Querying exercises from Company Schema

EMPLOYEE (ssn, fname, minit, lname, bdate, dno, gender, superssn)
Foreign Keys: dno REFERENCES department (dno),
Foreign Key: superssn REFERENCES employee (ssn)
DEPARTMENT (dno, dname, mgrssn, mgrstartdate)
Foreign Keys: mgrssn REFERENCES employee (ssn)
DEP_LOCATIONS (dno, dlocation)
Foreign Keys: dno REFERENCES department (dno),
PROJECT (pno, pname, plocation, dno)
Foreign Keys: dno REFERENCES department (dno),
WORKS_ON (essn, pno, hours)
Foreign Keys: essn REFERENCES employee (ssn)
Foreign Keys: pno REFERENCES project (pno)
DEPENDENT (essn, dep_name, gender, bdate date, relationship)
Foreign Keys: essn REFERENCES employee (ssn)

(Q-01) List employees working for dno=4 (Selection operation)

$\sigma_{DNO = 4}$ (EMPLOYEE)

```
SELECT * FROM employee WHERE dno = 4;
```

(Q-02) List employees having salary > 30000 (Selection operation)

$\sigma_{SALARY > 30000}$ (EMPLOYEE)

```
SELECT * FROM employee WHERE salary> 30000;
```

(Q-03) List first name, last name, and salary of all employees (Projection operation)

$\pi_{LNAME, FNAME, SALARY}$(EMPLOYEE)

```
SELECT fname, lname, salary FROM employee;
```

(Q-04) List first name, last name, and salary of employees that work for dno=5.
(Selection and Projection operation)

$\pi_{LNAME, FNAME, SALARY}(\sigma_{DNO=5}$ (EMPLOYEE))

```
SELECT fname, lname, salary FROM employee WHERE dno=5;
```

(Q-05) List employees having salary >= 10000 and <= 30000

$\sigma_{salary >= 10000 AND salary <= 30000}$(EMPLOYEE)

```
SELECT * FROM employee WHERE salary >= 10000 AND salary <= 30000;
```

(Q-06) List (fname, dno, salary) of employees having salary >= 30000

$r1 \leftarrow \sigma_{salary >= 30000}(EMPLOYEE)$
$result \leftarrow \pi_{fname, dno, salary}(r1)$
OR
$result \leftarrow \pi_{fname, dno, salary}(\sigma_{salary >= 30000}(EMPLOYEE))$

```
SELECT fname, dno, salary FROM employee WHERE salary >= 30000;
```

(Q-07) List Fname, Salary of all Female Employees

$\pi_{fname, salary}(\sigma_{GENDER='F'}(EMPLOYEE))$

```
SELECT fname, salary FROM employee WHERE gender='F';
```

(Q-08) List employees either working dno=4 and salary > 25000 or working dno=5 and salary > 30000.

$\sigma_{(DNO=4 \text{ AND } SALARY>25000) \text{ OR } (DNO=5 \text{ AND } SALARY > 30000)}(EMPLOYEE)$

```
SELECT * FROM employee WHERE (dno=4 AND salary > 25000) OR
    (dno=5 AND salary >= 30000);
```

(Q-09) List all employees supervised by employee having ssn = 123

$\sigma_{(superssn=123)}(EMPLOYEE)$

```
SELECT * FROM employee WHERE superssn=123;
```

(Q-10) List Fname, Dname of all employees

$r1 \leftarrow EMPLOYEE \bowtie_{employee.dno=department.dno} DEPARTMENT$
$result \leftarrow \pi_{fname, dname}(r1)$

```
SELECT fname, dname FROM employee AS e
    JOIN department AS d ON (e.dno=d.dno);
```

(Q-11) List Fname, Salary of all Female Supervisors

$s \leftarrow \pi_{SUPERSSN}(EMPLOYEE)$
$r1 \leftarrow s \bowtie_{s.superssn=ssn} EMPLOYEE$
$r2 \leftarrow \sigma_{GENDER='F'}(r1)$
$result \leftarrow \pi_{fname, salary}(r2)$

```
SELECT fname, salary FROM employee AS e JOIN
    (SELECT DISTINCT superssn FROM employee) AS r1
    ON (r1.superssn=e.ssn)
    WHERE gender='F';
```

(Q-12) List Fname, Salary of all Female Managers

$r1 \leftarrow EMPLOYEE \bowtie_{employee.ssn=department.mgrssn} DEPARTMENT$
$result(dname, mgr\_name) \leftarrow \pi_{dname,\ fname}(\sigma_{GENDER='F'}(r1))$

```
SELECT dname, fname AS mgr_name FROM employee AS e
    JOIN department AS d ON (e.ssn=d.mgrssn)
    WHERE gender='F';
```

