

COP 6726: DATABASE SYSTEM IMPLEMENTATION

Assignment 2.1: Sorted File Implementation

Group Info:

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I. INTRODUCTION

In this assignment, we have implemented the BigQ class. The BigQ class encapsulates the process of taking a stream of inserts, breaking the stream of inserts into runs, and then using an in-memory priority queue to organize the head of each run and give the records to the caller in sorted order. 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

Data Structures used in BigQ Class:-

1. **struct TPMMS_DS:** This structure is used during the algorithm.
2. **struct RecordSorter:** This struct is used by the vector of Records to sort records.
3. **struct RecordComparator:** This struct is used by a priority queue.
4. **struct Record1:** It's a wrapper around Record Class which has an instance of Record Class and an integer which stores the run number to which the record belongs.

Public Functions used in BigQ Class:-

1. **void* TPMMS_Algo(void* args)**

This method implements the TPMMS Algorithm/

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 gTest2

To run the unit tests, type
cd bin
./gTestProj2

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

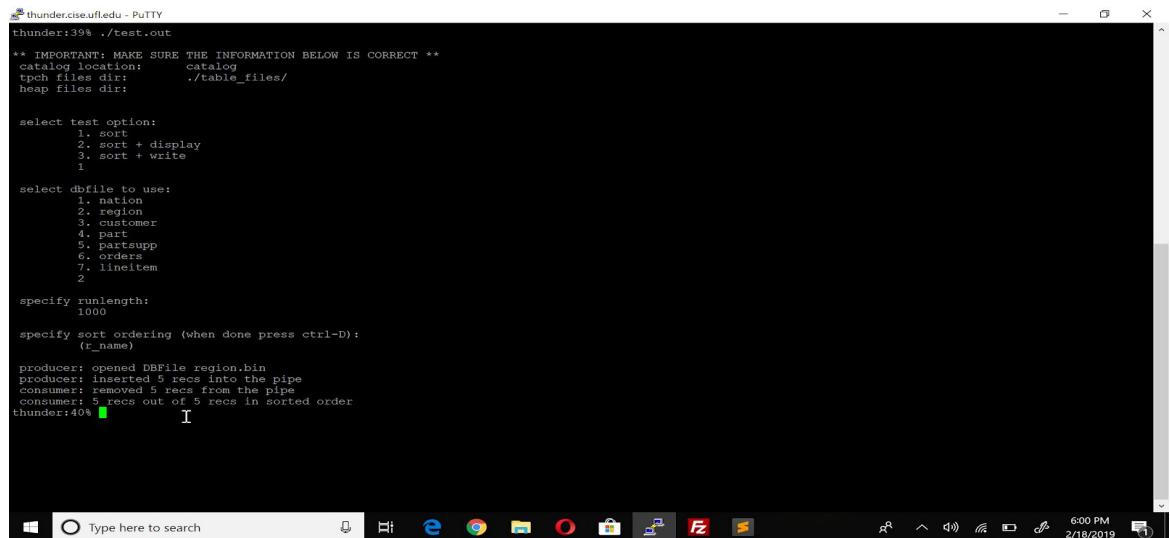
VI. RESULTS

We ran our program on 10M dataset.

A. 10M Data

We verified our results with the results which have been provided by the professor in the assignment folder.

