

# Unit III – Database Design

**Dependencies and Normal forms - Functional Dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers-Non- loss decomposition- First,Second,Third Normal Forms, Dependency Preservation-Boyce/Codd Normal Form-Multivalued Dependencies and Fourth Normal Form- Join Dependencies and Fifth Normal Form**



# Dependencies

Dependencies in DBMS is a relation between two or more attributes.

It has the following types in DBMS

- Functional Dependency
- Fully-Functional Dependency
- Transitive Dependency
- Multivalued Dependency
- Partial Dependency

# Normal Forms

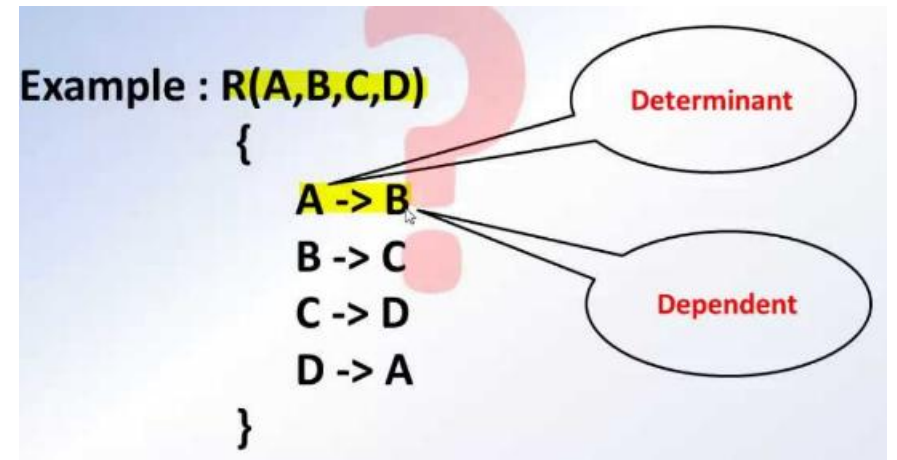
- **Normalization** is the process of minimizing **redundancy** from a relation or set of relations.
- Redundancy in relation may cause insertion, deletion, and update anomalies.
- So, it helps to minimize the redundancy in relations.
- **Normal forms** are used to eliminate or reduce redundancy in database tables.



## Normal Forms in DBMS



- A functional dependency is a **constraint that specifies the relationship between two sets of attributes**
  - where one set can accurately determine the value of other sets.
- It is denoted as  $X \rightarrow Y$ ,
- where X is a set of attributes that is capable of determining the value of Y.
- The attribute set on the left side of the arrow, **X** is called **Determinant**, while on the right side, **Y** is called the **Dependent**.





# Example 1

Roll_no	name	Marks	Dept	Course
1	A	78	CS	C1
2	B	60	EE	C1
3	A	78	CS	C2
4	B	60	EE	C3
5	C	80	IT	C3
6	d	80	EC	C2



## Example 2

<b>roll_no</b>	<b>name</b>	<b>dept_name</b>	<b>dept_building</b>
<b>42</b>	<b>abc</b>	<b>CO</b>	<b>A4</b>
<b>43</b>	<b>pqr</b>	<b>IT</b>	<b>A3</b>
<b>44</b>	<b>xyz</b>	<b>CO</b>	<b>A4</b>
<b>45</b>	<b>xyz</b>	<b>IT</b>	<b>A3</b>
<b>46</b>	<b>mno</b>	<b>EC</b>	<b>B2</b>
<b>47</b>	<b>jkl</b>	<b>ME</b>	<b>B2</b>

# Valid Functional Dependencies <sup>8/5</sup>

- $\text{roll\_no} \rightarrow \{ \text{name}, \text{dept\_name}, \text{dept\_building} \}$ ,  $\rightarrow$  Here,  $\text{roll\_no}$  can determine values of fields  $\text{name}$ ,  $\text{dept\_name}$  and  $\text{dept\_building}$ , hence a valid Functional dependency
- $\text{roll\_no} \rightarrow \text{dept\_name}$  , Since,  $\text{roll\_no}$  can determine whole set of  $\{ \text{name}, \text{dept\_name}, \text{dept\_building} \}$ , it can determine its subset  $\text{dept\_name}$  also.
- $\text{dept\_name} \rightarrow \text{dept\_building}$  ,  $\text{Dept\_name}$  can identify the  $\text{dept\_building}$  accurately, since departments with different  $\text{dept\_name}$  will also have a different  $\text{dept\_building}$
- More valid functional dependencies:  $\text{roll\_no} \rightarrow \text{name}$ ,  $\{ \text{roll\_no}, \text{name} \} \twoheadrightarrow \{ \text{dept\_name}, \text{dept\_building} \}$ , etc.



# invalid functional dependencies<sup>9/5</sup>

- $\text{name} \rightarrow \text{dept\_name}$  Students with the same name can have different dept\_name, hence this is not a valid functional dependency.
- $\text{dept\_building} \rightarrow \text{dept\_name}$  There can be multiple departments in the same building, For example, in the above table departments ME and EC are in the same building B2, hence  $\text{dept\_building} \rightarrow \text{dept\_name}$  is an invalid functional dependency.
- More invalid functional dependencies:  $\text{name} \rightarrow \text{roll\_no}$ ,  $\{\text{name}, \text{dept\_name}\} \rightarrow \text{roll\_no}$ ,  $\text{dept\_building} \rightarrow \text{roll\_no}$ , etc.



**sns**  
INSTITUTIONS™

**Thank You!**