



COMPUTER SCIENCE

Database Management System

Query Language

Lecture_7



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**TOPICS
TO BE
COVERED**

01

Queries

02

SQL Clauses



SQL

SELECT
FROM
WHERE
GROUP BY
HAVING.

AGGREGATE OPERATORS

SUM
COUNT
MIN
MAX
AVG

SET OPERATORS

- ① UNION & UNION ALL
- ② INTERSECT & INTERSECT ALL
- ③ MINUS & MINUS ALL.

Q.

P
W

Sid	Branch	Marks
S ₁	CS	60
S ₂	IT	70
S ₃	CS	90
S ₄	IT	60
S ₅	EC	55
S ₆	EC	NULL

ANSWER: 55

Q.

Retrieve Sid & Marks of the Student who secured Highest Marks?

function.

Note: Aggregate ~~friction~~ can not be in lower clause

Query I: Select Sid max(Marks)
From Student

Query II: Select Sid, max(marks)
From Student
Group By (Sid).

OUTER QUERY

Query III: Select Sid marks
From Student
Where marks =

Select max(Marks)
From Student

Inner Query

Sid	Marks
S ₃	90

OTHER SET OPERATOR

1. IN/NOT IN

2. ANY

3. ALL

4. EXISTS/NOT EXISTS

COMPARISION OPERATOR

<,>, <=,<>

Not equal

ANY: Compare a value with each value in a Set & Return true if any value is compared according to given condition.

Nested Queries

① Normal (Independent)
Nested Query

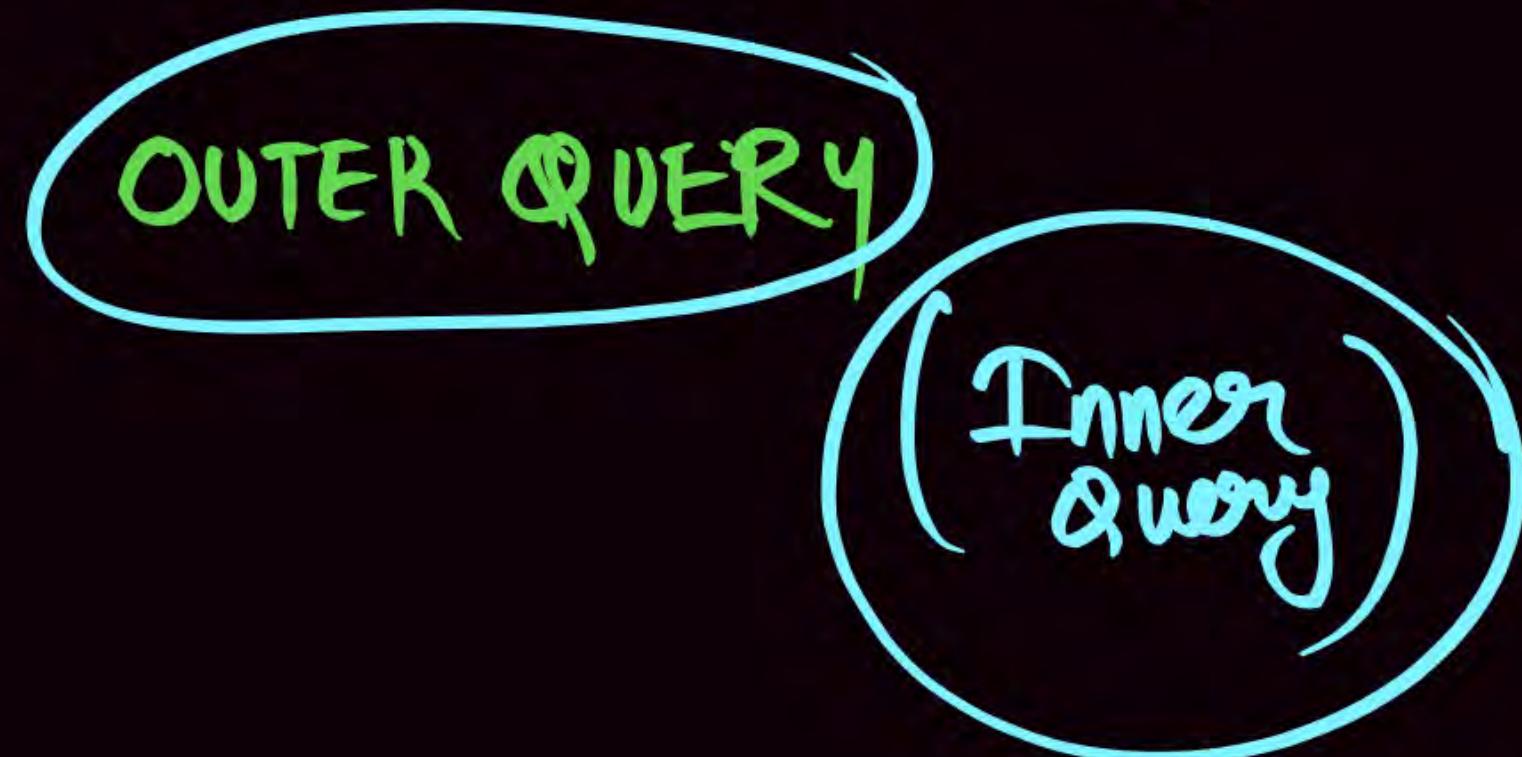
Correlated Nested
Query.

Execution Sequence

Bottom → TOP.

Inner Query → OUTER
QUERY.

Normal Nested Query.



OTHER SET OPERATOR

1. IN/NOT IN

2. ANY

3. ALL

4. EXISTS/NOT EXISTS

COMPARISION OPERATOR

<,>,<=,<>

Not equal

ANY: Compare a value with each value in a Set & Return true if any value is compared according to given condition.

ANY (OR)

① $x > \text{ANY}(10, 20, 40)$

$(x > 10) \text{ OR } (x > 20) \text{ OR } (x > 40)$

$\text{OIP} \rightarrow 11, 12, 13, 14, 15, 16, \dots$

② $x < \text{ANY}(10, 20, 40)$

$(x < 10) \text{ OR } (x < 20) \text{ OR } (x < 40)$

$\text{OIP} \rightarrow 39, 38, 37, 36, 35, 34, \dots$

ALL (AND)

① $x > \text{ALL}(10, 20, 40)$

$(x > 10) \text{ AND } (x > 20) \text{ AND } (x > 40)$

$\text{OIP} \rightarrow 41, 42, 43, 44, 45, 46, 47, \dots$

② $x < \text{ALL}(10, 20, 40)$

$(x < 10) \text{ AND } (x < 20) \text{ AND } (x < 40)$

$\text{OIP} \rightarrow 9, 8, 7, 6, 5, 4, \dots$

Example:

$x > \text{ANY } (10, 20, 30)$

$(x > 10) \text{ or } (x > 20) \text{ or } (x > 30) \xrightarrow{\text{output}} 11, 12, 13, \dots$

Example:

$x < \text{ANY } (10, 20, 30)$

$(x < 10) \text{ or } (x < 20) \text{ or } (x < 30) \xrightarrow{\text{output}} 29, 28, 27, \dots$

ALL: Compare a value with each value in a Set & Return true if given condition satisfied for every/each value in the Set.

