Relational Database Design – Company Schema – Nested Queries

Reference: Elmasri, R., 2018. Fundamentals of database systems. Pearson Education India.

1. With continuation to Session 03 exercise, execute all the example queries provided in Subsection 7.1.1 to 7.4.2 (excluding keywords 'TRIGGER', 'VIEW', 'EXCEPT' and 'CONTAINS').

```
mysql> use dev;
Database changed
mysql> show tables;
+----------------+
| Tables_in_dev  |
+----------------+
| DEPENDENT      |
| DEPT_LOCATIONS |
| Department     |
| WORKS_ON       |
| employee       |
| project        |
+----------------+
6 rows in set (0.00 sec)

mysql> show tables;
+----------------+
| Tables_in_dev  |
+----------------+
| DEPENDENT      |
| DEPT_LOCATIONS |
| Department     |
| WORKS_ON       |
| employee       |
| project        |
+----------------+
6 rows in set (0.00 sec)

mysql> describe employee;
+-----------+-------------+------+-----+---------+-------+
| Field     | Type        | Null | Key | Default | Extra |
+-----------+-------------+------+-----+---------+-------+
| Fname     | char(50)    | YES  |     | NULL    |       |
| Minit     | char(50)    | YES  |     | NULL    |       |
```

```
| Lname    | char(50)   | YES |    | NULL |    |
| Ssn      | int        | NO  | PRI | NULL |    |
| Bdate    | date       | YES |    | NULL |    |
| Address  | varchar(50)| YES |    | NULL |    |
| Sex      | char(10)   | YES |    | NULL |    |
| Salary   | int        | YES |    | NULL |    |
| Super_ssn| int        | YES |    | NULL |    |
| Dno      | int        | YES |    | NULL |    |
| email    | varchar(50)| YES |    | NULL |    |
+-----------+-------------+------+-----+---------+-------+
11 rows in set (0.00 sec)

mysql> select * from employee;
+----------+-------+---------+-----------+------------+----------------------+------+--------+-----------+------+-------+
| Fname    | Minit | Lname   | Ssn       | Bdate      | Address              | Sex  | Salary | Super_ssn | Dno  | email |
+----------+-------+---------+-----------+------------+----------------------+------+--------+-----------+------+-------+
| John     | B     | Smith   | 123456789 | 1965-01-09 | 731 Fondren          | M    | 30000  | 333445555 |    5 | NULL  |
| Jennifer | S     | Wallace | 987654321 | 1941-06-20 | 291 Berry Bellaire TX | F    | 70000  | 888665555 |    4 | NULL  |
| Alicia   | J     | Zelaya  | 999887777 | 1968-01-19 | 3321 Castle Spring TX | F    | 70000  | 987654321 |    4 | NULL  |
+----------+-------+---------+-----------+------------+----------------------+------+--------+-----------+------+-------+
3 rows in set (0.02 sec)

mysql> select * from Department;
+----------------+---------+-----------+----------------+
| Dname          | Dnumber | Mgr_ssn   | Mgr_start_date |
+----------------+---------+-----------+----------------+
| Headquarters   |    1    | 888665555 | 1981-06-19     |
| Administration |    4    | 987654321 | 1995-01-01     |
| Research       |    5    | 333445555 | 1988-05-22     |
| Headquarter2   |    7    | 123456789 | 1996-05-21     |
+----------------+---------+-----------+----------------+
4 rows in set (0.00 sec)

mysql> select Fname,Lname from employee where Super_ssn is NULL;
Empty set (0.00 sec)
```

```
mysql> select Fname,Lname from employee where Super_ssn is not  NULL;
+----------+---------+
| Fname    | Lname   |
+----------+---------+
| John     | Smith   |
| Jennifer | Wallace |
| Alicia   | Zelaya  |
+----------+---------+
3 rows in set (0.00 sec)

mysql> select Fname,Lname from employee where salary>ALL (select salary from employee
    where Dno=5);
+----------+---------+
| Fname    | Lname   |
+----------+---------+
| Jennifer | Wallace |
| Alicia   | Zelaya  |
+----------+---------+
2 rows in set (0.00 sec)

mysql> select Fname,Lname from employee where salary>ALL (select salary from employee
    where Dno=4);
Empty set (0.00 sec)

mysql> describe DEPENDENT;
+----------------+----------+------+-----+---------+-------+
| Field          | Type     | Null | Key | Default | Extra |
+----------------+----------+------+-----+---------+-------+
| Essn           | int      | NO   | PRI | NULL    |       |
| Dependent_name | char(50) | NO   | PRI | NULL    |       |
| Sex            | char(1)  | YES  |     | NULL    |       |
| Bdate          | date     | YES  |     | NULL    |       |
| Relationship   | char(50) | YES  |     | NULL    |       |
+----------------+----------+------+-----+---------+-------+
5 rows in set (0.00 sec)


mysql> select * from DEPENDENT;
+-----------+----------------+------+------------+--------------+
| Essn      | Dependent_name | Sex  | Bdate      | Relationship |
+-----------+----------------+------+------------+--------------+
```

```
| 333445555 | Alice      | F  | 1986-04-05 | Daughter   |
| 333445555 | Joy        | F  | 1958-05-03 | Spouse     |
| 333445555 | Theodore   | M  | 1983-10-25 | Son        |
+-----------+---------------+------+------------+--------------+
3 rows in set (0.00 sec)

mysql> describe employee;
+-----------+-------------+------+-----+---------+-------+
| Field     | Type        | Null | Key | Default | Extra |
+-----------+-------------+------+-----+---------+-------+
| Fname     | char(50)    | YES  |     | NULL    |       |
| Minit     | char(50)    | YES  |     | NULL    |       |
| Lname     | char(50)    | YES  |     | NULL    |       |
| Ssn       | int         | NO   | PRI | NULL    |       |
| Bdate     | date        | YES  |     | NULL    |       |
| Address   | varchar(50) | YES  |     | NULL    |       |
| Sex       | char(10)    | YES  |     | NULL    |       |
| Salary    | int         | YES  |     | NULL    |       |
| Super_ssn | int         | YES  |     | NULL    |       |
| Dno       | int         | YES  |     | NULL    |       |
| email     | varchar(50) | YES  |     | NULL    |       |
+-----------+-------------+------+-----+---------+-------+
11 rows in set (0.00 sec)
```

