

Database Management System: Assignment 4

Total Marks : 20

July 22, 2024

Question 1

Marks: 2 MCQ

Find the functional dependencies that stand valid on the part of the relation shown below:

P	Q	R
a	1	c
a	2	c
b	3	c
b	4	c

- a) $P \rightarrow Q, P \rightarrow R$
- b) $Q \rightarrow P, P \rightarrow R$
- c) $Q \rightarrow P, R \rightarrow P, P \rightarrow R$
- d) $P \rightarrow Q, P \rightarrow R, R \rightarrow P$

Answer: b)

Explanation: **P** cannot uniquely determine **Q**, because for the same value of **P** multiple values of **Q** are obtained. So $P \rightarrow Q$ is false. Options a) and d) are false hence.

$R \rightarrow P$ is also false because unique value of **R** determines multiple values of **P**. So, option c) is false.

Option b) is true because for unique values of **Q**, unique value of **P** is determined and unique value of **P** determines unique value of **R**.

Question 2

Marks: 2 MCQ

Consider the relation `Email(Sender, Receiver, Date, Time, Subject)` with the following functional dependencies.

FD1: $\{Receiver, Date\} \rightarrow Time$

FD2: $\{Sender, Date\} \rightarrow \{Receiver, Subject\}$

FD3: $Receiver \rightarrow Subject$

What is the highest normal form for the given relation?

- a) 1 NF
- b) 2 NF
- c) 3 NF
- d) BCNF

Answer: b)

Explanation: The primary key of the given relation is $\{Sender, Date\}$. in FD3, a non prime attribute depends on another non prime attribute. Hence, option (b) is correct.

Question 3

Marks: 2 MCQ

Consider the relation `Office`(OID, Emp, Branch, Dept) with the following functional dependencies:

FD1: $\{OID, Emp\} \rightarrow Branch$

FD2: $Branch \rightarrow Dept$

FD3: $Dept \rightarrow OID$

How many candidate keys are there for the given relation?

a) 1

b) 2

c) 3

d) 4

Answer: c)

Explanation: The candidate keys of the given relation are $\{OID, Emp\}$, $\{Emp, Branch\}$ and $\{Emp, Dept\}$.

Hence, option (c) is correct.

Question 4

Marks: 2 MCQ

Consider the relation TICKET(PNR, DEPARTURE, ARRIVAL, SEATNO, COACHNO) with the following functional dependencies.

FD1: {PNR, DEPARTURE} → ARRIVAL

FD2: ARRIVAL → SEATNO

FD3: {DEPARTURE, SEATNO} → COACHNO

Which of the following attributes cannot functionally determine COACHNO?

- a) {ARRIVAL}
- b) {PNR, DEPARTURE}
- c) {PNR, DEPARTURE, ARRIVAL}
- d) {DEPARTURE, ARRIVAL}

Answer: a)

Explanation: The closure of ARRIVAL contains {ARRIVAL, SEATNO} only. The closure of all other given sets of attributes contain COACHNO.

Hence, option a) is the answer.

Question 5

Marks: 2 MCQ

Find the canonical cover of Relation $R=(A, B, C)$ where $F=(A \rightarrow BC, B \rightarrow C, A \rightarrow B, AB \rightarrow C)$?

- a) $A \rightarrow BC$
- b) $A \rightarrow B, B \rightarrow C$
- c) $A \rightarrow B, AB \rightarrow C$
- d) $A \rightarrow BC, AB \rightarrow C$

Answer: b)

Explanation: $A \rightarrow B$ and $B \rightarrow C$ determines $A \rightarrow C$ (transitivity). So, $A \rightarrow C$ and $B \rightarrow C$ determines $AB \rightarrow C$. Hence, the FD $AB \rightarrow C$ is redundant.

After removing $AB \rightarrow C$, we have $(A \rightarrow BC, B \rightarrow C, A \rightarrow B)$.

Next, $A \rightarrow B$ and $A \rightarrow C$ determines $A \rightarrow BC$ (union). So, the FD $A \rightarrow BC$ is also redundant.

So, the canonical cover is $(B \rightarrow C, A \rightarrow B)$. Hence, option b) is the answer.

Question 6

Marks:2 MSQ

Consider the following relational table FRUIT_STORE:

FRUIT_STORE				
F_ID	F_Name	Category	Price	Owner
1281	Mango	Uttar Pradesh	100	W. Hanna
1282	Apple	Kashmir	200	C. Buck
1281	Mango	Uttar Pradesh	120	X
1282	Mango	West Bengal	150	K. Bhardwaj
1281	Banana	Tamil Nadu	80	T. Park

If (F_Name, Owner) is a key for this instance, what may be the value of X?

