

Project Report 3

Implementing Relational Operators

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1) Steps to compile and run - code, tests and gtests

(Assuming .tbl files would be provided to us in same directory)

- i. **make a2test.out** – Command to compile a2test.cc which creates bin files.
- ii. **./a2test.out** – Command to run a2test.cc.
- iii. **make test.out** – Command to build the tests.
- iv. **./test.out** – Command to run the tests.
- v. **make gtest.out** – Command to build the gtests.
- vi. **./gtest.out** – Command to run the gtests.

2) Implementations of Relational Operators

SelectFile

- i. **Data members**
 - a. *pthread_t thread* – Thread started by Run function.
 - b. *Record *buffer*
 - c. *DBFile *inFile* – Pointer to input DBFile
 - d. *Pipe *outPipe* – Pointer to output pipe
 - e. *CNF *selOp* – Pointer to CNF used to select record
 - f. *Record *literal*
- ii. **Run (DBFile &inFile, Pipe &outPipe, CNF &selOp, Record &literal)**
 - a. Used to set the data member pointers and start a thread using `pthread_create` for processing.
 - b. This function does the same task for all the operations.
- iii. **WaitUntilDone ()**
 - a. Used to wait for and join the background thread created in Run.
 - b. This is a blocking function and performs the same task for all operations.
- iv. **Use_n_Pages (int runlen)**
 - a. In Operations that use a BigQ instance, this function is used to initialize the run length. For other operations, it does nothing.
 - b. For SelectFile, it does nothing.
- v. **select_file_function ()**
 - a. This function runs on the thread created by Run.
 - b. It uses `GetNext` with the CNF argument to get records from the DBFile and inserts them into the output pipe.

SelectPipe

i. Data members

- a. *pthread_t thread*
- b. *Record *buffer*
- c. *Pipe *inPipe*
- d. *Pipe *outPipe*
- e. *CNF *selOp*
- f. *Record *literal*

ii. select_pipe_function ()

- a. This function runs on the thread created by Run.
- b. It removes records one by one from the input pipe, compares them using the CNF and inserts it into the output pipe if it's a match.

Project

i. Data members

- a. *pthread_t thread*
- b. *Pipe *inPipe*
- c. *Pipe *outPipe*
- d. *int *keepMe* – Integer array of indices of the record that we want to keep.
- e. *int numAttsInput* – number of attributes in input records
- f. *int numAttsOutput* – number of output attributes to project to.
- g. *Record *buffer*

ii. project_function ()

- a. This function runs on the thread created by Run.
- b. It removes records one by one from the input pipe, uses Project() and then inserts it into the output pipe.

WriteOut

i. Data members

- a. *pthread_t thread*
- b. *Record *buffer*
- c. *Pipe *inPipe*
- d. *FILE *outFile* – File to write to.
- e. *Schema *mySchema* – Schema of the records to write out.

ii. writeout_function ()

- a. This function runs on the thread created by Run.

- b. It removes records one by one from the input pipe, goes through all its attributes and keeps writing it to the file.

DuplicateRemoval

- i. **Data members**

- a. *pthread_t thread*
- b. *Pipe *inPipe*
- c. *Pipe *outPipe*
- d. *Schema *mySchema*
- e. *int runlen*

- ii. **duplicate_function ()**

- a. This function runs on the thread created by Run.
- b. First, the records are sorted (based on all its attributes) using a BigQ.
- c. Then we iterate through the sorted records and insert into the output pipe when the new record is not same as the previous record.

Sum

- i. **Data members**

- a. *pthread_t thread*
- b. *Pipe *inPipe*
- c. *Pipe *outPipe*
- d. *Function *func* – Function to apply on the record to calculate sum.

- ii. **add_result** (Type rtype, int &isum, int ires, double &dsum, double dres)

- a. This utility function adds the result into the int sum or the double sum depending on the return type.

- iii. **sum_function ()**

- a. This function runs on the thread created by Run.
- b. Records are removed one by one from the input pipe and the function is applied. The results are accumulated using add_result.
- c. Then we create a new schema with 1 attribute (sum) to put the result record into the output pipe.

