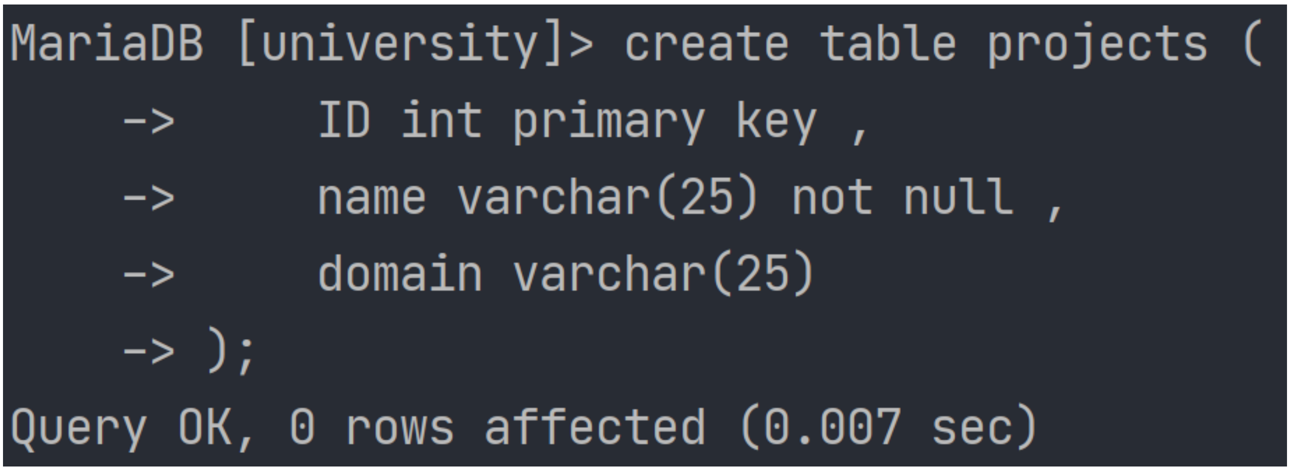
CS3120 Database Management Systems Laboratory

Assignment – 5

1.

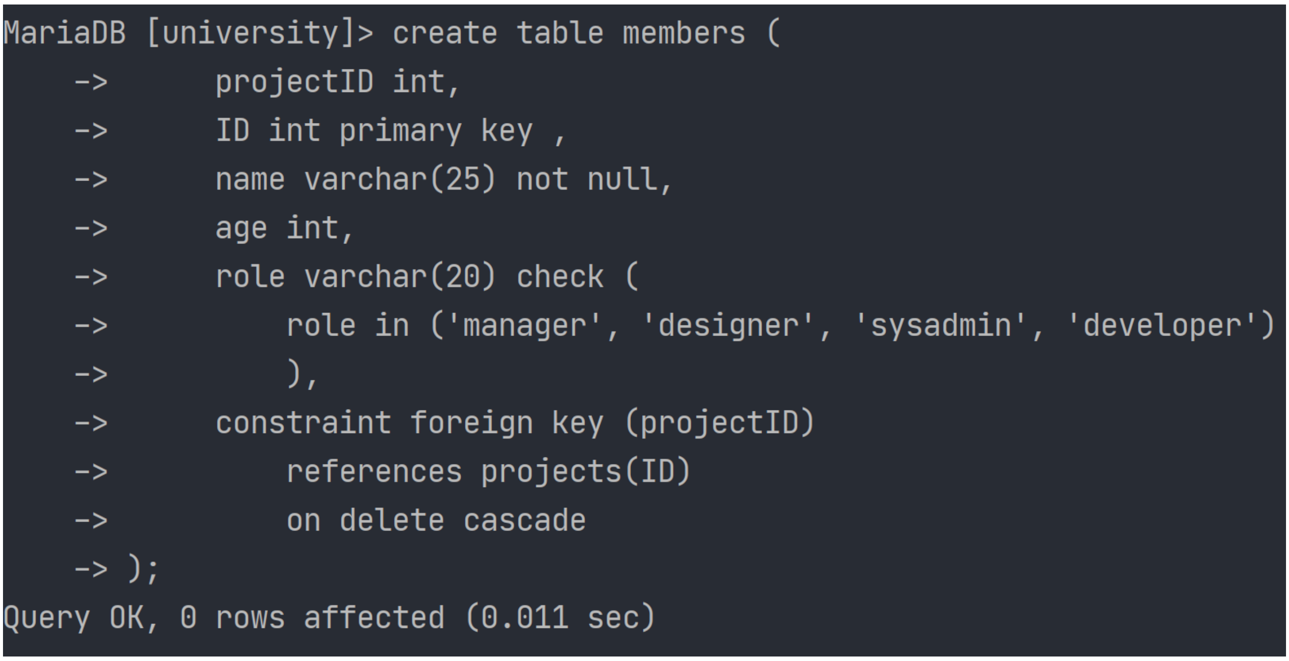
1.1 Create two tables with table 1 as referenced table and table 2 as referencing table.

Projects (Table 1)



```
MariaDB [university]> create table projects (
    ->      ID int primary key ,
    ->      name varchar(25) not null ,
    ->      domain varchar(25)
    -> );
Query OK, 0 rows affected (0.007 sec)
```

Members (Table 2)

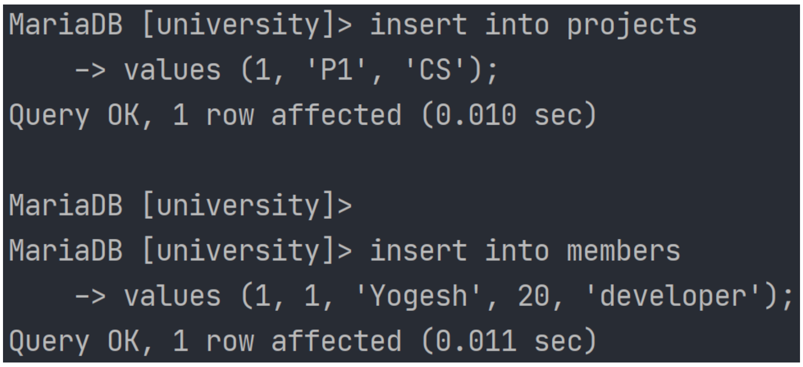


```
MariaDB [university]> create table members (
    ->      projectID int,
    ->      ID int primary key ,
    ->      name varchar(25) not null,
    ->      age int,
    ->      role varchar(20) check (
    ->          role in ('manager', 'designer', 'sysadmin', 'developer')
    ->          ),
    ->      constraint foreign key (projectID)
    ->          references projects(ID)
    ->          on delete cascade
    -> );
Query OK, 0 rows affected (0.011 sec)
```

1.2 Insert values in two tables and show two examples of all integrity constraint error.

Inserting Values (without errors):

One value for each table.

