Functional Dependency

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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 → 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->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 ->B is trivial functional dependency if B is a subset of A.

The following dependencies are also trivial: A->A & B->B .

For example:
Consider a table with two columns *Student_id* and *Student_Name.*
{Student_Id, Student_Name} -> Student_Id is a trivial functional dependency as Student_Id is a subset of {Student_Id, Student_Name}.
Also, *Student_Id -> Student_Id & Student_Name -> Student_Name* are trivial dependencies too.

Non-trivial functional dependency

If a functional dependency X->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 -> emp_name (emp_name is not a subset of emp_id)
emp_id -> emp_address (emp_address is not a subset of emp_id)

On the other hand, the following dependencies are trivial:
{emp_id, emp_name} -> emp_name [emp_name is a subset of {emp_id, emp_name}]

Completely non trivial FD:
If a Functional dependency X->Y holds true where X intersection 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 -> Z is a transitive dependency if the following three functional dependencies hold true: X->Y Y does not ->X Y->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).