NOC24-CS75
Data Base Management System

Tutorial by: Adwait P. Parsodkar
Week - 3

Consider the following instance of the relation MovieBooking(MovieName, TheatrID, HallNo, Glasses3D, MLanguage, ShowtimeID, ShowDay)

Question - 1

MovieBooking						
MovieName	TheatrID	HallNo	Glasses3D	MLanguage	ShowtimeID	ShowDay
The Martian	Inx K	2	Yes	English	12	Monday
Interstellar	Iks B	4	Yes	English	15	Wednsday
Gravity	Bssr K	1	No	Hindi	178	Wednesday
Gravity	Bssr K	4	No	English	24	Thursday
Inception	Inx K	3	Yes	English	13	Friday

Which of the following MovieNames are produced by the Relational Algebra expression given below?

$\Pi_{\text{MovieName}}(\sigma_{\text{HallNo}>2 \wedge \text{MLanguage}='\text{English}'}(\text{MovieBooking})) \cap$
$\Pi_{\text{MovieName}}(\sigma_{\text{Glasses3D}='\text{Yes}'}(\text{MovieBooking}))$

a) The Martian

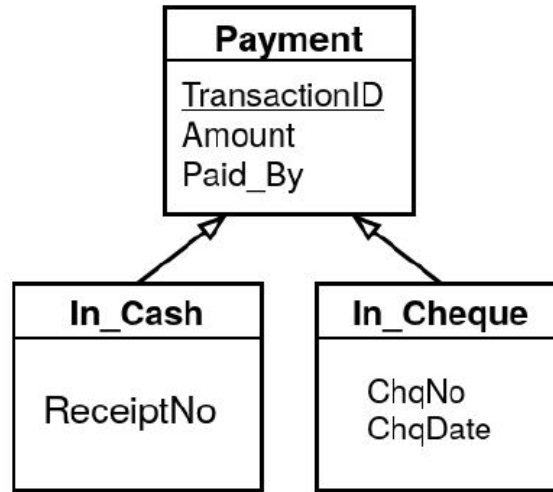b) Interstellar

c) Gravity

d) Inception

Solution - 1

Solution: (b) and (d)

Interpretation:

What are all the that have HallNo > 2 and are in English language and are 3D?

Consider the following Entity Relationship Diagram:

Question - 2

If n[Payment] is the number of attributes present in the relational schema of Payment, n[In_Cash] is the number of attributes present in the relational schema of In_Cash and n[In_Cheque] is the number of attributes present in the relational schema of In_Cheque, which of the following options can NOT be true?

a) n[Payment] = 6

b) n[In_Cheque] = 6

c) n[In_Cash] = 4

d) n[In_Cheque] = 3

Solution - 2

Solution: (a) and (b)

(a)   is incorrect since Payment cannot inherit attributes of In_Cash and In_Cheque

(b)   is incorrect because the maximum attributes In_Cheque can have even after inheriting all the attributes from Payment is 5

(c)   is correct since In_Cash can inherit all 3 attributes from Payment to have 4 attributes.

(d)   is correct since In_Cheque can inherit only the key of Payment to have 3 attributes.

Consider the Entity Relationship diagram:

Question - 3
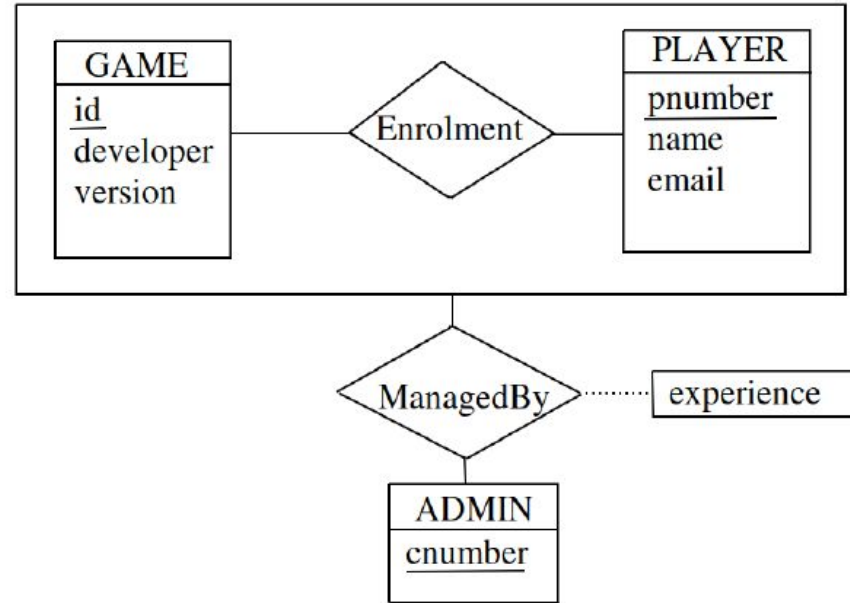
Which attribute will not be present in the schema of `ManagedBy`?

