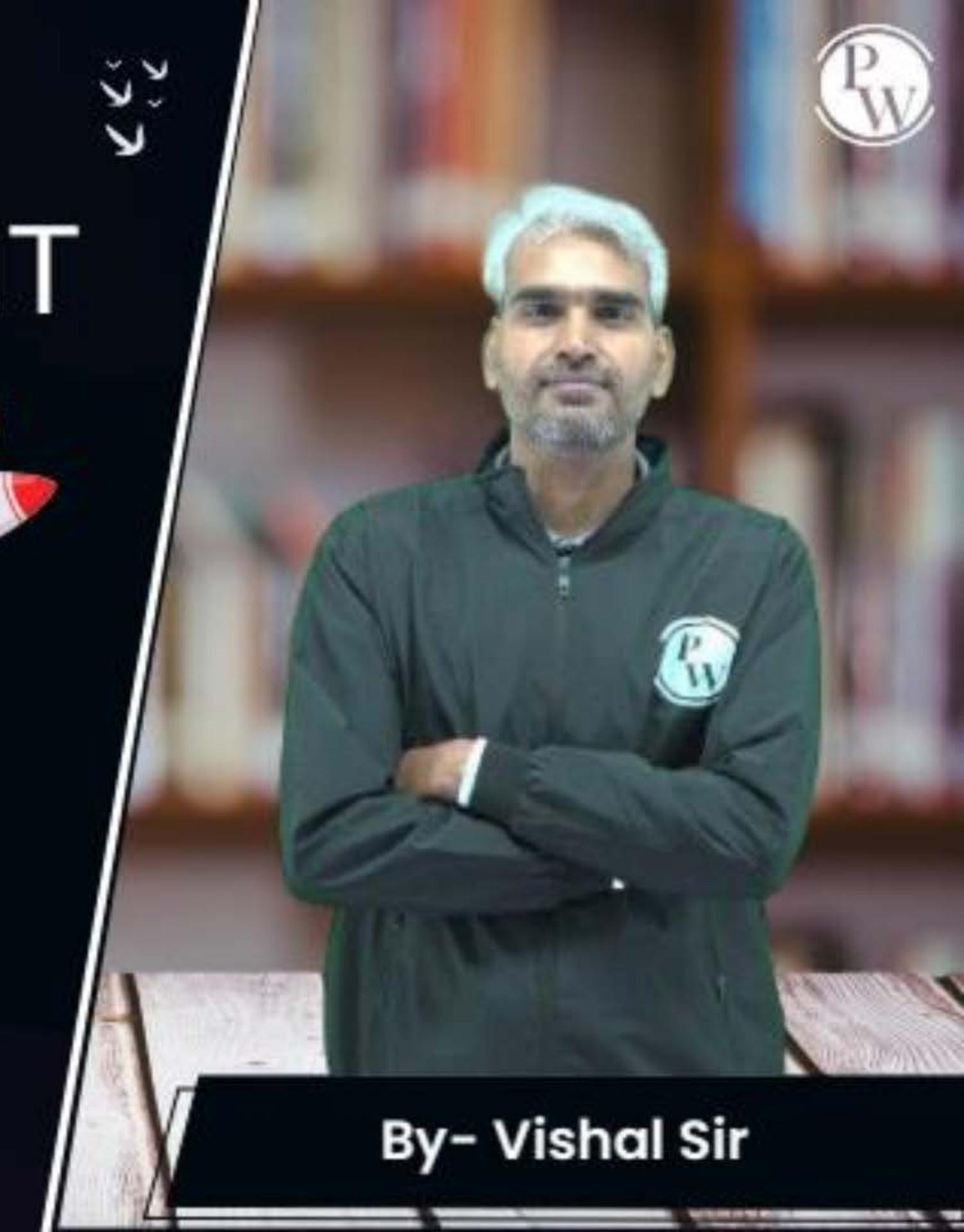


# Computer Science & IT

## Database Management System

Query Languages

Lecture No. 03



By- Vishal Sir

# Recap of Previous Lecture



- **Topic** Join operations
- **Topic** Division operation



# Topics to be Covered



Topic

Practice questions on relational algebra



Consider the following relational tables:

- \* Supplier (Sid, Sname, Rating)
- \* Parts (Pid, Pname, Color)
- \* Catalog (Sid, Pid, Cost)

