Branch : CSE & IT   Batch:Hinglish

WEEKLY TEST – 06
Database Management System

Maximum Marks 15

Q.1 to 5 Carry ONE Mark Each

[MCQ]

1. Consider a relation R(P, Q) and Q is a foreign key referring, key attribute P of the same relation R, with x distinct tuples. Assume that R is non-empty. What is the maximum and minimum number of tuples that can be generated as the output of the relational algebra query $\pi_{P, Q}$ (R) ⋈ $\pi_{Q, P}$ (R) respectively?
(a) x and x^2
(b) x and x
(c) 0 and x^2
(d) 0 and x

[NAT]

2. Assume the following relations R_1 (P,Q,R,S,T) R_2 (R,S,T,U,V), R_3 (T,U,V,W) and R_4 (A,B,C,D). Then number of attributes in the output of the relational table of relational algebra query $(R_1 ⋈ R_2) \times (R_3 ⋈ R_4)$ is ?

[MSQ]

3. Consider two relations R(P, Q) and S(P,Q) have exactly the same schema. Which of the following equalities in relational algebra holds in relational algebra?
(a) $R \cap S = R - (R - S)$
(b) $R \cap S = S - (S - R)$
(c) $R \cap S \subseteq R ⋈ S$
(d) $R \cap S = R \times S$

[MSQ]

4. Which of the following statement is/are True?
(a) For a given relation A(P, Q) and B (P, R) , the natural join A⋈ B is equal to A $\cap$ B.
(b) It is possible to define the relational algebra operator intersection ($\cap$) using the join operator ⋈.
(c) Given relation A(P, Q, R) and B (S, T), the natural join A ⋈B is equal to A $\times$ B.
(d) It is possible to express the relational algebra operator intersection ($\cap$) using the difference operators (–).

[MCQ]

5. Consider the following 3 relations schemas.
Show(ShowID, Title, Year, Studio, Language, Genre, PartOfStart, Length)
Actor(ActorsID, Name, Age, Gender)
Perform(ShowID, ActorsID) and the following two relational algebra expressions.
1. $\Pi_{title,\ year,\ name}$ ($\sigma_{year \geq 2001}$ (Show) ⋈ Perform ⋈ Actor)
2. $\Pi_{title,\ year,\ name}$ ($\sigma_{year \geq 2001}$ (show ⋈ perform ⋈ Actor))
Which of the following statement is/are true?
(a) Both queries returns identical row sets for any database instance.
(b) There exists some DB instances for which 1 and 2 reforms different row sets.
(c) There exist database instances for which 1 returns strictly fewer rows than 2.
(d) There exists dB instance for which 2 returns strictly fewer rows than 1

Q.6 to 10 Carry TWO Marks Each

[NAT]

6. Consider the following two relations A and B.

A		B	
P	Q	R	S
1	1	4	2
2	1	3	4
3	3	3	5
3	4	1	3

and the following relational algebra query.

$\pi_{P,S} (A \times B) - \rho_{Q \to P}(\pi_{Q,S} (A \bowtie_{Q=R} B)))$

The number of tuple returned by the above query is___.

[MSQ]

7. Given two relations A and B with exactly the same schema, where A contains x tuples, B contains y tuples, and $y > x > 0$. Which of the following statement is/are true?

   (a) The maximum number of tuples in the resulting relations produced by relational algebra expression $A \cup B$ is y.

   (b) The maximum number of tuples in resulting relations produced by relational algebra expression $A - B$ is y.

   (c) The maximum number of tuples in the resulting relations produced by relational algebra expression $A \bowtie B$ is $x + y$.

   (d) The maximum number of tuples in the resulting relation produced by relational algebra expression $A \times B$ is $x \times y$.

[MCQ]

8. A foreign key is a set of attributes in a table that refers to the _____of another table.

   (a) Primary key   (b) Foreign key

   (c) Composite key   (d) None of the above

[MSQ]

9. Select the true statement regarding foreign key.

   (a) Child records may have duplicates and nulls.

   (b) parent records can be deleted if no child exists.

   (c) Foreign key must refer composite key in primary table.

   (d) Foreign key column and constraint column should have matching data types.

[MCQ]

10. Consider the statements.

    S₁: The table with foreign key is called the child table and the table with the primary key is called the referenced or parent table.

    S₂: The foreign key constraint prevents invalid data from being inserted into the foreign key column.

    Which among the statements are true?

    (a) Only S_1

    (b) Only S_2

    (c) Both S_1 and S_2 are true

    (d) Neither S_1 nor S_2 is true.

