

# Homework 2

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**Class:** 21BIT

## Q1

- a. List the names of all employees in department 5 who work more than 10 hours per week on the Product X project.

$$\begin{aligned} \text{WD5} &\leftarrow \sigma_{\text{Dno} = 5}(\text{EMPLOYEE}) * \rho_{\text{Ssn}, \text{Pno}, \text{Hours}}(\text{WORKS\_ON}) \\ \text{WD5X} &\leftarrow \text{WD5} * \rho_{\text{Pno}}(\pi_{\text{Pnumber}}(\sigma_{\text{Pname} = \text{'Project X'}}(\text{PROJECT}))) \\ \text{RESULT} &\leftarrow \pi_{\text{Fname}, \text{Lname}}(\sigma_{\text{Hours} > 10}(\text{WD5X})) \end{aligned}$$

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

$$\begin{aligned} \text{DEP\_EMP} &\leftarrow \text{DEP} \bowtie_{\text{Essn} = \text{Ssn}} \text{EMPLOYEE} \\ \text{RESULT} &\leftarrow \sigma_{\text{Fname} = \text{Dependent\_name}}(\text{DEP\_EMP}) \end{aligned}$$

- c. List the names of employees who are directly supervised by Franklin Wong.

$$\begin{aligned} \text{FW\_SSN} &\leftarrow \pi_{\text{Ssn}}(\sigma_{(\text{Fname} = \text{'Franklin'}) \wedge (\text{Lname} = \text{'Wong'})}(\text{EMPLOYEE})) \\ \text{FW\_EMP} &= \text{EMPLOYEE} \bowtie_{\text{Super\_ssn} = \text{fw.Ssn}} \text{FW\_SSN} \\ \text{RESULT} &\leftarrow \pi_{\text{Fname}, \text{Lname}}(\text{FW\_EMP}) \end{aligned}$$

- d. List the names of employees who work on every project.

$$\begin{aligned} \text{E\_WO} &\leftarrow \pi_{\text{Essn}, \text{Pno}}(\text{WORKS\_ON}) \\ \text{P\_NO}(\text{Pno}) &\leftarrow \pi_{\text{Pnumber}}(\text{PROJECT}) \\ \text{RESULT} &\leftarrow \pi_{\text{Fname}, \text{Lname}}((\text{E\_WO} \div \text{P\_NO}) \bowtie_{\text{Essn} = \text{Ssn}} \text{EMPLOYEE}) \end{aligned}$$

- e. List the names of employees who do not work on any project.

$$E\_NW \leftarrow \pi_{Ssn}(\text{EMPLOYEE}) - \rho_{Ssn}(\pi_{Essn}(\text{WORKS\_ON}))$$

$$RES \leftarrow \pi_{Fname, Lname}(E\_NW * \pi_{Fname, Lname, Ssn}(\text{EMPLOYEE}))$$

- f. List the names and addresses of employees who work on at least one project located in Houston but whose department has no location in Houston.

$$R1 \leftarrow (\text{EMPLOYEE} \bowtie_{Ssn = wo.Essn} \text{WORKS\_ON}) \bowtie_{Pno = Pnumber} \text{PROJECT}$$

$$R2 \leftarrow R1 \bowtie_{Dnum = Dnumber} (\text{DEPARTMENT} * \text{DEPT\_LOCATIONS})$$

$$R3 \leftarrow \sigma_{(Plocation = 'Houston') \wedge (Dlocation \neq 'Houston')}(R2)$$

$$RESULT \leftarrow \pi_{Fname, Lname, Address} R3$$

- g. List the names of department managers who have no dependents.

$$DMGR\_NODP(Ssn) \leftarrow \pi_{Mgr\_ssn}(\text{DEPARTMENT}) - \pi_{Essn}(\text{DEPENDENT})$$

$$R \leftarrow \text{EMPLOYEE} \bowtie_{Ssn = dm.Ssn} DMGR\_NODP$$

$$RESULT \leftarrow \pi_{Fname, Lname}(R)$$

## Q2

- a. Retrieve the names of students enrolled in the Automata class during the fall 2009 term.

