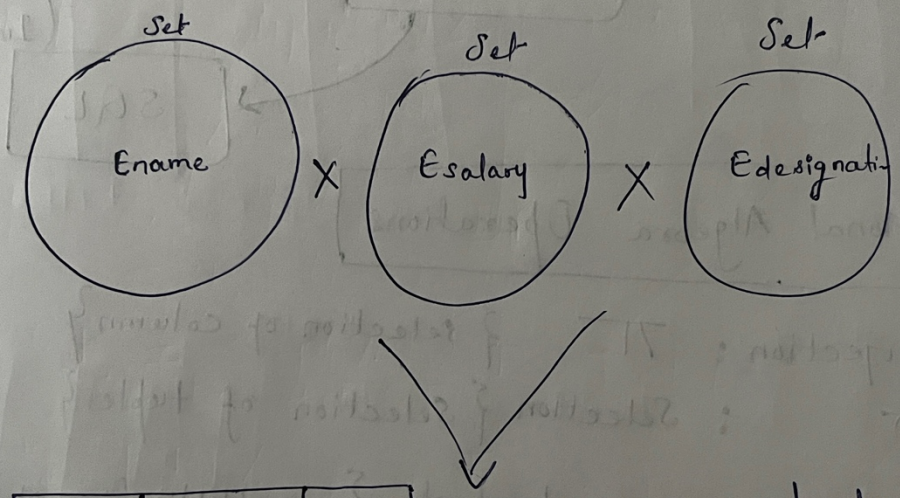
Relational Algebra

- RDBM —language→ SQL

  ↑ Practical Implementation of DB

- There are Conceptual level to understand



Ename	Esalary	Edesig

Subset of cross product of all sets as table known as Relational Mod

(theoretical or Algo)

Way of using RA/RC on the Relational model, help us to design SQL to use on RDBMS.

Relational Algebra or Relational calculus

Relational Model

(Implementation)

SQL

Relational Algebra Operations

Projection : Π {selection of column}

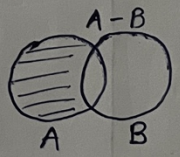
σ : Selection {selection of tuples}

$\times$: Cross-product {multiplication of tables}

$\cup$: Union {Colums must be of same types}

$-$: Minus {Set difference}

ρ : Rename { }



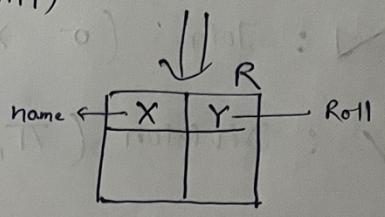
⊡ Rename

(i)

Student

Name	Roll	Marks

$$\rho_{R(X,Y)}\left(\pi_{name,Roll}\left(\sigma_{c}(Student)\right)\right)$$



⊡ Set operations:

∪

Std 1 (Sname, Roll) ∪ Std 2 (Sname, Roll)

But duplicates are not allowed

∩

$R_1(a, b, c)$ ∩ $R_2(c, d, e)$

no. of attributes & types of attributes must be the same.

−

R_1

a	b
1	5
9	6
2	1

R_2

c	d
7	6
9	6
2	3

$R - S$

a	b
1	5
2	1

(4)

- Relational Algebra Expression [Sequence of Basic operation]

  $\cap$: Intersection $(A - (A - B))$

  $\bowtie$: Join $(\sigma \times)$

  $/$: Division $(\pi, \times, -)$

- Since Relational Algebra is Completely derived from Relational Databases & Relational Model.

  In Relational Model every table is actualy modelled as set and in a set we are never going to allow duplicates.

  In Relational Algebra we remove duplicates.

Eg

R

A	B	C
1	Z	a
1	Y	a
2	Z	b
3	X	b

$\pi_{A,B}(R)$

A	B
1	Z
1	Y
2	Z
3	X

$\pi_{C}(R)$

C
a
b

← duplicates are not allowed.

- if attribute list is Super Key then we will get all the tuples.

- $\pi_{\langle att1 \rangle}\left(\pi_{\langle att2 \rangle}(Student)\right) \equiv \pi_{\langle att1 \rangle}(Student)$

- $\sigma_{c1}\left(\sigma_{c_2}(R)\right) \equiv \sigma_{c2}\left(\sigma_{c_1}(R)\right)$

- Commutative

$$R_1 \cup R_2 = R_2 \cup R_1$$
$$R_1 \cap R_2 = R_2 \cap R_2$$
$$R_1 - R_2 \neq R_2 - R_1$$

- Associative

$$R_1 \cup (R_2 \cup R_3) = (R_1 \cup R_2) \cup R_3$$
$$R_1 \cap (R_2 \cap R_3) = (R_1 \cap R_2) \cap R_3$$
$$R_1 - (R_2 - R_3) = (R_1 - R_2) - R_3$$

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

$$= R - (R - S)$$
$$= S - (S - R)$$

- $R \div S$

$$T1 \leftarrow \pi_{R-S}(R)$$
$$T_2 \leftarrow \pi_{R-S}((S \times T1) - R)$$
$$T \leftarrow T1 - T2$$

R

A	B
a_1	b1
a_1	b2
a2	b1
a3	b1
a3	b2

S

B
b1
b2

$R \div S =$

A
a_1
a3