

Computer Science & IT

Database Management System



Query Languages

Lecture No. 03



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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 ₁	A	3
S ₂	A	5
S ₃	B	7
S ₄	C	0

Parts

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

Catalog

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

★ Retrieve Sids of suppliers who supplied at least one part.

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

o/p =

Sid
S ₁
S ₂
S ₃

★ Retrieve Sids of all the suppliers

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

o/p =

Sid
S ₁
S ₂
S ₃
S ₄

Q:- Retrieve Sids[✓] of the suppliers whose rating is more than 5

$\pi_{sid} \left(\sigma_{Rating > 5} (Supplier) \right)$

q/p =

Sid
S3

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

Catalog

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

Pants

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

C.Sid	C.Pid	C.Cost	P.Pid	P.name	P.Color
S ₁	P ₁	10	P ₁	XYZ	Red
S ₁	P ₁	10	P ₂	PQR	Green
S ₁	P ₁	10	P ₃	XYZ	Red
S ₂	P ₂	20	P ₁	XYZ	Red
S ₂	P ₂	20	P ₂	PQR	Green
S ₂	P ₂	20	P ₃	XYZ	Red
S ₃	P ₃	30	P ₁	XYZ	Red
S ₃	P ₃	30	P ₂	PQR	Green
S ₃	P ₃	30	P ₃	XYZ	Red

Catalog (C) $\bowtie_{C.Sid} \left(\sigma_{(C.Pid=P.Pid \wedge P.Color='Red')} (S_C(Catalog) \times S_P(Pants)) \right)$

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

o/p =

Sid
S ₁
S ₃

Pants (P)

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

C.Sid	C.Pid	C.Cost	P.Pid	P.name	P.Color
✓ S ₁	P ₁	10	P ₁	XYZ	Red
S ₁	P ₁	10	P ₂	PQR	Green
S ₁	P ₁	10	P ₃	XYZ	Red
S ₂	P ₂	20	P ₁	XYZ	Red
✗ S ₂	P ₂	20	P ₂	PQR	Green
S ₂	P ₂	20	P ₃	XYZ	Red
S ₃	P ₃	30	P ₁	XYZ	Red
S ₃	P ₃	30	P ₂	PQR	Green
✓ S ₃	P ₃	30	P ₃	XYZ	Red

Catalog (C) ②

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

Pants (P)

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

$\pi_{sid}(\sigma_{color='Red'})$

o/p =

Sid
S ₁
S ₃

$(\rho_C(\text{Catalog}) \bowtie \rho_P(\text{Pants}))$

↓

Sid	Pid	Cost	Pname	Color
✓ S ₁	P ₁	10	XYZ	Red
S ₂	P ₂	20	PQR	Green
✓ S ₃	P ₃	30	XYZ	Red

Catalog

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

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

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

Parts

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

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

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

10,00000 1000 x 1000 only 50 of them are 'Red'

less efficient
- ② $\pi_{Sid} \left(\sigma_{Color = 'Red'} (C \bowtie P) \right)$
- ③ $\pi_{C.Sid} \left\{ \sigma_{C.Pid = P.Pid} \left(C \times \left(\sigma_{Color = 'Red'} (P) \right) \right) \right\}$

50,000 1000 50,000 50 1000

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

#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 ₁	P ₁	10
S ₂	P ₂	20
S ₃	P ₃	30

Parts

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

C.Sid	C.Pid	C.Cost	P.Pid	P.name	P.Color
S ₁	P ₁	10	P ₁	XYZ	Red
S ₁	P ₁	10	P ₂	PQR	Green
S ₁	P ₁	10	P ₃	XYZ	Red
S ₂	P ₂	20	P ₁	XYZ	Red
S ₂	P ₂	20	P ₂	PQR	Green
S ₂	P ₂	20	P ₃	XYZ	Red
S ₃	P ₃	30	P ₁	XYZ	Red
S ₃	P ₃	30	P ₂	PQR	Green
S ₃	P ₃	30	P ₃	XYZ	Red

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

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

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

$$\textcircled{3} \pi_{C.Sid} \left\{ \sigma_{C.Pid = P.Pid} \left(C \times \left(\sigma_{(Color = 'Red' \vee Color = 'Green')} (P) \right) \right) \right\}$$

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

#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 $\pi_{C.sid} \left(\sigma_{(C.pid = P.pid \wedge (P.color = 'Red' \wedge P.color = 'Green'))} (C \times P) \right)$