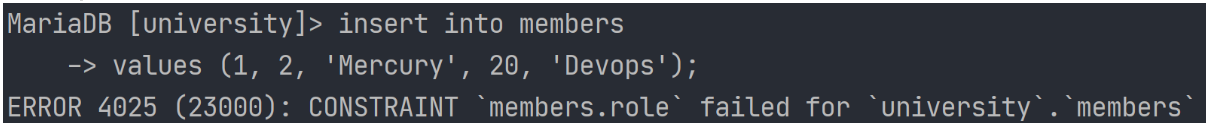


```
MariaDB [university]> insert into projects
    -> values (1, 'P1', 'CS');
Query OK, 1 row affected (0.010 sec)

MariaDB [university]>
MariaDB [university]> insert into members
    -> values (1, 1, 'Yogesh', 20, 'developer');
Query OK, 1 row affected (0.011 sec)
```

Constraints

1. **Domain Constraint:**

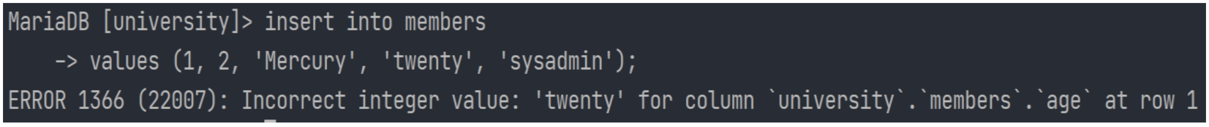
Example 1:



```
MariaDB [university]> insert into members
    -> values (1, 2, 'Mercury', 20, 'Devops');
ERROR 4025 (23000): CONSTRAINT `members.role` failed for `university`.`members`
```

Since Devops in not part of allowed roles.

Example 2:

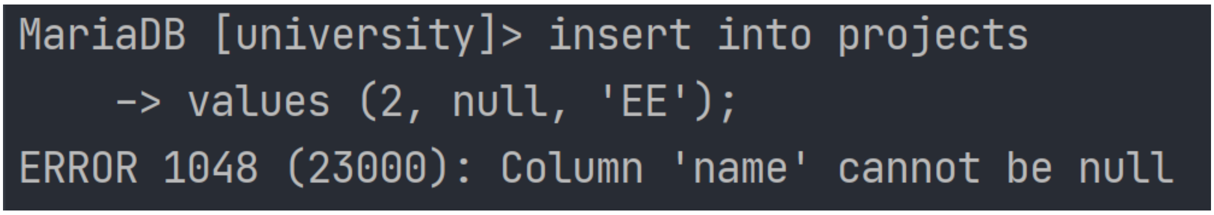


```
MariaDB [university]> insert into members
    -> values (1, 2, 'Mercury', 'twenty', 'sysadmin');
ERROR 1366 (22007): Incorrect integer value: 'twenty' for column `university`.`members`.`age` at row 1
```

The string ‘twenty’ is not type int

2. **Entity Integrity Constraint:**

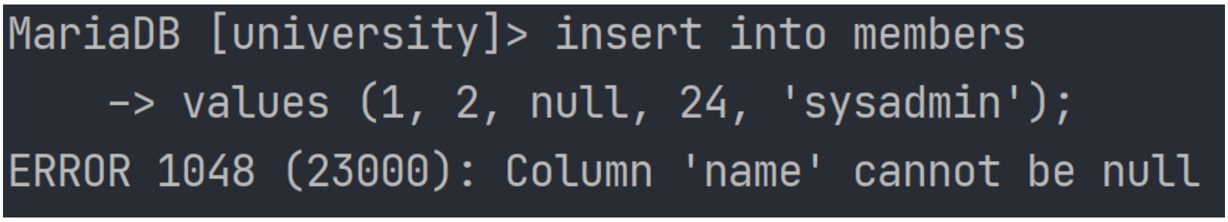
Example 1:



```
MariaDB [university]> insert into projects
    -> values (2, null, 'EE');
ERROR 1048 (23000): Column 'name' cannot be null
```

The name field of projects table cannot be null.

Example 2:

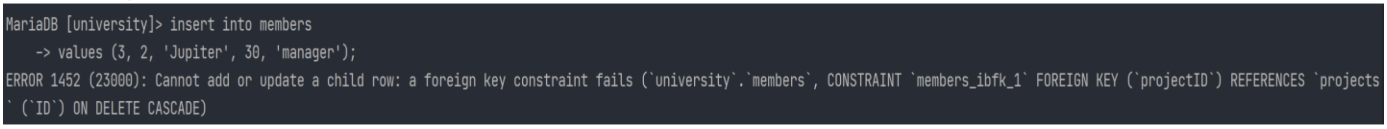


```
MariaDB [university]> insert into members
    -> values (1, 2, null, 24, 'sysadmin');
ERROR 1048 (23000): Column 'name' cannot be null
```

The name field of members table cannot be null.

3. **Referential Integrity Constraints:**

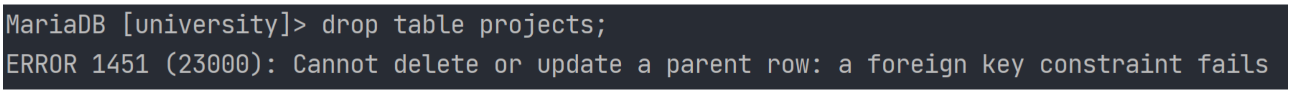
Example 1



```
MariaDB [university]> insert into members
    -> values (3, 2, 'Jupiter', 30, 'manager');
ERROR 1452 (23000): Cannot add or update a child row: a foreign key constraint fails (`university`.`members`, CONSTRAINT `members_ibfk_1` FOREIGN KEY (`projectID`) REFERENCES `projects
` (`ID`) ON DELETE CASCADE)
```

A project with ID=3 does not exist so creating a member with projectID=3 is invalid.

