Branch : CSE & IT **Batch : Hinglish**

Database Management System

Query Language

DPP 03

[MCQ]

1. Consider the following relational algebra query on relations A (p, q, r) and B (q, r):

$\pi_p(A) - \pi_p((\pi_p(A) \times \pi_{q,r}(B) - \pi_{p,q,r}(A))$

The above query is equivalent to?

(a) $A \cap B$

(b) $A \cup B$

(c) $A - B$

(d) $A \div B$

[MCQ]

2. Consider the following SQL query.

SELECT DISITNCT $P_1, P_2, P_3 \ldots. P_n$

FROM $R_1, R_2, R_3 \ldots.. R_m$

WHERE Q

Which of the following relational algebra query is equivalent to above SQL query?

(a) $\pi_{P1,\ P2,\ P3 \ldots.\ Pn}(\sigma_Q(R_1 \bowtie R_2 \bowtie R_3 \bowtie \ldots\ldots \bowtie R_m))$

(b) $\pi_{P1,\ P2,\ P3 \ldots.\ Pn}((R_1 \times R_2 \times R_3 \times \ldots\ldots \times R_m)$

(c) $\sigma_{P1,\ P2,\ P3 \ldots.\ Pn}(\pi_Q(R_1 \bowtie R_2 \bowtie R_3 \bowtie \ldots\ldots \bowtie R_m))$

(d) $\pi_{P1,\ P2,\ P3 \ldots.\ Pn}(\sigma_Q(R_1 \times R_2 \times R_3 \times \ldots\ldots \times R_m))$

[MCQ]

3. Consider the following equivalencies between expressions of relational algebra, each involving relations A (P, Q) and B (R, S). Assume that there is no foreign key, A attribute to table can be NULL, all attributes are of integer types which of the following equivalencies is/are TRUE?

(a) $\pi_{P,\ Q}(A \times B) = A$

(b) $A - \rho_{T\ (P,\ Q)}(B) = \rho_{T\ (P,\ Q)}(B - (\rho_{T\ (R,\ S)}(A)))$

(c) $\pi_{P,\ Q,\ S}(A \bowtie_{Q=R} B) = A \bowtie (\rho_{T(Q,\ S)}(B))$

(d) None of the above

[MCQ]

4. Let A = (P, Q, R) and a_1 and a_2 both be relations on schema A. Give on expression in the domain relation calculus List- I, match the List-I expression to its equivalent relational algebra query in List-II.

List-I	**List-II**
1. $a_1 \cup a_2$	(a) $\{<p, q, r> \mid <p, q, r> \in a_1 v <p, q, r> \in a_2\}$
2. $a_1 \cap a_2$	(b) $\{<p, q, r> \mid <p, q, r> \in a_1 \wedge <p, q, r> \in a_2\}$
3. $a_1 - a_2$	(c) $\{<p, q, r> \mid <p,q,r,> \mid \in a_1 \wedge <p, q, r> \notin a_2\}$

(a) 1– (a), 2 – (b), 3 – (c)

(b) 1– (b), 2 – (c), 3 – (a)

(c) 1– (a), 2 – (c), 3 – (b)

(d) 1– (b), 2 – (a), 3 – (c)

[NAT]

5. Consider the table which contains the data shown below.

Sailors (<u>SailID</u>, SailName, Rating, Age)

Reserves (<u>SailID, BoatID</u>, Date)

Boats (<u>BoatID</u>, BoatName, Color)

Sailors

SailID	**SailName**	**Rating**	**Age**
1	Ram	5	35
2	Shaym	9	22
3	Ramesh	10	19
4	Suresh	3	NULL
5	Akhil	NULL	35

Reserves

SailID	**BoatID**	**Date**
1	4	2017-03-15
1	5	2017-04-15
3	2	2014-04-15
4	4	2018-01-01
5	1	2017-12-25

Boats

BoatID	**BoatName**	**Color**
1	Lake	Red
2	Fish	Yellow
3	Clipper	Green
4	Yatch	Green
5	Fish	Yellow
6	Clipper	red

and the following relational algebra query.

π_{BoatID} ($\sigma_{Age\ =\ 35\ \wedge\ rating\ \geq\ 5}$ (sailors) ⋈ Reserves) $\cap\pi_{BoatID}$ ($\sigma_{Rating < 5}$ (Sailors)⋈Reserves)

The number of rows returned by the above query is______.

[MCQ]

6. Consider the relation schemas w(P, Q, R), *x* (S, P, T) y(P, Q, R, S, T) and z (R, S, T). A query that uses additional operators of relational algebra:

$((w \times x) \cap y) \div z$.