mysql> Select E.Fname,E.Lname from employee as E,DEPENDENT as D where E.Super_ssn=D.Essn and E.Sex=D.sex and E.Fname=D.Dependent_name;
Empty set (0.00 sec)

mysql> Select E.Fname,E.Lname from employee as E,DEPENDENT as D where E.Super_ssn=D.Essn;

```
+-------+-------+
| Fname | Lname |
+-------+-------+
| John  | Smith |
| John  | Smith |
| John  | Smith |
+-------+-------+
3 rows in set (0.00 sec)
```

mysql> Select E.Fname,E.Lname from employee as E,DEPENDENT as D where E.Super_ssn=D.Essn and E.Sex=D.sex;

```
+-------+-------+
```

```
| Fname | Lname |
+-------+-------+
| John  | Smith |
+-------+-------+
1 row in set (0.00 sec)

mysql> select Fname,Lname from employee where exists(select * from DEPENDENT where
    Super_ssn=Essn);
+-------+-------+
| Fname | Lname |
+-------+-------+
| John  | Smith |
+-------+-------+
1 row in set (0.00 sec)


mysql> select * from DEPENDENT;
+-----------+----------------+------+------------+--------------+
| Essn      | Dependent_name | Sex  | Bdate      | Relationship |
+-----------+----------------+------+------------+--------------+
| 333445555 | Alice          | F    | 1986-04-05 | Daughter     |
| 333445555 | Joy            | F    | 1958-05-03 | Spouse       |
| 333445555 | Theodore       | M    | 1983-10-25 | Son          |
+-----------+----------------+------+------------+--------------+
3 rows in set (0.00 sec)

mysql> Select E.Fname,E.Lname,D.Dependent_name from employee as E,DEPENDENT as
    D where E.Super_ssn=D.Essn and E.Sex=D.sex;
+-------+-------+----------------+
| Fname | Lname | Dependent_name |
+-------+-------+----------------+
| John  | Smith | Theodore       |
+-------+-------+----------------+
1 row in set (0.00 sec)

mysql> select E.Fname,E.Lname,D.Dependent_name from employee as E, DEPENDENT AS
    D where exists(select * from DEPENDENT where Super_ssn=Essn);
+-------+-------+----------------+
| Fname | Lname | Dependent_name |
+-------+-------+----------------+
| John  | Smith | Alice          |
| John  | Smith | Joy            |
```

```
| John  | Smith | Theodore     |
+-------+------+---------------+
3 rows in set (0.00 sec)

mysql> select E.Minti,D.Sex from employee as E ,DEPENDENT as D where not exists(select *
    from DEPENDENT where Super_ssn=Essn);
ERROR 1054 (42S22): Unknown column 'E.Minti' in 'field list'
mysql> select E.Minit,D.Sex from employee as E ,DEPENDENT as D where not exists(select *
    from DEPENDENT where Super_ssn=Essn);
+-------+------+
| Minit | Sex  |
+-------+------+
| J     | F    |
| S     | F    |
| J     | F    |
| S     | F    |
| J     | M    |
| S     | M    |
+-------+------+
6 rows in set (0.00 sec)

mysql> select Fname,Lname from employee where not  exists(select * from DEPENDENT
where Super_ssn=Essn);
+----------+---------+
| Fname    | Lname   |
+----------+---------+
| Jennifer | Wallace |
| Alicia   | Zelaya  |
+----------+---------+
2 rows in set (0.00 sec)

mysql> select E.Fname,E.Lname,D.Dependent_name from employee as E,DEPENDENT as
    D where not exists(select * from DEPENDENT where E.Super_ssn=D.Essn);
+----------+---------+----------------+
| Fname    | Lname   | Dependent_name |
+----------+---------+----------------+
| Alicia   | Zelaya  | Alice          |
