SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE NAME : 23CS207 - DATABASE MANAGEMENT SYSTEMS

II YEAR / IV SEMESTER

Unit 3- Database Design

Topic 3 : THIRD NORMAL FORM

Third Normal Form

- **Third Normal form (3NF)**

- A table design is said to be in 3NF if both the following conditions hold:

1. Table must be in 2NF
2. **Transitive functional dependency** of non-prime attribute on any super key should be removed.
3. An attribute that is not part of any **candidate key** is known as non-prime attribute.

- In other words 3NF can be explained like this: A table is in 3NF if it is in 2NF and for each functional dependency X-> Y at least one of the following conditions hold:

1. X is a **super key** of table
2. Y is a prime attribute of table
3. An attribute that is a part of one of the candidate keys is known as prime attribute.

Cont..

- **Example**: Suppose a company wants to store the complete address of each employee, they create a table named employee_details that looks like this:

p_id	emp_name	emp_zip	emp_state	emp_city	emp_district
1001	John	282005	UP	Agra	Dayal Bagh
1002	Ajeet	222008	TN	Chennai	M-City
1006	Lora	282007	TN	Chennai	Urrapakkam
1101	Lilly	292008	UK	Pauri	Bhagwan
1201	Steve	222999	MP	Gwalior	Ratan

Super keys: {emp_id}, {emp_id, emp_name}, {emp_id, emp_name, emp_zip}…so on

Candidate Keys: {emp_id}

Non-prime attributes: all attributes except emp_id are non-prime as they are not part of any candidate keys.

Cont..

- Here, emp_state, emp_city & emp_district dependent on emp_zip.

And,

- emp_zip is dependent on emp_id that makes non-prime attributes (emp_state, emp_city & emp_district) transitively dependent on super key (emp_id).
- This violates the rule of 3NF.
- To make this table complies with 3NF we have to break the table into two tables to remove the transitive dependency:

Con..

Employee Table:

emp_id	emp_name	emp_zip
1001	John	282005
1002	Ajeet	222008
1006	Lora	282007
1101	Lilly	292008
1201	Steve	222999

emp_zip	emp_state	emp_city	emp_district
282005	UP	Agra	Dayal Bagh
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Advantages of 3 normal form

- The advantages of removing transitive dependencies are mainly two-fold.
- First, the amount of data duplication is reduced and therefore your database becomes smaller.
- The second advantage is data integrity.

Boyce-Codd Normal Form

- For a table to satisfy the Boyce-Codd Normal Form, it should satisfy the following two conditions:

1. It should be in the **Third Normal Form**.
2. And, for any dependency A → B, A should be a **super key**.

Cont..

S_id	subject	professor
101	Java	P.Java
101	C++	P.Cpp
102	Java	P.Java2
103	C#	P.Chash
104	Java	P.Java

In the table above:

•One student can enrol for multiple subjects. For example, student with **student_id** 101, has opted for subjects - Java & C++

•For each subject, a professor is assigned to the student.

•And, there can be multiple professors teaching one subject like we have for Java.

Cont..

What do you think should be the **Primary Key**?
Well, in the table above student_id, subject together form the primary key, because
usingstudent_id and subject, we can find all the columns of the table.

one professor teaches only one subject, but one subject may have two different professors.
Hence, there is a dependency
between subject and professor here,
where subject depends on the professor name.
This table satisfies the
1st Normal form because all the values are atomic, column names are unique and all the values stored in a particular column are of same domain.
This table also satisfies the **2nd Normal Form** as their is no **Partial Dependency**.
And, there is no **Transitive Dependency**, hence the table also satisfies the **3rd Normal Form**.
But this table is not in **Boyce-Codd Normal Form**.

Cont..

Why this table is not in BCNF?
In the table above, student_id, subject form primary key, which means subject column is a **prime attribute**.
But, there is one more dependency, professor → subject.
And while subject is a prime attribute, professor is a **non-prime attribute**, which is not allowed by BCNF.

Student Table

student_id	p_id
101	1
101	2

Professor Table

p_id	professor	subject
1	P.Java	Java
2	P.Cpp	C++
and so on...		

Thank you