Database Management System: Assignment 3

Total Marks : 20

June 8, 2022

Question 1

Consider the following instance of the relation `Gardens(Name, Location, OpensAt, ClosesAt, KnownFor)`

Gardens				
Name	Location	OpensAt	ClosesAt	KnownFor
Bageecha	Delhi	10am	6pm	Orchids
FloralParadise	Delhi	10am	7.30pm	Sunflower
TreeLand	Mumbai	1pm	10pm	Anthuriums
TreeLand	Mumbai	1pm	10pm	Hyacinths
FloralParadise	Pune	8am	11pm	Celosia

Suppose, `R1` and `R2` are defined as follows:
`R1`=$\Pi_{\texttt{X,Y}}(\sigma_{\texttt{OpensAt='10am'}}(\texttt{Gardens}))$
`R2`=$\Pi_{\texttt{M,N}}(\sigma_{\texttt{Location='Pune'}}(\texttt{Gardens}))$
What attributes should replace `X, Y, M, N` such that `R1` $\bowtie$ `R2` produces the tuple

FloralParadise	Delhi	Celosia

as output? *Marks: 2* **MCQ**

a) `X=Name, Y=Location, M=Location, N=KnownFor`

b) `X=Name, Y=Location, M=Name, N=KnownFor`

c) `X=Name, Y=KnownFor, M=Location, N=KnownFor`

d) `X=Name, Y=KnownFor, M=Name, N=Location`

Answer: b)
Explanation: Option (a) and (c) are incorrect as the common attributes for the Natural Join do not have a common value for any tuple produced by `R1` and `R2`. Option (d) is incorrect as the it produces the tuple

FloralParadise	Sunflower	Pune

. Hence, option (b) is correct.

Question 2

Consider the following instance of the relation `Gardens(Name, Location, OpensAt, ClosesAt, KnownFor)`

Gardens				
Name	Location	OpensAt	ClosesAt	KnownFor
Bageecha	Delhi	10am	6pm	Orchids
FloralParadise	Delhi	10am	7.30pm	Sunflower
TreeLand	Mumbai	1pm	10pm	Anthuriums
TreeLand	Mumbai	1pm	10pm	Hyacinths
FloralParadise	Pune	8am	11pm	Celosia

Suppose, `R1` and `R2` are defined as follows.

$R1 = \Pi_{Name,Location}(Gardens)$
$R2 = ((\Pi_{Location}(\sigma_{ClosesAt='7.30pm'}(Gardens))) \cup (\Pi_{Location}(\sigma_{OpensAt='8am'}(Gardens))))$

Which of the following `Name`s will be produced by `R1` $\div$ `R2`?

Marks: 2 **MCQ**

a) `TreeLand`

b) `TreeLand, Bageecha`

c) `Bageecha, FloralParadise`

d) `FloralParadise`

Answer: d)
Explanation: `R2` produces `Delhi, Pune`. The only `Garden` present in both these cities is `FloralParadise`. Hence, option (d) is correct.

Question 3

A C program, with embedded SQL allows the users to enter their ticket number which is stored in the variables `tno`. With the help of an embedded SQL query, the program then displays the corresponding travel date and destination from a database with the following schema: `TravelReg(TicketNo, Destination, TravelDate, ReservationName)`. Select the correct Embedded SQL query that should be present in this C program. *Marks: 2* **MCQ**

a)
```
EXEC SQL
   declare c cursor for
   SELECT *
   FROM TravelReg
   WHERE tno=TicketNo
   END_EXEC
```

b)
```
EXEC SQL
   declare c cursor for
   SELECT TravelDate, Destination
   FROM TravelReg
   WHERE tno=:TicketNo
   END_EXEC
```

c)
```
EXEC SQL
   declare c cursor for
   SELECT *
   FROM TravelReg
   WHERE TicketNo=tno
   END_EXEC
```

d)
```
EXEC SQL
   declare c cursor for
   SELECT TravelDate, Destination
   FROM TravelReg
   WHERE TicketNo=:tno
   END_EXEC
```

Answer: d)
Explanation: As per the syntax and semantics of embedded SQL queries (Refer to slide 11.15). Hence, option (d) is correct.

