Lab 8

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1. Import database from “largeRelationsInsertFile.sql”

```
dbms@dbms-VirtualBox:~/lab8$ sudo mysql -u root -p university -h localhost<large
RelationsInsertFile.sql
Enter password:
```

2. Check the status of student table.

```
MariaDB [university]> show table status like 'student';
+---------+--------+---------+------------+------+----------------+-------------+-----------------+--------------+-----------+----------------+---------------------+-------------+------------+----
-------------+----------+----------------+---------+
| Name    | Engine | Version | Row_format | Rows | Avg_row_length | Data_length | Max_data_length | Index_length | Data_free | Auto_increment | Create_time         | Update_time | Check_time | Col
lation          | Checksum | Create_options | Comment |
+---------+--------+---------+------------+------+----------------+-------------+-----------------+--------------+-----------+----------------+---------------------+-------------+------------+----
-------------+----------+----------------+---------+
| student | InnoDB |      10 | Compact    | 2000 |             73 |      147456 |               0 |        81920 |         0 |           NULL | 2019-03-05 22:22:04 | NULL        | NULL       | utf
8mb4_general_ci |     NULL |                |         |
+---------+--------+---------+------------+------+----------------+-------------+-----------------+--------------+-----------+----------------+---------------------+-------------+------------+----
-------------+----------+----------------+---------+
1 row in set (0.00 sec)

MariaDB [university]>
```

3. Profiler for MariaDB

a. Set profiling option on

```
MariaDB [university]> select @@profiling;
+-------------+
| @@profiling |
+-------------+
|           0 |
+-------------+
1 row in set (0.00 sec)

MariaDB [university]> set @@profiling=1;
Query OK, 0 rows affected (0.00 sec)

MariaDB [university]> select @@profiling;
+-------------+
| @@profiling |
+-------------+
|           1 |
+-------------+
1 row in set (0.01 sec)

MariaDB [university]>
```

b. Show profile after execution of query to fetch details of students from student table whose name is ‘wood’.

```
MariaDB [university]> show profiles;
+----------+------------+--------------------+
| Query_ID | Duration   | Query              |
+----------+------------+--------------------+
|        1 | 0.00020251 | select @@profiling |
+----------+------------+--------------------+
1 row in set (0.01 sec)

MariaDB [university]> select from student where name='wood';
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual tha
 1
MariaDB [university]> select *from student where name='wood';
+-------+------+------------+----------+
| ID    | name | dept_name  | tot_cred |
+-------+------+------------+----------+
| 33791 | Wood | Civil Eng. |       92 |
| 39876 | Wood | Accounting |       14 |
| 62054 | Wood | Mech. Eng. |       13 |
| 96085 | Wood | Accounting |       70 |
+-------+------+------------+----------+
4 rows in set (0.00 sec)

MariaDB [university]> show profiles;
+----------+------------+---------------------------------------+
| Query_ID | Duration   | Query                                 |
+----------+------------+---------------------------------------+
|        1 | 0.00020251 | select @@profiling                    |
|        2 | 0.00008079 | select from student where name='wood' |
|        3 | 0.00157422 | select *from student where name='wood' |
+----------+------------+---------------------------------------+
3 rows in set (0.00 sec)
```

c. What is bottleneck for this query ? [Which task required most of the time]

```
MariaDB [university]> show profile for query 3;
+----------------------------------+----------+
| Status                           | Duration |
+----------------------------------+----------+
| starting                         | 0.000026 |
| Waiting for query cache lock     | 0.000005 |
| init                             | 0.000004 |
| checking query cache for query   | 0.000046 |
| checking permissions             | 0.000007 |
| Opening tables                   | 0.000022 |
| After opening tables             | 0.000007 |
| System lock                      | 0.000005 |
| Table lock                       | 0.000007 |
| Waiting for query cache lock     | 0.000022 |
| init                             | 0.000028 |
| optimizing                       | 0.000032 |
| statistics                       | 0.000026 |
| preparing                        | 0.000019 |
| executing                        | 0.000005 |
| Sending data                     | 0.001213 |
| end                              | 0.000010 |
| query end                        | 0.000008 |
| closing tables                   | 0.000004 |
| Unlocking tables                 | 0.000012 |
| freeing items                    | 0.000008 |
| updating status                  | 0.000006 |
| Waiting for query cache lock     | 0.000003 |
| updating status                  | 0.000029 |
| Waiting for query cache lock     | 0.000004 |
| updating status                  | 0.000003 |
| storing result in query cache    | 0.000011 |
| cleaning up                      | 0.000004 |
+----------------------------------+----------+
```

