CS143 Homework#1:

1. Suppose relation $R(A, B, C)$ has the tuples:

| A | B | C |
|---|---|---|
| 7 | 5 | 3 |
| 2 | 1 | 2 |
| 1 | 4 | 3 |
| 5 | 8 | 7 |
| 6 | 7 | 9 |

and relation $S(A, B, C)$ has the tuples:

| A | B | C |
|---|---|---|
| 2 | 1 | 2 |
| 1 | 4 | 4 |
| 8 | 3 | 2 |
| 5 | 8 | 7 |

Compute $(R - S) \cup (S - R)$, often called the "symmetric difference" of $R$ and $S$. List all the tuples in the result relation.

Answer:
(R – S) has the tuples:

| A | B | C |
|---|---|---|
| 7 | 5 | 5 |
| 1 | 4 | 3 |
| 6 | 7 | 9 |

(S – R) has the tuples:

| A | B | C |
|---|---|---|
| 1 | 4 | 4 |
| 8 | 3 | 2 |

(R – S) ∪ (S – R) has the tuples:

| A | B | C |
|---|---|---|
| 7 | 5 | 5 |
| 1 | 4 | 3 |
| 6 | 7 | 9 |
| 1 | 4 | 4 |
| 8 | 3 | 4 |

2. Suppose relation $R(L, M)$ has the tuples:

| L | M |
|---|---|
| 4 | 3 |
| 6 | 5 |
| 8 | 7 |

and relation $S(M, N, P)$ has the tuples:

| M | N | P |
|---|---|---|
| 6 | 1 | 8 |
| 1 | 6 | 4 |
| 2 | 5 | 1 |
| 3 | 4 | 7 |

Compute $\sigma_{R.L>S.M \wedge R.M<S.P}(R \times S)$. List all the tuples in the result relation.

(R × S) has the tuples:

| L | R.M | S.M | N | P |
|---|---|---|---|---|
| 4 | 3 | 6 | 1 | 8 |
| 4 | 3 | 1 | 6 | 4 |
| 4 | 3 | 2 | 5 | 1 |
| 4 | 3 | 3 | 4 | 7 |
| 6 | 5 | 6 | 1 | 8 |
| 6 | 5 | 1 | 6 | 4 |
| 6 | 5 | 2 | 5 | 1 |
| 6 | 5 | 3 | 4 | 7 |
| 8 | 7 | 6 | 1 | 8 |
| 8 | 7 | 1 | 6 | 4 |
| 8 | 7 | 2 | 5 | 1 |
| 8 | 7 | 3 | 4 | 7 |

σR.L>S.M∧R.M<S.P (R × S) has the tuples:

| L | R.M | S.M | N | P |
|---|---|---|---|---|
| 4 | 3 | 1 | 6 | 4 |
| 4 | 3 | 3 | 4 | 7 |
| 6 | 5 | 3 | 4 | 7 |
| 8 | 7 | 6 | 1 | 8 |

Problem3:

$\Pi_{i.ID,i.name}((\sigma_{i.salary > w.salary}(\varrho_i(instructor) \times \sigma_{w.id=12121}(\varrho_w(instructor)))))$

$\sigma_{dept\_name} =$"Physics"(instructor$\bowtie_{\text{instructor.ID=teaches.ID}}$ teaches)

$(\sigma_{deptname=\text{"Physics"}}(instructor))\bowtie_{instructor.ID=teaches.ID} teaches$

$\sigma_{dept\text{name = building}}$(department)

Student $\bowtie_{\text{Student.Student-name=Enrollment.Student-name}}$ Enrollment

a). Find the names of all students who are not enrolled in the 'Database Management Systems' course.

$\Pi_{Student\text{-}name}$ (Student) — $\Pi_{Student\text{-}name}$ ( $\sigma_{Course\text{-}name=\text{"Database Management Systems"}}$(Enrollment))

b). Find the names of all students who are enrolled in at least one course not offered by their home department.

$Student\_Enrolled \leftarrow Student \bowtie_{Student.Student\text{-}name=Enrollment.Student\text{-}name} Enrollment$

// *Result schema is :*

// $Student\_Enrolled(_{Student.Student\text{-}name}$, Department, $Enrollment.Student\text{-}name, Course\text{-}name)$

$Result2 \leftarrow Student\_Enrolled \bowtie_{Result1.Course\text{-}name=Course.Course\text{-}name} Course$

// *Result schema is:*

// $Result2 (\ Student.Student\text{-}name$, Student_Enrolled.Department, $Enrollment.Student\text{-}name, Student\_Enrolled.Course\text{-}name, Course.Course\text{-}name, Courese.Department)$

$\Pi_{Student.Student\text{-}name}(\sigma_{Student\_Enrolled.Department <> Course.Department}(Result2))$

c). Find the names of all courses which have no students enrolled.

$\Pi_{Course\text{-}name}(Course) - \Pi_{Course\text{-}name}(Enrollment)$

d). Find the department names that students belong to if the students takes at least one class offered by the CS department.

$\Pi_{\text{Student.Student-name, Student\_Enrolled.Department}}(\sigma_{\textit{Courese.Department} = \text{“CS”}}(\text{Result2}))$

*e*). Find the department names of all students who are enrolled in at most one course.

$\text{Result\_e1} \leftarrow \text{Enrollment} \times \varrho_{\textit{Enrollment2}}(\textit{Enrollment})$

$\text{Result\_e2} \leftarrow \sigma_{\textit{Enrollment.Student-name = Enrollment2.Student-name AND Enrollment.Course-name <> Enrollment2.Course-name}}(\text{Result\_e1})$

// Student who are taking more than 1 course:

$\text{Result\_e3} \leftarrow \varrho_{\textit{Studnet\_taking\_more\_than\_one}(\textit{Student-name})}(\Pi_{\text{Enrollment.Student-name}}\text{Result\_e2})$

$\text{Result\_e3} \leftarrow \text{Result\_e3} \bowtie_{\text{Result\_e3.Student-name=Student.Student-name}} \text{Student}$

$\varrho_{\textit{Studnet\_taking\_more\_than\_one\_course(Student-name, Department)}}(\Pi_{\text{Student.Student-name, Department}})$

$\textit{Final\_relation} \leftarrow \textit{Student} - \textit{Student\_taking\_more\_than\_one\_course}$

#4.

$\varrho_{Company2}$ (Company)

Not_Cheapest_Companies <— $\Pi_{\text{Company.company-name}}(\sigma_{Company.company\text{-}name > Company2.company\text{-}name}$ (Company × Company2))

Cheapest_Company = $\Pi_{\text{company-name}}$(Compamy) — Not_Cheapest_Companies