



COMPUTER SCIENCE

Database Management System

Query Language

Lecture_3



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TOPICS
TO BE
COVERED

01

SQL Clauses

02

SQL Operators



BASIC operatorsSelection [σ]Projection [π]CROSS Product [\times]Union [\cup]Set Difference [$-$]Rename [ρ]Derived operator① Intersection [\cap]

② JOIN & its type

③ DIVISION

Division

- It is used to retrieve attribute value of R which has paired with every attribute value of other relation S.
- $\pi_{AB}(R)/\pi_B(S)$: It will retrieve values of attribute 'A' from R for which there must be pairing 'B' value for every 'B' of S.

$\pi_{AB}(R) / \pi_B(S)$: find A, for every B

Expansion of '/' by using basic operator

- Example: Retrieve sid's who enrolled every course.

- Result:

$$\pi_{sidcid}(\text{Enroll}) / \pi_{cid}(\text{Course})$$

Step 1: Sid's not enrolled every course of course relation.

(Sid's enrolled proper subset of course)

$$\pi_{sid}((\pi_{sid}(\text{Enroll}) \times \pi_{cid}(\text{course})) - \pi_{sidcid}(\text{Enroll}))$$

- Step 2:

[sid's enrolled every course] = [sid's enrolled some course] - [sid's not enrolled every course]

$$\therefore \pi_{sidcid}(E) / \pi_{cid}(C) = \pi_{sid}(E) - \pi_{sid}((\pi_{sid}(E) \times \pi_{cid}(C)) - \pi_{sidcid}(E))$$

find the Name

T_{Sname} [-----]

Condition
 \hookrightarrow Condition

Division

Q.

Retrieve all student who are Enrolled Some course or Any course or at least one course?

Solution

$\Pi_{\text{Sid}}(\text{Enrolled})$

Output



Sid
S ₁
S ₂
S ₃

Enrolled	
Sid	Cid
S ₁	C ₁
S ₁	C ₂
S ₁	C ₃
S ₂	C ₁
S ₂	C ₃
S ₃	C ₁

Course
Cid
C ₁
C ₂
C ₃

Division

Q.

Retrieve all student who are Enrolled every course?

Solution

$\Pi_{\text{Sid}, \text{Cid}} (\text{Enrolled}) / \Pi_{\text{Cid}} (\text{Course})$

Find

2nd attribute must be same.

sid
S₁

Enrolled	
Sid	Cid
S ₁	C ₁
S ₁	C ₂
S ₁	C ₃
S ₂	C ₁
S ₂	C ₃
S ₃	C ₁

Course
Cid
C ₁
C ₂
C ₃

Division

Q.

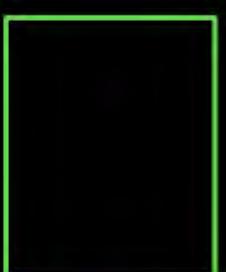
Retrieve all student who are Enrolled every course?

Solution

$\Pi_{\text{Sid}, \text{Cid}} (\text{Enrolled}) / \Pi_{\text{Cid}} (\text{Course})$

Find

2nd attribute must be same.



Enrolled	
Sid	Cid
S ₁	C ₁
S ₁	C ₂
S ₁	C ₃
S ₂	C ₁
S ₂	C ₃
S ₃	C ₁

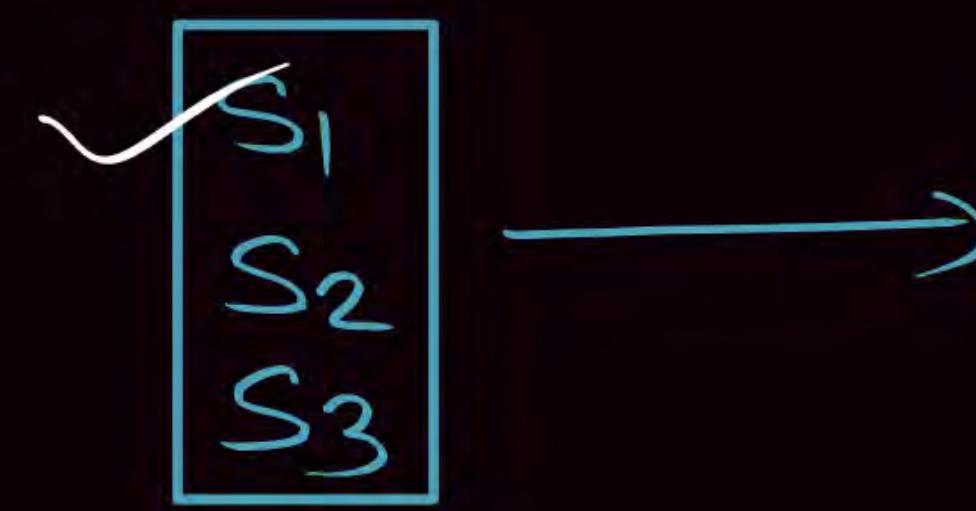
Course
Cid
C ₁
C ₂
C ₃

Enrolled
C₁
C₂
C₃

Enrolled/C₁

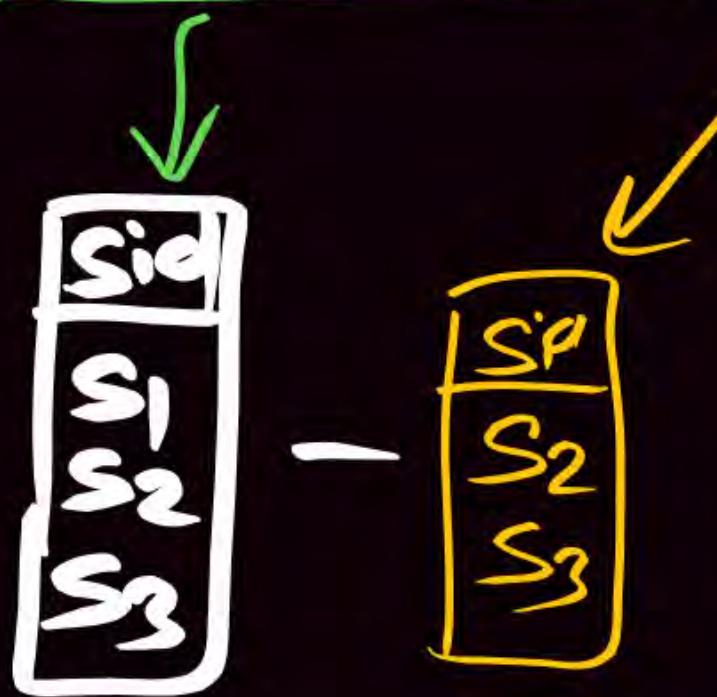
Enrolled
C₁
C₂

Enrolled
C₁
C₂
C₃



Ans[S₁].