Example 2

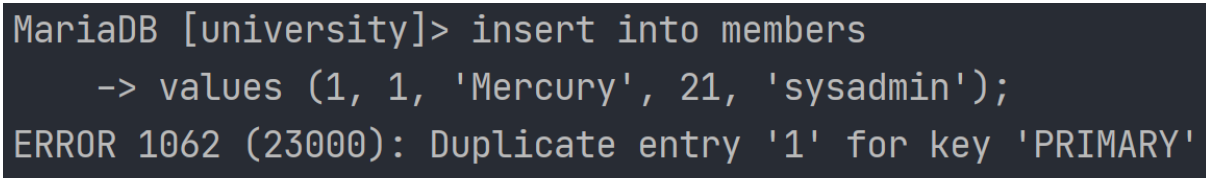


```
MariaDB [university]> drop table projects;
ERROR 1451 (23000): Cannot delete or update a parent row: a foreign key constraint fails
```

The project table cannot be dropped as it is a referenced table.

4. **Key Constraint:**

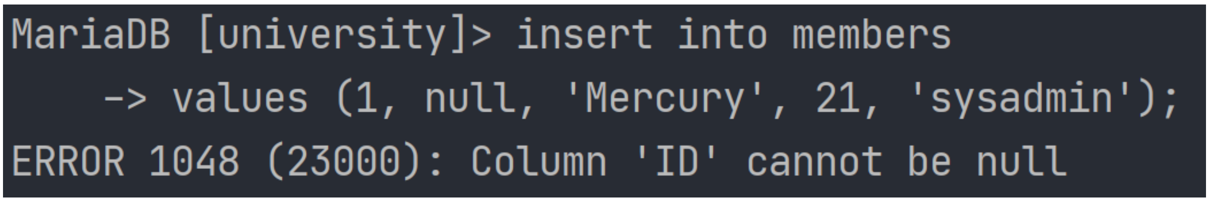
Example 1



```
MariaDB [university]> insert into members
    -> values (1, 1, 'Mercury', 21, 'sysadmin');
ERROR 1062 (23000): Duplicate entry '1' for key 'PRIMARY'
```

Primary Key = 1 already exist in members table and primary key cannot have duplicate values.

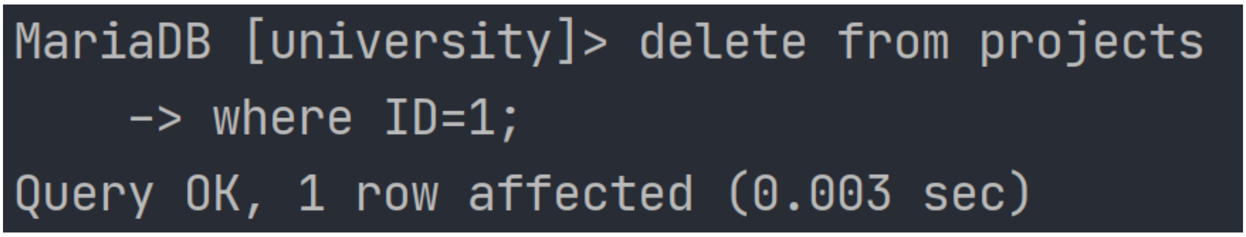
Example 2



```
MariaDB [university]> insert into members
    -> values (1, null, 'Mercury', 21, 'sysadmin');
ERROR 1048 (23000): Column 'ID' cannot be null
```

Primary Key cannot be null

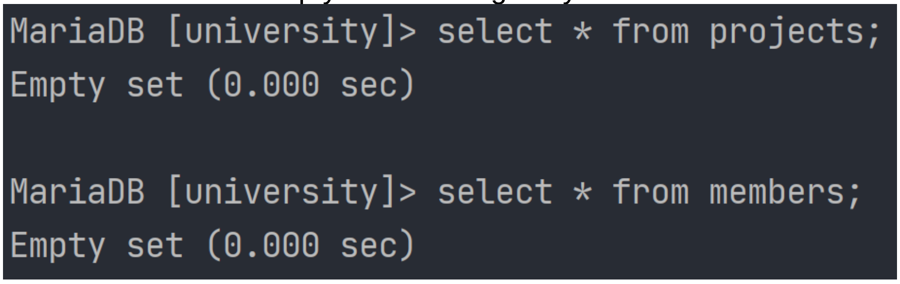
1.3 Also show ON DELETE CASCADE example.



```
MariaDB [university]> delete from projects
    -> where ID=1;
Query OK, 1 row affected (0.003 sec)
```

Deleting entry with ID=1 from projects

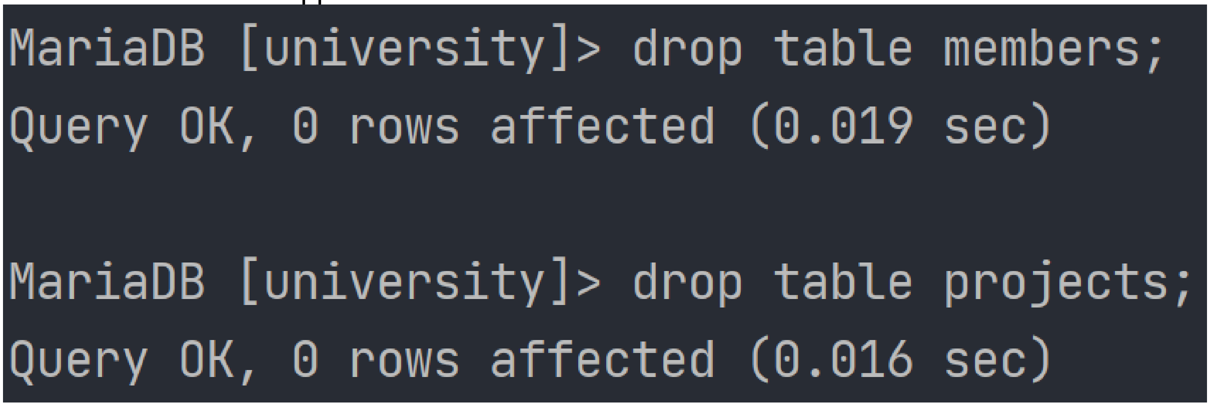
Both the tables are empty as the foreign key had on delete cascade



```
MariaDB [university]> select * from projects;
Empty set (0.000 sec)

MariaDB [university]> select * from members;
Empty set (0.000 sec)
```