What will be the result set if we write this query using only the basic operators of relational algebra?

(a) Result set of the basic operator's query will be greater than the result set of given query.

(b) Result set will only consist of attributes P and Q.

(c) Some of the operations in query cannot be performed due to incompatible relation schemas

(d) Query cannot be written by only using basic operations.

[MSQ]

7. Consider the following relational table A

A				
P	Q	R	S	T
p_1	q_1	r_1	s_1	t_1
p_2	q_2	r_2	s_2	t_2

Also, consider the decomposition of the relation A into relations A_1 = (P, Q, R) and A_2 = (R, S, T) which of the following is/are correct based on the above relations.

(a) π_{A1} (A) ⋈ π_{A2} (A) =A

(b) π_{A1} (A) ⋈ π_{A2} (A) $\neq$ A

(c) PQ $\rightarrow$T is true in the table π_{A1} (A) ⋈ π_{A2} (A)

(d) None of the above

[MSQ]

8. Which of the following relational algebra expression is/are always holds correct?

(a) (X ⋈ Y) ⋈Z = (Z ⋈ X) ⋈ Y

(b) $\sigma_A (\sigma_B (X)) = \sigma_B (\sigma_A (X)$

(c) $\pi_A (\pi_B (X)) = \pi_B (\pi_A (X)$

(d) None of the above

[MSQ]

9. Consider the following Database

Tool (ToolID, Brand, Price)

Jobsite (Location, compensation, Task)

ToolBox(ToolBoxID, location)$\rightarrow$location is a foreign key to jobsite.

Holds(ToolBoxID, ToolID) $\rightarrow$ToolBoxID is a foreign key to ToolBox. ToolID is a foreign key to Tool.

And consider the following SQL query.

SELECT DISTINCT T. ToolID

FROM Tool T, Holds H, ToolBox B, Jobsite J

WHERE T. ToolID = H.ToolId AND H.ToolBoxID = B. ToolBoxID AND B. location = J. location AND J. Task = 'welding'

Which of the following would be an equivalent relational algebra query?

(a) π_{ToolID} (Tool ⋈ Holds ⋈ ToolBox ⋈ $\sigma_{task\ =\ 'welding'}$(jobsite))

(b) π_{ToolID} ($\sigma_{task\ =\ 'welding'}$ (Tool ⋈ (Holds ⋈ Tool Box) ⋈ Jobsite)

(c) $\sigma_{task\ =\ 'welding'}$ (π_{ToolID} (Tool) ⋈ Holds ⋈ Tool Box ⋈ Jobsite)

(d) None of the above

[MSQ]

10. Consider the following two relations A (P, Q) and B (R, S). Which of the following statement is/are TRUE?

(a) The cardinality of (A$\bowtie_{P\ =\ R}$ B) is always larger than or equal to the size of (A$\bowtie_{P\ =\ R\ and\ Q=S}$ B).

(b) The cardinality of (A$\bowtie_{P\ =\ R\ and\ Q\ \neq\ S}$ B) is always larger than or equal to the size of (A$\bowtie_{P\ =\ R\ and\ Q\ =\ S}$ B).

(c) These two-expression ($\sigma_{P\ =\ 5}$ (A$\bowtie_{Q=R}$B)) and ($\sigma_{P\ =\ 5}$ (A) $\bowtie_{Q=R}$ B) are always equivalent.

(d) These two expressions (A × B) – (A $\bowtie_{Q\ =\ R}$ B) and (A$\bowtie_{Q\ \neq\ R}$ B) are always equivalent.

Answer Key

1. (d)
2. (d)
3. (c)
4. (a)
5. (1)
6. (c)
7. (a, c)
8. (a, b)
9. (a, b)
10. (a, c, d)

Hints & Solutions

1. (d)

In relational algebra A ÷ B is defined as $\pi_P(A) - \pi_P((\pi_P(A) \times \pi_{qr}(B) - \pi_{p,q,r}(A))$

A÷ B is used when we wish to express queries with "all".

2. (d)

SELECT DISTINCT $P_1, P_2, P_3 \ldots P_n$

FROM $R_1, R_2, R_3 \ldots R_m$

WHERE Q

So, from $R_1, R_2, R_3 \ldots R_m$

Here, there is no join condition, so it will perform cartesian product, then select σ_Q and perform projection.

$\pi_{P1, P2, P3 \ldots Pn}(\sigma_Q (R_1 \times R_2 \times R_3 \times \ldots \times R_m))$

3. (c)

(a) When B = ϕ, then result of A × B =ϕ then it is not equivalent to A. So, this equivalence is false.