- a) W. Hanna
- b) C. Buck
- c) W. Hanna or K. Bhardwaj
- d) O. Kuzovkov

Answer: b), d)

Explanation: The value of X can be any Owner Name except W. Hanna or K. Bhardwaj for (F_Name, Owner) to be a key.

Hence, options b) and d) are valid.

Question 7

Marks: 2 MSQ

Consider a relation `Customer(CID, NAME, ADDRESS)` with the following functional dependencies.

FD1: $CID \rightarrow NAME$

FD2: $NAME \rightarrow ADDRESS$

The current instance of this schema contains the tuple `{121, Lucy, Delhi}`.

Which of the following tuples can be inserted?

- a) `{255, Tom, Kolkata}`
- b) `{137, Lucy, Delhi}`
- c) `{233, Lucy, Mumbai}`
- d) `{121, Jenny, Kolkata}`

Answer: a), b)

Explanation: `CID` is the key and should be uniquely identifying `NAME`. So, `{CID, NAME}` cannot be `{121, Jenny}` in the new tuple. So, option d) is invalid.

Since `NAME` uniquely identifies `ADDRESS`, Lucy cannot be associated with any other `ADDRESS` except `Delhi`. So, option c) is invalid.

Hence, options a) and b) are correct.

Question 8

Marks:2 MCQ

The relation $R(A, B, C, D, E, F, G)$ with the functional dependencies: $\{ A \rightarrow B, A \rightarrow C, AE \rightarrow D, AEF \rightarrow G \}$ is normalised into BCNF.

Which of the following decomposition is obtained as a result of this normalisation?

- a) $R_1(\underline{A}, B, F), R_2(\underline{E}, C, D), R_3(\underline{A}, G)$
- b) $R_1(\underline{A}, B, C), R_2(\underline{A}, E, D), R_3(\underline{A}, E, F, G)$
- c) $R_1(\underline{A}, D, C), R_2(\underline{A}, B, D), R_3(\underline{A}, D, F, G)$
- d) $R_1(\underline{A}, B, C, F, G), R_2(\underline{A}, E, D)$

Answer: b)

Explanation: Closure of $AEF = \{A, B, C, D, E, F, G\}$. Thus, AEF is a candidate key. From the given FDs, we see that there are partial dependencies in $A \rightarrow B$, $A \rightarrow C$ and $AE \rightarrow D$. To normalise them, the correct decomposition is $R_1(\underline{A}, B, C), R_2(\underline{A}, E, D), R_3(\underline{A}, E, F, G)$. These tables are also in BCNF.

Hence, option b) is correct.

Question 9

Marks:2 MCQ

Consider a relation STUDENT(Name, Subject, Location, Marks).

Name	Subject	Location	Marks
John	Comp	NY	96
John	DBMS	NY	100

STUDENT is decomposed into the following

1. STU_SUB (Name, Subject, Location) and STU_LOC(Name, Location, Marks)
2. STU_LOC (Name, Location) and STU_SUB(Subject, Marks)

Which of the following is TRUE?

- a) 1 is lossy but 2 is lossless.
- b) 1 is lossless but 2 is lossy.
- c) Both 1 and 2 are lossless.
- d) Both 1 and 2 are lossy.

Answer: d)

Explanation: Decomposition 1) is lossy as Join operation between the tables does not return the table which is same as STUDENT.

Decomposition 2) is lossy as there is no common attribute between the decomposed relations. Hence, option d) is correct.

Question 10

Marks: 2 MCQ

Consider the relation DVDLibrary(Name, Company, Format, Price) with the following Functional Dependencies:

FD1: {Name, Company} \rightarrow {Format, Price}

FD2: Company \rightarrow Format

FD3: Format \rightarrow Price

Which of the following statements is (are) true?

- a) The primary key for DVDLibrary is Company.
- b) DVDLibrary is in 2NF.
- c) Decomposition of DVDLibrary into DVDLibrary1(Name, Company, Format), DVDLibrary2(Company, Price) will not be dependency preserving.
- d) Decomposition of DVDLibrary into DVDLibrary1(Name, Company, Format), DVDLibrary2(Company, Price) will be lossy.

Answer: c)

Explanation: Option (a) is false because the primary key is {Name, Company}.

Option (b) is false because partial dependency is there.

Option (d) is false as the decomposition is lossless.

Option (c) is true as the given decomposition, does not preserve functional dependencies.

Hence, option c) is correct.