

# **FUNCTIONAL DEPENDENCY**

Mr. C.B. Singh

Assistant Professor

Computer Science & Engineering Department

University of Lucknow

Lucknow

## Functional Dependency

Functional dependency is a relationship between attributes of a table which are dependent on each other.

Let  $R$  is a relation with attributes  $A$  and  $B$ .

Here

$$A \rightarrow B$$

is a functional dependency which means  $B$  is functionally dependent on attribute  $A$ . Here  $A$  is known as determinant set, whereas  $B$  is dependent attribute(s).

Ex let us a Relation Student

| RollNo | Name |
|--------|------|
| 101    | Ajay |
| 102    | Amit |
| 103    | Anit |

Here Roll-No  $\rightarrow$  Name

Here RollNo is Primary Key and it uniquely identifies the Name attribute.

we can say that if

$$X \rightarrow Y$$

that means value of  $Y$  can be determined with help of value of  $X$ .

or if  $t_1[X] = t_2[X]$

then  $t_1[Y] = t_2[Y]$

i.e. two different tuples (Here  $t_1$  &  $t_2$ ) having same value of  $X$  will have same value for  $Y$  also.

### Type of Functional Dependency:-

① Trivial functional dependency:

$X \rightarrow Y$  has trivial FD if  $Y$  is a subset of  $X$ .

② Non-Trivial functional dependency:

$X \rightarrow Y$  has Non-trivial FD if  $Y$  is not a subset of  $X$ .

Note:- if  $X$  intersection  $Y$  is Null then  $X \rightarrow Y$  has Completely Non-Trivial.

Following are six inference rules for functional dependency,

① Reflexivity Rule:-

if  $A$  is set of Attributes  
and  $B \subseteq A$  then  
 $A \rightarrow B$  will hold.

② Augmentation Rule:-

if  $A \rightarrow B$  holds  
then  $AC \rightarrow BC$  will also hold.

③ Transitivity Rule:-

if  $A \rightarrow B$  and  $B \rightarrow C$  holds  
then  $A \rightarrow C$  will also hold.

Note:- The above 3 rules (Reflexivity, Augmentation, Transitivity) is also known as Armstrong's Axioms.

Other 3 rules are also known as secondary or derived rules which as follows.

④ Union Rule:-

if  $A \rightarrow B$  and  $A \rightarrow C$   
then  $A \rightarrow BC$

⑤ Decomposition Rule:-

if  $X \rightarrow YZ$  holds then  
 $X \rightarrow Y$   
&  $X \rightarrow Z$  will also hold.

⑥ Pseudotransitivity rule:-

if  $A \rightarrow B$   
and  $BC \rightarrow D$  holds.  
then  $\boxed{AC \rightarrow D}$  holds.

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