

A Functional dependency is a relationship between attributes.

In functional dependency we can obtain the value of another attribute from given attribute.

For example,

If we know the value of student roll number, we can obtain student address, marks etc. By this, we say that student address and marks is functionally dependent on student roll number.

Types of functional dependency:

1. Single Valued Functional Dependency
2. Fully Functional Dependency
3. Partial Functional Dependency
4. Transitive Functional Dependency
5. Trivial Functional Dependency

1) Single Valued Functional Dependency

A simple example of single value functional dependency is when Roll_Number is the primary key of an entity and Student_Name is some single valued attribute of the entity. Then, $\text{Roll_Number} \rightarrow \text{Student_Name}$

| Roll_Number | Student_Name | Student_Address |
|-------------|------------------|-----------------|
| 011 | Jayesh Umre | Burhanpur |
| 012 | Kunal Batra | Burhanpur |
| 013 | Nilesh Nimborkar | Ichchapur |

| | | |
|-----|---------------|--------|
| 014 | Aryan Jagdale | Ujjain |
|-----|---------------|--------|

2) Fully Functional Dependency

A functional dependency $P \rightarrow Q$ is full functional dependency if removal of any attribute A from P means that the dependency does not hold any more.

| Roll_Number | Subject_Name | Paper_Hours |
|-------------|--------------|-------------|
| 011 | DBMS | 3 |
| 012 | Python | 1 |
| 013 | AWT | 3 |
| 025 | DBMS | 2 |

From above table, $\{Roll_Number, Subject_Name\} \rightarrow Paper_Hour$ Since neither $Roll_Number \rightarrow Paper_Hour$ nor $Subject_Name \rightarrow Paper_Hour$ hold.

3) Partial Functional Dependency

A Functional Dependency in which one or more non key attributes are functionally depending on a part of the primary key is called partial functional dependency.

| Roll_Number | Subject_Name | Student_Name |
|-------------|--------------|------------------|
| 011 | DBMS | Jayesh Umre |
| 012 | Python | Kunal Batra |
| 013 | AWT | Nilesh Nimborkar |

| | | |
|-----|------|---------------|
| 014 | DBMS | Aryan Jagdale |
|-----|------|---------------|

From above table, $\{ \text{Roll_Number}, \text{Subject_Name} \} \rightarrow \text{Student_Name}$ is not a full FD. Since $\text{Roll_Number} \rightarrow \text{Student_Name}$ also hold.

4) Transitive Functional Dependency

Given a relation $R(A,B,C)$ then dependency like $A \rightarrow B$, $B \rightarrow C$ is a transitive dependency, since $A \rightarrow C$ is implied

| Roll_Number | Pin_Code | City_Name |
|-------------|----------|-----------|
| 011 | 450331 | Burhanpur |
| 012 | 450001 | Khandwa |
| 013 | 456001 | Ujjain |
| 014 | 452020 | Indore |

From above table, $\text{Roll_Number} \rightarrow \text{Pin_Code}$ and $\text{Pin_Code} \rightarrow \text{City_Name}$ hold. Then $\text{Roll_Number} \rightarrow \text{City_Name}$ is a transitive FD.

5) Trivial Functional Dependency

Functional dependency of the form $A \rightarrow B$ is trivial if B subset of A or $B = A$.

| Roll_Number | Student_Name |
|-------------|--------------|
| 011 | Jayesh Umre |

| | |
|-----|------------------|
| 012 | Kunal Batra |
| 013 | Nilesh Nimborkar |
| 014 | Aryan Jagdale |

From above table, $\{Roll_Nuber, Student_Name\} \rightarrow Roll_Number$ is a trivial functional dependency as $Roll_Number$ is a subset of $\{Roll_Number, Student_Name\}$.