Third Normal Form (3NF)

In our last tutorial, we learned about the second normal form and even normalized our **Score** table into the 2nd Normal Form.

So let's use the same example, where we have 3 tables, **Student**, **Subject** and **Score**.

Student Table

student_id	name	reg_no	branch	address
10	Akon	07-WY	CSE	Kerala
11	Akon	08-WY	IT	Gujarat
12	Bkon	09-WY	IT	Rajasthan

Subject Table

subject_id	subject_name	teacher
1	Java	Java Teacher
2	C++	C++ Teacher
3	Php	Php Teacher

Score Table

score_id	student_id	subject_id	marks
1	10	1	70
2	10	2	75
3	11	1	80

In the Score table, we need to store some more information, which is the exam name and total marks, so let's add 2 more columns to the Score table.

score_id	student_id	subject_id	marks	exam_name	total_marks

Requirements for Third Normal Form

For a table to be in the third normal form,

1. It should be in the Second Normal form.
2. And it should not have Transitive Dependency.

What is Transitive Dependency?

With `exam_name` and `total_marks` added to our Score table, it saves more data now. Primary key for our Score table is a composite key, which means it's made up of two attributes or columns → **student_id + subject_id**.

Our new column `exam_name` depends on both student and subject. For example, a mechanical engineering student will have Workshop exam but a

computer science student won't. And for some subjects you have Prctical exams and for some you don't. So we can say that `exam_name` is dependent on both `student_id` and `subject_id`.

And what about our second new column `total_marks`? Does it depend on our Score table's primary key?

Well, the column `total_marks` depends on `exam_name` as with exam type the total score changes. For example, practicals are of less marks while theory exams are of more marks.

But, `exam_name` is just another column in the score table. It is not a primary key or even a part of the primary key, and `total_marks` depends on it.

This is **Transitive Dependency**. When a non-prime attribute depends on other non-prime attributes rather than depending upon the prime attributes or primary key.

How to remove Transitive Dependency?

Again the solution is very simple. Take out the columns `exam_name` and `total_marks` from Score table and put them in an **Exam** table and use the `exam_id` wherever required.

Score Table: In 3rd Normal Form

score_id	student_id	subject_id	marks	exam_id

The new Exam table

exam_id	exam_name	total_marks
1	Workshop	200
2	Mains	70

3	Practicals	30

Advantage of removing Transitive Dependency

The advantage of removing transitive dependency is,

- Amount of data duplication is reduced.
- Data integrity achieved.