1.4 Delete the two tables

Both the tables are dropped

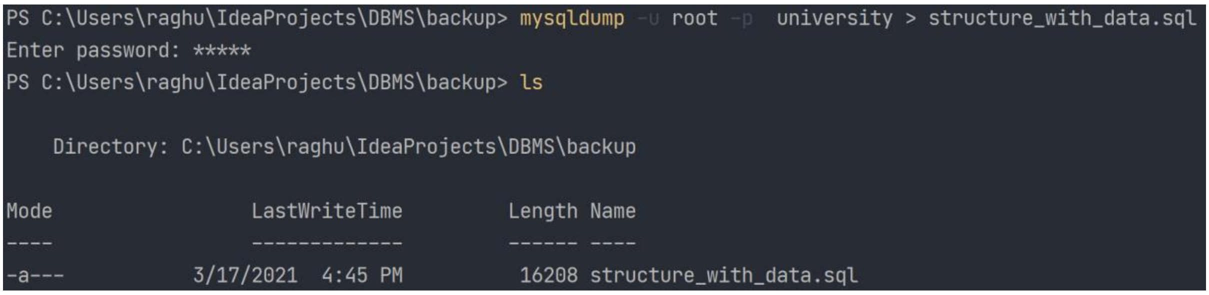


```
MariaDB [university]> drop table members;
Query OK, 0 rows affected (0.019 sec)

MariaDB [university]> drop table projects;
Query OK, 0 rows affected (0.016 sec)
```

2.

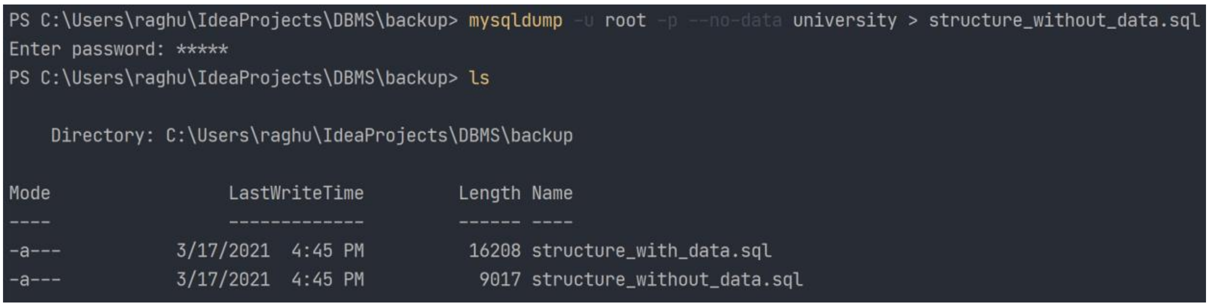
2.1 backup databases with data and without data and store it as structure_with_data.sql and structure_without_data.sql(show proof by taking screenshot of location where it is stored)

Backup with data



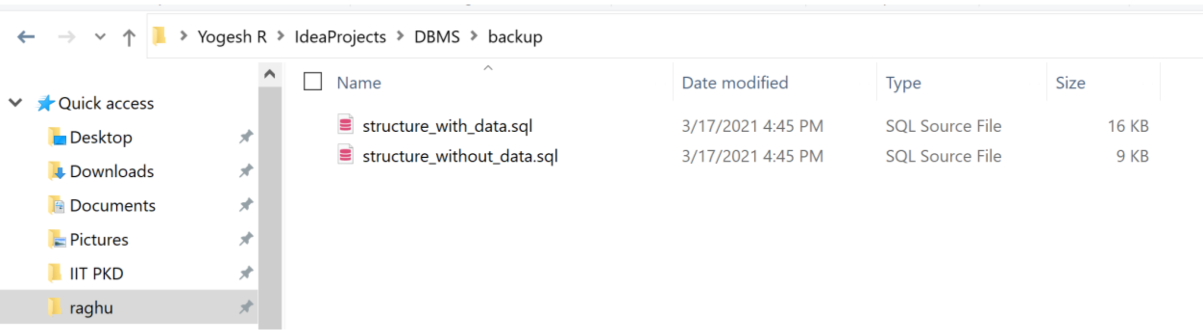
```
PS C:\Users\raghu\IdeaProjects\DBMS\backup> mysqldump -u root -p  university > structure_with_data.sql
Enter password: *****
PS C:\Users\raghu\IdeaProjects\DBMS\backup> ls

    Directory: C:\Users\raghu\IdeaProjects\DBMS\backup

Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
-a---           3/17/2021   4:45 PM         16208 structure_with_data.sql
```

Backup without data:



```
PS C:\Users\raghu\IdeaProjects\DBMS\backup> mysqldump -u root -p --no-data university > structure_without_data.sql
Enter password: *****
PS C:\Users\raghu\IdeaProjects\DBMS\backup> ls

    Directory: C:\Users\raghu\IdeaProjects\DBMS\backup

Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
-a---           3/17/2021   4:45 PM         16208 structure_with_data.sql
-a---           3/17/2021   4:45 PM          9017 structure_without_data.sql
```

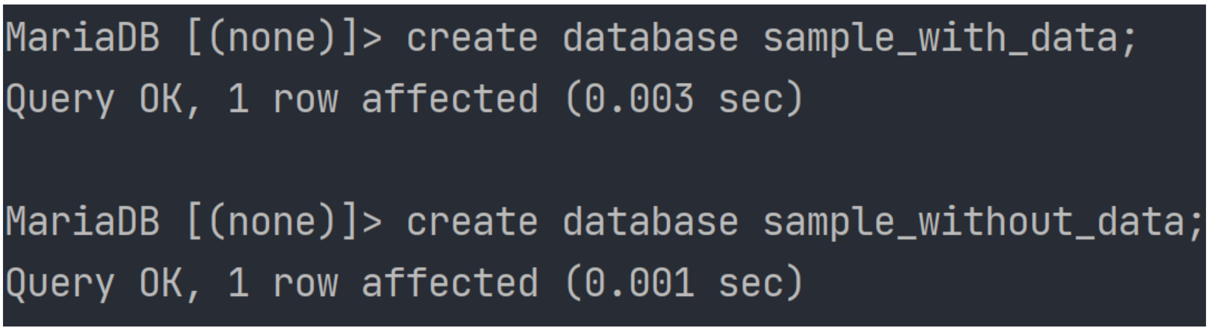
Proof in Explorer



Name	Date modified	Type	Size
structure_with_data.sql	3/17/2021 4:45 PM	SQL Source File	16 KB
structure_without_data.sql	3/17/2021 4:45 PM	SQL Source File	9 KB

