KLE Technological University
Creating Value
Leveraging Knowledge
B. V. Bhoomaraddi Engineering & Technology College Campus, Hubballi - India

Problem Solving with Data Structures

School of Computer Science & Engg
KLE Technological University
Hubballi

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Chapter 4

Queues

Content

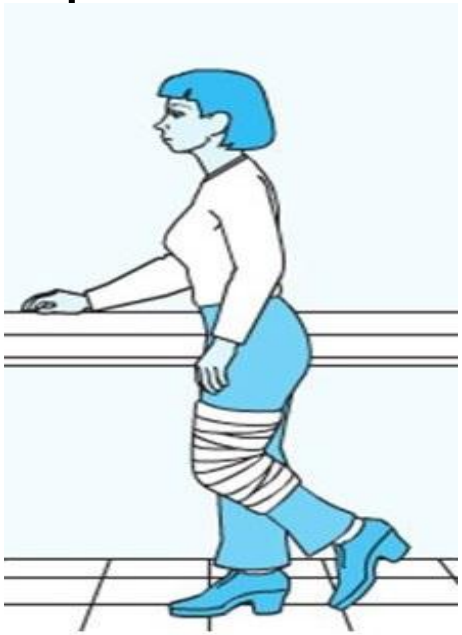
- Queue
  - Definition, Operations
- Different Types of queues
  - Linear Queue
  - Circular Queue
  - Priority Queue
  - Double Ended Queue
  - Multiple Queue
- Applications
  - Scheduling Algorithms in OS
  - E-Commerce Platforms
  - Stock Market

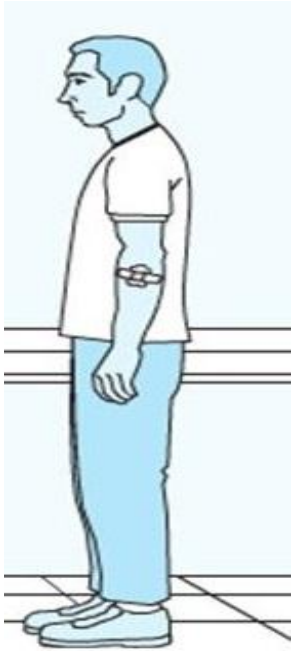
Recap

- Introduction to queue
  - Queue structure
    - Front, rear
  - Operation on queue
    - Enqueue,Dequeue, Empty, full
- Linear queue
- Circular queue
  - x=(x+1)%MAX

Activity

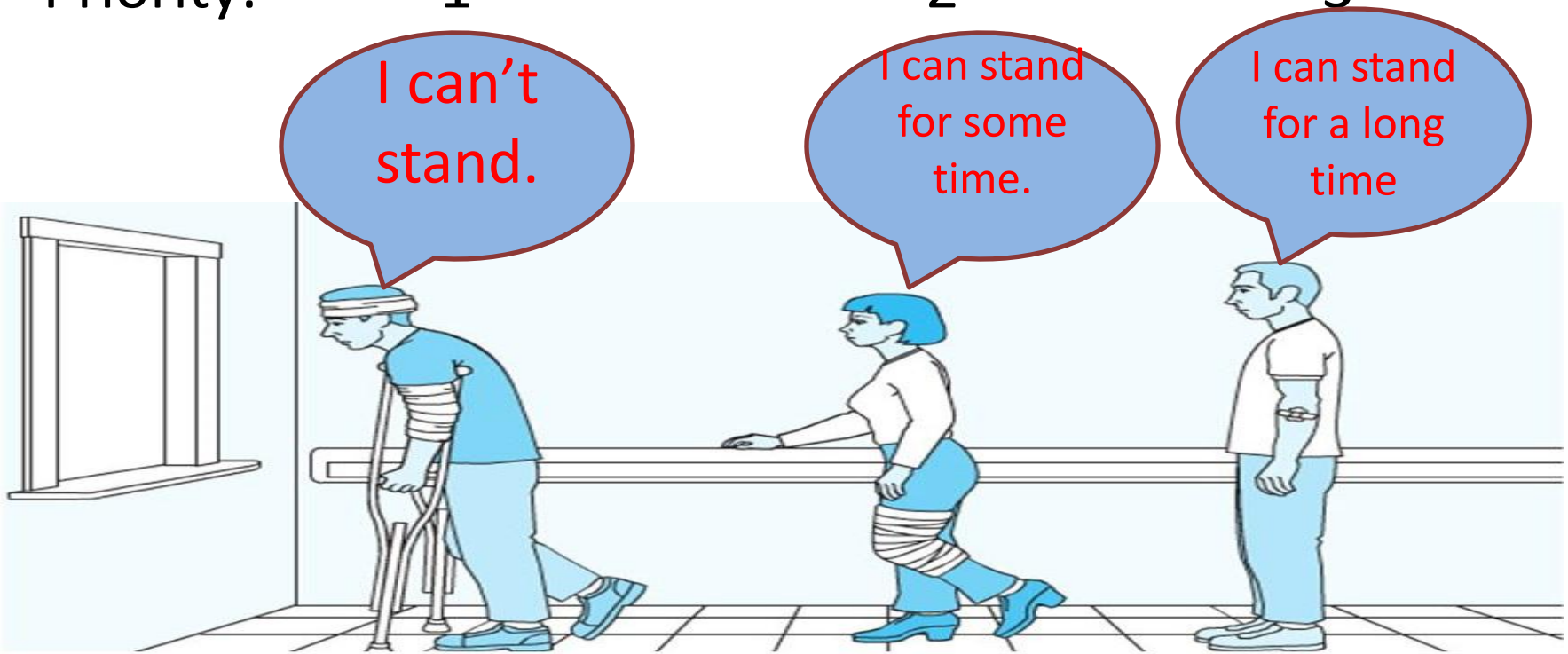
- How the order of treatment will be given to the patients?





