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CS 143 – Lab 1A

Homework 1

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

$(R - S) =$

A	B	C
4	5	6
1	2	6

$(S - R) =$

A	B	C
2	5	4

$(R - S) \cup (S - R) =$

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

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

$$R \bowtie_{R.A<S.C \wedge R.B<S.D} S = \sigma_{R.A<S.C \wedge R.B<S.D}(R \times S)$$

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$(R \times S) =$

A	B_R	B_S	C	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	2	4	6
5	6	8	6	8
5	6	7	5	9

$\sigma_{R.A<S.C \land R.B<S.D}(R \times S) =$

A	B_R	B_S	C	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

3.

Customer(<u>customer-name</u>, street, city) =

Customer-name	Street	city
…	…	…

Branch(<u>branch-name</u>, city) =

Branch-name	city
…	…

Account(<u>customer-name</u>, <u>branch-name</u>, <u>account-number</u>) =

Customer-name	Branch-name	Account-number
…	…	…

a) Find the names of all customers who have an account in the 'Region12' branch.

$$\prod_{customer-name}(\sigma_{branch-name='Region12'}(Customer \bowtie Branch \bowtie Account))$$

b) Find the names of all customers who have an account in a branch NOT located in the same city that they live in.

$$\prod_{customer-name}(\sigma_{branch.city \neq customer.city}(Customer \times Branch) \bowtie Account)$$

c) Find branches that do not have any accounts.

$$\prod_{branch-name}(Branch) - \prod_{branch-name}(\sigma_{account.branch-name=branch.branch-name}(Branch \times Account))$$

d) Find the customer names who do not have any account in the 'Region12' branch.

$$\prod_{customer-name}(Customer) - \prod_{customer-name}(\sigma_{branch-name='Region12'}(Customer \bowtie Account))$$

e) Find the customer names who have accounts in all the branches located in 'Los Angeles'.

$$\prod_{customer-name}(\sigma_{Branch.city='LosAngeles'}(Customer \times Branch) \bowtie Account)$$

f) Find the customer names who have only one account.

$\prod_{customer-name}(Customer)$
$- \prod_{customer-name}(Account \bowtie_{Account.customer-name=Y.customer-name \land Account.account-number \neq Y.account-number} \rho_Y(Account))$

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4. The relation Student(**sid**, **GPA**) captures the student-GPA information, where **sid** is the id of a student and **GPA** is the student's GPA. Write a relational algebra that finds the ids of the students with the lowest GPA.

$$\Pi_{Student.sid}(\text{Student}) - \Pi_{Student.sid}(\sigma_{Student.GPA>Y.GPA}(Student \times \rho_Y(Student)))$$