GATE

CS & IT

Database Management System

DPP: 1

Query Languages

Q1 Consider the following statements:

S_1: $\pi_{\text{List N}}(\pi_{\text{List N-1}\ldots\ldots}(\pi_{\text{List 1}}(R))$
$\equiv \pi_{\text{List 1}}(\pi_{\text{List 2}\ldots\ldots}(\pi_{\text{List N}}(R))$

S_2: $\sigma_{c_n}(\sigma_{c_{n-1}}\ldots.(\sigma_{c_1}(R)))$
$\equiv \sigma_{c_1}(\sigma_{c_2}\ldots(\sigma_{C_N}(C)))$

Which of the following statement(s) is/are correct?

(A) S_1 only
(B) S_2 only
(C) Both S_1 and S_2 only
(D) Neither S_1 nor S_2

Q2 Consider the following table

I(pq)

p	q
0	1
4	5
8	9

J(qr)

q	r
1	2
5	2
5	6
5	10
13	10

K(rs)

r	s
2	3
6	7
10	11
10	3

The number of tuples in (I⋈J⋈K) where ⋈ is the natural join is

(A) 5 (B) 8
(C) 10 (D) 11

Q3 Let R_1 and R_2 be two relations which are union compatible with the same set of attributes.

S_1: $R_1 \cap R_2 = R_1 \bowtie R_2$

S_2: $R_1 \cup R_2 = R_1 \bowtie R_2$

Which of the above statement(s) are INCORRECT?

(A) S_1 only
(B) S_2 only
(C) Both S_1 and S_2 only
(D) Neither S_1 nor S_2

Q4 Consider the following relations:
Enroll (Sid, Papercode), Paper(Papercode, Desc)

Which of the following relational algebra displays the sid's who only enrolled for Papercode having descriptions (Desc) as "CS"?

(A) π_{sid} (Enroll ⋈ Paper)
Desc = CS

(B) π_{sid} (Enroll) – π_{sid} ((Enroll ⋈ σ Paper))
Desc = CS

(C) π_{sid} (Enroll) –π_{sid}((Enroll ⋈ σ (Paper))
Desc < > CS

(D) None

Q5 Consider a relation work (EmpID, Project ID)
The suitable relational algebra expression that projects the employee ids who work exactly in one project is-

(A) p_{Empid} (Work) – p_{Empid}(Work ⋈ $^{r}_{E,P}$ (work))
Empid = E
∧
Project Id = P

(B) p_{Empid} (Work ⋈ $^{r}_{E,P}$ (work))
Empid = E
∧
Project ID ¹ P

(C) p_{Empid} (work) –p_{Empid} (work ⋈ $\rho_{E,P}$ (work))
Empid = E
∧
Project ID ≉ P

(D) None

Q6 Consider the relation R(ABCD) which of the following relational algebra expression return the lowest value of B? (R_1 and R_2 are rename of R)

I.

$$\Pi_{R_2.B}$$

($R_1 \bowtie_{R1.B < R2.B} R_2$)

II.

GATE

$$\Pi_B(R) - \Pi_{R_1.B}$$

$(R_1 \bowtie_{R1.B > R2.B} R_2)$

III.

$$\Pi_B(R) - \Pi_{R_1.B}$$

$(R_1 \bowtie_{R1.B < R2.B} R_2)$

IV.

$$\Pi_B(R)$$

(A) I (B) II

(C) III (D) IV

Q7 Consider a Schema with Two Relations P (U, V, X) and Q (X, Y, Z) where all values are integer. There is no assumptions about the keys. Consider the following relational algebra expression.

I. $\pi_{U.Z}(P \bowtie \sigma_{X=3} Q)$

II. $\pi_{U.Z}(\pi_U(P) \times \sigma_{C=3}(Q))$

III. $\pi_U(\sigma_{x=3}(P)) \times \pi_E(\sigma_{x=3}(Q))$

IV. $\pi_{U.}(\sigma_{x=3}(P) \times \pi_x(Q))$

Which of the above are equivalent?