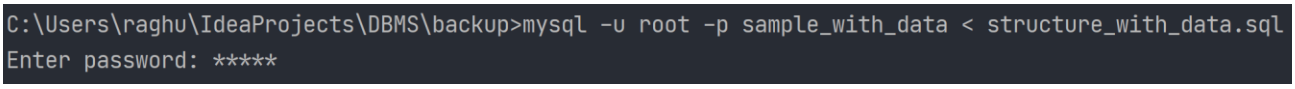
2.2 restore these databases as name: with_data and without_data.(show proofs by showing table)

Creating two sample databases

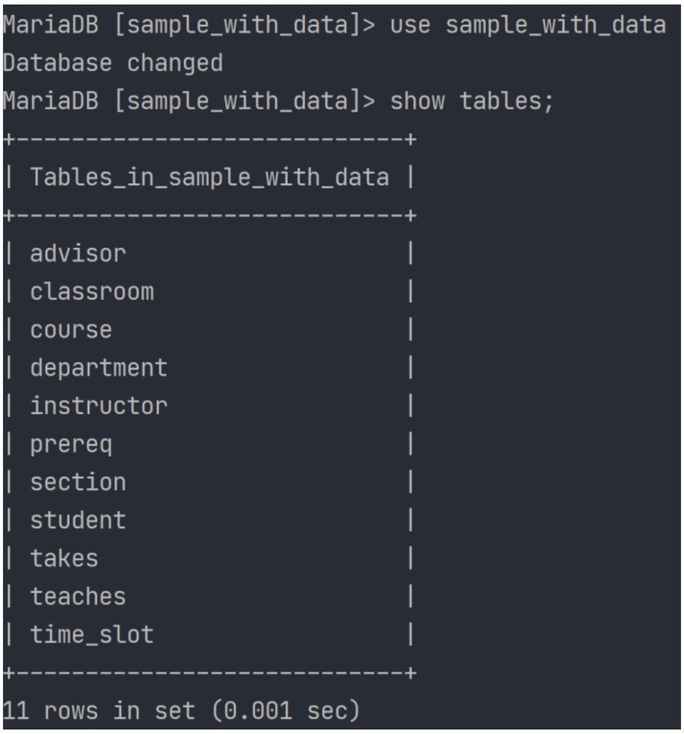


```
MariaDB [(none)]> create database sample_with_data;
Query OK, 1 row affected (0.003 sec)

MariaDB [(none)]> create database sample_without_data;
Query OK, 1 row affected (0.001 sec)
```

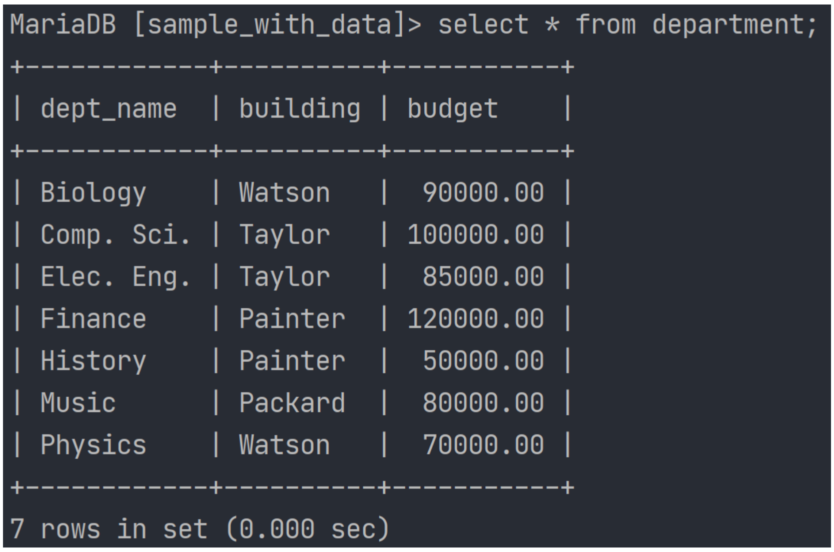
Restoring database with data



```
C:\Users\raghu\IdeaProjects\DBMS\backup>mysql -u root -p sample_with_data < structure_with_data.sql
Enter password: *****
```

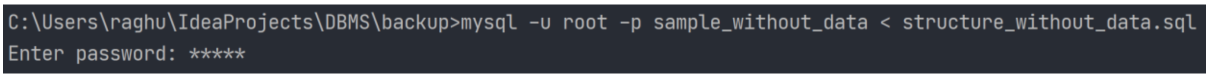


```
MariaDB [sample_with_data]> use sample_with_data
Database changed
MariaDB [sample_with_data]> show tables;
+----------------------------+
| Tables_in_sample_with_data |
+----------------------------+
| advisor                    |
| classroom                  |
| course                     |
| department                 |
| instructor                 |
| prereq                     |
| section                    |
| student                    |
| takes                      |
| teaches                    |
| time_slot                  |
+----------------------------+
11 rows in set (0.001 sec)
```

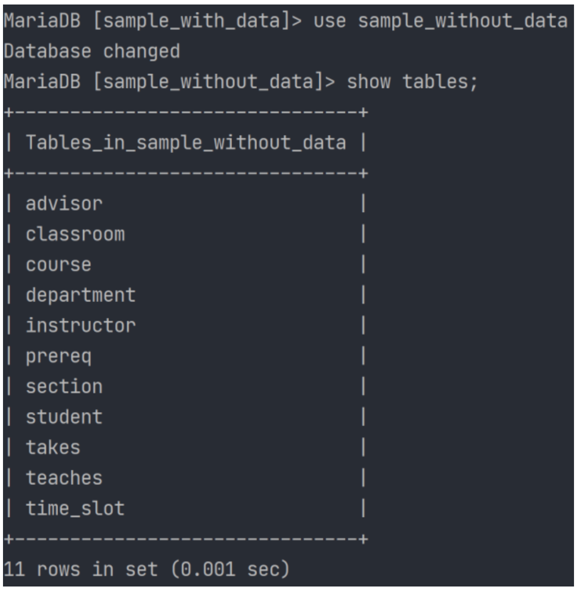


```
MariaDB [sample_with_data]> select * from department;
+------------+----------+-----------+
| dept_name  | building | budget    |
+------------+----------+-----------+
| Biology    | Watson   |  90000.00 |
| Comp. Sci. | Taylor   | 100000.00 |
| Elec. Eng. | Taylor   |  85000.00 |
| Finance    | Painter  | 120000.00 |
| History    | Painter  |  50000.00 |
| Music      | Packard  |  80000.00 |
| Physics    | Watson   |  70000.00 |
+------------+----------+-----------+
7 rows in set (0.000 sec)
```

