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E/19/310

Exercise
1. Create database company security.

```
MySQL  localhost:3306 ssl  SQL > create database company_security;
Query OK, 1 row affected (0.0208 sec)
MySQL  localhost:3306 ssl  SQL > |
```

2. Load the given company security.sql file to the company security database.

```
MySQL  localhost:3306 ssl  SQL > SOURCE "D:/#Pera/Academic/Semester 6/CO527 - Advanced Database Systems/Labs/Lab 05/company_security.sql"
Default schema set to `company_security`."D:/#Pera/Academic/Semester 6/CO527 - Advanced Database Systems/Labs/Lab 05/company_security.sql"
Fetching global names, object names from `company_security` for auto-completion... Press ^C to stop.
Query OK, 0 rows affected (0.0664 sec)
Query OK, 0 rows affected (0.0963 sec)
Query OK, 0 rows affected (0.0496 sec)
Query OK, 0 rows affected (0.0920 sec)
Query OK, 0 rows affected (0.0806 sec)
Query OK, 0 rows affected (0.0361 sec)
Query OK, 1 row affected (0.0206 sec)
Query OK, 1 row affected (0.0065 sec)
Query OK, 1 row affected (0.0051 sec)
Query OK, 1 row affected (0.0058 sec)
Query OK, 1 row affected (0.0053 sec)
Query OK, 1 row affected (0.0056 sec)
Query OK, 1 row affected (0.0044 sec)
Query OK, 1 row affected (0.0044 sec)
Query OK, 1 row affected (0.0119 sec)
Query OK, 1 row affected (0.0031 sec)
Query OK, 1 row affected (0.0062 sec)
Query OK, 5 rows affected (0.0080 sec)

Records: 5  Duplicates: 0  Warnings: 0
Query OK, 6 rows affected (0.0071 sec)

Records: 6  Duplicates: 0  Warnings: 0
Query OK, 16 rows affected (0.0119 sec)

Records: 16  Duplicates: 0  Warnings: 0
Query OK, 7 rows affected (0.0080 sec)

Records: 7  Duplicates: 0  Warnings: 0
Query OK, 8 rows affected (0.1755 sec)

Records: 8  Duplicates: 0  Warnings: 0
MySQL  localhost:3306 ssl  company_security  SQL >
```

3. Create a new user 'user1' within the MySQL shell.

```
MySQL  localhost:3306 ssl  company_security  SQL > CREATE USER 'user1'@'localhost' IDENTIFIED BY 'password1';
Query OK, 0 rows affected (0.0324 sec)
```

4. Login to MySQL with a new user account and password and see if the new user has any authorities or privileges to the database.

```
MySQL  SQL > \connect user1@localhost:3306
Creating a session to 'user1@localhost:3306'
Please provide the password for 'user1@localhost:3306': *********
Save password for 'user1@localhost:3306'? [Y]es/[N]o/Ne[v]er (default No): n
Fetching global names for auto-completion... Press ^C to stop.
Error during auto-completion cache update: Access denied; you need (at least one of) the PROCESS privilege(s)
for this operation
Your MySQL connection id is 13
Server version: 8.0.36 MySQL Community Server - GPL
No default schema selected; type \use <schema> to set one.
MySQL  localhost:3306 ssl  SQL > SHOW GRANTS;
+------------------------------------------+
| Grants for user1@localhost               |
+------------------------------------------+
| GRANT USAGE ON *.* TO `user1`@`localhost` |
+------------------------------------------+
```

5. Make sure the new user has only read only permission to 'Employee' table.

```
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON company_security.Employee TO 'user1
'@'localhost';
Query OK, 0 rows affected (0.0085 sec)
```

```
MySQL  localhost:3306 ssl  SQL > SHOW GRANTS;
+----------------------------------------------------------------------+
| Grants for user1@localhost                                           |
+----------------------------------------------------------------------+
| GRANT USAGE ON *.* TO `user1`@`localhost`                            |
| GRANT SELECT ON `company_security`.`employee` TO `user1`@`localhost` |
+----------------------------------------------------------------------+
2 rows in set (0.0019 sec)
MySQL  localhost:3306 ssl  SQL >
```

6. Now allow 'user1' to query the followings: SELECT * FROM Employee; INSER into Employee(...)VALUES(...). What happens? Fix the problem.

