



## **Normal Forms**

Prepared By, K.Revathi, AP/IT







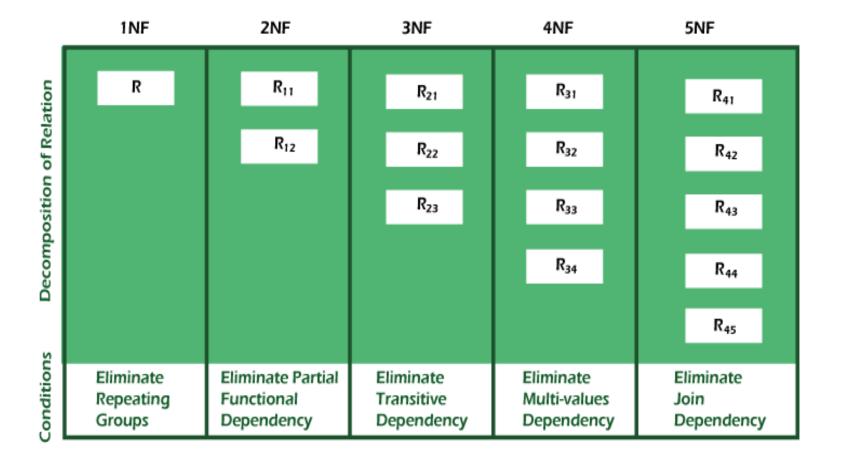
## **Definition:**

- Normalization is the process of organizing the data in the database.
- Normal forms are used to eliminate or reduce redundancy in database tables.













#### Normalization: Advantages and Disadvantages

#### Advantages and Disadvantages of Normalization

Advantages

Eliminate modification anomalies

Reduce duplicated data

- Eliminate data integrity problems
- Save file space

Single table queries will run faster

Disadvantages

More complicated SQL required for multitable subqueries and joins

Extra work for DBMS can mean slower applications







## **Definition:**

A relation is said to be in **1NF** (**first normal form**), if it doesn't contain any multi-valued attribute.



Example



Emp_Id	Emp_Name	Emp_Address	Emp_Mobile
101	Herschel	New Delhi	8912312390
102	Jon	Kanpur	8812121212, 9900012222



## **Solution: 1NF**



Emp_Id	Emp_Name	Emp_Address	Emp_Mobile
101	Herschel	New Delhi	8912312390
102	Jon	Kanpur	8812121212
102	Jon	Kanpur	9900012222



## Second normal form (2NF)



A table is said to be in 2NF if both the following conditions hold:

- Table is in 1NF (First normal form)
- No non-prime attribute is dependent on the proper subset of any <u>candidate key</u> of table.





Teacher_Id	Subject	Teacher_Age
111	Maths	38
111	Physics	38
222	Biology	38
333	Physics	40
333	Chemistry	40





# **Candidate Keys:** {Teacher Id, Subject} Non prime attribute:

Teacher\_Age





## This violates the rule for 2NF as the rule says "no non-prime attribute is dependent on the proper subset of any candidate key of the table".



## SOLUTION IN 2NF Teacher\_Details table

Teacher_Id	Teacher_Age
111	38
222	38
333	40

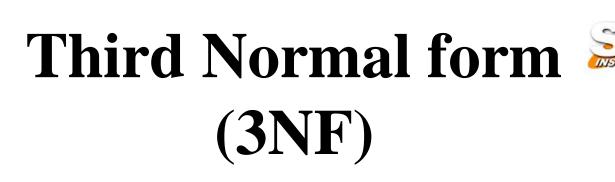


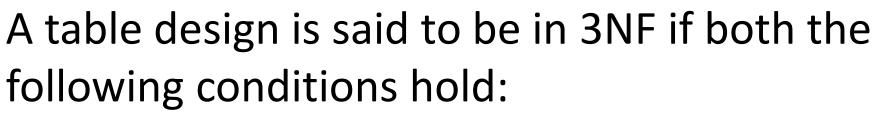


## **Teacher\_Subject table:**

Teacher_Id	Subject
111	Maths
111	Physics
222	Biology
333	Physics
333	Chemistry







- Table must be in 2NF
- Transitive functional dependency of nonprime attribute on any super key should be removed.





