





# CSE3103 : Database FALL 2020

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# Relational Algebra

- The relational algebra is a mathematical form.
- It is basically a theoretical language with operations that work on one or more relations to define another relation without changing the original relation.
- It is used to manipulate relations to obtain a desired result.

$\pi$   $\sigma$   $\rho$

$\bowtie$   $\cup$   $\cap$

# Relational Algebra Operation

- Unary Operation

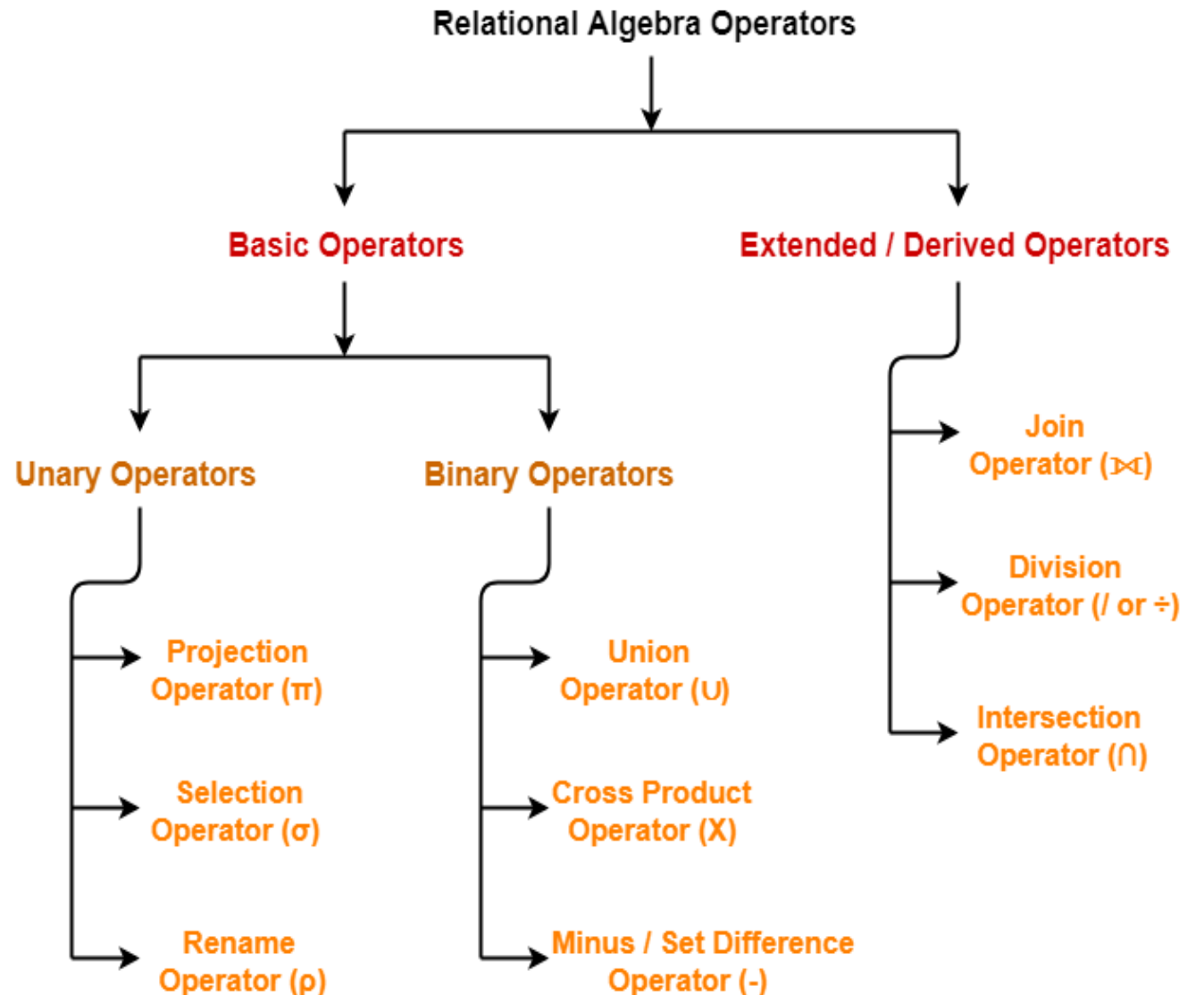
- Selection
- Projection
- Renaming

- Binary Operation

- Union
- Difference
- Cartesian product

- Extended Operation:

- Intersection
- Join
- Division



# Selection Operation

- Works on the condition statement.
- Works on selecting specific row.
- Syntax:

$$\sigma_{\text{predicate}} (R)$$

- $\sigma$  = selection [ sigma ]
- Predicate = condition
- R = relation

$$\sigma_{\text{condition}} (\text{Relation})$$

- Symbols:

- $<>$  or  $\neq$
- $\leq$  ,  $\geq$  ,  $>$  ,  $<$
- $\wedge$  ,  $\vee$  ,  $\neg$

# Selection Operation Example

Student		
Roll	Name	GPA
01	Arif	3.51
02	Rupa	3.25
03	Rimi	2.56
04	Shuvo	3.14
05	Sami	2.89
06	Poly	3.81
07	Keya	3.65

**Question:**

Find the student whose GPA is more than 3.50.

**Answer:**

$\sigma_{\text{gpa} > 3.50}$  ( Student)

Student		
Roll	Name	GPA
01	Arif	3.51
06	Poly	3.81
07	Keya	3.65

# Selection Operation Example

Employee		
Name	Age	Salary (USD)
Marly	24	9000
Lucky	40	3000
Mark	26	4500
John	42	3900

## Question:

1. Find the employee whose age is less than 30 years.
2. Find the employee whose age is less than 25 and get more than 5000 USD as salary.
3. Find the employee whose age is below 25 or higher 40.
4. Find the employee name starts with “mar”.

## Answer:

1.  $\sigma_{\text{age} < 30}(\text{employee})$
2.  $\sigma_{\text{age} < 25 \wedge \text{salary} > 5000}(\text{employee})$
3.  $\sigma_{\text{age} < 25 \vee \text{age} > 40}(\text{employee})$
4.  $\sigma_{\text{name} = \text{“mar\%”}}(\text{employee})$

# Projection Operation

- Works on the showing specific result.
- Works on specific columns.
- Syntax:

$\Pi_{\text{attributes}} (R)$

- $\pi$  = projection [pie]
- attributes =  $a_1, a_2, a_3, \dots, a_N$
- $R$  = relation

$\Pi_{a_1, a_2, a_3, \dots, a_N} (\text{Relation})$



# Projection Operation Example

Staff		
Name	Age	Salary(USD)
Marly	24	9000
Lucky	40	3000
Mark	26	4500
John	42	3900

Question:

1. Show the names of staff relation.
2. Show the names and salary of the staff relation.
3. Show the all the details of the staff whose salary is more than 5000 USD.

Answer:

1.  $\Pi_{\text{name}}(\text{staff})$

Name	Salary(USD)
Marly	9000
Lucky	3000
Mark	4500
John	3900

2.  $\Pi_{\text{name, salary}}(\text{staff})$

3.  $\Pi_{\text{name, age, salary}}(\sigma_{\text{salary} > 5000}(\text{staff}))$

Name	Age	Salary(USD)
Marly	24	9000

# Rename Operation

- When tables are not compatible for binary operation.
- When need to compare same relation.
- Syntax for renaming an attribute:

$\rho_{\text{old name} \rightarrow \text{new name}}$  (Relation)

- Syntax for renaming a table:

$\rho_{\text{new table}}$  ( Old table)

# Rename Operation Example

- There is an entity named Employee where attributes are name, branch, salary. So we want to change the attribute branch to location and salary to pay. Then we need to change the employee entity to staff.

- Schema Before : Employee ( name, branch, salary)

- Algebra for renaming an attribute:

$$\rho_{\text{branch, salary} \rightarrow \text{location, pay}} (\text{Employee})$$

- Algebra for renaming a table:

$$\rho_{\text{staff}} (\text{Employee})$$

- Schema After : Staff ( name, location, pay)

