

# PRACTICE PROBLEM SET #6

CSC 261/461 (Database Systems), Spring 2018,  
University of Rochester  
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## Problem 1

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

### EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
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### DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
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### DEPT\_LOCATIONS

<u>Dnumber</u>	<u>Dlocation</u>
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### PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
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### WORKS\_ON

<u>Essn</u>	<u>Pno</u>	Hours
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### DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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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

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.  $WONG\_SSN \leftarrow \pi_{Ssn} (\sigma_{Fname='Franklin' \text{ AND } Lname='Wong'} (EMPLOYEE))$   
 $WONG\_EMPS \leftarrow (EMPLOYEE) \bowtie_{SUPERSSN=SSN} (WONG\_SSN)$   
 $RESULT \leftarrow \pi_{Lname,Fname} (WONG\_EMPS)$
4.  $PROJ\_EMPS(PNO,SSN) \leftarrow \sigma_{PNO,ESSN} (WORKS\_ON)$   
 $ALL\_PROJS(PNO) \leftarrow \pi_{Pnumber} (PROJECT)$   
 $EMPS\_ALL\_PROJS \leftarrow PROJ\_EMPS \div ALLPROJS$   
 $RESULT \leftarrow \pi_{Lname,Fname} (EMPLOYEE * EMP\_ALL\_PROJS)$
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.  $E\_P\_HOU(SSN) \leftarrow \pi_{Essn} (WORKS\_ON \bowtie_{PNO=PNumber} (\sigma_{Plocation='Houston'} (PROJECT)))$   
 $D\_NO\_HOU \leftarrow \pi_{Dnumber} (DEPARTMENT) - \pi_{Dnumber} (\sigma_{Dlocation='Houston'} (DEPARTMENT))$   
 $E\_D\_NO\_HOU \leftarrow \pi_{Ssn} (EMPLOYEE \bowtie_{Dno=Dnumber} (D\_NO\_HOU))$   
 $RESULT\_EMPS \leftarrow E\_P\_HOU \cap E\_D\_NO\_HOU$   
 $RESULT \leftarrow \pi_{Lname,Fname,Address} (EMPLOYEE * RESULT\_EMPS)$
7.  $DEPT\_MANAGERS(SSN) \leftarrow \pi_{Mgr\_ssn} (DEPARTMENT)$   
 $EMPS\_WITH\_DEPENDENTS(SSN) \leftarrow \pi_{Essn} (DEPENDENT)$   
 $RESULT\_EMPS \leftarrow DEPT\_MANAGERS - EMPS\_WITH\_DEPENDENTS$   
 $RESULT \leftarrow \pi_{Lname} (EMPLOYEE * RESULT\_EMPS)$