

Introduction of Relational Algebra in DBMS

Relational Algebra is procedural query language, which takes Relation as input and generate relation as output. Relational algebra mainly provides theoretical foundation for relational databases and SQL.

Operators in Relational Algebra

Projection (π)

Projection is used to project required column data from a relation.

Example :

```
R
(A B C)
-----
1 2 4
2 2 3
3 2 3
4 3 4
 $\pi$  (BC)
B C
----
2 4
2 3
3 4
```

Note: By Default projection removes duplicate data.

Selection (σ)

Selection is used to select required tuples of the relations.

for the above relation

$\sigma (c>3)R$

will select the tuples which have c more than 3.

Note: selection operator only selects the required tuples but does not display them. For displaying, data projection operator is used.

For the above selected tuples, to display we need to use projection also.

$\pi (\sigma (c>3)R)$ will show following tuples.

A B C

1 2 4

4 3 4

Union (U)

Union operation in relational algebra is same as union operation in set theory, only constraint is for union of two relation both relation must have same set of Attributes.

Set Difference (-)

Set Difference in relational algebra is same set difference operation as in set theory with the constraint that both relation should have same set of attributes.

Rename (ρ)

Rename is a unary operation used for renaming attributes of a relation.

$\rho (a/b)R$ will rename the attribute 'b' of relation by 'a'.

Cross Product (X)

Cross product between two relations let say A and B, so cross product between A X B will results all the attributes of A followed by each attribute of B. Each record of A will pairs with

every record of B.

below is the example

A		B		
(Name	Age	Sex)	(Id	Course)
-----		-----		
Ram	14	M	1	DS
Sona	15	F	2	DBMS
kim	20	M		

A X B

Name	Age	Sex	Id	Course
------	-----	-----	----	--------

Ram	14	M	1	DS
Ram	14	M	2	DBMS
Sona	15	F	1	DS
Sona	15	F	2	DBMS
Kim	20	M	1	DS
Kim	20	M	2	DBMS

Note: if A has 'n' tuples and B has 'm' tuples then A X B will have 'n*m' tuples.

Natural Join (\bowtie)

Natural join is a binary operator. Natural join between two or more relations will result set of all combination of tuples where they have equal common attribute.

Let us see below example

Emp			Dep	
(Name	Id	Dept_name)	(Dept_name	Manager)

A	120	IT	Sale	Y
B	125	HR	Prod	Z
C	110	Sale	IT	A
D	111	IT		

Emp ⋈ Dep

Name	Id	Dept_name	Manager
------	----	-----------	---------

A	120	IT	A
C	110	Sale	Y
D	111	IT	A

Conditional Join

Conditional join works similar to natural join. In natural join, by default condition is equal between common attribute while in conditional join we can specify the any condition such as greater than, less than, not equal

Let us see below example

R			S		
(ID	Sex	Marks)	(ID	Sex	Marks)

1	F	45	10	M	20
2	F	55	11	M	22
3	F	60	12	M	59

Join between R And S with condition R.marks >= S.marks

R.ID R.Sex R.Marks S.ID S.Sex S.Marks

1	F	45	10	M	20
1	F	45	11	M	22
2	F	55	10	M	20
2	F	55	11	M	22
3	F	60	10	M	20
3	F	60	11	M	22
3	F	60	12	M	59