



COMPUTER SCIENCE

Database Management System

Query Language

Lecture_5



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TOPICS
TO BE
COVERED

01

SQL Clauses

02

SQL Operators



SELECT
FROM
WHERE
GROUP BY
HAVING

Set Operators

UNION & UNION ALL

INTERSECT & INTERSECT ALL

MINUS & MINUS ALL

Aggregate operator

- ① COUNT
- ② SUM
- ③ AVG
- ④ MIN
- ⑤ MAX

Q) Retrieve Sid & marks of the Student Who Secured Highest Marks ?

Query I Select Sid, max(marks)
 FROM Student X Syntax Error.

Query II Select Sid, max(marks)
 FROM Student
 GROUP BY (Sid) X Query II Not give Sid & marks of the topper (Highest) of the class.

Note

Query executed on a DB Table Tuple By Tuple
(Row By Row)

One Tuple at a time.

where marks = $\max(\text{marks})$ 

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

X Query I: Select Sid max(Marks)
From Student

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

Query III: Select Sid, marks
From Student
Where marks =

Sid	Marks
S ₃	90

Note: Aggregate function can not be used in lower clause

→ Syntax Error

In Aggregate function & other Attribute Used in Select clause is allowed Only if other Attribute must be in group By clause.

Not giving Required op According to Question.

90
 (Select max(Marks)
From Student)

OTHER SET OPERATOR

1. IN/NOT IN

✓ 2. ANY

✓ 3. ALL

4. EXISTS/NOT EXISTS

COMPARISION OPERATOR

$<$, $>$, $<=$, $<>$, \neq

Not equal
 $<>$ or \neq

$>=$

Greater than equal

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

$x > \text{Any } (20, 40, 50)$

$x > \text{ALL}(20, 40, 50)$

Q.1 Which of the following is Not Possible?

- (a) 25
- (b) 39
- (c) 19
- (d) 51

Q.2 Which of the following is possible?

