COM S 461: ASSIGNMENT III

Date Assigned: Oct. 3, 2004
Due: October 13, 2004 by 2:00 pm
Percentage in your final grade: 4%
Maximum score for this assignment: 100 points

Objectives:

1. Exercise on relational algebra and calculus.

Questions

1. (80 points): Given the following database schema, specify the following queries in both relational algebra and tuple relational calculus. Column names that are not specified in the questions must not appear in the answers.

   Employee(Ssn, Fname, Minit, Lname, Bdate, Address, Gender, Salary, SuperSSN, Dno)
   Superssn is a foreign key to Employee. Dno is a foreign key to department.
   Lname is the last name of an employee.

   Department(Dnumber, Dname, MgrSSN, Mgrstartdate)
   MgrSSN is a foreign key to Employee.

   Dept.Locations(Dnumber, DLocations)
   Dnumber is a foreign key to Department.

   Project(Pnumber, Pname, Plocation, Dnum)
   Dnum is a foreign key to Department.
   Pname is unique.
   Plocation describes the name of the city where the project is located.

   Works_On(Essn, Pno, Hour)
   Hour specifies the number of hours per week that the employee works on this project.
   Essn is a foreign key to Employee.
   Pno is a foreign key to Project.

   Dependent(Essn, Dependent_Name, Gender, Bdate, Relationship)
   Essn is a foreign key to Employee.

(a) Retrieve all the attributes in Employee table about each employee in department 5 who works more than 10 hours per week on the “ProductX” project.

(b) List the last name of each department manager who has no dependents.

(c) Retrieve the last name of each employee who works on every project.

(d) Find the last name and addresses of each employee who works on at least one project located in Houston but whose department has no location in Houston.

Answer:

(a) \{E \in Employee \land E.Dno = 5 \land \exists W \in Works_On(E.Ssn = W.Essn \land \exists P \in Project(W.Pno = P.Pnumber \land P.Pname = 'ProductX' \land W.Hours > 10))\}

   EMP.SSN ← π_{ssn}(σ_{hour>10,pname='ProductX'}(Works_On ⊲ ⊳ Project))
   σ_{dno=5}(EMP.SSN ⊲ ⊳ Employee)

(b) \{O \exists E \in Employee(O.Lname = E.Lname \land \exists D \in Department(E.Ssn = D.MgrSSN \land \neg(∃X \in Dependent(E.ssn = X.Essn))))\}

   ALL_MGRS(ssn) ← π_{mgrssn}(Department)
   EMP.SAVING.EMP(ssn) ← π_{ssn}(Dependent)
   π_{Lname}((ALL_MGRS − EMP.SAVING.EMP) ⊲ Employee)
(c) \( \{ O \exists E \in Employee(O.Lname = E.Lname \land (\forall P)(P \notin Project \lor \exists W \in Works_On(P.Pnumber = W.Pno \land W.Essn = E.Ssn))) \} \). 

\[
\text{ALL.PROJ}(\text{pno}) \leftarrow \pi_{\text{pnumber}}(\text{Project}) \\
\text{SSN.PROJ}(\text{ssn}, \text{pno}) \leftarrow \pi_{\text{essn}, \text{pno}}(\text{Works_On}) \\
\pi_{\text{Lname}}((\text{ALL.PROJ} \div \text{SSN.PROJ}) \bowtie \text{Employee})
\]

(d) \( \{ E.Lname, E.Address | E \in Employee \land \exists P \in Project(\exists W \in \text{Works_On}(E.Ssn = W.Essn \land W.Pno = P.Pnumber \land P.Location = 'Houston' \land \text{not}(\exists L \in \text{Dept.Location}(E.Dno = L.Dnumber \land L.Dlocation = 'Houston'))) \} \)

\[
\text{PROJ.HOUS}(\text{pno}) \leftarrow \pi_{\text{pnumber}}(\sigma_{\text{plocation}='Houston'}(\text{Project})) \\
\text{SSN.PROJ.HOUS}(\text{ssn}) \leftarrow \pi_{\text{essn}}(\text{Works_On} \bowtie \text{PROJ.HOUS}) \\
\text{SSN.DEPT.HOUS} \leftarrow \pi_{\text{ssn}}(\sigma_{\text{dlocation}='Houston'}(\text{Employee} \bowtie_{\text{dno} = \text{dnumber}} \text{Dept.Locations})) \\
\pi_{\text{Lname}, \text{Address}}((\text{SSN.PROJ.HOUS} \div \text{SSN.DEPT.HOUS}) \bowtie \text{Employee})
\]

2. (20 points) Use Query Analyzer program to access a MS SQL Server on KISSEL to view the execution plan of each of the SQL statements in Question 4. Include the screenshot of each execution plan as your answer.

Submission Requirements:
Put your answers in a Word document. Submit your word document using the turnin script with “hw3” as the last argument for the script.