Query 1 (Sort): (r_name)



```
thunder:cise.ufl.edu - PuTTY
thunder:39% ./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. sort
    2. sort + display
    3. sort + write
    1

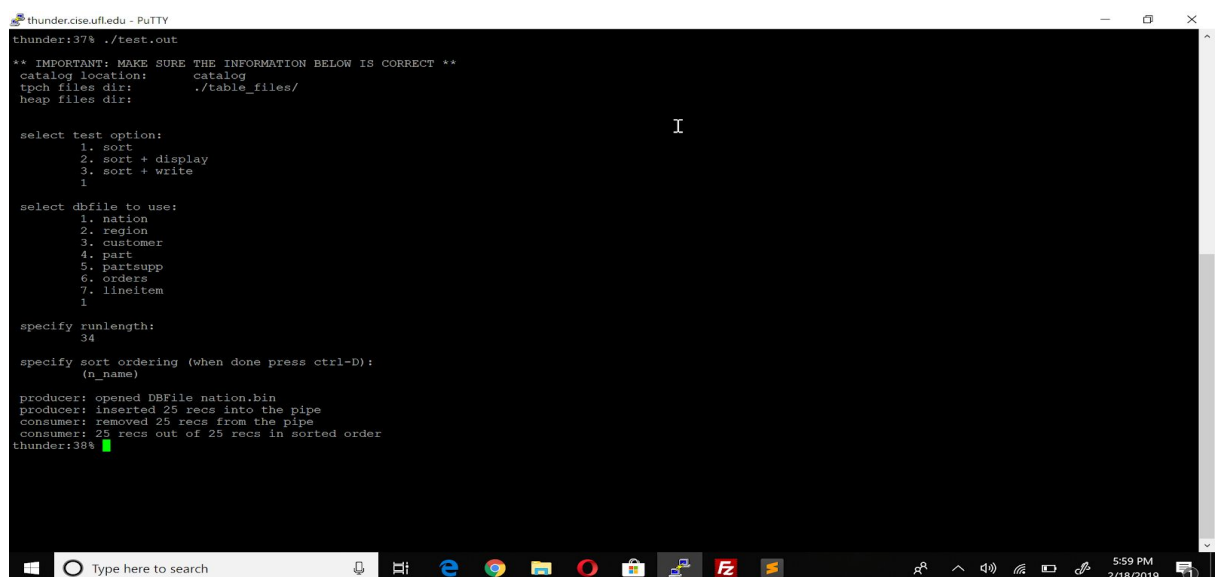
select dbfile to use:
    1. nation
    2. region
    3. customer
    4. part
    5. partsupp
    6. orders
    7. lineitem
    2

specify runlength:
    1000

specify sort ordering (when done press ctrl-D):
    (r_name)

producer: opened DBFile region.bin
producer: inserted 5 recs into the pipe
consumer: removed 5 recs from the pipe
consumer: 5 recs out of 5 recs in sorted order
thunder:40% █
```

Query 2 (Sort): (n_name)



```
thunder:cise.ufl.edu - PuTTY
thunder:37% ./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. sort
    2. sort + display
    3. sort + write
    1

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

specify runlength:
    34

specify sort ordering (when done press ctrl-D):
    (n_name)

producer: opened DBFile nation.bin
producer: inserted 25 recs into the pipe
consumer: removed 25 recs from the pipe
consumer: 25 recs out of 25 recs in sorted order
thunder:38% █
```

Query 3 (Sort):

(o_totalprice)

```
thunderciseufledu - PuTTY
thunder:47% ./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. sort
  2. sort + display
  3. sort + write
  1

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

specify runlength:
  119

specify sort ordering (when done press ctrl-D):
  (o_totalprice)

producer: opened DBFile orders.bin
producer: inserted 15000 recs into the pipe
consumer: removed 15000 recs from the pipe
consumer: 15000 recs out of 15000 recs in sorted order
thunder:48% █
```

Query 4: (Sort)

(ps_suppkey) AND (ps_partkey)

```
thunderciseufledu - PuTTY
thunder:45% ./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. sort
  2. sort + display
  3. sort + write
  1

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

specify runlength:
  32

specify sort ordering (when done press ctrl-D):
  (ps_suppkey) AND (ps_partkey)

producer: opened DBFile partsupp.bin
producer: inserted 8000 recs into the pipe
consumer: removed 8000 recs from the pipe
consumer: 8000 recs out of 8000 recs in sorted order
thunder:46% █
```

Query 5 (Sort + Display):