- (a) 21
- (b) 41
- (c) 51
- (d) 49

Any $\Rightarrow \textcircled{OR}$

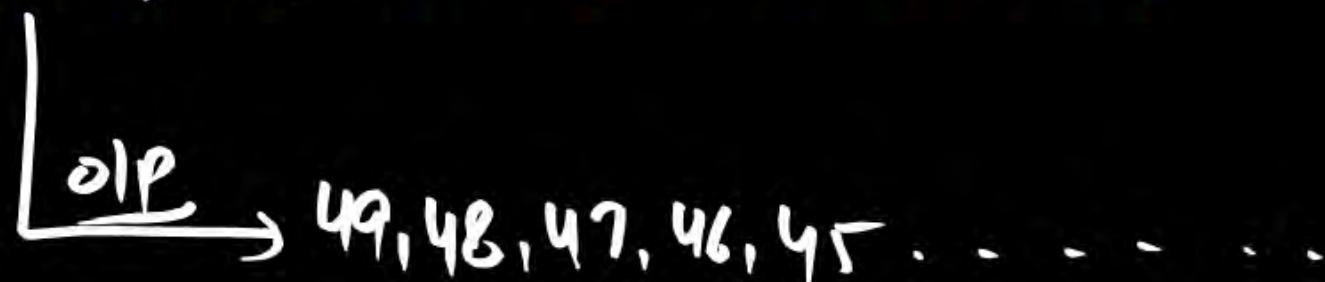
$x > \text{Any}(20, 40, 50)$

$(x > 20) \textcircled{OR} (x > 40) \textcircled{OR} (x > 50)$



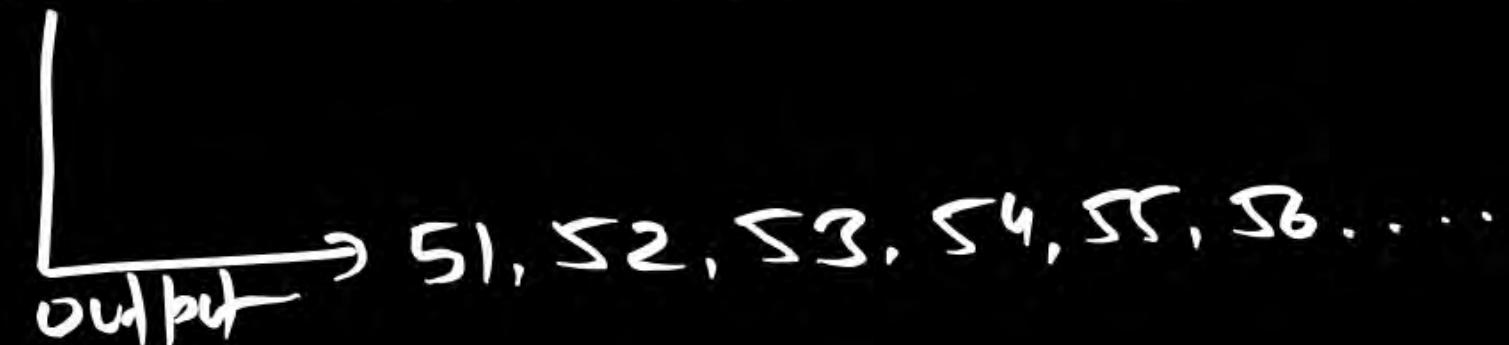
$x < \text{Any}(20, 40, 50)$

$(x < 20) \text{ OR } (x < 40) \text{ OR } (x < 50)$



$x > \underline{\text{ALL}}(20, 40, 50)$

$(x > 20) \text{ AND } (x > 40) \text{ AND } (x > 50)$



$x < \text{ALL}(20, 40, 50)$

$(x < 20) \text{ AND } (x < 40) \text{ AND } (x < 50)$



Example:

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

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

Example:

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

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

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

Example:

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

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

Example:

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

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

Q.

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

Select
From
Where

Sname
Supplier
City \neq Delhi AND
turnover > ANY

\nearrow Not equal
 \nearrow (4, 6)

(4, 6)
Select turnover
From Supplier

Where City = Delhi)

Delhi \Rightarrow 4 Cr., 6 Cr.

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

$(x > 4) \text{ OR } (x > 6)$

Sname
B
C
D

But 'C' belongs
to Delhi.

C is not in the answer.
(City != Delhi.)

Sname
B
D

Ans

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

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

$(x > 4) \text{ AND } (x > 6)$

Sname
D

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

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

O/P B, C, D

Here C belongs to Delhi

City <> Delhi AND

turnover > ANY (Select turnover
From S
WHERE city = Delhi)

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 ✓

Select Eid
FROM Emp

$\Rightarrow \text{ANY} (30, 50)$

WHERE Dept <> '5'

AND Sal > ANY

(30k, 50k)



Select Eid
FROM Emp

WHERE Dept <> 5

AND Salary >

$\left(\begin{array}{l} \text{select min(Sal)} \\ \text{FROM Emp} \\ \text{WHERE Dno=5} \end{array} \right)$

30

Query I:

Select
From
WHERE
AND

Eid
Emp
dno $\neq 5$
Salary > ANY

30k, 50k

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

output

Eid
E ₄
E ₅

Query II:

Select
From
WHERE
AND

Eid
Emp
dno $\neq 5$
Salary >

30k, 50k

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

output

Eid
E ₄
E ₅

All employee of dno = 5

Query I:

Select

From

WHERE

AND

ALL

Eid

Emp

dno <> 5

ALL (30, 50)

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

output

Eid
E ₅

(n>30) AND (n>50)

Query II:

Select

From

WHERE

AND

Eid

Emp

dno <> 5

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

output

Eid
E ₅

ANY \Rightarrow OR
(MIN)

ALL \Rightarrow AND
(MAX)

,

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


OR

$x > 10$ $\left(\min(10, 20, 30) \right)$

P
W

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)



In R.A = σ

Rename operator.

With clause.

In SQL
Rename operator
AS, Space.

③ Catalog AS C, Parts P, Supplier S.
↑
SPACE

Q1) Retrieve Sid of Supplier who supplied some Red color Part?



Query I

Select Sid
FROM Catalog c, Part P
WHERE P.Pid = C.Pid
AND P.Color = Red

Sid
S1
S2

Q9) Retrive Sname of Supplier who supplied some Red color Part?

