Normalization Rules

And Denormalization Scenarios

Database for Software Developers

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Normalization

In Database Schema Design

Normalization is a process used to organize data efficiently in a database.

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Normalization is a process used to organize data efficiently in a database.

- ☑ Avoid Anomalies
- ☑ Reduce Redundancy

Let’s take an Example Scenario

```
CREATE TABLE StudentCourses (
    student_id INT,
    student_name VARCHAR(100),
    course_code INT,
    course_name VARCHAR(100),
    insructor_name VARCHAR(50),
    insructor_phone CHAR(15),
    grade CHAR(2)
);
```

StudentCourses

student_id	*student_name*	*course_code*	*course_name*	*instructor_name*	*instructor_phone*	*grade*
1	Zayd	101	Mathematics	Ahmad	17222	A
1	Zayd	102	Literature	Jahid	17333	B
2	Anas	101	Mathematics	Ahmad	17222	C
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- Redundancy
- Update Anomalies
- Deletion Anomalies

First Normal Form (1NF)

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1. The table has a primary key (Uniquely identify the records)
2. All attributes contain atomic (indivisible) values

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1. The table is already in 1NF
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Action: Move *student_name* and *course_name* to *students* and *courses* tables

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    grade CHAR(2),
    PRIMARY KEY (student_id, course_code)
);
```

```
CREATE TABLE students (
    id INT PRIMARY KEY,
    name VARCHAR(100),
);
```

```
CREATE TABLE courses (
    code INT PRIMARY KEY,
    name VARCHAR(100),
);
```

* Not defining foreign keys for simplifying the example

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2	103	Khairul	17444	B

Students

id	*name*
1	Zayd
2	Anas

Courses

code	*name*
101	Mathematics
102	Literature
103	Physics

Third Normal Form (3NF)

1. The table is already in 2NF
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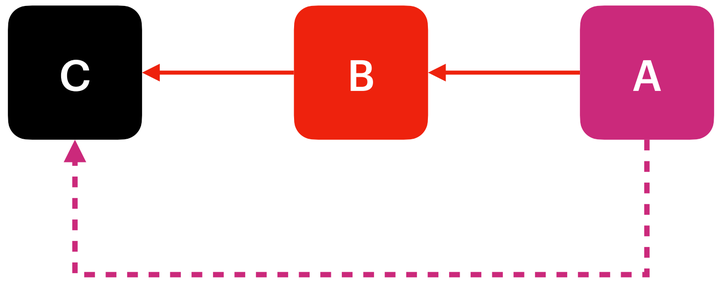

One attribute in a table depends on another attribute through a third attribute.

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Action: Move *instructor_name* and *instructor_phone* to *instructors* tables

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    course_name VARCHAR(100),
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    insructor_phone CHAR(15),
    grade CHAR(2),
    PRIMARY KEY (student_id, course_code)
);
```

```
CREATE TABLE students (
    id INT PRIMARY KEY,
    name VARCHAR(100),
);
```

```
CREATE TABLE courses (
    code INT PRIMARY KEY,
    name VARCHAR(100),
);
```

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CREATE TABLE StudentCourses (
    student_id INT,
    course_code INT,
    course_name VARCHAR(100),
    instructor_id INT,
    grade CHAR(2),
    PRIMARY KEY (student_id, course_code)
);
```

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```
CREATE TABLE students (
    id INT PRIMARY KEY,
    name VARCHAR(100),
);
```

```
CREATE TABLE courses (
    code INT PRIMARY KEY,
    name VARCHAR(100),
);
```

```
CREATE TABLE instructors (
    id INT PRIMARY KEY,
    name VARCHAR(100),
    phone VARCHAR(100),
);
```

Questions?