a) cnumber

b) id

c) experience

d) Enrolment

Solution - 3

Solution: (d)

In Aggregation, the schema representation contains the primary keys of the relationship set, associated entity and any descriptive attribute that is present. Here, the primary keys of the relationship set Enrolment are id and pnumber. That of the associated entity ADMIN is cnumber and the descriptive attribute is experience.

Question - 4

In a company, the `Building` relation maintains information about the `BuildingLocation`, `BuildingFloors`, `BuildingType` and `BuildingColor`.
What will be the Domain Relational Calculus expression to obtain the `BuildingLocation`s of those `Buildings` whose `BuildingColor` is "Gray"?

a) $\{p \mid \exists n, t, c \ (<n,t,c> \in Building \wedge c="Gray")\}$

b) $\{p \mid \exists n, t, c \ (n,t,c \in Building \wedge c="Gray")\}$

c) $\{<p> \mid \exists n, t, c \ (p,n,t,c \in Building \vee c="Gray")\}$

d) $\{<p> \mid \exists n, t, c \ (<p,n,t,c> \in Building \wedge c="Gray")\}$

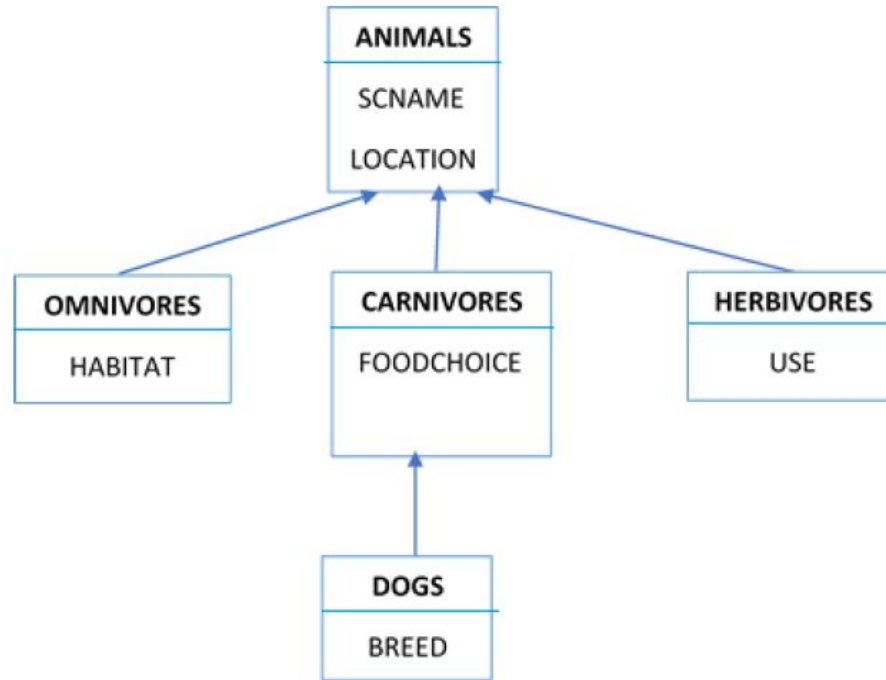# Solution - 4

Solution: (d)

According to the syntax and semantics of Tuple Relational Calculus.

Consider the Entity Relationship diagram:
Which of the following statement(s) is/are TRUE?

Question - 5

ANIMALS
SCNAME
LOCATION

OMNIVORES
HABITAT

CARNIVORES
FOODCHOICE

HERBIVORES
USE

DOGS
BREED

a) DOGS inherit the attributes of CARNIVORES but not of ANIMALS.

b) DOGS inherit the attributes of CARNIVORES and ANIMALS.

c) CARNIVORES inherit the attributes of DOGS but not of OMNIVORES.

d) ANIMALS inherit the attributes of CARNIVORES, OMNIVORES, HERBIVORES and DOGS.