Supplier

sid	sname	rating
S1	A.	1
S2	B.	2
S3	C.	3
S4	D	4

Catalog

sid	pid	cost
S1	P1	10
S1	P2	20
S2	P3	30
S4	P4	40

Parts

pid	part	color
P1	Red	✓
P2	Green	
P3	Red	✓
P4	Yellow	

Query I

Select

FROM Catalog C, Part P

Supplier S

WHERE P.Color = Red AND

P.Pid = C.Pid AND

C.Sid = S.Sid

Sname

sname
A
B

Op:

IN
R
NOT IN.
operator

.

/

Q.

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

P
W

Query I:

Select
From

WHERE

Sid
Catalog C, Parts P output →

S_1
S_2

P.Pid = C.Pid

Color = Red

Retainive Sid of Supplier who supplied

some Red
Color Part?

Catalog.

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

Parts

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

Q. Color Not Red

P₂ & P₄

S₁
S₄
Ans
Color Not Red.

Query II:

Select
From

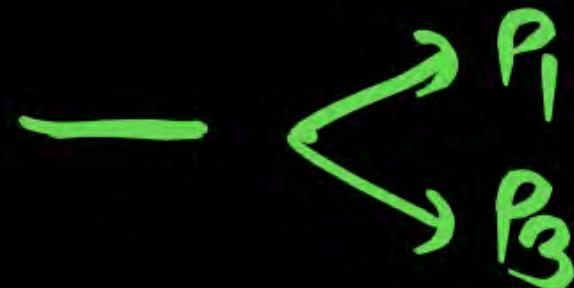
WHERE

Sid
Catalog

Pid = (Select Pid
FROM Parts
WHERE Color = Red)

Pid
P ₁
P ₃

One to many
Comparison not
Directly allowed



Normal Nested Query.



One to Many Comparison

Not allowed Directly

So here IN , NOT IN
USING .

Retrive Sid of Supplier who supplied some Red color Part?

Catalog .

Sid
S ₁
S ₂

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

Parts

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

$\checkmark P_1 \text{ IN}(P_1, P_3)$

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

$\checkmark P_3 \text{ IN}(P_1, P_3)$

$\times P_4 \text{ IN}(P_1, P_3)$

Peteitive Sid of Supplier who supplied some Red color Part?

Catalog .

Sid
S ₁
S ₄

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

Color Not Red

Parts

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

X P₁ NOT IN (P₁, P₃)