(n_name)

```
thunder.cise.ufl.edu - PuTTY

specify sort ordering (when done press ctrl-D):
(n_name)

producer: opened DBFile nation.bin
producer: inserted 25 recs into the pipe
n_nationkey: [0], n_name: [ALGERIA], n_regionkey: [0], n_comment: [ haggle. carefully final deposits detect slyly again]
n_nationkey: [1], n_name: [ARGENTINA], n_regionkey: [1], n_comment: [al foxes promise slyly according to the regular accounts. bold requests along]
n_nationkey: [2], n_name: [BRAZIL], n_regionkey: [1], n_comment: [y alongside of the pending deposits. carefully special packages are about the ironic forges
. slyly special ]
n_nationkey: [3], n_name: [CANADA], n_regionkey: [1], n_comment: [eas hang ironic, silent packages. slyly regular packages are furiously over the tithes. flu
ffily bold]
n_nationkey: [18], n_name: [CHINA], n_regionkey: [2], n_comment: [c dependencies. furiously express notornis sleep slyly regular accounts. ideas sleep. depos
]
n_nationkey: [4], n_name: [EGYPT], n_regionkey: [4], n_comment: [y above the carefully unusual theodolites. final dugouts are quickly across the furiously re
gular d]
n_nationkey: [5], n_name: [ETHIOPIA], n_regionkey: [0], n_comment: [ven packages wake quickly. regu]
n_nationkey: [6], n_name: [FRANCE], n_regionkey: [3], n_comment: [refully final requests. regular, ironi]
n_nationkey: [7], n_name: [GERMANY], n_regionkey: [3], n_comment: [l platelets. regular accounts x-ray; unusual, regular acco]
n_nationkey: [8], n_name: [INDIA], n_regionkey: [2], n_comment: [ss excuses cajole slyly across the packages. deposits print around]
n_nationkey: [9], n_name: [INDONESIA], n_regionkey: [2], n_comment: [ slyly express asymptotes. regular deposits haggle slyly. carefully ironic hockey player
s sleep blithely. carefull]
n_nationkey: [10], n_name: [IRAN], n_regionkey: [4], n_comment: [efully alongside of the slyly final dependencies. ]
n_nationkey: [11], n_name: [IRAQ], n_regionkey: [4], n_comment: [nic deposits boost atop the quickly final requests? quickly regula]
n_nationkey: [12], n_name: [JAPAN], n_regionkey: [2], n_comment: [ously. final, express gifts cajole a]
n_nationkey: [13], n_name: [JORDAN], n_regionkey: [4], n_comment: [lc deposits are blithely about the carefully regular pal]
n_nationkey: [14], n_name: [KENYA], n_regionkey: [0], n_comment: [ pending excuses haggle furiously deposits. pending, express pinto beans wake fluffily past
t]
n_nationkey: [15], n_name: [MOROCCO], n_regionkey: [0], n_comment: [rns. blithely bold courts among the closely regular packages use furiously bold platelets
?]
n_nationkey: [16], n_name: [MOZAMBIQUE], n_regionkey: [0], n_comment: [s. ironic, unusual asymptotes wake blithely r]
n_nationkey: [17], n_name: [PERU], n_regionkey: [1], n_comment: [platelets. blithely pending dependencies use fluffily across the even pinto beans. carefully
silent account]
n_nationkey: [19], n_name: [ROMANIA], n_regionkey: [3], n_comment: [ular asymptotes are about the furious multipliers. express dependencies nag above the iro
nically 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: [20], n_name: [SAUDI ARABIA], n_regionkey: [4], n_comment: [ts. silent requests haggle. closely express packages sleep across the blithely]
n_nationkey: [23], n_name: [UNITED KINGDOM], n_regionkey: [3], n_comment: [eans boost carefully special requests. accounts are. carefull]
n_nationkey: [24], n_name: [UNITED STATES], n_regionkey: [1], n_comment: [y final packages. slow foxes cajole quickly. quickly silent platelets breach ironic
accounts. unusual pinto be]
n_nationkey: [21], n_name: [VIETNAM], n_regionkey: [2], n_comment: [hely enticingly express accounts. even, final ]
consumer: removed 25 recs from the pipe
consumer: 25 recs out of 25 recs in sorted order
thunder:52%
```

