

# Data Base System Implementation

## COP-6726

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### Introduction:

This document is intended to present the outcomes and the process of the completed work for the Project 2 milestone 1. The heap file implementation has been successfully materialized and tested. The repository for all the work is present [here](#).

### Source File Hierarchy:

```
[naman@0xb1ad3] - (~/tmp/submission/proj2_1)
> tree -L 1 .
.
├── al-test.cc
├── BigQ.cc
├── BigQ.h
├── bin
├── catalog
├── Comparison.cc
├── ComparisonEngine.cc
├── ComparisonEngine.h
├── Comparison.h
├── DBFile.cc
├── DBFile.h
├── Defs.h
├── File.cc
├── File.h
├── gtest.cc
├── Lexer.l
├── Makefile
├── Parser.y
├── ParseTree.h
├── Pipe.cc
├── Pipe.h
├── Record.cc
├── Record.h
├── RunGen.cc
├── RunGen.h
├── RunMerge.cc
├── RunMerge.h
├── runTestCases.sh
├── Schema.cc
├── Schema.h
├── test.cc
├── test.h
├── Timer.cc
├── Timer.h
├── tmp
├── Tournament.cc
├── Tournament.h
├── tpch-dbggen
├── TwoWayList.cc
└── TwoWayList.h

3 directories, 37 files
[naman@0xb1ad3] - (~/tmp/submission/proj2_1)
>
[tmp] 0:sub* 1:zsh-
```

The directories are arranged in a flat manner with the exception of exactly three, viz. bin/, tpch-dbggen/ and tmp/. The bin/ directory is the output destination for the dbfile, i.e. dbfile directory. The tpch-dbggen is the git repository for the TPCCH sub program. tmp/ houses all the test case

files, tc{1,2,3,4}.txt along with some patch files viz, tc{1,2,3,4}\_txt.patch, test\_{cc,h}.patch, runTestCases\_sh.patch and a1-test\_cc.patch. These patch files demark where the respective files differ from the vanilla ones provided. Output1.txt exists in tmp/ directory too.

*\*Note that since the test.cc and a1-test.cc have been modified to provide all the relations as options, the second line of test cases have been altered to reflect the same relations.*

#### The compilation process:

The compilation process is accomplished by a recursive call to Makefiles in each subdirectory by the Makefile in the src/ directory.

The provided NamanArora\_NikunjSarda\_p1.zip has one sub-directory, src/.

```
$> unzip NamanArora_NikunjSarda_p1.zip
```

```
$> cd proj2_1
```

Now to build the test.out:

```
$> make test.out
```

Also, to build a1-test.out:

```
$> make a1-test.out
```

To make the gtest (assuming the gtest framework is installed and available in default linker library path)

```
$> make gtest.out
```

To generate tpch-dbgen files (tpch-dbgen/ sub-dir is always compiled with all of the above targets)

```
$> cd tpch-dbgen/
```

```
$> make
```

```
$> ./dbgen <options> -s <size>
```

All the available relation binary files are available in bin/

To clean the repository,

```
$> make clean
```

#### Change Log:

- ➔ Added Tournament class in mem/tournament.{cc,h}
- ➔ Added Run\_Gen class in mem/run\_gen.{cc,h}
- ➔ Added Run\_Merge class in mem/run\_merge.{cc,h}
- ➔ Finished the BigQ class in mem/bigq.{cc,h}
- ➔ Changed the output1.txt location from root to tmp/
- ➔ Changed tc\*.txt locations from root to tmp/
- ➔ Modified options provided for selecting relations as \*.tbl files in a1-test.cc and test.cc files, and reflected those same number selection changes in tc\*.txt files too.

#### BigQ Class:

- ➔ thread\_arg :: thread\_arg(Pipe \*in\_pipe, Pipe \*out\_pipe, int run\_len, OrderMaker \*order, File \*f, Page \*pg)

Initializing the class variable to their respective values.

- ➔ `BigQ :: BigQ(Pipe *in_pipe, Pipe *out_pipe, OrderMaker *order, int run_len)`  
The class constructor to start the worker thread.
- ➔ `struct thread_arg *wrkr_init(struct thread_arg *a)`  
The function to instantiate the initial thread and return the same.
- ➔ `void *wrkr_run(void *a)`  
The function to start the run generation and the run merge and free the memory.