| Jennifer | Wallace | Alice          |
| Alicia   | Zelaya  | Joy            |
| Jennifer | Wallace | Joy            |
| Alicia   | Zelaya  | Theodore       |
| Jennifer | Wallace | Theodore       |
```

```
+----------+---------+----------------+
mysql> select Fname,Lname from employee where Dno in (1,2,3,4,5);
+----------+---------+
| Fname    | Lname   |
+----------+---------+
| John     | Smith   |
| Jennifer | Wallace |
| Alicia   | Zelaya  |
+----------+---------+
3 rows in set (0.00 sec)

mysql> select Fname,Lname from employee where Dno in (3,4);
+----------+---------+
| Fname    | Lname   |
+----------+---------+
| Jennifer | Wallace |
| Alicia   | Zelaya  |
+----------+---------+
2 rows in set (0.00 sec)

mysql> select Fname,Lname from employee where Dno=3 and Dno=4;
Empty set (0.00 sec)

mysql> select Fname,Lname from employee where Dno=3 or Dno=4;
+----------+---------+
| Fname    | Lname   |
+----------+---------+
| Jennifer | Wallace |
| Alicia   | Zelaya  |
+----------+---------+
2 rows in set (0.00 sec)
mysql> select * from Department;
+----------------+---------+-----------+----------------+
| Dname          | Dnumber | Mgr_ssn   | Mgr_start_date |
+----------------+---------+-----------+----------------+
| Headquarters   |       1 | 888665555 | 1981-06-19     |
| Administration |       4 | 987654321 | 1995-01-01     |
| Research       |       5 | 333445555 | 1988-05-22     |
| Headquarter2   |       7 | 123456789 | 1996-05-21     |
+----------------+---------+-----------+----------------+
4 rows in set (0.00 sec)
```

```
mysql> select Fname,Lname,Address from (employee join Department on Dno=Dnumber);
+----------+---------+------------------------+
| Fname    | Lname   | Address                |
+----------+---------+------------------------+
| John     | Smith   | 731 Fondren            |
| Jennifer | Wallace | 291 Berry Bellaire TX  |
| Alicia   | Zelaya  | 3321 Castle Spring  TX |
+----------+---------+------------------------+
3 rows in set (0.00 sec)

mysql> select Fname,Lname,Address from (employee join Department on Dno=Dnumber)
    where Dname='Administration';
+----------+---------+------------------------+
| Fname    | Lname   | Address                |
+----------+---------+------------------------+
| Jennifer | Wallace | 291 Berry Bellaire TX  |
| Alicia   | Zelaya  | 3321 Castle Spring  TX |
+----------+---------+------------------------+
2 rows in set (0.00 sec)

mysql> select sum(salary),max(salary),min(salary),avg(salary) from employee;
+-------------+-------------+-------------+-------------+
| sum(salary) | max(salary) | min(salary) | avg(salary) |
+-------------+-------------+-------------+-------------+
|      170000 |       70000 |       30000 | 56666.6667  |
+-------------+-------------+-------------+-------------+
1 row in set (0.00 sec)

mysql> select sum(salary) as totalsalary,max(salary) as highestsalary,min(salary) as
    lowestsalary,avg(salary) as averagesalary from employee;
+-------------+---------------+--------------+---------------+
| totalsalary | highestsalary | lowestsalary | averagesalary |
+-------------+---------------+--------------+---------------+
|      170000 |         70000 |        30000 | 56666.6667    |
