Question-wise Details

Section 1

Question 1:

Time: 9 Min 35 Sec **Marks: 2 / 2**

Explain the significance of **Closure of Set of Functional Dependencies** using appropriate example.

Response:

The closure of a set of functional dependency contains all the possible attributes that can be generated or derived from the functional dependency in that set. It is denoted using F*{}.
Take two FDs :
F1 : ID -> Name,
F2 : Name -> City, State

Closure of F*{ID,Name,City, State}

We use closure of a set of FDs to verify that everytime we update the database, it says consistant and integrity isnt compromised.
For eg, on adding a tuple : (101, xyz, ahmedabad, gujarat), we can check if it follows all the functional dependencies mentioned in the closure, then it is a legal value and it can be added. Or when updating or deleting a value :
If we update the different cities for same ID, we check the closure and see that is not satisfying ID-> City so it must be an illegal value

Words : 145

Question 2:

Time: 3 Min 39 Sec **Marks: 0 / 2**

Suppose relation **R (A, B)** has tuples **{ (1,2), (1,2),(3,4) }** and relation **S (B, C)** has tuples **{ (2,5), (2,5), (4,6), (7,10) }.**

Write down all the tuples in the result of the SQL query:

SELECT *

FROM R NATURAL OUTER JOIN S

Response:

Outer join will include all the elements in R-S and S-R
A, B, C
(1, 2, 5)
(1, 2, 5)
(null, 4, 6)
(null, 7, 10)
(3, 4, null)

Words : 29

Question 3:

Time: 8 Min 4 Sec **Marks: 2 / 2**

Explain the statement:

The Canonical Cover for given sets of R and F is not unique.

Response:

Canonical cover means the set of reduced functional dependencies. There can be more than one canonical cover for a set of FDs. We remove the extraneous attributes from LHS and RHS. Suppose we have to check if set of FDs of R covers FDs of G.

Consider :
AB -> C
B-> A
A -> B

the canonical cover can be :
A-> C
A->B

or it can include
B->A
B->C

and it will both satisfy the same closure as that of F

Words : 83

Question 4:

Time: 2 Min 42 Sec **Marks: 2 / 2**

Explain the purpose of **Canonical Cover of Set of Functional Dependencies** in the context of the database design.

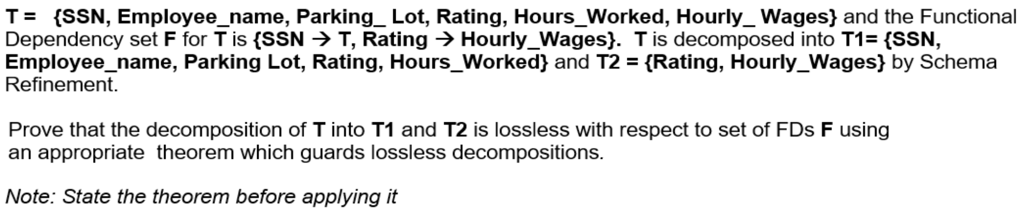
Response:

To maintain the consistency and integrity of the database, on every modfication, the system must check that it satisfies all the Functional Dependencies. The set of FDs can be big and it can be very expensive to check. So, we form a canonical cover of F which does not have any extraneous attributes and so it has reduced FDs. Here, the cost of the system is reduced in maintaining the database. Checking for Fc is similar to checking for F as while making Fc , we ensure that the closure of F and Fc is the same.

Words : 97

Section 2

Question 1: **Time:** 8 Min 3 Sec **Marks: 2 / 3**



T = {SSN, Employee_name, Parking_ Lot, Rating, Hours_Worked, Hourly_ Wages} and the Functional Dependency set **F** for **T** is **{SSN → T, Rating → Hourly_Wages}. T** is decomposed into **T1= {SSN, Employee_name, Parking Lot, Rating, Hours_Worked}** and **T2 = {Rating, Hourly_Wages}** by Schema Refinement.

Prove that the decomposition of **T** into **T1** and **T2** is lossless with respect to set of FDs **F** using an appropriate theorem which guards lossless decompositions.

Note: State the theorem before applying it

Response:

Functional dependencies :
SSN -> T, Rating -> Hourly wages

Here, SSN is the Primary Key as the closure of SSN = T. The Heath's theorem for lossless decomposition says that a relation R having a dependency X-> Y can be split into two relations having lossless join decomposition property which are :
XY and XZ where Z = U - XY

Take X = Rating, Y = Hourly wages, Z = {SSN, Employee_name, Parking_Lot, Hours_worked}

Hence, XY = {Rating, Hourly_wages} = T2
and XZ = {SSN, Employee_Name, Parking lot, Hours Worked, Rating } = T1

Since T1 and T2 are equal to the relations derived by Heath's theorem, they will also follow the lossless decomposition property.

Words : 117

Question 2: **Time:** 3 Min 50 Sec **Marks: 2 / 3**

The sets relation **R(A,B,C,D,E)** and Functional Dependencies **F= {A->D, B->E,DE->C}** are given. For Fragment set **R1(A,B,C)** obtained during the schema refinement of **R**.

Calculate all the FDs holding on R1 using attribute closure method.

Response:

The FDs holding on R1 will be the subest of FDs belonging to the closure of Functional dependency set F which have only the attributes of R1 in them.

Set R1 has attributes : A, B, C

Functional Dependencies :
1. A->D and B -> E, their union gives AB -> DE.
Now, DE -> C so by transitivity, we get **AB->C.**

FD : {AB->C}

Words : 65

Question 3:

Time: 9 Min 20 Sec **Marks: 3 / 3**

State all the attributes and Primary Key of the relation mentioned for each of the following database systems:

a. Attributes for relation **Librarian** of *Digital Library Database System*

b. Attributes for relation **Voter** of *Loksabha Election Database System*

c. Attributes for relation **Order** of *Online Shopping Database System*

Response:

Librarian(Login_ID, Name, DOB, Phone number, Email ID, Position, Salary)
Primary Key : Login_ID

Voter :(Voter_ID, First Name, Last Name, DOB, Add_street, Add_city, Voting_region, Add_state, Add_PIN)
Primary Key : Voter_ID

Order :(Order_id, Buyer_Name, Buyer_Address, {Item}, {Quantity}, Cost, Payment Status, Mode of Payment)
Primary Key : Order_id

Words : 47

Question 4:

Time: 14 Min 47 Sec **Marks: 3 / 3**

Explain the following statement.

The schedule **S2: W2(Y), W1(X), W2(X)** is possible with *2PL protocol* but not possible with *optimistic CC protocol.*

Response:

With the 2PL protocol, below is the locking and unlocking that will take place. Here, there is no starvation or deadlock as T1 will simply wait for T2 to reach the Unlock phase.

```
T2 :  X(Y)W2(Y)                  (wait for T1 to unlock) X(X)  W2(X) U(X)U(Y)--commit----finish
T1 :                  X(X) W1(X) (lock point)U(X) ----commit --------finish
```

With optimistic CC protocol, we do use locking but we check for conflicts before commiting. Here, there is conflict between W1(X) and W2(X). Suppose W1 writes the value of X. If the TS(T1)>TS(T2) which is true in this case, by protocol, T2 will be rolled back. SO this wont work.

Words : 102