

# Homework 2

**Student ID:** 2159003

**Name:** Đào Minh Đức

**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.

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

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

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

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

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

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

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

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

$$\begin{aligned} E\_NW &\leftarrow \pi_{Ssn}(\text{EMPLOYEE}) - \rho_{Ssn}(\pi_{Essn}(\text{WORKS\_ON})) \\ RES &\leftarrow \pi_{Fname, Minit, Lname}(E\_NW * \pi_{Fname, Minit, Lname, Ssn}(\text{EMPLOYEE})) \end{aligned}$$

- 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.

$$\begin{aligned} R1 &\leftarrow (\text{EMPLOYEE} \bowtie_{Ssn = wo.Essn} \text{WORKS\_ON}) \bowtie_{Pno = Pnumber} \text{PROJECT} \\ R2 &\leftarrow R1 \bowtie_{Dnum = Dnumber} (\text{DEPARTMENT} * \text{DEPT\_LOCATIONS}) \\ R3 &\leftarrow \sigma_{(Plocation = 'Houston') \wedge (Dlocation \neq 'Houston')}(R2) \\ RESULT &\leftarrow \pi_{Fname, Minit, Lname, Address} R3 \end{aligned}$$

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

$$\begin{aligned} DMGR\_NODP(Ssn) &\leftarrow \pi_{Mgr\_ssn}(\text{DEPARTMENT}) - \pi_{Essn}(\text{DEPENDENT}) \\ R &\leftarrow \text{EMPLOYEE} \bowtie_{Ssn = dm.Ssn} DMGR\_NODP \\ RESULT &\leftarrow \pi_{Fname, Minit, Lname}(R) \end{aligned}$$

## Q2

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

$$\begin{aligned} AUTO &\leftarrow \sigma_{Ctitle = 'Automata'}(\text{CATALOG}) \\ F19 &\leftarrow \sigma_{Term = 'fall 2019'}(\text{ENROLLS}) \\ RESULT &\leftarrow \pi_{Fname, Lname, Minit}(\text{STUDENTS} * \text{COURSES} * AUTO * F19) \end{aligned}$$

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

$$\begin{aligned} E\_6O7 &\leftarrow \sigma_{(Cno = 226) \wedge (Cno = 227)}(\text{ENROLLS} * \text{COURSES}) \\ RESULT &\leftarrow \pi_{Sid}(\text{STUDENTS} * C) \end{aligned}$$

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

$$\begin{aligned} E\_6A7 &\leftarrow \sigma_{(Cno = 226) \vee (Cno = 227)}(\text{ENROLLS} * \text{COURSES}) \\ RESULT &\leftarrow \pi_{Sid}(\text{STUDENTS} * C) \end{aligned}$$

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

$$\begin{aligned} & \rho_S(\text{STUDENTS}), \rho_C(\text{COURSES}) \\ \text{NEC} & \leftarrow S \bowtie_{\text{Sid} = \text{nc.Sid}} \rho_{(\text{nc.Sid})}(\pi_{\text{Sid}}(S) - \pi_{\text{Sid}}(C)) \\ \text{RESULT} & \leftarrow \pi_{\text{Fname}, \text{Lname}, \text{Minit}}(\text{NEC}) \end{aligned}$$

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

$$\begin{aligned} \text{ECC} & \leftarrow \pi_{\text{Sid}, \text{Cno}}(\text{ENROLLS} * \text{COURSES} * \text{CATALOG}) \\ \text{CNO} & \leftarrow \pi_{\text{Cno}}(\text{CATALOG}) \\ \text{S}(\text{s.Sid}, \text{Fname}, \text{Lname}, \text{Minit}) & \leftarrow \text{STUDENTS} \\ \text{RESULT} & \leftarrow \pi_{\text{Fname}, \text{Lname}, \text{Minit}}((\text{ECC} \div \text{CNO}) \bowtie_{\text{Sid} = \text{s.Sid}} S) \end{aligned}$$

### Q3

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

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

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

$$\begin{aligned} \text{P\_G50} & \leftarrow \sigma_{\text{Price} > 50.00}(\text{PARTS}) \\ \text{RESULT} & \leftarrow \pi_{\text{Ename}}(\text{P\_G50} * \text{ODETAILS} * \text{ORDERS} * \text{EMPLOYEES}) \end{aligned}$$

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

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

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

$$\begin{aligned} \text{WI\_EMP} & \leftarrow \pi_{\text{Eno}}(\sigma_{\text{City} = \text{'Wichita'}}(\text{EMPLOYEES} * \text{ZIP\_CODES})) \\ \text{RESULT} & \leftarrow \pi_{\text{Cname}}(\text{CUSTOMERS} * \text{ORDERS} * \text{WI\_EMP}) \end{aligned}$$

- 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
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