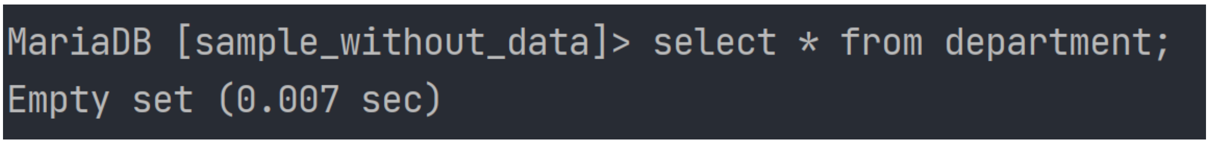
Restoring database without data



```
C:\Users\raghu\IdeaProjects\DBMS\backup>mysql -u root -p sample_without_data < structure_without_data.sql
Enter password: *****
```

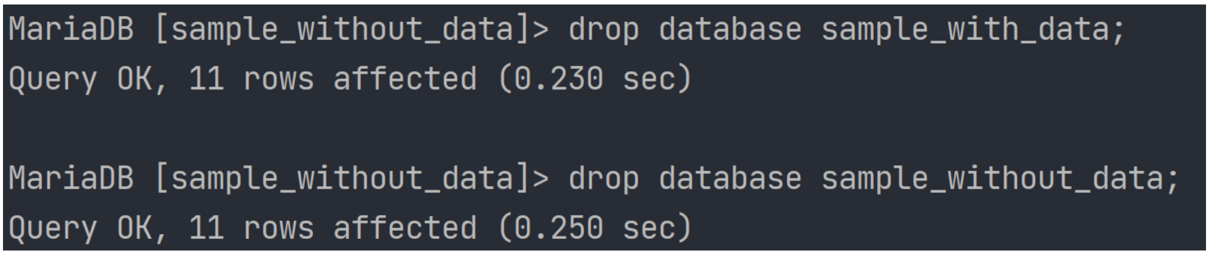


```
MariaDB [sample_with_data]> use sample_without_data
Database changed
MariaDB [sample_without_data]> show tables;
+-------------------------------+
| Tables_in_sample_without_data |
+-------------------------------+
| advisor                       |
| classroom                     |
| course                        |
| department                    |
| instructor                    |
| prereq                        |
| section                       |
| student                       |
| takes                         |
| teaches                       |
| time_slot                     |
+-------------------------------+
11 rows in set (0.001 sec)
```



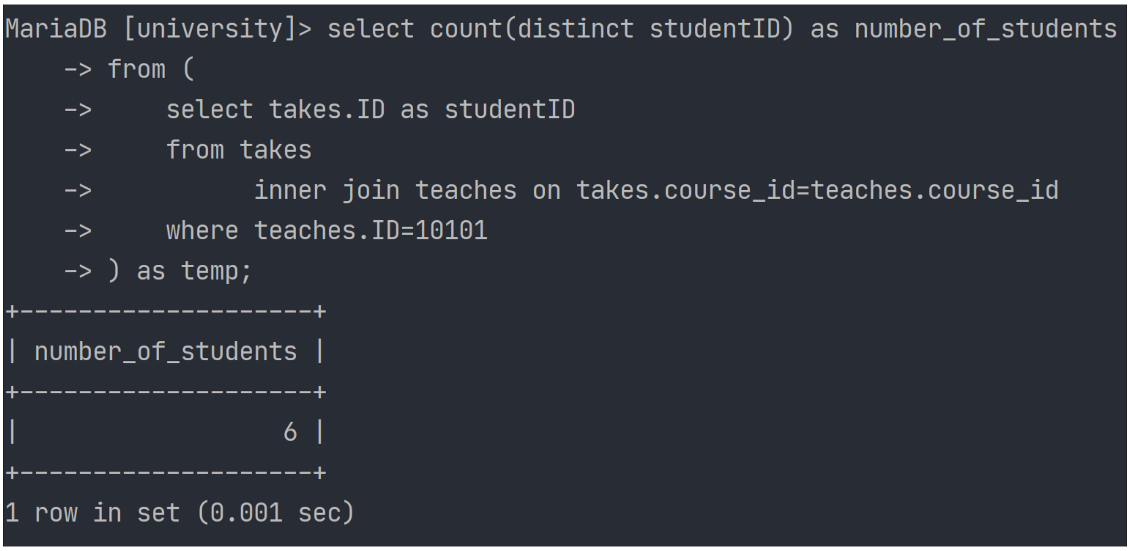
```
MariaDB [sample_without_data]> select * from department;
Empty set (0.007 sec)
```

2.3 Delete these databases.



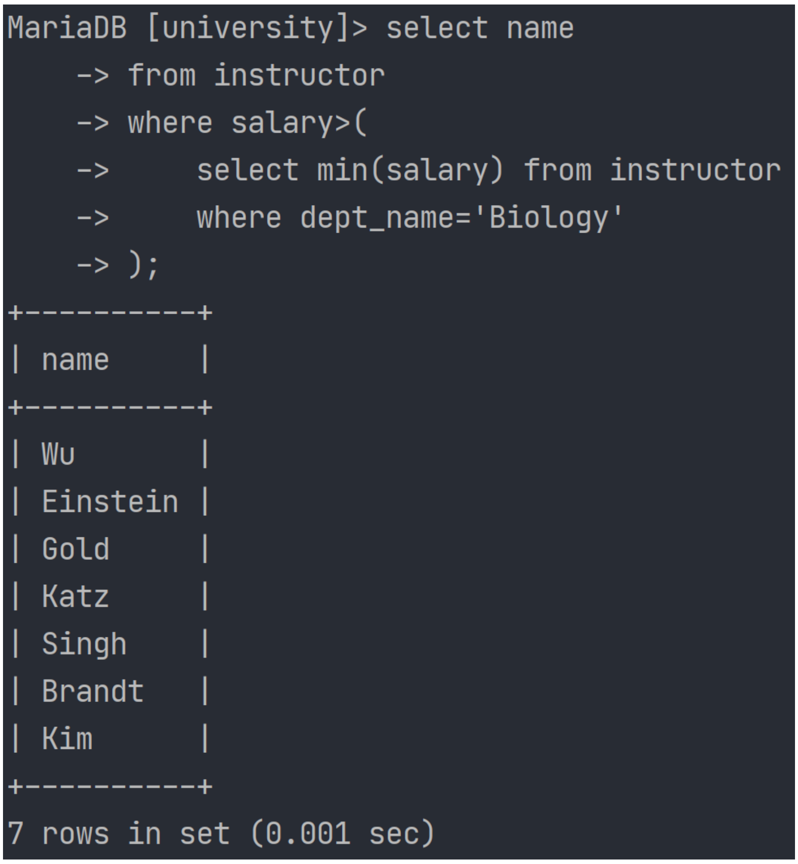
```
MariaDB [sample_without_data]> drop database sample_with_data;
Query OK, 11 rows affected (0.230 sec)

MariaDB [sample_without_data]> drop database sample_without_data;
Query OK, 11 rows affected (0.250 sec)
```