Sending data takes maximum time

d. Show list of processes running in your DB

```
MariaDB [university]> show processlist;
+----+------+-----------+------------+---------+------+-------+------------------+----------+
| Id | User | Host      | db         | Command | Time | State | Info             | Progress |
+----+------+-----------+------------+---------+------+-------+------------------+----------+
|  7 | root | localhost | university | Query   |    0 | init  | show processlist |    0.000 |
+----+------+-----------+------------+---------+------+-------+------------------+----------+
1 row in set (0.01 sec)

MariaDB [university]>
```

4. Change indexing and check performance

a. List all the storage engines . Which one is default? Find out which storage engine support hash index.

```
MariaDB [university]> SHOW ENGINES;
+--------------------+---------+----------------------------------------------------------------------------------------------------+--------------+------+------------+
| Engine             | Support | Comment                                                                                            | Transactions | XA   | Savepoints |
+--------------------+---------+----------------------------------------------------------------------------------------------------+--------------+------+------------+
| MRG_MyISAM         | YES     | Collection of identical MyISAM tables                                                              | NO           | NO   | NO         |
| CSV                | YES     | Stores tables as CSV files                                                                         | NO           | NO   | NO         |
| MEMORY             | YES     | Hash based, stored in memory, useful for temporary tables                                          | NO           | NO   | NO         |
| MyISAM             | YES     | Non-transactional engine with good performance and small data footprint                            | NO           | NO   | NO         |
| SEQUENCE           | YES     | Generated tables filled with sequential values                                                     | YES          | NO   | YES        |
| Aria               | YES     | Crash-safe tables with MyISAM heritage                                                             | NO           | NO   | NO         |
| PERFORMANCE_SCHEMA | YES     | Performance Schema                                                                                 | NO           | NO   | NO         |
| InnoDB             | DEFAULT | Percona-XtraDB, Supports transactions, row-level locking, foreign keys and encryption for tables   | YES          | YES  | YES        |
+--------------------+---------+----------------------------------------------------------------------------------------------------+--------------+------+------------+
8 rows in set (0.00 sec)

MariaDB [university]>
```

InnoDB is default.Memory supports hashing.

b. Create a table takes_hash , cloned from takes table but use <ENGINE> as storage engine where <ENGINE> support hash index. Create an hash index ‘take_hash_gr’ on grade of table t akes_hash

```
Database changed
MariaDB [university]> create table takes_hash engine=MEMORY as select *from take
s;
Query OK, 30000 rows affected (0.05 sec)
Records: 30000  Duplicates: 0  Warnings: 0

MariaDB [university]>
```

```
MariaDB [university]> create index take_hash_gr using hash on takes_hash(grade);
Query OK, 30000 rows affected (0.03 sec)
Records: 30000  Duplicates: 0  Warnings: 0

MariaDB [university]> show index from takes_hash;
+------------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| Table      | Non_unique | Key_name    | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment |
+------------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| takes_hash |          1 | take_hash_gr |            1 | grade       | NULL      |           9 |     NULL | NULL   | YES  | HASH       |         |               |
+------------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
1 row in set (0.02 sec)

MariaDB [university]>
```

c. Show the current default index present in takes . If you try to create an hash index ‘take_gr’ on grade attribute of t akes . What will happen? [check what kind of indexes are there in takes table and what is the type of ‘take_gr’]. Report your Observations.

```
MariaDB [university]> show index from takes;
+-------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| Table | Non_unique | Key_name | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment |
+-------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| takes |          0 | PRIMARY  |            1 | ID          | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY  |            2 | course_id   | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY  |            3 | sec_id      | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY  |            4 | semester    | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY  |            5 | year        | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id |           1 | course_id   | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id |           2 | sec_id      | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id |           3 | semester    | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id |           4 | year        | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
+-------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
9 rows in set (0.00 sec)

MariaDB [university]> create index take_gr using hash on takes(grade);
Query OK, 0 rows affected (0.16 sec)
Records: 0  Duplicates: 0  Warnings: 0

MariaDB [university]> show index from takes;
+-------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| Table | Non_unique | Key_name | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment |
+-------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| takes |          0 | PRIMARY  |            1 | ID          | A         |        4517 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY  |            2 | course_id   | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY  |            3 | sec_id      | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY  |            4 | semester    | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY  |            5 | year        | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id |           1 | course_id   | A         |         170 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id |           2 | sec_id      | A         |         200 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id |           3 | semester    | A         |         200 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id |           4 | year        | A         |         200 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | take_gr  |            1 | grade       | A         |          18 |     NULL | NULL   | YES  | BTREE      |         |               |
+-------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
10 rows in set (0.01 sec)

MariaDB [university]>
```

