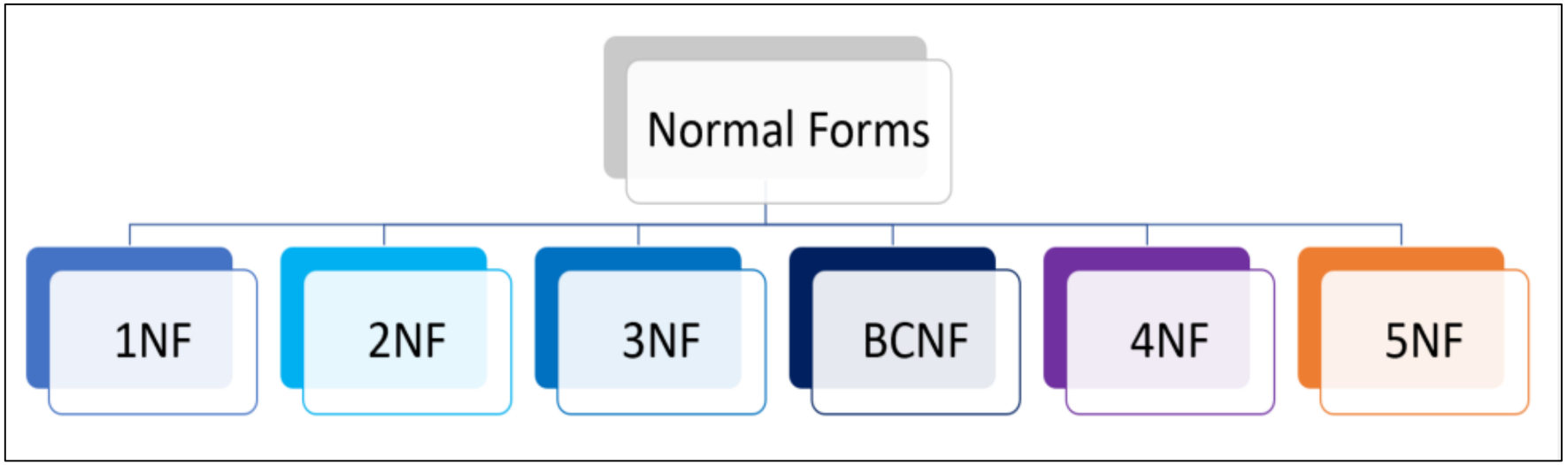
GLA UNIVERSITY
MATHURA
Recognised by UGC Under Section 2(f)

Accredited with A Grade by NAAC

12-B Status from UGC

Database Management Systems (BCSC-0003)

Topic: Normal Forms: 4NF & 5NF



Nikhil Govil

Assistant Professor, Dept. of CEA, GLA University, Mathura.

Fourth Normal Form (4NF)

- A relation will be in 4NF if it is in Boyce–Codd normal form and has no multi-valued dependency.
- For a dependency A → B, if for a single value of A, multiple values of B exists, then the relation will be a multi-valued dependency.

Example: STUDENT

STD_ID	COURSE	HOBBY
21	COMPUTER	DANCING
21	MATH	SINGING
34	CHEMISTRY	DANCING
74	BIOLOGY	CRICKET
59	PHYSICS	HOCKEY

Fourth Normal Form (4NF)

- 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.
- In the STUDENT relation, a student with STD_ID, 21 contains two courses, Computer and Math and two hobbies, Dancing and Singing.
- So there is a Multi-valued dependency on STD_ID, which leads to unnecessary repetition of data.

Fourth Normal Form (4NF)

- So to make the above table into 4NF, we can decompose it into two tables:

Example: STUDENT_COURSE

STD_ID	COURSE
21	COMPUTER
21	MATH
34	CHEMISTRY
74	BIOLOGY
59	PHYSICS

STUDENT_HOBBY

STD_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 satisfied when all the tables are broken into as many tables as possible in order to avoid redundancy.
- 5NF is also known as Project-join normal form (PJ/NF).

Example: SUBJECT_DETAILS

SUBJECT	LECTURER	SEMESTER
COMPUTER	ANSHIKA	SEMESTER 1
COMPUTER	JOHN	SEMESTER 1
MATH	JOHN	SEMESTER 1
MATH	AKASH	SEMESTER 2
CHEMISTRY	PRAVEEN	SEMESTER 1

Fifth Normal Form (5NF)

- In the SUBJECT_DETAILS table, John takes both Computer and Math class for Semester 1 but he doesn't take Math class for Semester 2. In this case, combination of all these fields required to identify a valid data.

- Suppose we add a new Semester as Semester 3 but do not know about the subject and who will be taking that subject so we leave Lecturer and Subject as NULL. But all three columns together acts as a primary key, so we can't leave other two columns blank.

- So to make the above table into 5NF, we can decompose it into three relations T1, T2 & T3:

Fifth Normal Form (5NF)

T1 table:

SEMESTER	SUBJECT
SEMESTER 1	COMPUTER
SEMESTER 1	MATH
SEMESTER 1	CHEMISTRY
SEMESTER 2	MATH

T2 table:

SUBJECT	LECTURER
COMPUTER	ANSHIKA
COMPUTER	JOHN
MATH	JOHN
MATH	AKASH
CHEMISTRY	PRAVEEN

Fifth Normal Form (5NF)

T3 table:

SEMESTER	LECTURER
SEMESTER 1	ANSHIKA
SEMESTER 1	JOHN
SEMESTER 1	JOHN
SEMESTER 2	AKASH
SEMESTER 1	PRAVEEN

References

- Korth, Silbertz and Sudarshan (1998), “Database Concepts”, 4th Edition, TMH.
- Elmasri and Navathe (2010), “Fundamentals of Database Systems”, 5th Edition, Addision Wesley.
- Date C J,” An Introduction to Database Systems”, 8th Edition, Addision Wesley.
- M. Tamer Oezsu, Patrick Valduriez (2011). “Principles of Distributed Database Systems”, 2nd Edition, Prentice Hall.
- https://www.javatpoint.com/ last accessed on 07 Feb’2021.


Thank
you