(b) It is clearly seen that it is false / not equivalence as difference is not commutative.

(c) Both expressions are equivalent. In expression $A \bowtie_{\rho\, T(Q,\, S)} (B)$, first we are performing rename operation on attribute of relation B and then performing natural join on common column Q.

4. (a)

$a_1 \cup a_2 = \{< p, q, r > | < p,q,r > \in a_1 \vee < p, q, r > \in a_2\}$

$a_1 \cap a_2 = \{< p, q, r > | < p,q,r > \in a_1 \wedge < p, q, r > \in a_2\}$

$a_1 - a_2 = \{< p, q, r > | < p,q,r > \in a_1 \wedge < p, q, r > \notin a_2\}$

5. (1)

Let $\sigma_{\text{age} = 35 \wedge \text{rating} \geq 5}$ (sailors) as T

T:	1	Ram	5	35

is selected.

(5, Akhil, Null, 35) is not selected as rating contains NULL value and NULL cannot be compared to '5'.

NOTE: Null compared with value result will be undefined.

S: T ⋈ Reserves

Sail ID	Sail Name	Rating	Age	Boat ID	Date
1	Ram	5	35	4	2017-03-15
2	Ram	5	35	5	2017-04-15

U: $\sigma_{\text{rating}<5}$ (Sailors) ⋈ Reserves

4	Suresh	3	NULL	4	2018-01-01

$\pi_{\text{BoatID}}(S) \cap \pi_{\text{BoatID}}(u) = \{4, 5\} \cap \{4\} = \{4\}$

6. (c)

Given:

w (P, Q, R), *x* (S, P, T) y(P, Q, R, S, T) and z (R, S, T)

(w × x) contains 6 attributes whereas y contains 5 attributes. So, they aren't union-compatible. Hence intersection operation can't be performed.

NOTE: If number of attributes in Relation A is n and number of attributes in relation B is m then number of attributes "A x B" will be "n + m".

7. (a, c)

(a) TRUE

A				
P	Q	R	S	T
p_1	q_1	r_1	s_1	t_1
p_2	q_2	r_2	s_2	t_2

$\pi_{A1}(A)$			$\pi_{A2}(A)$		
P	Q	R	R	S	T
p_1	q_1	r_1	r_1	s_1	t_1
p_2	q_2	r_2	r_2	s_2	t_2

$\pi_{A1}(A) \bowtie \pi_{A2}(A)$				
P	Q	R	S	T
p_1	q_1	r_1	s_1	t_1
p_2	q_2	r_2	s_2	t_2

$\therefore \pi_{A1}(A) \bowtie \pi_{A2}(A) = A$

(b) FALSE since $\pi_{A1}(A) \bowtie \pi_{A2}(A) = A$

(c) TRUE. PQ→T holds in $\pi_{A1}(A) \bowtie \pi_{A2}(A)$. An FD PQ→T holds if and only iff- for same values of PQ, the T value must be same.

8. (a, b)

(a) Natural join is commutative and Associative so it is always true.

(b) Selection is commutative.

(c) Projection is not commutative.

Hence, a and b are correct.

9. (a, b)

(a) σ_{Task} = 'welding' (Jobsite)
From this we will get all row of jobsite having task welding.
Tool ⋈ holds ⋈ Tool Box ⋈ Jobsite
Natural join is done and with $\pi_{ToolID\rightarrow}$ ToolID column gets displayed.

(b) same explanation as (A)

(c) incorrect because after projecting ToolID we cannot apply condition on task.
Hence corrects option is a and b.

10. (a, c, d)

(a) True, because $(A \bowtie_{P=R \text{ and } Q=S} B)$ is more restrictive than $(A \bowtie_{P = R} B)$, it will also filter out the row in which Q is not equal to S therefore the cardinality (Number of rows) of $(A \bowtie_{P=R} B)$ is always larger than or equal to the size of $(A \bowtie_{P = R \text{ and } Q = S} B)$.

(b) False, the cardinality of $(A \bowtie_{P = R \text{ and } Q \neq S} B)$ is always larger than or equal to the size of $(A \bowtie_{P = R \text{ and } Q = S} B)$.

(c) True, because the results of both $(\sigma_{P=5} (A \bowtie_{Q=R} B))$ and $(\sigma_{P=5} (A) \bowtie_{Q=R} B)$ are always equivalent.

(d) True because the result $(A \times B) - (A \bowtie_{Q = R} B)$ and $(A \bowtie_{Q \neq R} B)$ are always equivalent.

Hence, correct answer is a, c and d.