

Q1: Functional Dependency

→ The dependency of an attribute on a set of attributes is known as functional dependency if the set of attributes includes that attribute.

Symbolically : $A \rightarrow Y$ where A is a subset of X .

e.g. Consider a table with two columns : student_id & student_name

$\{ \text{student_id}, \text{student_name} \} \rightarrow \text{student_id}$ is a functional dependency.

Non-Functional Dependency

If a functional dependency $X \rightarrow Y$ holds true where Y is not a subset of X , then, this dependency is called non-functional dependency.

e.g. consider a table employee :

with attributes : emp_id, emp_name, emp_address

The following functional dependency are non-functional -

$\text{emp_id} \rightarrow \text{emp_name}$ { emp_name & emp_address are }
 $\text{emp_id} \rightarrow \text{emp_address}$ { not a subset of emp_id }

Transitive Functional Dependency

When an indirect relationship causes functional dependency, it is called Transitive Dependency.

i.e., if $P \rightarrow Q$ & $Q \rightarrow R$ is true, then $P \rightarrow R$ is transitive functional dependency.

e.g., Name is a relation with attributes :

Movie_id, Rating_id, Listing_type and DVD-name.

clearly,

Movie_id \rightarrow Rating_id

Rating_id \rightarrow Listing-type

\Rightarrow Movie_id \rightarrow Listing-type is a transitive functional dependency.

1NF (First Normal Form)

A relation is said to be in 1NF (first normal form), if it doesn't contain any multi-valued attributes. In other words, in 1NF each attribute contains only atomic (single) value only.

Eg 1 -

Stud_no	stud_name	stud_phone	stud_state	stud_country
1	Ram	976291721, 987777778	Karnataka	India
2	Ram	9898247281	Kerala	India
3	Suresh		Kerala	India

Table 1

Stud_no	stud_name	stud_phone	stud_state	stud_country
1	Ram	976291721	Karnataka	India
1	Ram	987777778	Karnataka	India
2	Ram	9898247281	Kerala	India

Table 2

2 NF (Second Normal Form)

To be in second normal form, a relation must be in first normal form and relation must not contain any partial dependency.

A relation is in 2NF if it has no partial dependency i.e., no non-prime attribute (attribute which does not part of any candidate key) is dependent on any proper subset of any candidate key of the table.

e.g., Let's say a school teacher store the teachers data in Teacher table,

Teacher_ID	Subject	Teacher_Age
I101	Physics	45
I102	Chemistry	45
I102	Maths	45
I203	Physics	42
I203	English	42

The table has only one candidate key, which is { Teacher_ID, Subject }, also the attribute Teacher_Age, is a non-prime attribute as it doesn't belong to this candidate key.

But, Teacher_id \rightarrow Teacher_Age. Non-prime attribute Teacher_Age is dependent on a proper subset of the candidate key, which is a partial dependency and so this set is not in 2NF.

To convert the above relation to 2NF, we need to split the table into 2 tables such as :

Table 1 : Teacher_ID, Teacher_Age

Table 2 : Teacher_ID, Subject

3 NF (Third Normal Form)

If a table is in 2NF and all non-prime attributes refer to other non-prime attributes, then the relation is in 3NF.