# Supplier

<u>Sid</u>	Sname	Rating
S <sub>1</sub>	A	3
S <sub>2</sub>	A	5
S <sub>3</sub>	B	7
S <sub>4</sub>	C	0

# Parts

<u>Pid</u>	Pname	Color
P <sub>1</sub>	XYZ	Red
P <sub>2</sub>	PQR	Green
P <sub>3</sub>	XYZ	Red

# Catalog

<u>Sid</u>	<u>Pid</u>	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>2</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30

- \* Retrieve Sids of suppliers who supplied at least one part.
- \* Retrieve Sids of all the suppliers

$\pi_{\text{Sid}}$  (Catalog)

$\%P =$

Sid
$S_1$
$S_2$
$S_3$

$\pi_{\text{Sid}}$  (Supplier)

$\%P =$

Sid
$S_1$
$S_2$
$S_3$
$S_4$

Q:- Retrieve Sids of the supplies whose rating is more than 5

$\pi_{\text{Sid}} (\sigma_{\text{Rating} > 5} (\text{Supplier}))$

Q/P =

Sid
S <sub>3</sub>

g. Retrieve Sids of Suppliers who supplied some  
red color parts.

# Catalog

<u>Sid</u>	<u>Pid</u>	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>2</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30

# Pointe

<u>Pid</u>	Pname	Color
P <sub>1</sub>	XYZ	Red
P <sub>2</sub>	PQR	Green
P <sub>3</sub>	XYZ	Red

<u>CSid</u>	<u>CPid</u>	<u>CCost</u>	<u>P.Pid</u>	<u>P.name</u>	<u>P.Color</u>
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>1</sub>	XYZ	Red
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>2</sub>	PQR	Green
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>3</sub>	XYZ	Red
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>1</sub>	XYZ	Red
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>2</sub>	PQR	Green
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>3</sub>	XYZ	Red
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>1</sub>	XYZ	Red
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>2</sub>	PQR	Green
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>3</sub>	XYZ	Red

Catalog (C)

Sid	Pid	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>2</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30

Parts (P)

Pid	Pname	Color
P <sub>1</sub>	XYZ	Red
P <sub>2</sub>	PQR	Green
P <sub>3</sub>	XYZ	Red

$\sigma_{CSid} \left( \sigma_{CPid = P.Pid} \wedge P.Color = 'Red' \right) (S_C(Catalog) \times S_P(Parts))$

O/P:

Sid
S <sub>1</sub>
S <sub>3</sub>

C.Sid	C.Pid	C.Cost	P.Pid	P.name	P.color
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>1</sub>	XYZ	Red
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>2</sub>	PQR	Green
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>3</sub>	XYZ	Red
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>1</sub>	XYZ	Red
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>2</sub>	PQR	Green
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>3</sub>	XYZ	Red
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>1</sub>	XYZ	Red
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>2</sub>	PQR	Green
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>3</sub>	XYZ	Red

## Catalog (C) $\textcircled{2}$

<u>Sid</u>	<u>Pid</u>	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>2</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30

## Parts (P)

<u>Pid</u>	Pname	Color
P <sub>1</sub>	XYZ	Red
P <sub>2</sub>	PQR	Green
P <sub>3</sub>	XYZ	Red

$\pi_{\text{Sid}}(\sigma_{\text{Color} = \text{'Red}}(S_C(\text{Catalog}) \bowtie S_P(\text{Parts})))$

O/P: 

Sid
S <sub>1</sub>
S <sub>3</sub>

<u>Sid</u>	<u>Pid</u>	Cost	Pname	Color
S <sub>1</sub>	P <sub>1</sub>	10	XYZ	Red
S <sub>2</sub>	P <sub>2</sub>	20	PQR	Green
S <sub>3</sub>	P <sub>3</sub>	30	XYZ	Red

## Catalog

<u>Sid</u>	<u>Pid</u>	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>2</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30

③  $\pi_{C.Sid}(\sigma_{C.Pid = P.Pid}(C \times \sigma_{Color='Red'}(P)))$

④  $\pi_{Sid}(C \bowtie \sigma_{Color='Red'}(P))$

## Parts

<u>Pid</u>	Pname	Color
P <sub>1</sub>	XYZ	Red
P <sub>2</sub>	PQR	Green
P <sub>3</sub>	XYZ	Red

