

Boyce Codd normal form (BCNF)

- BCNF is the advance version of 3NF. It is stricter than 3NF.
- A table is in BCNF if every functional dependency $X \rightarrow Y$, X is the super key of the table.
- For BCNF, the table should be in 3NF, and for every FD, LHS is super key.

Example: Let's assume there is a company where employees work in more than one department.

EMPLOYEE table:

| EMP_ID | EMP_COUNTRY | EMP_DEPT | DEPT_TYPE | EMP_DEPT_NO |
|--------|-------------|------------|-----------|-------------|
| 264 | India | Designing | D394 | 283 |
| 264 | India | Testing | D394 | 300 |
| 364 | UK | Stores | D283 | 232 |
| 364 | UK | Developing | D283 | 549 |

In the above table Functional dependencies are as follows:

1. $EMP_ID \rightarrow EMP_COUNTRY$
2. $EMP_DEPT \rightarrow \{DEPT_TYPE, EMP_DEPT_NO\}$

Candidate key: {EMP-ID, EMP-DEPT}

The table is not in BCNF because neither EMP_DEPT nor EMP_ID alone are keys.

To convert the given table into BCNF, we decompose it into three tables:

EMP_COUNTRY table:

| EMP_ID | EMP_COUNTRY |
|--------|-------------|
| 264 | India |
| 264 | India |

EMP_DEPT table:

| EMP_DEPT | DEPT_TYPE | EMP_DEPT_NO |
|------------|-----------|-------------|
| Designing | D394 | 283 |
| Testing | D394 | 300 |
| Stores | D283 | 232 |
| Developing | D283 | 549 |

EMP_DEPT_MAPPING table:

| EMP_ID | EMP_DEPT |
|--------|----------|
| D394 | 283 |
| D394 | 300 |
| D283 | 232 |
| D283 | 549 |

Functional dependencies:

1. $\text{EMP_ID} \rightarrow \text{EMP_COUNTRY}$
2. $\text{EMP_DEPT} \rightarrow \{\text{DEPT_TYPE}, \text{EMP_DEPT_NO}\}$

Candidate keys:

For the first table: EMP_ID

For the second table: EMP_DEPT

For the third table: {EMP_ID, EMP_DEPT}

Now, this is in BCNF because left side part of both the functional dependencies is a key.