$\Pi_{\text{Sid}}(\text{Enrolled}) - \Pi_{\text{Sid}}[\Pi_{\text{Sid}}(\text{Enrolled}) \times \Pi_{\text{cid}}(\text{Course}) - \text{Enrolled}]$



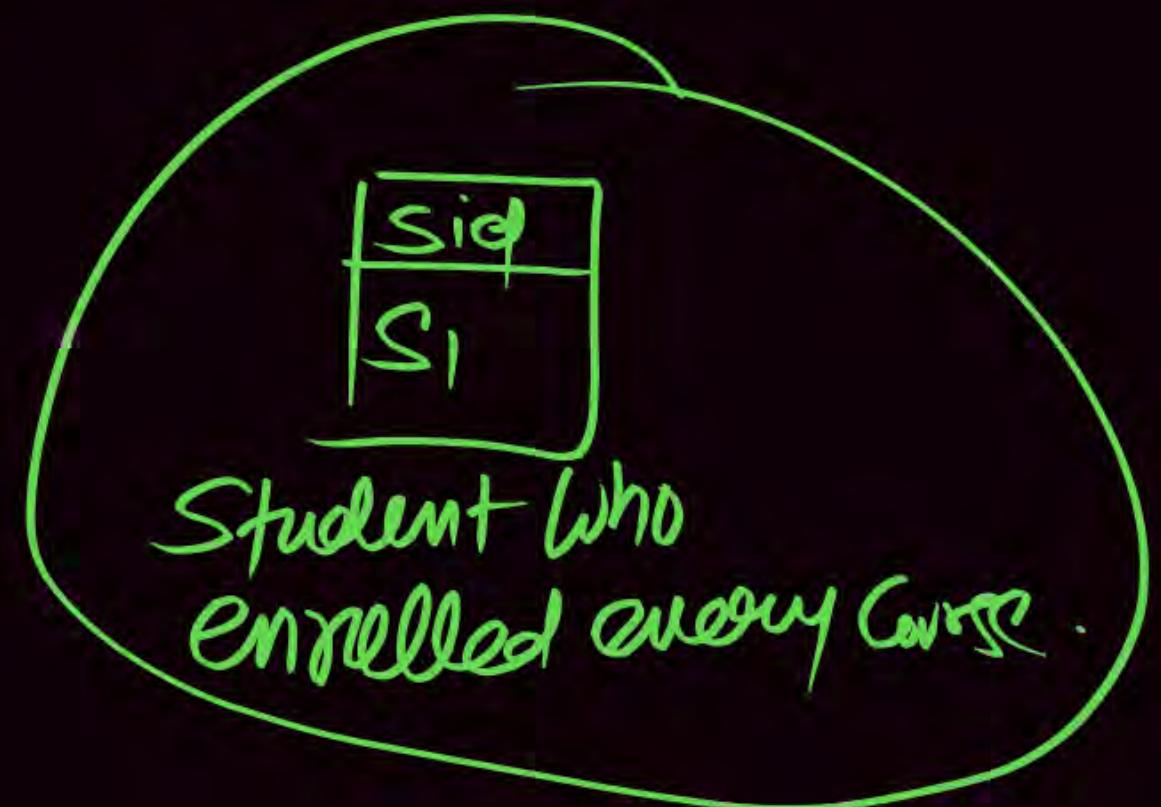
$$\begin{array}{|c|} \hline \text{Sid} \\ \hline S_1 \\ \hline S_2 \\ \hline S_3 \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{cid} \\ \hline C_1 \\ \hline C_2 \\ \hline C_3 \\ \hline \end{array}$$

$$\begin{array}{|c|c|} \hline \text{Sid} & \text{cid} \\ \hline S_1 & C_1 \\ \hline S_1 & C_2 \\ \hline S_1 & C_3 \\ \hline S_2 & C_1 \\ \hline S_2 & C_2 \\ \hline S_2 & C_3 \\ \hline S_3 & C_1 \\ \hline S_3 & C_2 \\ \hline S_3 & C_3 \\ \hline \end{array}$$

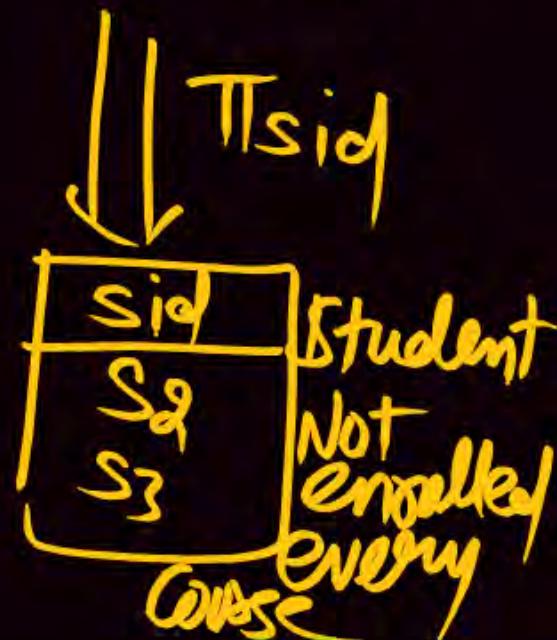
$$\begin{array}{|c|c|} \hline \text{Sid} & \text{cid} \\ \hline S_1 & C_1 \\ \hline S_1 & C_2 \\ \hline S_1 & C_3 \\ \hline S_2 & C_1 \\ \hline S_2 & C_3 \\ \hline S_3 & C_1 \\ \hline \end{array}$$

$$\begin{array}{|c|c|} \hline \text{Sid} & \text{cid} \\ \hline S_2 & C_2 \\ \hline S_3 & C_2 \\ \hline S_3 & C_3 \\ \hline \end{array}$$

These Student
Not enrolled
these course.



