Justin Anthony Timberlake
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Assignment 4

*When relations are otherwise unnamed, I arbitrarily called them all "F" in order to display their schema in addition to the table.

1. R natural join S = F(R.A,R.B,R.C,S.D) =

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

F

R.A	**R.B**	**R.C**	**S.D**
6	4	3	9
3	5	1	6

2. R theta-join S = F (R.A, R.B, S.B, S.C, S.D) =

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

F

R.A	**R.B**	**S.B**	**S.C**	**S.D**
10	t	t	8	9

3. Given that natural-join for the described relations R (with r unique tuples within R) and S (with s unique tuples within S) can be expanded:

R natural join S =

$$\pi_{R.A,\ R.B,\ S.C}\ (\sigma_{R.B = S.B}\ (R(A,B) \times S(B,C)))$$

We will have to consider the resulting relation from the selection statement of the cross product (theta-join) of these sets. Because the tuples within S and R are respectively unique within S and R, each value in the B column can only have exactly one match within R × S. Given that a tuple can also be defined as one row (or record) in any given relation, we know that for every matching value between the two different B columns, one tuple will be included in the natural-join of R and S. As stated before, this is equivalent to as many unique tuples there are in each B column of each set, which is r or s in R or S respectively.

Thus, the number of tuples in the final relation is in the range from 0 (where there are no matching values between R.B and S.B) to t = r or t = s depending on which value, s or r, is larger. For example, if s < r, then t = s because we know there can then only be s possible tuple combination which could overlap in the B columns.

In the case of R natural-join R, however, there would be no overlapping values between R.B and S.B because all values of the set R must be unique within R. Therefore, t = 0 in all instances of R.

4. F(R.B, R.A) = π B, A (R)

F

R.B	**R.A**
2	1
2	4
5	4
5	2

5.

R∪S = F(R.A, R.B, R.C)

R.A	**R.B**	**R.C**
a	b	c
d	b	c
d	e	f
b	e	c
a	b	f
b	e	d

R∩S = F(R.A, R.B, R.C)

R.A	**R.B**	**R.C**
a	b	c
d	e	f
b	e	c

R-S = F(R.A, R.B, R.C)

R.A	**R.B**	**R.C**
d	b	c
a	b	f

S-R = F(R.A, R.B, R.C)

S.A	**S.B**	**S.C**
b	e	d

I, Justin Anthony Timberlake, declare that I have completed this assignment completely and entirely on my own, without any consultation with others. I understand that any breach of the UAB Academic Honor Code may result in severe penalties.