Georgi Baghdasaryan
UID: 603 875 284
Class/Discussion Section: CS143/1A

<u>PROBLEM 1:</u> Suppose relation $R(A, B, C)$ has the tuples:

A	B	C
3	2	1
4	2	3
4	5	6
2	5	3
1	2	6

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

A	B	C
2	5	3
2	5	4
4	2	3
3	2	1

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

SOLUTION: Relation $(R - S) \cup (S - R)$ has tuples:

A	B	C
4	5	6
1	2	6
2	5	4

<u>PROBLEM 2:</u> Suppose relation $R(A, B)$ has the tuples:

A	B
1	2
3	4
5	6

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

B	C	D
2	4	6
8	6	8
7	5	9

Compute $R \bowtie_{R.A<S.C \cap R.B<S.D} S$ and list all the result tuples.

Georgi Baghdasaryan
UID: 603 875 284
Class/Discussion Section: CS143/1A

SOLUTION: Relation $R \bowtie_{R.A<S.C} S$ has tuples:

R.A	R.B	S.B	S.C	S.D
1	2	2	4	6
1	2	8	6	8
1	2	7	5	9
3	4	2	4	6
3	4	8	6	8
3	4	7	5	9
5	6	8	6	8

Relation $R \bowtie_{R.B<S.D} S$ has tuples:

R.A	R.B	S.B	S.C	S.D
1	2	2	4	6
1	2	8	6	8
1	2	7	5	9
3	4	2	4	6
3	4	8	6	8
3	4	7	5	9
5	6	8	6	8
5	6	7	5	9

Relation $R \bowtie_{R.A<S.C \cap R.B<S.D} S$ has tuples:

R.A	R.B	S.B	S.C	S.D
1	2	2	4	6
1	2	8	6	8
1	2	7	5	9
3	4	2	4	6
3	4	8	6	8
3	4	7	5	9
5	6	8	6	8

<u>PROBLEM 3:</u> Assume the following database for this problem. The relations represent information on bank branches:

$$\boldsymbol{Customer}(customer - name, street, city)$$
$$\boldsymbol{Branch}(branch - name, city)$$
$$\boldsymbol{Account}(customer - name, branch - name, account - number)$$

The $\boldsymbol{Customer}$ relation has the customer names and their addresses.

Write a relational-algebra expression for each of the following queries:

Georgi Baghdasaryan
UID: 603 875 284
Class/Discussion Section: CS143/1A

a) Find names of all customers who have an account in 'Region12' branch.
b) Find names of all customers who have an account in a branch NOT located in the same city as the one they live in.
c) Find the branches that do not have any accounts.
d) Find names of customers who do not have any accounts in the 'Region12' branch.
e) Find names of customers who have accounts in all the branches located in 'Los Angeles'.
f) Find names of customers who have only one account.

SOLUTIONS:

a) $\pi_{customer-name}\left(\sigma_{branch-name='Region12'}(Account)\right)$

b) $\pi_{customer-name}\left(\sigma_{A.city<>B,city \wedge A.branch-name=B.branch-name}\left(\rho_B(Branch) \times \rho_A(Customer \bowtie Account)\right)\right)$

c) $\pi_{branch-name}(Branch) - \pi_{branch-name}(Account)$

d) $\pi_{customer-name}(Customer) - \pi_{customer-name}\left(\sigma_{branch-name='Region12'}(Account)\right)$

e) $\pi_{customer-name}(Customer) - \pi_{customer-name}\left(\pi_{customer-name}(Customer) \times \pi_{branch-name}\left(\sigma_{city='LosAngeles'}(Branch)\right) - \pi_{customer-name,branch-name}(Account)\right)$

f) $\pi_{customer-name}(Customer) - \pi_{A.customer-name}\left(\sigma_{\substack{(A.branch-name<>B.branch-name \vee A.account-number<>B.account-number) \\ \wedge A.customer-name=B.customer-name}}\left(\rho_A(Account) \times \rho_B(Account)\right)\right)$

<u>PROBLEM 4:</u> The relation $\boldsymbol{Student}(\boldsymbol{sid}, \boldsymbol{GPA})$ captures the student-GPA information, where $\boldsymbol{sid}$ is the id of a student and $\boldsymbol{GPA}$ is the student's GPA. Write a relational algebra that finds the ids of the students with the lowest GPA.

SOLUTION:

$$\pi_{sid}(Student) - \pi_{A.sid}\left(\sigma_{A.sid<>B.sid \wedge A.GPA>B.GPA}\left(\rho_A(Student) \times \rho_B(Student)\right)\right)$$