Quiz 3

Question **1**

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The **result of R(a,c) $JN_{c=c}$ S(c,d) is empty**, when

{Note $JN_{c=c}$ is an equi-join operator, Π is a project operator}

a. **(Π_c(R) intersection Π_c(S))** is **Π_c(S)**

- (above operator is set intersection)

b. None of the others

c. **(Π_c(R) intersection Π_c(S))** is **Empty** ✔

- (above operator is set intersection)

d. **Π_c(R) = Π_c(S)**

e. **(Π_c(R) intersection Π_c(S))** is **Π_c(R)**

- (above operator is set intersection)

Correct Answer : Option C

Explanation:

a. (Πc(R) ∩ Πc(S)) is Πc(S): This implies that the set of c values in R is a subset of the set of c values in S. Since there's an intersection, it means there are some common values in c between R and S. Hence, the join on c would not be empty.

c. (Πc(R) ∩ Πc(S)) is Empty: If the intersection of the projected c values from R and S is empty, it means there are no common c values between R and S. Therefore, an equi-join on c would indeed result in an empty set.

d. Πc(R) = Πc(S): This means the sets of c values in both R and S are identical. An equi-join on c would therefore not be empty, as all c values in R can be paired with c values in S.

e. (Πc(R) ∩ Πc(S)) is Πc(R): This implies that the set of c values in S is a subset of the set of c values in R. Like in option a, there are common values in c between R and S, so the join would not be empty.

Question **2**
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Consider **R(K, A) having at least ten rows**, with **K as the key attribute** and **attribute A is a positive integer, the result of**

$\Pi_{(K, A)}$ [R(K,A) $JN_{A>A}$ R(K,A)]

{Note **$JN_{A>A}$ is a theta join operator**. **Π** is the project operator. **$\Pi_{(K, A)}$ takes the K, A attributes of the left hand side relation of the $JN_{A>A}$ operator}**.

Select one or more:

- [ ] a. Can be the relation R(K,A)
- [ ] b. **Number of rows in ($\Pi_{(K.A)}$ (R(K,A) $JN_{A>A}$ R(K,A)))**
  is **always greater than**
  number of rows of R(K,A)
- [ ] c. None of the others
- [x] d. Can be empty. ✔
- [ ] e. **Number of rows in $\Pi_{(K.A)}$ (R(K,A) $JN_{A>A}$ R(K,A))**
  can be
  (number of rows of R(K,A) * number of rows of R(K,A))

Correct Answer : Option D
Explanation:

a. The row with smallest value of attribute A in left hand relation $R(K, A)$ will not join with any row on the right side since the join condition $\left(R(K, A) \bowtie_{A>A} R(K, A)\right)$ is going to fail. Thus the row will never projected in the result of

$$\pi_{K,A}\left(R(K, A) \bowtie_{A>A} R(K, A)\right)$$

b. Consider the relation $R(K, A)$ as below

K	A
1	10
2	10
3	10

Since every attribute of A is same after the result of join operation $\left(R(K, A) \bowtie_{A>A} R(K, A)\right)$ is empty and thus $\pi_{K,A}\left(R(K, A) \bowtie_{A>A} R(K, A)\right)$ is also empty . Therefore zero rows in result.Therefore number of rows is not always greater than number of rows in $R(K, A)$

d. Can be empty is possible as shown above.
e. For this to happen . Every row of the left hand relation must be joined with every row of right hand relation, which is not possible for the given join condition $\left(R(K, A) \bowtie_{A>A} R(K, A)\right)$. As explained in option.a the lowest element of attribute A on LHS will not join to any element in RHS .

Question **3**

Incorrect

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Consider relation **R(A) having at least ten rows**, where attribute **A is a positive integer**, then

Select one or more:

- [ ] a. **R(A) = R(A) $\cup_B$ R(A)**

  [$\cup_B$ is bag union]

- [x] b. **R(A) = (R(A) Intersection$_B$ R(A))** ✖

  [Intersection$_B$ is bag intersection]

- [ ] c. **(Π_A(R(A)) – Π_A(R(A))) is empty**

  [- is set difference, and Π is project operation]

- [x] d. **(R(A) $-_B$ R(A)) is empty** ✖

  [$-_B$ is bag difference]

- [ ] e. None of the others

Correct Answer : Option b,c,d
Explanation:

a. Each row of R(A) is repeated twice in bag union thus $R(A) \neq R(A) \uplus R(A)$

b. An element appears in the intersection of two bags the minimum of the number of times it appears in either.

   Therefore $R(A) = R(A) \cap_B R(A)$

c. set difference of two equal relations is empty since you're effectively asking for the set of elements that are in ΠA(R(A)) but not in ΠA(R(A))

d. Similarly bag difference of two equal relations is empty.

Question **4**

Correct

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Let R, S, T be three relations, then

[Note: X is a cartesian product, JN is an equi-join operator.]

Select one or more:

- [ ] a. (RXS) JN T = (R JN S) X T
- [x] b. (R JN S) JN T = R JN (S JN T) ✖
- [ ] c. R X (S JN T) = (R X S) JN (R X T)
- [x] d. R X(S JN T) = (RX S) JN T ✔

Correct Answer : option b,d

a. cartesian product and equi join operator cannot be swapped with each other (R JN S) X T has every tuple of T since we are doing cartesian product with T whereas (RXS) JN T joins only selected tuples of T based on equi join condition.

b. The equivalence of the join operations (R JN S) JN T and R JN (S JN T) is upheld due to the associativity property of join operations in relational algebra. This holds true under the condition that the join operations between R and S, as well as between S and T, are based on independent attributes

c. RHS has more attributes than LHS which fails the case

d. True, The join condition applied in the equi-join operation is the same in both cases, and it only involves attributes from S and T. Therefore, whether the join is performed before or after the Cartesian product with R does not affect the outcome. R is effectively 'independent' in this context as it does not influence the join condition between S and T.

Question **5**

Incorrect

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Let **d** be the duplicate eliminator operator, then

[Note JN is an equi-join operator.]

Select one or more:

- [ ] a. **d** (R JN (S JN T)) = **d**(R) JN (S JN T)
- [x] b. **d** (R JN (S JN T)) = **d**(R) JN **d**(S JN T) ✖
- [ ] c. **d** (R JN (S JN T)) = R JN **d**(S) JN T
- [x] d. **d** (R JN (S JN T)) = **d**(R) JN **d**(S) JN **d**(T) ✖
- [ ] e. None of the others

Correct Answer: b,d
Explanation:

R

A	B
1	3
2	4
3	4

S

B	C
3	4
4	5
5	6

T

C	D
4	5
4	5
5	6

S JN T

B	C	D
3	4	5
3	4	5
4	5	6

R JN (S JN T)

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

d (R JN (S JN T))

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

In the choosen relations , note that d(R) = R and d(S)

Consider ,the relations as below,

a. As we can see from above relations, d (R JN (S JN T)) not same as d(R) JN (S JN T)
b. This is true as it will not generate any duplicate rows as we are equi joining two relations without duplicates in them.
c. Same explanation as option a , in our example we can observe d(R)=R and d(S)=S. Thus this option is not correct.
d. This is true similar to option b by equi joining relations without duplicates we will not observe duplicates in result.