Index take_gr is created with index type Btree.

d. Compare the performance of following SQL query in both table takes and takes_hash “ select * from <table_name> where grade like '%C% '. Report your observation/

```
MariaDB [university]> show profiles;
+----------+------------+-------------------------------------------------+
| Query_ID | Duration   | Query                                           |
+----------+------------+-------------------------------------------------+
|        1 | 0.00184018 | select *from takes_hash where grade like '%C%' |
|        2 | 0.00181241 | select *from takes where grade like '%C%'      |
+----------+------------+-------------------------------------------------+
2 rows in set (0.00 sec)

MariaDB [university]>
```

Table takes _hash takes more than table takes because of hashing index in takes_hash table.on bigger table hash will perform better.

e. Try to create an unique index on grade of takes. Report your observation

```
MariaDB [university]> show profiles;
+----------+------------+-------------------------------------------------+
| Query_ID | Duration   | Query                                           |
+----------+------------+-------------------------------------------------+
|        1 | 0.00184018 | select *from takes_hash where grade like '%C%' |
|        2 | 0.00181241 | select *from takes where grade like '%C%'      |
+----------+------------+-------------------------------------------------+
2 rows in set (0.00 sec)

MariaDB [university]> create unique index un_takes_gr on takes(grade);
ERROR 1062 (23000): Duplicate entry 'B+' for key 'un_takes_gr'
MariaDB [university]>
```

B+ is value in not unique . it has multiple values.so we are getting error.

f. Create an composite index on ID and course_id in takes

```
MariaDB [university]> create  index id_course_id on takes(ID,course_id);
Query OK, 0 rows affected (0.11 sec)
Records: 0  Duplicates: 0  Warnings: 0

MariaDB [university]>
```

g. Check the present indexes in takes

```
MariaDB [university]> show  index from takes;
+-------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| Table | Non_unique | Key_name    | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment |
+-------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| takes |          0 | PRIMARY     |            1 | ID          | A         |        4517 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY     |            2 | course_id   | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY     |            3 | sec_id      | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY     |            4 | semester    | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          0 | PRIMARY     |            5 | year        | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id   |            1 | course_id   | A         |         170 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id   |            2 | sec_id      | A         |         200 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id   |            3 | semester    | A         |         200 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | course_id   |            4 | year        | A         |         200 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | take_gr     |            1 | grade       | A         |          18 |     NULL | NULL   | YES  | BTREE      |         |               |
| takes |          1 | id_course_id |            1 | ID          | A         |        4517 |     NULL | NULL   |      | BTREE      |         |               |
| takes |          1 | id_course_id |            2 | course_id   | A         |       31623 |     NULL | NULL   |      | BTREE      |         |               |
+-------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
12 rows in set (0.00 sec)

MariaDB [university]>
```

5. Physical level parameter

a. Check the data directory

```
MariaDB [university]> select @@datadir;
+-----------------+
| @@datadir       |
+-----------------+
| /var/lib/mysql/ |
+-----------------+
1 row in set (0.00 sec)

MariaDB [university]>
```

b. Create a test database, and a table candidates with columns id and name. Insert values (1,tom),(2,jerry). Check the files for candidates.

```
MariaDB [university]> create database test;
Query OK, 1 row affected (0.00 sec)

MariaDB [university]> use test;
Database changed
MariaDB [test]> create table candidates
    -> (id int not null,
    -> name varchar(10) not null,
    -> primary key(id));
Query OK, 0 rows affected (0.02 sec)

MariaDB [test]> insert into candidates values('1','tom');
Query OK, 1 row affected (0.17 sec)

MariaDB [test]> insert into candidates values('2','jerry');
Query OK, 1 row affected (0.02 sec)

MariaDB [test]>
```

```
root@dbms-VirtualBox:/home/dbms# cd /var/lib/mysql/test/
root@dbms-VirtualBox:/var/lib/mysql/test# ls
candidates.frm  candidates.ibd  db.opt  places.frm  places.ibd  view_loc.frm
root@dbms-VirtualBox:/var/lib/mysql/test#
```

