Types of Queues

- Circular Queue
- Priority Queue
- **deQueue (Double Ended Queue)**

Why need for dequeue?

- The point is that you need "fast access" to insert/deletes at both ends of the line, hence a deque. One example where deque can be used is the A-Steal job scheduling algorithm. ...
- To execute the next thread, the processor gets the first element from the deque (using the "remove first element" deque operation).

Deque

Definition

- A **deque** is a list in which elements can be inserted or deleted at either end.

Main features

- 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).
- no element can be added and deleted from the **middle**

Implementation

- A **deque** can be implemented either using a **circular array or a circular doubly linked list.**

Deque

Key points to remember

- The elements in a deque stretch from **LEFT** end to the **RIGHT** and since it is circular, **Dequeue[N-1]** is followed by **Dequeue[0]**.

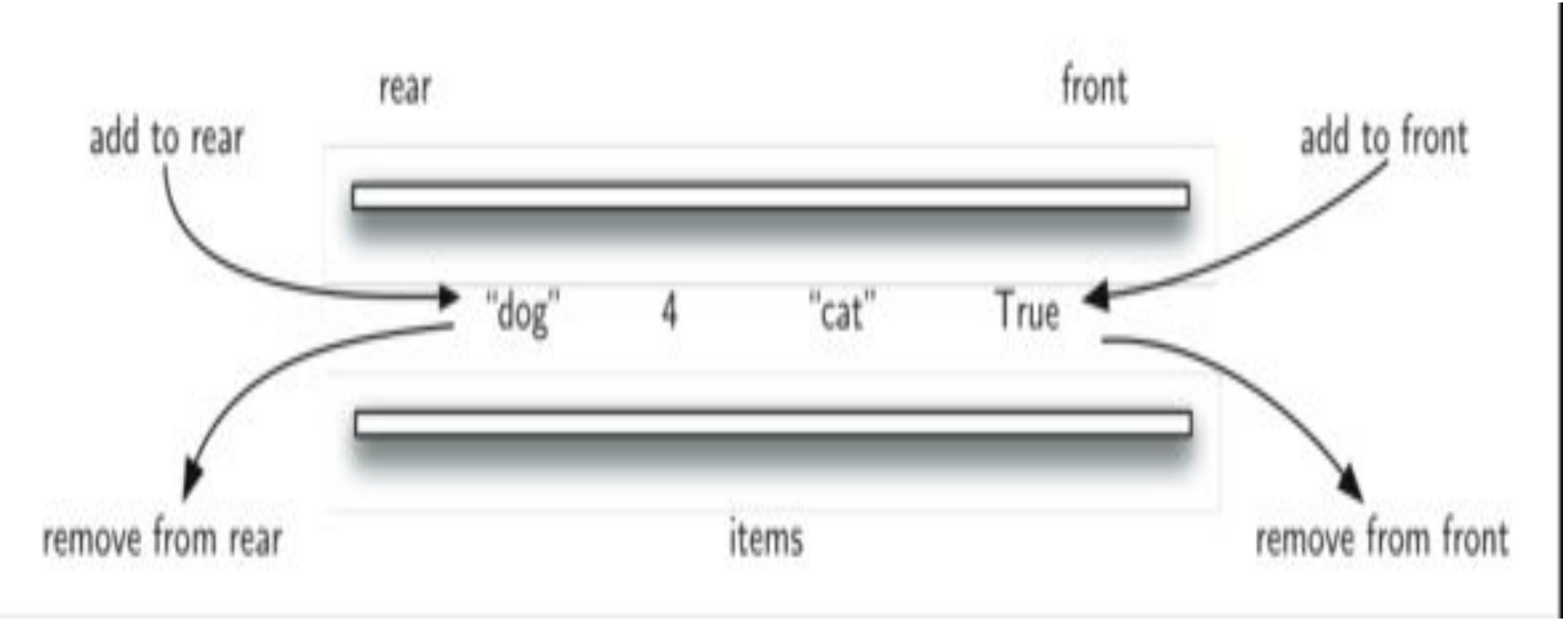
- **Two pointers** are maintained, **LEFT and RIGHT** which point to **either end of the deque**.

- This differs from the queue abstract data type or **First-In-First-Out List** (FIFO), where elements can only be **added to one end** and **removed from the other end** like a line in front of supermarket**.**

- Algorithm **INSERT-AT-FRONT** and **DELETE-FROM-REAR** are new and special in DeQueue and other are same as circular queue.

