📘 3. Hash Table / Hashing – Data Structure

🔹 Definition:

A **Hash Table** is a data structure that stores **key-value pairs** using a **hash function**. It provides **fast access** to values based on the key.

🔹 How it works:

- A **hash function** converts a key into an index.
- The value is stored at that index in an array.
- In case of collision (same index), **collision resolution** is used (like chaining or open addressing).

🔹 Operations:

- **Insert:** O(1) average time
- **Search:** O(1) average time
- **Delete:** O(1) average time

🔹 Collision Handling Techniques:

1. **Chaining** – Using linked lists at each index
2. **Open Addressing** – Probing for the next free index (Linear, Quadratic)

🔹 Real-life Examples:

- Dictionary lookup
- Caching (e.g., LRU Cache)
- Database indexing
- Username to user data mapping