Database Management System: Assignment 3

Total Marks : 20

July 26, 2023

Question 1

Consider the relation `Payments` as follows:

Payments			
Mode	TransactionID	PaymentDate	Amount
UPI	42	12/03/2021	1000
UPI	53	12/03/2021	2000
Cash	14	12/03/2021	2500
NEFT	15	14/04/2022	25000
Card	32	12/03/2022	5000
Card	4	14/04/2022	1500

What is the output of the following Relational Algebra?

$\Pi_{\texttt{Mode},\texttt{PaymentDate},\texttt{Amount}}(\texttt{Payments}) \div (\Pi_{\texttt{PaymentDate},\texttt{Amount}}(\sigma_{\texttt{Amount}<=2000}\texttt{Payments}) -$

$\Pi_{\texttt{PaymentDate},\texttt{Amount}}(\sigma_{\texttt{TransactionID}=4}\texttt{Payments}))$

Marks: 2 **MCQ**

a) UPI

b) Cash

c) NEFT

d) Card

Answer: a)

Explanation: As per the given Relational Algebra,

$(\Pi_{\texttt{PaymentDate},\texttt{Amount}}(\sigma_{\texttt{Amount}<=2000}\texttt{Payments}) - \Pi_{\texttt{PaymentDate},\texttt{Amount}}(\sigma_{\texttt{TransactionID}=4}\texttt{Payments}))$ produces the tuples $< 12/03/2021, 1000 >$ and $< 12/03/2021, 2000 >$. These tuples are associated with UPI only. Hence, the `division` operation returns UPI.

Hence, option a) is correct.

Question 2

Consider the relation `Payments` as follows:

Payments					PaymentBy		
Mode	TransactionID	PaymentDate	Amount		TransactionID	FName	LName
UPI	42	12/03/2021	1000		42	Anil	Khanna
UPI	53	12/03/2021	2000		53	Ajay	Arora
Cash	14	12/03/2021	2500		14	Anil	Khanna
NEFT	15	14/04/2022	25000		15	Manali	Shah
Card	32	12/03/2022	5000		32	Ananda	Mishra
Card	4	14/04/2022	1500		4	Anil	Khanna

Consider the following relational algebra expressions

$R1 = \Pi_{\text{PaymentBy.TransactionID}}(\Pi_{\text{Mode,TransactionID,Amount}}(\sigma_{\text{Amount}>5000}\text{Payments}) \times \text{PaymentBy})$

$R2 = \Pi_{\text{Payments.TransactionID}}(\Pi_{\text{Mode,TransactionID,Amount}}(\sigma_{\text{Amount}>5000}\text{Payments}) \times \text{PaymentBy})$

Which of the `TransactionID`s will NOT be present in the output of `R1-R2`?

Marks: 2 **MCQ**

a) 42

b) 15

c) 14

d) 4

Answer: b)
Explanation: As per the syntax and semantics of Relational Algebra.
Hence, option b) is correct.

Question 3

Consider the relation `Content(Channel, VideoTitle, Likes, Dislikes)`.
Choose the correct Tuple Relational Calculus that represents the following statement:
"Display the titles of those videos that are published on YouTube Channels and have more than 50,000 likes."   *Marks: 2* **MCQ**

a) $\{t | \exists s \in \texttt{Content}(t[\texttt{VideoTitle}] = s[\texttt{VideoTitle}] \wedge t[\texttt{Channel}] = s[\texttt{'YouTube'}] \wedge t[\texttt{Likes}] > s[\texttt{50000}])\}$

b) $\{< t > | \forall s \in t(t[\texttt{VideoTitle}] = s[\texttt{VideoTitle}] \wedge t[\texttt{Channel}] = s[\texttt{'YouTube'}] \wedge t[\texttt{Likes}] > s[\texttt{50000}])\}$

c) $\{t | \exists s \in \texttt{Content}(t[\texttt{VideoTitle}] = s[\texttt{VideoTitle}] \wedge s[\texttt{Channel}] = \texttt{'YouTube'} \wedge s[\texttt{Likes}] > 50000)\}$

d) $\{< t > | \forall s \in \texttt{Content}(t[\texttt{VideoTitle}] = s[\texttt{VideoTitle}] \wedge s[\texttt{Channel}] = \texttt{'YouTube'} \wedge s[\texttt{Likes}] > 50000)\}$

Answer: c)
Explanation: The tuple to be selected is represented by 't' and the selection conditions are written with $\wedge$ as per the given question. According to the projection and selection operations shown in lecture slides 12.26 - 12.28, option (c) shows the correct syntax and semantics of the Tuple Relational Calculus.
Hence, option c) is correct.