At first, insert command is denied to user1 on the database

```
MySQL  localhost:3306 ssl  company_security  SQL > INSERT INTO EMPLOYEE VALUES('Matt','C','Johnson',23
1342904,'1985-01-02','331 Fondren, Housten, TX','M', 34000,'3334445555',5);
ERROR: 1142 (42000): INSERT command denied to user 'user1'@'localhost' for table 'employee'
MySQL  localhost:3306 ssl  company_security  SQL >
```

Then, insert privilege is granted to user1

```
MySQL  localhost:3306 ssl  company_security  SQL > GRANT INSERT ON company_security.Employee TO 'user1
'@'localhost';
Query OK, 0 rows affected (0.0133 sec)
```

After that, user1 can insert into the table employee.

```
MySQL  localhost:3306 ssl  company_security  SQL > INSERT INTO EMPLOYEE VALUES('Matt','C','Johnson',231342904,'1985-01-02','331 Fondren, Housten, TX','M',
34000,'3334445555',5);
Query OK, 1 row affected (0.0148 sec)
MySQL  localhost:3306 ssl  company_security  SQL > select * employee;
ERROR: 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MySQL server version for the right syntax to use near '
employee' at line 1
MySQL  localhost:3306 ssl  company_security  SQL > select * from employee;
+----------+-------+----------+-----------+------------+-------------------------+-----+----------+-----------+-----+
| Fname    | Minit | Lname    | Ssn       | Bdate      | Address                 | Sex | Salary   | Super_ssn | Dno |
+----------+-------+----------+-----------+------------+-------------------------+-----+----------+-----------+-----+
| John     | B     | Smith    | 123456789 | 1965-01-09 | 731 Fondren, Housten, TX| M   | 30000.00 | 333445555 | 5   |
| Matt     | C     | Johnson  | 231342904 | 1985-01-02 | 331 Fondren, Housten, TX| M   | 34000.00 | 333445555 | 5   |
| Franklin | T     | Wong     | 333445555 | 1955-12-08 | 638 Voss, Houston, TX   | M   | 40000.00 | 888665555 | 5   |
| Joyce    | A     | English  | 453453453 | 1972-07-31 | 5631 Rice, Houston, TX  | F   | 25000.00 | 333445555 | 5   |
| Ramesh   | K     | Narayan  | 666884444 | 1962-09-15 | 975 Fire Oak, Humble, TX| M   | 38000.00 | 333445555 | 5   |
| James    | E     | Borg     | 888665555 | 1937-11-10 | 450 Stone, Houston, TX  | M   | 30000.00 | NULL      | 1   |
| Jennifer | S     | Wallace  | 987654321 | 1941-06-20 | 291 Berry, Bellaire, TX | F   | 43000.00 | 888665555 | 4   |
| Ahmad    | V     | Jabbar   | 987987987 | 1969-03-29 | 980 Dallas, Houston, TX | M   | 25000.00 | 987654321 | 4   |
| Alicia   | J     | Zelaya   | 999887777 | 1968-01-19 | 3321 Castle, Spring, TX | F   | 25000.00 | 987654321 | 4   |
+----------+-------+----------+-----------+------------+-------------------------+-----+----------+-----------+-----+
9 rows in set (0.0012 sec)
MySQL  localhost:3306 ssl  company_security  SQL >
```

7. From user1 create a view WORKS ON1(Fname,Lname,Pno) on EMPLOYEE and WORKS ON. (Note: You will have to give permission to user1 on CREATE VIEW). Give another user 'user2' permission to select tuples from WORKS ON1(Note: user2 will not be able to see WORKS ON or EMPLOYEE).