+-------------+---------------+--------------+---------------+
1 row in set (0.00 sec)

mysql> select count(salary) from employee;
+---------------+
| count(salary) |
+---------------+
```

```
|          3 |
+---------------+
1 row in set (0.00 sec)

mysql> select count(distinct salary) from employee;
+------------------------+
| count(distinct salary) |
+------------------------+
|                     2 |
+------------------------+
1 row in set (0.03 sec)

mysql> select count(*) from employee;
+----------+
| count(*) |
+----------+
|       3 |
+----------+
1 row in set (0.00 sec)

mysql> select count(*) from Department;
+----------+
| count(*) |
+----------+
|       4 |
+----------+
1 row in set (0.00 sec)
mysql> select Dno,count(*),avg(salary) from employee group by Dno;
+------+----------+-------------+
| Dno  | count(*) | avg(salary) |
+------+----------+-------------+
|    5 |        1 | 30000.0000 |
|    4 |        2 | 70000.0000 |
+------+----------+-------------+
2 rows in set (0.00 sec)
mysql> select Dno,count(*),avg(salary) from employee group by Ssn;
+------+----------+-------------+
| Dno  | count(*) | avg(salary) |
+------+----------+-------------+
|    5 |        1 | 30000.0000 |
|    4 |        1 | 70000.0000 |
|    4 |        1 | 70000.0000 |
```

```
+------+----------+-------------+
3 rows in set (0.00 sec)
mysql> select Dno,count(*),avg(salary) from employee group by Ssn;
+------+----------+-------------+
| Dno  | count(*) | avg(salary) |
+------+----------+-------------+
|    5 |        1 |  30000.0000 |
|    4 |        1 |  70000.0000 |
|    4 |        1 |  70000.0000 |
+------+----------+-------------+
3 rows in set (0.00 sec)

mysql> select* from DEPENDENT;
+-----------+----------------+------+------------+--------------+
| Essn      | Dependent_name | Sex  | Bdate      | Relationship |
+-----------+----------------+------+------------+--------------+
| 333445555 | Alice          | F    | 1986-04-05 | Daughter     |
| 333445555 | Joy            | F    | 1958-05-03 | Spouse       |
| 333445555 | Theodore       | M    | 1983-10-25 | Son          |
+-----------+----------------+------+------------+--------------+
3 rows in set (0.00 sec)

mysql> select count(*) from DEPENDENT group by Essn;
+----------+
| count(*) |
+----------+
|        3 |
+----------+
1 row in set (0.00 sec)

mysql> select Essn,count(*) from DEPENDENT group by Essn;
+-----------+----------+
| Essn      | count(*) |
+-----------+----------+
| 333445555 |        3 |
+-----------+----------+
1 row in set (0.00 sec)

mysql> select * from DEPENDENT;
+-----------+----------------+------+------------+--------------+
| Essn      | Dependent_name | Sex  | Bdate      | Relationship |
+-----------+----------------+------+------------+--------------+
```

```
| 333445555 | Alice       | F   | 1986-04-05 | Daughter    |
| 333445555 | Joy         | F   | 1958-05-03 | Spouse      |
| 333445555 | Theodore    | M   | 1983-10-25 | Son         |
+-----------+---------------+------+------------+--------------+
3 rows in set (0.00 sec)

mysql> select count(Dno) from employee group by Super_ssn;
+------------+
| count(Dno) |
+------------+
|          1 |
|          1 |
|          1 |
+------------+
3 rows in set (0.00 sec)
```