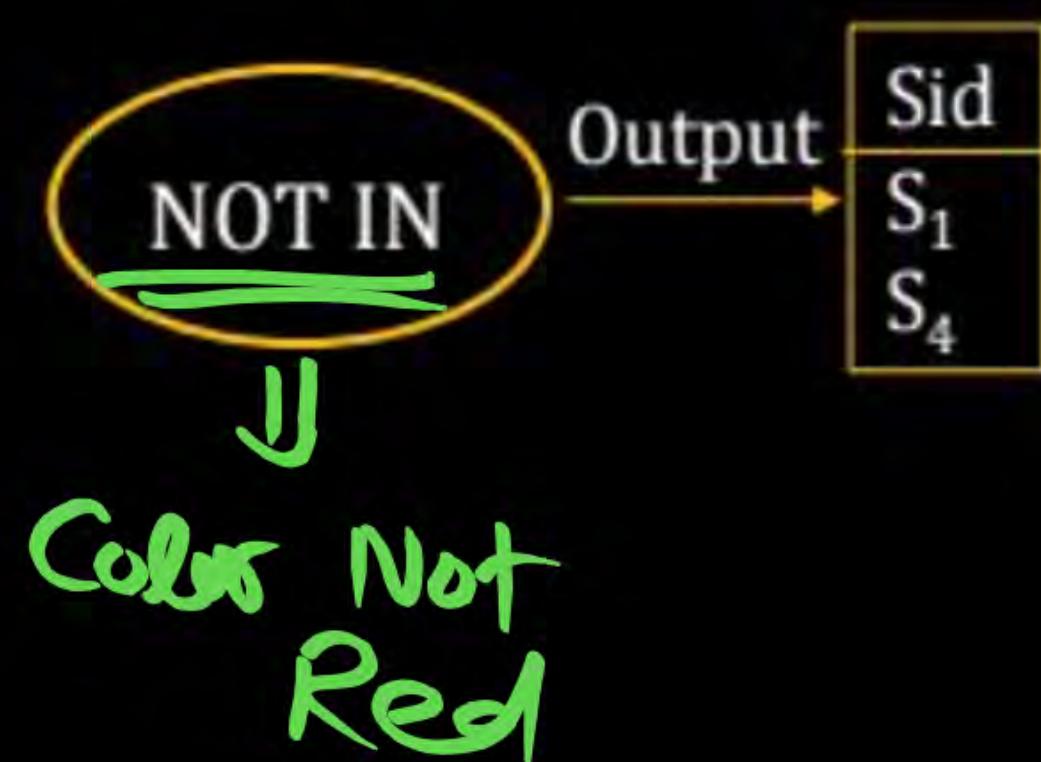
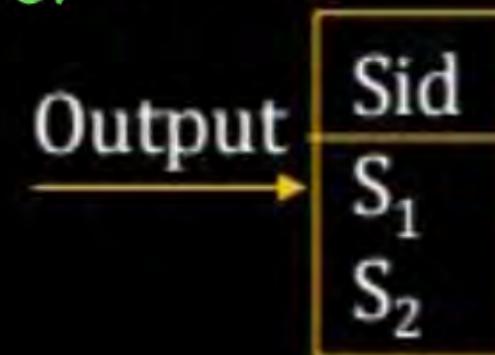
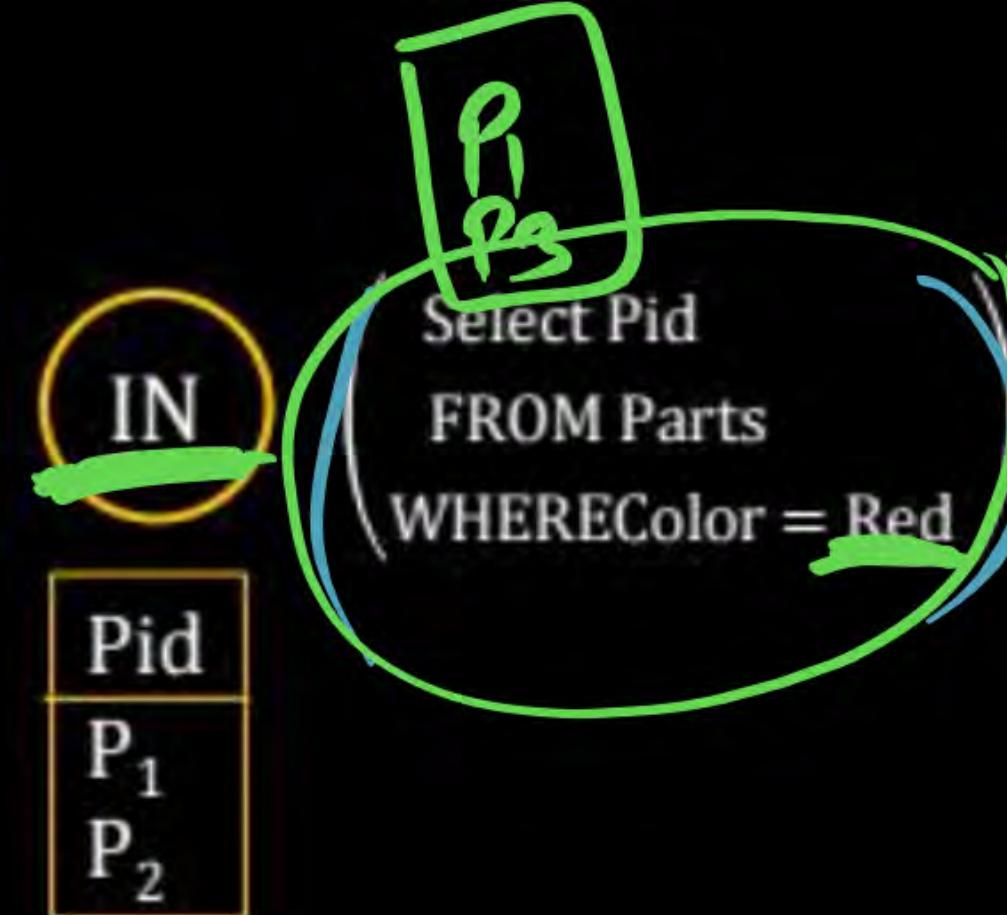
✓ P₂ NOT IN (P₁, P₃)

X P₃ NOT IN (P₁, P₃)

✓ P₄ NOT IN (P₁, P₃)

Query III:

```
Select      Sid  
FROM       Catalog  
WHERE      Pid
```



MINUS.

