

5. Compare BCNF & 3NF

Basis for comparison	3NF	BCNF
concept	No non-prime attribute must be transitively dependent on the candidate key.	For any trivial dependency in a relation R say $x \rightarrow y$, x should be a super key of relation R.
Dependency	3NF can be obtained without sacrificing all dependencies.	Dependencies may not be preserved in BCNF.
Decomposition	Lossless decomposition can be achieved in 3NF.	Lossless decomposition is hard to achieve in BCNF.

Hence BCNF is much restrictive than 3NF which helps in normalizing the table more. The relation in 3NF has minimum redundancy left which is further removed by BCNF.

6. Prove that every 2 attribute relation is in BCNF

Consider a relation R having 2 attributes A & B.

A relation R is in Boyce-Codd Normal Form (BCNF)

if for every non-trivial functional dependency $x \rightarrow A$ holds in R, then x is a superkey of R

For the above considered relation $R(A, B)$, the possible functional dependencies are as follows:

(i) case 1

LHS contains both attributes

$AB \rightarrow \dots$

clearly this is a trivial functional dependency because RHS attributes form subset of LHS attributes.

ii) case 2

LHS contains only one attribute.

$A \rightarrow B$

$B \rightarrow A$

clearly in this case, the LHS attribute will be the candidate key.

So the possible functional dependencies are either trivial or the LHS attributes form a superkey.

Hence, every two attribute relation is in BCNF.

7. Write short notes on:-

(i) Boyce-Codd Normal Form (BCNF)

A relation schema R is in BCNF, if for every non-trivial functional dependency $x \rightarrow A$ holds in R , then x is a superkey of R .

BCNF is a simpler form of 3NF, but it is stricter than 3NF, i.e., every relation in BCNF is also in 3NF; however a relation in 3NF is not necessarily in BCNF.

(ii) Third Normal Form (3NF)

A relation schema R is in third normal form (3NF) if, whenever a non-trivial functional dependency $x \rightarrow A$ holds in R , either

- (i) x is a superkey of R , or
- (ii) A is a prime attribute of R .

A functional dependency $x \rightarrow y$ in a relation schema R is a transitive dependency if there is a set of attributes z that is neither a candidate nor a subset of any key of R & both $x \rightarrow z$ & $z \rightarrow y$ hold.

Third normal form (3NF) is based on the concept of transitive dependency.