Example:

x > ALL (10, 20, 30)

$(x > 10) \text{ AND } (x > 20) \text{ AND } (x > 30)$  31, 32, 33, 34
✓ ✓ ✓ ✓ ✓

Example:

x < ALL (10, 20, 30)

$(x < 10) \text{ AND } (x < 20) \text{ AND } (x < 30)$  9, 8, 7, 6
✓ ✓ ✓ ✓

Note

Query executed on a DB Table, Tuple By Tuple

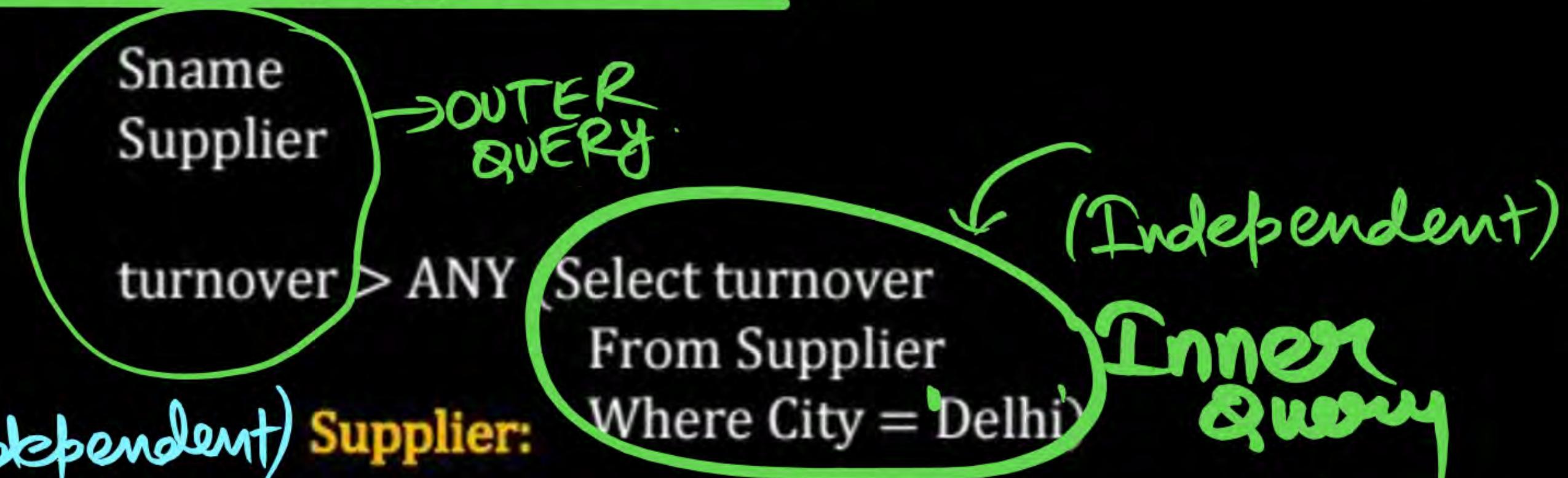
One Tuple at a time.

Normal (Independent)
Nested Query.

Q.

Find Name of Supplier whose turnover is better than the turnover of any (some) Supplier of Delhi?

Select
From
Where



Normal (Independent)
Nested Query

Inner → Outer
Query Query.

Sno	Sname	City	turnover
1	A	Delhi	4 Cr.
2	B	Bang.	5 Cr.
3	C	Delhi	6 Cr.
4.	D	Konchi	7 Cr.

Q.

Find Name of Supplier whose turnover is better than the turnover of any (some) Supplier of Delhi?

Select

✓ From

✓ Where

Sname

Supplier

4
6

turnover > ANY (Select turnover

>ANY(4,6) From Supplier

Supplier: Where City = 'Delhi')

Wrong QP

Sname
B
C
D

Delhi

Sno	Sname	City	turnover
1	A	Delhi	4 Cr.
2	B	Bang.	5 Cr.
3	C	Delhi	6 Cr.
4.	D	Konchi	7 Cr.

①

$x > \text{ANY } (4, 6)$

$(x > 4) \text{ OR } (x > 6) \xrightarrow{\text{OP}} 5, 6, 7, 8, 9, \dots$

②

$x > \text{ALL } (4, 6)$

$(x > 4) \text{ AND } (x > 6) \xrightarrow{\text{OP}} 7, 8, 9, 10, 11$

Q.

Find Name of Supplier whose turnover is better than the turnover of any (some) Supplier of Delhi?

Not equal

Select
From
Where

(ii) All Supplier of Delhi ?

Sname

Supplier

City <> Delhi AND

(4,6)

turnover > ANY (Select turnover

ALL
n>ALL(4,6)

ALL From Supplier $(n>4) \text{ AND } (n>6)$

Supplier: Where City = Delhi)

ANY

<u>Sname</u>
B
D

ALL

<u>Sname</u>
D

Sno	Sname	City	turnover
1	A	Delhi	4 Cr.
2	B	Bang.	5 Cr.
3	C	Delhi	6 Cr.
4.	D	Konchi	7 Cr.

ALL: (WHERE City = Delhi)

↓
output

Sname
D

$$x > \text{ANY } (4, 6)$$

$$(x > 4) \text{ or } (x > 6) = 5, 6, 7$$

B, C, D

In outer Query

City \hookrightarrow Delhi

Q.P.
ALL
($x > 4$) AND ($x > 6$)

Q. Retrieve eid who get more salary than any employee of dept = 5? P
W

$(50k, 30k)$ EMP

Eid	dno	Salary
E ₁	5	50 k
E ₂	3	20 k
E ₃	5	30 k
E ₄	3	40 k
E ₅	4	60 k

OP

eid
E ₄
E ₅

ANY

Query I SELECT Eid

FROM Emp

WHERE dno \neq '5' $(30k, 30k)$

AND Salary > ANY

Select Salary
FROM Emp
WHERE dno = '5'

Without ANY

Query II Select Eid

FROM Emp

WHERE dno \neq '5'

AND Salary >

Select min(Salary)
FROM Emp
WHERE dno = '5'

Q.

Retrieve eid who get more salary than ~~any~~ employee of dept = 5?

P
W

EMP

Eid	dno	Salary
E ₁	5	50 k
E ₂	3	20 k
E ₃	5	30 k
E ₄	3	40 k
E ₅	4	60 k

All :

eid
E ₅

(50k, 30k)
(20k, 30k)
or
(40k, 50k)

Query I SELECT Eid

FROM Emp

WHERE dno <> '5'

AND Salary > ALL

(30k, 50k)
Select Salary
FROM Emp
WHERE dno = '5'

without ANY

Query II Select Eid

FROM Emp

WHERE dno <> '5'

AND Salary >

50K

Select Max(Salary)
FROM Emp
WHERE dno = '5'

Query I:

Select
From
WHERE
AND

Eid
Emp
dno <> 5

ANY

30k, 50k

Salary > **ANY**
$$\left(\begin{array}{ll} \text{Select} & \text{Salary} \\ \text{From} & \text{Emp} \\ \text{Where} & \text{dno=5} \end{array} \right)$$

output

Eid
E ₄
E ₅

Query II:

Select
From
WHERE
AND

Eid
Emp
dno <> 5

30k, 50k

Salary > **min(Salary)**
$$\left(\begin{array}{ll} \text{Select} & \underline{\text{min(Salary)}} \\ \text{From} & \text{Emp} \\ \text{Where} & \text{dno='5} \end{array} \right)$$

output

Eid
E ₄
E ₅

All employee of dno = 5

Query I:

Select
From
WHERE
 $dno <> 5$

AND

Eid
Emp
dno <> 5
Salary > ALL $\left(\begin{array}{l} \text{Select Salary} \\ \text{From Emp} \\ \text{Where dno=5} \end{array} \right)$

output

Eid
E ₅

Query II:

Select
From
WHERE
 $dno <> 5$

AND

Eid
Emp
dno <> 5
Salary > $50 \left(\begin{array}{l} \text{Select } \underline{\max(\text{Salary})} \\ \text{From Emp} \\ \text{Where dno='5'} \end{array} \right)$

output

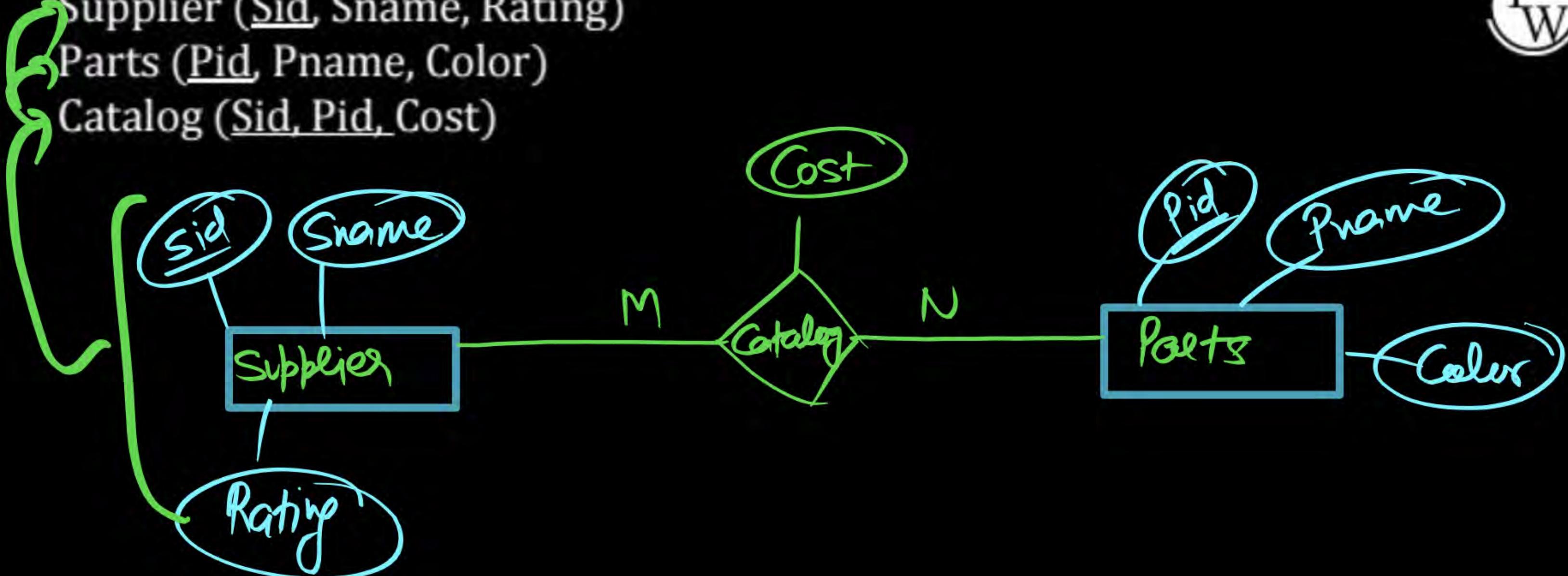
Eid
E ₅

P
W

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)



Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Supplier .

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Q.L W.A.Q to Find Sid of Supplier
whose Rating > 8 ?

P
W

Supplier .

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Query I

Select Sid
FROM Supplier
WHERE Rating > 8

OR

Select T.Sid
FROM Supplier T
WHERE T.Rating > 8

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

sid
S ₂
S ₃
S ₄
S ₅

Ans

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Q.2 W.A.Q to find Sid whose parts cost greater than 7K ?

P
W

Supplier .

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Select X.Sid
FROM Catalog X
WHERE X.Cost > 7000

OP

Select Sid
FROM Catalog
WHERE Cost > 7000.

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

Soln 2

<u>Sid</u>
S ₂
S ₄

Avg

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Select Pid
FROM Parts
WHERE Color = 'Red'

(OR)

SELECT P.Pid
FROM Parts AS P
WHERE P.Color = 'Red'.

Supplier .

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

Sol'n 3

Pid
P ₁
P ₃

Ans



Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Q.4 W.A.Q to Find Sid Who Supplied Some Red Color Parts ?

P
W

Supplier .

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

W.A.Q to Find Sid of Supplier who Supplied Red Color Parts ?

(Q.4)

SQL

```
SELECT C.Sid  
FROM Catalog C, Parts P  
WHERE C.Pid = P.Pid AND  
P.Color = 'Red'
```

Sid
S1
S2

:

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Q.5 W.A.Q to Find sName' who Supplied  Some Red Color Parts ?

Supplier .

Total 3 ✓

Table
Required.

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

W.A.Q. to find Name of Supplier who supplied Red Color Parts ?

(Q.5)

SQL

```
SELECT S.Sname  
① FROM Catalog C, Parts P, Supplier As S.  
② WHERE C.Pid = P.Pid AND  
C.Sid = S.Sid AND  
P.Color = 'Red'
```

sname
Abhay
Mukesh

Ans

..

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Q6 W.A.Q to Find Sid Who Not Supplied Red Color Parts ?

Supplier .

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

W.A.Q. to Find Sid of Supplier who NOT Supplied Red Color Parts ?

Q.6

SQL

```
SELECT C.Sid  
FROM Catalog C, Parts P  
WHERE C.Pid = P.Pid AND  
P.Color <> 'Red'
```

↑
Not equal

Sid
S1
S4

Ans

11

$$\pi_{S.id} \left(\sigma_{P.P.id = C.P.id} \left(\sigma_{P.CatID = Red^1} (Parts) \bowtie Catalog \right) \right)$$

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Q.4 W.A.Q to Find Sid Who Supplied Some Red Color Parts ?

P
W

Supplier .

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Supplier .

<u>Sid</u>	Sname	Rating
S ₁	Abhay	8
S ₂	Mukesh	9
S ₃	Priya	9
S ₄	Pooja	9
S ₅	Alok	9

Catalog .

<u>Sid</u>	<u>Pid</u>	Cost
S ₁	P ₁	6K
S ₁	P ₂	7K
S ₂	P ₃	8K
S ₄	P ₄	9K

Parts

<u>Pid</u>	Pname	Color
P ₁	A	Red
P ₂	B	Green
P ₃	C	Red
P ₄	D	Yellow

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

Q.4

Retrieve Sid of the Supplier who supplied some Red Color Parts?