D

(Set Difference)

MINUS \Rightarrow EXCEPT

:

R
EXCEPT
S

Those which
Present in R
Not in S

MINUS ALL \Rightarrow EXCEPT ALL.

①

A₁₁ A₁₂

EXCEPT

A₁₂ A₂₂

ALL

②

A₁₁ A₁₂

EXCEPT

A₁₁ A₃₄

A₁₂

③

A₁₁ A₁₂

EXCEPT

A₁₁ A₁₂

Empty

④

A₁₁ A₁₂

EXCEPT

A₂₄ A₂₆

A₁₁ A₁₂.

EXIST : Return True if Inner Query
Result Non Empty.

NOT EXIST : Return True if Inner Query
Result Empty.

Q) find sid who supplied some Red Color Part ?

✓ Simple Query
① → Nested → Correlated Nested Query
→ EXIST →

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

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)

Inner Query Using
the attribute [C.Pid]
of the Outer Query.

Inner Query
are Independent

Nested Query

Normal Nested
Query

Execution: Inner \rightarrow Outer
Query Query

Bottom \rightarrow Top

((Outer Query
WHERE - = (INNER
Query))

Correlated Nested
Query

OUTER \rightarrow INNER \rightarrow OUTER

TOP \rightarrow BOTTOM \rightarrow TOP.

Corelated Nested Query

sid who some
Red Color Parts.



Select C.sid

FROM Catalog C

WHERE EXISTS

SELECT Sid

FROM Catalog C

WHERE Pid IN

Select*

FROM Parts P

WHERE P.Pid = C.Pid

AND Color = Red

Inner Query using
Attributes defined in
the Outer Query

Outer Table [Catalog C]

Normal (Independent)
Nested Query

Note Before IN or NOT In Attribute is Required

Before EXIST & NOT EXIST No Attribute is Required

Corelated Nested Query

sid who some
Red Color Parts.



```
Select C.sid  
FROM Catalog C
```

WHERE EXISTS

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

WHEN

Inner Query using
Attributes defined in
the Outer Query

Outer Table [Catalog C].