Universal Result
Every student enrolled
Every Course.



Q.

How to Find Name of Student Who
enrolled Every Course .

Sid
S1
S2
S3

Cid
C1
C2
C3

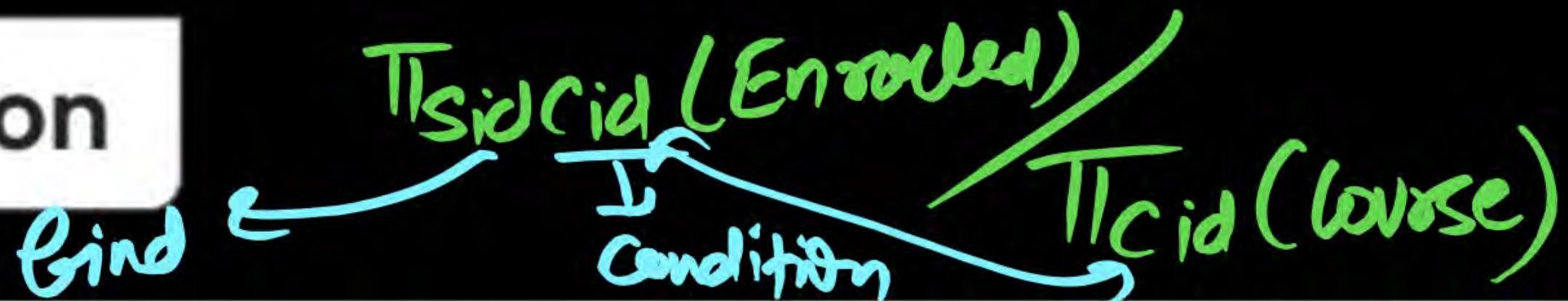
Division

$$\Pi_{\text{Sid}}(\text{Enrolled}) - \Pi_{\text{Sid}}[\Pi_{\text{Sid}}(\text{Enrolled}) \times \Pi_{\text{cid}}(\text{Course}) - \text{Enrolled}]$$


$$\Pi_{\text{Sid cid}}(\text{Enrolled}) / \Pi_{\text{cid}}(\text{Course})$$

Division

P
W



$$\Pi_{\text{Sid}}(\text{Enrolled}) - \Pi_{\text{Sid}}[\Pi_{\text{Sid}}(\text{Enrolled}) \times \Pi_{\text{Cid}}(\text{Course}) - \text{Enrolled}]$$

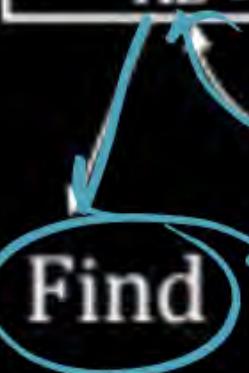
$$\frac{\Pi_{AB}(R)}{\Pi_B(S)} = \Pi_A(R) - \Pi_A[\Pi_A(R) \times \Pi_B(S) - R]$$

$$\frac{\Pi_{ABCD}(R)}{\Pi_{CD}(S)} = \Pi_{AB}(R) - \Pi_{AB}[\Pi_{AB}(R) \times \Pi_{CD}(S) - R]$$

:

Division

$$\Pi_{AB}(R) / \Pi_B(S) = \Pi_A(R) - \Pi_A[\Pi_A(R) \times \Pi_B(S) - R]$$

 Find Connection

$$\Pi_{ABCD}(R) / \Pi_{CD}(S) \Rightarrow \Pi_{AB}(R) - \Pi_{AB}[\Pi_{AB}(R) \times \Pi_{CD}(S) - R]$$

Q.

Consider the following three relations in a relational database:

P
W

Employee (eId, Name), Brand (bId, bName), Own(eId, bId)

Which of the following relational algebra expressions return the set of eIds who own all the brands?

[GATE: 2022]

A

$$\pi_{eId} (\pi_{eId, bId} (Own) / \pi_{bId} (Brand))$$

B

$$\pi_{eId} (Own) - \pi_{eId} ((\pi_{eId} (Own) \times \pi_{bId} (Brand)) - \pi_{eId, bId} (Own))$$

C

$$\pi_{eId} (\pi_{eId, bId} (Own) / \pi_{bId} (Own))$$

D

$$\pi_{eId} ((\pi_{eId} (Own) \times \pi_{bId} (Own)) / \pi_{bId} (Brand))$$

Brand

bid Name
b ₁ AT
b ₂ WC

Own

eid	bid
e ₁	b ₁
e ₁	b ₂
e ₂	b ₁
e ₃	b ₁
e ₃	b ₂

Consider the two relation Suppliers and Parts are given below.

Suppliers Parts

S _{no}	P _{no}
P _{no}	
S ₁	P ₁
S ₁	<u>P₂</u>
S ₁	P ₃
S ₁	<u>P₄</u>
S ₂	P ₁
S ₂	<u>P₂</u>
S ₃	<u>P₂</u>
S ₄	<u>P₂</u>
S ₄	<u>P₄</u>