Giving permission to user1 to create views on the database and to select on WORKS_ON table.

```
MySQL  localhost:3306 ssl  company_security  SQL > GRANT CREATE VIEW ON company_security.* TO 'user1'@
'localhost';
Query OK, 0 rows affected (0.0157 sec)
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON company_security.WORKS_ON TO 'user1
'@'localhost';
Query OK, 0 rows affected (0.0122 sec)
MySQL  localhost:3306 ssl  company_security  SQL >
```

Creating the view WORKS_ON1

```
MySQL  localhost:3306 ssl  company_security  SQL > CREATE VIEW WORKS_ON1 AS SELECT Fname, Lname, Pno F
ROM Employee JOIN WORKS_ON ON Ssn=Essn;
Query OK, 0 rows affected (0.0168 sec)
```

Creating a new user called "user2"

```
MySQL  localhost:3306 ssl  company_security  SQL > CREATE USER 'user2'@'localhost' IDENTIFIED BY 'pass
word2';
Query OK, 0 rows affected (0.0243 sec)
```

Granting permission to user2 on works_on1 to SELECT.

```
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON company_security.WORKS_ON1 TO 'user
2'@'localhost';
Query OK, 0 rows affected (0.0093 sec)
```

8. Select tuples from user2 account. What happens?

```
MySQL  localhost:3306 ssl  company_security  SQL > select * from works_on1;
+----------+----------+-----+
| Fname    | Lname    | Pno |
+----------+----------+-----+
| John     | Smith    |   1 |
| John     | Smith    |   2 |
| Franklin | Wong     |   2 |
| Franklin | Wong     |   3 |
| Franklin | Wong     |  10 |
| Franklin | Wong     |  20 |
| Joyce    | English  |   1 |
| Joyce    | English  |   2 |
| Ramesh   | Narayan  |   3 |
| James    | Borg     |  20 |
| Jennifer | Wallace  |  20 |
| Jennifer | Wallace  |  30 |
| Ahmad    | Jabbar   |  10 |
| Ahmad    | Jabbar   |  30 |
| Alicia   | Zelaya   |  10 |
| Alicia   | Zelaya   |  30 |
+----------+----------+-----+
16 rows in set (0.0045 sec)
```

```
MySQL  localhost:3306 ssl  company_security  SQL > select * from employee;
ERROR: 1142 (42000): SELECT command denied to user 'user2'@'localhost' for table 'employee'
MySQL  localhost:3306 ssl  company_security  SQL > select * from works_on;
ERROR: 1142 (42000): SELECT command denied to user 'user2'@'localhost' for table 'works_on'
MySQL  localhost:3306 ssl  company_security  SQL >
```

user2 can see the rows form the created view WORKS_ON1 but he cannot see any data from the
separate tables EMPLOYEE and WORKS_ON. This is because the user2 hasn't permission on those
separate table but the created view only.

9. Remove privileges of user1 on WORKS ON and EMPLOYEE. Can user1 still access WORKS ON1? What happened to WORKS ON1? Why?

Removing all the permissions from user1

```
MySQL  localhost:3306 ssl  company_security  SQL > REVOKE ALL PRIVILEGES ON company_security.WORKS_ON
FROM 'user1'@'localhost';
Query OK, 0 rows affected (0.0154 sec)
MySQL  localhost:3306 ssl  company_security  SQL > REVOKE ALL PRIVILEGES ON company_security.EMPLOYEE
FROM 'user1'@'localhost';
Query OK, 0 rows affected (0.0110 sec)
MySQL  localhost:3306 ssl  company_security  SQL >
```

