What is Normalization?

☑ Simple Definition:

Normalization is the process of organizing data in a database to:

- Remove **duplicate/repeated data**
- Improve **data consistency**
- Make **inserting, updating, and deleting** data easier and error-free

☑ Step-by-Step Normalization:

We'll go up to **2NF** (First and Second Normal Form) using a simple **student-course** example.

🟐 Unnormalized Table (Bad Design – Repeating Data):

```
+-----------+--------+-----------------+
| StudentID | Name   | Courses         |
+-----------+--------+-----------------+
| 1         | Milan  | DBMS, OS        |
| 2         | Riya   | DBMS, CN        |
+-----------+--------+-----------------+
```

❌ Problem:

- Courses are stored as **comma-separated values** → violates First Normal Form

☑ 1 NF (First Normal Form)

Rule:👉 Each column should contain **atomic (single) values**, no commas or arrays.

☑ Converted Table (1NF):

```
+-----------+--------+--------+
| StudentID | Name   | Course |
+-----------+--------+--------+
| 1         | Milan  | DBMS   |
| 1         | Milan  | OS     |
| 2         | Riya   | DBMS   |
| 2         | Riya   | CN     |
+-----------+--------+--------+
```

✔!! Now every column has only **one value** → 1NF achieved.

☑ 2 NF (Second Normal Form)

Rule:👉 It should be in **1NF**, and👉 **Non-key columns must depend on the full primary key**, not just part of it.

In the above table:

- StudentID + Course is the **composite primary key**.
- But Name depends **only on StudentID**, not on Course → ❌ Partial dependency

🎯 So we split the table into two:

📄 Students Table:

```
+-----------+--------+
| StudentID | Name   |
+-----------+--------+
| 1         | Milan  |
| 2         | Riya   |
+-----------+--------+
```

📄 Courses Table:

```
+-----------+--------+
| StudentID | Course |
+-----------+--------+
| 1         | DBMS   |
| 1         | OS     |
| 2         | DBMS   |
| 2         | CN     |
+-----------+--------+
```

✔!! Now Name depends only on StudentID (in its own table)✔!! All non-key columns depend on the **full key** → ☑ 2 NF achieved

☑ Summary of 1NF and 2NF:

Normal Form Rule (Simple Words) **1NF** No commas or multiple values in a single column **2NF** No partial dependency – every column depends fully on the key

Let me know when you're ready to move to **3NF**, or want a visual summary or note-style format!