P
W

Query I:

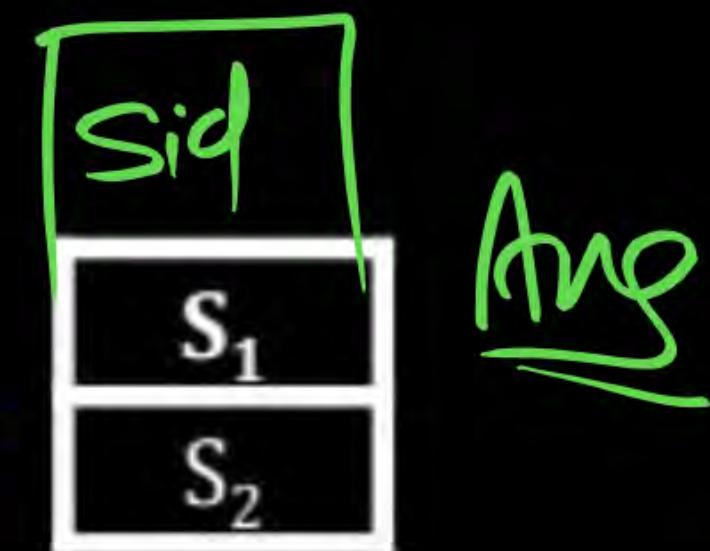
Select
From

Sid
Catalog C, Parts P

output

WHERE
P.Pid = C.Pid

Color = Red





Query II:

Select

Sid

From

Catalog

WHERE

Pid = $\left(\begin{array}{l} \text{Select Pid} \\ \text{FROM Parts} \\ \text{WHERE Color = Red} \end{array} \right)$



Pid
P ₁
P ₃

One to many
→ Comparison not
Directly allowed

X

$$P_1 = P_3$$

$$X P_3 = P_3$$

X

$$P_2 = P_3$$

$$X P_4 = P_3$$



Q.W
~~Query II:~~

Select
From

WHERE

Sid
Catalog

Pid =

after Query

Select Pid
FROM Parts
WHERE Color = Red

Inner Query

Pid
P ₁
P ₃

→ One to many
Comparison not
Directly allowed

IN

: Membership Set

$x = 5$

R_{DLP} : $\{1, 2, 3, 4, 5\}$

$x \text{ IN } R$

if R Contain x then
'belongs' True.

~~X~~

$x > \text{ANY}(\underline{\text{Relation}} R)$

$x > \text{ANY}(\text{Inner Query Result})$
OR
Values.

ANY, ALL

IN, NOT IN

EXIST, NOT EXIST

$x = 5$

$R \xrightarrow{\text{op}} [1, 2, 3, 4, 5]$

$S \xrightarrow{\text{op}} [1, 2, 6, 7, 8]$

① $x \text{ IN } R$

'5' IN $[1, 2, 3, 4, 5] \Rightarrow \text{True.}$

② $x \text{ IN } S$

'5' IN $(1, 2, 6, 7, 8) \Rightarrow \text{False.}$

$x = 5$

$R \xrightarrow{\text{OP}} [1, 2, 3, 4, 5]$

$S \xrightarrow{\text{OP}} [1, 2, 6, 7, 8]$

①

$x \text{ NOTIN } R$

'5' NOTIN $[1, 2, 3, 4, 5] \Rightarrow \text{False}$

②

$x \text{ NOT IN } S$

'5' NOTIN $(1, 2, 6, 7, 8) \Rightarrow \text{True}$.

P
W

Query III:

Select Sid
FROM Catalog
WHERE Pid

IN

$$\left(\begin{array}{l} \text{Select Pid} \\ \text{FROM Parts} \\ \text{WHERE Color = Red} \end{array} \right)$$

(i)

$P_1 \text{ IN } (P_1, P_3)$: True

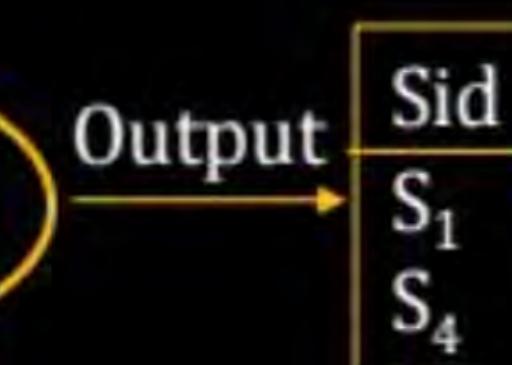
↳ S_1 selected

Pid
P_1
P_2

(ii)

$P_2 \text{ IN } (P_1, P_3)$: False

Nothing Selected



(iii) $P_3 \text{ IN } (P_1, P_3)$: True

↳ S_3 selected

Red Sid
S_1
S_2

(iv) $P_4 \text{ IN } (P_1, P_3)$: False

Nothing Selected

NOT IN

$P_1 \text{ NOT IN } (P_1, P_3)$: False

$P_2 \text{ NOT IN } (P_1, P_3)$: True

↳ S_1 selected

$P_3 \text{ NOT IN } (P_1, P_3)$: False

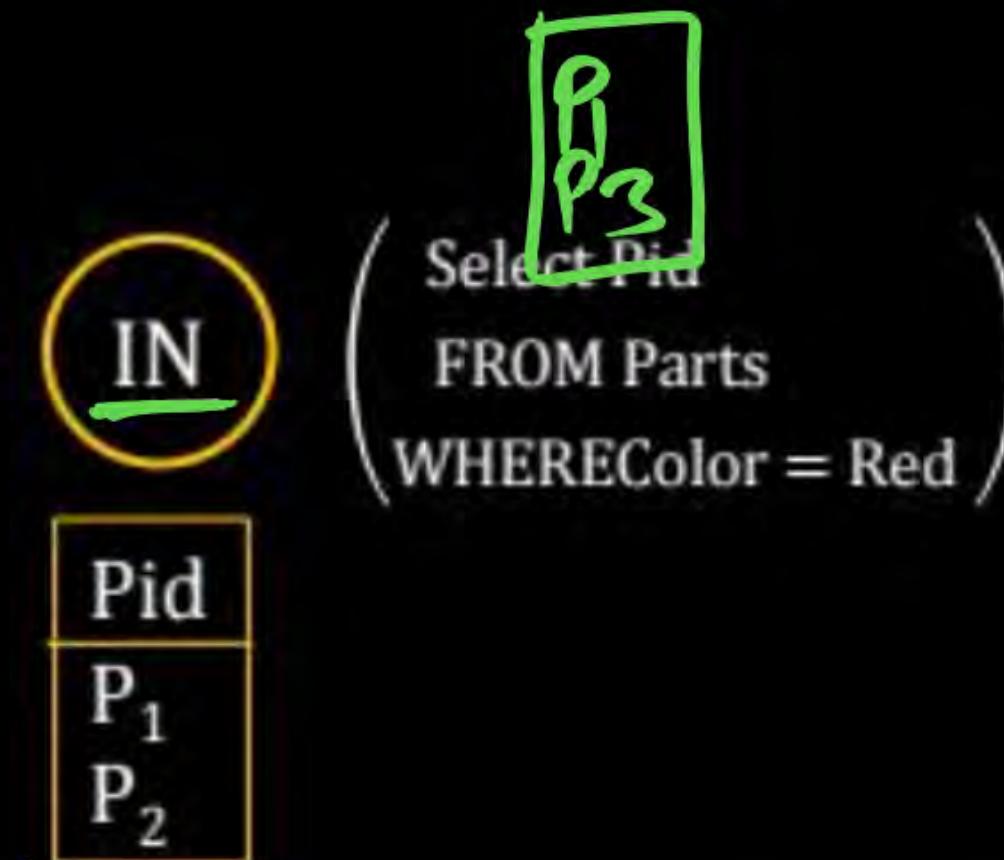
$P_4 \text{ NOT IN } (P_1, P_3)$: True

Color Not Red
S_1
S_4

P
W

Query III:

Select Sid
FROM Catalog
WHERE Pid

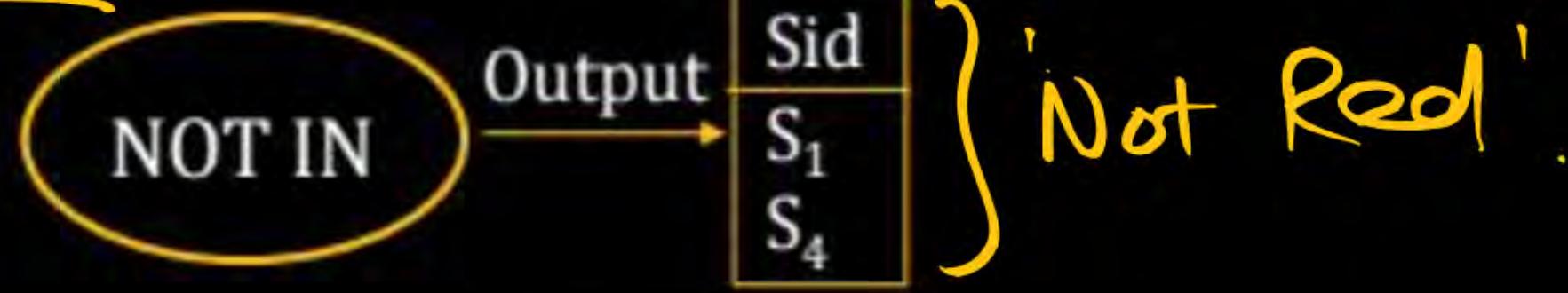


'Reel'

Output

Sid
S ₁
S ₂

If Color Not Red



- ① ANY
- ② ALL
- ③ IN
- ④ NOT IN
- ⑤ Write Queries
- ⑥ Analysis of the Query

Q.1 W.A.Q to Find Sid who supplied some Red
Color Parts **OR** Some GREEN Color Parts ?

Q.2 W.A.Q to Find Sid who supplied some Red
Color Parts **AND** Some GREEN Color Parts ?

Supplier (Sid Sname Rating)

Parts (Pid . Pname Color)

Catalog (Sid Pid Cost)

STUDENT (ID, Name, Branch, Marks)

Q.1 W.A.Q to Retrive Id of Student Who Secured

Highest Marks (1st Highest Marks)
(1st Topper)

- (i) R.A
- (ii) SQL
- (iii) Using Max (Aggregate) function

Q.2 W.A.Q to Retrive Id of the Student Who Secured

2nd Highest Marks. [2nd Topper]

- (i) RA
- (ii) SQL
- (iii) Using Max (Aggregate function)

EXISTS: (Checks): Return True if Inner Query Result

EXISTS: (Checks): Return True if Inner Query Result Not Empty

NOT EXIST: Return True if Inner Result Empty

Correlated Nested Query: Inner Query Using attribute defined in Outer Query

```
Select C.Sid  
FROM Catalog C  
WHERE EXISTS
```

```
(Select *  
FROM Part P  
WHERE P.Pid = C.Pid)
```

Corelated Nested Query

```
Select C.sid  
FROM Catalog  
WHERE EXISTS
```

```
( Select*  
  FROM Parts P  
 WHERE P.Pid = C.Pid  
   AND Color = Red )
```

Inner Query using
Attributes defined in
the Outer Query

Nested Queries

(Independent)
Normal Nest Query

Inner → Outer

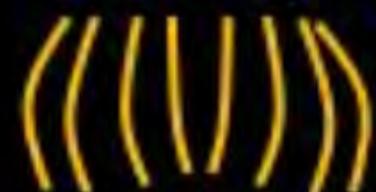
Bottom → Top

Corelated Nested
Query

Outer → Inner → Outer

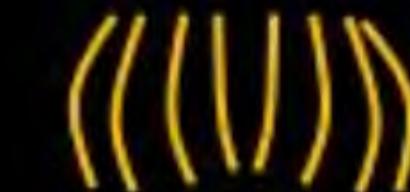
Top → Bottom → Top

```
for(i = 1; i <= n; i++)  
    for(j = 1; j <= m, j++)
```

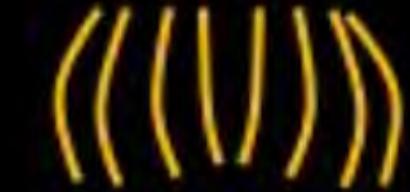
i = 1

J = 1...m

i = 2

J = 1...m

i = 3

J = 1...m

.....

i = n

J = 1...m

Ist Iteration:

[Pid Match & color = Red]

1 Tuple Return

Catalog

Sid	Pid
S ₁	P ₁
S ₁	P ₂
S ₂	P ₃
S ₄	P ₄

Parts

Pid	Color
P ₁	Red
P ₂	Green
P ₃	Red
P ₄	Yellow

IInd Iteration:

S_1	P_2	P_1	Red
	P_2	P_2	Green
		P_3	Red
		P_4	Yellow

[Pid Match but color not Red]

0 Tuple Return

IIIrd Iteration:

S_2	P_3	P_1	Red
		P_2	Green
		P_3	Red
		P_4	Yellow

[Pid Match & Color Red]

1 Tuple Return

IVth Iteration:

S ₄	P ₄	P ₁	Red
		P ₂	Green
		P ₃	Red
		P ₄	Yellow

[Pid Match but color not Red]

0 Tuple Return

EXISTS

o/p

Sid
S_1
S_2

If NOT EXIST then output

Sid
S_1
S_4

Before EXIST & NOT EXISTS No Attribute is required.

Before IN & NOT IN Attribute is Required.

Q.

Given Relative Schema

Emp(Eid, Ename, Salary)

Department(Eid, dname, code)

Retrieve Employee ID who have no Department?

Query I: Select Eid

FROM Emp E, Dep D

WHERE E.Eid <> D.Eid

Which is true?