~~Supplier~~
~~P₂~~

~~Supplier~~
~~P₂~~
~~P₄~~

S₁
S₂
S₃
S ₄



S ₁
S ₄

2 Ans

$$\pi_{S_{no} P_{no}}(\text{Suppliers}) / \pi_{P_{no}}(\text{Parts})$$

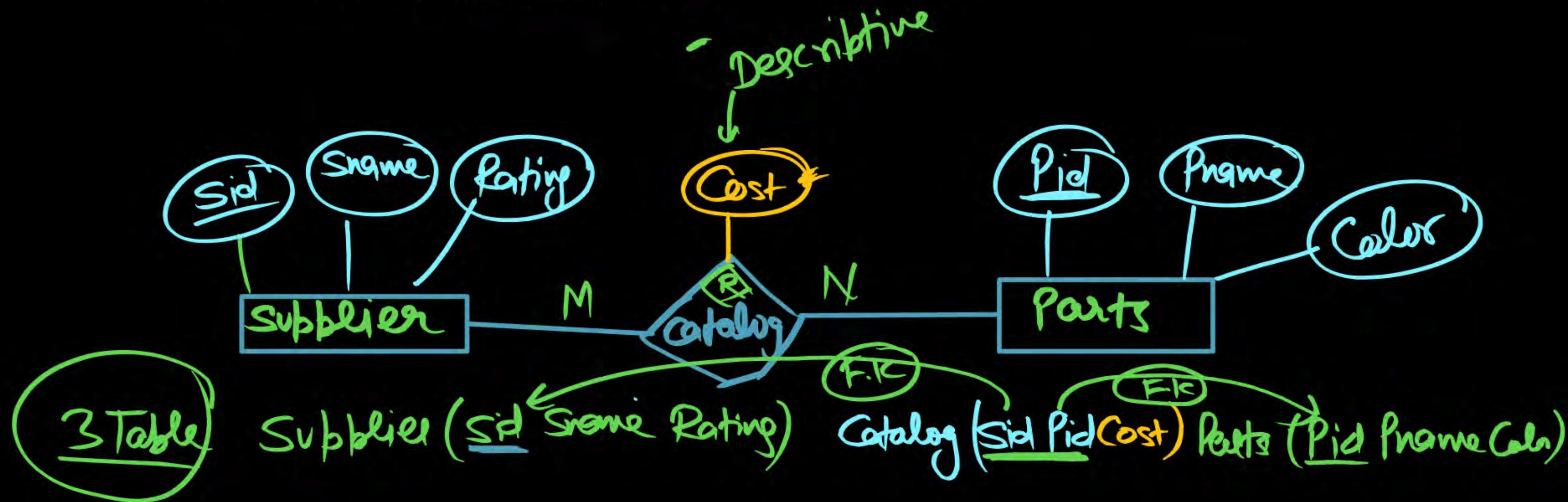
The number of tuples are there in the result when the above relational algebra query executes is ____.

Consider the Database with relations:

S Supplier (Sid, Sname, Rating)

P Parts (Pid, Pname, Color)

S Catalog (Sid Pid, Cost)



Consider the Database with relations:

S	Supplier (<u>Sid</u> , Sname, Rating)
P	Parts (<u>Pid</u> , Pname, Color)
S	Catalog (<u>Sid</u> <u>Pid</u> , Cost)

Q.1

Find the Sid of Supplier whose Rating greater than 9?

$$\pi_{\text{Sid}} \left[\sigma_{\text{Rating} > 9} (\text{Supplier}) \right]$$



Find the Pid of Red Color Parts?



$\text{TrPid} \left[\text{Color = Red (Parts)} \right]$

Q.3

Retrieve Sid of Supplier whose cost is greater than 20,000?

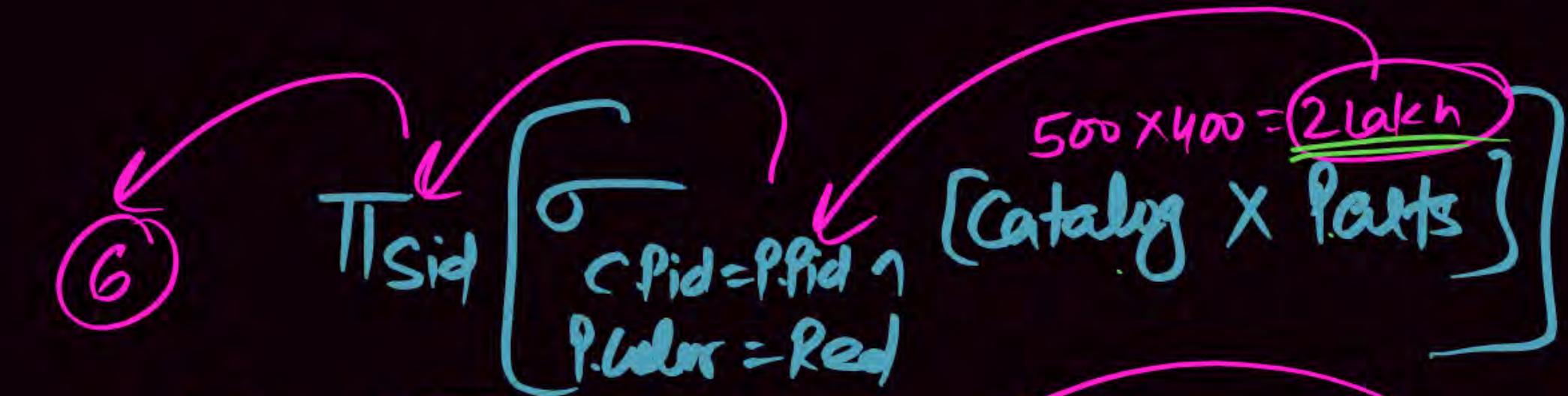
P
W

$$\pi_{\text{Sid}} \left(\sigma_{\text{Cost} > 20000} [\text{Catalog}] \right)$$

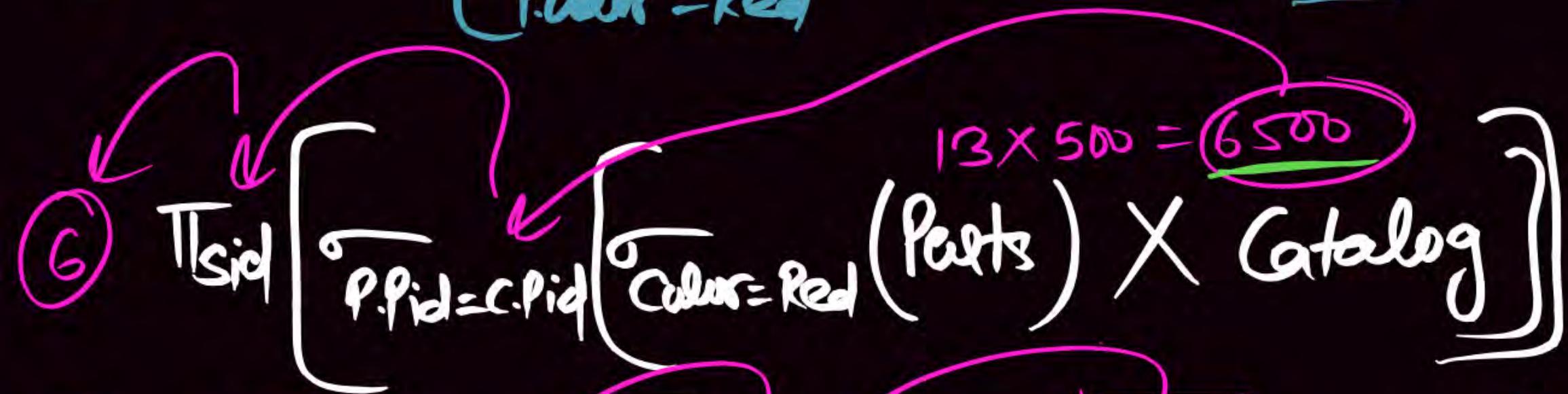
Q.4

Find Sid of the Sublier who Supplied Some Red Color Parts ?