3. Find the total number of (distinct) students who have taken course sections taught by the instructor with ID 10101 (using nested subquery).



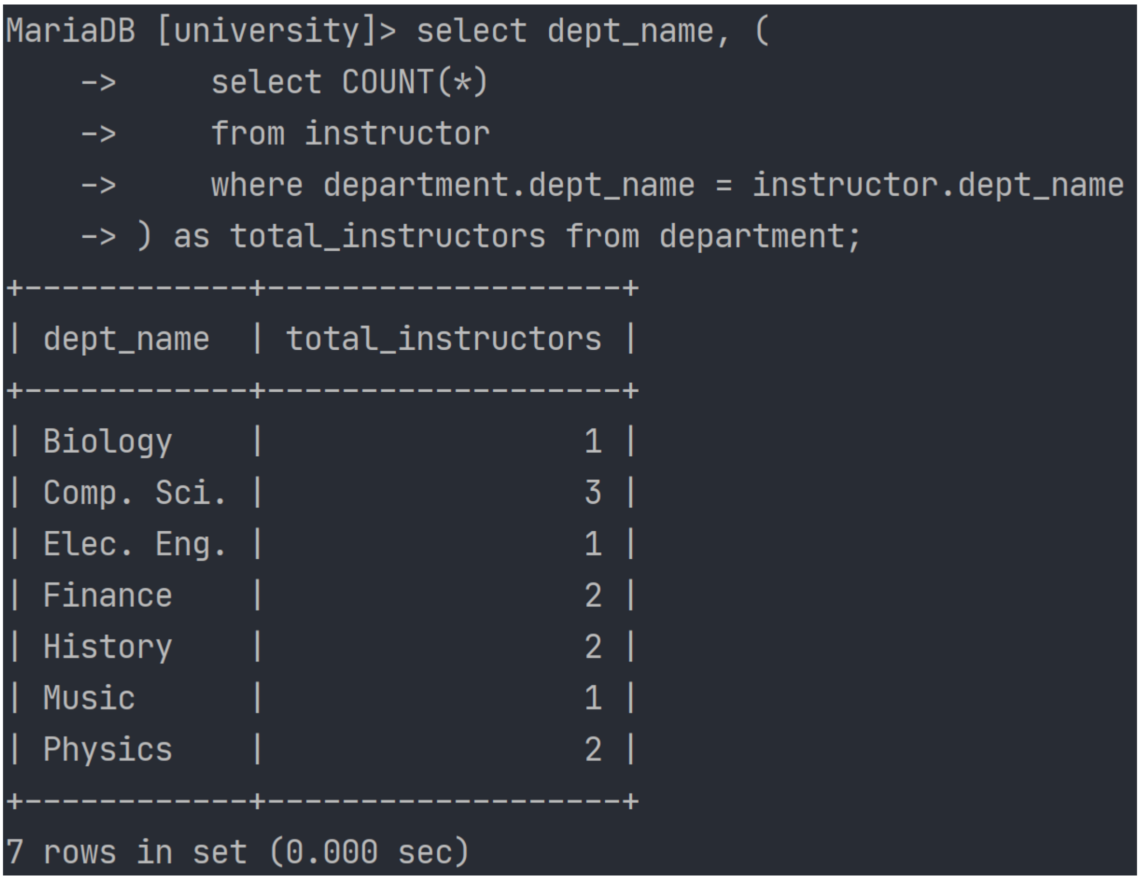
```
MariaDB [university]> select count(distinct studentID) as number_of_students
    -> from (
    ->     select takes.ID as studentID
    ->     from takes
    ->           inner join teaches on takes.course_id=teaches.course_id
    ->     where teaches.ID=10101
    -> ) as temp;
+--------------------+
| number_of_students |
+--------------------+
|                  6 |
+--------------------+
1 row in set (0.001 sec)
```

4. Find the names of all instructors whose salary is greater than at least one instructor in the Biology department (using nested subquery).



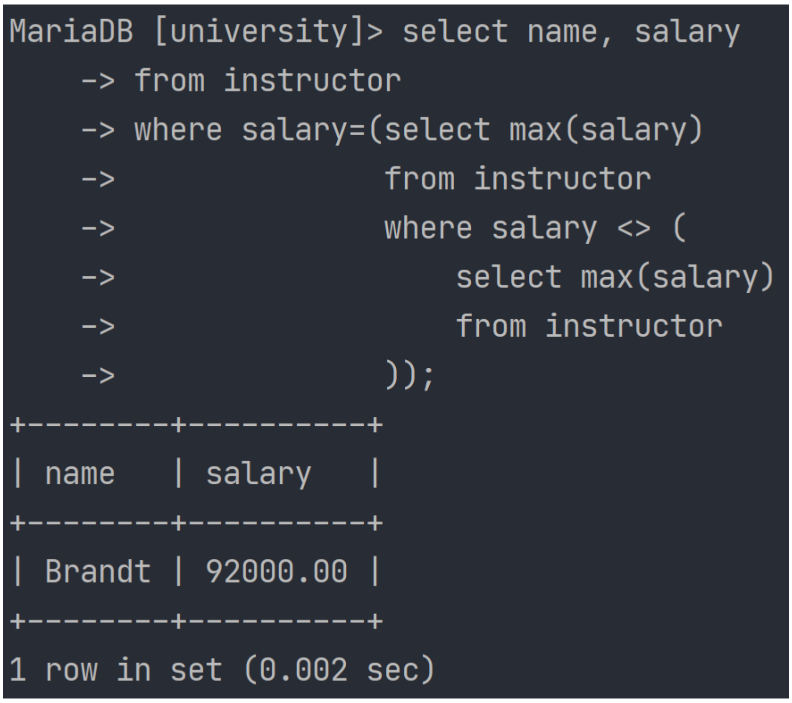
```
MariaDB [university]> select name
    -> from instructor
    -> where salary>(
    ->     select min(salary) from instructor
    ->     where dept_name='Biology'
    -> );
+----------+
| name     |
+----------+
| Wu       |
| Einstein |
| Gold     |
| Katz     |
| Singh    |
| Brandt   |
| Kim      |
+----------+
7 rows in set (0.001 sec)
```

5. Write a query to list all departments along with the number of instructors in each department (using nested subquery).