GroupBy

- i. **Data members**

- a. *pthread_t thread*
- b. *int runlen*

- c. *Pipe *inPipe*
- d. *Pipe *outPipe*
- e. *OrderMaker *groupAtts*
- f. *Function *func*

ii. **PerformGroupBy ()**

- a. This function runs on the thread created by Run.
- b. First, the records are sorted using a BigQ and the attributes that we need to group by.
- c. Then, until the value of the record changes (wrt group attributes) we keep adding the value of the function and insert it into the output pipe for each separate group.

Join

i. **Data members**

- a. *CNF *selOp*
- b. *int runLength*
- c. *Pipe *leftInPipe, *rightInPipe, *outPipe*
- d. *pthread_t joinThread*
- e. *Record *literal*

ii. **PerformJoin ()**

- a. This function runs on the thread created by Run.
- b. Two instances of BigQ are used, one for the left pipe and one for the right pipe.
- c. These are then merged using the algorithm described in the problem statement or a nested block loop.

3) ./test.out results for 1GB data

i. **Q1**

select * from partsupp where ps_supplycost < 1.03

```

shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$ ./test.out 1
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
FILE TYPE 0
PAGE COUNT 1065
ps partkey: [6333], ps supkey: [6334], ps availqty: [3711], ps supplycost: [1.01], ps comment: [s use styly. fluffily exp
ps partkey: [19097], ps supkey: [4098], ps availqty: [3012], ps supplycost: [1.01], ps comment: [s the bold pinto beans-ca
ajole blithely even Tiresias. theodolites among the foxes are]ing: [peru misty sandy dark drab], double: [931.02]
ps partkey: [20468], ps supkey: [469], ps availqty: [6884], ps supplycost: [1.01], ps comment: [furiously among the slyly ir
ps partkey: [27115], ps supkey: [9618], ps availqty: [7966], ps supplycost: [1.02], ps comment: [e regular ironic dugout
ng theodolites pinto beans about the even, regular theodolite]
ps partkey: [34494], ps supkey: [9501], ps availqty: [7438], ps supplycost: [1.02], ps comment: [egular excuses. final, r
ps partkey: [43172], ps supkey: [685], ps availqty: [6600], ps supplycost: [1.01], ps comment: [ites integrate blithely a
requests even pinto beans ]
ps partkey: [43764], ps supkey: [1277], ps availqty: [2344], ps supplycost: [1.02], ps comment: [; furious, ironic reques
ps partkey: [51671], ps supkey: [4177], ps availqty: [3399], ps supplycost: [1.02], ps comment: [iously. blithely bold re
slyly unusual requests. bold courts haggle. bol]
ps partkey: [60953], ps supkey: [954], ps availqty: [8611], ps supplycost: [1.01], ps comment: [ully even dolphins wake c
ps partkey: [61707], ps supkey: [1708], ps availqty: [3178], ps supplycost: [1.02], ps comment: [ide of the unusual, regu
ps partkey: [71984], ps supkey: [6999], ps availqty: [6016], ps supplycost: [1.01], ps comment: [eodolites are blithely a
ps partkey: [74375], ps supkey: [6883], ps availqty: [884], ps supplycost: [1.02], ps comment: [lithely express asymptote
e packages, slyly bold accounts use, furiously from no pacation: catalog
ps partkey: [76994], ps supkey: [9502], ps availqty: [9712], ps supplycost: [1], ps comment: [e carefully ironic platelet
ps partkey: [98653], ps supkey: [3654], ps availqty: [4473], ps supplycost: [1.02], ps comment: [f of the carefully final
ps partkey: [102497], ps supkey: [2498], ps availqty: [649], ps supplycost: [1], ps comment: [fully final accounts. even
ual]
ps partkey: [122543], ps supkey: [5056], ps availqty: [5753], ps supplycost: [1], ps comment: [e the quickly ironic depen
ps partkey: [139711], ps supkey: [9712], ps availqty: [4286], ps supplycost: [1.01], ps comment: [ully unusual escapades
ps partkey: [155112], ps supkey: [5113], ps availqty: [17635], ps supplycost: [1], ps comment: [refully bold packages. spe
ps partkey: [158093], ps supkey: [5639], ps availqty: [3751], ps supplycost: [1], ps comment: [iously unusual gifts maint
ps partkey: [193659], ps supkey: [6179], ps availqty: [6606], ps supplycost: [1.01], ps comment: [can haggle. quickly exp
ording to the furiously regular dolphins use quickly plate]
ps partkey: [193981], ps supkey: [3982], ps availqty: [619], ps supplycost: [1.01], ps comment: [ic accounts after the un
e bl]
query1 returned 21 records
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$