Solution - 5

Solution: (b)

Question - 6

In a company, a **Handicraft** is made by multiple **Artisans** and an **Artisan** makes multiple **Handicrafts**. The **Handicrafts** are identified by their unique **Tags**. A **Handicraft** is made of a particular **Material** and is multi- **Colored**. An **Artisan** has a unique **ID**. Assuming there is a **Creates** relation between **Handicraft** and **Artisan**, what will be the correct schema for **Creates** and **Handicraft**?

a) `Creates(Tag, ID)`
   `Handicraft(Tag, Material, Color)`

b) `Creates(ID)`
   `Handicraft(Tag Material)`
   `Handicraft_color(Tag, Color)`

c) `Creates(Tag, ID, Color)`
   `Handicraft(Tag, Material)`

d) `Creates(Tag, ID)`
   `Handicraft(Tag, Material)`
   `Handicraft_color(Tag, Color)`

Solution - 6

Solution: (d)

Justification: In many-to-many relation, the relation Creates should have the primary keys of the participating entities and since Color is multivalued, a separate schema has to be created named Handicraft color.

Question - 7

Consider 2 instances:

Chapter		
PageNumber	Topic	Length
11	Introduction	5
20	SQL	136
33	RA	567
40	FD	898
33	ERD	204

Paragraph	
PageNumber	Topic
20	SQL
33	RA

Which PageNumber is not produced by the following Relational Algebra?

$$\Pi_{\text{Chapter.PageNumber}}((\Pi_{\text{PageNumber,Topic}}(\text{Chapter}) - \text{Paragraph}) \times \text{Paragraph})$$

a) 11

b) 40

c) 20

d) 33

Solution - 7

Solution: (c)

Question - 8

An organization, collecting car renters' information, considers the following relations:

```
Renter(Renter_ID, Contact)
Renting(Renter_ID, Car_Number)
Car(Car_Number, Model).
```

What will the following relational algebra expression return to the organization?

$$\Pi_{Car\_Number}(Car) - \Pi_{Car\_Number}(Renter \bowtie Renting)$$

a) The Car_Number of those Cars that are rented by at most one Renter.

b) The Car_Number of those Cars that are rented by at least one Renter.

c) The Car_Number of those Cars that are rented by all Renters.

d) The Car_Number of those Cars that are not rented by any Renter.

Solution - 8

Solution: (d)

Question - 9

Consider the following relations A(X,Y,Z) and B(X,Y) and the given instances.
What is the result of A ÷ B ?

X	Y	Z
1	2	3
1	2	4
2	4	5
2	4	3
3	6	4
1	2	5

÷

X	Y
1	2
2	4

Solution - 9

A relation with scheme Z and tuples { (3), (5) }

X	Y	Z
1	2	3
1	2	4
2	4	5
2	4	3
3	6	4
1	2	5

÷

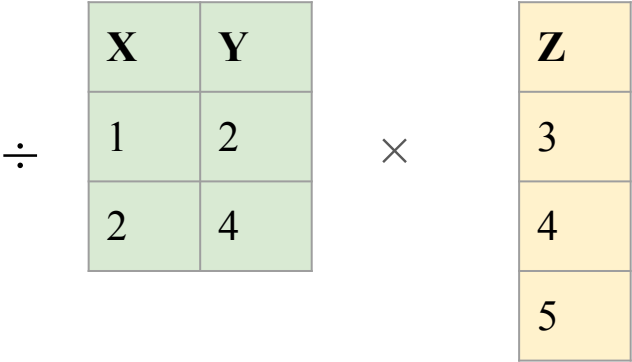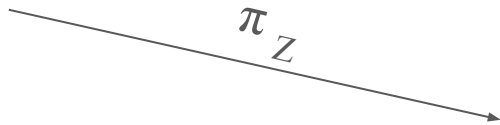| X	Y
1	2
2	4

