\*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) =

π R.A, R.B, R.C, S.D

(σ R.B = S.B ∧ R.C = S.C

( R(A,B,C,D) ⨯ 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) =

σ R.B = S.B ( R(A,B) ⨯ 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 =

π R.A, R.B, S.C

(σ R.B = S.B

( R(A,B) ⨯ 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.