [28], l_extendedprice: [45968.7], l_discount: [0.08], l_tax: [0.03], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1993-07-24], l_commitdate: [1993-08-20], l_receiptdate: [1993-08-05], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [ironic packages nag slyly: carefully fin]
l_orderkey: [261], l_partkey: [970], l_supplykey: [5], l_linenumber: [0], l_quantity: [20], l_extendedprice: [37419.4], l_discount: [0.06], l_tax: [0.06], l_returnflag: [A], l_linstatus: [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 deposit]
l_orderkey: [294], l_partkey: [597], l_supplykey: [88], l_linenumber: [1], l_quantity: [31], l_extendedprice: [46425.3], l_discount: [0], l_tax: [0.01], l_returnflag: [R], l_linstatus: [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: [295], l_partkey: [914], l_supplykey: [17], l_linenumber: [2], l_quantity: [26], l_extendedprice: [47187.7], l_discount: [0.04], l_tax: [0.03], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1994-12-13], l_commitdate: [1994-11-01], l_receiptdate: [1994-06-14], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [deposits grow slyly according to th]
l_orderkey: [322], l_partkey: [1833], l_supplykey: [77], l_linenumber: [4], l_quantity: [10], l_extendedprice: [17348.3], l_discount: [0.06], l_tax: [0.03], l_returnflag: [R], l_linstatus: [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_supplykey: [91], l_linenumber: [0], l_quantity: [3], l_extendedprice: [3702.99], l_discount: [0.08], l_tax: [0.05], l_returnflag: [A], l_linstatus: [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: [327], l_partkey: [418], l_supplykey: [48], l_linenumber: [2], l_quantity: [0], l_extendedprice: [11865.7], l_discount: [0.09], l_tax: [0.05], l_returnflag: [A], l_linstatus: [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]
l_orderkey: [333], l_partkey: [1194], l_supplykey: [67], l_linenumber: [1], l_quantity: [4], l_extendedprice: [44992.8], l_discount: [0], l_tax: [0.06], l_returnflag: [A], l_linstatus: [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 theodol]
l_orderkey: [258], l_partkey: [1465], l_supplykey: [6], l_linenumber: [0], l_quantity: [36], l_extendedprice: [49192.6], l_discount: [0.09], l_tax: [0.04], l_returnflag: [A], l_linstatus: [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 f]
l_orderkey: [261], l_partkey: [1740], l_supplykey: [25], l_linenumber: [3], l_quantity: [28], l_extendedprice: [45968.7], l_discount: [0.08], l_tax: [0.03], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1993-07-24], l_commitdate: [1993-08-20], l_receiptdate: [1993-08-05], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [ironic packages nag slyly: carefully fin]
l_orderkey: [261], l_partkey: [970], l_supplykey: [5], l_linenumber: [0], l_quantity: [20], l_extendedprice: [37419.4], l_discount: [0.06], l_tax: [0.06], l_returnflag: [A], l_linstatus: [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 deposit]
l_orderkey: [294], l_partkey: [597], l_supplykey: [88], l_linenumber: [1], l_quantity: [31], l_extendedprice: [46425.3], l_discount: [0], l_tax: [0.01], l_returnflag: [R], l_linstatus: [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: [295], l_partkey: [914], l_supplykey: [17], l_linenumber: [2], l_quantity: [26], l_extendedprice: [47187.7], l_discount: [0.04], l_tax: [0.03], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1994-12-13], l_commitdate: [1994-11-01], l_receiptdate: [1994-06-14], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [deposits grow slyly according to th]
l_orderkey: [322], l_partkey: [1833], l_supplykey: [77], l_linenumber: [4], l_quantity: [10], l_extendedprice: [17348.3], l_discount: [0.06], l_tax: [0.03], l_returnflag: [R], l_linstatus: [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_supplykey: [91], l_linenumber: [0], l_quantity: [3], l_extendedprice: [3702.99], l_discount: [0.08], l_tax: [0.05], l_returnflag: [A], l_linstatus: [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: [327], l_partkey: [418], l_supplykey: [48], l_linenumber: [2], l_quantity: [0], l_extendedprice: [11865.7], l_discount: [0.09], l_tax: [0.05], l_returnflag: [A], l_linstatus: [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]
l_orderkey: [333], l_partkey: [1194], l_supplykey: [67], l_linenumber: [1], l_quantity: [4], l_extendedprice: [44992.8], l_discount: [0], l_tax: [0.06], l_returnflag: [A], l_linstatus: [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 theodol]
```

srlnadhk7373@srlnadh-ubuntu: ~/Desktop/DB1/P1