Trying to access WORKS_ON1 view

```
MySQL  localhost:3306 ssl  company_security  SQL > select * from works_on1;
ERROR: 1142 (42000): SELECT command denied to user 'user1'@'localhost' for table 'works_on1'
MySQL  localhost:3306 ssl  company_security  SQL >
```

```
MySQL  localhost:3306 ssl  company_security  SQL > show grants;
+----------------------------------------------------------------------+
| Grants for user1@localhost                                           |
+----------------------------------------------------------------------+
| GRANT USAGE ON *.* TO `user1`@`localhost`                            |
| GRANT CREATE VIEW ON `company_security`.* TO `user1`@`localhost`     |
+----------------------------------------------------------------------+
2 rows in set (0.0009 sec)
MySQL  localhost:3306 ssl  company_security  SQL >
```

Since all the privileges of user1 are provoked, he doesn't have permission to access the view WORKS_ON1.

SQL Injection Attacks

Since you do not have any authentication related tables in your database, you can try the following two queries to see what happens in an SQL injection.
Observe the result. What happens?

```
MySQL  localhost:3306 ssl  company_security  SQL > SELECT *
                                               -> FROM employee
                                               -> WHERE ssn=999887777;
+--------+-------+--------+-----------+------------+---------------------------+-----+----------+-----------+-----+
| Fname  | Minit | Lname  | Ssn       | Bdate      | Address                   | Sex | Salary   | Super_ssn | Dno |
+--------+-------+--------+-----------+------------+---------------------------+-----+----------+-----------+-----+
| Alicia | J     | Zelaya | 999887777 | 1968-01-19 | 3321 Castle, Spring, TX   | F   | 25000.00 | 987654321 |   4 |
+--------+-------+--------+-----------+------------+---------------------------+-----+----------+-----------+-----+
1 row in set (0.0097 sec)
MySQL  localhost:3306 ssl  company_security  SQL > SELECT *
                                               -> FROM employee
                                               -> WHERE ssn=999887777 or 'x'='x';
+----------+-------+---------+-----------+------------+----------------------------+-----+----------+-----------+-----+
| Fname    | Minit | Lname   | Ssn       | Bdate      | Address                    | Sex | Salary   | Super_ssn | Dno |
+----------+-------+---------+-----------+------------+----------------------------+-----+----------+-----------+-----+
| John     | B     | Smith   | 123456789 | 1965-01-09 | 731 Fondren, Housten, TX   | M   | 30000.00 | 333445555 |   5 |
| Matt     | C     | Johnson | 231342904 | 1985-01-02 | 331 Fondren, Housten, TX   | M   | 34000.00 | 333445555 |   5 |
| Franklin | T     | Wong    | 333445555 | 1955-12-08 | 638 Voss, Housten, TX      | M   | 40000.00 | 888665555 |   5 |
| Joyce    | A     | English | 453453453 | 1972-07-31 | 5631 Rice, Houston, TX     | F   | 25000.00 | 333445555 |   5 |
| Ramesh   | K     | Narayan | 666884444 | 1962-09-15 | 975 Fire Oak, Humble, TX   | M   | 38000.00 | 333445555 |   5 |
| James    | E     | Borg    | 888665555 | 1937-11-10 | 450 Stone, Houston, TX     | M   | 30000.00 | NULL      |   1 |
| Jennifer | S     | Wallace | 987654321 | 1941-06-20 | 291 Berry, Bellaire, TX    | F   | 43000.00 | 888665555 |   4 |
| Ahmad    | V     | Jabbar  | 987987987 | 1969-03-29 | 980 Dallas, Houston, TX    | M   | 25000.00 | 987654321 |   4 |
| Alicia   | J     | Zelaya  | 999887777 | 1968-01-19 | 3321 Castle, Spring, TX    | F   | 25000.00 | 987654321 |   4 |
+----------+-------+---------+-----------+------------+----------------------------+-----+----------+-----------+-----+
```

The second query exposes an SQL injection flaw by including the always-true condition 'x'='x', which retrieves all records from the employee table regardless of the SSN value.