=

Z
3
5

Question 10

Explain how the ÷ operator can be expressed in terms operators from the set

$$\{\sigma , \pi , \times , \cup, - \}$$

Solution 10

÷

X	Y	Z
1	2	3
1	2	4
2	4	5
2	4	3
3	6	4
1	2	5

÷

X	Y
1	2
2	4

×

Z
3
4
5

π_Z

→

X	Y	Z
1	2	3
2	4	3
1	2	4
2	4	4
1	2	5
2	4	5

Solution 10

÷

X	Y	Z
1	2	3
1	2	4
2	4	5
2	4	3
3	6	4
1	2	5

$-$

X	Y	Z
2	4	4

π_Z

Z
4

Z
3
5

Z
3
4
5
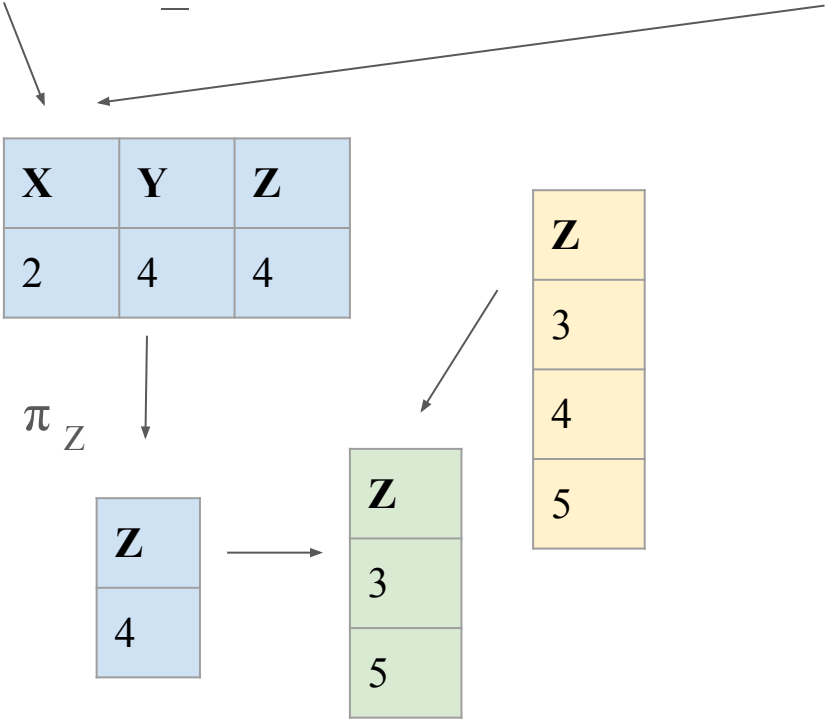
X	Y	Z
1	2	3
2	4	3
1	2	4
2	4	4
1	2	5
2	4	5

Question - 11

Consider the following instances:

University			
UName	Branch	Capacity	Fees
JFTT	Bangalore	15000	200000
KSSL	Bangalore	40000	500000
JFTT	Jalandhar	5000	200000
LKUniversity	Kolkata	2000	100000
LKUniversity	Mumbai	2000	150000

Consider the Relational Algebra on these given instances:

$\Pi_{\text{UName,Branch,Capacity}}(\text{University}) \div (\Pi_{\text{Branch,Capacity}}(\sigma_{\text{Fees}<=200000}\text{University}) \cap \Pi_{\text{Branch,Capacity}}(\sigma_{\text{Capacity}>2000}\text{University}))$

Solution - 11

Solution: JFTT

Question - 12

Consider the following instances:

Dishes		
Name	Price	Rating
Pasta	800	5
Fajita	500	4
Pizza	1000	4
Pasta	200	5
Pasta	150	5
Cheesecake	800	5

Dips		
Name	Price	Rating
Cheese	200	5
Hummus	150	5
Salsa	80	4

How many tuples are returned by the following Relational Algebra?

$$\Pi_{Dips.Name}(Dips \cap (Dips \bowtie (\sigma_{Dips1.Rating<5 \vee Dips1.Price\leq80}(\rho_{Dips1}(Dips)))))$$

Solution - 12

Solution: 1

Question - 13

Consider the relational schema `Sensor(SensorID, Battery, BaseStationID, Range)`.
Choose the correct Tuple Relational Calculus that represents the following statement
"Display all the SensorIDs associated with BaseStationID BS1."

a) $\{s|t < t[\text{BaseStationID}]=\text{`BS1'}>\}$

b) $\{<s, t>|\exists s \in \text{Sensor } (p[\text{BaseStationID}]=\text{`BS1'})\}$

c) $\{t|\exists s \in \text{Sensor } (t[\text{SensorID}]=s[\text{BaseStationID}] \wedge t[\text{BaseStationID}]=\text{`BS1'})\}$

d) $\{t|\exists s \in \text{Sensor } (t[\text{SensorID}]=s[\text{SensorID}] \wedge s[\text{BaseStationID}]=\text{`BS1'})\}$

Solution - 13

Solution: (d)

Question - 14

Consider the relational schema `Sensor(SensorID, Battery, BaseStationID, Range)`. Choose the correct Domain Relational Calculus equivalent to the following SQL query
`SELECT Range FROM Sensor WHERE Battery='500'`

a) $\{s | \exists c, d, i \ (c, d, i, s \in Sensor \wedge Battery='500')\}$

b) $\{<s> | \exists c, d, i \ (<c, d, i, s> \in Sensor \wedge d='500')\}$

c) $\{<s> | \exists c, d, i \ (<c, d, i> \in s \wedge Battery='500')\}$

d) $\{s | \exists <c, d, i> \ (c, d, i, s \in Sensor \wedge d='500')\}$

Solution - 14

Solution: (b)