Answer Key

1. (d)
2. (15)
3. (a, b)
4. (b, c, d)
5. (a)
6. (9)
7. (d)
8. (a)
9. (a, b, d)
10. (c)

Hints and Solutions

1. **(d)**

Consider the following instance of table R.

π (R)		π (R)	
P	Q	Q	P
1	Null	Null	1
2	Null	Null	2
3	Null	Null	3
4	Null	Null	4
5	Null	Null	5
6	Null	Null	6
7	Null	Null	7

The tuples that can be generated as the output of the relational algebra query is 0.

Now consider the following instance of table

π (R)		π (R)	
P	Q	Q	P
1	1	1	1
2	1	1	2
3	1	1	3

The tuples that can be generated as the output of relational algebra query is 3.

2. **(15)**

Natural join combine the common attributes while generating the output relation table:

So, number of column in $(R_1 \bowtie R_2)$ = PQRSTUV and in $(R_3 \bowtie R_4)$ = TUVWABCD.

But in the **Cross Product** or **Cartesian product** (R x S), it generate the number of attributes as "number of attributes in R + number of attributes in S".

Hence, the total number of column in the cartesian product will be 15 i.e.

P Q R S T U V T U V W A B C D.

3. **(a, b)**

Consider the following instence of table.

R		S	
P	Q	P	Q
1	2	1	2
1	3	2	3
2	4	2	4
		3	5

Option (a) true

$R \cap S = R - (R - S)$

R∩S		R–S		R–(R–S)	
P	Q	P	Q	P	Q
1	2	1	3	1	2
2	4			2	4

Option (b) true

$R \cap S = S - (S - R)$

R ∩ S		S – R		S – (S – R)	
P	Q	P	Q	P	Q
1	2	2	3	1	2
2	4	3	5	2	4

Option (c) when both relation contains not null rows then $R \cap S = R \bowtie S$, but when table has row which is null then $R\bowtie S \subseteq R \cap S$. So, this is false.

R ∩ S		R ⋈ S	
P	Q	P	Q
1	2	1	2
2	4	2	4

NOTE: Intersection operation work on relation with Union compatible, where as Natural Join work on equality of common attributes.

Option (d) false

The resulting table of "INTERSECTION" operation will have 2 attributes that P and Q whereas the "CROSS PRODUCT" will have 4 attribites that is R.P R.Q S.P S.Q with 16 tuples in resulting table. Hence, resulting table would not be same always.

4. **(b, c, d)**
   Option a: False

A	B	A⋈B			A∩B		
1	2	1	3	P	Q	S	P	Q	R
2	3			1	2	3			
4	5								

   Option b is true as A ∩ B = A⋈B when no null values are there.

   Option c is true because if there is no common colmun so the result of natural join and cartesian product is same.

   Option d is true as A∩B = B − (B − A).

5. **(a)**
   Both the query is eqivalent as we know that natural join (⋈) is associatve so the result will be same for (show) ⋈ (performs ⋈ Actor) and show ⋈ (performs ⋈ Actor).

6. **(9)**

π_{PS} (A×B)		−	π_{QS} (A ⋈ B)	
1	2		P	S
1	4		1	3
1	5		3	4
1	3		4	2
2	2		3	5
2	5			
2	3			
2	2			
3	2			
3	4			
3	5			
3	3			

   The number of rows returned by query is 9.

7. **(d)**
   (a) False, The maximum number of tuples in the resulting relations produced by relational algebra expression A∪ B is $x + y$.
   (b) Flase, the maximum number of tuples in the result produced by relational algebra expression A − B is x.
   (c) False, The maximum numbe of tuple in the resulting relation produced by relational algebra rexpression A ⋈B is maximum (x, y).
   (d) True, The maximum number of tuple in the resulting relation produced by relational algebra expression A ×B is $x \times y$.

8. **(a)**
   A foreign key is a set of attributes in a table that refers to the primary key of another table.

9. **(a, b, d)**
   (True a) Child may have duplicate and nulls.

   (True b) Parent records can be deleled if no child exists.

   (False c) Foreign key must refer primary key in primary table but not composite key.

   (True d:) Foreign key columns and constraint column should have matching data types.

10. **(c)**
   S_1 **(True):** The table with foreign key is called child table, and the table with the primary key is called the referenced or parent table.
   S_2**(True):** The foreign key constraint prevents invalid data form being inserted into the foreign key column, because it has to be one of the values contained in the parent table.