Continued:

Priority: 1 2 3



Examples of priority queue

- List few example of priority queue.
- Document verification in CET counseling process.
- Selection of colleges depending on CET rank. (Rank is considered as priority).
- Zomato provides additional discount for regular customers.
- Stock Market etc.

Priority queue

- A priority queue is a special type of queue in which each element is associated with a priority and is served according to its priority.
- If elements with the same priority occur, they are served according to their order in the queue.
- An element with high **priority** is served before an element with low **priority**

Priority queue

Operations :

- Insert/Enqueue: Insert an element with priority
- Remove/Dequeue: Remove the highest priority element

Variants of Priority queues

- **Ascending priority queue :** smallest priority item is removed.
- **Descending priority queue:** largest priority item is removed.

Enqueue in priority Queue

- Ascending priority queue currently has these elements.
  - Priority →
  - Elements →

5	8	11
25	76	52

- Insert element 22 with priority 9.

5	8	9	11
25	76	22	52

- Insert element 44 with priority 4.

4	5	8	9	11
44	25	76	22	52

Dequeue in priority Queue

- Ascending priority queue currently has these elements.

4	5	8	9	11
44	25	76	22	52

- Delete element.

5	8	9	11
25	76	22	52

Lets watch the animation of priority queue..

Double Ended Queue

Double Ended Queue

- Double Ended Queue is also a Queue data structure.
- The insertion and deletion operations are performed at both the ends (**front** and **rear**).
- Implemented using doubly linked list.

Applications of Double Ended queue

- A-Steal job scheduling algorithm, which used in multiprocessor scheduling.
- Palindrome checker
- Can implement both stack and queue.

Operations of Double Ended Queue

- ***InsertFront()***: Adds an item at the front of Deque.
- ***InsertLast()***: Adds an item at the rear of Deque.
- ***DeleteFront()***: Deletes an item from front of Deque.
- ***DeleteLast()***: Deletes an item from rear of Deque.

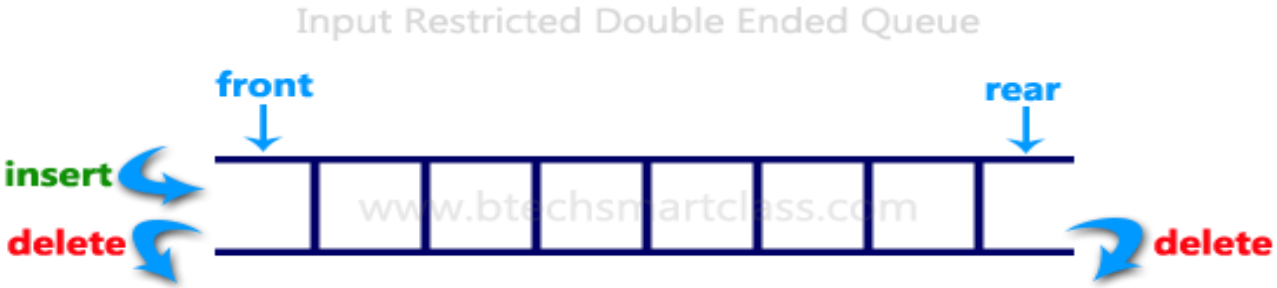
Lets watch the animation of double ended queue..

