1. Retrieve information about the projects (title, status and whether archived or not) that have an ‘Optional’ reviewer. (hint: Role is “optional”)

```
mysql> SELECT P.Title, P.Project_Status, P.Archived
    -> FROM PROJECT P
    -> INNER JOIN REVIEWS R ON P.Project_ID = R.Project_ID
    -> WHERE R.Reviewer_Role = 'Optional';
+-----------+----------------+----------+
| Title     | Project_Status | Archived |
+-----------+----------------+----------+
| Project 1 | Active         |        0 |
| Project 2 | Active         |        0 |
+-----------+----------------+----------+
2 rows in set (0.00 sec)
```

2. Retrieve the information about the investigators (first name, last name and organization) who have done more than one project.

```
mysql> SELECT I.First_Name, I.Last_Name, I.Organization
    -> FROM INVESTIGATOR I
    -> JOIN WORKS_ON W ON I.SSN = W.SSN
    -> GROUP BY I.SSN
    -> HAVING COUNT(W.Project_ID) > 1;
+------------+-----------+--------------+
| First_Name | Last_Name | Organization |
+------------+-----------+--------------+
| John       | Smith     | University A |
| Michael    | Johnson   | University C |
+------------+-----------+--------------+
2 rows in set (0.00 sec)

mysql>
```

3. Retrieve the information of reviewers (first name and last name), investigators (first name and last name) for the project “Air Quality”.

```
mysql> SELECT I.First_Name AS first, I.Last_Name AS last
    -> FROM INVESTIGATOR I
    -> JOIN WORKS_ON W ON I.SSN = W.SSN
    -> JOIN PROJECT P ON W.Project_ID = P.Project_ID
    -> WHERE P.Title = 'Air Quality'
    -> UNION
    -> SELECT R.First_Name AS first, R.Last_Name AS last
    -> FROM REVIEWER R
    -> JOIN REVIEWS RV ON R.SSN = RV.SSN
    -> JOIN PROJECT P ON RV.Project_ID = P.Project_ID
    -> WHERE P.Title = 'Air Quality';
+---------+-------+
| first   | last  |
+---------+-------+
| John    | Smith |
| Jessica | Clark |
| Emily   | Brown |
+---------+-------+
3 rows in set (0.00 sec)
```

4. Retrieve information about each project and the Investigator of the project. List project ID, title, and SSN and last name of the Investigator. Order the result in ascending order of Project ID

```
mysql> SELECT P.Project_ID, P.Title, I.SSN, I.Last_Name AS Investigator_Last_Name
    -> FROM PROJECT P
    -> JOIN WORKS_ON W ON P.Project_ID = W.Project_ID
    -> JOIN INVESTIGATOR I ON W.SSN = I.SSN
    -> ORDER BY P.Project_ID ASC;
+------------+-------------+-----------+-----------------------+
| Project_ID | Title       | SSN       | Investigator_Last_Name |
+------------+-------------+-----------+-----------------------+
|          1 | Project 1   | 123456789 | Smith                 |
|          1 | Project 1   | 234567890 | Smith                 |
|          2 | Project 2   | 345678901 | Johnson               |
|          3 | Project 3   | 345678901 | Johnson               |
|          3 | Project 3   | 456789012 | Taylor                |
|          4 | Project 4   | 123456789 | Smith                 |
|          4 | Project 4   | 345678901 | Johnson               |
|          5 | Air Quality | 123456789 | Smith                 |
|          5 | Air Quality | 678901234 | Clark                 |
+------------+-------------+-----------+-----------------------+
9 rows in set (0.00 sec)
```

5. Retrieve information about each project and the Principle Investigator of the project. List project ID, title, and SSN and first name of the Principle Investigator. (hint: the role of the investigator is “PI”.)

```
mysql> SELECT P.Project_ID, P.Title, I.SSN, I.First_Name AS Principal_Investigator_First_Name
    -> FROM PROJECT P
    -> JOIN WORKS_ON W ON P.Project_ID = W.Project_ID
    -> JOIN INVESTIGATOR I ON W.SSN = I.SSN
    -> WHERE W.Inv_Role = 'PI';
+------------+-------------+-----------+----------------------------------+
| Project_ID | Title       | SSN       | Principal_Investigator_First_Name |
+------------+-------------+-----------+----------------------------------+
|          1 | Project 1   | 123456789 | John                             |
|          2 | Project 2   | 345678901 | Michael                          |
|          3 | Project 3   | 456789012 | Emily                            |
|          4 | Project 4   | 345678901 | Michael                          |
|          5 | Air Quality | 123456789 | John                             |
+------------+-------------+-----------+----------------------------------+
5 rows in set (0.00 sec)
```

