

CSE 4125: Distributed Database Systems

Chapter – 2: Part C

Review of Databases and Computer
Networks

Symmetric?

$$\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} = \begin{pmatrix} 3 & 5 \\ 3 & 5 \end{pmatrix}$$

while

$$\begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} \cdot \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix} = \begin{pmatrix} 3 & 3 \\ 5 & 5 \end{pmatrix}.$$

Which Relational Algebra is symmetric?

- Selection
- Projection
- Union
- Difference
- Cartesian product
- Join
- Natural Join
- Semi join
- Natural Semi Join

Prove that, semi – join is not symmetric.

The Relational Model

- ✓ Grade: Number of columns
- ✓ Cardinality: Number of rows

Unary: Selection

Example: $SL_{A=a} R$

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

Result		
A	B	C
a	1	a
a	1	d

G(Result)

Unary: Projection

Example: $PJ_{A,B} R$

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

Result	
A	B
a	1
b	1
b	2

G(Result)

Binary: Union

Example: $R \cup S$

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

Result		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f
a	3	f

G(Result)

Binary: Difference

Example: *R* **DF** *S*

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

Result		
A	B	C
b	1	b
a	1	d
b	2	f

G(Result)

Binary: Cartesian Product

Example: $R \bowtie C P S$

G(Result)

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

Result					
R.A	R.B	R.C	S.A	S.B	S.C
a	1	a	a	1	a
b	1	b	a	1	a
a	1	d	a	1	a
b	2	f	a	1	a
a	1	a	a	3	f
b	1	b	a	3	f
a	1	d	a	3	f
b	2	f	a	3	f

Binary: Join

Example: $R \bowtie_{R.C=T.C} T$

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

G(Result)

Result					
A	R.B	R.C	T.B	T.C	D
a	1	a	1	a	1
a	1	a	2	a	3
b	1	b	3	b	1
a	1	d	1	d	4

Binary: Natural Join

Example: $R \bowtie T$

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

Result			
A	B	C	D
a	1	a	1
a	1	d	4

G(Result)

Binary: Semi-join

Example: $R \text{ SJ}_{R.C=T.C} T$

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

Result		
A	B	C
a	1	a
b	1	b
a	1	d

G(Result)

Binary: Natural Semi-join

Example: $R \bowtie_{NSJ} T$

R		
A	B	C
a	1	a
b	1	b
a	1	d
b	2	f

S		
A	B	C
a	1	a
a	3	f

T		
B	C	D
1	a	1
3	b	1
3	c	2
1	d	4
2	a	3

Result		
A	B	C
a	1	a
a	1	d

G(Result)

- Join is Cartesian Product of two relations followed by a selection operation.
- Semi-join is Join between two relations followed by a projection operation.

Sample Questions

- a) If R and S are the input relations, and T is the output relation, for which relational algebraic operation(s) the following statements are true?
- i. $\text{grade}(R) = \text{grade}(S) = \text{grade}(T)$
 - ii. $\text{grade}(R) + \text{grade}(S) = \text{grade}(T)$
- b) Give examples of protocol and session from the context of DDB.