FUNCTIONAL DEPENDENCIES

Functional dependency is just like a constraint. It determines the relation between two and more entities or attributes in a relation. In simple words it shows the properties of an entity or attribute.

If an entity depends on another entity for its recognition, then this is known as functional dependency. Take an example:

Sid	Name
01	Raj
02	Raj

Table Student

In this student table, students name are similar “Raj”, but we know that both are two different students, because they both have separate and unique Sid (Student ID). So here in this table “Name” attribute is functionally depend on “Sid” attribute. If we remove “SID” attribute then we can’t differentiate between both entries that are they same or different entries.

Also, with the help of “Sid” we can retrieve student’s other details like address, results, mobile number, school name etc.

So, we can say that Functional dependency is a constraint through which we can find out values of another attribute’s values with given attribute A, but that attribute A must be unique or a key attribute.

It is denoted as **A → B**, where A is an attribute or a set of attributes that is capable of determining the value of attribute B. (B may be a set of attributes as well).

The left side of FD (functional dependencies) is known as a **determinant**, the right side of the relation is known as a **dependent**.

So, in A → B, A is determinant and B is dependent.

TYPES OF FUNCTIONAL DEPENDENCIES

1. Multivalued Dependency
2. Trivial Functional Dependency
3. Non-Trivial Functional Dependency
4. Transitive Dependency
5. Partial Functional Dependency
6. Full Functional Dependency

1. MULTIVALUED DEPENDENCY:

If a table has more than two attributes or at least has 3 attribute which are independent attributes then Multivalued Dependency occurs.

Mobile	Manufactured year	Camera
Samsung A21	2017	Dual Camera
Vivo Reno	2018	Quad Camera

Mobile-Details table

In this above given table Manufactured year and Camera are two independent attributes which has no relation in between, but both are related to Mobile attribute.

Mobile → Manufactured year [Exist]

Mobile → Camera [Exist]

Manufactured year → Camera [Not Exist]

Camera → Manufactured year [Not Exist]

2. TRIVIAL FUNCTIONAL DEPENDENCY:

A → B has trivial functional dependency if B is a subset of A.
The following dependencies are also trivial like: A → A, B → B.

Sid	Name
01	Raj
02	Raj

In this table Sid → Name, means with the help of Sid we can find out name of the student.

Here {Sid, Name} is a set S.

{Sid, Name} → Sid shows Trivial Functional Dependency because Sid is also a subset of Set S. Also, Name is also a subset of Set S.

Also, Sid → Sid and Name → Name shows Trivial Functional Dependency.

3. NON-TRIVIAL FUNCTIONAL DEPENDENCY

A → B has a non-trivial functional dependency if B is not a subset of A.

When value of A intersection B is NULL means in both sets no common values found, then A → B is called as complete non-trivial. Also, these both sets are not related to each other.

Sid	Name
01	Raj
02	Raj

student1

Name	Class
Raj	11
Raj	12

Student2

Here {Sid, Name} is a set S1 from table student1, and {Name, Class} is a set S2 from table student2.

So, Sid and Name are subset of set S1, but Class is a subset of set S2. Means Class is not a subset of set S1.

Here Sid → Name, and Name → Class.

In simple words we can find out name of any student with the help of Sid directly, because both are from common set S1.

we can't find out class of any student with the help of Sid directly, because both are from different sets.

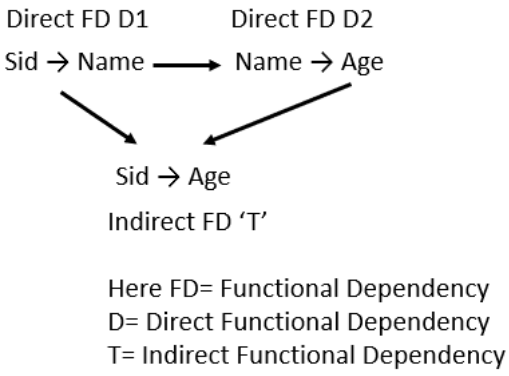
4. TRANSITIVE DEPENDENCY:

If a relation has more then two attributes and more then one functional dependency occurs in that relation then this is Transitive Dependency.

Sid	Name	Age
01	Raj	17
02	Raj	15

Here in this student table, we have three attributes Sid, Name, Age. If we know student id, we can find out their name and if we know name then we can find out their age. So, here in this table

Sid → Name, and Name → Age, it means Sid → age also occur.



Here due to D1 and D2, T is formed. This is called Transitive Dependency.

Transitive Dependency only occurs in a relation or table in which at-least three or more attributes are present.

5. PARTIAL FUNCTIONAL DEPENDENCY:

If a table has more than one key attributes with at least three or more attributes, then Partial Functional Dependency occurs.

Sid	Class	Name	Age
01	11	Raj	17
02	12	Raj	15

Table Student

In this table Sid and Class are candidate keys, means both are unique, then Name and Age of any student can be determined by Sid or Class, or by combination of both as well.

So, if we remove Sid, then still Name and Class can be determined by Class attribute. Similarly, if we remove Class, then still Name and Class can be determined by Sid attribute.

Here Set A= {Sid, Class}

Set B= {Name, Age}

Also, set B is functionally dependent on set A.

So A → B

{Sid, Class} → {Name, Age}

Also,

{Class} → {Name, Age} [Exist]

{Sid} → {Name, Age} [Exist]

6. FULL FUNCTIONAL DEPENDENCY:

If a table has only one key attributes with at least 3 attributes or more, then Full Functional Dependency occurs.

Sid	Name	Age
01	Raj	17
02	Raj	15

Table Student

In this table Sid is candidate key and Name and Age of any student can be determined by Sid.

So, if we remove Sid then we can't find Name and Age of any student.

Here Set A= {Sid}

Set B= {Name, Age}

Also, set B is functionally dependent on set A.

So, A → B

{Sid} → {Name, Age}