RELATIONAL ALGEBRA (CHAPTER -9)

1) What is the main purpose of Relational Algebra ?
   - The main use of Relational algebra is to query a DB to get the specific data which the user needed.
2) Example of Relational Algebra ?
   - Data Query Language(DQL) is an example of relational algebra.
3) What are the operations of Single Relations ?
   - Relational algebra works on relations. In single relations operations are 3 types – i) Selection ii) Projection iii) Rename.
4) Write briefly on selection operation ?
   - Selection operation is used to select a subset of rows from a relation R that satisfies a selection condition C.
     It is denoted by a symbol σ (sigma). The resultant relation is given by σ_c (R). The C indicates the condition that needs to be satisfied to select specific tuples from R.

     Eg. **Table Name is BOOK**

BookID	Title	Author	Price
B001	Rudiments of C.S.	J.Bhattacharya	450
B002	Let us C	Kanetkar	250
B003	C	Dennis Riche	180
B004	C++	Lipschus	200

     i) The condition C in this case is **R=σ price>200(BOOK)**

     Result is =

BookID	Title	Author	Price
B001	Rudiments of C.S.	J.Bhattacharya	450
B002	Let us C	Kanetkar	250

     ii) The condition C in this case is **R=σ price>200 or Author='Dennis Riche'(BOOK)**

     Result is =

BookID	Title	Author	Price
B001	Rudiments of C.S.	J.Bhattacharya	450
B002	Let us C	Kanetkar	250
B003	C	Dennis Riche	180

     As any one of these conditions need to be satisfied simultaneously, we have to use logical **OR operator/v symbol.**

     iii) The condition C in this case is **R=σ price>200 and Title='Rudiments of C.S.'(BOOK)**

     Result is =

BookID	Title	Author	Price
B001	Rudiments of C.S.	J.Bhattacharya	450

     As the conditions need to satisfied simultaneously, we have to use logical **AND operator/ ^ symbol.**
5) Write briefly on Projection operation ?
   - The projection operation is used to select a subset of columns from a relation R.
     It is used to create from a relation a new relation which has only some of the attributes from the original relation. It indicates the symbol Π.

     Eg. i) The condition C indicates Only show the Title & Author of Book Table

     $R=\Pi_{Title,Author}(BOOK)$

     Result is =

Title	Author
Rudiments of C.S.	J.Bhattacharya
Let us C	Kanetkar
C	Dennis Riche
C++	Lipschus

6) Give an example of how selection & projection operation works together ?
   - **Suppose there is a condition C is that show only those Title & author whose(BOOK) price is >200**

     $R=\Pi_{Title,Author}\sigma$ price>200 (BOOK)

Title	Author
Rudiments of C.S.	J.Bhattacharya
Let us C	Kanetkar

7) Write briefly on Rename operation ?
   - Rename operation can be used to change both the relation name & the names of the attributes of a relation. It is indicated by the symbol **ρ(rho).**

     eg. – **i) Rename the Table BOOK to BOOKS.**

     ρ_{BOOKS}(BOOK).

     ii) Rename the Title column as Bookname , Author as writer & table BOOK as Bookdetails.

     $\rho_{Bookdetails}$(Bookname,writer) ($\Pi_{Title,Author}$(BOOK).
8) What are the diff. set operations on Relation ?
   - There are 4 types of set operations on relation. These are i) Union ii) Intersection iii) Difference iv) Cartesian product.
9) Write briefly on Union operation ?
   - Union operation when applied on 2 relations finds the data that occur in **either or both** the relations involved. It is denoted by symbol ∪**.**

eg. – **Table Bio_Sc & Para_Sc**

Roll	F_Name	L_Name	Class	Sec
15	Yasmin	Dutta	XII	A
17	Raja	Sinha	XI	B
19	Tanay	Roy	XII	A
28	Tumpa	Dey	XI	B

Roll	F_Name	L_Name	Class	Sec
11	Surya	Dutta	XII	A
17	Raja	Sinha	XI	B
13	Tanima	Roychowdhury	XII	A
28	Tumpa	Dey	XI	B

i) show the student details who are either Bio sc table or para sc table or both the table.

Roll	F_Name	L_Name	Class	Sec
15	Yasmin	Dutta	XII	A
17	Raja	Sinha	XI	B
19	Tanay	Roy	XII	A
28	Tumpa	Dey	XI	B
11	Surya	Dutta	XII	A
13	Tanima	Roychowdhury	XII	A

R= Bio_Sc ∪ Para_Sc

10) Write briefly on intersection operation ?

- Intersection operation when applied on 2 relations finds the data that occur in **both** the relations involved. It is denoted by symbol **∩.**

eg.-

i) show the student details who are Bio sc table & para sc table both the table.

Roll	F_Name	L_Name	Class	Sec
17	Raja	Sinha	XI	B
28	Tumpa	Dey	XI	B

R= Bio_Sc ∩ Para_Sc.

11) Write briefly on difference operation ?

- Difference operation when applied on 2 relations finds the data that occur in **only occurs in one relation but not in the other** relations. It is denoted by symbol **-.**

i) Display separately student of Bio_Sc table and Para_Sc table.

Roll	F_Name	L_Name	Class	Sec
15	Yasmin	Dutta	XII	A
19	Tanay	Roy	XII	A

R = Bio_Sc – Para_Sc(Bio_Sc students only)

Roll	F_Name	L_Name	Class	Sec
17	Raja	Sinha	XI	B
28	Tumpa	Dey	XI	B

R = Para_Sc - Bio_Sc (Para_Sc studently only)

12) Write short notes on Cartesian Product ?

