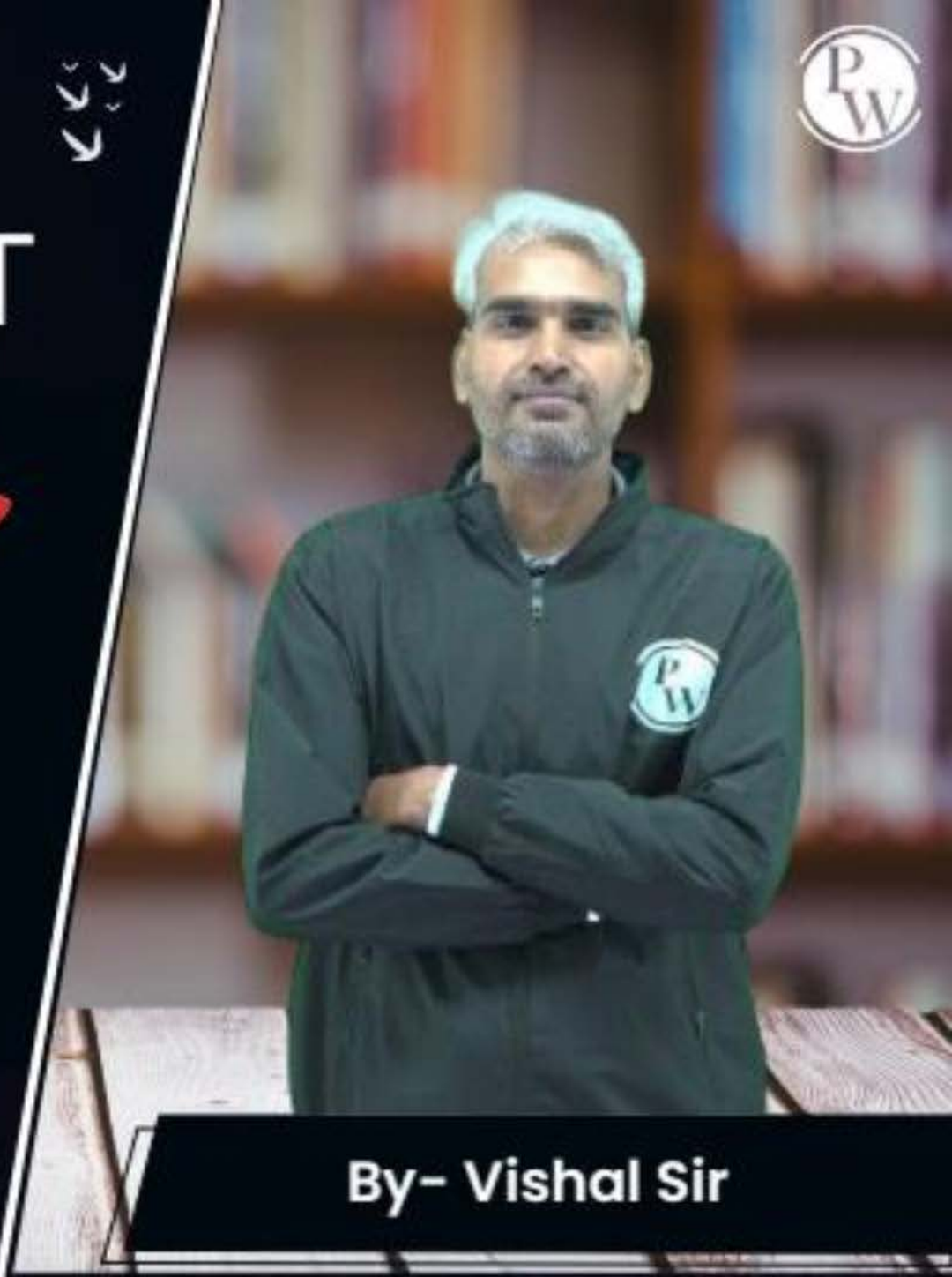
Computer Science & IT

Database Management System

Query Languages

Lecture No. 04



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Recap of Previous Lecture

Topic Practice questions on relational algebra

Topics to be Covered

- Topic: Practice questions on relational algebra
- Topic: SQL
- Topic: Basic SQL clauses
- Topic: Aggregate functions

Consider the following relational tables:

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

Supplier

Sid	Sname	Rating
S_1	A	3
S_2	A	5
S_3	B	7
S_4	C	0

Parts

Pid	Pname	Color
P_1	XYZ	Red
P_2	PQR	Green
P_3	XYZ	Red

Catalog

Sid	Pid	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.