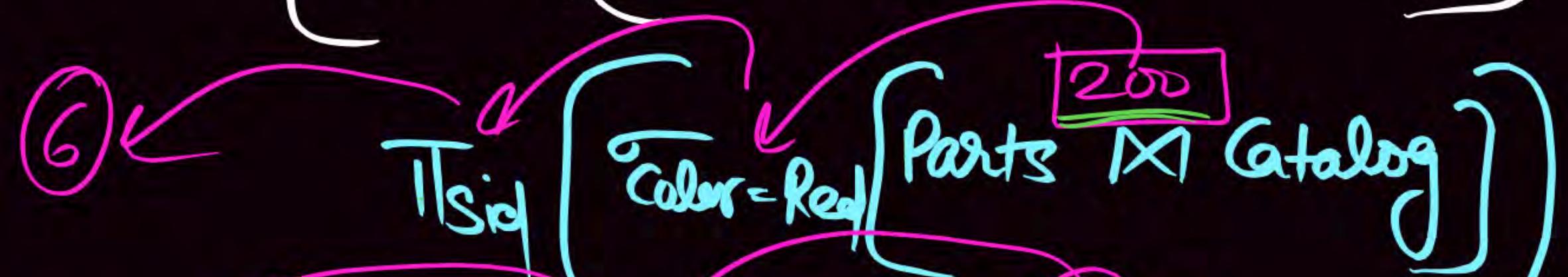
Query I:



Query II



Query III



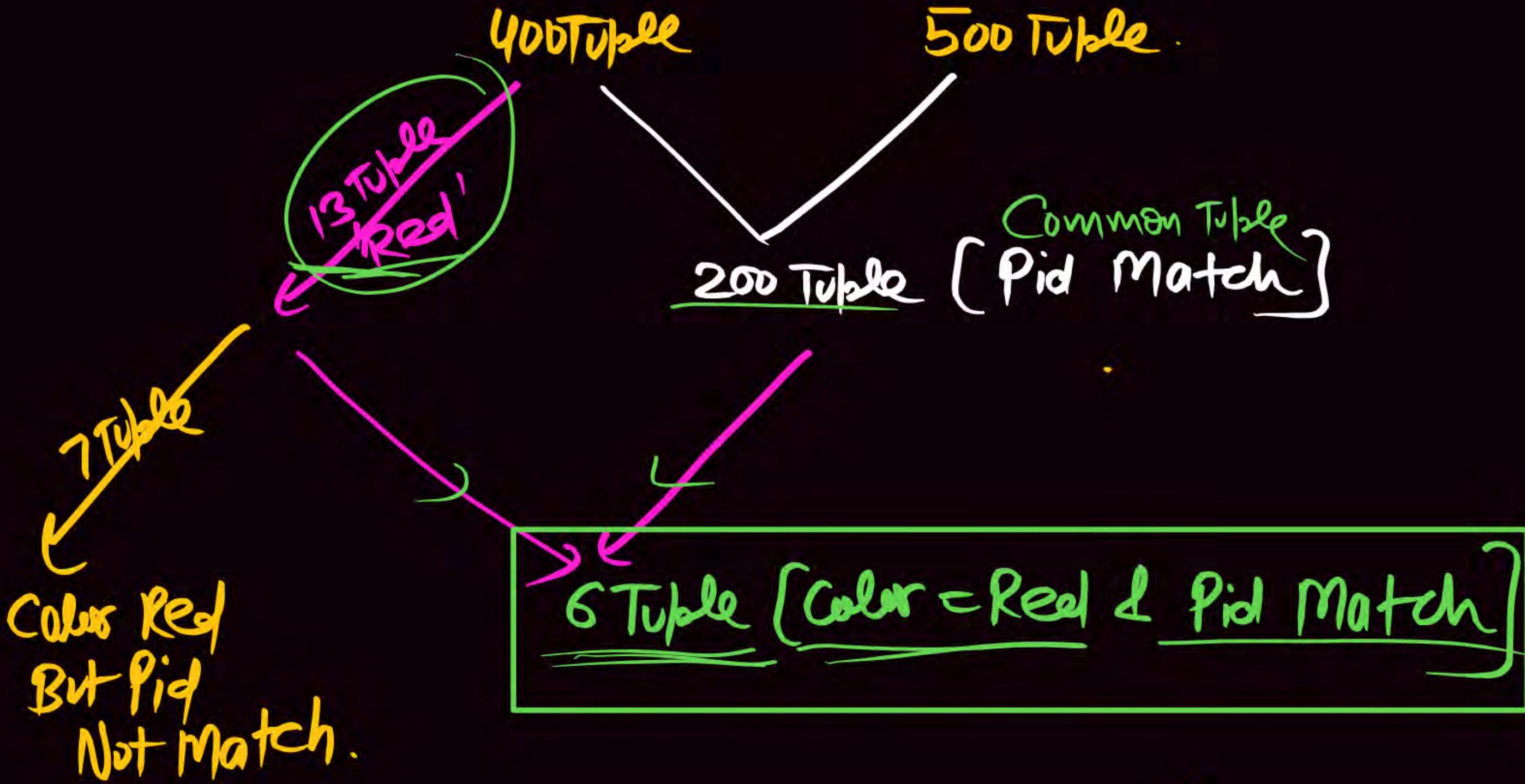
optimized

Query IV



Parts

Catalog



Q.

Retrieve Sid of Supplier who supplied some Red color parts?