Variants of Double ended Queue

- To reduce the complexity of double Ended Queue, it can be represented as:
  - ❖ Input Restricted Double Ended Queue
  - ❖ Output Restricted Double Ended Queue

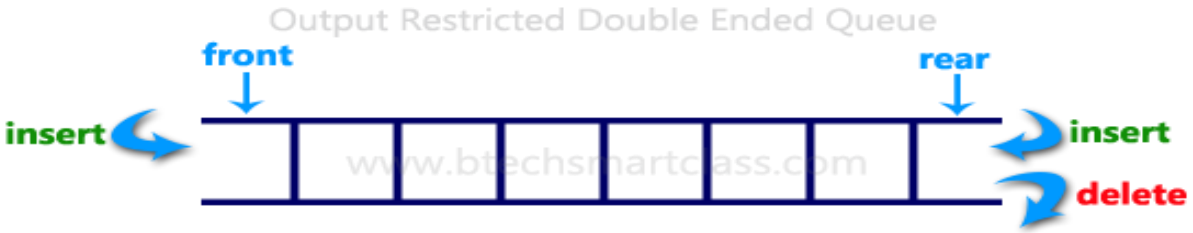
Input Restricted Double Ended Queue

- The insertion operation is performed at only one end and deletion operation is performed at both the ends.



Output Restricted Double Ended Queue

- The deletion operation is performed at only one end and insertion operation is performed at both the ends.



Lets watch the animation of input and output restricted double ended queue..

Multiple Queues

Multiple Queues

- Several practical applications in computer science needs several queues.
- In this data structure multiple queues are maintained.
- Each queue can have its own scheduling algorithms.
- Priorities are assigned to each queue.
- The queues may processed in FIFO order also.

Multiple Queues

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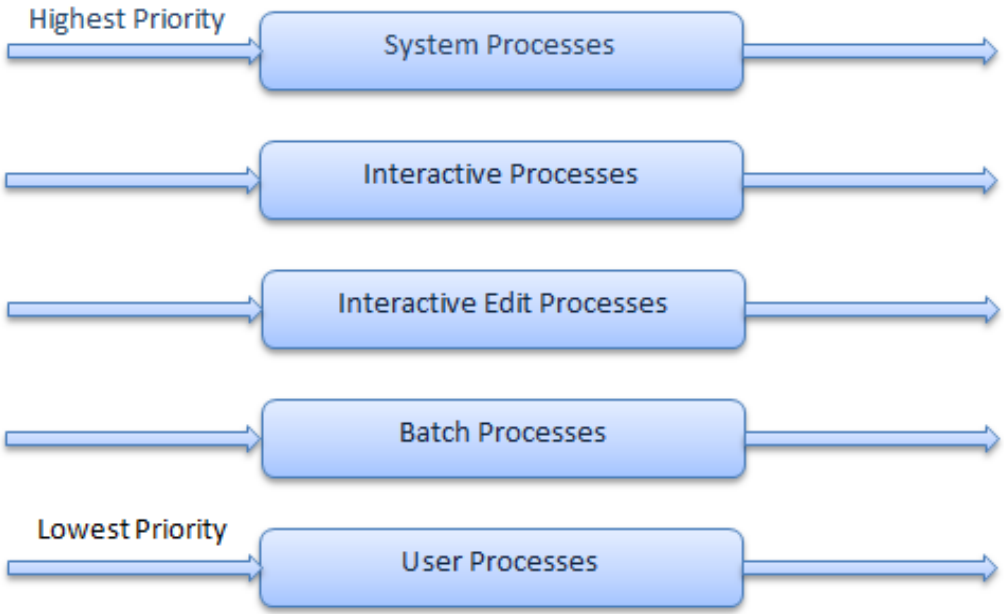
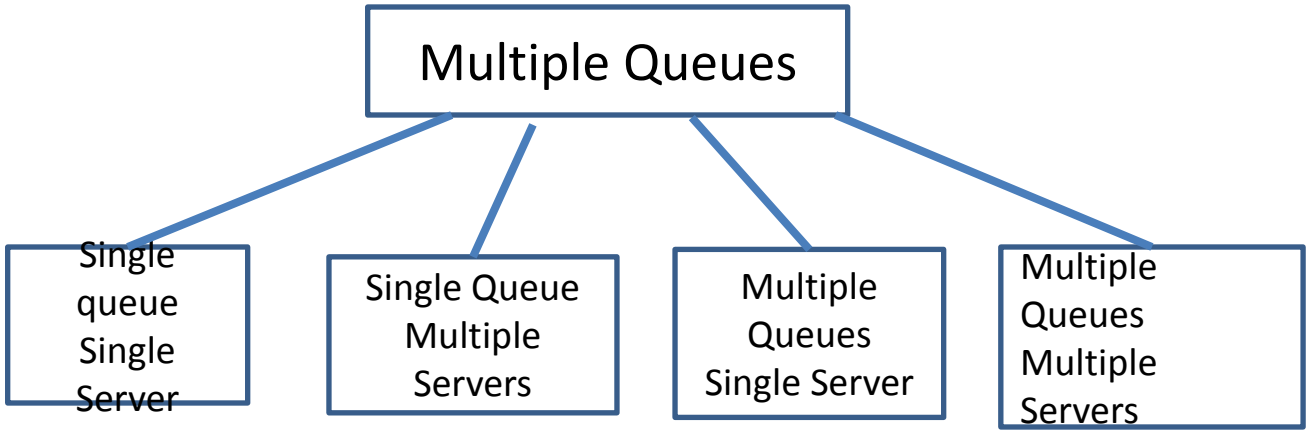
- OS like window/Linux maintains multiple queues
- Based on priority the queues are processed by the OS.



