## PRACTICE PROBLEM SET #6

CSC 261/461 (Database Systems), Spring 2018, University of Rochester 03/20/2018

## **Problem 1**

Specify the following queries on the COMPANY relational database schema shown in Figure 1, using the relational operators.

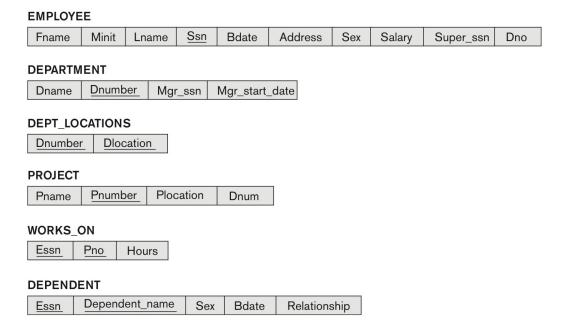


Figure 1: Company Schema

- 1. Retrieve the names of employees in department 5 who work more than 10 hours per week on the 'ProductX' project.
- 2. List the names of employees who have a dependent with the same first name as themselves.
- 3. Find the names of employees that are directly supervised by 'Franklin Wong'.
- 4. Retrieve the names of employees who work on every project.
- 5. Retrieve the names of employees who do not work on any project.
- 6. Find the names and addresses of employees who work on at least one project located in Houston but whose department has no location in Houston.
- 7. List the last names of department managers who have no dependents.

## **Solution:**

In the relational algebra, as in other languages, it is possible to specify the same query in multiple ways. We give one possible solution for each query. We use the symbol  $\sigma$  for SELECT,  $\pi$  for PROJECT,  $\bowtie$  for EQUIJOIN, \* for NATURAL JOIN

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- 1. EMP\_W\_X  $\leftarrow$  ( $\sigma_{Pname='ProductX'}$  (PROJECT)) $\bowtie_{PNumber=PnO}$  (WORKS\_ON) EMP\_WORK\_10  $\leftarrow$  (EMPLOYEE) $\bowtie_{Ssn=Essn}$  ( $\sigma_{Hours>10}$  (EMP\_W\_X)) RESULT  $\leftarrow$   $\pi_{Lname,Fname}$  ( $\sigma_{Dno=5}$  (EMP\_WORK\_10))
- 2.  $E \leftarrow (EMPLOYEE)\bowtie_{(Ssn,Fname) = (Essn,Dependent\_name)} (DEPENDENT)$  $R \leftarrow \pi_{Lname,Fname} (E)$
- 3. WONG\_SSN  $\leftarrow \pi_{Ssn}$  ( $\sigma_{Fname='Franklin'}$  AND Lname='Wong' (EMPLOYEE)) WONG\_EMPS  $\leftarrow$  (EMPLOYEE) $\bowtie_{SUPERSSN=SSN}$  (WONG\_SSN) RESULT  $\leftarrow \pi_{Lname.Fname}$  (WONG\_EMPS)
- 4. PROJ\_EMPS(PNO,SSN)  $\leftarrow \sigma_{\text{PNO,ESSN}}$  (WORKS\_ON) ALL\_PROJS(PNO)  $\leftarrow \pi_{\text{Pnumber}}$  (PROJECT) EMPS\_ALL\_PROJS  $\leftarrow$  PROJ\_EMPS  $\div$ ALLPROJS RESULT  $\leftarrow \pi_{\text{Lname,Fname}}$  (EMPLOYEE \* EMP\_ALL\_PROJS)
- 5. ALL\_EMPS  $\leftarrow \pi_{SSN}$  (EMPLOYEE) WORKING\_EMPS(SSN)  $\leftarrow \pi_{Essn}$  (WORKS\_ON) NON\_WORKING\_EMPS  $\leftarrow$  ALL\_EMPS - WORKING\_EMPS RESULT  $\leftarrow \pi_{Lname,Fname}$  (EMPLOYEE \* NON\_WORKING\_EMPS)
- 6.  $E\_P\_HOU(SSN) \leftarrow \pi_{Essn}$  (WORKS\_ON  $\bowtie_{PNO} = PNumber$  ( $\sigma_{Plocation='Houston'}$  (PROJECT)))  $D\_NO\_HOU \leftarrow \pi_{Dnumber}$  (DEPARTMENT)  $\pi_{Dnumber}$  ( $\sigma_{Dlocation='Houston'}$  (DEPARTMENT))  $E\_D\_NO\_HOU \leftarrow \pi_{Ssn}$  (EMPLOYEE  $\bowtie_{Dno} = Dnumber$  ( $D\_NO\_HOU$ ))  $RESULT\_EMPS \leftarrow E\_P\_HOU \cap E\_D\_NO\_HOU$   $RESULT \leftarrow \pi_{L,name,Fname,Address}$  (EMPLOYEE \* RESULT\_EMPS)
- 7. DEPT\_MANAGERS(SSN)  $\leftarrow \pi_{\text{Mgr\_ssn}}$  (DEPARTMENT) EMPS\_WITH\_DEPENDENTS(SSN)  $\leftarrow \pi_{\text{Essn}}$  (DEPENDENT) RESULT\_EMPS  $\leftarrow$  DEPT\_MANAGERS - EMPS\_WITH\_DEPENDENTS RESULT  $\leftarrow \pi_{\text{Lname}}$  (EMPLOYEE \* RESULT\_EMPS)