Q. Retrieve Sids of Suppliers who supplied some red color parts.

①  $\pi_{C.Sid} \left( \sigma_{C.Pid = P.Pid \wedge P.Color = 'Red'} (C \times P) \right)$

②  $\pi_{Sid} \left( \sigma_{Color = 'Red'} (C \bowtie P) \right)$

③  $\pi_{C.Sid} \left\{ \begin{array}{l} \sigma_{C.Pid = P.Pid} \\ \sigma_{Color = 'Red'} \end{array} \right. \left( C \times \left( \sigma_{Color = 'Red'} (P) \right) \right) \right\}$

④  $\pi_{Sid} \left\{ C \bowtie \left( \sigma_{Color = 'Red'} (P) \right) \right\}$

10,000000

1000 x 1000

only 50 of them are Red

less efficient

More efficient

#Q. Retrieve Sid of the suppliers who have supplied some Red or some  
Green color parts.

# Catalog

<u>Sid</u>	<u>Pid</u>	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>2</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30

# Parts

<u>Pid</u>	<u>Pname</u>	Color
P <sub>1</sub>	XYZ	Red
P <sub>2</sub>	PQR	Green
P <sub>3</sub>	XYZ	Red

<u>C.Sid</u>	<u>C.Pid</u>	<u>C.Cost</u>	<u>P.Pid</u>	<u>P.name</u>	<u>P.Color</u>
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>1</sub>	XYZ	Red
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>2</sub>	PQR	Green
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>3</sub>	XYZ	Red
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>1</sub>	XYZ	Red
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>2</sub>	PQR	Green
S <sub>2</sub>	P <sub>2</sub>	20	P <sub>3</sub>	XYZ	Red
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>1</sub>	XYZ	Red
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>2</sub>	PQR	Green
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>3</sub>	XYZ	Red

g. Retrieve Sids of Suppliers who supplied some Red or some green Color parts.

- ①  $\pi_{C.Sid} \left( \sigma_{\begin{array}{l} C.Pid = P.Pid \\ (P.Color = 'Red' \vee P.Color = 'Green') \end{array}} (C \times P) \right)$
- ②  $\pi_{Sid} \left( \sigma_{\begin{array}{l} Color = 'Red' \\ Color = 'Green' \end{array}} (C \bowtie P) \right)$
- ③  $\pi_{C.Sid} \left\{ \sigma_{\begin{array}{l} C.Pid = P.Pid \\ (Color = 'Red' \vee Color = 'Green') \end{array}} \left( C \times \left( \sigma_{\begin{array}{l} Color = 'Red' \\ Color = 'Green' \end{array}} (P) \right) \right) \right\}$
- ④  $\pi_{Sid} \left\{ C \bowtie \left( \sigma_{\begin{array}{l} Color = 'Red' \\ Color = 'Green' \end{array}} (P) \right) \right\}$

#Q. Retrieve Sid of the suppliers who have supplied some Red and some Green color parts.

Q. Retrieve Sids of Suppliers who supplied some red and some green Color Parts.

①

$\pi_{C.Sid}$

$(\sigma_{C.Pid = P.Pid} (C \times P))$

$(P.color = 'Red' \wedge P.color = 'Green'))$

②

$\pi_{S.sid}$

$(\sigma_{Color = 'Red'} (C \bowtie P))$

$Color = 'Green')$

③

$\pi_{C.Sid}$

$\{ \sigma_{C.Pid = P.Pid} (C \times (\sigma_{Color = 'Red'} (P))) \}$

$Color = 'Green')$

④

$\pi_{S.sid}$

$\{ C \bowtie (\sigma_{Color = 'Red'} (P)) \}$

$Color = 'Green')$

All are wrong,



All four queries  
will always produce  
Empty relation



In a single tuple,  
Color will either be  
'Red' or 'Green' but  
Can never be both

g. Retrieve Sids of Supplies who supplied some  
zed and some green Color pants.

Q. Retrieve Sids of Suppliers who supplied some  
zed or some green Color pants.

\* Another approach to retrieve Sids of Suppliers  
who supplied some red and some green  
Color parts.