```
l_orderkey: [258], l_partkey: [1465], l_supplykey: [6], l_linenumber: [0], l_quantity: [36], l_extendedprice: [49192.6], l_discount: [0.09], l_tax: [0.04], l_returnflag: [A], l_linstatus: [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 f]
l_orderkey: [261], l_partkey: [1740], l_supplykey: [25], l_linenumber: [3], l_quantity: [28], l_extendedprice: [45968.7], l_discount: [0.08], l_tax: [0.03], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1993-07-24], l_commitdate: [1993-08-20], l_receiptdate: [1993-08-05], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [ironic packages nag slyly: carefully fin]
l_orderkey: [261], l_partkey: [970], l_supplykey: [5], l_linenumber: [0], l_quantity: [20], l_extendedprice: [37419.4], l_discount: [0.06], l_tax: [0.06], l_returnflag: [A], l_linstatus: [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 deposit]
l_orderkey: [294], l_partkey: [597], l_supplykey: [88], l_linenumber: [1], l_quantity: [31], l_extendedprice: [46425.3], l_discount: [0], l_tax: [0.01], l_returnflag: [R], l_linstatus: [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: [295], l_partkey: [914], l_supplykey: [17], l_linenumber: [2], l_quantity: [26], l_extendedprice: [47187.7], l_discount: [0.04], l_tax: [0.03], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1994-12-13], l_commitdate: [1994-11-01], l_receiptdate: [1994-06-14], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [AIR], l_comment: [deposits grow slyly according to th]
l_orderkey: [322], l_partkey: [1833], l_supplykey: [77], l_linenumber: [4], l_quantity: [10], l_extendedprice: [17348.3], l_discount: [0.06], l_tax: [0.03], l_returnflag: [R], l_linstatus: [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_supplykey: [91], l_linenumber: [0], l_quantity: [3], l_extendedprice: [3702.99], l_discount: [0.08], l_tax: [0.05], l_returnflag: [A], l_linstatus: [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: [327], l_partkey: [418], l_supplykey: [48], l_linenumber: [2], l_quantity: [0], l_extendedprice: [11865.7], l_discount: [0.09], l_tax: [0.05], l_returnflag: [A], l_linstatus: [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]
l_orderkey: [333], l_partkey: [1194], l_supplykey: [67], l_linenumber: [1], l_quantity: [4], l_extendedprice: [44992.8], l_discount: [0], l_tax: [0.06], l_returnflag: [A], l_linstatus: [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 theodol]
l_orderkey: [416], l_partkey: [1742], l_supplykey: [85], l_linenumber: [3], l_quantity: [25], l_extendedprice: [41099.5], l_discount: [0.07], l_tax: [0.01], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1993-10-16], l_commitdate: [1993-12-04], l_receiptdate: [1993-10-29], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [ses boost after the bold requests:]
l_orderkey: [450], l_partkey: [781], l_supplykey: [82], l_linenumber: [5], l_quantity: [2], l_extendedprice: [3363.56], l_discount: [0.09], l_tax: [0], l_returnflag: [A], l_linstatus: [F], l_shipdate: [1995-03-11], l_commitdate: [1995-05-21], l_receiptdate: [1995-03-16], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [y even into beans: qui]
l_orderkey: [481], l_partkey: [287], l_supplykey: [8], l_linenumber: [2], l_quantity: [19], l_extendedprice: [21636.8], l_discount: [0.08], l_tax: [0.01], l_returnflag: [R], l_linstatus: [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_supplykey: [93], l_linenumber: [5], l_quantity: [3], l_extendedprice: [31654.7], l_discount: [0.05], l_tax: [0.01], l_returnflag: [A], l_linstatus: [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]
l_orderkey: [548], l_partkey: [568], l_supplykey: [59], l_linenumber: [4], l_quantity: [21], l_extendedprice: [38839.8], l_discount: [0.08], l_tax: [0.03], l_returnflag: [A], l_linstatus: [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: [549], l_partkey: [653], l_supplykey: [54], l_linenumber: [3], l_quantity: [36], l_extendedprice: [55931.4], l_discount: [0.08], l_tax: [0.04], l_returnflag: [R], l_linstatus: [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: [is against the ironic, even theodolites end]