$$AUTO \leftarrow \sigma_{Ctitle = 'Automata'}(\text{CATALOG})$$

$$F19 \leftarrow \sigma_{Term = 'fall 2019'}(\text{ENROLLS})$$

$$RESULT \leftarrow \pi_{Fname, Lname}(\text{STUDENTS} * \text{COURSES} * AUTO * F19)$$

- b. Retrieve the Sid values of students who have enrolled in CSc226 and CSc227.

$$E\_6O7 \leftarrow \sigma_{(Cno = 226) \wedge (Cno = 227)}(\text{ENROLLS} * \text{COURSES})$$

$$RESULT \leftarrow \pi_{Sid}(\text{STUDENTS} * C)$$

- c. Retrieve the Sid values of students who have enrolled in CSc226 or CSc227.

$$E\_6A7 \leftarrow \sigma_{(Cno = 226) \vee (Cno = 227)}(\text{ENROLLS} * \text{COURSES})$$

$$RESULT \leftarrow \pi_{Sid}(\text{STUDENTS} * C)$$

- d. Retrieve the names of students who have not enrolled in any class.

$$\rho_S(\text{STUDENTS}), \rho_C(\text{COURSES})$$

$$\text{NEC} \leftarrow S \bowtie_{S.\text{Sid} = nc.\text{Sid}} \rho_{nc.\text{Sid}}(\pi_{S.\text{Sid}}(S) - \pi_{S.\text{Sid}}(C))$$

$$\text{RESULT} \leftarrow \pi_{Fname, Lname}(\text{NEC})$$

- e. Retrieve the names of students who have enrolled in all courses in the CATALOG table.

$$\text{ECC} \leftarrow \pi_{S.\text{Sid}, Cno}(\text{ENROLLS} * \text{COURSES} * \text{CATALOG})$$

$$\text{CNO} \leftarrow \pi_{Cno}(\text{CATALOG})$$

$$S(s.\text{Sid}, Fname, Lname) \leftarrow \text{STUDENTS}$$

$$\text{RESULT} \leftarrow \pi_{Fname, Lname}((\text{ECC} \div \text{CNO}) \bowtie_{S.\text{Sid} = s.\text{Sid}} S)$$

### Q3

- a. Retrieve the names of parts that cost less than \$20.00

$$\pi_{Pname}(\sigma_{Price < 20.00}(\text{PARTS}))$$

- b. Retrieve the names and cities of employees who have taken orders for parts costing more than \$50.00

$$P\_G50 \leftarrow \sigma_{Price > 50.00}(\text{PARTS})$$

$$\text{RES} \leftarrow \pi_{Ename, City}(P\_G50 * \text{ODETAILS} * \text{ORDERS} * \text{EMPLOYEES} * \text{ZIP})$$

- c. Retrieve the pairs of customer number values of customers who live in the same ZIP Code

$$\pi_{(Cno, c1.Cno)}(\text{CUSTOMERS} \bowtie_{(Zip = c1.Zip) \wedge (Cno \neq c1.Cno)} \text{CUSTOMERS})$$

- d. Retrieve the names of customers who have ordered parts from employees living in Wichita

$$\text{WI\_EMP} \leftarrow \pi_{Eno}(\sigma_{City = 'Wichita'}(\text{EMPLOYEES} * \text{ZIP\_CODES}))$$

$$\text{RESULT} \leftarrow \pi_{Cname}(\text{CUSTOMERS} * \text{ORDERS} * \text{WI\_EMP})$$

- e. Retrieve the names of customers who have ordered parts costing less than \$20.00

$$\begin{aligned} P\_L20 &\leftarrow \sigma_{Price < 20.00}(PARTS) \\ RESULT &\leftarrow \pi_{Cname}(P\_L20 * ODETAILS * ORDERS * CUSTOMERS) \end{aligned}$$

- f. Retrieve the names of customers who have not placed an order

$$\pi_{Cname}((\pi_{Cno}(CUSTOMERS) - \pi_{Cno}(ORDERS)) * CUSTOMERS)$$

- g. Retrieve the names of customers who have placed exactly two orders

$$\begin{aligned} R1 &\leftarrow ORDERS * CUSTOMERS \\ R2(Cno, Cname, Num) &\leftarrow_{Cno, Cname} \mathcal{J}_{COUNT(Cno)}(\pi_{Cno, Cname}(R1)) \\ RESULT &\leftarrow \pi_{Cname}(\sigma_{Num=2}(R2)) \end{aligned}$$