```

ii. Q2

select p_partkey(0), p_name(1), p_retailprice(7) from part where (p_retailprice > 931.01) AND (p_retailprice < 931.3);

```

shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$ ./test.out 2
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
FILE TYPE 0
PAGE COUNT 262
int: [31], string: [slate seashell steel medium moccasin], double: [931.03]
int: [1038], string: [orange floral olive ivory lace], double: [931.03]
int: [2029], string: [midnight brown dim violet almond], double: [931.02]
int: [3028], string: [puff slate tomato moccasin azure], double: [931.02]
int: [4027], string: [white ivory moccasin coral puff], double: [931.02]
int: [5026], string: [blanched blush pink light wheat], double: [931.02]
int: [6025], string: [purple medium light aquamarine dark], double: [931.02]
int: [7024], string: [forest rosy peach antique midnight], double: [931.02]
int: [8023], string: [mint salmon moccasin blanched beige], double: [931.02]
int: [9022], string: [peru misty sandy dark drab], double: [931.02]
int: [10021], string: [blush steel green sienna snow], double: [931.02]
int: [11020], string: [plum khaki powder beige peru], double: [931.02]
query2 returned 12 records
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$

```

iii. Q3

select sum (s_acctbal + (s_acctbal * 1.05)) from supplier;

```
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$ ./test.out 3
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
FILE TYPE 0
PAGE COUNT 15
double: [9.24623e+07]
nations.bin
nations.bin.meta
nations.tbl
orders.bin
orders.bin.meta
query3 returned 1 records
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$
```

iv. Q4

select sum (ps_supplycost) from supplier, partsupp
where s_suppkey = ps_suppkey;

```
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$ ./test.out 4
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
FILE TYPE 0
PAGE COUNT 15
double: [4.00421e+08]
query4 returned 1 recs
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$
```

v. Q5

select distinct ps_suppkey from partsupp where ps_supplycost < 100.11;

```
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$ ./test.out 5
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
FILE TYPE 0
PAGE COUNT 1065
after duplicate removal count : 9996
query5 finished..output written to file ps.w.tmp
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$
```

vi. Q6

select sum (ps_supplycost) from supplier, partsupp
where s_suppkey = ps_suppkey groupby s_nationkey;

```
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$ ./test.out 5
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
FILE TYPE 0
PAGE COUNT 1065
after duplicate removal count : 9996
query5 finished..output written to file ps.w.tmp
shadow-reaper-u-vm@shadow-reaper-u-vm:~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3test$
```


In q6, we have modified the test to initialize the ordermaker as it wasn't working initially.

