

Queues

A queue is a **FIFO** (First-In, First-Out) data structure in which the element that is inserted first is the first one to be taken out. The elements in a queue are added at one end called the **REAR** and removed from the other end called the **FRONT**. Queues can be implemented by using either arrays or linked lists.

Operations on Linked Queues

A queue has two basic operations:

- **insert**
- **delete**

The **insert** operation adds an element to the end of the queue, and the **delete** operation removes an element from the front or the start of the queue. There is a third operation **peek** which returns the value of the first element of the queue.

Types of Queues

- Circular Queues
- Deques
 - A deque is a list in which the elements can be inserted or deleted at either end.
- Priority Queues
 - A priority queue is a data structure in which each element is assigned a priority.
 - The priority of the element will be used to determine the order in which the elements will be processed.
- Multiple Queues

Implementation of Priority Queues

There are two ways to implement a priority queue:

- We can use a sorted list to store the elements
- We can use an unsorted list

The sorted list takes $O(n)$ time to insert an element, it takes $O(1)$ time to delete an element. An unsorted list takes $O(1)$ time to insert an element and $O(n)$ ti delete an element.

Linked Representation of a Priority Queue

When a priority queue is implemented using a linked list, then every node of the list will have three parts:

- (a) the information or data part,
- (b) the priority number of the element, and
- (c) the address of the next element.

Points to Remember

- A queue is a FIFO data structure in which the element that is inserted is the first one to be taken out.
- The elements in a queue are added at one end called the **REAR** and removed from the other end called the **FRONT**.
- In the computer's memory, queues can be implemented using both arrays and linked lists.
- The storage requirement of linked representation of queue with n elements is $O(n)$ and the typical time requirement for operations is $O(1)$.
- In a circular queue, the first index comes after the last index.
- Multiple queues means to have more than one queue in the same array of sufficient size.
- A deque is a list in which elements can be inserted or deleted at either end. It is also known as a head-tail linked list because elements can be added to or removed from the front (head) or back (tail). However, no element can be added or deleted from the middle. In the computer's memory, a deque is implemented using either a circular array or a circular doubly linked list.
- In an input restricted deque, insertions can be done only at one end, while deletions can be done from both the ends. In an output restricted deque, deletions can be done at both ends.
- A priority queue is a data structure in which each element is assigned a priority. The priority of the element will be used to determine the order in which the elements will be processed.
- When a priority queue is implemented using a linked list, then every node of the list will have three parts:
 - (a) the information or data part,
 - (b) the priority number of the element, and
 - (c) the address of the next element.