P
W

Solution:

$$\Pi_{\text{Sid}} \left[\begin{array}{l} \sigma_{P.PId = CPid} \wedge (\text{Catalog} \times \text{Parts}) \\ P.Color = \text{Red} \end{array} \right]$$

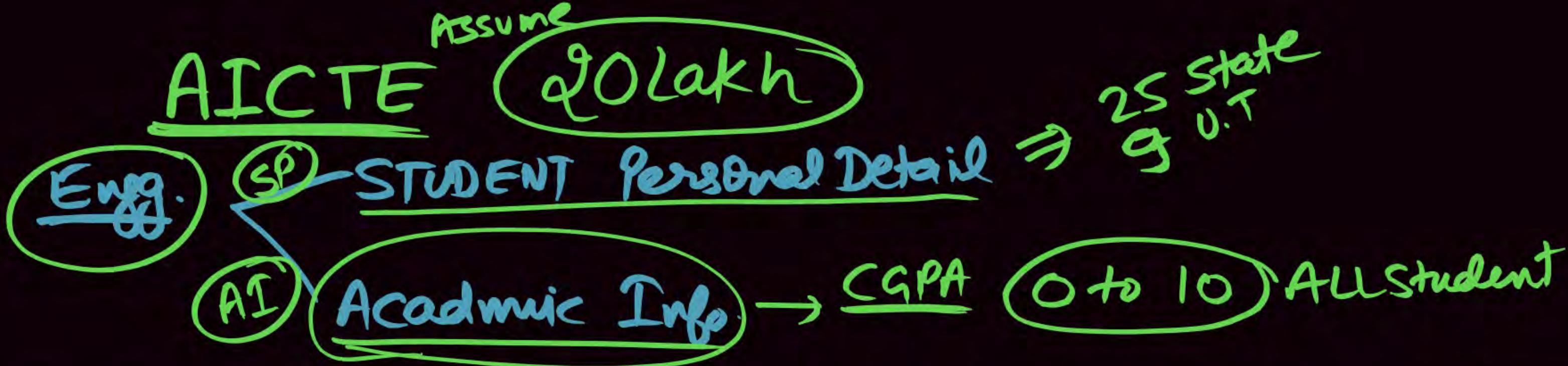
Note: Let an Attribute A belongs to R only then

$$\sigma_{A = 'a'} (R \bowtie S) = \sigma_{A = 'a'} (R) \bowtie S \rightarrow \text{More efficiency query}$$

Note: Let an Attribute A belongs to R only and Attribute B belongs to S only then

$$\sigma_{A = 'a' \wedge B = 'b'} (R \bowtie S) = \sigma_{A = 'a'} (R) \bowtie \sigma_{B = 'b'} (S)$$

Most efficient
Query



WB & CGPA > 9



Best Query

TTsname {
 $State = WB \wedge CGPA \geq 9$ } \wedge (SP \bowtie AI)

Q.

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:

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

Q.

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
 $R_2(A, C) = (1, 7)(4, 9)$

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

P
W

Q.

Consider the following relations given below:

P
W

R

A	B
6	6
7	6
8	8

S

C	D
6	7
8	9
8	10

$$\Pi_{AD}(R \times S) - P_{A \leftarrow B}(\Pi_{BD}(R \bowtie_{B=C} S))$$

Number of tuples return by the above query when it is executed on the above instance of relation R and S is __

Summary

OPERATION	PURPOSE	NOTATION
SELECT ✓	Selects all tuples that satisfy the selection condition from a relation R.	$\sigma_{\langle \text{selection condition} \rangle}(R)$
PROJECT ✓	Produces a new relation with only some of the attributes of R, and removes duplicate tuples.	$\pi_{\langle \text{attribute list} \rangle}(R)$
THETA JOIN ✓	Produces all combinations of tuples from R_1 and R_2 that satisfy the join condition.	$R_1 \bowtie_{\langle \text{join condition} \rangle} R_2$
EQUIJOIN ✓	Produces all the combinations of tuples from R_1 and R_2 that satisfy a join condition with only equality comparisons.	$R_1 \bowtie_{\langle \text{join condition} \rangle} R_2$, OR $R_1 \bowtie_{[\langle \text{join condition 1} \rangle, \langle \text{join condition 2} \rangle]} R_2$
NATURAL JOIN	Same as EQUIJOIN except that the join attributes of R_2 are not included in the resulting relation; if the join attributes have the same names, they do not have to be specified at all.	$R_1 *_{\langle \text{join condition} \rangle} R_2$, OR $R_1 *_{[\langle \text{join attributes 1} \rangle, \langle \text{join attributes 2} \rangle]} R_2$ OR $R_1 * R_2$

OPERATION	PURPOSE	NOTATION
UNION	Produces a relation that includes all the tuples in R_1 or R_2 or both R_1 and R_2 ; R_1 and R_2 must be union compatible.	$R_1 \cup R_2$
INTERSECTION	Produces a relation that includes all the tuples in both R_1 and R_2 ; R_1 and R_2 must be union compatible.	$R_1 \cap R_2$
DIFFERENCE	Produces a relation that includes all the tuples in R_1 and that are not in R_2 ; R_1 and R_2 must be union compatible.	$R_1 - R_2$
CARTESIAN PRODUCT	Produces a relation that has the attributes of R_1 and R_2 and includes as tuples all possible combinations of tuples from R_1 and R_2 .	$R_1 \times R_2$
DIVISION	Produces a relation $R(X)$ that includes all tuples $t[X]$ in $R_1(Z)$ that appear in R_1 in combination with every tuple from $R_2(Y)$, where $Z = X \cup Y$	$R_1(Z) \div R_2(Y)$

NAT

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 4 Ans.

[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

~~CR/CA~~

SA
SC
SD
SE
SF

~~CR/CA
CB~~

SA
SC
SD
SE
SF

~~CR
CA
CB
CC~~

SA
SC
SD
SE
SF



T2/CA
CB
CC
CD

SD

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

empAge(empNo, age)

Consider the following relational algebra expression:

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

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]

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

SQL[Structured Query Language]

- DDL(Data Definition Language): Modification allowed at schema (Definition) level
 - CREATE
 - ALTER
 - DROP TABLE
- DML(Data Manipulation Language): Modification allowed at data level
 - INSERT
 - UPDATE
 - DELETE
- DCL(Data Control Language): Control Transactional Operation
 - COMMIT
 - ABORT
- DQL(Data Query Language): Used to Retrieve the Data from DB
 - SELECT
 - FROM
 - WHERE

SQL

R.A

SELECT [DISTINCT] A₁ A₂ A₃ A_n... ≡ Projection (π)FROM R₁ R₂ R₃..... R_m ≡ CROSS Product (x)WHERE Condition ≡ Selection [σ]

R.A: $\pi_{A_1 A_2 A_3 .. A_n} [\sigma_{\text{Condition}} (R_1 \times R_2 \times R_3 \dots \times R_m)]$

Select: Not going to eliminate Duplicate Value.