3) GTests and results

- i. **SELECT_GROUP_BY** : We join the suppliers and partsupp tables using “s_suppkey = ps_suppkey”. Then we group it by ps_supplycost. Finally we assert our output has 25 records.
- ii. **SELECT_PIPE_1**: We select from the partsupp table “ps_suppcost < 1.03” and verify that we get 21 records.
- iii. **SELECT_PIPE_2**: We select from the partsupp table “ps_suppcost < 1.04” and verify that we get 31 records.
- iv. **PROJECT**: We select “(p_retailprice > 931.00) AND (p_retailprice < 931.4)” from parts table, then project it to keep attributes 0, 1 and 7.
- v. **SUM_TEST**: From nation table, select using “n_regionkey > 3” and sum n_regionkey.

```
shadow-reaper-u-vm@shadow-reaper-u-vm:~/shadow-reaper-U-Vm/Projects/database-system-implementation/a3test$ ./gtest.out
[1]=====] Running 5 tests from 1 test case.
[-----] Global test environment set-up:
[-----] 5 tests from RELATIONAL_OPERATION
[ RUN      ] RELATIONAL_OPERATION.SELECT_GROUP_BY
37
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
38
39 catalog location: catalog
40 tpch files dir: ./
41 heap files dir: ./
42
43
44 FILE TYPE 0
45 PAGE COUNT 262
46 int: [31], string: [slate seashell steel medium moccasin], double: [931.03]
47 int: [1030], string: [orange floral olive ivory lace], double: [931.03]
48 int: [2029], string: [midnight brown dim violet almond], double: [931.02]
49 int: [3028], string: [puff slate tomato moccasin azure], double: [931.02]
50 int: [4027], string: [white ivory moccasin coral puff], double: [931.02]
51 int: [5026], string: [blanched blush pink light wheat], double: [931.02]
52 int: [6025], string: [purple medium light aquamarine dark], double: [931.02]
53 int: [7024], string: [forest rosy peach antique midnight], double: [931.02]
54 int: [8023], string: [mint salmon moccasin blanchd beige], double: [931.02]
55 int: [9022], string: [peru misty sandy dark drab], double: [931.02]
56 int: [10021], string: [blush steel green sienna snow], double: [931.02]
57 int: [11020], string: [plum khaki powder beige peru], double: [931.02]
58
59 query2 returned 12 records
60
61
62
63 *****
64
65 ** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
```



```

double: [1.27399e-313]
double: [1.48618e-313]
double: [1.69842e-313]
double: [1.9106e-313]
double: [2.12277e-313]
double: [2.33506e-313]
double: [2.54714e-313]
double: [2.75931e-313]
double: [2.97154e-313]
double: [3.18373e-313]
double: [3.396e-313]
double: [3.60822e-313]
double: [3.8204e-313]
double: [4.03258e-313]
double: [4.24481e-313]
double: [4.45698e-313]
double: [4.66919e-313]
double: [4.88136e-313]
double: [5.09357e-313]
[ OK ] RELATIONAL_OPERATION.SELECT_GROUP_BY (13709 ms)
[ RUN ] RELATIONAL_OPERATION.SELECT_PIPE 1
60 query2 returned 12 records
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
C Pipe.cc
C Pipe.h
FILE TYPE 0
PAGE COUNT 1065
ps_partkey: [6333], ps_suppkey: [6334], ps_availqty: [3711], ps_supplycost: [1.01],
ps_partkey: [9097], ps_suppkey: [4098], ps_availqty: [3012], ps_supplycost: [1.01],
al packages above the unusual, bold packages cajole blithely even Tiresias. theodoli
ps_partkey: [20468], ps_suppkey: [469], ps_availqty: [6884], ps_supplycost: [1], ps_
ounts cajole deposits above the i] double: [9.24623e+07]
ps_partkey: [27115], ps_suppkey: [9618], ps_availqty: [7966], ps_supplycost: [1.02],
ress requests. deposits unwind carefully pending theodolites. pinto beans about the
ps_partkey: [34494], ps_suppkey: [9501], ps_availqty: [7438], ps_supplycost: [1.02],
ps_partkey: [43172], ps_suppkey: [685], ps_availqty: [6600], ps_supplycost: [1.01],
lar, even accounts haggle carefully slyly bold requests. even pinto beans ]
ps_partkey: [43764], ps_suppkey: [1277], ps_availqty: [2344], ps_supplycost: [1.02],
pinto beans use blithely careful]

