Solutions for the Relational Algebra Exercises

(a) Retrieve the names of employees in department 5 who work more than 10 hours per week on the 'ProductX' project.

Solution:

$$PRODX \leftarrow \sigma_{Pname = \text{'ProductX'}} (PROJECT)$$

$$EMPS \leftarrow PRODX \bowtie_{Pnumber = Pno} WORKS\_ON$$

$$10HOURS \leftarrow \sigma_{Hours > 10} (EMPS)$$

$$RESULTING\_EMPS \leftarrow EMPLOYEE \bowtie_{Ssn = Essn} 10HOURS$$

$$DEPT5EMPS \leftarrow \sigma_{Dno = 5} (RESULTING\_EMPS)$$

$$RESULT \leftarrow \pi_{Fname, Minit, Lname} (DEPT5EMPS)$$

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

Solution:

$$EMPS\_WITH\_DEPENDENTS \leftarrow EMPLOYEE \bowtie_{Ssn = Essn} DEPENDENT$$

$$SAME\_NAME \leftarrow \sigma_{Fname = Dependent\_name} (EMPS\_WITH\_DEPENDENTS)$$

$$RESULT \leftarrow \pi_{Fname, Minit, Lname} (SAME\_NAME)$$

(c) Find the names of employees that are directly supervised by 'Franklin Wong'.

Solution:

$$WONG\_SSN \leftarrow \pi_{Ssn}(\sigma_{Fname = 'Franklin' \text{ AND } Lname = 'Wong'}(EMPLOYEE))$$

$$WONG\_EMPS \leftarrow EMPLOYEE \bowtie_{EMPLOYEE.Superssn = WONG\_SSN.Ssn} WONG\_SSN$$

$$RESULT \leftarrow \pi_{Fname, Minit, Lname}(WONG\_EMPS)$$

(d) Retrieve the names and salaries of employees who work on every project.

Solution:

$$PROJ\_EMPS(Pno, SSn) \leftarrow \pi_{Pno, Essn}(WORKS\_ON)$$

$$ALL\_PROJS(Pno) \leftarrow \pi_{Pnumber}(PROJECT)$$

$$EMPS\_ALL\_PROJS \leftarrow PROJ\_EMPS \div ALL\_PROJS$$

$$RESULT \leftarrow \pi_{Fname, Minit, Lname, Salary}(EMPLOYEE * EMPS\_ALL\_PROJS)$$

(e) Retrieve the names of employees who do not work on any project.

Solution:

$$ALL\_EMPS \leftarrow \pi_{Ssn}(EMPLOYEE)$$

$$WORKING\_EMPS(Ssn) \leftarrow \pi_{Essn}(WORKS\_ON)$$

$$NON\_WORKING\_EMPS \leftarrow ALL\_EMPS - WORKING\_EMPS$$

$$RESULT \leftarrow \pi_{Fname, Minit, Lname}(EMPLOYEE * NON\_WORKING\_EMPS)$$

(f) 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.

Solution:

$$HOU\_PROJS(Pno) \leftarrow \pi_{Pnumber}(\sigma_{Plocation = 'Houston'}(PROJECT))$$

$$HOU\_EMPS(Ssn) \leftarrow \pi_{Essn}(WORKS\_ON * HOU\_PROJS)$$

$$DEPTS\_IN\_HOUSTON \leftarrow \pi_{Dnumber}(\sigma_{Dlocation = 'Houston'}(DEPT\_LOCATIONS))$$

$$DEPTS\_NO\_HOUSTON \leftarrow (\pi_{Dnumber}(DEPARTMENT) - DEPTS\_IN\_HOUSTON)$$

$$EMP\_DEPT\_NO\_HOU \leftarrow \pi_{Ssn}(EMPLOYEE \bowtie_{Dno = Dnumber} DEPTS\_NO\_HOUSTON)$$

$$RES\_EMPS \leftarrow HOU\_EMPS \cap EMP\_DEPT\_NO\_HOU$$

$$RESULT \leftarrow \pi_{Fname, Minit, Lname, Address}(EMPLOYEE * RES\_EMPS)$$

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

Solution:

$$DEPT\_MGRS(Ssn) \leftarrow \pi_{Mgr\_ssn}(DEPARTMENT)$$

$$EMPS\_WITH\_DEPS(Ssn) \leftarrow \pi_{Essn}(DEPENDENT)$$

$$MGR\_NO\_DEPS \leftarrow DEPT\_MGRS - EMPS\_WITH\_DEPS$$

$$RESULT \leftarrow \pi_{Fname, Minit, Lname}(MGR\_NO\_DEPS * EMPLOYEE)$$