Main operations of dequeue

- **delete_fr_beg() (or) delete_fr_left()**: Deletes an item from front of Dequeue.
- **delete_fr_rear() (or) delete_fr_right()**: Deletes an item from rear or end of Dequeue.
- **insert_at_beg() (or) insert_at_left()**: inserts an item at the front of Dequeue.
- **insert_at_end() (or) insert_at_right()**: inserts an item at the rear or end of Dequeue.


rear
front
add to rear
add to front
"dog"
4
"cat"
True
remove from rear
items
remove from front

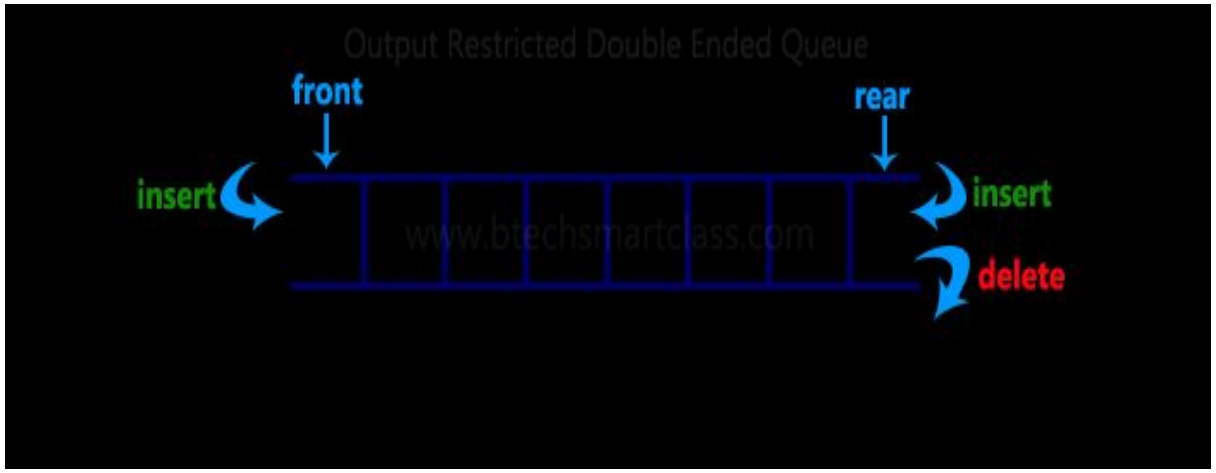
Deque

- There are two variants of a double-ended queue:

- ***Input restricted deque:*** In this dequeue insertions can be done only at one of the ends while deletions can be done from both the ends.

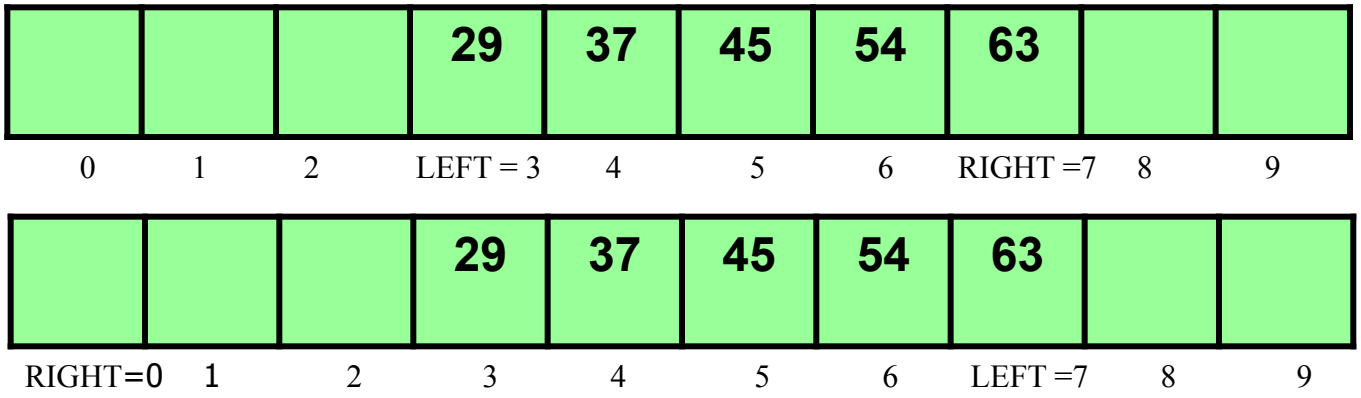
- ***Output restricted deque:*** In this dequeue deletions can be done only at one of the ends while insertions can be done on both the ends.

Output restricted dequeue



Input restricted dequeue

The elements in a deque extend from the LEFT end to the RIGHT end and since it is circular, in a deque of N elements, Nth element of deque is followed by the first element of the deque.



Applications of Queues

- Queues are widely used as waiting lists for a single shared resource like printer, disk, CPU.
- Queues are used to transfer data asynchronously e.g., pipes, file IO, sockets.
- Queues are used as buffers on MP3 players and portable CD players, iPod playlist.
- Queues are used in Playlist for jukebox to add songs to the end, play from the front of the list.
- Queues are used in OS for handling interrupts. When programming a real-time system that can be interrupted, for ex, by a mouse click, it is necessary to process the interrupts immediately before proceeding with the current job. If the interrupts have to be handled in the order of arrival, then a FIFO queue is the appropriate data structure