Query 6 (Sort + Display):

(ps_suppkey) AND (ps_partkey)

```
thunder.cise.ufl.edu - PuTTY

ps_partkey: [1811], ps_suppkey: [98], ps_availqty: [8110], ps_supplycost: [708.08], ps_comment: [y blithely even deposits. carefully ironic accounts nod bli]
ps_partkey: [1894], ps_suppkey: [98], ps_availqty: [9635], ps_supplycost: [681.61], ps_comment: [e finally even excuses. furiously express requests integrate
. even decoys wake blithely after the even pinto beans.]
ps_partkey: [1868], ps_suppkey: [98], ps_availqty: [6200], ps_supplycost: [855.52], ps_comment: [ts. ironic accounts grow silent, special foxes. final, regul
ar forges boost along the blithely unusual packages. depend]
ps_partkey: [1897], ps_suppkey: [98], ps_availqty: [4442], ps_supplycost: [592.77], ps_comment: [packages? close, pending requests sleep carefully. ]
ps_partkey: [1909], ps_suppkey: [98], ps_availqty: [8614], ps_supplycost: [104.99], ps_comment: [ ideas. slyly pending foxes cajole blithely. special depende
ncies sleep alongside of th]
ps_partkey: [1953], ps_suppkey: [98], ps_availqty: [8441], ps_supplycost: [190.5], ps_comment: [ even requests. fluffily ironic dolphins are about the regula
r instructions / accounts are across the ironic, final platelets. unusua deposits haggle closely across the blithe]
ps_partkey: [1965], ps_suppkey: [98], ps_availqty: [5473], ps_supplycost: [538.98], ps_comment: [ts wake about the slyly final requests. regular theodolites
above ]
ps_partkey: [1997], ps_suppkey: [98], ps_availqty: [9746], ps_supplycost: [943.84], ps_comment: [er across the special, final packages. furiously even excuse
s cajole fluffily after the slyly special accounts. furiously]
ps_partkey: [23], ps_suppkey: [99], ps_availqty: [7035], ps_supplycost: [51.75], ps_comment: [xcuses; decoys wake after the pending packages. final instructi
ons are furil]
ps_partkey: [48], ps_suppkey: [99], ps_availqty: [5564], ps_supplycost: [668.19], ps_comment: [al pinto beans. furiously final frays use slyly according to t
he ironic theodolites. regular ideas cajole furiously after the slyly even deposits. ]
ps_partkey: [73], ps_suppkey: [99], ps_availqty: [7729], ps_supplycost: [920.66], ps_comment: [ecial accounts sleep according to the slyly sly accounts. slyl
y express instructions nag. accounts cajole furiously quickly even foxes. furiously regular requests wake. carefully even frets haggle ]
ps_partkey: [98], ps_suppkey: [99], ps_availqty: [9486], ps_supplycost: [908.21], ps_comment: [usly final deposits mold furiously above the even deposits. ca
refully ironic packages across the quickly regular dolphins are slyly according to the slyly even]