l_orderkey: [577], l_partkey: [259], l_supplykey: [14], l_linenumber: [1], l_quantity: [25], l_extendedprice: [28981.2], l_discount: [0.06], l_tax: [0.01], l_returnflag: [A], l_linstatus: [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: [677], l_partkey: [1497], l_supplykey: [15], l_linenumber: [5], l_quantity: [25], l_extendedprice: [34962.2], l_discount: [0], l_tax: [0.05], l_returnflag: [A], l_linstatus: [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: [678], l_partkey: [975], l_supplykey: [76], l_linenumber: [5], l_quantity: [16], l_extendedprice: [30815.5], l_discount: [0.06], l_tax: [0.04], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1993-03-09], l_commitdate: [1993-04-18], l_receiptdate: [1993-04-07], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [about the l]
l_orderkey: [738], l_partkey: [1871], l_supplykey: [72], l_linenumber: [2], l_quantity: [4], l_extendedprice: [7691.48], l_discount: [0], l_tax: [0.03], l_returnflag: [A], l_linstatus: [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: [738], l_partkey: [1749], l_supplykey: [34], l_linenumber: [5], l_quantity: [36], l_extendedprice: [45922.2], l_discount: [0.02], l_tax: [0], l_returnflag: [A], l_linstatus: [F], l_shipdate: [1995-03-20], 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: [742], l_partkey: [1919], l_supplykey: [64], l_linenumber: [4], l_quantity: [16], l_extendedprice: [29134.6], l_discount: [0.01], l_tax: [0.05], l_returnflag: [A], l_linstatus: [F], l_shipdate: [1995-01-15], l_commitdate: [1995-02-25], l_receiptdate: [1995-01-24], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [edolites haggle carefully regul]
l_orderkey: [769], l_partkey: [1951], l_supplykey: [64], l_linenumber: [1], l_quantity: [36], l_extendedprice: [59499], l_discount: [0.02], l_tax: [0.02], l_returnflag: [A], l_linstatus: [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: [772], l_partkey: [1799], l_supplykey: [26], l_linenumber: [4], l_quantity: [10], l_extendedprice: [17007.9], l_discount: [0.08], l_tax: [0.02], l_returnflag: [A], l_linstatus: [F], l_shipdate: [1993-05-17], l_commitdate: [1993-06-09], l_receiptdate: [1993-05-29], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [o the furiously final deposits: fur]
l_orderkey: [801], l_partkey: [947], l_supplykey: [16], l_linenumber: [2], l_quantity: [21], l_extendedprice: [38806.7], l_discount: [0.05], l_tax: [0.06], l_returnflag: [A], l_linstatus: [F], l_shipdate: [1992-03-14], l_commitdate: [1992-04-01], l_receiptdate: [1992-04-05], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [wake silently furiously idle deposits: ]
l_orderkey: [802], l_partkey: [1328], l_supplykey: [29], l_linenumber: [2], l_quantity: [34], l_extendedprice: [41796.9], l_discount: [0.08], l_tax: [0.06], l_returnflag: [A], l_linstatus: [F], l_shipdate: [1995-03-01], l_commitdate: [1995-03-15], l_receiptdate: [1995-03-12], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [instructions cajole carefully: quiet]
l_orderkey: [866], l_partkey: [1358], l_supplykey: [59], l_linenumber: [1], l_quantity: [5], l_extendedprice: [6296.75], l_discount: [0.08], l_tax: [0], l_returnflag: [R], l_linstatus: [F], l_shipdate: [1993-01-22], l_commitdate: [1993-01-14], l_receiptdate: [1993-02-07], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [tegrate fluffily: carefully f]
l_orderkey: [928], l_partkey: [104], l_supplykey: [31], l_linenumber: [7], l_quantity: [11], l_extendedprice: [11045.1], l_discount: [0], l_tax: [0.01], l_returnflag: [A], l_linstatus: [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: [930], l_partkey: [173], l_supplykey: [52], l_linenumber: [2], l_quantity: [47], l_extendedprice: [50439], l_discount: [0.08], l_tax: [0], l_returnflag: [A], l_linstatus: [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: [933], l_partkey: [992], l_supplykey: [27], l_linenumber: [3], l_quantity: [26], l_extendedprice: [49217.7], l_discount: [0.05], l_tax: [0], l_returnflag: [A], l_linstatus: [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 e]
l_orderkey: [960], l_partkey: [1070], l_supplykey: [6], l_linenumber: [1], l_quantity: [1], l_extendedprice: [971.07], l_discount: [0.07], l_tax: [0], l_returnflag: [A], l_linstatus: [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 ]
selected 35 recs
```

srlnadhk7373@srlnadh-ubuntu: ~/Desktop/DB1/P1\$

Query 12 : for 1 GB data
 (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)