π_{sid} (Catalog)

o/p =

Sid
S_1
S_2
S_3

* Retrieve Sids of all the suppliers

π_{sid} (Supplier)

o/p =

Sid
S_1
S_2
S_3
S_4

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

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

o/p =

Sid
S_3

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

Catalog

Sid	Pid	Cost
S_1	P_1	10
S_2	P_2	20
S_3	P_3	30

Parts

Pid	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)

Sid	Pid	Cost
S_1	P_1	10
S_2	P_2	20
S_3	P_3	30

Parts (P)

Pid	Pname	Color
P_1	xyz	Red
P_2	PQR	Green
P_3	xyz	Red

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

o/p:

Sid
S_1
S_3

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

Sid	Pid	Cost
S_1	P_1	10
S_2	P_2	20
S_3	P_3	30

Parts (P)

Pid	Pname	Color
P_1	xyz	Red
P_2	PQR	Green
P_3	xyz	Red

$$\pi_{Sid}\left(\sigma_{Color='Red}\left(\rho_C(Catalog) \bowtie \rho_P(Parts)\right)\right)$$

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

o/p:

Sid
S_1
S_3

Catalog

Sid	Pid	Cost
S_1	P_1	10
S_2	P_2	20
S_3	P_3	30

Parts

Pid	Pname	Color
P_1	XYZ	Red
P_2	PQR	Green
P_3	XYZ	Red

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

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

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 × 1000 — only '50' of them are 'Red'

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 — 1000

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

less efficient

More efficient

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

Catalog

Sid	Pid	Cost
S_1	P_1	10
S_2	P_2	20
S_3	P_3	30

Parts

Pid	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.

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

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

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

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.

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

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

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

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

Catalog

Sid	Pid	Cost
S_1	P_1	10
S_1	P_2	20
S_3	P_3	30

Parts

Pid	Pname	Color
P_1	XYZ	Red
P_2	PQR	Green
P_3	XYZ	Red

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

o/p =

Sid
S_1

$(C \times P)$

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.

$$\pi_{C_1.Sid}\left(\sigma_{C_1.Sid = C_2.Sid \wedge C_1.Pid <> C_2.Pid}\left(C_1 \times C_2\right)\right)$$

<> != !==

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

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.

↑ division

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

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

C P

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

H.W.

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

↳ division

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

{ O/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 − At least two

{1, 2, 3, ...} − {2, 3, ...}

↓

{1}

$$= \left[\pi_{Sid}(C) - \pi_{C_1.Sid}\left(\sigma_{\substack{C_1.Sid = C_2.Sid \\ C_1.Pid \; != \; C_2.Pid}} (C_1 \times C_2) \right) \right]$$

Today's Topic

#Q. H.W. Retrieve Sid of the suppliers who have supplied at most one part.

At most one part = {0 or 1}

= Suppliers who have supplied any no. of parts − Suppliers who have supplied at least two parts

= {0, 1, 2, 3, . . .} − {2, 3, 4, . . .}

$$= \pi_{Sid}(Supplies) - \pi_{C_1.Sid}\left(\sigma_{C_1.Sid = C_2.Sid \,\wedge\, C_1.Pid \,!= C_2.Pid}(C_1 \times C_2)\right)$$

#Q. H.W. Retrieve Sid of the suppliers who have supplied at least three parts.

$$\pi_{C_1.Sid}\left(\sigma\left((C_1.Sid = C_2.Sid \wedge C_2.Sid = C_3.Sid \wedge C_1.Sid = C_3.Sid) \wedge (C_1.Pid \neq C_2.Pid \wedge C_2.Pid \neq C_3.Pid \wedge C_1.Pid \neq C_3.Pid)\right)(C_1 \times C_2 \times C_3)\right)$$

it is optional (because of transitivity)

it is mandatory

#Q. Retrieve Sids of the suppliers who have supplied most expensive parts.

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

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

(Union Compatibility)

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

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

$$\Pi_{C_1.Sid,\ C_1.Pid,\ C_1.Cost}\left(\sigma_{C_1.Cost < C_2.Cost}(C_1 \times C_2)\right) = o/p$$

Sid	Pid	Cost
S_1	P_1	10
S_3	P_2	20

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

$-$

Sid	Pid	Cost
S_1	P_1	10
S_3	P_2	20

$=$

Sid	Pid	Cost
S_1	P_2	30
S_2	P_2	30
S_3	P_3	30

Project Sid

Sid
S_1
S_2
S_3

#Q. Retrieve Sids of the suppliers who have supplied most expensive parts.

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

$$\pi_{Sid}\left[(Catalog) - \pi_{C_1.Sid, C_1.Pid, C_1.Cost}\left(\sigma_{C_1.Cost < C_2.Cost}(C_1 \times C_2)\right)\right]$$

if we use $C_1.Cost > C_2.Cost$ then

o/p of main query will be the Sids of Suppliers who have supplied some parts at minimum cost

#Q. Retrieve Sids of the suppliers who have supplied most expensive parts.

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

$$\pi_{Sid}(Catalog) - \pi_{C_1.Sid}\left(\pi_{C_1.Sid, C_1.Pid, C_1.Cost}\left(\sigma_{C_1.Cost < C_2.Cost}(C_1 \times C_2)\right)\right)$$

↳ This query need not produce the correct o/p

H.W.

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

↳ division

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

{ O/p will be Sids from Catalog that are associated with all Pids of red Color parts }

$$\left[\pi_{Sid}(C) - \pi_{Sid}\left[\left(\pi_{Sid}(C) \times \pi_{Pid}\left(\sigma_{Color='Red'}(P)\right)\right) - \pi_{Sid, Pid}(C)\right]\right]$$


SQL

Topic : SQL

Structured Query language

It is a non-procedural query language

i.e. we must understand the "Syntax" of SQL

2 mins Summary

- **Topic** Practice questions on relational algebra
- **Topic** SQL
- **Topic** Basic SQL clauses
- **Topic** Aggregate functions

THANK - YOU

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