(A) I (B) II

(C) III (D) IV

Q8 Consider the following RA expression-

P: ρ_{sid} (student) $-\rho_{sid}$ (student $\bowtie r_{I, G, M}$ (Student))

Marks < M

$\wedge$ Gender = G

On a relation student (sid, Gender, Marks) and $r_{I = sid}$, $r_{G = Gender}$, $r_{M = Marks}$.

The above R.A displays?

(A) The sid of the student who obtained the maximum marks.

(B) The sids of the male and female students who obtained the maximum marks in their respective gender.

(C) The sids of male student who scored higher than all the female students

(D) None

Q9 Consider the relation-

Works (Eid Pid) project (Pid, Name)

The relational algebra expression that displays the Eids who work in every project named 'M' is?

(A) $\rho_{Eid, Pid}$ (works)/ ρ_{Pid} ($s_{Name = M}$ (Project))

(B) $\pi_{Eid}(Work)$

$$- \underset{Eid}{\pi} \left[\begin{array}{c} \pi_{Eid}(Work) \\ \times \pi_{pid}\left(\underset{Name = M}{\sigma}(Project)\right) \\ - \pi_{Eid\ Pid}(works) \end{array} \right]$$

(C) $\pi_{Eid}(Work)$

$$- \left[\begin{array}{c} \pi_{Eid}(Work) \\ \times \pi_{pid}\left(\underset{Name <> M}{\sigma}(Project)\right) - \pi_{Eid\ Pid} \\ (works) \end{array} \right]$$

(D) None

Q10 Consider the two relations R_1 and R_2 such that they have no attributes in common then-

S_1: $R_1 \bowtie R_2 = R_1 \times R_2$

S_2: $R_1 \bowtie R_2 = \phi$

Which of the given statement(s) is/are correct?

(A) S_1 only

(B) S_2 only

(C) Both S_1 and S_2

(D) Neither S_1 nor S_2

Android App | iOS App | PW Website

GATE

Answer Key

Q1	(B)
Q2	(A)
Q3	(B)
Q4	(C)
Q5	(C)
Q6	(B)
Q7	(A, C, D)
Q8	(B)
Q9	(A, B)
Q10	(A)

Android App | iOS App | PW Website

GATE

Hints & Solutions

Q1 Text Solution:

Selection is commutative whereas projection is not commutative.

Consider the following relation R (A, B, C)

3 2 0

1 2 5

I. Statement S_1: Incorrect 2 3 4

$\pi_B(\pi_{B,C}(R))$ $\pi_{B,C}(\pi_B(R))$

$\pi_B \begin{bmatrix} B & C \\ 2 & 0 \\ 2 & 5 \\ 3 & 4 \end{bmatrix}$ $\pi_{B,C} \begin{bmatrix} 2 \\ 2 \\ 3 \end{bmatrix}$

$\rightarrow$ Not Possible

II. Statement S_2: Correct

$\sigma_{B=2}(\sigma_{c>0}(R)) = [1 \quad 2 \quad 5]$

$\sigma_{c>0}(\sigma_{B=2}(R)) = [1 \quad 2 \quad 5]$

Q2 Text Solution:

I(pq)

p	q
0	1
4	5
8	9

J(qr)

q	r
1	2
5	2
5	6
5	10
13	10

K(rs)

r	s
2	3
6	7
10	11
10	3

(I⋈J)

p	q	r
0	1	2
4	5	2
4	5	6
4	5	10

(I⋈J⋈K)

p	q	r	s
0	1	2	3
4	5	2	3
4	5	6	7
4	5	10	11
4	5	10	3

Total 5 tuples in result.

Option (a) is correct

Q3 Text Solution:

R_1 and R_2 are union compatible means they have the same number of attributes and the domains of the attributes also the same.

