

Functional Dependency

Functional Dependency

Functional dependency concept is a relationship that exists when one attribute determines differently another attribute.

A functional dependency (FD) on a relation schema R is a constraint $X \rightarrow Y$, where X and Y are subsets of attributes of R, which indicates that Y is dependent on X.

The table features are said to depend on each other when the table attribute separately identifies another similar table attribute.

For example:

Suppose we have a student table with attributes: **Stu_Id, Stu_Name, Stu_Age**.

Here the Stu_Id attribute uniquely identifies the **Stu_Name** attribute of the student table because if we know the student id we can tell the student name associated with it.

Functional dependency and can be written as :

Stu_Id $\rightarrow$ Stu_Name .

We can say Stu_Name is functionally dependent on Stu_Id.

Types of Functional Dependencies

- Trivial functional dependency
- Non-trivial functional dependency

Trivial functional dependency

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

It can be written as :

$A \rightarrow B$ is trivial functional dependency if B is a subset of A.

The following dependencies are also trivial: $A \rightarrow A$ & $B \rightarrow B$.

For example:

Consider a table with two columns *Student_id* and *Student_Name*.

$\{Student_Id, Student_Name\} \rightarrow Student_Id$ is a trivial functional dependency as *Student_Id* is a subset of $\{Student_Id, Student_Name\}$.

Also, $Student_Id \rightarrow Student_Id$ & $Student_Name \rightarrow Student_Name$ are trivial dependencies too.

Non-trivial functional dependency

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

Example :

An employee table with three attributes: *emp_id*, *emp_name*, *emp_address*.

The following functional dependencies are non-trivial:

$emp_id \rightarrow emp_name$ (*emp_name* is not a subset of *emp_id*)

$emp_id \rightarrow emp_address$ (*emp_address* is not a subset of *emp_id*)

On the other hand, the following dependencies are trivial:

$\{emp_id, emp_name\} \rightarrow emp_name$ [*emp_name* is a subset of $\{emp_id, emp_name\}$]

Completely non trivial FD:

If a Functional dependency $X \rightarrow Y$ holds true where $X \cap Y$ is Null then this dependency is said to be completely non trivial functional dependency.

Multivalued dependency

Multivalued dependency occurs when there are more than one independent multivalued attribute in a table.

A multivalued dependency is a full constraint between two sets of attributes in a relation. In contrast to the functional dependency, the multivalued dependency requires that certain tuples be present in a relation.

Transitive dependency

A functional dependency is said to be transitive if it is indirectly formed by two functional dependencies.

$X \rightarrow Z$ is a transitive dependency if the following three functional dependencies hold true: $X \rightarrow Y$ $Y \not\rightarrow X$ $Y \rightarrow Z$

A transitive dependency can only occur in a relation of three or more attributes. This dependency helps us normalize the database in 3NF (3rd Normal Form).