6. Get the project information (project id, title, status and whether archived or not) which has a ‘Co-PI’. (hint: the role of the investigator is “Co-PI”).

```
mysql> SELECT P.Project_ID, P.Title, P.Project_Status, P.Archived
    -> FROM PROJECT P
    -> JOIN WORKS_ON W ON P.Project_ID = W.Project_ID
    -> WHERE W.Inv_Role = 'CO-PI';
+------------+-------------+----------------+----------+
| Project_ID | Title       | Project_Status | Archived |
+------------+-------------+----------------+----------+
|          1 | Project 1   | Active         |        0 |
|          3 | Project 3   | Active         |        0 |
|          4 | Project 4   | Completed      |        1 |
|          5 | Air Quality | Active         |        0 |
+------------+-------------+----------------+----------+
4 rows in set (0.00 sec)
```

7. Retrieve all the projects (project id, title) in which “John Smith” serves as a principle investigator.

```
mysql> SELECT p.Project_ID, p.Title
    -> FROM PROJECT p
    -> JOIN WORKS_ON w ON p.Project_ID = w.Project_ID
    -> JOIN INVESTIGATOR i ON w.SSN = i.SSN
    -> WHERE i.First_Name = 'John' AND i.Last_Name = 'Smith' AND w.Inv_Role = 'PI';
+------------+-------------+
| Project_ID | Title       |
+------------+-------------+
|          1 | Project 1   |
|          5 | Air Quality |
+------------+-------------+
2 rows in set (0.00 sec)
```

8. Retrieve the reviewers who reviewed more than 2 projects. Please list reviewer’s SSN and number of projects reviewed by the reviewer.

```
mysql> SELECT rv.SSN, COUNT(DISTINCT rv.Project_ID) AS Num_Projects_Reviewed
    -> FROM REVIEWS rv
    -> GROUP BY rv.SSN
    -> HAVING COUNT(DISTINCT rv.Project_ID) > 1;
+-----------+----------------------+
| SSN       | Num_Projects_Reviewed |
+-----------+----------------------+
| 567890123 |                    2 |
| 678901234 |                    2 |
+-----------+----------------------+
2 rows in set (0.00 sec)

mysql>
```

9. Retrieve the investigators who serve as “PI” for at least 2 projects. Please list the SSN, last name, and number of projects served as “PI”.

```
mysql> SELECT w.SSN, i.Last_Name, COUNT(*) AS Num_Projects_As_PI
    -> FROM WORKS_ON w
    -> JOIN INVESTIGATOR i ON w.SSN = i.SSN
    -> WHERE w.Inv_Role = 'PI'
    -> GROUP BY w.SSN, i.Last_Name
    -> HAVING COUNT(*) >= 2;
+-----------+-----------+--------------------+
| SSN       | Last_Name | Num_Projects_As_PI |
+-----------+-----------+--------------------+
| 123456789 | Smith     |                  2 |
| 345678901 | Johnson   |                  2 |
+-----------+-----------+--------------------+
2 rows in set (0.00 sec)

mysql>
```

10. Retrieved the SSN of all reviewers and all investigators who have “Smith” as the last name.

```
mysql> SELECT SSN
    -> FROM (
    ->     SELECT SSN FROM REVIEWER WHERE Last_Name = 'Smith'
    ->     UNION
    ->     SELECT SSN FROM INVESTIGATOR WHERE Last_Name = 'Smith'
    -> ) AS Smiths;
+-----------+
| SSN       |
+-----------+
| 123456789 |
| 234567890 |
+-----------+
2 rows in set (0.00 sec)

mysql>
```