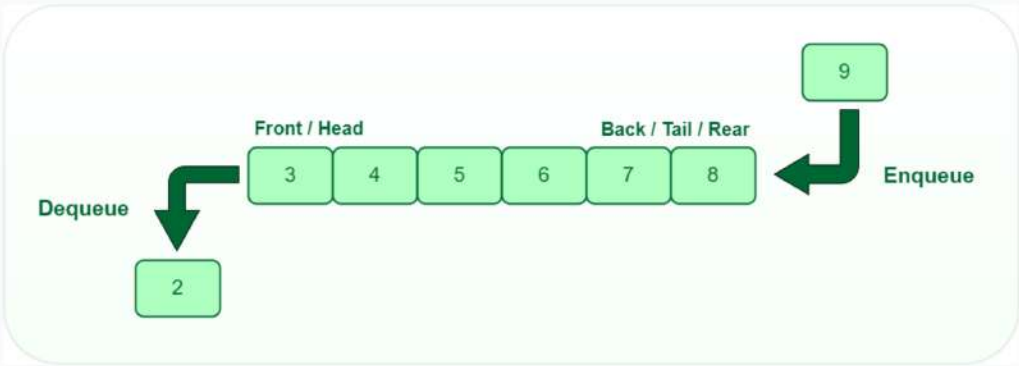
Queue Data Structure



Introduction

A Queue is a linear data structure that follows the FIFO (First In, First Out) principle.
This means that the element added first will be removed first, just like a line of people waiting for tickets — the one who comes first gets served first.

In simple words:
"Insertion happens at one end (rear) and deletion happens at the other end (front)."

Example:
When people stand in a line at a railway counter, the first person in the line is served first — that's a Queue!

Key Operations

- **Enqueue (Insertion):**
  Adds an element to the rear end of the queue.
  Example: `enqueue(5)` adds 5 at the end.
- **Dequeue (Deletion):**
  Removes the element from the front of the queue.
  Example: `dequeue()` removes the first element.
- **Front (Peek):**
  Returns the element at the front without removing it.
- **isEmpty():**
  Checks whether the queue is empty.
- **isFull():**
  Checks whether the queue is full (in case of array implementation).

Characteristics of Queue

- **Linear Structure:** Elements are arranged sequentially.
- **FIFO Order:** First inserted → first removed.
- **Two Ends:**
  - Front → for deletion
  - Rear → for insertion
- **Limited Access:** You can only insert at rear and delete from front.
- **Dynamic or Static:** Can be implemented using **arrays** or **linked lists.**
- **Can be Extended:**
  - **Circular Queue** – connects end to start.
  - **Priority Queue** – elements removed based on priority.
  - **Double Ended Queue (Deque)** – insertion/deletion from both ends.

Real-Life Use Cases of Queue

1. Printer Queue

When multiple documents are sent to a printer,
they are lined up in a **queue**.
The document sent first is printed first —
exactly like FIFO order.

2. Call Center Systems

Incoming calls are stored in a **queue** and
attended one by one by the operators.

3. Network Requests

Web servers use queues to handle incoming
client requests.
Requests are processed one after another.

*This note is not created by Saurabh Shukla sir, as if am continuing the challenge with his channel, hence his image is given.