Question 4

Consider the relation `Content(Channel, VideoTitle, Likes, Dislikes)`.
Choose the correct Domain Relational Calculus that is equivalent to the following SQL Query:
`SELECT Channel, VideoTitle FROM Content`
`WHERE Dislikes<100;`   *Marks: 2* **MCQ**

a) $\{< \texttt{c},\texttt{v} > | \exists \texttt{l},\texttt{d}(< \texttt{c},\texttt{v},\texttt{l},\texttt{d} > \in \texttt{Content} \wedge \texttt{d} < 100)\}$

b) $\{\texttt{c},\texttt{v}|\exists \texttt{c},\texttt{v},\texttt{l},\texttt{d}(< \texttt{c},\texttt{v},\texttt{l},\texttt{d} > \in \texttt{Content} \wedge \texttt{Dislikes} < 100)\}$

c) $\{< \texttt{c},\texttt{v} > | \exists \texttt{c},\texttt{v},\texttt{l},\texttt{d} \in \texttt{Content} \wedge \texttt{d} < 100\}$

d) $\{\texttt{c},\texttt{v}|\exists < \texttt{l},\texttt{d} > \in \texttt{Content} \wedge \texttt{Dislikes} < 100\}$

Answer: a)
Explanation: According to the syntax and semantics of Domain Relational Algebra shown in lecture slides 12.26-12.28.
Hence, option a) is correct.

Question 5

A C program, with embedded SQL query, allows the users to enter a date and an amount to check the transactions that were made on that day. The entered date is stored in the variable `Tdate` and the amount in variable `amt`. The SQL query returns the `TransactionID` and `Amount` of those payments from `Payments(Mode, TransactionID, PaymentDate, Amount)` whose `PaymentDate` match with the user's entered date and the `Amount` is more than the entered amount. Which of the following SQL queries is correct for the purpose?

Marks: 2 **MCQ**

a) ```
EXEC SQL
DECLARE c CURSOR FOR
SELECT TransactionID, Amount
FROM Payments
WHERE PaymentDate= :Tdate AND Amount>:amt
END EXEC
```

b) ```
EXEC SQL
DECLARE c CURSOR FOR
SELECT *
FROM Payments
WHERE PaymentDate= Tdate AND Amount>amt
END EXEC
```

c) ```
EXEC SQL
DECLARE c CURSOR FOR
SELECT *
FROM Payments
WHERE Tdate=PaymentDate AND amt>Amount
```

d) ```
EXEC SQL
DECLARE c CURSOR FOR
SELECT TransactionID, Amount
FROM Payments
WHERE :PaymentDate= :Tdate AND :Amount>:amt
END EXEC
```

Answer: a)
Explanation: As per the syntax and semantics of embedded SQL, option (a) is correct.

Question 6

A cloth factory maintains a schema of manufactured `Clothes` where each clothing item is identified by a tag. The clothes are also associated with corresponding sizes and materials. However, each cloth can be designed by multiple designers. Which of the following schema correctly represents the `Clothes` entity set? *Marks: 2* **MCQ**

a) `Clothes(`Tag`, Size, Material, Designer)`

b) `Clothes(`Tag`, Size, Material), Clothes_Designer(`Tag`, Designer)`

c) `Clothes(`Tag, Size, Material`), Clothes_Designer(`Tag`, Designer)`

d) `Clothes(`Tag`, Size, Material), Clothes_Designer(`Tag, Designer`)`

Answer: d)

Explanation: Multi valued attributes like `Designer` should be placed in a separate schema where it is used as an attribute of the composite primary key, along with the unique identifier. Hence, option (d) is correct.
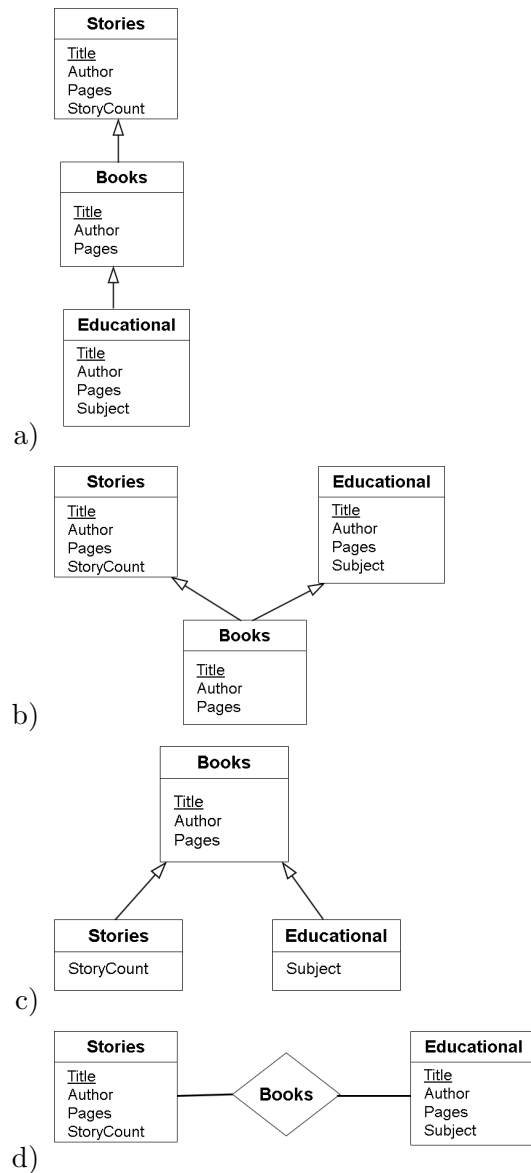
Question 7