#### Tournament Class:

- ➔ `Tournament :: node :: node(Record * in, int init_pos)`  
The function to initialize the node structure.
- ➔ `Tournament :: Tournament(int n_ext, struct OrderMaker *order)`  
The class constructor to create tournament tree and comparison engine.
- ➔ `Tournament :: ~Tournament()`  
The class destructor to free up the memory.
- ➔ `Tournament :: push_winner(struct node *winner)`  
The function to push the winner in winner queue
- ➔ `int Tournament :: promote(struct node *winner, int pos)`  
This function
- ➔ `int Tournament :: play_matches(int pos)`  
The function to determined the winner among the two player.
- ➔ `int Tournament :: feed(Record *in)`  
The function to feed the tree.
- ➔ `std :: queue <Record *> *Tournament :: flush()`  
The function to return the winner queue.
- ➔ `int Tournament :: get_nxt_spot(int pop)`  
The function to locate an empty spot.
- ➔ `int Tournament :: get_player_num()`  
The function to get number of players.
- ➔ `Record *Tournament :: get_nxt_winner()`  
The function to return the next, if any, record in sorted fashion

#### RunGen Class:

- ➔ `RunGen :: RunGen(Pipe *in_pipe, int run_len, OrderMaker *order)`  
The class constructor to initialize class variable to initial values.
- ➔ `RunGen :: ~RunGen()`  
The class destructor to free up the memory.
- ➔ `int RunGen :: setup_dbf()`  
The function to create run db file to write present run.
- ➔ `void RunGen :: write(std :: queue <Record *> *que)`  
The function to write the records in the run db file.

- ➔ `int RunGen :: fetch_rec(Record **rec)`  
The function to fetch the record from the input pipe.
- ➔ `std :: vector<int> *RunGen :: generator()`  
The function to start the run and sent the record to tournament tree for sorting.

#### RunMerge Class:

- ➔ `thread :: thread(pthread_t *tid, Pipe *pipe, const RunMerge *ref, int r_no, int r_size)`  
The function to initialize the structure thread with respective values.
- ➔ `RunMerge :: RunMerge(Pipe *out_pipe, std :: vector <int> *run_sizes, struct OrderMaker *order)`  
The class constructor to initialize class variable with respective values.
- ➔ `RunMerge :: ~RunMerge()`  
The class destructor to free up the memory.
- ➔ `thread *RunMerge :: init_thread(pthread_t *tid, int r_no, int r_size)`  
The function to initialize the initial thread.
- ➔ `void RunMerge :: join_wait()`  
The function to join individual threads together.
- ➔ `void RunMerge :: merge_init()`  
The function to create merge thread.
- ➔ `void RunMerge :: new_feed()`  
The function to get the sorted record for the merging process.
- ➔ `void *thread_handler(void *a)`  
The function to write the record in the output pipe.

Outputs:

# Output1.txt

```
3 n_nationkey: [11], n_name: [IRAQ], n_regionkey: [4], n_comment: [nic deposits boost atop the quickly final requests? quickly regula]
4 n_nationkey: [10], n_name: [IRAN], n_regionkey: [4], n_comment: [efully alongside of the slyly final dependencies. ]
5 n_nationkey: [9], n_name: [INDONESIA], n_regionkey: [2], n_comment: [ slyly express asymptotes. regular deposits haggle slyly. carefully ironic hockey players sleep blith
ely. carefull]
6 n_nationkey: [8], n_name: [INDIA], n_regionkey: [2], n_comment: [ss excuses cajole slyly across the packages. deposits print around]
7 n_nationkey: [7], n_name: [GERMANY], n_regionkey: [3], n_comment: [l platelets. regular accounts x-ray: unusual, regular acco]
8 consumer: removed 25 recs from the pipe
9 consumer: 25 recs out of 25 recs in sorted order
10 Calling cleanup!
11 *****
12 consumer: removed 150000 recs from the pipe
13 consumer: 150000 recs out of 150000 recs in sorted order
14 Calling cleanup!
15 *****
16 o_orderkey: [524451], o_custkey: [51430], o_orderstatus: [0], o_totalprice: [420623], o_orderdate: [1997-09-22], o_orderpriority: [1-URGENT], o_clerk: [Clerk#000000755],
o_shippriority: [0], o_comment: [inal pinto beans pr]
17 o_orderkey: [524450], o_custkey: [21094], o_orderstatus: [0], o_totalprice: [187237], o_orderdate: [1996-02-28], o_orderpriority: [3-MEDIUM], o_clerk: [Clerk#000000087],
o_shippriority: [0], o_comment: [carefully silent sheave]
18 o_orderkey: [524449], o_custkey: [68072], o_orderstatus: [0], o_totalprice: [73680.1], o_orderdate: [1995-08-06], o_orderpriority: [4-NOT SPECIFIED], o_clerk: [Clerk#00000
00407], o_shippriority: [0], o_comment: [lithely against the regular deposits. blithely special ideas across]
19 o_orderkey: [524448], o_custkey: [98731], o_orderstatus: [0], o_totalprice: [83530.3], o_orderdate: [1998-01-15], o_orderpriority: [5-LOW], o_clerk: [Clerk#000000015], o
_shippriority: [0], o_comment: [instructions boost fluffily according to the never ironic ideas. ironic id]
20 o_orderkey: [524423], o_custkey: [72682], o_orderstatus: [0], o_totalprice: [132826], o_orderdate: [1995-07-29], o_orderpriority: [2-HIGH], o_clerk: [Clerk#000000344], o
_shippriority: [0], o_comment: [ress requests sleep slyly pending accounts. fin]
21 o_orderkey: [524422], o_custkey: [98321], o_orderstatus: [0], o_totalprice: [119840], o_orderdate: [1997-10-17], o_orderpriority: [4-NOT SPECIFIED], o_clerk: [Clerk#00000
0043], o_shippriority: [0], o_comment: [und the furiously bold instructions. multipliers aff]
22 o_orderkey: [524421], o_custkey: [15161], o_orderstatus: [0], o_totalprice: [213110], o_orderdate: [1997-07-08], o_orderpriority: [1-URGENT], o_clerk: [Clerk#000000204],
o_shippriority: [0], o_comment: [eep carefully. slyly bold asymptotes sleep across the final pinto ]
23 consumer: removed 1500000 recs from the pipe
24 consumer: 1500000 recs out of 1500000 recs in sorted order
25 Calling cleanup!
26 *****
27 n_nationkey: [13], n_name: [JORDAN], n_regionkey: [4], n_comment: [ic deposits are blithely about the carefully regular pa]
28 n_nationkey: [12], n_name: [JAPAN], n_regionkey: [2], n_comment: [ously. final, express gifts cajole a]
29 n_nationkey: [11], n_name: [IRAQ], n_regionkey: [4], n_comment: [nic deposits boost atop the quickly final requests? quickly regula]
30 n_nationkey: [10], n_name: [IRAN], n_regionkey: [4], n_comment: [efully alongside of the slyly final dependencies. ]
31 n_nationkey: [9], n_name: [INDONESIA], n_regionkey: [2], n_comment: [ slyly express asymptotes. regular deposits haggle slyly. carefully ironic hockey players sleep blith
ely. carefull]
32 n_nationkey: [8], n_name: [INDIA], n_regionkey: [2], n_comment: [ss excuses cajole slyly across the packages. deposits print around]
33 n_nationkey: [7], n_name: [GERMANY], n_regionkey: [3], n_comment: [l platelets. regular accounts x-ray: unusual, regular acco]
34 consumer: removed 25 recs from the pipe
35 consumer: 25 recs out of 25 recs in sorted order
36 Calling cleanup!
```