(Q-13) List ssn of non-managers, i.e. they are not manager of any department

$\pi_{SSN}(EMPLOYEE)$ EXCEPT $\pi_{MGRSSN}(DEPARTMENT)$

```
SELECT ssn FROM employee
EXCEPT
SELECT DISTINCT mgrssn FROM department;
```

(Q-14) List ssn, and name of non-managers

$NM \leftarrow \pi_{SSN}(EMPLOYEE)$ EXCEPT $\pi_{MGRSSN}(DEPARTMENT)$
$RES \leftarrow \pi_{SSN,FNAME}(EMPLOYEE * NM)$

```
SELECT ssn, fname FROM employee
    NATURAL JOIN
(SELECT ssn FROM employee EXCEPT SELECT mgrssn FROM department) AS nm;
```

```
SELECT ssn, fname FROM employee
    WHERE ssn NOT IN (SELECT mgrssn FROM department);
```

*Note: operator * between two relations here, represent Natural Join.*

(Q-15) List SSN, FNAME of employees who do not work on any project.

$NW \leftarrow \pi_{SSN}(EMPLOYEE)$ EXCEPT $\pi_{ESSN}(WORKS\_ON)$
$RES \leftarrow \pi_{SSN,FNAME}(EMPLOYEE * NW)$

```
SELECT ssn, fname FROM employee
    NATURAL JOIN
(SELECT ssn FROM employee EXCEPT SELECT essn FROM works_on) AS nw;
```

```
SELECT ssn, fname FROM employee
    WHERE ssn NOT IN (SELECT essn FROM works_on); //SEMI-DIFFERENCE
```

(Q-16) List SSN, FNAME of employees who work on at least one project.

$EW \leftarrow \pi_{SSN}(EMPLOYEE)$ INTERSECT $\pi_{ESSN}(WORKS\_ON)$
$result \leftarrow \pi_{SSN,FNAME}(EMPLOYEE * EW)$

```
SELECT ssn, fname FROM employee
    NATURAL JOIN
(SELECT ssn FROM employee INTERSECT SELECT essn FROM works_on) AS ew;

SELECT ssn, fname FROM employee
    WHERE ssn IN (SELECT essn FROM works_on); //SEMI-JOIN or SEMI-INTERSECT
```

(Q-17) Find out Employees that either work for DNO=4 or associated with a department as manager

$e1 \leftarrow \sigma_{DNO=4}(EMPLOYEE)$
$e2 \leftarrow \pi_{EMPLOYEE.*}(\sigma_{department.dno=4}(EMPLOYEE * DEPARTMENT))$
$result \leftarrow e1$ UNION $e2$

```
SELECT * FROM employee WHERE dno=4
UNION
SELECT employee.* FROM employee NATURAL JOIN department
    WHERE department.dno=4;
```

(Q-18) List Employee that are working on projects monitored by DNO=4

$\pi_{EMPLOYEE.*}((\sigma_{DNO=4}(PROJECT)) * WORKS\_ON) * EMPLOYEE)$

```
SELECT employee.* FROM project NATURAL JOIN works_on
    JOIN employee ON(ssn=essn) WHERE project.dno=4
```

(Q-19) List Employee Name, SupervisorName (if any)

$\pi_{e.fname,s.fname}(EMPLOYEE\ e$ LEFT JOIN $EMPLOYEE\ s$ ON $(e.superssn=s.ssn))$

```
SELECT e.fname, s.fname FROM employee AS e LEFT JOIN employee AS s
    ON(e.superssn=s.essn)
```

(Q-20) List employees(ssn, fname) that work on projects managed by department 'Research'.

$r1 \leftarrow \sigma_{DNAME='Research'}(DEPARTMENT)$
$r2 \leftarrow r1 * PROJECT * WORKS\_ON$
$r3 \leftarrow r2 \bowtie_{ESSN=SSN} EMPLOYEE$
$RESULT \leftarrow \pi_{SSN,\ FNAME}(r3)$

```
SELECT ssn, fname FROM (
(SELECT * FROM department WHERE dname = 'Research') AS r1
    NATURAL JOIN project NATURAL JOIN works_on) AS r2
        JOIN employee AS e ON (ssn=essn);
```

(Q-21) What is total salary company pays? Also give count of employees, maximum, minimum, average salary the company pays to its employees.