# Catalog

Sid	Pid	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>1</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30

$\pi_{Q \cdot Sid}$

$$\exists C_1, C_2 \left( \begin{array}{l} (C_1.Sid = C_2.Sid) \\ (C_1.Pid = P_1.Pid \wedge P_1.Color = 'Red') \\ (C_2.Pid = P_2.Pid \wedge P_2.Color = 'Green') \end{array} \right) \quad ((C \times P) \times (C \times P))$$

O/P =

Sid
S <sub>1</sub>

# Parts

Pid	Pname	Color
P <sub>1</sub>	XYZ	Red
P <sub>2</sub>	PQR	Green
P <sub>3</sub>	XYZ	Red

C.Sid	C.Pid	C.Cost	P.Pid	P.name	P.color
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>1</sub>	XYZ	Red
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>2</sub>	PQR	Green
S <sub>1</sub>	P <sub>1</sub>	10	P <sub>3</sub>	XYZ	Red
S <sub>1</sub>	P <sub>2</sub>	20	P <sub>1</sub>	XYZ	Red
S <sub>1</sub>	P <sub>2</sub>	20	P <sub>2</sub>	PQR	Green
S <sub>1</sub>	P <sub>2</sub>	20	P <sub>3</sub>	XYZ	Red
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>1</sub>	XYZ	Red
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>2</sub>	PQR	Green
S <sub>3</sub>	P <sub>3</sub>	30	P <sub>3</sub>	XYZ	Red

Note: For upcoming queries use the following Catalog relation

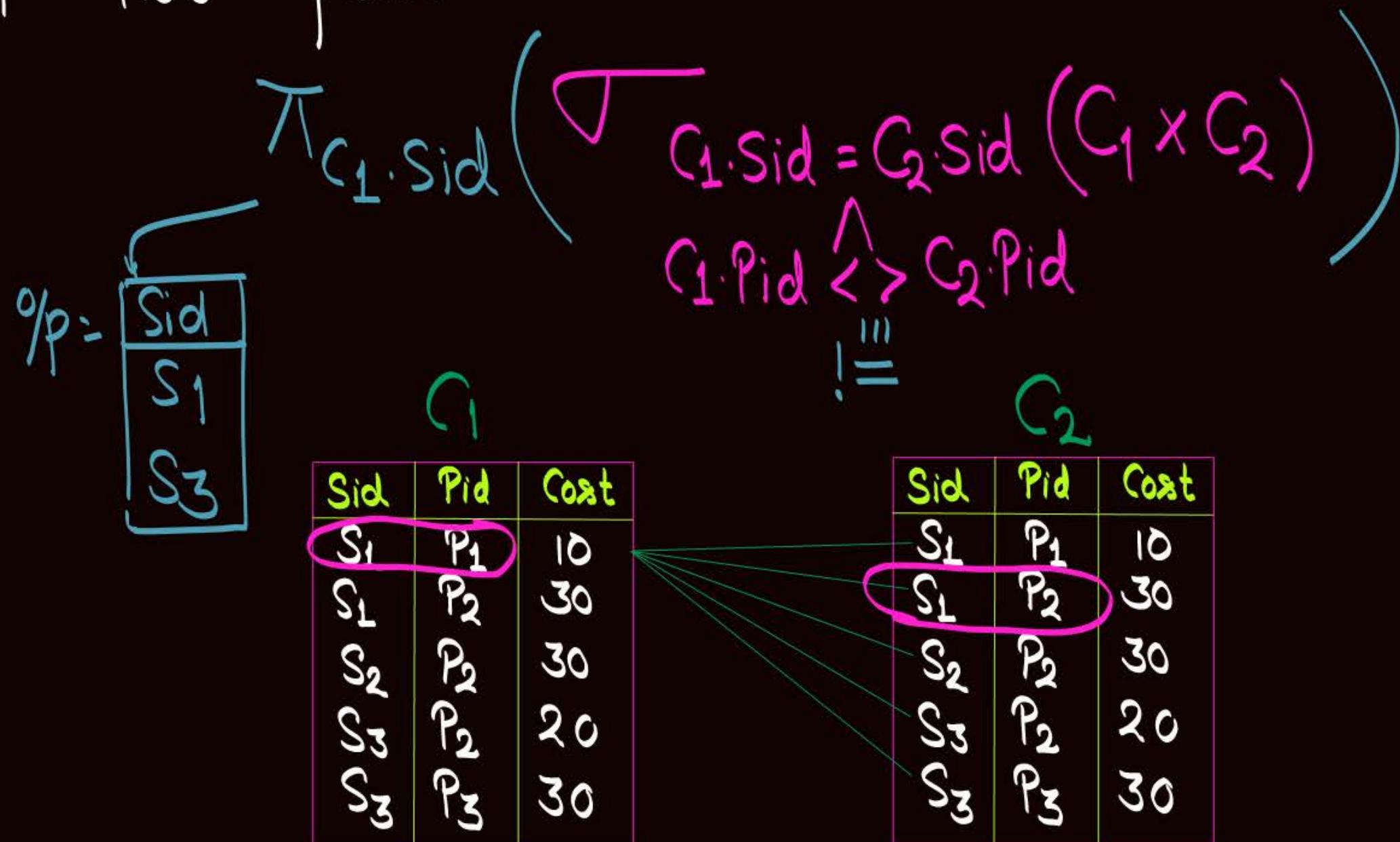
Sid	Pid	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>1</sub>	P <sub>2</sub>	30
S <sub>2</sub>	P <sub>2</sub>	30
S <sub>3</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30