Assignment

Consider the relational database schema provided. Suppose that all the relations were created by (and hence are owned by) user X, who wants to grant the following privileges to user accounts A, B, C, D, and E:

```
 MySQL  localhost:3306 ssl  company_security  SQL > CREATE USER 'A'@'localhost' IDENTIFIED BY 'pw1';
Query OK, 0 rows affected (0.0104 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > CREATE USER 'B'@'localhost' IDENTIFIED BY 'pw2';
Query OK, 0 rows affected (0.0076 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > CREATE USER 'C'@'localhost' IDENTIFIED BY 'pw2';
Query OK, 0 rows affected (0.0080 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > CREATE USER 'D'@'localhost' IDENTIFIED BY 'pw3';
Query OK, 0 rows affected (0.0099 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > CREATE USER 'E'@'localhost' IDENTIFIED BY 'pw4';
Query OK, 0 rows affected (0.0169 sec)
 MySQL  localhost:3306 ssl  company_security  SQL >
```

I. Account A can retrieve or modify any relation except DEPENDENT and can grant any of these privileges to other users.

```
 MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT, INSERT, UPDATE, DELETE ON EMPLOYEE TO 'A'@'localhost' WITH GRANT OPTION;
RANT SELECT, INSERT, UPDATE, DELETE ON EMPLOYEE TO 'A'@'localhost' WITH GRANT OPTION;
Query OK, 0 rows affected (0.0166 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT, INSERT, UPDATE, DELETE ON DEPARTMENT TO 'A'@'localhost' WITH GRANT OPTION;
Query OK, 0 rows affected (0.0085 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT, INSERT, UPDATE, DELETE ON DEPT_LOCATIONS TO 'A'@'localhost' WITH GRANT OPTION;
Query OK, 0 rows affected (0.0092 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT, INSERT, UPDATE, DELETE ON PROJECT TO 'A'@'localhost' WITH GRANT OPTION;
Query OK, 0 rows affected (0.0062 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT, INSERT, UPDATE, DELETE ON WORKS_ON TO 'A'@'localhost' WITH GRANT OPTION;
Query OK, 0 rows affected (0.0120 sec)
 MySQL  localhost:3306 ssl  company_security  SQL >
```

```
 MySQL  localhost:3306 ssl  SQL > show grants;
+-----------------------------------------------------------------------------------------------------+
| Grants for A@localhost                                                                               |
+-----------------------------------------------------------------------------------------------------+
| GRANT USAGE ON *.* TO `A`@`localhost`                                                                |
| GRANT SELECT, INSERT, UPDATE, DELETE ON `company_security`.`department` TO `A`@`localhost` WITH GRANT OPTION   |
| GRANT SELECT, INSERT, UPDATE, DELETE ON `company_security`.`dept_locations` TO `A`@`localhost` WITH GRANT OPTION |
| GRANT SELECT, INSERT, UPDATE, DELETE ON `company_security`.`employee` TO `A`@`localhost` WITH GRANT OPTION     |
| GRANT SELECT, INSERT, UPDATE, DELETE ON `company_security`.`project` TO `A`@`localhost` WITH GRANT OPTION      |
| GRANT SELECT, INSERT, UPDATE, DELETE ON `company_security`.`works_on` TO `A`@`localhost` WITH GRANT OPTION     |
+-----------------------------------------------------------------------------------------------------+
6 rows in set (0.0012 sec)
 MySQL  localhost:3306 ssl  SQL > |
```