ps_partkey: [120], ps_suppkey: [99], ps_availqty: [3102], ps_supplycost: [566.34], ps_comment: [ctions; realms beside the blithely final theodolites unwind b
lithely packages. regular dolphins sleep carefully-- carefully express accounts wake quickly. pending depths use never courts.]
ps_partkey: [146], ps_suppkey: [99], ps_availqty: [5893], ps_supplycost: [858.59], ps_comment: [sual instructions believe. fluffily unusual warhorses nag. un
usual dependencies sleep. slow sheaves haggle furiously. carefully ironic dependencies cajole slyly against the accounts. ]
ps_partkey: [172], ps_suppkey: [99], ps_availqty: [8333], ps_supplycost: [920.74], ps_comment: [ronic foxes. quickly unusual accounts cajole blithely. blithe
ly bold deposits cajole. blithely close pinto beans cajole requests. quickly express excuses around the quickly even deposits nag again]
ps_partkey: [198], ps_suppkey: [99], ps_availqty: [6878], ps_supplycost: [587.41], ps_comment: [y even accounts poach carefully about the asymptotes. deposit
s haggle slyly. finally unusual requests run silently regular, bold packages: instructions after the ]
ps_partkey: [217], ps_suppkey: [99], ps_availqty: [9247], ps_supplycost: [637.64], ps_comment: [y to wake at the packages. regular theodolites boost furiousl
y furiously ironic r]
ps_partkey: [244], ps_suppkey: [99], ps_availqty: [1352], ps_supplycost: [978.74], ps_comment: [n platelets integrate. furiously stealthy foxes believe fluffl
ily. furiously final excuses above the furiously unusual packages boost quickly careful]
ps_partkey: [271], ps_suppkey: [99], ps_availqty: [7762], ps_supplycost: [296.66], ps_comment: [nal requests are carefully slyly express foxes. regularly eve
n requests ]
ps_partkey: [298], ps_suppkey: [99], ps_availqty: [9804], ps_supplycost: [314.49], ps_comment: [nst the regular, furious platelets. regular packages cajole.
ironic, pending ideas sleep slyly ironic excuses. requests cajole? blithely express req]
ps_partkey: [314], ps_suppkey: [99], ps_availqty: [4839], ps_supplycost: [923.67], ps_comment: [ough the slyly special theodolites. regular tiresias wake acr
oss the final, regular deposits. furiously final ideas breach. unusual ]
ps_partkey: [342], ps_suppkey: [99], ps_availqty: [6128], ps_supplycost: [105.32], ps_comment: [ckly bold accounts. slyly pending deposits wake af]
ps_partkey: [370], ps_suppkey: [99], ps_availqty: [4006], ps_supplycost: [892.4], ps_comment: [egular courts nod quickly above the fluffily pending accounts.
fluffily sly dolphins haggle furiously slyly bold account]
```