P
WA) Q₁ ✓ Q₂ ✗B) Q₂ ✓ Q₁ ✗C) Q₁ ✓ Q₂ ✓D) Q₁ ✗ Q₂ ✗

Eid	Eid	Dname
E ₁	E ₁	A
E ₂	E ₁	B
E ₃	E ₂	A
E ₄		

Query II: Select Eid
 FROM Emp E
 WHERE NOT EXISTS $\left(\begin{array}{l} \text{Select *} \\ \text{FROM Dep D} \\ \text{WHERE E.Eid = D.Eid} \end{array} \right)$

Query I:

$E_1 <> E_1 \rightarrow F$

$E_1 <> E_1 \rightarrow F$

$E_1 <> E_2 \rightarrow T$

$E_2 <> E_1 \rightarrow T$

$E_2 <> E_1 \rightarrow T$

$E_2 <> E_2 \rightarrow F$

$E_3 <> E_1 \rightarrow T$

$E_3 <> E_1 \rightarrow T$

$E_3 <> E_2 \rightarrow T$

$E_4 <> E_1 \rightarrow T$

$E_4 <> E_1 \rightarrow T$

$E_4 <> E_2 \rightarrow T$

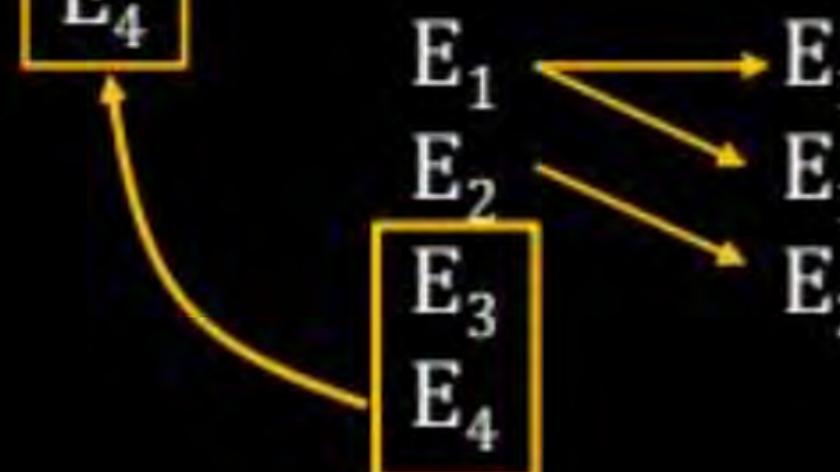
Output of Query I

Eid
E_1
E_2
E_2
E_3
E_3
E_3
E_3
E_4
E_4
E_4

Output of Query II

E_3
E_4

E_3
E_4



NULL:

- Non Zero
- Unknown
- Un existed
- No Two Null are equal

Q.

Retrieve Eid who does not have any Passport Details?



→ Select Eid
FROM Emp
WHERE PPro = NULL

Employee

eid	ename	PassPortNo
E1	A	20
E2	B	NULL
E3	B	16

NOTE: for comparison with NULL SQL support IS/ IS Not Clause

WHERE PPro IS NULL

Q. Retrieve Eid who are having some passport details?

→ Select Eid
FROM Emp
WHERE PPro IS NOT NULL

Regular Expression:

%: Zero or More Character

_ : Exactly One character

Q.

Retrieve Student whose Name Start with 'S' & end with M
& at least 5 character?

P
W

→ 'S _ _ _ % M'

Select *
FROM Student
WHERE Sname = 'S _ _ _ % M'

Output: Pattern → 'S _ _ _ % M'

LIKE: is used to compare to specify certain search
Condition for a Pattern in a column.

Select *
FROM Student
WHERE Sname LIKE 'S _ _ _ % M'

Q.

Retrieve all student whose Name NOT Start with 'C'?

P
W

→ Select *
FROM Student
WHERE Sname NOT LIKE 'C%'

```
Select *  
FROM Student  
WHERE Sname
```

LIKE A% →	Starts with A
%J →	end with J
%I% →	Contain join I
'____' →	All 4 length Name
'S ____' →	Starts with S & exactly 4 length character
'S ____ %' →	Starts with S & at least length

$R \times S$: CROSS Join

$R \cup S$: Union Join

$R \bowtie S$: Inner Join

$R \bowtie S$: Outer Join

ORDER By: Order By Clause is used to sort the Rows.

Company (Name, invoice no)

Q. Display all the company in alphabetical order of their Name?

Query: Select *
FROM Company
Order by Name asc;

Q. If Reverse alphabetical order then
Order by Name Desc



Consider the following relation schemas:

b-Schema = (b-name, b-city, assets)

a-Schema = (a-num, b-name, bal)

d-Schema = (c-name, a-number)

Let branch, account and depositor be respectively instances of the above schemas. Assume that account and depositor relations are much bigger than the branch relation.

Consider the following query:

$$\Pi_{c\text{-name}} (\sigma_{b\text{-city} = \text{"agra"} \wedge \text{bal} < 0} (\text{branch} \bowtie \text{account} \bowtie \text{depositor}))$$



Which one of the following queries is the most efficient version of the above query?

[GATE-2007: 2 Marks]

A

$\Pi_{c\text{-name}} (\sigma_{\text{bal} < 0} (\sigma_{b\text{-city} = \text{"Agra"}} \text{ branch} \bowtie \text{account}) \bowtie \text{depositor})$

B

$\Pi_{c\text{-name}} (\sigma_{b\text{-city} = \text{"Agra"}} \text{ branch} \bowtie (\sigma_{\text{bal} < 0} = \text{account}) \bowtie \text{depositor})$

C

$\Pi_{c\text{-name}} (\sigma_{b\text{-city} = \text{"Agra"}} \text{ branch} \bowtie \sigma_{b\text{-city} = \text{"Agra} \wedge \text{bal} < 0} \text{ account} \bowtie \text{depositor})$

D

$\Pi_{c\text{-name}} (\sigma_{b\text{-city} = \text{"Agra"}} \text{ branch} \bowtie (\sigma_{b\text{-city} = \text{"Agra} \wedge \text{bal} < 0} \text{ account} \bowtie \text{depositor}))$

Q

Consider two relations $R_1(A, B)$ with the tuples $(1, 5), (3, 7)$ and
 $R_2(A, C) = (1, 7)(4, 9)$

P
W

Assume that $R(A, B, C)$ is the full natural outer join of R_1 and R_2 .
Consider the following tuples of the form (A, B, C) ; $a = (1, 5, null)$,
 $b = (1, null, 7)$, $c = (3, null, 9)$, $d = (4, 7, null)$, $e = (1, 5, 7)$,
 $f = (3, 7, null)$, $g = (4, null, 9)$. Which one of the following
statements is correct?

[GATE-2015: 1 Mark]

- A R contains a, b, e, f, g, but not c, d
- B R contains all of a, b, c, d, e, f, g
- C R contains e, f, g, but not a, b
- D R contains e but not f, g

Consider a database that has the relation schema CR(StudentName, CourseName). An instance of the schema CR is as given below:

The following query is made on the database.

$T1 \leftarrow \pi_{CourseName}(\sigma_{StudentName='SA'}(CR))$

$T2 \leftarrow CR \div T1$; Division

The number of rows in $T2$ is _____.

[GATE-2017-CS: 2M]

CR	
Student Name	Course Name
SA	CA
SA	CB
SA	CC
SB	CB
SB	CC
SC	CA
SC	CB
SC	CC
SD	CA
SD	CB

Student Name	Course Name
SD	CC
SD	CD
SE	CD
SE	CA
SE	CB
SF	CA
SF	CB
SF	CC

The following relation records the age of 500 employees of a company, where empNo {indicating the employee number} is the key:

$\text{empAge}(\underline{\text{empNo}}, \text{age})$

Consider the following relational algebra expression:

$\prod_{\text{empNo}}(\text{empAge} \bowtie_{(\text{age} > \text{age1})} \rho_{\text{empNo1}, \text{age1}}(\text{empAge}))$

What does the above expression generate?