## Q5

- a. Retrieve the part numbers that are supplied to exactly two projects.

$$\begin{aligned} R1(Pno, SupTo) &\leftarrow_{Pno} \mathcal{J}_{COUNT(Jno)}(\pi_{Pno, Jno}(SUPPLY)) \\ RESULT &\leftarrow \pi_{Pno}(\sigma_{SupTo=2}(R1)) \end{aligned}$$

- b. Retrieve the names of suppliers who supply more than two parts to project 'J1'.

$$\begin{aligned} J1 &\leftarrow \sigma_{Jname = 'J1'}(SUPPLY * PROJECT * SUPPLIER) \\ R1(Sno, Sname, SupTo) &\leftarrow_{Sno, Sname} \mathcal{J}_{COUNT(Jno)}(J1) \\ RESULT &\leftarrow \pi_{Sname}(\sigma_{SupTo > 2}(R1)) \end{aligned}$$

- c. Retrieve the part numbers that are supplied by every supplier.

$$\begin{aligned} SUPPLIED(Pno, NumS) &\leftarrow_{Pno} \mathcal{J}_{COUNT(Sno)}(SUPPLY) \\ ALL\_SUPS(Total) &\leftarrow \mathcal{J}_{COUNT(Sno)}(SUPPLIER) \\ RESULT &\leftarrow \pi_{Pno}(SUPPLIED \bowtie_{NumS = Total} ALL\_SUPS) \end{aligned}$$

- d. Retrieve the project names that are supplied by supplier 'S1' only.

$$\begin{aligned} \text{NUM\_OF\_SUP}(\text{Jno}, \text{NOS}) &\leftarrow \text{Jno} \mathcal{I}_{\text{COUNT}(\text{Sno})}(\text{SUPPLY}) \\ \text{R1} &\leftarrow \text{NUM\_OF\_SUP} * \text{SUPPLY} * \text{SUPPLIER} * \text{PROJECT} \\ \text{S1\_ONLY} &\leftarrow \pi_{\text{Jname}}(\sigma_{(\text{Sname} = \text{S1}) \wedge (\text{NOS} = 1)}(\text{R1})) \end{aligned}$$

- e. Retrieve the names of suppliers who supply at least two different parts each to at least two different projects

$$\begin{aligned} \text{SUPPED}(\text{Sno}, \text{Parts}, \text{Projs}) &\leftarrow \text{Sno} \mathcal{I}_{\text{COUNT}(\text{Pno}), \text{COUNT}(\text{Jno})}(\text{SUPPLY}) \\ \text{RESULT} &\leftarrow \pi_{\text{Sname}}(\sigma_{(\text{Parts} \geq 2) \wedge (\text{Projs} \geq 2)}(\text{SUPPED} * \text{SUPPLIER})) \end{aligned}$$

# Homework 3

## Q1

### Q1

- a. List the names of all employees in department 5 who work more than 10 hours per week on the Product X project.

```
select e.Fname, e.Lname
from EMPLOYEE e,
     WORKS_ON w,
     PROJECT p
where e.Ssn = w.Essn
     and w.Pno = p.Pnumber
     and p.Pname = 'Product X'
     and w.Hours > 10
     and e.Dno = 5
```

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

```
select e.Fname, e.Lname
from EMPLOYEE e,
     DEPENDENT d
where e.Ssn = d.Essn
     and e.Fname = d.Dependent_name
```

- c. List the names of employees who are directly supervised by Franklin Wong.

```
select e.Fname, e.Lname
from EMPLOYEE e,
     EMPLOYEE e2
where e.Super_ssn = e2.Ssn
     and e2.Fname = 'Franklin'
     and e2.Lname = 'Wong'
```

- d. List the names of employees who work on every project.

```
select e.Fname, e.Lname
from EMPLOYEE e
where not exists (select *
                  from PROJECT p
                  where not exists (select *
                                    from WORKS_ON w
                                    where w.Essn = e.Ssn
                                    and w.Pno = p.Pnumber))
```

