

# Database Management Systems

## Activity: Normalization

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### Normalization Example: 1NF, 2NF, 3NF

#### Original Table

|       | StudentID | AdvID | AdvName | AdvRoom | Class1 | Class2 |
|-------|-----------|-------|---------|---------|--------|--------|
| Row 1 | 123       | 123A  | James   | 555     | 102-8  | 104-9  |
| Row 2 | 124       | 123B  | Smith   | 467     | 209-0  | 102-8  |

This table has repeating groups for classes (Class1, Class2). We will normalize it step by step.

#### 1. First Normal Form (1NF)

##### Requirement:

1. Each table has a primary key.
2. Each column must contain atomic values.
3. No repeating groups.

**Potential primary key: (Student#, Class)**

## 2. Second Normal Form (2NF)

### Requirement:

1. Table is already in 1NF.
2. No partial dependency: All non-key attributes must depend on the entire primary key, not just part of it.

Currently, if the primary key is (Student#, Class), then AdvID, AdvName, and AdvRoom depend on Student# but not on Class. This is a partial dependency.

### Splitting Into Two Tables

1. **Students** (storing Student# and Advisor info)
2. **StudentClasses** (storing which classes each student is taking)

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### 3. Third Normal Form (3NF)

**Requirement:**

1. Table is in 2NF.
2. No transitive dependencies: non-key attributes must depend directly on the primary key, not through another non-key attribute.

In the Students table, AdvName and AdvRoom depend on AdvID, which depends on Student#. That is a transitive dependency.

**Note:** There is a many-to-many between Student and Class

#### Splitting Advisor Details

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## UML Diagram

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### Normalize the table

| StudentID | StudentName | Courses       | Instructors    | InstructorDepartments   |
|-----------|-------------|---------------|----------------|-------------------------|
| 1         | Alice       | Math, English | Smith, Johnson | Mathematics, Humanities |
| 2         | Bob         | Science       | Brown          | Science                 |
| 3         | Carol       | Math, Science | Smith, Brown   | Mathematics, Science    |

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