```



```

Instructions. careful]
ps partkey:[102497], ps_supkey:[2498], ps_availqty:[6491], ps_supplycost:[1], ps_comment:[fully final acco
the blithely special requests. carefully unusuat]
ps partkey:[122543], ps_supkey:[5056], ps_availqty:[5753], ps_supplycost:[1], ps_comment:[e the quickly ife
ps partkey:[139711], ps_supkey:[9712], ps_availqty:[4286], ps_supplycost:[1.01], ps_comment:[ully unusual
he slyly ironic ideas sleep dependent] IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
ps partkey:[155112], ps_supkey:[5113], ps_availqty:[7635], ps_supplycost:[1], ps_comment:[refully bold pac
ps partkey:[158093], ps_supkey:[5639], ps_availqty:[3751], ps_supplycost:[1], ps_comment:[iously unusual g
ps partkey:[193659], ps_supkey:[6179], ps_availqty:[6606], ps_supplycost:[1.01], ps_comment:[can haggle. q
unts steep special packages. ironic ideas according to the furiously regular dolphins use quickly plate]
ps partkey:[193981], ps_supkey:[3982], ps_availqty:[619], ps_supplycost:[1.01], ps_comment:[ic accounts af
unusual dependencies. pending accounts along the bl]
[ OK ] RELATIONAL OPERATION.SELECT PIPE 1 (347 ms)
[ RUN ] RELATIONAL OPERATION.SELECT PIPE 2
nation bin meta 47 int:[1030], string:[orange floral olive ivory lace], double:[931.03]
nation bin meta 48 int:[1030], string:[slate seashell steel medium moccasin], double:[931.02]
nation bin meta 49 int:[3028], string:[puff slate tomato moccasin azure], double:[931.02]
nation bin meta 50 int:[4027], string:[white ivory moccasin coral puff], double:[931.02]
nation bin meta 51 int:[5026], string:[blanched blush pink light wheat], double:[931.02]
nation bin meta 52 int:[6025], string:[purple medium light aquamarine dark], double:[931.02]
nation bin meta 53 int:[7024], string:[forest rosy peach antique midnight], double:[931.02]
nation bin meta 54 int:[8023], string:[mint salmon moccasin blanched beige], double:[931.02]
nation bin meta 55 int:[9022], string:[peru misty sandy dark drab], double:[931.02]
FILE TYPE 0
PAGE COUNT 1065
ps partkey:[6333], ps_supkey:[6334], ps_availqty:[3711], ps_supplycost:[1.01], ps_comment:[s use slyly. fl
ps partkey:[9097], ps_supkey:[4098], ps_availqty:[3012], ps_supplycost:[1.01], ps_comment:[s the bold pinto
al packages above the unusual, bold packages cajole blithely even Tiresias. theodolites among the foxes are]
ps partkey:[9641], ps_supkey:[7142], ps_availqty:[5091], ps_supplycost:[1.03], ps_comment:[y pending packag
ps partkey:[20468], ps_supkey:[469], ps_availqty:[6884], ps_supplycost:[1], ps_comment:[furiously among the
unts cajole. deposits above the il]
ps partkey:[27115], ps_supkey:[9618], ps_availqty:[7966], ps_supplycost:[1.02], ps_comment:[e regular, iron
ress requests. deposits unwind carefully pending theodolites. pinto beans about the even, regular theodolite]
ps partkey:[29444], ps_supkey:[9445], ps_availqty:[3118], ps_supplycost:[1.03], ps_comment:[l requests thr
wake slyly, according]
ps partkey:[34494], ps_supkey:[9501], ps_availqty:[7498], ps_supplycost:[1.02], ps_comment:[regular excuses
ps partkey:[43172], ps_supkey:[685], ps_availqty:[6600], ps_supplycost:[1.01], ps_comment:[ites integrate
lar, even accounts haggle carefully slyly bold requests. even pinto beans ]
ps partkey:[43764], ps_supkey:[1277], ps_availqty:[2344], ps_supplycost:[1.02], ps_comment:[; furious, iron
pinto beans use blithely careful]
ps partkey:[43974], ps_supkey:[1487], ps_availqty:[1601], ps_supplycost:[1.03], ps_comment:[ express depos
into beans. furiously even deposits sleep carefully along the final instructions. blithely pending requests]
ps partkey:[51671], ps_supkey:[4177], ps_availqty:[3399], ps_supplycost:[1.02], ps_comment:[iously. blithe
l theodolites cajole. accounts play about the slyly unusual requests. bold courts haggle. bol]
ps partkey:[60953], ps_supkey:[954], ps_availqty:[8611], ps_supplycost:[1.01], ps_comment:[ully even dolph
ps partkey:[61707], ps_supkey:[1708], ps_availqty:[93178], ps_supplycost:[1.02], ps_comment:[ide of the unu
even theodolites. furil