[GATE-2020-CS: 1M]

- A Employee numbers of only those employees whose age is the maximum
- B Employee numbers of only those employees whose age is more than the age of exactly one other employee
- C Employee numbers of all employees whose age is not the minimum
- D Employee numbers of all employees whose age is the minimum

Consider the following relations P(X, Y, Z), Q(X, Y, T) and R(Y, V)

P		
X	Y	Z
X1	Y1	Z1
X1	Y1	Z2
X2	Y2	Z2
X2	Y4	Z4

Q		
X	Y	T
X2	Y1	2
X1	Y2	5
X1	Y1	6
X3	Y3	1

R	
Y	V
Y1	V1
Y3	V2
Y2	V3
Y2	V2

How many tuples will be returned by the following relational algebra query?

$$[\Pi_X(\sigma(P.Y=R.Y \wedge R.V=V2)(P \times R)) - \Pi_X(\sigma(Q.Y=R.Y \wedge Q.T>2)(Q \times R))]$$

① Ans

[GATE-2019-CS: 2M]

Suppose $R_1(A, B)$ and $R_2(C, D)$ are two relation schemes. Let r_1 and r_2 be the corresponding relation instances. B is a foreign key that refers to C in R_2 . If data in r_1 and r_2 satisfy referential integrity constraints, which of the following is ALWAYS TRUE?

[GATE-2013-CS: 2M]

A $\Pi_B(r_1) \cdot \Pi_C(r_2) = \phi$

B $\Pi_C(r_2) \cdot \Pi_B(r_1) = \phi$

C $\Pi_B(r_1) = \Pi_C(r_2)$

D $\Pi_B(r_1) \cdot \Pi_C(r_2) \neq \phi$

Consider the following table named Student in a relational database. The primary key of this table is rollNum.

Student

Roll Num	Name	Gender	Marks
1	Naman	M	62
2	Aliya	F	70 ✓
3	Aliya	F	80 ✓
4	James	M	82
5	Swati	F	65

The SQL query below is executed on this database.

~~SELECT *
FROM Student
WHERE gender = 'F' AND marks > 65;~~ Ans

The number of rows returned by the query is

[GATE-2023-CS: 2M]

Consider the following relation A, B and C:

A		
ID	Name	Age
12	Arun	60
15	Shreya	24
99	Rohit	11

B		
ID	Name	Age
15	Shreya	24
25	Hari	40
98	Rohit	20
99	Rohit	11

C		
ID	Phone	Area
10	2200	02
99	2100	01

How many tuples does the result of the following relational algebra expression contain? Assume that the schema of $A \cup B$ is the same as that of A.

$$(A \cup B) \bowtie_{\underline{A.Id > 40 \vee C.Id < 15}} C$$

[GATE-2012-CS: 2M]

A 7

B 4

C 5

D 9

Q.

P
W

Consider the following relation

Cinema (theatre, address, capacity)

Which of the following options will be needed at the end of the SQL query

SELECT P1.address
FROM Cinema P1

such that it always finds the addresses of theaters with maximum capacity?

[MCQ: 2015]

A

WHERE P1.capacity ~~>=~~ ALL (select P2.capacity from Cinema P2)

B

WHERE P1.capacity ~~>=~~ Any (select P2.capacity from Cinema P2)

C

WHERE P1.capacity > ~~ALL~~ (select max (P2.capacity) from Cinema P2)

D

WHERE P1.capacity > ~~Any~~ (select max (P2.capacity) from Cinema P2)

Now with Example

T ₁	A	100
T ₂	B	200
T ₃	C	300
T ₄	D	400

Q.

Consider the following relation

Cinema (theatre, address, capacity)

Which of the following options will be needed at the end of the SQL query

**SELECT P1.address
FROM Cinema P1**

such that it always finds the addresses of theaters with maximum capacity?

[MCQ: 2015]

A

WHERE P1.capacity > = ALL (select P2.capacity from Cinema P2)

B

WHERE P1.capacity > = Any (select P2.capacity from Cinema P2)

C

WHERE P1.capacity > ALL (select max (P2.capacity) from Cinema P2)

D

WHERE P1.capacity > Any (select max (P2.capacity) from Cinema P2)

@

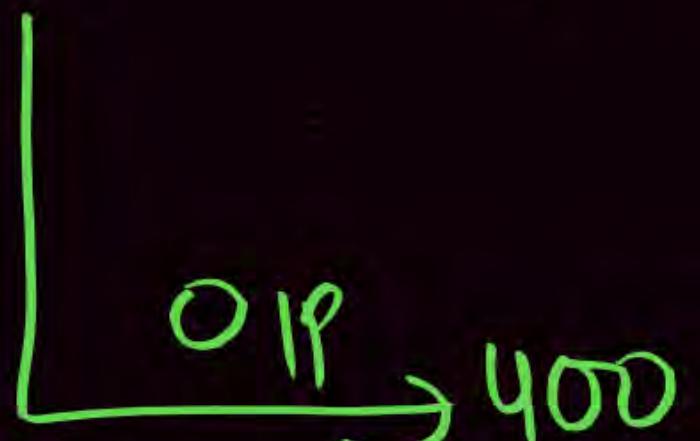
WHERE P_i.Capacity >= ALL

Select P₂.Capacity
FROM Cinema P₂

↳ 100, 200, 300, 400

n >= ALL (100, 200, 300, 400)

(n >= 100) AND (n >= 200) AND (n >= 300) AND (n >= 400)



Maximum Capacity.

~~C~~ WHERE $P_1.\text{Capacity} > \text{ALL} \left(\begin{array}{l} \text{Select max } (P_2.\text{Capacity}) \\ \text{FROM Cinema } P_2 \end{array} \right)$

400

$n > \text{ALL } (400) \rightarrow \text{OTuple}$

~~d~~ WHERE $P_1.\text{Capacity} > \text{ANY} \left(\begin{array}{l} \text{Select max } (P_2.\text{Capacity}) \\ \text{FROM Cinema } P_2 \end{array} \right)$

400

$x > \text{ANY } (400) \rightarrow \text{OTuple}$

Cinema		
theatre address	capacity	
T ₁	A	100
T ₂	B	200
T ₃	C	300
T ₄	D	400

~~A~~ WHERE $P_1.\text{Capacity} \geq \text{ANY}$

Select $P_2.\text{Capacity}$
FROM Cinema P_2

100
200
300
400

$x \geq \text{ANY } (100, 200, 300, 400)$

OIP

A
B
C
D

Q.

Database table by name Loan_Records is given below:
What is the output of the following SQL query?

```
SELECT count(*)  
FROM (  
    SELECT Borrower, Bank_Manager  
    FROM Loan_Records) AS S NATURAL JOIN  
(SELECT Bank_Manager, Loan_Amount  
    FROM Loan_Records) AS T  
);
```

[MCQ: 2011:2M]

- A 3
- B 9
- C 5
- D 6

Borrower	Bank_Manager	Loan_Amaount
Ramesh	Sunderajan	10000.00
Suresh	Ramgopal	5000.00
Mahesh	Sunderajan	7000.00



SELECT operation in SQL is equivalent to

[MCQ: 2015-1M]



- A The selection operation in relational algebra.
- B The selection operation in relational algebra, except that SELECT in SQL retains duplicates.
- C The projection operation in relational algebra.
- D The projection operation in relational algebra, except that SELECT in SQL retains duplicates.