Types of Multiple Queues

- Consider FIFO is the order of processing, and can be classified in four different categories.

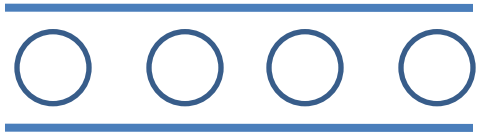


Single Queue Single Server

- It is your normal queue processing system

Single Queue Multiple Servers

- It is your normal queue processing system

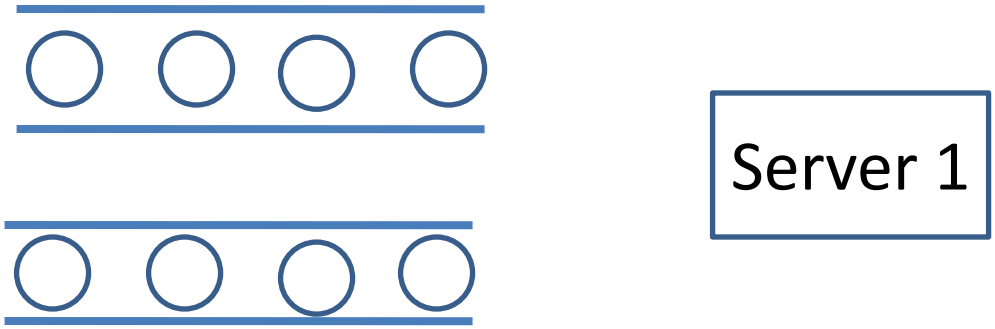


Server 1

Server 2

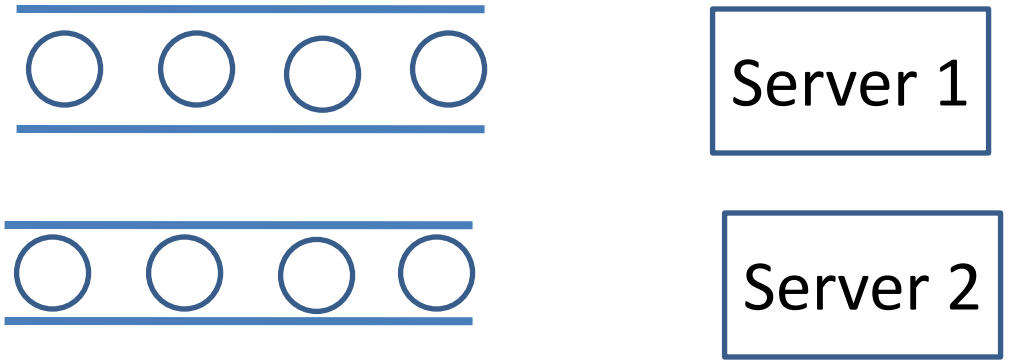
Multiple Queues Single Server

- More than one servers with single queue system
- May follow different order of processing but in FIFO manner only.



Multiple Queues Multiple Servers

- More than one servers with its corresponding queue.



Applications of Multiple Queues

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- Servicing systems in banking, Library, railway station, Airports etc.
- Web server request processing.
- OS / CPU process scheduling etc.

Qu s

Linear queue

Priority queue

Double Ended queue

1. If a person joins in a line at one end, where at the front of li served.
2. If a person joins in e though there are people are standing in line.
3. Poor people are sta meals from distributors. As line got too big so distributors t ght would serve at the both ends, where people can join any end and leave any end.

Lets see the sample code of priority queue implementation using multiple queue..

Thank You