2. Execute the following Queries over the Company Schema you have already created.
    a. For each department whose average employee salary is more than 30,000, retrieve the department name and the number of employees working for that department.

    SELECT D.dept_name, COUNT(E.emp_id) AS num_employees
    FROM Department D
    JOIN Employee E ON D.dept_id = E.dept_id
    GROUP BY D.dept_name
    HAVING AVG(E.salary) > 30000;

    b. i. Retrieve the number of female employees in each department making more than 30,000.
    SELECT D.dept_name, COUNT(E.emp_id) AS num_female_employees
    FROM Department D
    JOIN Employee E ON D.dept_id = E.dept_id
    WHERE E.gender = 'F' AND E.salary > 30000
    GROUP BY D.dept_name;

ii. For each department whose average employee salary is more than 30,000, retrieve the department name and number of male employees working for that department.
    SELECT D.dept_name, COUNT(E.emp_id) AS num_male_employees
    FROM Department D
    JOIN Employee E ON D.dept_id = E.dept_id
    WHERE E.gender = 'M'
    GROUP BY D.dept_name
    HAVING AVG(E.salary) > 30000;

c. Retrieve the names of all employees who work in the department that has the employee with the highest salary among all employees.

SELECT E.name
FROM Employee E
WHERE E.dept_id = (SELECT dept_id FROM Employee ORDER BY salary DESC LIMIT 1);

d. Retrieve the names of employees who make at least 10,000 more than the employee who is paid the least in the company.

SELECT E.name
FROM Employee E
WHERE E.salary > (SELECT MIN(salary) + 10000 FROM Employee);

e. Retrieve the names of all employees in department 5 who work more than 10 hours per week on the Product X's project.

SELECT E.name
FROM Employee E
JOIN Project P ON E.emp_id = P.emp_id
WHERE E.dept_id = 5 AND P.project_name = 'Product X' AND E.hours_per_week > 10;

f. List the names of all employees who have a dependent with the same first name as themselves.

SELECT E.name
FROM Employee E
JOIN Dependent D ON E.emp_id = D.emp_id
WHERE E.first_name = D.first_name;

g. Find the names of all employees who are directly supervised by 'Tejaswi Kumar'.

SELECT E.name
FROM Employee E
WHERE E.supervisor_id = (SELECT emp_id FROM Employee WHERE name = 'Tejaswi Kumar');

h. Find the names of employees who work on all the projects controlled by department number 5.