Q.

Consider the following database table named top_scorer.

Consider the following SQL Query:

```
SELECT ta.player FROM top_scorer AS ta
WHERE ta.goals > ALL (SELECT tb.goals
    FROM top_scorer AS tb
    WHERE tb.country = 'Spain')
AND ta.goals > ANY (SELECT tc.goals
    FROM top_scorer AS tc
    WHERE tc.country = 'Germany')
```

The number of tuples returned by the above SQL query is ____.

[NAT:2017-2M]



top_scorer		
player	country	goals
Klose	Germany	16
Ronaldo	Brazil	15
G Muller	Germany	14
Fountaine	France	13
Pele	Brazil	12
Klinsmann	Germany	11
Kocsis	Hungary	11
Batistuta	Argentina	10
Cubillas	Peru	10
Lato	Poland	10
Lineker	England	10
T Muller	Germany	10
Rahn	Germany	10

Q.

Consider the following relations:

P
W

Student	
Roll_No	Student_Name
1	Raj
2	Rohit
3	Raj

Performance			
Roll_No	Course	Marks	
1	Math	80	
1	English	70	
2	Math	75	
3	English	80	
2	Physics	65	
3	Math	80	

Consider the following SQL query.

```
SELECT S.Student_Name, Sum(P.Marks)
FROM Student S, Performance P
WHERE S.Roll_No = P.Roll_No
Group BY S.Student_Name
```

The number of rows that will be returned by the SQL query is ____.

[NAT: 2015-2M]

Q.

Consider the relational database with the following four schemes and their respective instances.

Student(sNo, sName, dNo) **Dept(dNo, dName)**
Course(cNo, cName, dNo) **Register(sNo, cNo)**

Student		
<u>sNo</u>	sName	dNo
S01	James	D01
S02	Rocky	D01
S03	Jackson	D02
S04	Jane	D01
S05	Milli	D02

Dept	
<u>dNo</u>	dName
D01	CSE
D02	EEE

Course		
<u>cNo</u>	cName	dNo
C11	DS	D01
C12	OS	D01
C21	DE	D02
C22	PT	D02
C23	CV	D03

Register	
<u>sNo</u>	<u>cNo</u>
S01	C11
S01	C12
S02	C11
S03	C21
S03	C22
S03	C23
S04	C11
S04	C12
S05	C11
S05	C21

SQL Query:

```
SELECT * FROM Student AS S WHERE NOT EXIST  
    (SELECT cNo FROM Course WHERE dNo = "D01".  
        EXCEPT  
        SELECT cNo FROM Register WHERE sNo = S.sNo)
```

The number of rows returned by the above SQL query is _____.

[NAT: 2022: 2M]

Q.

Consider a database that has the relation schema EMP(EmpId, EmpName, and DeptName). An instance of the schema EMP and a SQL query on it are given below:

```
SELECT AVG(EC.Num)
FROM EC
WHERE(DeptName, Num) IN
    (SELECT DeptName, COUNT(EmpId)AS
     EC(DeptName, Num)
    FROM EMP
    GROUP BY DeptName)
```

The output of executing the SQL query is ____.

[NAT:2017-1M]

EMP		
EmpId	EmpName	DeptName
1	XYA	AA
2	XYB	AA
3	XYC	AA
4	XYD	AA
5	XYE	AB
6	XYF	AB
7	XYG	AB
8	XYH	AC
9	XYI	AC
10	XYJ	AC
11	XYK	AD
12	XYL	AD
13	XYM	AE

Q.

A relational database contains two tables Student and Performance as shown below:

Student	
Roll_no	Student_name
1	Amit
2	Priya
3	Vinit
4	Rohan
5	Smita

Performance		
Roll_no	Student_code	Marks
1	A	86
1	B	95
1	C	90
2	A	89
2	C	92
3	C	80

The primary key of the Student table is Roll_no. For the Performance table, the columns Roll_no. and Subject_code together form the primary key. Consider the SQL query given below:

```
SELECT S.Student_name, sum(P.Marks) FROM Student S, Performance P
WHERE P.Marks > 84 GROUP BY S.Student_name;
```

The number of rows returned by the above SQL query is _____.

[NAT: 2019–2M]

Q.

Consider the following database table named water_schemes:
The number of tuples returned by the following SQL query is:

```
with total(name, capacity) as
select district_name, sum(capacity)
from water_schemes
group by district_name
with total_avg(capacity) as
select avg(capacity)
from total
select name
from total, total_avg
where total.capacity ≥ total_avg.capacity
```

water_schemes		
scheme_no	district_name	capacity
1	Ajmer	20
1	Bikaner	10
2	Bikaner	10
3	Bikaner	20
1	Churu	10
2	Churu	20
1	Dungargarh	10

[NAT:2016-2M]

P
W

Q.

Suppose $R_1(A, B)$ and $R_2(C, D)$ are two relation schemas. Let r_1 and r_2 be the corresponding relation instances. B is a foreign key that refers to C in R_2 . If data in r_1 and r_2 satisfy referential integrity constraints, which of the following is **ALWAYS TRUE?**

[MCQ: 2012–2M]

- A** $\Pi_B(r_1) - \Pi_C(r_2) = \phi$
- B** $\Pi_C(r_2) - \Pi_B(r_1) = \phi$
- C** $\Pi_B(r_1) = \Pi_C(r_2)$
- D** $\Pi_B(r_1) - \Pi_C(r_2) \neq \phi$

Q.

Consider a relational database containing the following schemas.



Catalogue		
sno	pno	cost
S1	P1	150
S1	P2	50
S1	P3	100
S2	P4	200
S2	P5	250
S3	P1	250
S3	P2	150
S3	P5	300
S3	P4	250

Suppliers		
sno	sname	location
S1	M/s Royal furniture	Delhi
S2	M/s Balaji furniture	Bangalore
S3	M/s Premium furniture	Chennai

Parts		
pno	pname	part_spec
P1	Table	Wood
P2	Chair	Wood
P3	Table	Steel
P4	Almirah	Steel
P5	Almirah	Wood

Question Continues in Next Slide

The primary key of each table is indicated by underlining the constituent fields

```
SELECT s.no, s.name  
FROM Suppliers s, Catalogue c  
WHERE s.sno = c.sno AND  
cost > (SELECT AVG (cost)  
          FROM Catalogue  
          WHERE pno = 'p4'  
          GROUP BY pno);
```

The number of rows returned by the above SQL query is

[MCQ: 2020-2M]

- A 4
- B 5
- C 0
- D 2

MCQ

Consider a database table T containing two columns X and Y each of type integer. After the creation of the table, one record ($X=1, Y=1$) is inserted in the table.

Let MX and MY denote the respective maximum values of X and Y among all records in the table at any point in time. Using MX and MY, new records are inserted in the table 128 times with X and Y values being $MX+1, 2*MY+1$ respectively. It may be noted that each time after the insertion, values of MX and MY change.

What will be the output of the following SQL query after the steps mentioned above are carried out?

SELECT Y FROM T WHERE X=7;

[GATE-2011-CS: 2M]

A 127

B 255

C 129

D 257

**THANK
YOU!**