Q4 Text Solution:

Sid who enrolled for only 'CS' Papercode-

= All sids – Sid who enrolled for some non CS Courses/ Papers

$= \pi_{sid}(Enroll) - \pi_{sid}(Enroll \bowtie \sigma(Paper))$

Desc < >cs

∴ Option c is correct.

Q5 Text Solution:

Retrieve employee ID's work exactly in one project

= All emp IDs – Emp IDs who work in at least two projects etc.

$= \text{All emp IDs} - p_{Empid}(Work \bowtie \rho_{E,P}(work))$

Empid = E

∧

Project ID ≠ P

Q6 Text Solution:

II.

$$\Pi_B(R) - \Pi_{R_1.B}$$

$(R_1 \bowtie_{R1.B > R2.B} R_2)$

Only II return the lowest value of B.

I, III, IV do not return the lowest value of B.

Q7 Text Solution:

I, III, IV are equivalent.

Lets assume P & Q as

P

U	V	X
1	2	4

Q

X	Y	Z
3	5	6

I. $\pi_{U.Z}(P \bowtie \sigma_{x=3} S)$

Produce Empty result because no common attribute value for natural join.

II. $\pi_{U.Z}(\pi_U(p) \times \sigma_{x=3}(q))$

Produce (1, 6) as a result.

III. $\pi_U(\sigma_{x=3}(P)) \times \pi_z(\sigma_{x=3}(q))$

\(\phi \times 6 \Rightarrow {\rm{Produce empty result}}\]

IV:

GATE

$$\pi_{u.Z}\left(\sigma_{x=3}(p) \times \pi_x(s)\right)$$

$$\phi \times 3 \Rightarrow \text{Produceemptyresult}$$

Q8 **Text Solution:**

R : ρ_{sid} (Student $\bowtie \rho_{I,G,M}$ (Student))

Marks < m

$\wedge$

Gender = G

R will result in the sids of student of the same gender who scored less marks than the same student of the same gender.

π_{sid} (Student) – R $\equiv$ The sids of the students who scored maximum marks in a particular gender category.

$\therefore$ Hence, b is correct.

Q9 **Text Solution:**

Relative Eid who works in every project having name = 'M' is equivalent to division operation in relational algebra.

So, (a) is correct.

(b)

Works (Eid, Pid)

A	1
B	2
A	3
C	3
C	2
C	1
A	3

Project (Pid, name)

1	M
2	P
3	M

$$P: \pi_{Eid}(\text{works}) \times \pi_{Pid}\left(\underset{Name = M}{\sigma}(\text{Project})\right)$$

$$\begin{bmatrix} A \\ B \\ C \end{bmatrix} \qquad \begin{bmatrix} 1 \\ 3 \end{bmatrix}$$

P:	A	1
	A	3
	B	1
	B	3
	C	1
	C	3

$$\underbrace{\pi_{Eid}\left[P - \pi_{EidPid}(\text{Works})\right]}_{Q} = \begin{bmatrix} A & 1 \\ A & 3 \\ B & 1 \\ B & 3 \\ C & 1 \\ C & 3 \end{bmatrix} - \begin{bmatrix} A \\ B \\ A \\ C \\ C \\ C \\ A \end{bmatrix}$$

$$\text{Gives Eid who dose not} \leftarrow = \underset{Eid}{\pi}\begin{bmatrix} B & 1 \\ B & 3 \end{bmatrix}$$

$$= [B]$$

p_{Eid} (Works) – Q = $\begin{bmatrix} A \\ B \\ C \end{bmatrix}$ – [B] = $\begin{bmatrix} A \\ B \end{bmatrix}$ ← Eids who works in all 'M' projects

Q10 **Text Solution:**

If the relations R_1 and R_2 have no attributes in common, the result of natural join is equal to the cross product of R_1 and R_2.

The condition of equijoin is not inaccessibility between two same attributes. So, S1 is CORRECT.

Android App | iOS App | PW Website