

Database Management System: Assignment 1

Total Marks : 20

January 10, 2021

Question 1

Consider the following instance:

ImageSet				
FileName	FolderName	LastAccessed	CreatedBy	Theme
Sunrise	AsiaPic	12-Jan-2020	Aman	Landscape
Sunrise1	AsiaPic	11-Feb-2020	Nadia	Landscape
Ocean	Corals	12-Jan-2020	Aman	Landscape
Oceanic	Corals	18-Feb-2020	Nadia	Landscape

In ImageSet, FileName is selected as the primary key, X as secondary key and Y as a superkey. Which of the following set of attributes can form X and Y? *Marks: 2 MCQ*

- a) $X=\{\text{FolderName}, \text{CreatedBy}\}$, $Y=\{\text{CreatedBy}, \text{Theme}\}$
- b) $X=\{\text{LastAccessed}, \text{CreatedBy}\}$, $Y=\{\text{FolderName}, \text{Theme}\}$
- c) $X=\{\text{FolderName}, \text{LastAccessed}\}$, $Y=\{\text{FileName}, \text{Theme}\}$
- d) $X=\{\text{FileName}, \text{LastAccessed}\}$, $Y=\{\text{LastAccessed}, \text{CreatedBy}, \text{Theme}\}$

Answer: c)

Explanation: For a set of attributes to serve as a secondary key, they should be a candidate key (superkey which is minimal) and not a primary key. For a set to be a superkey, they should form a superset of a candidate key. In option (a), X can be a secondary key but Y is not a superkey. In option (b), neither X nor Y is a secondary/ super key. Option (c) is correct as $\{\text{FolderName}, \text{LastAccessed}\}$ can uniquely identify any tuple and $\text{FileName} \subseteq \{\text{FileName}, \text{Theme}\}$. Option (d) is incorrect as X is a superkey and Y is not a key.

Question 2

A restaurant maintains top two ingredients for each of their recipe in the schema *Recipe* (*FoodName*, *CuisineType*, *Taste*, *Ingredient1*, *Ingredient2*). $\{\text{FoodName}, \text{CuisineType}\}$ and $\{\text{FoodName}, \text{Taste}\}$ are two minimal sets of attributes that can uniquely identify each tuple of an instance of *Recipe*. What is the maximum number of possible superkeys of *Recipe*?

Marks: 2 MCQ

- a) 10
- b) 12
- c) 14
- d) 16

Answer: b)

Explanation: In the given problem, the candidate keys are $\{\text{FoodName}, \text{CuisineType}\}$ and $\{\text{FoodName}, \text{Taste}\}$. The possible combinations of superkeys are:

1. $\{\text{FoodName}, \text{CuisineType}\}$
2. $\{\text{FoodName}, \text{CuisineType}, \text{Taste}\}$
3. $\{\text{FoodName}, \text{CuisineType}, \text{Ingredient1}\}$
4. $\{\text{FoodName}, \text{CuisineType}, \text{Ingredient2}\}$
5. $\{\text{FoodName}, \text{CuisineType}, \text{Taste}, \text{Ingredient1}\}$
6. $\{\text{FoodName}, \text{CuisineType}, \text{Taste}, \text{Ingredient2}\}$
7. $\{\text{FoodName}, \text{CuisineType}, \text{Ingredient1}, \text{Ingredient2}\}$
8. $\{\text{FoodName}, \text{CuisineType}, \text{Taste}, \text{Ingredient1}, \text{Ingredient2}\}$
9. $\{\text{FoodName}, \text{Taste}\}$
10. $\{\text{FoodName}, \text{Taste}, \text{Ingredient1}\}$
11. $\{\text{FoodName}, \text{Taste}, \text{Ingredient2}\}$
12. $\{\text{FoodName}, \text{Taste}, \text{Ingredient1}, \text{Ingredient2}\}$

Hence, option (b) is correct.

Question 3

Consider the relations: Temp_India(Place, Celsius) and Temp_France(Place, Celsius) with following instances:

Temp_India		Temp_France	
Place	Celsius	Place	Celsius
Ahmadabad	29	Nice	20
Jaipur	22	Paris	18
Roorkee	22	Dijon	11
Kolkata	21		

$X = \text{Temp_India} - ((\text{Temp_India} \cup \text{Temp_France}) - (\text{Temp_India} - \text{Temp_France}))$
Which of the following is X?

Marks: 2 MCQ

- a) Temp_India
- b) Temp_France
- c) $\text{Temp_India} \cup \text{Temp_France}$
- d) $\text{Temp_India} \cap \text{Temp_France}$

Answer: a)

Explanation: $((\text{Temp_India} \cup \text{Temp_France}))$ produces all tuples from both relations.
 $(\text{Temp_India} - \text{Temp_France}) = \text{Temp_India}$.

Thus, $((\text{Temp_India} \cup \text{Temp_France}) - (\text{Temp_India} - \text{Temp_France})) = \text{Temp_France}$ and
 $\text{Temp_India} - ((\text{Temp_India} \cup \text{Temp_France}) - (\text{Temp_India} - \text{Temp_France})) = \text{Temp_India}$.
Hence, option (a) is correct.

Question 4

Consider a truth table having the following columns

P	Q	$R=P \wedge Q$	$S=P \vee Q$
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If the truth table, with all the values, is represented as a relational instance, which column(s) (attribute(s)) should be chosen as the primary key?

