Subject: Datbase management system and RDBMS
Topic: BCNF
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Boyce-Codd Normal Form-

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A given relation is called in BCNF if and only if-

1. Relation already exists in 3NF.
2. For each non-trivial functional dependency $A \rightarrow B$, A is a super key of the relation.

Example-

Consider a relation- R (A , B , C) with the functional dependencies-

$$A \rightarrow B$$

$$B \rightarrow C$$

$$C \rightarrow A$$

The possible candidate keys for this relation are-A , B , C

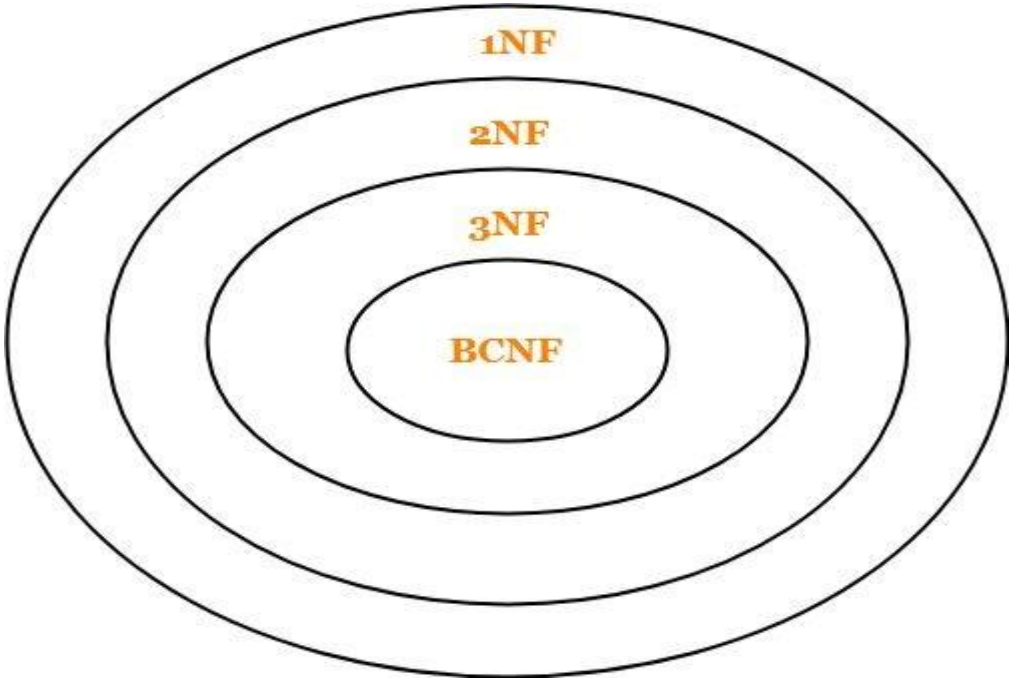
Now, we can observe that RHS of each given functional dependency is a candidate key.

Thus, we conclude that the given relation is in BCNF.

Point-01:

Remember the following diagram which implies-

- A relation in BCNF will surely be in all other normal forms.
- A relation in 3NF will surely be in 2NF and 1NF.
- A relation in 2NF will surely be in 1NF.



Point-02:

The above diagram also implies-

- BCNF is stricter than 3NF.
- 3NF is stricter than 2NF.
- 2NF is stricter than 1NF.

Point-03:

While determining the normal form of any given relation,

- Start checking from BCNF.
- This is because if it is found to be in BCNF, then it will surely be in all other normal forms.
- If the relation is not in BCNF, then start moving towards the outer circles and check for other normal forms in the order they appear.

Point-04:

- In a relational database, a relation is always in First Normal Form (1NF) at least.

Point-05:

- Singleton keys are those that consist of only a single attribute.
- If all the candidate keys of a relation are singleton candidate keys, then it will always be in 2NF at least.
- This is because there will be no chances of existing any partial dependency.
- The candidate keys will either fully appear or fully disappear from the dependencies.
- Thus, an incomplete candidate key will never determine a non-prime attribute.

Point-06:

- If all the attributes of a relation are prime attributes, then it will always be in 2NF at least.
- This is because there will be no chances of existing any partial dependency.
- Since there are no non-prime attributes, there will be no **Functional Dependency** which determines a non-prime attribute.

Point-07:

- If all the attributes of a relation are prime attributes, then it will always be in 3NF at least.
- This is because there will be no chances of existing any transitive dependency for non-prime attributes.

Point-08:

- Third Normal Form (3NF) is considered adequate for normal relational database design.

Point-09:

- Every binary relation (a relation with only two attributes) is always in BCNF.

Point-10:

- BCNF is free from redundancies arising out of functional dependencies (zero redundancy).

Point-11:

- A relation with only trivial functional dependencies is always in BCNF.
- In other words, a relation with no non-trivial functional dependencies is always in BCNF.

Point-12:

- BCNF decomposition is always lossless but not always dependency preserving.

Point-13:

- Sometimes, going for BCNF may not preserve functional dependencies.
- So, go for BCNF only if the lost functional dependencies are not required else normalize till 3NF only.

Point-14:

- There exist many more normal forms even after BCNF like 4NF and more.
- But in the real world database systems, it is generally not required to go beyond BCNF.

Point-15:

- Lossy decomposition is not allowed in 2NF, 3NF and BCNF.
- So, if the decomposition of a relation has been done in such a way that it is lossy, then the decomposition will never be in 2NF, 3NF and BCNF.

Point-16:

- Unlike BCNF, Lossless and dependency preserving decomposition into 3NF and 2NF is always possible.

Point-17:

- A prime attribute can be transitively dependent on a key in a 3NF relation.
- A prime attribute can not be transitively dependent on a key in a BCNF relation.

Point-18:

- If a relation consists of only singleton candidate keys and it is in 3NF, then it must also be in BCNF.

Point-19:

- If a relation consists of only one candidate key and it is in 3NF, then the relation must also be in BCNF.