Question 4

Consider the following instance of the relation `Gardens(Name, Location, OpensAt, ClosesAt, KnownFor)`

Gardens				
Name	Location	OpensAt	ClosesAt	KnownFor
Bageecha	Delhi	10am	6pm	Orchids
FloralParadise	Delhi	10am	7.30pm	Sunflower
TreeLand	Mumbai	1pm	10pm	Anthuriums
TreeLand	Mumbai	1pm	10pm	Hyacinths
FloralParadise	Pune	8am	11pm	Celosia

What is the result of the following Tuple Relational Calculus expression?
$\{t \mid \exists p \in$ `Gardens (t[KnownFor]=p[KnownFor]` $\wedge$ `p[Location]='Mumbai')}`

Marks: 2 **MCQ**

a)

TreeLand

b)

Mumbai	Anthuriums
Mumbai	Hyacinths

c)

TreeLand	Mumbai	1pm	10pm	Anthuriums
TreeLand	Mumbai	1pm	10pm	Hyacinths

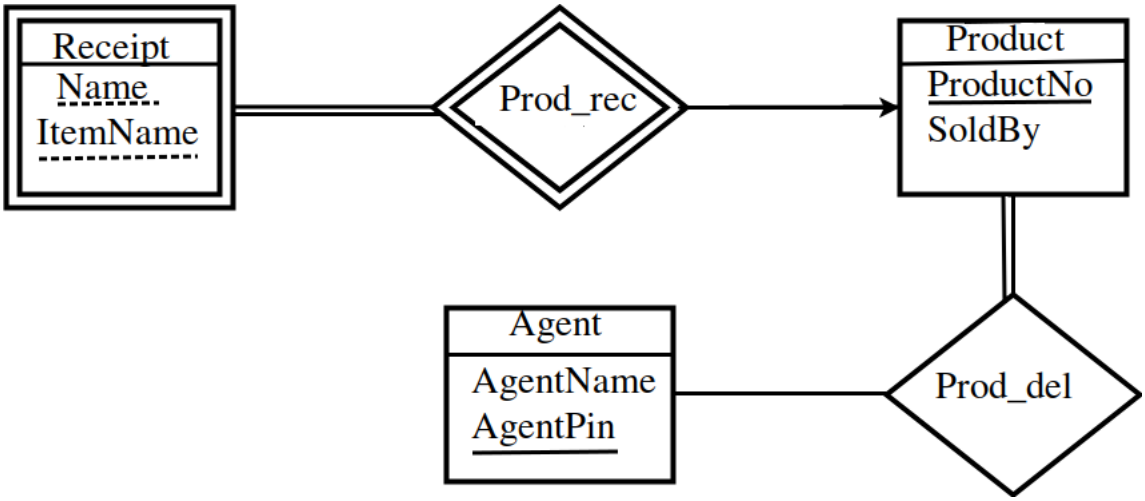
d)

Anthuriums
Hyacinths

Answer: d)
Explanation: According to the syntax and semantics of Tuple Relational Calculus, option (d) is correct.

Question 5

Consider the following Entity Relationship Diagram:



Which of the following options is (are) true? *Marks: 2* **MSQ**

a) Participation of `Product` is total is `Prod_del`.

b) The primary key in the relational schema for `Receipt` is {`Name, ItemName, ProductNo`}.

c) The primary key in the relational schema for `Receipt` will be {`Name, ItemName, AgentPin`}.

d) Participation of `Product` is total in `Prod_rec`.

Answer: a), b)
Explanation: Total participation is identifies by a double line. The primary key of a weak entity set contains the primary key of its identifying entity set. Hence, options (a) and (b) are correct.

Question 6

Consider the relation `Planets(pname, rank, satellites, diameter)`
What is the Domain Relational Calculus expression equivalent to the statement
"Select the names of those Planets which have a diameter of more than 50,000 kms"?

Marks: 2 **MCQ**

a) {p|∃<r,s,d> (p,r,s,d ∈ Planets ∧ p>50000)}

b) {<p>|∃r,s,d (<p,r,s,d> ∈ Planets ∧ d>50000)}

c) {<p>|∃<r,s,d (p,r,s,d> ∈ [Planets] ∧ d>50000)}

d) {p|∃[p, 50000] (<p,50000> ∈ Planets ∧ p>50000)}

Answer: b)
Explanation: Options (a) and (d) are ruled out as <> are not present. Option (c) is syntactically incorrect (Refer to slide 12.28). Option (b) is syntactically and semantically correct.