Marks: 2 MCQ

- a) {P, Q}
- b) {P, R}
- c) {P, S}
- d) {R, S}

Answer: a)

Explanation: According to the truth table, the instance should be

P	Q	R	S
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

We see that only {P, Q} has unique and non-null values that can be used to identify any tuple uniquely.

Hence, option (a) is correct.

Question 5

Identify the INCORRECT statement(s) from the following.

Marks:2 MSQ

- a) The **Intersect** operator takes the results of two queries and returns only rows that appear in first relation.
- b) The result of **Cartesian product** contains all pairs of tuples from the two relations, regardless of whether their attribute values match or not.
- c) **Selection** operation is used to view the tuples of the relation with or without some constraints.
- d) **Domain relational calculus** corresponds to a procedural language.

Answer: a), d)

Explanation: The **Intersect** operator takes the results of two queries and returns only rows that appear in **both relations**.

And **Domain relational calculus** corresponds to a **non-procedural** language.

Hence, option a) and d) are answer.

Question 6

Consider the following two relations:

Person(P_id, Name, DoB, Contact_No) and

Employee (E_id, Name, DoB, Salary, Contact_No)

Suppose that we first perform the Cartesian Product of **Person** and **Employee**, and then perform a Selection operation on that result with the predicate $P_id = E_id$. With which of the following symbolic notation of relational algebra, the above set of operations are equivalent ?

Marks:2 MSQ

- a) $\sigma_{P_id = E_id}(\text{Person} \times \text{Employee})$
- b) $\Pi_{P_id = E_id}(\text{Person} \times \text{Employee})$
- c) $\sigma_{P_id = E_id}(\text{Person} \bowtie \text{Employee})$
- d) $\Pi_{P_id = E_id}(\text{Person} \bowtie \text{Employee})$

Answer: a), c)

Explanation: As per the syntax and semantics of relational algebra:

$\sigma_{P_id = E_id}(\text{Person} \times \text{Employee})$ is equivalent with $\sigma_{P_id = E_id}(\text{Person} \bowtie \text{Employee})$.

Hence, options (a) and (c) are correct.

Question 7

Consider a relational table `Visitor(SSN_No, Name, Nationality, Passport_No, BankAccount_No, Hotel_Stay)`. With a single record of each `Visitor`, the following describes the attributes.

- `SSN_No`: Unique social security number of each visitor from the same country.
- `Name`: Name of the visitor.
- `Nationality`: The country where the passport is issued.
- `Passport_No`: Unique Passport number of each visitor from the same country.
- `BankAccount_No`: Unique account number in the bank. A Visitor can have multiple accounts or joint accounts. This attribute stores an account number chosen by a visitor.
- `Hotel_Stay`: Name of the hotel where the visitor stays in.

Which of the following option(s) is (are) INCORRECT?

Marks:2 MSQ

- a) `{Passport_No, Nationality}` can be a primary key.
- b) `BankAccount_No` can be a candidate key.
- c) `{BankAccount_No, Hotel_Stay}` can be a superkey.
- d) `SSN_No` cannot be a candidate key.

Answer: b), c)

Explanation: A `BankAccount_No` can be joint; so, more than one visitor can have the same account number. Therefore, it can not be a candidate key.

`{BankAccount_No, Hotel_Stay}` can not be a superkey, more than one visitor can stay in the same hotel and more than one visitor can have the same `BankAccount_No`.

Hence, statements of options (b) and (c) are incorrect.

Question 8

Identify the option that correctly describes the order of query processing.

Marks:2 MCQ

- a) Parsing, Translation, Optimization, Evaluation.
- b) Parsing, Translation, Evaluation, Optimization.
- c) Translation, Parsing, Evaluation, Optimization.
- d) Translation, Parsing, Optimization, Evaluation.

Answer: d)

Explanation: As per the lecture notes of module 03 slide 16, option (d) is correct.

Question 9

Consider the following tables:

R_1			R_2		
ItemId	ItemName	CostPrice	ItemId	ItemName	CostPrice
1	Charger	100	2	Headphone	200
2	Headphone	200	3	Battery	300
3	Battery	300	11	HB Pencil	50
4	Memory Card	400	12	Pen	100
5	Mobile	500	13	Stapler	150
12	Pen	100	14	Highlighter Card	200
13	Stapler	150	15	Glue Stick	250

Identify the correct operation(s) which produces the following output from the above two instances.

Marks: 2 MSQ

OutputTable		
ItemId	ItemName	CostPrice
2	Headphone	200
3	Battery	300
12	Pen	100
13	Stapler	150

- a) $R_1 - R_2$
- b) $(R_1 \cup R_2) \cap (R_1 \cap R_2)$
- c) $(R_1 \cup R_2) - (R_1 \cap R_2)$
- d) $(R_1 \cup R_2) - [(R_1 - R_2) \cup (R_2 - R_1)]$

Answer: b), d)

Explanation: The output is basically $(R_1 \cap R_2)$. Expressions in (b) and (d) are equivalent to $(R_1 \cap R_2)$. So, options (b) and (d) are correct.

Question 10

Consider the following relational schema:

Suppliers(sid, sname, address)

Parts(pid, pname, color)

Catalog(sid, pid, cost)

Marks: 2 MCQ

Identify the option(s) which is/are **incorrect** for the above relational schemas.

- a) Referencing relation is Catalog and Foreign keys are sid and pid.
- b) Referenced relation is Catalog and Foreign keys are sid and pid.
- c) Referenced relation is Parts and Primary key is pid.
- d) Referenced relation is Suppliers and Primary key is sid.

Answer: b)

Explanation: Refer to lecture notes of module 04, slide 14, according to which option (b) is the answer.