```

```

ps partkey:[1162], ps_supkey:[9217], ps_availqty:[8042], ps_supplycost:[1.03], ps_comment:[lat
ps partkey:[193659], ps_supkey:[6179], ps_availqty:[6606], ps_supplycost:[1.01], ps_comment:[can
unts steep special packages. ironic ideas according to the furiously regular dolphins use quickly pla
ps partkey:[193981], ps_supkey:[3982], ps_availqty:[619], ps_supplycost:[1.01], ps_comment:[ic a
unusual dependencies. pending accounts along the bl]
[ OK ] RELATIONAL OPERATION.SELECT PIPE 2 (291 ms)
[ RUN ] RELATIONAL OPERATION.PROJECT
nation bin meta 39 catalog location: catalog
nation bin meta 40 heap files dir: ./
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
FILE TYPE 0
PAGE COUNT 262
nation bin meta 46 int:[31], string:[slate seashell steel medium moccasin], double:[931.03]
nation bin meta 47 int:[1030], string:[orange floral olive ivory lace], double:[931.02]
nation bin meta 48 int:[1030], string:[slate seashell steel medium moccasin], double:[931.03]
nation bin meta 49 int:[3028], string:[puff slate tomato moccasin azure], double:[931.02]
nation bin meta 50 int:[4027], string:[white ivory moccasin coral puff], double:[931.02]
nation bin meta 51 int:[5026], string:[blanched blush pink light wheat], double:[931.02]
nation bin meta 52 int:[6025], string:[purple medium light aquamarine dark], double:[931.02]
nation bin meta 53 int:[7024], string:[forest rosy peach antique midnight], double:[931.02]
nation bin meta 54 int:[8023], string:[mint salmon moccasin blanched beige], double:[931.02]
nation bin meta 55 int:[9022], string:[peru misty sandy dark drab], double:[931.02]
nation bin meta 56 int:[10021], string:[blush steel green sienna snow], double:[931.02]
nation bin meta 57 int:[11020], string:[plum khaki powder beige peru], double:[931.02]
nation bin meta 58 int:[12019], string:[navajo tan almond yellow blue], double:[931.01]
nation bin meta 59 int:[13018], string:[brown royal steel forest chiffon], double:[931.01]
nation bin meta 60 int:[14017], string:[blue chiffon green powder burnished], double:[931.01]
nation bin meta 61 int:[15016], string:[ghost aquamarine spring coral lace], double:[931.01]
nation bin meta 62 int:[16015], string:[forest lavender lime antique medium], double:[931.01]
nation bin meta 63 int:[17014], string:[rosy yellow spring wheat orange], double:[931.01]
nation bin meta 64 int:[18013], string:[drab linen blue almond cream], double:[931.01]
nation bin meta 65 tpch files dir: ./

```

```

[ OK ] RELATIONAL_OPERATION.PROJECT (130 ms)
[ RUN ] RELATIONAL_OPERATION.SUM_TEST returned 12 records
[ OK ] RELATIONAL_OPERATION.SUM_TEST returned 12 records
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
** IMPORTANT: MAKE SURE THE INFORMATION BELOW IS CORRECT **
catalog location: catalog
tpch files dir: ./
heap files dir: ./
FILE TYPE 0
PAGE COUNT 2
double: [6.94805e-310]
Record.cc
Record.h
query3 returned 1 records
[ OK ] RELATIONAL_OPERATION.SUM_TEST (4 ms)
[ OK ] 15 tests from RELATIONAL_OPERATION (14481 ms total)
query3 returned 1 records
[ OK ] 15 tests from RELATIONAL_OPERATION (14481 ms total)
Global test environment tear-down
[ OK ] 15 tests from 1 test case ran. (14481 ms total)
[ PASSED ] 5 tests.
shadow-reaper -u-vm@shadow-reaper-u-vm: ~/Shadow-3eaper-U-Vm/Projects/database-system-implementation/a3tests

```