NORMAL tmp/output1.txt

text utf-8[unix] 482 words 100% 36/36 : 16



# GTests

Screenshot 1

```
<> ./gtest.out

** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: db/catalog
tpch files dir: tpch-dbgen/
heap files dir: bin/

[=====] Running 7 tests from 3 test cases.
[-----] Global test environment set-up.
[-----] 3 tests from DBFILETEST
[ RUN ] DBFILETEST.DBCreate
tpch file will be loaded from tpch-dbgen/supplier.tbl
EOF!
[ OK ] DBFILETEST.DBCreate (47 ms)
[ RUN ] DBFILETEST.DBOpen
[ OK ] DBFILETEST.DBOpen (0 ms)
[ RUN ] DBFILETEST.DBClose
[ OK ] DBFILETEST.DBClose (0 ms)
[-----] 3 tests from DBFILETEST (47 ms total)

[-----] 1 test from RUNGEN_DBSETUPTTEST
[ RUN ] RUNGEN_DBSETUPTTEST.DBSetup
[ OK ] RUNGEN_DBSETUPTTEST.DBSetup (0 ms)
[-----] 1 test from RUNGEN_DBSETUPTTEST (0 ms total)

[-----] 3 tests from TOURNAMENTTEST
[ RUN ] TOURNAMENTTEST.Playnum
[ OK ] TOURNAMENTTEST.Playnum (0 ms)
[ RUN ] TOURNAMENTTEST.Promote
[ OK ] TOURNAMENTTEST.Promote (0 ms)
[ RUN ] TOURNAMENTTEST.InvalidNumberOfPlayer
[ OK ] TOURNAMENTTEST.InvalidNumberOfPlayer (1 ms)
[-----] 3 tests from TOURNAMENTTEST (1 ms total)

[-----] Global test environment tear-down
[=====] 7 tests from 3 test cases ran. (48 ms total)
[ PASSED ] 7 tests.
[=====] Running 7 tests from 3 test cases.
[-----] Global test environment set-up.
[-----] 3 tests from DBFILETEST
[ RUN ] DBFILETEST.DBCreate
tpch file will be loaded from tpch-dbgen/partsupp.tbl
```

