Date: 10th Mar 2023

MON TUE WED THR FRI SAT SUN

ASSIGNMENT-3

[A]

1. What functional dependency type is/are not present in the following dependencies
   Empno -> EName, Salary, Deptno, DName
   DeptNo -> DName
   EmpNo -> DName
   Partial Functional Dependency

2. Every time attribute A appears, it is matched with the same value of attribute B, but not the same value of attribute C. Therefore, it is true that:
   A ---> B

3. Consider a schema R(A, B, C, D) and functional dependencies A->B and C->D. Then the decomposition of R into R_1(AB) and R(CD) is
   Dependency preserving but not lossless join

4. If one attribute is determinant of second, which in turn is determinant of third, then the relation cannot be:
   3 NF

5. Anomalies are avoided by splitting the offending relation into multiple relations, is also known as
   Decomposition

6. A ______ is an indirect functional dependency, one in which x->y only by virtue of x->y and y->z.
   Transitive Dependencies

7. Let R (A, B, C, D) be a relation schema with the following functional dependencies:
$A \rightarrow B$, $B \rightarrow C$, $C \rightarrow D$ and $D \rightarrow B$
The decomposition of R into
(A, B), (B, C), (B, D)
gives a lossless join, and is depending preserving

8. A table is in BCNF it is in 3NF and if every determinant is a _____ key.
Candidate

9. Consider the schema R (S, T, U, V) and the dependencies $S \rightarrow T$, $T \rightarrow U$, $U \rightarrow V$, $V \rightarrow S$. Let $R = \{R_1, R_2\}$ such that $R_1 \cap R_2 = \phi$. Then the decomposition is:
in 2NF but not in 3NF

10. Third normal form is inadequate in situations where the relation:
None of the above.

[B.] 1. Let us take another example to show the relationship between two FD sets. A relation R_2 (A, B, C, D) having two FD sets $FD1 = \{A \rightarrow B, B \rightarrow C, A \rightarrow C\}$ and $FD2 = \{A \rightarrow B, B \rightarrow C, A \rightarrow D\}$
Checking whether all FDs of FD1 is present in FD2

$A \rightarrow B$ $\quad (A)^+ = \{A, B, C\}$ $\quad A \rightarrow C$

$B \rightarrow C$

$A \rightarrow C$ $\quad FD2 \supset FD1$ is true checking whether all FDs of FD2 are present in FD1

A -> B $\qquad$ $(A)^+ = \{A, B, C\}$ $\quad$ $A \rightarrow D$

B -> C

A -> D $\qquad$ FD2 $\not\subset$ FD1

In this case, FD2 $\supset$ FD1 and FD2 $\not\subset$ FD1 are not semantically equivalent.

3. Finding candidate keys and super keys of a relation using FD set. The set of attributes for example, the EMPLOYEE relation shown in Table 1 has following FD set. {E-ID -> E-NAME, E-ID -> E-CITY, E-ID -> E-CITY, E-ID -> E-STATE, E-CITY -> E-STATE}

FD = {E-ID -> E-NAME}

{E-ID -> E-CITY}

{E-ID -> E-STATE}

{E-CITY -> E-STATE}

$(E\text{-}ID)^+$ = {E-ID, E-NAME, E CITY, E-STATE}

$(E\text{-}NAME)^+$ = {E-NAME}

$(E\text{-}CITY)^+$ = {E-CITY, E-STATE}

$(E\text{-}ID, E\text{-}NAME)^+$ = {E-ID, E-NAME, E-CITY, E-STATE}

$(E\text{-}ID, E\text{-}CITY)^+$ = {E-ID, E-NAME, E-CITY, E-STATE}

$(E\text{-}ID, E\text{-}STATE)^+$ = {E-ID, E-NAME, E-CITY, E-STATE}

$(E\text{-}ID, E\text{-}CITY, E\text{-}STATE)^+$ = {E-ID, E-NAME, E-CITY, E-STATE}

(E-ID, E-CITY, E-STATE), (E-ID, E-CITY), (E-ID, E-STATE),
(E-ID) is super key.

(E-ID) is Candidate key

4. What is multivalued dependency.

Multivalued dependency occurs when two attributes in a table are independent of each other but both depend on a third attribute.

A multivalued dependency consist of at least two attributes that are dependent on a third attribute that's why it always require at least three attributes.

C.