Nested Queries

(Independent)
Normal Nest Query

Inner → Outer

Bottom → Top

Corelated Nested
Query

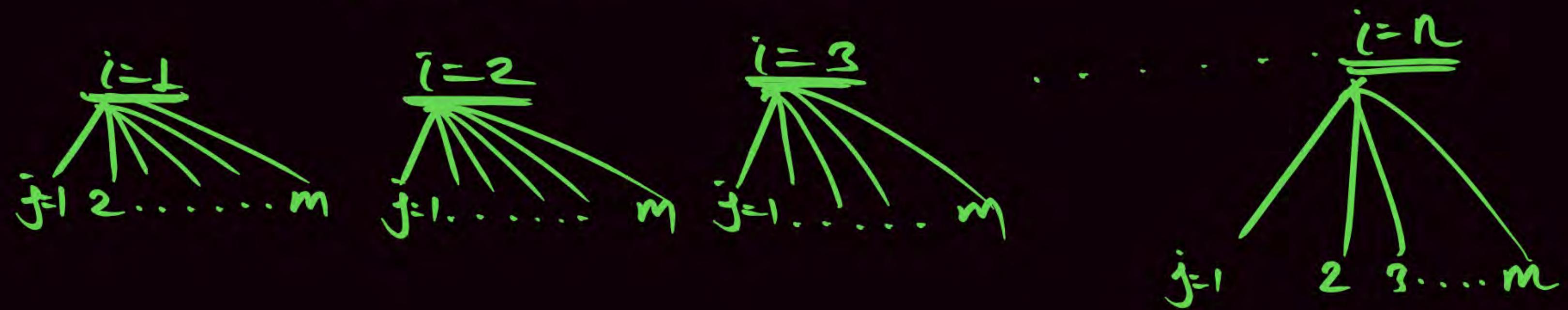
Outer → Inner → Outer

Top → Bottom → Top

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

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

TOP → Bottom → TOP
Outer → Inner → Outer



P
W

i = 1
((|))
J = 1...m

i = 2
((|))
J = 1...m

i = 3
((|))
J = 1...m

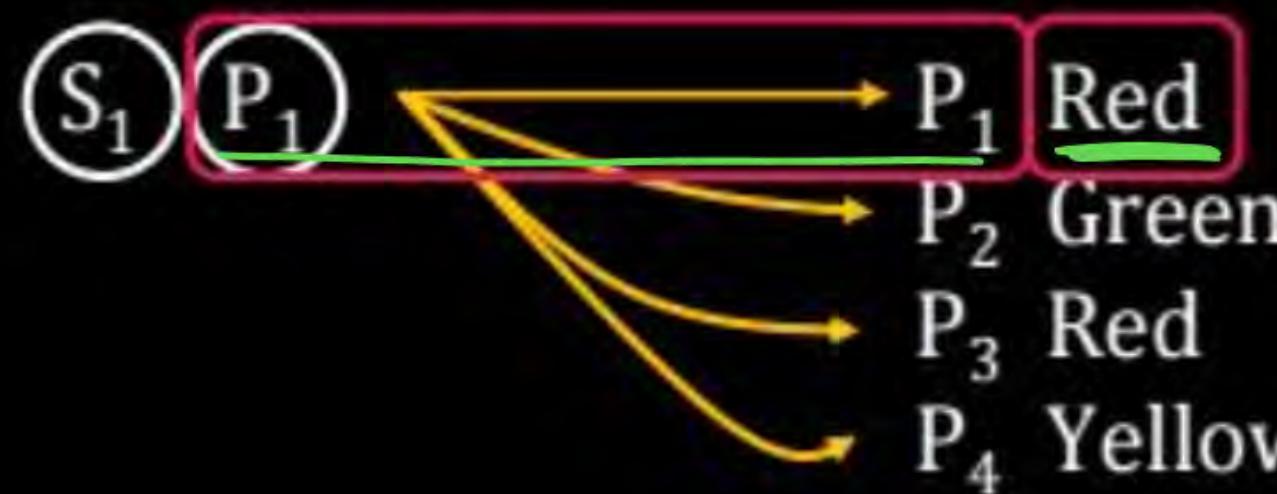
.....

i = n
((|))
J = 1...m

i = L j = L
 j = m.

Ist Iteration:

S₁, P₁



[Pid Match & color = Red]