1) SELECT AB Output
FROM R

A	B
1	2
1	2
2	4

2) $\pi_{AB}(R)$



A	B
1	2
2	4

3) SELECT [DISTINCT] AB Output
FROM R

A	B
1	2
2	4

R(A B C)

A	B	C
1	2	3
1	2	4

SQL Clauses

```
SELECT [DISTINCT] A1 A2 A3...An
      [ ] ← Optional clause
      FROM R1 R2 R3...Rm
      [WHERE P]
      [GROUP By Attribute [[HAVING Condition]]]
      [ORDER By Attribute [[DESC]]]
```

Query Execution

- (1) FROM Clause: It is the first executable Clause. It just simply Relation (or) CROSS Product of Two or more Relation
- (2) WHERE Clause: It is the second executable clause. It selects the tuple based on specified condition.
- (3) GROUP By Clause: It is the third executable clause if used in the query. It groups the table based on the specified attributes.

Sid	(Branch)	Marks
S ₁	CS	90
S ₂	IT	70
S ₃	CS	70
S ₄	EC	56
S ₅	CS	NULL

GROUP By
(Branch) →

Sid	(Branch)	Marks
S ₁	CS	90
S ₃	CS	70
S ₅	CS	NULL
S ₂	IT	70
S ₄	EC	56

Aggregation operator \Rightarrow Always Discard Null Value

- | | |
|---------------------------------|---|
| 1) COUNT ([DISTINCT] Attribute) | 1) Count(marks) = 4 |
| 2) SUM ([DISTINCT] Attribute) | 2) Count (*) = 5 |
| 3) AVG ([Distinct] Attribute) | 3) Count ([DISTINCT]marks) = 3 |
| 4) MIN (Attribute) | 4) SUM(marks) = 286 |
| 5) MAX (Attribute) | 5) SUM([Distinct]marks) = 216 |
| | 6) $AVG(marks) = \frac{286}{4}$ |
| | 7) $AVG([Distinct]marks) = \frac{216}{3}$ |

$$\frac{\text{SUM[DISTINCT]marks}}{\text{COUNT[DISTINCT]marks}} \Rightarrow \frac{216}{3}$$

Aggregation operator \Rightarrow Always Discard Null Value

- 1) COUNT ([DISTINCT] Attribute)
- 2) SUM ([DISTINCT] Attribute)
- 3) AVG ([Distinct] Attribute)
- 4) MIN (Attribute)
- 5) MAX (Attribute)

- 1) Count(marks) =
- 2) Count (*) =
- 3) Count ([DISTINCT]marks) =
- 4) SUM(marks) =
- 5) SUM([Distinct]marks) =
- 6) AVG(marks) =
- 7) AVG([Distinct]marks) =

HAVING: Fourth executable clause (if used in query).

It is used to select the group which satisfy the condition (condition is for each group).

STUDENT

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

(GROUP By
Branch)

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

Select * FROM STUDENT
GROUP By (Branch)
HAVING AVG(Marks) > 61

Sid	Branch	Marks
S ₁	CS	60
S ₃	CS	90
S ₂	IT	70
S ₄	IT	60

Q.1 Select min(marks)

FROM Student

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.2 Select min(marks)

FROM Student

WHERE Branch = 'CS'

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: 60

Q.3 Select min(marks)

FROM Student

GROUP By (Branch)

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

Q.3 Select min(marks)
FROM Student
GROUP By (Branch)

60
60
55

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

Q.4

Select min(marks), Branch
FROM Student



Q.4 Select min(marks), Branch
 FROM Student

→ Such Syntax is not allowed in SQL

CS
IT
CS
IT
EC
EC

NOTE:

When aggregate operator & other Attribute used in select clause is
Allowed only if other attribute must be in Group of Clause.

Select min (marks) Branch

FROM Student

GROUP By (Branch)

Q. Select min(A) B
FROM R

Group By (C) ✗

Group by (B) ✓

- OTHER Set Operator
- | | |
|------------------------------|--------------|
| Followed by | Not followed |
| R.A ↓ | By R.A↓ |
| 1) UNION / UNION ALL | |
| 2) INTERSECT / INTERSECT ALL | |
| 3) MINUS / MINUS ALL | |

R	S
1	1
1	1
1	2
2	4
2	5
4	5
6	
6	

1) R UNION S

↳ Result Distinct
tuple

1
2
4
6
5

2) R UNION ALL S

↳ Result all values

1
1
1
2
2
4
6
6
1
1
2
4
5
5

3) R INTERSECT S

↳ Distinct Common tuples from R & S

1
2
4

4) R INTERSECT ALL S

↳ How many maximum number of times Common in both R & S

1
1
2
4

4) R MINUS S

Distinct tuples from R

those are not there in S

6

5) R MINUS ALL S

↳ # Duplicates - # Duplicates
in R in S

1
2
6
6

Q.

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



Query I: Select Sid max(Marks)
From Student

Note: Aggregate function can not be
in lower clause

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

Query III: Select Sid marks
From Student
Where marks =

$$\left(\begin{array}{l} \text{Select max(Marks)} \\ \text{From Student} \end{array} \right)$$

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.

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:

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

$(x > 10) \text{ AND } (x > 20) \text{ AND } (x > 30)$ $\xrightarrow{\text{output}}$ 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 <> Delhi AND
turnover > ANY (Select turnover
From Supplier
Where City = 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.