II. Account B can retrieve all the attributes of EMPLOYEE and DEPARTMENT except for Salary, Mgr ssn, and Mgr start date.

```
 MySQL  localhost:3306 ssl  company_security  SQL > CREATE VIEW EMPLOYEE_B AS SELECT Fname,Minit,Lname, Ssn, Bdate, Address, Sex, Super_ssn, Dno FROM EMPLOYEE;
Query OK, 0 rows affected (0.0115 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON EMPLOYEE_B TO 'B'@'localhost';
Query OK, 0 rows affected (0.0042 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > CREATE VIEW DEPARTMENT_B AS SELECT Dname, Dnumber FROM DEPARTMENT;
Query OK, 0 rows affected (0.0064 sec)
 MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON DEPARTMENT_B TO 'B'@'localhost';
Query OK, 0 rows affected (0.0092 sec)
 MySQL  localhost:3306 ssl  company_security  SQL >
```

```
MySQL  localhost:3306 ssl  SQL > show grants;
+-------------------------------------------------------------------------------+
| Grants for B@localhost                                                        |
+-------------------------------------------------------------------------------+
| GRANT USAGE ON *.* TO `B`@`localhost`                                         |
| GRANT SELECT ON `company_security`.`department_b` TO `B`@`localhost`          |
| GRANT SELECT ON `company_security`.`employee_b` TO `B`@`localhost`            |
+-------------------------------------------------------------------------------+
3 rows in set (0.0011 sec)
```

```
MySQL  localhost:3306 ssl  company_security  SQL > select * from employee_b;
+----------+-------+---------+-----------+------------+-------------------------+-----+-----------+-----+
| Fname    | Minit | Lname   | Ssn       | Bdate      | Address                 | Sex | Super_ssn | Dno |
+----------+-------+---------+-----------+------------+-------------------------+-----+-----------+-----+
| John     | B     | Smith   | 123456789 | 1965-01-09 | 731 Fondren, Housten, TX | M   | 333445555 |   5 |
| Matt     | C     | Johnson | 231342904 | 1985-01-02 | 331 Fondren, Housten, TX | M   | 333445555 |   5 |
| Franklin | T     | Wong    | 333445555 | 1955-12-08 | 638 Voss, Housten, TX    | M   | 888665555 |   5 |
| Joyce    | A     | English | 453453453 | 1972-07-31 | 5631 Rice, Houston, TX   | F   | 333445555 |   5 |
| Ramesh   | K     | Narayan | 666884444 | 1962-09-15 | 975 Fire Oak, Humble, TX | M   | 333445555 |   5 |
| James    | E     | Borg    | 888665555 | 1937-11-10 | 450 Stone, Houston, TX   | M   | NULL      |   1 |
| Jennifer | S     | Wallace | 987654321 | 1941-06-20 | 291 Berry, Bellaire, TX  | F   | 888665555 |   4 |
| Ahmad    | V     | Jabbar  | 987987987 | 1969-03-29 | 980 Dallas, Houston, TX  | M   | 987654321 |   4 |
| Alicia   | J     | Zelaya  | 999887777 | 1968-01-19 | 3321 Castle, Spring, TX  | F   | 987654321 |   4 |
+----------+-------+---------+-----------+------------+-------------------------+-----+-----------+-----+
9 rows in set (0.0017 sec)
MySQL  localhost:3306 ssl  company_security  SQL > select * from department_b;
+----------------+---------+
| Dname          | Dnumber |
+----------------+---------+
| Administration |       4 |
| Headquarters   |       1 |
| Research       |       5 |
+----------------+---------+
3 rows in set (0.0015 sec)
```