$F_{COUNT(SSN),\ SUM(SALARY),\ MAX(SALARY),\ MIN(SALARY),\ AVG(SALARY)}$ (EMPLOYEE)

```
SELECT count(ssn), sum(salary), max(salary), min(salary), avg(salary) FROM employee;
```

(Q-22) Give department wise sum of salary. Also give count of employees, maximum, minimum, average salary that each department of the company pays.

$_{DNO}\ F_{COUNT(SSN),\ SUM(SALARY),\ MAX(SALARY),\ MIN(SALARY),\ AVG(SALARY)}$ (EMPLOYEE)

```
SELECT dno, count(ssn), sum(salary), max(salary), min(salary), avg(salary)
    FROM employee GROUP BY dno;
```

May also give names to aggregated columns -

r1(dno, no_emps, total_salary, max_salary, min_salary, avg_salary)
← $_{DNO}\ F_{COUNT(SSN),\ SUM(SALARY),\ MAX(SALARY),\ MIN(SALARY),\ AVG(SALARY)}$ (EMPLOYEE)

```
SELECT dno, count(ssn) AS no_emps, sum(salary) AS total_salary, max (salary) AS  max_salary,
min(salary) AS  min_salary, avg(salary) AS avg_salary
    FROM employee GROUP BY dno;
```

(Q-23) List DNO, Department Name, and No of Employees for each department of the company.

r1(dno, no_emps) ← $_{DNO}\ F_{COUNT(SSN)}$ (EMPLOYEE)
r2 ← r1 * DEPARTMENT
result ← $\pi_{DNO,\ DNAME,\ NO\_EMPS}$(r2)

```
SELECT dno, dname, no_emps FROM (SELECT dno, count(ssn) AS no_emps FROM employee
GROUP BY dno) AS r1 NATURAL JOIN department;
```

(Q-24) List DNO, Department Name, Manager Name, and Number of Employees for each department of the company.

r1(dno, no_emps) ← $_{DNO}\ F_{COUNT(SSN)}$ (EMPLOYEE)
r2 ← r1 * DEPARTMENT
r3 ← r2 ⋈ $_{MGRSSN=SSN}$ EMPLOYEE
result ← $\pi_{DNO,\ DNAME,\ FNAME,\ NO\_EMPS}$ (r3)

```
SELECT r1.dno, dname, no_emps, fname AS manager_name FROM (SELECT dno, count(ssn)
    AS no_emps FROM employee GROUP BY dno) AS r1 NATURAL JOIN department
    JOIN employee ON (mgrssn=ssn);
```

(Q-25) List employee-ssn along with count of employees they are supervising for employees who are supervising more than 2 employees

r1(superssn, no_emps) ← $_{SUPERSSN}\mathcal{F}_{COUNT(SSN)}$ (EMPLOYEE)
result ← $\sigma_{NO\_EMPS > 2}$ (r1)

```
SELECT superssn, count(ssn) FROM employee
    GROUP BY superssn
    HAVING count(ssn) > 2;
```

(Q-26) List DNO, Department Name, Number of Employees, and No of Projects it controls for each department of the company.

r1(dno, no_emps) ← $_{DNO}\mathcal{F}_{COUNT(SSN)}$ (EMPLOYEE)
r2(dno, no_projs) ← $_{DNO}\mathcal{F}_{COUNT(PNO)}$ (PROJECTS)
r3 ← r1 * r2 * DEPARTMENT
result ← $\pi_{DNO, DNAME, NO\_EMPS, NO\_PROJS}$(r3)

```
SELECT dno, dname, no_emps, no_projs FROM (SELECT dno, count(ssn) AS no_emps FROM
employee GROUP BY dno) AS r1 NATURAL JOIN (SELECT dno, count(pno) AS no_projs FROM
project GROUP BY dno) AS r2 NATURAL JOIN department;
```

(Q-27) List SSN, Name, SALARY, Department Name, and Number of Employees supervising for each employee of the company.

r1(superssn, no_emps) ← $_{SUPERSSN}\mathcal{F}_{COUNT(SSN)}$ (EMPLOYEE)
r2 ← EMPLOYEE LEFT JOIN $_{E.SSN = r1.SUPERSSN}$ (r1)
r3 ← r2 * DEPARTMENT
result ← $\pi_{E.SSN, FNAME, SALARY, DNAME, NO\_EMPS}$ (r3)

```
SELECT e.ssn, fname, salary, dname, no_emps FROM (SELECT superssn, count(ssn) AS no_emps
FROM employee GROUP BY superssn) AS r1 RIGHT JOIN employee AS e ON (r1.superssn=e.ssn)
NATURAL JOIN department;
```