ALL: (WHERE City = Delhi)

↓ output

Sname
D

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

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

B, C, D

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

Query I:

Select
 From
 WHERE
 $dno <> 5$

AND

Eid
 Emp
 $30k, 50k$
 $Salary > \text{ANY} \left(\begin{array}{l} \text{Select Salary} \\ \text{From Emp} \\ \text{Where } dno=5 \end{array} \right)$

output

Eid
E_4
E_5

Query II:

Select
 From
 WHERE
 $dno <> 5$

AND

Eid
 Emp
 $30k, 50k$
 $Salary > \text{min}(\text{Salary}) \text{ of employees in department } 5$
 $\text{All employee of } dno = 5$

output

Eid
E_4
E_5

Query I:

Select
From
WHERE
 $dno <> 5$

AND

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

output

Eid
E_5

Query II:

Select
From
WHERE
 $dno <> 5$

AND

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

output

Eid
E_5

Supplier (Sid, Sname, Rating)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost)

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

Q.

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

P
W

Query I:

Select
From

Sid
Catalog C, Parts P

output

A diagram illustrating the output of a query. On the left, the query is shown: "Select Sid From Catalog C, Parts P". An arrow labeled "output" points to the right, where a rectangular box contains two lines of text: "S₁" and "S₂". This represents the result set of the query, which consists of two supplier identifiers.

S ₁
S ₂

WHERE
P.Pid = C.Pid

Color = Red

Query II:

Select Sid
From Catalog

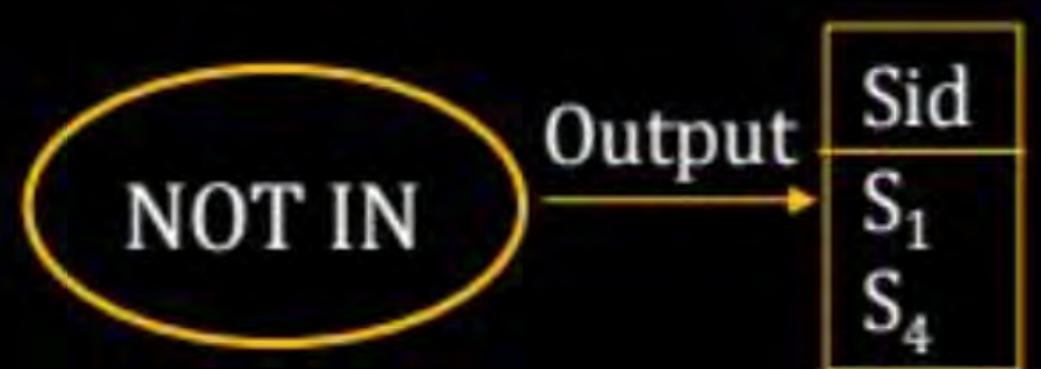
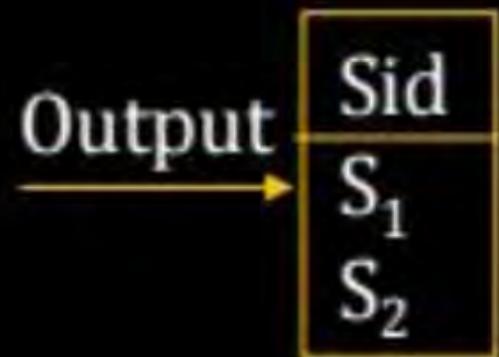
WHERE Pid = $\left(\begin{array}{l} \text{Select Pid} \\ \text{FROM Parts} \\ \text{WHERE Color = Red} \end{array} \right)$

Pid
P ₁
P ₃

→ One to many
Comparison not
Directly allowed

Query III:

Select Sid
FROM Catalog
WHERE Pid



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)
```

The diagram illustrates the correlation between the outer query and the inner query. Two yellow arrows point from the 'C.Sid' and 'C' in the outer query to the 'P.Pid' in the inner query. The first arrow originates from the 'C.Sid' and points to the first 'P.Pid'. The second arrow originates from the 'C' and points to the second 'P.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

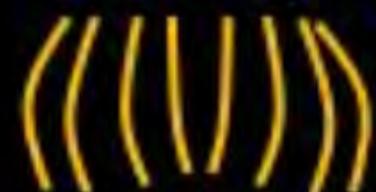
Bottom → Top

Corelated Nested
Query

Outer → Inner → Outer

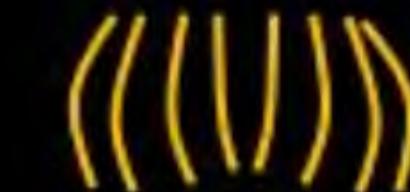
Top → Bottom → Top

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

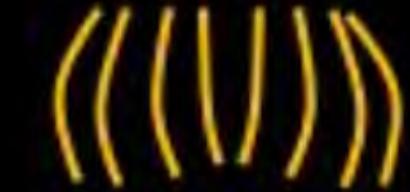
i = 1

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
W

A) 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:

$E_1 <> E_1 \rightarrow F$

$E_1 <> E_1 \rightarrow F$

$E_1 <> E_2 \rightarrow T$

$E_2 <> E_1 \rightarrow T$

$E_2 <> E_1 \rightarrow T$

$E_2 <> E_2 \rightarrow F$

$E_3 <> E_1 \rightarrow T$

$E_3 <> E_1 \rightarrow T$

$E_3 <> E_2 \rightarrow T$

$E_4 <> E_1 \rightarrow T$

$E_4 <> E_1 \rightarrow T$

$E_4 <> E_2 \rightarrow T$

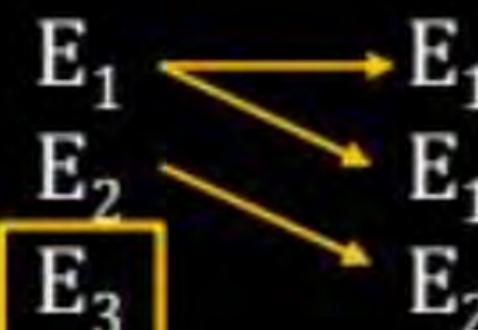
Output of Query I

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.

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

Q.

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

P
W

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:

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

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?

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

[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;
```

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.

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)

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

P
W

Q.

SELECT operation in SQL is equivalent to

[MCQ: 2015-1M]

P
W

- 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		
sNo	sName	dNo
S01	James	D01
S02	Rocky	D01
S03	Jackson	D02
S04	Jane	D01
S05	Milli	D02

Dept	
dNo	dName
D01	CSE
D02	EEE

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

Register	
sNo	cNo
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]

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]

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!**