- The Cartesian product of 2 relation R1 & R2 is a relation that is formed by taking each tuple from R1 & combining it with every tuple from R2. The resultant product relation R has all the attributes from R1 & R2 is denoted by R =R1 X R2.

BNo	**Title**	**Author**
A1	Rudiments of C.S.	J.Bhattacharya
A2	Let us C	Kanetkar
A3	C	Dennis Riche
A4	C++	Lipschus

Table : Book

BNo	F_Name	L_Name	Class	Sec
A1	Yasmin	Dutta	XII	A
B5	Raja	Sinha	XI	B
C6	Tanay	Roy	XII	A
D28	Tumpa	Dey	XI	B

Table : Student

Cartesian product of R= Book X Student

Book.BNo	Title	Author	Student.BNo	F_Name	L_Name	Class	Sec
A1	Rudiments of C.S.	J.Bhattacharya	A1	Yasmin	Dutta	XII	A
A1	Rudiments of C.S.	J.Bhattacharya	A1	Raja	Sinha	XI	B
A1	Rudiments of C.S.	J.Bhattacharya	A1	Tanay	Roy	XII	A
A1	Rudiments of C.S.	J.Bhattacharya	A1	Tumpa	Dey	XI	B
A2	Let us C	Kanetkar	B5	Yasmin	Dutta	XII	A
A2	Let us C	Kanetkar	B5	Raja	Sinha	XI	B
A2	Let us C	Kanetkar	B5	Tanay	Roy	XII	A
A2	Let us C	Kanetkar	B5	Tumpa	Dey	XI	B
A3	C	Dennis Riche	C6	Yasmin	Dutta	XII	A
A3	C	Dennis Riche	C6	Raja	Sinha	XI	B
A3	C	Dennis Riche	C6	Tanay	Roy	XII	A
A3	C	Dennis Riche	C6	Tumpa	Dey	XI	B
A4	C++	Lipschus	D28	Yasmin	Dutta	XII	A
A4	C++	Lipschus	D28	Raja	Sinha	XI	B
A4	C++	Lipschus	D28	Tanay	Roy	XII	A
A4	C++	Lipschus	D28	Tumpa	Dey	XI	B

As BNo is appears in both the relations, hence to differenciate them the dot notation is used.

13) What is the use of Join Operations on Relations ?

- Cartesian Product does not produce any sensible result. It only gives all possible combinations of paired tuples from the 2 relations.
- A join is a binary operation that is used to combine related tuples from 2 relations into single tuples.

14) What is Theta Join ?

- When joining formed with 2 relation with a general condition is called a Theta Join.
- Each such condition may involve one of the comparison operator like $>, <, >=, <=, =, \neq$ etc.

$J = R \bowtie_\theta S$ Which is equivalent to the operation $J = \sigma_\theta(R \times S)$.

Eg. – i) Display is Name of the employee whose salary is > 25000 .

ii) Display is Name of the employee whose Dept is equal to IT .

EId	EName	Dept
E001	Sayan	IT
E003	Soumya	IT
E007	Pritam	IT
E008	Abir	IT
E009	Bapan	Marketing

Table – Employee

EId	Salary	Bonus
E002	35000	15000
E007	38000	12000
E009	25000	10000
E010	30000	13000
E003	21000	7000

Table – Salary

Output –

i) R = Π_{SALARY} (EMPLOYEE $\bowtie$ (EMPLOYEE.EId = SALARY.EId) AND SALARY >25000) SALARY

EId	EName	Dept	Salary	Bonus
E007	Pritam	IT	38000	12000
E009	Bapan	Marketing	25000	10000
E003	Soumya	IT	21000	7000

ii) R = Π_{DEPT} (EMPLOYEE $\bowtie$ (EMPLOYEE.EId = SALARY.EId) AND DEPT="IT") SALARY

EId	EName	Dept	Salary	Bonus
E003	Soumya	IT	21000	7000

15) What is EquiJoin in Relations ?

- When we have a join with only equality then such a join is called an Equijoin.

Eg. – Display only the details whose EId is common in both table

R = EMPLOYEE $\bowtie$ (EMPLOYEE.EId = SALARY.EId) SALARY.

16) What is Natural Join ?

- A Natural Join on 2 relations is a binary operation that 1st forms a Cartesian product between the relations. It then selects only those tuples with equality on pairs of common attributes that appear in relations, & finally removes the duplicate attributes.

Eg. –

BNo	Title	Author
A1	Rudiments of C.S.	J.Bhattacharya
A2	Let us C	Kanetkar
A3	C	Dennis Riche
A4	C++	Lipschus

Table : Book

BNo	F_Name	L_Name	Class	Sec
A1	Yasmin	Dutta	XII	A
A2	Raja	Sinha	XI	B
A3	Tanay	Roy	XII	A
A4	Tumpa	Dey	XI	B

Table : Student

i) Display the Natural Join of 2 relations Book & Student.

output –

BNo	Title	Author	F_Name	L_Name	Class	Sec
A1	Rudiments of C.S.	J.Bhattacharya	Yasmin	Dutta	XII	A
A2	Let us C	Kanetkar	Raja	Sinha	XI	B
A3	C	Dennis Riche	Tanay	Roy	XII	A
A4	C++	Lipschus	Tumpa	Dey	XI	B

R= Book ⋈Student.