- e. List the names of employees who do not work on any project.

```
select e.Fname, e.Lname
from EMPLOYEE e
where not exists (select *
                  from WORKS_ON w
                  where w.Essn = e.Ssn)
```

- f. List the names and addresses of employees who work on at least one project located in Houston but whose department has no location in Houston.

```
select e.Fname, e.Lname, e.Addr
from EMPLOYEE e,
     WORKS_ON w,
     PROJECT p,
     DEPT_LOCATIONS dl
where e.Ssn = w.Essn
     and w.Pno = p.Pnumber
     and p.Plocation = 'Houston'
     and e.Dno = dl.Dnumber
     and dl.Dlocation != 'Houston'
```

- g. List the names of department managers who have no dependents.

```
select e.Fname, e.Lname
from EMPLOYEE e
```

```
where not exists (select *
                  from DEPENDENT d
                  where d.Essn = e.Ssn)
and e.Ssn in (select d.Mgr_ssn
              from DEPARTMENT d)
```

---

## Q2

- a. Retrieve the names of students enrolled in the Automata class during the fall 2009 term.

```
select Sid, Fname, Minit, Lname
from STUDENTS
where Sid in (select Sid
              from ENROLLS
              where Term = 'Fall 2009'
                 and Sec_no = '1')
```

- b. Retrieve the Sid values of students who have enrolled in CSc226 and CSc227.

```
select Sid
from ENROLLS
where Cno = 'CSc226'
   and Cno = 'CSc227'
```

- c. Retrieve the Sid values of students who have enrolled in CSc226 or CSc227.

```
select Sid
from ENROLLS
where Cno = 'CSc226'
   or Cno = 'CSc227'
```

- d. Retrieve the names of students who have not enrolled in any class.

```
select Ssn, Fname, Lname
from STUDENTS
```



```
where Ssn not in (select Sid
                  from ENROLLS)
```

- e. Retrieve the names of students who have enrolled in all courses in the CATALOG table.

```
select Ssn, Fname, Lname
from STUDENTS
where Sid in (select Sid
              from ENROLLS
              where Cno in (select Cno
                           from CATALOG))
```

---

## Q3

- a. Retrieve the names of parts that cost less than \$20.00

```
select Pname
from PARTS
where Price < 20
```

- b. Retrieve the names and cities of employees who have taken orders for parts costing more than \$50.00

```
select Ename, City
from EMPLOYEES e,
     ZIP_CODES z,
     ORDERS o,
     ODETAILS od,
     PARTS p
where e.Zip = z.Zip
     and e.Eno = o.Eno
     and o.Ono = od.Ono
     and od.Pno = p.Pno
     and p.Price > 50
```

- c. Retrieve the pairs of customer number values of customers who live in the same ZIP Code

```
select c1.Cno, c2.Cno
from CUSTOMERS c1,
     CUSTOMERS c2
where c1.Zip = c2.Zip
     and c1.Cno != c2.Cno
```

- d. Retrieve the names of customers who have ordered parts from employees living in Wichita

```
select c.Cname
from CUSTOMERS c,
     ORDERS o,
     EMPLOYEES e,
     ZIP_CODES z
where c.Cno = o.Cno
     and o.Eno = e.Eno
     and e.Zip = z.Zip
     and z.City = 'Wichita'
```

- e. Retrieve the names of customers who have ordered parts costing less than \$20.00

```
select c.Cname
from CUSTOMERS c,
     ORDERS o,
     ODETAILS od,
     PARTS p
where c.Cno = o.Cno
     and o.Ono = od.Ono
     and od.Pno = p.Pno
     and p.Price < 20
```

- f. Retrieve the names of customers who have not placed an order

```
select c.Cname
from CUSTOMERS c
where not exists (select *
```

```
from ORDERS o
where o.Cno = c.Cno)
```

- g. Retrieve the names of customers who have placed exactly two orders

```
select c.Cname
from CUSTOMERS c
where c.Cno in (select o.Cno
                from ORDERS o
                group by o.Cno
                having count(*) = 2)
```

---

## Q5

- a. Retrieve the part numbers that are supplied to exactly two projects.

```
select Pno
from SUPPLY
group by Pno
having count(distinct Jno) = 2
```