III. Account C can retrieve or modify WORKS ON but can only retrieve the Fname, Minit, Lname, and Ssn attributes of EMPLOYEE and the Pname and Pnumber attributes of PROJECT.

```
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT, INSERT, UPDATE, DELETE ON WORKS-ON TO 'C'@'localhost';
Query OK, 0 rows affected (0.0114 sec)
MySQL  localhost:3306 ssl  company_security  SQL > CREATE VIEW EMPLOYEE_C AS SELECT Fname, Minit, Lname, Ssn FROM EMPLOYEE;
Query OK, 0 rows affected (0.0080 sec)
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON EMPLOYEE_C TO 'C'@'localhost';
Query OK, 0 rows affected (0.0052 sec)
MySQL  localhost:3306 ssl  company_security  SQL > CREATE VIEW PROJECT_C AS SELECT Pname, Pnumber FROM PROJECT;
Query OK, 0 rows affected (0.0085 sec)
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON PROJECT_C TO 'C'@'localhost';
Query OK, 0 rows affected (0.0036 sec)
MySQL  localhost:3306 ssl  company_security  SQL >
```

```
MySQL  localhost:3306 ssl  SQL > show grants;
+---------------------------------------------------------------------------------------+
| Grants for C@localhost                                                                |
+---------------------------------------------------------------------------------------+
| GRANT USAGE ON *.* TO `C`@`localhost`                                                 |
| GRANT SELECT ON `company_security`.`employee_c` TO `C`@`localhost`                    |
| GRANT SELECT ON `company_security`.`project_c` TO `C`@`localhost`                     |
| GRANT SELECT, INSERT, UPDATE, DELETE ON `company_security`.`works_on` TO `C`@`localhost` |
+---------------------------------------------------------------------------------------+
```

```
MySQL  localhost:3306 ssl  company_security  SQL > select * from employee_c;
+-----------+--------+-----------+------------+
| Fname     | Minit  | Lname     | Ssn        |
+-----------+--------+-----------+------------+
| John      | B      | Smith     | 123456789  |
| Matt      | C      | Johnson   | 231342904  |
| Franklin  | T      | Wong      | 333445555  |
| Joyce     | A      | English   | 453453453  |
| Ramesh    | K      | Narayan   | 666884444  |
| James     | E      | Borg      | 888665555  |
| Jennifer  | S      | Wallace   | 987654321  |
| Ahmad     | V      | Jabbar    | 987987987  |
| Alicia    | J      | Zelaya    | 999887777  |
+-----------+--------+-----------+------------+
9 rows in set (0.0020 sec)
MySQL  localhost:3306 ssl  company_security  SQL > select * from project_c;
+------------------+----------+
| Pname            | Pnumber  |
+------------------+----------+
| Computerization  |       10 |
| Newbenefits      |       30 |
| ProductX         |        1 |
| ProductY         |        2 |
| ProductZ         |        3 |
| Reorganization   |       20 |
```

