

Database Normalization – Exercise Practices on 3NF

Q.1 Suppose a relational schema R (A B C D E) and set of functional dependencies

$$F: \{ \begin{array}{l} A \rightarrow B \\ B \rightarrow E \\ C \rightarrow D \end{array} \}$$

Check out that relation is in 3NF or not? If not decompose it in 3NF.

Solution1:

Firstly find the candidate key in the relation:

$$(AC)^+ = ABCDE$$

AC is the candidate key, because closure of AC has all the attributes of R.

Prime attributes: AC

Non prime attributes: BDE

A relation is said to be 3NF, if it holds at least one of the following for every non trivial functional dependency $\alpha \rightarrow \beta$:

- α is super key.
- β is prime attribute.

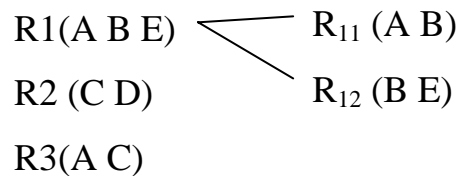
$A \rightarrow B$ -- Neither A is super key, nor B is prime attribute.

$B \rightarrow E$ -- Neither B is not super key, nor E is prime attribute.

$C \rightarrow D$ -- Neither C is not super key, nor D is prime attribute.

So, the relation is not in 3NF as it is not following the rules of 3NF.

Therefore, R(ABCDE) needs to be divided into following:



Now **R₁₁, R₁₂, R2, R3** are in 3NF.

Q.2 Suppose a relational schema R (A B C D E F G H I) and set of functional dependencies

F: { $AB \rightarrow C$,
 $AD \rightarrow GH$,
 $BD \rightarrow EF$,
 $A \rightarrow I$,
 $H \rightarrow J$ }

Check out that relation is in 3NF or not? If not decompose it in 3NF.

Solution 2:

Firstly find the candidate key in the relation:

$(ABD)^+ = A B C D E F G H I$

ABD is the candidate key, because closure of ABD has all the attributes of R.

Prime attributes: A B D

Non prime attributes: C E F G H I

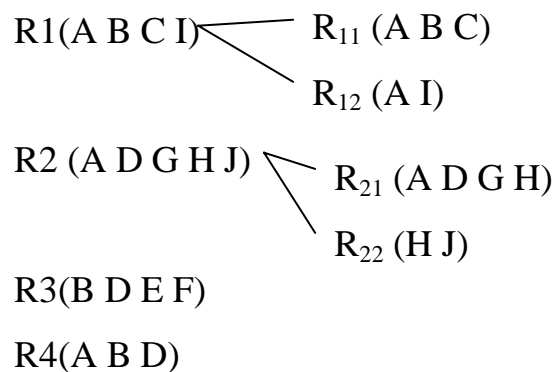
A relation is said to be 3NF, if it holds at least one of the following for every non trivial functional dependency $\alpha \rightarrow \beta$:

- α is super key.
- β is prime attribute.

AB \rightarrow C -- Neither AB is super key, nor C is prime attribute.
AD \rightarrow GH -- Neither AD is not super key, nor GH is prime attribute.
BD \rightarrow EF -- Neither BD is not super key, nor EF is prime attribute.
A \rightarrow I -- Neither A is not super key, nor I is prime attribute.
H \rightarrow J -- Neither H is not super key, nor J is prime attribute.

So, the relation is not in 3NF as it is not following the rules of 3NF.

Therefore, R(ABCDE) needs to be divided into following:



Now R_{11} , R_{12} , R_{21} , R_{22} , R_3 , R_4 are in 3NF.