- b. Retrieve the names of suppliers who supply more than two parts to project 'J1'.

```
select Sname
from SUPPLIER
where Sno in (select Sno
              from SUPPLY
              where Jno = 'J1'
              group by Sno
              having count(distinct Pno) > 2)
```

- c. Retrieve the part numbers that are supplied by every supplier.

```
select Pno
from SUPPLY
group by Pno
```

```
having count(distinct Sno) = (select count(Sno)
                             from SUPPLIER)
```

- d. Retrieve the project names that are supplied by supplier 'S1' only.

```
select Jname
from PROJECT
where Jno in (select Jno
              from SUPPLY
              where Sno = 'S1'
              group by Jno
              having count(distinct Pno) = (select count(Pno)
                                           from PART))
```

- e. Retrieve the names of suppliers who supply at least two different parts each to at least two different projects

```
select Sname
from SUPPLIER
where Sno in (select Sno
              from SUPPLY
              group by Sno
              having count(distinct Pno) >= 2
                 and count(distinct Jno) >= 2)
```

## Q2

- a. Retrieve the names of all senior students majoring in 'cs' (computer science).

```
select Student_name
from STUDENT
where Class = 'senior'
   and Major = 'cs'
```

- b. Retrieve the names of all courses taught by Professor King in 2007 and 2008.

```

select Course_name
from COURSE
where Course_number in (select Course_number
                        from SECTION
                        where Instructor = 'King'
                        and Year in ('2007', '2008'))

```

- c. For each section taught by Professor King, retrieve the course number, semester, year, and number of students who took the section.

```

select Course_number, Semester, Year, count(Student_number)
from SECTION
where Instructor = 'King'
group by Course_number, Semester, Year

```

- d. Retrieve the name and transcript of each senior student (Class = 4) majoring in CS. A transcript includes course name, course number, credit hours, semester, year, and grade for each course completed by the student.

```

select Student_name, Course_name, Course_number, Credit_hours, Semester, Year, Grade
from STUDENT
  join GRADE_REPORT on Student_number = Student_number
  join SECTION on Section_identifier = Section_identifier
  join COURSE on Course_number = Course_number
where Class = 'senior'
  and Major = 'cs'

```

- e. Retrieve the names and major departments of all straight-A students (students who have a grade of A in all their courses).

```

select Student_name, Major
from STUDENT
where Student_number in (select Student_number
                        from GRADE_REPORT
                        group by Student_number
                        having count(Grade) = (select count(Grade)
                                              from GRADE_REPORT
                                              where Grade = 'A'))

```

- f. Retrieve the names and major departments of all students who do not have a grade of A in any of their courses.

```
select Student_name, Major
from STUDENT
where Student_number not in (select Student_number
                             from GRADE_REPORT
                             where Grade = 'A')
```

### Q3

- a. A view that has the department name, manager name, and manager salary for every department

```
create view DEPT_MGR_SALARY
as select d.Dname, e.Fname, e.Lname, e.Salary
from DEPARTMENT d,
     EMPLOYEE e
where d.Mgr_ssn = e.Ssn
```

- b. A view that has the employee name, supervisor name, and employee salary for each employee who works in the 'Research' department

```
create view EMPLOYEE_SUPERVISOR_SALARY
as select e.Fname, e.Lname, e2.Fname, e2.Lname, e.Salary
from EMPLOYEE e,
     EMPLOYEE e2
where e.Super_ssn = e2.Ssn
     and e.Dno = 5
```

- c. A view that has the project name, controlling department name, number of employees, and total hours worked per week on the project for each project

```
create view PROJECT_INFO
as select p.Pname, d.Dname, count(w.Essn), sum(w.Hours)
from PROJECT p,
     DEPARTMENT d,
     WORKS_ON w
where p.Dnum = d.Dnumber
     and p.Pnumber = w.Pno
```

- d. A view that has the project name, controlling department name, number of employees, and total hours worked per week on the project for each project with more than one employee working on it

```
create view PROJECT_INFO
as select p.Pname, d.Dname, count(w.Essn), sum(w.Hours)
from PROJECT p,
     DEPARTMENT d,
     WORKS_ON w
where p.Dnum = d.Dnumber
     and p.Pnumber = w.Pno
```