c. Change the location of storage and create table places with columns city and country. Insert two records. Check the files for places.

```
Database changed
MariaDB [test]> create table places
    -> (city varchar(10) not null,
    -> country varchar(10) not null,
    -> primary key(city));
Query OK, 0 rows affected (0.18 sec)

MariaDB [test]> insert into places values('New Delhi','India');
Query OK, 1 row affected (0.01 sec)

MariaDB [test]> insert into places values('Carlifornia','USA');
Query OK, 1 row affected, 1 warning (0.00 sec)

MariaDB [test]> select *from places;
+------------+---------+
| city       | country |
+------------+---------+
| Carliforni | USA     |
| New Delhi  | India   |
+------------+---------+
2 rows in set (0.00 sec)
```

d. Create a view view_location by merging candidates and places tables side by side that is four columns and matching the records with the order of input. Check the location of the view, and how it is stored. Compare the size of files corresponding to views and tables.

```
drop view if exists view_location;
create view view_location as
(select A.id,A.name,B.city,B.country
from(select candidates.*,row_number() over(order by id)
as seqnum from candidates) as A join(select places.*,row_number() over(order by city) as
seqnum from places) as B on A.seqnum=B.seqnum);
```

```
MariaDB [test]> select *from view_location;
+----+-------+--------+---------+
| id | name  | city   | country |
+----+-------+--------+---------+
|  1 | tom   | Delhi  | India   |
|  2 | jerry | London | England |
+----+-------+--------+---------+
2 rows in set (0.001 sec)
```

```
root@baskey:~# cd /var/lib/mysql/test
root@baskey:/var/lib/mysql/test# ls -l
total 208
-rw-rw---- 1 mysql mysql   955 Mar  5 18:14 candidates.frm
-rw-rw---- 1 mysql mysql 98304 Mar  5 18:15 candidates.ibd
-rw-rw---- 1 mysql mysql    65 Mar  5 18:13 db.opt
-rw-rw---- 1 mysql mysql   966 Mar  5 18:16 places.frm
-rw-rw---- 1 mysql mysql 98304 Mar  5 18:17 places.ibd
-rw-rw---- 1 mysql mysql  1494 Mar  5 18:26 view_location.frm
root@baskey:/var/lib/mysql/test#
```

Size of the views is smaller than size of tables.

e. Create a trigger check_city that will update entries for cities to Proper casing (that is palakkad -> Palakkad). Check the location where this trigger is created, and the information is stored about the trigger with the table.

```
drop trigger if exists check_city;
DELIMITER $$
create trigger check_city
before insert on places for each row
begin
set @atemp=SUBSTRING(NEW.city,1,1);
set @atemp=UCASE(@atemp);
set @btemp=SUBSTRING(NEW.city,2);
set @ctemp=CONCAT(@atemp,@btemp);
set NEW.city=@ctemp;
end$$
DELIMITER ;
```

```
Database changed
MariaDB [test]> insert into places values ('palakkad','india')
    -> ;
Query OK, 1 row affected (0.09 sec)

MariaDB [test]> select *from places;
+------------+---------+
| city       | country |
+------------+---------+
| Carliforni | USA     |
| New Delhi  | India   |
| Palakkad   | india   |
+------------+---------+
3 rows in set (0.00 sec)

MariaDB [test]>
```

f. Check the following system variables

i.Default storage engine

```
MariaDB [test]> show global variables like '%storage_engine%';
+-------------------------------+---------+
| Variable_name                 | Value   |
+-------------------------------+---------+
| default_storage_engine        | InnoDB  |
| default_tmp_storage_engine    |         |
| enforce_storage_engine        |         |
| storage_engine                | InnoDB  |
+-------------------------------+---------+
4 rows in set (0.002 sec)
```

ii.Buffer size

```
MariaDB [test]> show global variables like '%buffer_size%';
+-------------------------------+-----------+
| Variable_name                 | Value     |
+-------------------------------+-----------+
| aria_pagecache_buffer_size    | 134217728 |
| aria_sort_buffer_size         | 268434432 |
| bulk_insert_buffer_size       | 16777216  |
| innodb_log_buffer_size        | 8388608   |
| innodb_sort_buffer_size       | 1048576   |
| join_buffer_size              | 262144    |
| key_buffer_size               | 134217728 |
| mrr_buffer_size               | 262144    |
| myisam_sort_buffer_size       | 536870912 |
| preload_buffer_size           | 32768     |
| read_buffer_size              | 2097152   |
| read_rnd_buffer_size          | 1048576   |
| sort_buffer_size              | 4194304   |
+-------------------------------+-----------+
```

iii.Change the buffer size half of current buffer size.

6. [B] Open question: Show something interesting by yourself regarding physical level of MariaDB. Explain what you have shown, and the significance of it. Some examples:

a. Partitioning big tables for faster access

b. Copying tables through files without going through sql

c. Checking logs for executed sql queries

d. ...