SELECT E.name
FROM Employee E
WHERE NOT EXISTS (
SELECT P.project_id
FROM Project P
WHERE P.dept_id = 5 AND NOT EXISTS (
SELECT EP.emp_id
FROM Employee_Project EP
WHERE EP.emp_id = E.emp_id AND EP.project_id = P.project_id));

i. For each project, list the project name and the total hours per week (by all employees) spent on that project.
SELECT P.project_name, SUM(E.hours_per_week) AS total_hours
FROM Project P
JOIN Employee_Project EP ON P.project_id = EP.project_id
JOIN Employee E ON EP.emp_id = E.emp_id
GROUP BY P.project_name;

j. Retrieve the names of all employees who work on every project.
SELECT E.name
FROM Employee E
WHERE NOT EXISTS (
SELECT P.project_id
FROM Project P
WHERE NOT EXISTS (
SELECT EP.emp_id
FROM Employee_Project EP
WHERE EP.emp_id = E.emp_id AND EP.project_id = P.project_id));

k. Retrieve the names of all employees who do not work on any project.
SELECT E.name
FROM Employee E
WHERE NOT EXISTS (
SELECT EP.emp_id
FROM Employee_Project EP
WHERE EP.emp_id = E.emp_id);

l. Retrieve the average salary of all female employees.
SELECT AVG(E.salary) AS average_female_salary
FROM Employee E
WHERE E.gender = 'F';

m. Find the names and addresses of all employees who work on at least one project located in Madurai but whose department has no location in Madurai.
SELECT E.name, E.address
FROM Employee E
JOIN Dependent D ON E.emp_id = D.emp_id
WHERE D.location = 'Madurai' AND E.dept_id NOT IN (
SELECT dept_id FROM Department WHERE location = 'Madurai');

n. List the last names of all department managers who have no dependents.
SELECT E.last_name
FROM Employee E
WHERE E.role = 'Manager' AND NOT EXISTS (
SELECT D.emp_id

```
FROM Dependent D
WHERE D.emp_id = E.emp_id
);
```

o. Display employee names (e'') who are supervised by an e' who is immediately supervised by an employee with lname "XYZ".
```
SELECT E1.name
FROM Employee E1
WHERE E1.supervisor_id IN (
SELECT E2.emp_id
FROM Employee E2
WHERE E2.supervisor_id = (SELECT emp_id FROM Employee WHERE last_name = 'XYZ')
);
```

p. Display names of all employees who work on some project controlled by department number 10.
```
SELECT E.name
FROM Employee E
JOIN Employee_Project EP ON E.emp_id = EP.emp_id
JOIN Project P ON EP.project_id = P.project_id
WHERE P.dept_id = 10;
```

q. Print all the ssn and the first name of supervisors who supervise at least 2 projects in ascending order of the number of employee he/she supervise under him/her.
```
SELECT E.ssn, E.first_name
FROM Employee E
WHERE (SELECT COUNT(P.project_id)
FROM Project P
WHERE P.supervisor_id = E.emp_id) >= 2
ORDER BY (SELECT COUNT(E2.emp_id) FROM Employee E2 WHERE E2.supervisor_id = E.emp_id) ASC;
```

r. Display all male employee names who also have dependents along with their dependent names.
```
SELECT E.name, D.dependent_name
FROM Employee E
JOIN Dependent D ON E.emp_id = D.emp_id
WHERE E.gender = 'M';
```

s. Display those employees whose salary exceeds the department managers salary that the employee(s) work for.
```
SELECT E.name
FROM Employee E
WHERE E.salary > (SELECT M.salary FROM Employee M WHERE M.emp_id = E.manager_id);
```

t. Display employee names who either work in CS department or supervise an employee working for CS department.

```
SELECT E.name
FROM Employee E
WHERE E.dept_id = (SELECT dept_id FROM Department WHERE dept_name = 'CS')
OR E.emp_id IN (SELECT supervisor_id FROM Employee WHERE dept_id = (SELECT
    dept_id FROM Department WHERE dept_name = 'CS'));
```