```

srlinadhk7373@srlinadh-ubuntu: ~/Desktop/DBI/P1
srlinadhk7373@srlinadh-ubuntu: ~/Desktop/DBI/P1$ ./test.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location:      catalog
tpch files dir:       /home/srlinadhk7373/Desktop/DBI/P1/glt/tpch-dbggen/
heap files dir:

select test:
1. load file
2. scan
3. scan & filter
3

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

Filter with CNF for : llnetlem
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)
Heap Type of File Opened Successfully
l_orderkey: [130], l_partkey: [1739], l_suppkey: [4240], l_linenumbr: [2], l_quantity: [48], l_extendedprice: [78755], l_discount: [0.03], l_tax: [0.02], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1992-07-01], l_commitdate: [1992-07-12], l_receiptdate: [1992-07-24], l_shipinstruct: [NONE], l_shipmode: [AIR], l_comment: [lithely alongside of the regu]
l_orderkey: [194], l_partkey: [2594], l_suppkey: [5095], l_linenumbr: [1], l_quantity: [17], l_extendedprice: [25442], l_discount: [0.05], l_tax: [0.04], l_returnflag: [R], l_linestatus: [F], l_shipdate: [1992-05-24], l_commitdate: [1992-05-22], l_receiptdate: [1992-05-30], l_shipinstruct: [COLLECT COO], l_shipmode: [AIR], l_comment: [ regular deposit]
selected 2 rows
srlinadhk7373@srlinadh-ubuntu: ~/Desktop/DBI/P1$

```

Method Description of the GTest.cc class:

TEST(DBFileTest, Create_Equal)

This method tests whether the file is created.

TEST(DBFileTest, Create_NotEqual)

This method tests whether program is exiting when an invalid file is asked to create.

TEST(DBFileTest, Open_Equal)

This method tests whether file is opened successfully.

TEST(DBFileTest, Open_NotEqual)

This method tests whether all invalid file open scenarios are handled.

TEST(DBFileTest, Close_nation_DBFile)

This method tests whether the given file is closed successfully.

TEST(DBFileTest, Close_Empty_File)

This method tests whether program handles the case where an empty file is asked to close.

Screenshots of GTest results:

```
srinadhk7373@Srinadh-ubuntu: ~/Desktop/DBI/P1$
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ make GTest.out
g++ -O2 -Wno-deprecated -g -c GTest.cc
g++ -O2 -Wno-deprecated -o GTest.out Record.o ComparisonEngine.o Schema.o File.o DBFile.o HeapImplementation.o y.tab.o lex.yy.o GTest.o -lfl -lpthread -lgtest
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$ ./GTest.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: /home/srinadhk7373/Desktop/DBI/P1/glt/tpch-dbggen/
heap files dir: binaryfiles

[*****] Running 6 tests from 1 test case.
[*****] Global test environment set-up.
[*****] 6 tests from DBFileTest
[ RUN ] DBFileTest.DBCreate_SUCCESS (0 ms)
[ RUN OK ] DBFileTest.DBCreate_SUCCESS (0 ms)
[ RUN ] DBFileTest.DBCreate_Failure
[*****] Global test environment tear-down
[*****] 6 tests from 1 test case ran. (2 ms total)
[*****] PASSED
srinadhk7373@Srinadh-ubuntu:~/Desktop/DBI/P1$
```