Query 7 (Sort + Display):

(l_shipdate) AND (l_extendedprice) AND (l_quantity)

```
thunder:cise.ufl.edu - PuTTY
REG AIR], l_comment: [n, even warthogs wake]
l_orderkey: [14694], l_partkey: [503], l_suppkey: [4], l_linenumber: [1], l_quantity: [45], l_extendedprice: [63157.5], l_discount: [0.07], l_tax: [0.05], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-21], l_commitdate: [1998-10-22], l_receiptdate: [1998-11-26], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [SHIP], l_comment: [r, express packages wake, furiously re]
l_orderkey: [11523], l_partkey: [315], l_suppkey: [16], l_linenumber: [1], l_quantity: [31], l_extendedprice: [37674.6], l_discount: [0.08], l_tax: [0.02], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-22], l_commitdate: [1998-09-13], l_receiptdate: [1998-12-11], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [deposits haggle about t]
l_orderkey: [53377], l_partkey: [736], l_suppkey: [69], l_linenumber: [5], l_quantity: [35], l_extendedprice: [57285.6], l_discount: [0.02], l_tax: [0.01], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-22], l_commitdate: [1998-09-20], l_receiptdate: [1998-12-16], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [y players, carefully special packages]
l_orderkey: [47394], l_partkey: [366], l_suppkey: [85], l_linenumber: [1], l_quantity: [33], l_extendedprice: [41789.9], l_discount: [0.1], l_tax: [0.01], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-23], l_commitdate: [1998-10-14], l_receiptdate: [1998-12-12], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [SHIP], l_comment: [e, fluffily even deposits; final, l]
l_orderkey: [19876], l_partkey: [1159], l_suppkey: [32], l_linenumber: [3], l_quantity: [45], l_extendedprice: [47706.8], l_discount: [0.08], l_tax: [0.07], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-23], l_commitdate: [1998-10-04], l_receiptdate: [1998-12-02], l_shipinstruct: [COLLECT COD], l_shipmode: [FOB], l_comment: [furiously daring requests, un]
l_orderkey: [43969], l_partkey: [1485], l_suppkey: [64], l_linenumber: [2], l_quantity: [36], l_extendedprice: [49913.3], l_discount: [0.08], l_tax: [0.01], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-24], l_commitdate: [1998-09-03], l_receiptdate: [1998-12-24], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [TRUCK], l_comment: [ instructions cajole along ]
l_orderkey: [26561], l_partkey: [1461], l_suppkey: [40], l_linenumber: [2], l_quantity: [41], l_extendedprice: [55860.9], l_discount: [0.04], l_tax: [0.01], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-25], l_commitdate: [1998-10-16], l_receiptdate: [1998-12-17], l_shipinstruct: [DELIVER IN PERSON], l_shipmode: [SHIP], l_comment: [es, furiously special asymptotes mail]
l_orderkey: [1124], l_partkey: [923], l_suppkey: [58], l_linenumber: [3], l_quantity: [35], l_extendedprice: [63837.2], l_discount: [0.1], l_tax: [0.05], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-25], l_commitdate: [1998-10-08], l_receiptdate: [1998-12-25], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [ut the slyly bold pinto beans; fil]
l_orderkey: [47394], l_partkey: [1941], l_suppkey: [74], l_linenumber: [2], l_quantity: [41], l_extendedprice: [75560.5], l_discount: [0.05], l_tax: [0.03], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-25], l_commitdate: [1998-10-14], l_receiptdate: [1998-12-17], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [SHIP], l_comment: [ fluffily alongside of the furiously ex]
l_orderkey: [12384], l_partkey: [842], l_suppkey: [42], l_linenumber: [5], l_quantity: [6], l_extendedprice: [10457], l_discount: [0.04], l_tax: [0], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-26], l_commitdate: [1998-10-04], l_receiptdate: [1998-12-08], l_shipinstruct: [COLLECT COD], l_shipmode: [RAIL], l_comment: [ep blithely, blithely ironic r]
l_orderkey: [4678], l_partkey: [574], l_suppkey: [5], l_linenumber: [1], l_quantity: [35], l_extendedprice: [51609.9], l_discount: [0.04], l_tax: [0.08], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-27], l_commitdate: [1998-10-02], l_receiptdate: [1998-12-17], l_shipinstruct: [TAKE BACK RETURN], l_shipmode: [AIR], l_comment: [he accounts, fluffily bold sheaves b]
l_orderkey: [20195], l_partkey: [370], l_suppkey: [55], l_linenumber: [2], l_quantity: [26], l_extendedprice: [33029.6], l_discount: [0.1], l_tax: [0.04], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-29], l_commitdate: [1998-09-20], l_receiptdate: [1998-12-06], l_shipinstruct: [COLLECT COD], l_shipmode: [RAIL], l_comment: [enticingly silent packages, l]
l_orderkey: [22403], l_partkey: [468], l_suppkey: [98], l_linenumber: [2], l_quantity: [44], l_extendedprice: [60212.2], l_discount: [0.09], l_tax: [0], l_returnflag: [N], l_linestatus: [O], l_shipdate: [1998-11-29], l_commitdate: [1998-09-29], l_receiptdate: [1998-12-05], l_shipinstruct: [COLLECT COD], l_shipmode: [AIR], l_comment: [ n,ag carefully special ideas.]
consumer: removed 60175 recs from the pipe
consumer: 60175 recs out of 60175 recs in sorted order
thunder:54%
```

Query 8 (Sort + Display):