### **EMPLOYEE\_DETAIL table:**

EMP_ID	EMP_NAME	EMP_ZIP	EMP_STATE	EMP_CITY
222	Harry	201010	UP	Noida
333	Stephan	02228	US	Boston
444	Lan	60007	US	Chicago
555	Katharine	06389	UK	Norwich
666	John	462007	MP	Bhopal





- Super key in the table above:
- {EMP\_ID}, {EMP\_ID, EMP\_NAME}, {EMP\_ID, E MP\_NAME, EMP\_ZIP}....so on
- Candidate key: {EMP\_ID}
- Non-prime attributes: In the given table, all attributes except EMP\_ID are non-prime.





## **Solution in 3NF**

#### **EMPLOYEE table:**

EMP_ID	EMP_NAME	EMP_ZIP
222	Harry	201010
333	Stephan	02228
444	Lan	60007
555	Katharine	06389
666	John	462007











## Boyce Codd normal form (BCNF)

- BCNF is the advance version of 3NF.
- A table is in BCNF if every functional dependency X → Y, X is the super key of the table.





#### • EMPLOYEE table:

EMP_ID	EMP_COUNTRY	EMP_DEPT	DEPT_TYPE	EMP_DEPT_NO
264	India	Designing	D394	283
264	India	Testing	D394	300
364	UK	Stores	D283	232
364	UK	Developing	D283	549



## **Solution: BCNF**



#### we decompose it into three tables

#### **EMP\_COUNTRY** table:

EMP_ID	EMP_COUNTRY
264	India
264	India





#### **EMP\_DEPT** table:

EMP_DEPT	DEPT_TYPE	EMP_DEPT_NO
Designing	D394	283
Testing	D394	300
Stores	D283	232
Developing	D283	549





#### **EMP\_DEPT\_MAPPING** table:

EMP_ID	EMP_DEPT
D394	283
D394	300
D283	232
D283	549





## Fourth normal form (4NF)

A relation will be in 4NF if it is in Boyce Codd normal form and has no multi-valued dependency.





## Fourth normal form (4NF)

A relation will be in 4NF if it is in Boyce Codd normal form and has no multi-valued dependency.







#### **STUDENT Table**

STU_ID	COURSE	HOBBY
21	Computer	Dancing
21	Math	Singing
34	Chemistry	Dancing
74	Biology	Cricket
59	Physics	Hockey





- The given STUDENT table is in 3NF, but the COURSE and HOBBY are two independent entity. Hence, there is no relationship between COURSE and HOBBY.
- So to make the above table into 4NF, we can decompose it into two tables:





#### **STUDENT\_COURSE** Table

STU_ID	COURSE
21	Computer
21	Math
34	Chemistry
74	Biology
59	Physics





#### **STUDENT\_HOBBY** Table

STU_ID	HOBBY
21	Dancing
21	Singing
34	Dancing
74	Cricket
59	Hockey





# Fifth normal form (5NF)

- A relation is in 5NF if it is in 4NF and not contains any join dependency and joining should be lossless.
- 5NF is also known as Project-join normal form (PJ/NF).





## **Example Teacher Table**

SUBJECT	LECTURER	SEMESTER
Computer	Anshika	Semester 1
Computer	John	Semester 1
Math	John	Semester 1
Math	Akash	Semester 2
Chemistry	Praveen	Semester 1





## So to make the above table into 5NF, we can decompose it into three relations P1, P2 & P3





## P1

SEMESTER	SUBJECT
Semester 1	Computer
Semester 1	Math
Semester 1	Chemistry
Semester 2	Math





## P2

SUBJECT	LECTURER
Computer	Anshika
Computer	John
Math	John
Math	Akash
Chemistry	Praveen





## Sixth normal form (6NF)

 A relation is in 6NF, only if, It is in 5NF, and every join dependency on the relation is trivial.





## **Example Student Table**

Student_ID	Student_FirstName	Student_LastName	Marks
S01	Tom	Alter	90
S02	Jacob	Watson	80
S03	Harry	Smith	85





## **Solution: 6NF**

#### **StudentFirstName**

Student_ID	Student_FirstName
S01	Tom
S02	Jacob
S03	Harry





#### **StudentLastName**

Student_ID	Student_LastName
S01	Alter
S02	Watson
S03	Smith





#### StudentResult

Student_ID	Marks
S01	90
S02	80
S03	85