1. **What is database normalization?**

Normalization is a process of organizing the columns and tables of a relational database to minimize data redundancy and improve data integrity.

1. **Why is normalization important?**

Normalization is crucial for several reasons that contribute to a healthy and efficient database;

1. Reduce data redundancy: By eliminating duplicate data, its saves storage space and prevents inconsistencies that can arise when the same data is stored in multiple places.
2. Improve data integrity: Ensures that data is consistent and accurate across the database. When data changes, it only needs to be updated in one place.
3. Enhances Data Consistency: Prevents update, insertion, and deletion anomalies, which are problems that occur when data is not properly organized.
4. Simplifies Queries: While it might seem counterintuitive due to more joins, a normalized schema often makes it easier to write clear and specific queries because each piece of information has a designated, logical home.
5. Better Database Design: Promotes a cleaner, more logical, and more scalable database structure.

Imagine a school database. If you store student details (name, address, phone) directly in a Courses table for every course a student takes, you'll repeat the student's name and address multiple times. If the student moves, you'd have to update their address in many places, risking errors. Normalization would put student details in a separate Students table, and the Courses table would just have a StudentID to link to it.

**What is De-normalization?**  
De-normalization is the process of combining normalized tables into a single table to improve read performance, even if it introduces some redundancy.

**Advantages of Normalization**

1. Removes redundancy
2. Improves data integrity
3. Easy to update & maintain
4. Saves storage
5. Better organization

**Disadvantages of Normalization**

1. More complex quires
2. Slower reads
3. Hard for beginners
4. Difficult for reporting
5. **Difference between Normalization and Denormalization**

| **Feature** | **Normalization** | **Denormalization** |
| --- | --- | --- |
| 🔍 Purpose | Reduce redundancy, ensure consistency | Improve read/query performance |
| 📦 Data Storage | Less storage, compact | More storage, duplicate data |
| 🔁 Joins | More joins needed | Fewer joins |
| ⚠️ Redundancy | Redundancy removed | Redundancy introduced |
| 🧩 Data Integrity | High data integrity | Lower integrity (more chances of error) |

**Difference between Normalization and De-normalization**

**What is Redundancy?**

Redundancy means storing the same piece of data in multiple places unnecessarily.