1 Tuple Return

S₁

$C.Pid = P.Pid \text{ AND Color} = \text{Red}$

P_W

Catalog

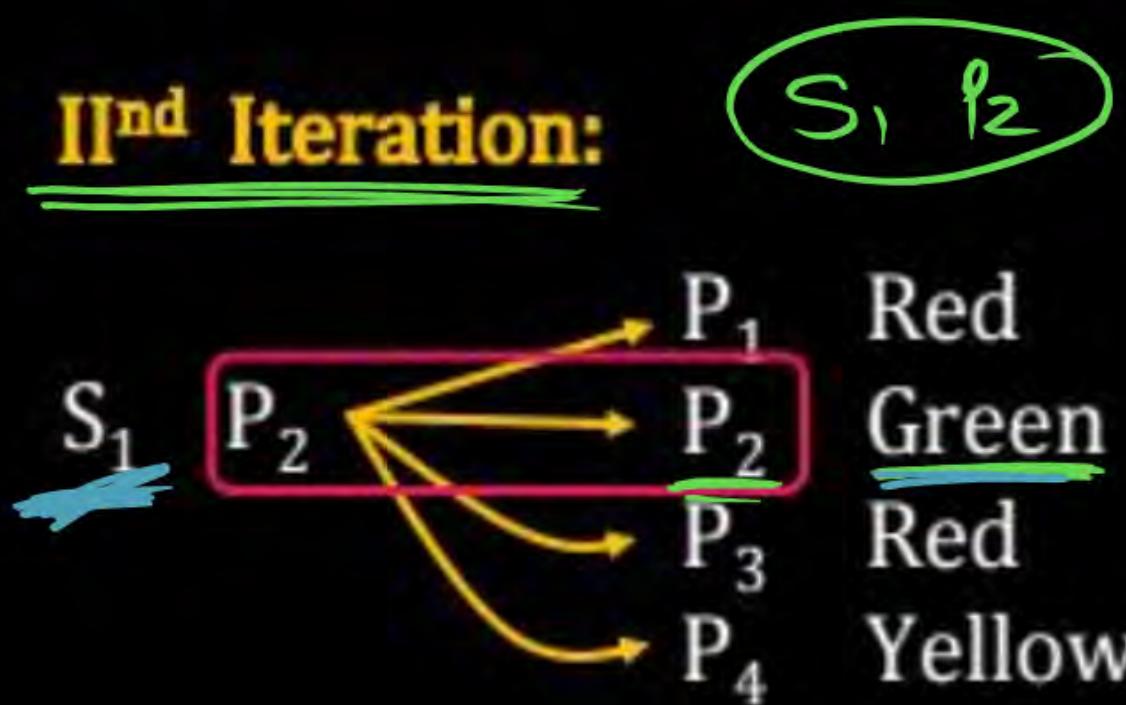
Sid	Pid
S ₁	P ₁
S ₁	P ₂
S ₂	P ₃
S ₄	P ₄

Parts

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

EXISTS: Return True, if Inner Query Result Non Empty.
 NOT EXIST: " True " Inner Query Result Empty

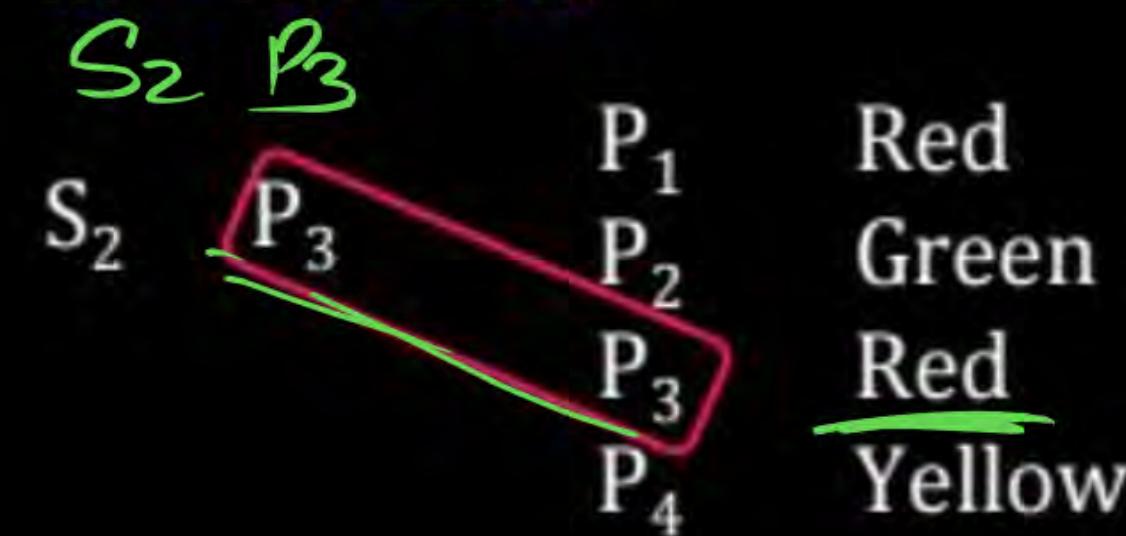
IInd Iteration:



[Pid Match but color not Red]