1. Given a relation R(P,Q,R,S,T) and Functional Dependency set FD = {PQ → R, S → T}, determine whether the given R is in 2NF? If not convert it into 2NF.

Given - R(P, Q, R, S, T)

FD - {PQ → R, S → T}

R (P, Q, R, S, T)

$(PQS)^+ = \{PQRST\}$ → only 1 Candidate key

PQ-R does not satisfy the definition of 2NF that non prime attribute (R) is partially dependent on part of Candidate key PQS.

$S \rightarrow T$ does not satisfy the definition of 2NF

Hence, FD - $PQ \rightarrow R$
$S \rightarrow T$ are not in 2NF

Conversion -
Decompose the table gives -

R_1 (P, Q, R) → fully FD, R1 is in 2NF
R_2 (S, T) → fully FD, R2 is in 2NF
R_3 (P, Q, S) → Candidate Key

2. Given a relation R (x, y, z, W, P) and Functional dependency set FD = {X → Y, Y → P and Z → W} determine whether the given R is in 3NF? If not convert it into 3NF.

R (X, Y, Z, W, P)

$(XZ)^+ = \{XZYPW\}$ Hence, XZ is only 1 candidate key.

Candidate key is a super key whose no proper subset is a super key.

$X \rightarrow Y$ does not satisfy the definition of 3NF, that neither X is super key nor Y is prime attribute.

Date: / /

MON TUE WED THR FRI SAT SUN

$Y \to P$ does not satisfy the definition of 3NF, that neither Y is super key nor P is a prime attribute.

$Z \to W$ satisfies the definition of 3NF, that neither Z is super key nor W is a prime attribute

Conversion –

R_1 (X, Y) {Using FD $X \to Y$}
R_2 (Y, P) {Using FD $Y \to P$}
R3 (Z, W) {Using FD $Z \to W$}
R4 (X, Z) {Using Candidate key XZ}

All the decomposed tables R1, R2, R3, R4 are in 2NF (as there is no partial dependency) as well as in 3NF.

D

1. Find the highest normal form of a relation R (A, B, C, D, E) with FD set {$B \to A$, $A \to C$, $BC \to D$, $AC \to BE$}

$(B)^+ = \{B, A, C, D, E\}$
$(C)^+ = \{C\}$
$(A)^+ = \{A, C, B, E, D\}$

B will be candidate key. B can be derived from AC using ($AC \to B$, $AC \to E$). A will be candidate key. So there will be two candidate keys {A, B}.

Date: / /

MON TUE WED THR FRI SAT SUN

The prime attribute is those attribute which is part of Candidate key $\{A, B\}$ in this example and others will be non-prime $\{C, D, E\}$ in this example.

The relation R is in 1st Normal Form as a relational DBMS does not allow multi-valued or composite attributes.

The relation is 2NF because $B \rightarrow A$ (B is a super key) $A \rightarrow C$ is in 2NF (A is a super key) $BC \rightarrow D$ is in 2NF (BC is a super key) $AC \rightarrow BE$ is in 2NF AC (is a super key).

The relations is 3NF because LHS of all FD's is super key. The relation is in BCNF as all LHS of all FD's are super keys. So the highest NF is BCNF.

2. Explain function dependency with example?

A functional dependency is a constraint that specifies the relationship between two set of attribute where one set can accurately determine the value of other sets. It is denoted as $X \rightarrow Y$, where X is a set of attributes ~~that~~ ~~is~~ that is capable of determine the value of X. The attributes set on the left side of the arrow X is called Determinant, while on right side, Y is called the dependent.

Date: / /

MON TUE WED THR FRI SAT SUN

Types of Dependency:

1. Trivial Functional Dependency:
In Trivial functional dependency, a dependent is always a subset of the determine
i.e., If $X \rightarrow Y$ and Y is the subset of X, then it is called trivial function dependency.

2. Non-Trivial Functional Dependency:
The dependent is strictly not a subset of the determinant i.e., If $X \rightarrow Y$ and Y is not a subset of X

3. Multivalued Functional Dependency:
Entities of the dependent set are not dependent on each other. i.e., If $a \rightarrow \{b, c\}$ and there exists no functional dependency b/w b and c

4. Transitive Functional Dependency:
Dependent is indirectly dependent on determinant. i.e., If $a \rightarrow b$ and $b \rightarrow c$, then ~~acto~~ accordingly to axiom of transitivity, a-c.