#Q. Retrieve Sid of the suppliers who have supplied at least two parts.

Query: Retrieve Sids of Suppliers who have supplied at least two parts.

Catalog

Sid	Pid	Cost
S <sub>1</sub>	P <sub>1</sub>	10
S <sub>1</sub>	P <sub>2</sub>	30
S <sub>2</sub>	P <sub>2</sub>	30
S <sub>3</sub>	P <sub>2</sub>	20
S <sub>3</sub>	P <sub>3</sub>	30



#Q. Retrieve Sid of the suppliers who have supplied all parts.

Catalog (Sid, Pid, Cost)  
 Parts (Pid, Pnames, Color) } We are looking for Sids from Catalog table that are associated with all Pids of Part table

$$\pi_{\text{Sid}, \text{Pid}}(\text{Catalog}) \div \pi_{\text{Pid}}(\text{Parts})$$

$$= \left[ \pi_{\text{Sid}}(C) - \pi_{\text{Sid}} \left[ (\pi_{\text{Sid}}(C) \times \pi_{\text{Pid}}(P)) - \pi_{\text{Sid}, \text{Pid}}(C) \right] \right]$$

~~H.W.~~  
#Q.

P  
W

Retrieve Sid of the suppliers who have supplied all Red color parts.

$$\pi_{\text{Sid}, \text{Pid}}(\text{C}) \div \pi_{\text{Pid}}(\overline{\sigma_{\text{Color} = \text{Red}}(\text{P})})$$

= ?  
(derivation)

→ division

U/P will be Sids from Catalog  
that are associated with  
all Pids of red Color parts

#Q. Retrieve Sid of the suppliers who have supplied exactly one part.

$$\begin{aligned}
 \text{Exactly One} &= \text{At least one} - \text{At least two} \\
 &= \{1, 2, 3, \dots\} - \{2, 3, \dots\} \\
 &\quad \downarrow \\
 &\quad \{1\} \\
 &= \boxed{\pi_{\text{Sid}}(C) - \pi_{C_1 \cdot \text{Sid}} \left( \sigma_{C_1 \cdot \text{Sid} = C_2 \cdot \text{Sid}} (C_1 \times C_2) \right)}
 \end{aligned}$$

$\uparrow$   
 $C_1 \cdot \text{Pid} = C_2 \cdot \text{Pid}$

#Q. H.W.

Retrieve Sid of the suppliers who have supplied at most one part.

#Q. H.W.

Retrieve Sid of the suppliers who have supplied at least three parts.

#Q.

Retrieve Sid<sub>n</sub> of the suppliers who have supplied most expensive parts.

i.e. Retrieve Sids of Suppliers who have supplied some parts at maximum cost.

Hint:

$$\pi_{\text{Sid}} = \boxed{(\text{All tuples})} - \boxed{(\text{Tuples of Catalog in which cost is not maximum})}$$



## 2 mins Summary



Topic

Practice questions on relational algebra

# THANK - YOU