

Unit: 4
Lecture: 2
Database Normalization

3. Third Normal Form -

A relation is in third normal form, if there is **no transitive dependency** for non-prime attributes as well as it is in second normal form.

A relation is in 3NF if **at least one of the following condition holds** in every non-trivial function dependency $X \rightarrow Y$

1. X is a super key.
2. Y is a prime attribute (each element of Y is part of some candidate key).

STUD_NO	STUD_NAME	STUD_STATE	STUD_COUNTRY	STUD_AGE
1	RAM	HARYANA	INDIA	20
2	RAM	PUNJAB	INDIA	19
3	SURESH	PUNJAB	INDIA	21

Table 4

Transitive dependency - If $A \rightarrow B$ and $B \rightarrow C$ are two FDs then $A \rightarrow C$ is called transitive dependency.

- **Example 1** - In relation STUDENT given in Table 4,
FD set: { $STUD_NO \rightarrow STUD_NAME$, $STUD_NO \rightarrow STUD_STATE$, $STUD_STATE \rightarrow STUD_COUNTRY$, $STUD_NO \rightarrow STUD_AGE$ }
Candidate Key: { $STUD_NO$ }

For this relation in table 4, $STUD_NO \rightarrow STUD_STATE$ and $STUD_STATE \rightarrow STUD_COUNTRY$ are true. So $STUD_COUNTRY$ is transitively dependent on $STUD_NO$. It violates the third normal form. To convert it in third normal form, we will decompose the relation STUDENT ($STUD_NO$, $STUD_NAME$, $STUD_PHONE$, $STUD_STATE$, $STUD_COUNTRY$, $STUD_AGE$) as:
 $STUDENT (STUD_NO, STUD_NAME, STUD_PHONE, STUD_STATE, STUD_AGE)$
 $STATE_COUNTRY (STATE, COUNTRY)$

4. Boyce-Codd Normal Form (BCNF) -

A relation R is in BCNF if R is in Third Normal Form and for every FD, LHS is super key. A relation is in BCNF iff in every non-trivial functional dependency $X \rightarrow Y$, X is a super key.