IV. Account D can retrieve any attribute of EMPLOYEE or DEPENDENT and can modify DEPENDENT.

```
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON EMPLOYEE TO 'D'@'localhost';
Query OK, 0 rows affected (0.0099 sec)
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT, INSERT, UPDATE, DELETE ON DEPENDENT TO 'D'@'localhost';
Query OK, 0 rows affected (0.0099 sec)
MySQL  localhost:3306 ssl  company_security  SQL >
```

```
+-------------------------------------------------------------------------------+
| GRANT USAGE ON *.* TO `D`@`localhost`                                          |
| GRANT SELECT, INSERT, UPDATE, DELETE ON `company_security`.`dependent` TO `D`@`localhost` |
| GRANT SELECT ON `company_security`.`employee` TO `D`@`localhost`               |
+-------------------------------------------------------------------------------+
3 rows in set (0.0011 sec)
MySQL  localhost:3306 ssl  SQL > use company_security;
Default schema set to `company_security`.
Fetching global names, object names from `company_security` for auto-completion... Press ^C to stop.
Error during auto-completion cache update: Access denied; you need (at least one of) the PROCESS privilege(s) for this operation
MySQL  localhost:3306 ssl  company_security  SQL > select * from employee;
+-----------+--------+-----------+-----------+------------+-----------------------------+-----+----------+------------+-----+
| Fname     | Minit  | Lname     | Ssn       | Bdate      | Address                     | Sex | Salary   | Super_ssn  | Dno |
+-----------+--------+-----------+-----------+------------+-----------------------------+-----+----------+------------+-----+
| John      | B      | Smith     | 123456789 | 1965-01-09 | 731 Fondren, Housten, TX    | M   | 30000.00 | 333445555  |  5  |
| Matt      | C      | Johnson   | 231342904 | 1985-01-02 | 331 Fondren, Housten, TX    | M   | 34000.00 | 333445555  |  5  |
| Franklin  | T      | Wong      | 333445555 | 1955-12-08 | 638 Voss, Housten, TX       | M   | 40000.00 | 888665555  |  5  |
| Joyce     | A      | English   | 453453453 | 1972-07-31 | 5631 Rice, Houston, TX      | F   | 25000.00 | 333445555  |  5  |
| Ramesh    | K      | Narayan   | 666884444 | 1962-09-15 | 975 Fire Oak, Humble, TX    | M   | 38000.00 | 333445555  |  5  |
| James     | E      | Borg      | 888665555 | 1937-11-10 | 450 Stone, Houston, TX      | M   | 30000.00 | NULL       |  1  |
| Jennifer  | S      | Wallace   | 987654321 | 1941-06-20 | 291 Berry, Bellaire, TX     | F   | 43000.00 | 888665555  |  4  |
| Ahmad     | V      | Jabbar    | 987987987 | 1969-03-29 | 980 Dallas, Houston, TX     | M   | 25000.00 | 987654321  |  4  |
| Alicia    | J      | Zelaya    | 999887777 | 1968-01-19 | 3321 Castle, Spring, TX     | F   | 25000.00 | 987654321  |  4  |
+-----------+--------+-----------+-----------+------------+-----------------------------+-----+----------+------------+-----+
9 rows in set (0.0015 sec)
MySQL  localhost:3306 ssl  company_security  SQL > select * from dependant;
ERROR: 1142 (42000): SELECT command denied to user 'D'@'localhost' for table 'dependant'
MySQL  localhost:3306 ssl  company_security  SQL > select * from dependent;
+-----------+----------------+-----+------------+---------------+
| Essn      | Dependent_name | Sex | Bdate      | Relationship  |
+-----------+----------------+-----+------------+---------------+
| 123456789 | Alice          | F   | 1988-12-30 | Daughter      |
| 123456789 | Elizabeth      | F   | 1967-05-05 | Spouse        |
| 123456789 | Michael        | M   | 1988-01-04 | Son           |
| 333445555 | Alice          | F   | 1986-04-05 | Daughter      |
| 333445555 | Joy            | F   | 1958-05-03 | Spouse        |
| 333445555 | Theodore       | M   | 1983-10-25 | Son           |
| 987654321 | Abner          | M   | 1942-02-28 | Spouse        |
+-----------+----------------+-----+------------+---------------+
```

V. Account E can retrieve any attribute of EMPLOYEE but only for EMPLOYEE tuples that have Dno = 3.

```
MySQL  localhost:3306 ssl  company_security  SQL > CREATE VIEW EMPLOYEE_E AS SELECT * FROM EMPLOYEE WHERE Dno = 3;
Query OK, 0 rows affected (0.0131 sec)
MySQL  localhost:3306 ssl  company_security  SQL > GRANT SELECT ON EMPLOYEE_E TO 'E'@'localhost';
Query OK, 0 rows affected (0.0041 sec)
MySQL  localhost:3306 ssl  company_security  SQL >
```

```
MySQL  localhost:3306 ssl  SQL > show grants;
+------------------------------------------------------------------+
| Grants for E@localhost                                           |
+------------------------------------------------------------------+
| GRANT USAGE ON *.* TO `E`@`localhost`                            |
| GRANT SELECT ON `company_security`.`employee_e` TO `E`@`localhost` |
+------------------------------------------------------------------+
2 rows in set (0.0010 sec)
MySQL  localhost:3306 ssl  SQL > select * from employee_e;
ERROR: 1046 (3D000): No database selected
MySQL  localhost:3306 ssl  SQL > use company_security;
Default schema set to `company_security`.
Fetching global names, object names from `company_security` for auto-completion... Press ^C to stop.
Error during auto-completion cache update: Access denied; you need (at least one of) the PROCESS privilege(s) for this operation
MySQL  localhost:3306 ssl  company_security  SQL > select * from employee_e;
Empty set (0.0018 sec)
MySQL  localhost:3306 ssl  company_security  SQL >
```