0 Tuple Return

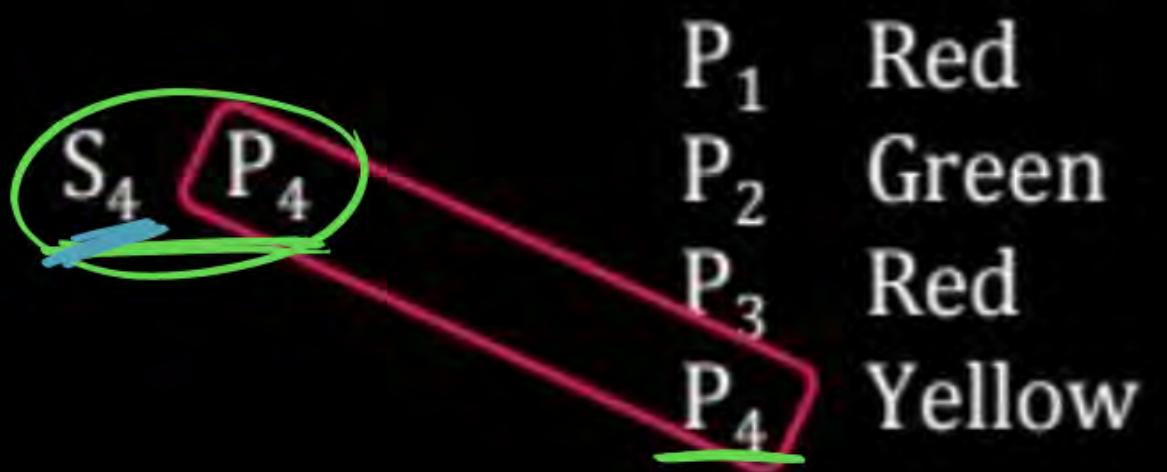
IIIrd Iteration:



[Pid Match & Color Red]

1 Tuple Return



IVth Iteration:

[Pid Match but color not Red]

0 Tuple Return

EXISTSo/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

Query II: Select Eid

FROM Emp E

WHERE NOT EXISTS

$$\left(\begin{array}{l} \text{Select *} \\ \text{FROM Dep D} \\ \text{WHERE E.Eid = D.Eid} \end{array} \right)$$

Which is true?

P
W

A) Q₁ ✓ Q₂ ✗

B) Q₂ ✓ Q₁ ✗

C) Q₁ ✓ Q₂ ✓

D) Q₁ ✗ Q₂ ✗

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:

$E_1 <> E_1 \rightarrow F$

$E_1 <> E_1 \rightarrow F$

$E_1 <> E_2 \rightarrow T$

$E_2 <> E_1 \rightarrow T$

$E_2 <> E_1 \rightarrow T$

$E_2 <> E_2 \rightarrow F$

$E_3 <> E_1 \rightarrow T$

$E_3 <> E_1 \rightarrow T$

$E_3 <> E_2 \rightarrow T$

$E_4 <> E_1 \rightarrow T$

$E_4 <> E_1 \rightarrow T$

$E_4 <> E_2 \rightarrow T$

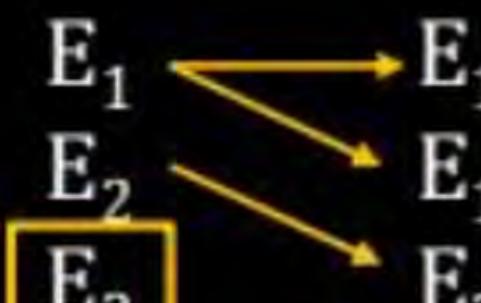
Output of Query I

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

Q.1

P
W

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:

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

.



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

Q9

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

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) ; $a = (1, 5, \text{null})$, $b = (1, \text{null}, 7)$, $c = (3, \text{null}, 9)$, $d = (4, 7, \text{null})$, $e = (1, 5, 7)$, $f = (3, 7, \text{null})$, $g = (4, \text{null}, 9)$. 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.

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

$T2 \leftarrow CR \div T1;$

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:

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

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?

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

[GATE-2019-CS: 2M]

MCQ ⑥

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;
```

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.

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

[GATE-2012-CS: 2M]

A 7

B 4

C 5

D 9

Q.9

**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)

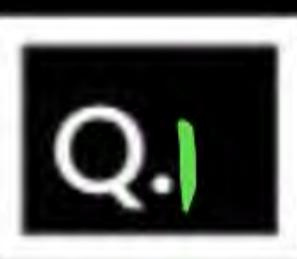
Database table by name Loan_Records is given below:
What is the output of the following SQL query?

```
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.12

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]

P
W

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

Consider the following relations:

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.14

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

Question Continues in Next Slide

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]

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.16

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. 7

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

P
W

```
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]

Q.18

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** $\Pi_B(r_1) - \Pi_C(r_2) \neq \phi$

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

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**20**

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

Any Doubt ?

**THANK
YOU!**