Question 7

Consider the following scenario:
A Natural resource management company keeps a record of different forests, identified by their names. A forest is associated with its location that contains the Country and area in which the forest is present. In each forest, there are different types of trees that are also recorded by the company.
Which of the following schema correctly represents the `Forest` entity set? *Marks: 2* **MCQ**

a) `Forest (Name, Location, Trees)`

b) `Forest (Name, Country, Area), Forest_trees (Name, Trees)`

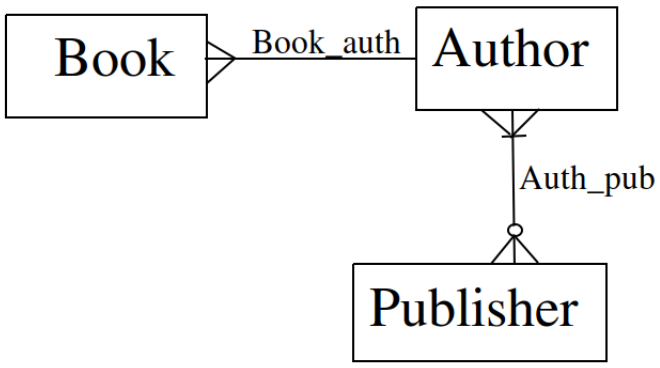
c) `Forest (Name, Trees), Forest_Location (Name, Location, Country, Area)`

d) `Forest (Name, Country, Area), Forest_trees (Name, Trees)`

Answer: b)
Explanation: Refer to slide 14.23 for details.
In the schema of option (a), the location is not properly explained.
In the schema of option (c), the attribute `Name` cannot be primary key in the `Forest` relation.
In the schema of option (d), the attribute `Name` cannot be primary key in the `Forest_trees` relation.
The schema in option (b) specifies the location correctly and captures the tree information in a forest as well.
Hence, option (b) is correct.

Question 8

Consider the following Entity Relationship Diagram:



Which of the following is (are) true? *Marks: 2* **MCQ**

a) Participation of `Author` in `Auth_pub` is total.

b) Participation of `Publisher` in `Auth_pub` is total.

c) A `Book` can be written by multiple `Authors`.

d) An `Author` can be associated with at most one `Book`.

Answer: b)
Explanation: According to the syntax of Crows feet notation, the following can be concluded.
One `Author` may write many `Books`.
One `Author` may be related to zero or more `Publisher`. So, the participation of `Author` in the relation `Auth_pub` is partial.
A `Publisher` may have one or more `Authors`. So, the participation of `Publisher` in the relation `Auth_pub` is total.
Hence, option (b) is correct.

Question 9

Consider the instance of the relational schema `Gallery(PaintingID, Artist, Theme)` and `Price(PaintingID, Cost)`:

Gallery		
PaintingID	Artist	Theme
A12	J.Ray	Landscape
A187	J.Ray	Portrait
B3	KatieP	Abstract
H23	L.Houston	Landscape

Price	
PaintingID	Cost
A12	124000
A187	239876
B3	1000000
H23	50000

How many tuples will be generated by the following Tuple Relational Calculus expression?
$\{t|\exists p \in \texttt{Gallery}\ \exists q \in \texttt{Price}(t[\texttt{PaintingID}] = p[\texttt{PaintingID}] \wedge t[\texttt{Artist}] = p[\texttt{Artist}] \wedge t[\texttt{Theme}] = p[\texttt{Theme}] \wedge t[\texttt{Cost}] = q[\texttt{Cost}] \wedge p[\texttt{PaintingID}] = q[\texttt{PaintingID}])\}$

Marks: 2 **MCQ**

a) 3

b) 4

c) 8

d) 10

Answer: b)
Explanation: According to slide 12.33, the given Tuple Relational Calculus expression is equivalent to
`Gallery` $\bowtie$ `Price` in Relational Algenra.
Hence, option (b) is correct.

Question 10

Consider the instance of the relational schema `Gallery(PaintingID, Artist, Theme)`:

Gallery		
PaintingID	Artist	Theme
A12	J.Ray	Landscape
A187	J.Ray	Portrait
B3	KatieP	Abstract
H23	L.Houston	Landscape

Which of the following Relational Algebra expressions produce(s) exactly the same tuples as present in this instance of `Gallery`? *Marks: 2* **MSQ**

a) $\Pi_{\texttt{PaintingID,Artist}}(\texttt{Gallery}) \bowtie \Pi_{\texttt{PaintingID,Theme}}(\texttt{Gallery})$

b) $\Pi_{\texttt{PaintingID,Artist}}(\texttt{Gallery}) \bowtie \Pi_{\texttt{Artist,Theme}}(\texttt{Gallery})$

c) $\Pi_{\texttt{PaintingID,Theme}}(\texttt{Gallery}) \bowtie \Pi_{\texttt{PaintingID,Theme}}(\texttt{Gallery})$

d) $\Pi_{\texttt{PaintingID,Theme,Artist}}(\texttt{Gallery}) \bowtie \Pi_{\texttt{Theme}}(\texttt{Gallery})$

Answer: a), d)
Explanation: Option (c) is incorrect as `Artist` will not be present in the output. Option (b) is incorrect as it produces 2 extra tuples due to the redundant value `J. Ray` in the common attribute.
Options (a) and (d) are correct.