Question - 15

A company maintains a schema of `Reports` where each report is identified by a Heading. The reports are also associated with corresponding a Date and Length. Moreover, each report can be written by multiple Authors. Which of the following schema correctly represents the `Reports` entity set?
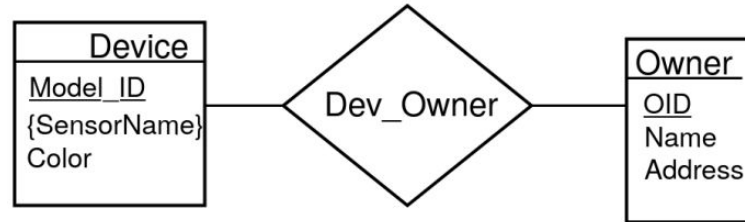
a) Reports(<u>Heading</u>, Date, Length, Authors)

b) Reports(<u>Heading, Date, Length</u>), Reports1(<u>Heading</u>, Authors)

c) Reports(<u>Heading, Date, Length</u>), Reports1(<u>Heading, Authors</u>)

d) Reports(<u>Heading</u>, Date, Length), Reports1(<u>Heading, Authors</u>)

Solution - 15

Solution: (d)

Question - 16

Consider the Entity Relationship Diagram

Which of the following is true?

a) The schema for the Device entity will be Device(Model_ID, Color) and DeviceSensor(Model_ID, SensorName).

b) The schema for the Dev_Owner will be Dev_Owner(Model_ID, OID).

c) The schema for the Owner will be Owner(OID, Model_ID, Name, Address).

d) The schema for the Device entity will be Device(Model_ID) and DeviceSensor(SensorName, Color).
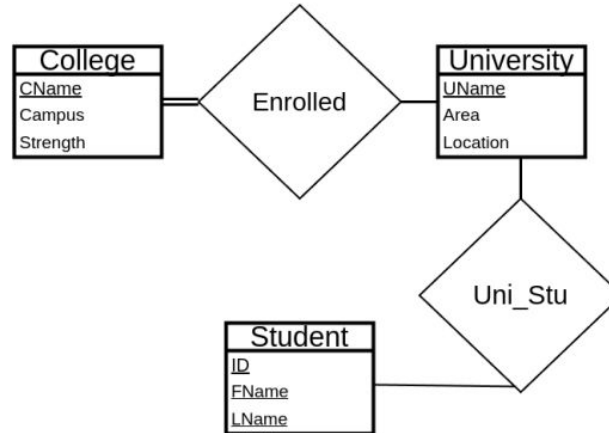
Solution - 16

Solution: (b)

A multi valued attribute is placed in a separate schema with the primary attribute of the entity. Hence, options (a) and (d) are not true. Similarly, the schema for Owner will be Owner(OID, Name, Address). Thus, option (b) is correct.

Question - 17

Consider the Entity Relationship Diagram

Which of the following is true?

a) Participation of `College` in `University` is total.

b) Participation of `College` in `Enrolled` is total.

c) Participation of `Student` in `University` is partial.

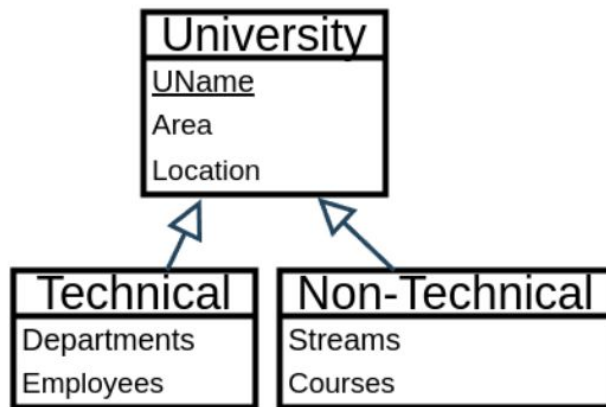d) Participation of `Uni_Stu` in `Student` is partial.

Solution - 17

Solution: (b)

Total participation of an entity in a relation is indicated by a double line whereas partial participation (default) is indicated by single lines. Hence, option (b) is correct.

Question - 18

Consider the Entity Relationship Diagram

Which of the following is false?

a) The schema of University is University(UName, Area, Location).

b) The schema of University is University(UName, Area, Location, Departments, Employees).

c) The schema of Technical is Technical(UName, Departments, Employees).

d) The schema of Technical are Technical1(UName, Departments) and Technical2(UName, Employees).

Solution - 18

Solution: (b), (d)