Screenshot 2

```
tpch file will be loaded from tpch-dbgen/partsupp.tbl
EOF!
[ OK ] DBFILETEST.DBCreate (4469 ms)
[ RUN ] DBFILETEST.DBOpen
[ OK ] DBFILETEST.DBOpen (1 ms)
[ RUN ] DBFILETEST.DBClose
[ OK ] DBFILETEST.DBClose (0 ms)
[-----] 3 tests from DBFILETEST (4470 ms total)

[-----] 1 test from RUNGEN_DBSETUPTTEST
[ RUN ] RUNGEN_DBSETUPTTEST.DBSetup
[ OK ] RUNGEN_DBSETUPTTEST.DBSetup (0 ms)
[-----] 1 test from RUNGEN_DBSETUPTTEST (0 ms total)

[-----] 3 tests from TOURNAMENTTEST
[ RUN ] TOURNAMENTTEST.Playnum
[ OK ] TOURNAMENTTEST.Playnum (0 ms)
[ RUN ] TOURNAMENTTEST.Promote
[ OK ] TOURNAMENTTEST.Promote (0 ms)
[ RUN ] TOURNAMENTTEST.InvalidNumberOfPlayer
[ OK ] TOURNAMENTTEST.InvalidNumberOfPlayer (2 ms)
[-----] 3 tests from TOURNAMENTTEST (2 ms total)

[-----] Global test environment tear-down
[=====] 7 tests from 3 test cases ran. (4472 ms total)
[ PASSED ] 7 tests.
[=====] Running 7 tests from 3 test cases.
[-----] Global test environment set-up.
[-----] 3 tests from DBFILETEST
[ RUN ] DBFILETEST.DBCreate
tpch file will be loaded from tpch-dbgen/part.tbl
EOF!
[ OK ] DBFILETEST.DBCreate (1090 ms)
[ RUN ] DBFILETEST.DBOpen
[ OK ] DBFILETEST.DBOpen (0 ms)
[ RUN ] DBFILETEST.DBClose
[ OK ] DBFILETEST.DBClose (0 ms)
[-----] 3 tests from DBFILETEST (1090 ms total)

[-----] 1 test from RUNGEN_DBSETUPTTEST
[ RUN ] RUNGEN_DBSETUPTTEST.DBSetup
[ OK ] RUNGEN_DBSETUPTTEST.DBSetup (0 ms)
[-----] 1 test from RUNGEN_DBSETUPTTEST (0 ms total)
```

# GTests (Contd.)

```
[-----] 3 tests from TOURNAMENTTEST
[ RUN      ] TOURNAMENTTEST.Playnum
[          OK ] TOURNAMENTTEST.Playnum (0 ms)
[ RUN      ] TOURNAMENTTEST.Promote
[          OK ] TOURNAMENTTEST.Promote (0 ms)
[ RUN      ] TOURNAMENTTEST.InvalidNumberOfPlayer
[          OK ] TOURNAMENTTEST.InvalidNumberOfPlayer (1 ms)
[-----] 3 tests from TOURNAMENTTEST (1 ms total)

[-----] Global test environment tear-down
[=====] 7 tests from 3 test cases ran. (1091 ms total)
[ PASSED ] 7 tests.
[=====] Running 7 tests from 3 test cases.
[-----] Global test environment set-up.
[-----] 3 tests from DBFILETEST
[ RUN      ] DBFILETEST.DBCreate
tpch file will be loaded from tpch-dbgen/nation.tbl
EOF!
[          OK ] DBFILETEST.DBCreate (1 ms)
[ RUN      ] DBFILETEST.DBOpen
[          OK ] DBFILETEST.DBOpen (0 ms)
[ RUN      ] DBFILETEST.DBClose
[          OK ] DBFILETEST.DBClose (0 ms)
[-----] 3 tests from DBFILETEST (1 ms total)

[-----] 1 test from RUNGEN_DBSETUPTEST
[ RUN      ] RUNGEN_DBSETUPTEST.DBSetup
[          OK ] RUNGEN_DBSETUPTEST.DBSetup (0 ms)
[-----] 1 test from RUNGEN_DBSETUPTEST (0 ms total)

[-----] 3 tests from TOURNAMENTTEST
[ RUN      ] TOURNAMENTTEST.Playnum
[          OK ] TOURNAMENTTEST.Playnum (0 ms)
[ RUN      ] TOURNAMENTTEST.Promote
[          OK ] TOURNAMENTTEST.Promote (0 ms)
[ RUN      ] TOURNAMENTTEST.InvalidNumberOfPlayer
[          OK ] TOURNAMENTTEST.InvalidNumberOfPlayer (1 ms)
[-----] 3 tests from TOURNAMENTTEST (1 ms total)

[-----] Global test environment tear-down
[=====] 7 tests from 3 test cases ran. (2 ms total)
[ PASSED ] 7 tests.
[=====] Running 7 tests from 3 test cases.
[-----] Global test environment set-up.
[src] 0:test 1:Makefile* 2:tpch- 3:git 4:try
```

Screenshot 3