

# Quiz 3

Question 1

Correct

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

**{Note  $\bowtie_{c=c}$  is an equi-join operator,  $\Pi$  is a project operator}**

☐ a.  **$(\Pi_c(R) \text{ intersection } \Pi_c(S))$  is  $\Pi_c(S)$**

- (above operator is set intersection)

☐ b. None of the others

☒ c.  **$(\Pi_c(R) \text{ intersection } \Pi_c(S))$  is Empty**

- (above operator is set intersection)

☐ d.  **$\Pi_c(R) = \Pi_c(S)$**

☐ e.  **$(\Pi_c(R) \text{ intersection } \Pi_c(S))$  is  $\Pi_c(R)$**

- (above operator is set intersection)



**Correct Answer : Option C**

**Explanation:**

- a.  $(\Pi_c(R) \cap \Pi_c(S))$  is  $\Pi_c(S)$ : 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.  $(\Pi_c(R) \cap \Pi_c(S))$  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.  $\Pi_c(R) = \Pi_c(S)$ : 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.  $(\Pi_c(R) \cap \Pi_c(S))$  is  $\Pi_c(R)$ : 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

Correct

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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

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

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

Select one or more:

- ☐ a. Can be the relation  $R(K, A)$
- ☐ b. Number of rows in  $(\Pi_{(K, A)} (R(K, A) \bowtie_{A > A} R(K, A)))$  is always greater than number of rows of  $R(K, A)$
- ☐ c. None of the others
- ☒ d. Can be empty.
- ☐ e. Number of rows in  $\Pi_{(K, A)} (R(K, A) \bowtie_{A > A} R(K, A))$  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  $(R(K, A) \bowtie_{A > A} R(K, A))$  is going to fail. Thus the row will never projected in the result of

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

- 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  $(R(K, A) \bowtie_{A > A} R(K, A))$  is empty and thus  $\pi_{K, A} (R(K, A) \bowtie_{A > A} R(K, A))$  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  $(R(K, A) \bowtie_{A>A} R(K, A))$ . 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]

☒ b.  $R(A) = (R(A) \text{ Intersection}_B R(A))$  ✗

[  $\text{Intersection}_B$  is bag intersection]

☐ c.  $(\Pi_A(R(A)) - \Pi_A(R(A)))$  is empty

[ - is set difference, and  $\Pi$  is project operation]

☒ 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  $R(A) \neq R(A) \cup R(A)$
- 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  $\Pi_A(R(A))$  but not in  $\Pi_A(R(A))$
- 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.  $(RXS) JN T = (R JN S) X T$

☒ b.  $(R JN S) JN T = R JN (S JN T)$

☐ c.  $R X (S JN T) = (R X S) JN (R X T)$

☒ d.  $R X (S JN T) = (R X S) JN T$

✗

✓

### 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.  $d(R \text{ JN } (S \text{ JN } T)) = d(R) \text{ JN } (S \text{ JN } T)$

☒ b.  $d(R \text{ JN } (S \text{ JN } T)) = d(R) \text{ JN } d(S \text{ JN } T)$

✗

☐ c.  $d(R \text{ JN } (S \text{ JN } T)) = R \text{ JN } d(S) \text{ JN } T$

☒ d.  $d(R \text{ JN } (S \text{ JN } T)) = d(R) \text{ JN } d(S) \text{ JN } d(T)$

✗

☐ 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 chosen relations, note that  $d(R) = R$  and  $d(S)$

Consider the relations as below,

- a. As we can see from above relations,  $d(R \bowtie (S \bowtie T))$  not same as  $d(R) \bowtie (S \bowtie T)$
- 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.