(r_comment)

```
thunder:cise.ufl.edu - PuTTY
thunder:61% ./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. sort
2. sort + display
3. sort + write
2

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

specify runlength:
11

specify sort ordering (when done press ctrl-D):
(r_comment)

producer: opened DBFile region.bin
producer: inserted 5 recs into the pipe
r_regionkey: [2], r_name: [ASIA], r_comment: [ges, thinly even pinto beans ca]
r_regionkey: [1], r_name: [AMERICA], r_comment: [hs use ironic, even requests. s]
r_regionkey: [0], r_name: [INDIA], r_comment: [lar deposits, blithely final packages cajole, regular waters are final requests, regular accounts are according to ]
r_regionkey: [3], r_name: [EUROPE], r_comment: [ly final courts cajole furiously final excuse]
r_regionkey: [4], r_name: [MIDDLE EAST], r_comment: [wicky special accounts cajole carefully blithely close requests, carefully final asymptotes haggle furiously]
consumer: removed 5 recs from the pipe
consumer: 5 recs out of 5 recs in sorted order
thunder:62%
```

Query 9 (Sort + Write):

(o_totalprice) AND (o_shippriority)

```
thunder:ciseufledu - PuTTY
thunder:63% ./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. sort
  2. sort + display
  3. sort + write
  3

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

specify runlength:
  22

specify sort ordering (when done press ctrl-D):
  (o_totalprice) AND (o_shippriority)

producer: opened DBFile orders.bin
producer: inserted 15000 recs into the pipe
consumer: removed 15000 recs from the pipe
consumer: recs removed written out as heap DBFile at orders.bin.bigq
consumer: 15000 recs out of 15000 recs in sorted order
thunder:64%
```

Query 10 (Sort + Write):

(p_size) AND (p_type)

```
thunder:ciseufledu - PuTTY

(o_totalprice) AND (o_shippriority)

producer: opened DBFile orders.bin
producer: inserted 15000 recs into the pipe
consumer: removed 15000 recs from the pipe
consumer: recs removed written out as heap DBFile at orders.bin.bigq
consumer: 15000 recs out of 15000 recs in sorted order
thunder:64% ./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. sort
  2. sort + display
  3. sort + write
  3

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

specify runlength:
  4

specify sort ordering (when done press ctrl-D):
  (p_size) AND (p_type)

producer: opened DBFile part.bin
producer: inserted 2000 recs into the pipe
consumer: removed 2000 recs from the pipe
consumer: recs removed written out as heap DBFile at part.bin.bigq
consumer: 2000 recs out of 2000 recs in sorted order
thunder:65%
```

Google Test Results:

```
neel@nrami:~/Desktop/DBI/Projects/Project2$ cd bin
neel@nrami:~/Desktop/DBI/Projects/Project2/bin$ ./gTestProj2
[=====] Running 5 tests from 5 test cases.
[-----] Global test environment set-up.
[-----] 1 test from TPMMS_Test1
[ RUN      ] TPMMS_Test1.SubTest
[      OK   ] TPMMS_Test1.SubTest (1 ms)
[-----] 1 test from TPMMS_Test1 (1 ms total)

[-----] 1 test from TPMMS_Test2
[ RUN      ] TPMMS_Test2.SubTest
[      OK   ] TPMMS_Test2.SubTest (0 ms)
[-----] 1 test from TPMMS_Test2 (0 ms total)

[-----] 1 test from TPMMS_Test3
[ RUN      ] TPMMS_Test3.SubTest
[      OK   ] TPMMS_Test3.SubTest (1 ms)
[-----] 1 test from TPMMS_Test3 (1 ms total)

[-----] 1 test from TPMMS_Test4
[ RUN      ] TPMMS_Test4.SubTest
[      OK   ] TPMMS_Test4.SubTest (0 ms)
[-----] 1 test from TPMMS_Test4 (0 ms total)

[-----] 1 test from TPMMS_Test5
[ RUN      ] TPMMS_Test5.SubTest
[      OK   ] TPMMS_Test5.SubTest (0 ms)
[-----] 1 test from TPMMS_Test5 (0 ms total)

[-----] Global test environment tear-down
[=====] 5 tests from 5 test cases ran. (3 ms total)
[ PASSED  ] 5 tests.
neel@nrami:~/Desktop/DBI/Projects/Project2/bin$
```