Consider the three relational schemas:
Stories(<u>Title</u>, Author, Pages, StoryCount)
Books(<u>Title</u>, Author, Pages)
Educational(<u>Title</u>, Author, Pages, Subject)
Which of the Entity Relationship diagrams correspond to the given schemas?
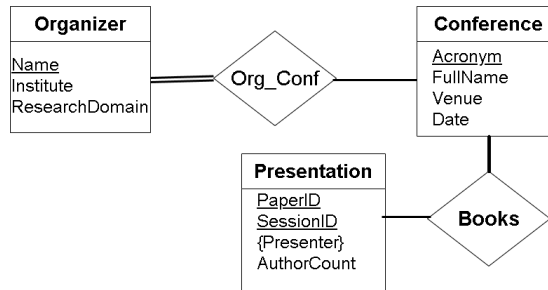
Marks: 2 **MCQ**

a)

Stories
<u>Title</u> Author Pages StoryCount

Books
<u>Title</u> Author Pages

Educational
<u>Title</u> Author Pages Subject

b)

Stories
<u>Title</u> Author Pages StoryCount

Educational
<u>Title</u> Author Pages Subject

Books
<u>Title</u> Author Pages

c)

Books
<u>Title</u> Author Pages

Stories
StoryCount

Educational
Subject

d)

Stories
<u>Title</u> Author Pages StoryCount

Books

Educational
<u>Title</u> Author Pages Subject

Answer: c)
Explanation: Refer to week 3, slide 15.11. Hence, option (c) is correct.

Question 8

Consider the Entity Relationship Diagram:

Which of the following is/are true?   *Marks: 2* **MSQ**

a) The participation of `Organizer` in `Org_Conf` is partial.

b) The participation of `Conference` in `Org_Conf` is partial.

c) `Presenter` is a composite attribute of `Presentation`.

d) `Presenter` is a multivalued attribute of `Presentation`.

Answer: b), d)

Explanation: Total participation is indicated by a double line whereas partial participation (default) is indicated by single lines. Multivalued attributes are enclosed within curly braces in ER diagrams. Hence, options (b) and (d) are correct.

Question 9

Consider the Entity Relationship Diagram:
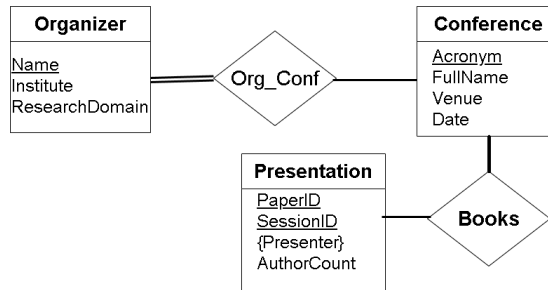
What is the correct schema for `Books`?   *Marks: 2* **MCQ**

a) `Books(Acronym, PaperID, SessionID).`

b) `Books(`<u>`Acronym, PaperID, SessionID`</u>`).`

c) `Books(`<u>`Acronym, PaperID, SessionID`</u>`, Presenter).`

d) `Books(`<u>`Presenter`</u>`, Acronym, PaperID, SessionID).`

Answer: b)

Explanation: For a many-to-many relationship, the schema for the relationship contains the primary keys of the participating entities, as its composite primary key. Hence, option (b) is correct.

Question 10

Consider the following instance of `Organizer`:

Organizer		
Name	Institute	ResearchDomain
MathewsL.	SMT	HCI
LouisA.	SMT	ML
StephanieH.	GKI	Networks
HarryH.	GKI	HCI

How many tuples will be returned by the following Relational Algebra?

$\sigma_{\text{x.Name<>y.Name}}(\rho_{\text{x}}\text{Organizer} \times \rho_{\text{y}}\text{Organizer}) \cap$
$\sigma_{\text{x.ResearchDomain=y.ResearchDomain}}(\rho_{\text{x}}\text{Organizer} \times \rho_{\text{y}}\text{Organizer})$

Marks: 2 **MCQ**

a) 2

b) 6

c) 14

d) 16

Answer: a)

Explanation: $\sigma_{\text{x.Name<>y.Name}}(\rho_{\text{x}}\text{Organizer} \times \rho_{\text{y}}\text{Organizer})$ returns 12 tuples where the `Names` are not the same between x and y. $\sigma_{\text{x.ResearchDomain=y.ResearchDomain}}(\rho_{\text{x}}\text{Organizer} \times \rho_{\text{y}}\text{Organizer})$ returns the 6 tuples where the `ResearchDomain` matches between x and y. Thus, the intersection between the two returns those tuples where the `Names` are different but `ResearchDomains` are same in the cross product of x and y. The following is the output of the Relational Algebra:

x.Name	x.Institute	x.ResearchDomain	y.Name	y.Institute	y.ResearchDomain
MathewsL.	SMT	HCI	HarryH.	GKI	HCI
HarryH.	GKI	HCI	MathewsL.	SMT	HCI

Hence, option (a) is correct.