Course Name: **A Level (1st Sem)** Subject : **Introduction to DBMS**
Topic: **DB Normalization – Exercise Practices on 2NF (Part 6)** Date: **20-May-2020**

Database Normalization – Exercise Practices on 2NF

Que 1: Suppose R(A B C D E) is relational schema and set of functional dependency :

FDs: $A \rightarrow B$
$B \rightarrow E$
$C \rightarrow D$

Find out the relation R is in 2NF or not? If not decompose it in 2NF.

Solution:

First find out the candidate key of the relation.

Since AC^+ = A C D B E, (closure of AC contains all the attributes of R)

So **AC is candidate key** in above table.

Prime attribute - AC (because AC is the candidate key)

Non prime attribute - DBE (because DBE are not the part of the candidate key)

Now, the functional dependency $A \rightarrow B$ and $B \rightarrow E$ follow the rule of 2NF,

But **functional dependency $C \rightarrow D$ violates the rule of 2NF, because attribute C which is prime attribute (part of the candidate key AC) is determining the non prime attribute D.** It is partial dependency and this type of partial dependency is not allowed in 2NF.

Therefore, to convert the relation R(A B C D) in 2NF, It is divided into three relations:

R1 (A B E) -- [$A \rightarrow B$, $B \rightarrow E$]
R2 (C D) -- [$C \rightarrow D$]
R3 (A C) -- [AC is candidate key]

Now R1, R2 and R3 are following the rules of 2NF.

[**Note**: Although relation R1 and R2 covers all the FDs, but it is necessary to keep the attributes of candidate key of original relation together to maintain the consistency and integrity of data, that's why attribute A C are kept in R3.]

Que 2: Suppose R(A B C D E F G H I J) is relational schema and set of functional dependency :

FDs: AB → C
AD → GH
BD → EF
A → I
H → J

Find out the relation R is in 2NF or not? If not decompose it in 2NF.

Solution:

First find out the candidate key of the relation.

Since ABD^+ = A B C D E F G H I J, (closure of ABD contains all the attributes of R)

So **ABD is candidate key** in above table.

Prime attributes – A B D (because ABD is the candidate key)

Non prime attributes – C E G H I J (because these are not the part of the candidate key)

Now, Only functional dependency H → J follows the rule of 2NF,

But **functional dependencies {AB →C, AD →GH, BD →EF, A → I} are violating the rule of 2NF, because prime attributes are determining the non prime attributes.** It is the case of partial dependency and this type of partial dependency is not allowed in 2NF.

Therefore, to convert the relation R(A B C D) in 2NF, It is divided into five relations:

R1 (A B C) -- [AB → C]
R2 (A D G H J) -- [AD → GH, H →J]
R3 (B D E F) -- [BD → EF]
R3 (A I) -- [A → I]
R3 (A B D) -- [ABD is candidate key]

Now R1, R2, R3, R4 and R5 are following the rules of 2NF.

[**Note**: Although relation R1, R2, R3 and R4 covers all the FDs, but it is necessary to keep the attributes of candidate key of original relation together to maintain the consistency and integrity of data, that's why attribute ABD are kept in R5.]

Exercise (Attempt it):

1. Suppose a relational schema R1 (A B C D E), and

   FDs: $AB \rightarrow C$

   $D \rightarrow E$

Check out the relation R1 is in 2NF or not? If not decompose it in 2NF.

2. Suppose a relational schema R2 (A B C D E), and

   FDs: $A \rightarrow C$

   $B \rightarrow DE$

Check out the relation R2 is in 2NF or not? If not decompose it in 2NF.