Database Design
CS 6360.003: Homework #2

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Problem 1

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

$$
\begin{aligned}
Works\_Project &\leftarrow Project \bowtie_{Pnumber=Pno} Works\_on \\
Employee\_Works &\leftarrow Employee \bowtie_{Ssn=Essn} Works\_Project \\
Target\_Employee &\leftarrow \sigma_{Dno=5 \text{ AND } Pname='ProductX' \text{ AND } Hours>10}(Employee\_Works) \\
Result &\leftarrow \pi_{Fname,\ Minit,\ Lname}(Target\_Employee)
\end{aligned}
$$

Problem 2

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

$$
\begin{aligned}
Employee\_Dependent &\leftarrow Employee \times Dependent \\
Target\_Employee &\leftarrow \sigma_{Ssn=Essn \text{ AND } Fname=Dependent\_name}(Employee\_Dependent) \\
Result &\leftarrow \pi_{Fname,\ Minit,\ Lname}(Target\_Employee)
\end{aligned}
$$

Problem 3

Find the names of all employees who are directly supervised by Franklin Wong.

$$
\begin{aligned}
Manager &\leftarrow \sigma_{Fname='Franklin' \text{ AND } Lname='Wong'}(Employee) \\
Target\_Employee &\leftarrow Employee \bowtie_{Employee.Super\_ssn=Manager.Ssn} Manager \\
Result &\leftarrow \pi_{Fname,\ Minit,\ Lname}(Target\_Employee)
\end{aligned}
$$

Problem 4

For each project, list the project name and the total hours per week (by all employees) spent on that project.

$$
\begin{aligned}
Hours &\leftarrow \rho_{(Pnumber,Sum\_Hours)}({}_{Pno}\mathcal{F}_{SUM\ Hours}(Works\_on) \\
Project\_Hours &\leftarrow Hours \star Project \\
Result &\leftarrow \pi_{Pname,\ Sum\_Hours}(Project\_Hours)
\end{aligned}
$$

Problem 5

Retrieve the names of all employees who work on every project.

$$Project\_Count \leftarrow \rho_{(Count)}(\mathcal{F}_{COUNT\ Pnumber}(Project))$$
$$Employee\_Project\_Count \leftarrow \rho_{(Ssn,\ Count)}({}_{Essn}\mathcal{F}_{COUNT\ Pno}(Works\_on))$$
$$Target\_Employee \leftarrow Project\_Count\ \star\ Employee\_Project\_Count$$
$$Target\_Employee\_Info \leftarrow Target\_Employee\ \star\ Employee$$
$$Result \leftarrow \pi_{Fname,\ Minit,\ Lname}(Target\_Employee\_Info)$$

Problem 6

Retrieve the names of all employees who do not work on any project.

$$All\_ssn \leftarrow \pi_{Ssn}(Employee)$$
$$Work\_ssn \leftarrow \rho_{Ssn}(\pi_{Essn}(Work\_on))$$
$$Not\_work\_ssn \leftarrow All\_ssn - Work\_ssn$$
$$Target\_Eployee \leftarrow Not\_work\_ssn\ \star\ Employee$$
$$Result \leftarrow \pi_{Fname,\ Minit,\ Lname}(Target\_Employee)$$

Problem 7

For each department, retrieve the department name and the average salary of all employees working in that department.

$$Salary \leftarrow \rho_{Dnum,\ Average\_Salary}({}_{Dno}\mathcal{F}_{AVERAGE\ Salary}(Employee))$$
$$Target \leftarrow Salary\ \star\ Department$$
$$Result \leftarrow \pi_{Dname,\ Average\_Salary}(Target)$$

Problem 8

Retrieve the average salary of all female employees.

$$Female\_Employee \leftarrow \sigma_{Sex='Female'}(Employee)$$
$$Result \leftarrow \rho_{Avg\_Salary}(\mathcal{F}_{AVERAGE\ Salary}(Female\_Employee))$$

Problem 9

Find the names and addresses of all employees who work on at least one project located in Houston but whose department has no location in Houston.

$$
\begin{aligned}
Houston\_Deparment &\leftarrow \pi_{Dnumber}(\sigma_{Dlocation='Houston'}(Department \star Dept\_Locations)) \\
Target\_Department &\leftarrow \rho_{Dno}(\pi_{Dnumber}(Department) - Houston\_Department) \\
Houston\_Project &\leftarrow \sigma_{Plocation='Houston'}(Project) \\
Works\_on\_Houston &\leftarrow \rho_{Ssn}(\pi_{Essn}(Works\_on \bowtie_{Pno=Pnumber} Houston\_Project)) \\
Target\_Employee &\leftarrow Employee \star Works\_on\_Houston \star Target\_Department \\
Result &\leftarrow \pi_{Fname,\ Minit,\ Lname,\ Address}(Target\_Employee)
\end{aligned}
$$

Problem 10

List the last names of all department managers who have no dependents.

$$
\begin{aligned}
Manager\_ssn &\leftarrow \rho_{Ssn}(\pi_{Mgr\_ssn}(Department)) \\
Dependent\_ssn &\leftarrow \rho_{Ssn}(\pi_{Essn}(Dependent)) \\
Target\_Manager &\leftarrow Manager\_ssn - Dependent\_ssn \\
Result &\leftarrow \pi_{Lname}(Target\_Manager \star Employee)
\end{aligned}
$$