② $\pi_{sid} \left(\sigma_{(color = 'Red' \wedge color = 'Green')} (C \bowtie P) \right)$

③ $\pi_{C.sid} \left\{ \sigma_{C.pid = P.pid} \left(C \times \left(\sigma_{(color = 'Red' \wedge color = 'Green')} (P) \right) \right) \right\}$

④ $\pi_{sid} \left\{ C \bowtie \left(\sigma_{(color = 'Red' \wedge color = 'Green')} (P) \right) \right\}$

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

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

$$\pi_{C_1.Sid} \left(\sigma_{\substack{C_1.Pid = P_1.Pid \\ P_1.Color = 'Red'}} (C_1 \times P_1) \right) \cap \pi_{C_2.Sid} \left(\sigma_{\substack{C_2.Pid = P_2.Pid \\ P_2.Color = 'Green'}} (C_2 \times P_2) \right)$$

Q. Retrieve Sids of Suppliers who supplied some red or some green Color parts.

$$\pi_{C_1.Sid} \left(\sigma_{\substack{C_1.Pid = P_1.Pid \\ P_1.Color = 'Red'}} (C_1 \times P_1) \right) \cup \pi_{C_2.Sid} \left(\sigma_{\substack{C_2.Pid = P_2.Pid \\ P_2.Color = 'Green'}} (C_2 \times P_2) \right)$$

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

Catalog

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

Parts

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

\uparrow $\pi_{C.Sid}$
 \downarrow $\sigma/p =$

Sid
S ₁

$((C_1.Sid = C_2.Sid) \wedge (C_1.Pid = P_1.Pid \wedge P_1.Color = 'Red') \wedge (C_2.Pid = P_2.Pid \wedge P_2.Color = 'Green'))$
 $((C_1 \times P_1) \times (C_2 \times P_2))$
 $(C \times P)$

C.Sid	C.Pid	C.Cost	P.Pid	P.name	P.Color
S ₁	P ₁	10	P ₁	XYZ	Red
S ₁	P ₁	10	P ₂	PQR	Green
S ₁	P ₁	10	P ₃	XYZ	Red
S ₁	P ₂	20	P ₁	XYZ	Red
S ₁	P ₂	20	P ₂	PQR	Green
S ₁	P ₂	20	P ₃	XYZ	Red
S ₃	P ₃	30	P ₁	XYZ	Red
S ₃	P ₃	30	P ₂	PQR	Green
S ₃	P ₃	30	P ₃	XYZ	Red

Note:- For upcoming queries use the following
Catalog relation

Sid	Pid	Cost
S ₁	P ₁	10
S ₁	P ₂	30
S ₂	P ₂	30
S ₃	P ₂	20
S ₃	P ₃	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 ₁	P ₁	10
S ₁	P ₂	30
S ₂	P ₂	30
S ₃	P ₂	20
S ₃	P ₃	30

%p =

Sid
S ₁
S ₃

$$\pi_{C_1.Sid} \left(\bigtriangledown_{\substack{C_1.Sid = C_2.Sid \ (C_1 \times C_2) \\ C_1.Pid \neq C_2.Pid}} \right)$$

C_1

Sid	Pid	Cost
S ₁	P ₁	10
S ₁	P ₂	30
S ₂	P ₂	30
S ₃	P ₂	20
S ₃	P ₃	30

C_2

Sid	Pid	Cost
S ₁	P ₁	10
S ₁	P ₂	30
S ₂	P ₂	30
S ₃	P ₂	20
S ₃	P ₃	30

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

Catalog (Sid, Pid, Cost)
 Parts (Pid, Pname, Color)

We are looking for Sids from Catalog table that are associated with all Pids of Part table

division

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

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

How.
#Q.



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

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

division

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

= ?
(derivation)

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

Exactly One = At least one $\{1, 2, 3, \dots\}$ — At least two $\{2, 3, \dots\}$
 \downarrow
 $\{1\}$

$$= \left[\pi_{\text{sid}}(C) - \pi_{C_1.\text{sid}} \left(\sigma_{\substack{C_1.\text{sid} = C_2.\text{sid} \\ C_1.\text{pid} \neq C_2.\text{pid}}} (C_1 \times C_2) \right) \right]$$

#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 of the suppliers who have supplied most expensive parts.

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

Hint:

$$\pi_{\text{Sid}} \left[\left(\text{All tuples of Catalog} \right) - \left(\text{Tuples of Catalog in which cost is not maximum} \right) \right]$$



2 mins Summary



Topic

Practice questions on relational algebra

Slide

THANK - YOU