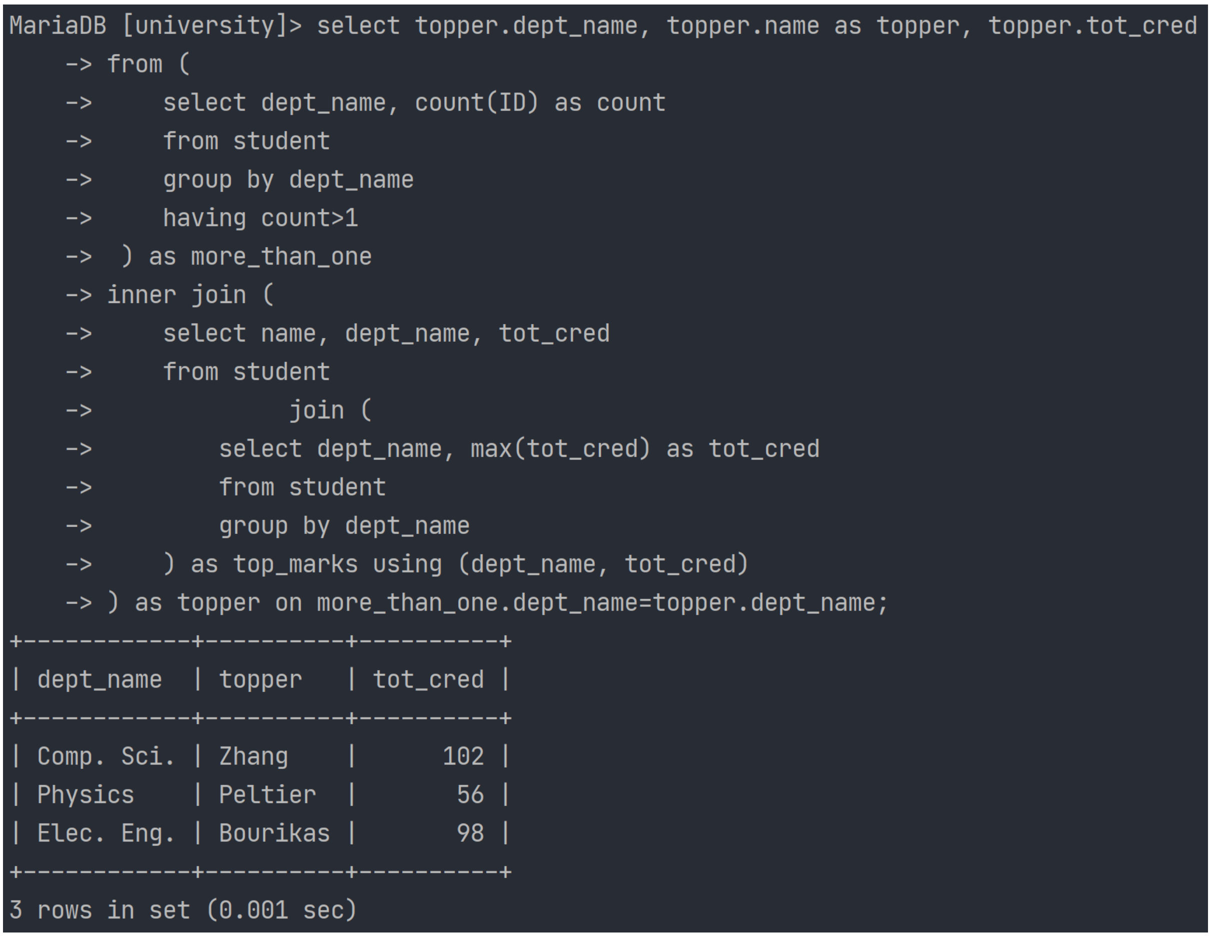
```
MariaDB [university]> select dept_name, (
    ->     select COUNT(*)
    ->     from instructor
    ->     where department.dept_name = instructor.dept_name
    -> ) as total_instructors from department;
+------------+-------------------+
| dept_name  | total_instructors |
+------------+-------------------+
| Biology    |                 1 |
| Comp. Sci. |                 3 |
| Elec. Eng. |                 1 |
| Finance    |                 2 |
| History    |                 2 |
| Music      |                 1 |
| Physics    |                 2 |
+------------+-------------------+
7 rows in set (0.000 sec)
```

6.Write query to show instructor name with second highest salary. (using nested subquery).



```
MariaDB [university]> select name, salary
    -> from instructor
    -> where salary=(select max(salary)
    ->               from instructor
    ->               where salary <> (
    ->                   select max(salary)
    ->                   from instructor
    ->               ));
+--------+----------+
| name   | salary   |
+--------+----------+
| Brandt | 92000.00 |
+--------+----------+
1 row in set (0.002 sec)
```

7.Show toppers name,dept_name and total credits from dept with more than one students.(using nested subquery)



```
MariaDB [university]> select topper.dept_name, topper.name as topper, topper.tot_cred
    -> from (
    ->     select dept_name, count(ID) as count
    ->     from student
    ->     group by dept_name
    ->     having count>1
    ->  ) as more_than_one
    -> inner join (
    ->     select name, dept_name, tot_cred
    ->     from student
    ->              join (
    ->         select dept_name, max(tot_cred) as tot_cred
    ->         from student
    ->         group by dept_name
    ->     ) as top_marks using (dept_name, tot_cred)
    -> ) as topper on more_than_one.dept_name=topper.dept_name;
+------------+----------+----------+
| dept_name  | topper   | tot_cred |
+------------+----------+----------+
| Comp. Sci. | Zhang    |      102 |
| Physics    | Peltier  |       56 |
| Elec. Eng. | Bourikas |       98 |
+------------+----------+----------+
3 rows in set (0.001 sec)
```