Queues -1

Lecture-49

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Today's checklist

1) Introduction
2) Queue vs Stack
3) STL Operations performed on queue
4) Overflow vs Underflow
5) Array implementation of queue
6) Linked list implementation of queue
7) Introduction to Circular queue
8) Array implementation of circular queues
9) Deque introduction

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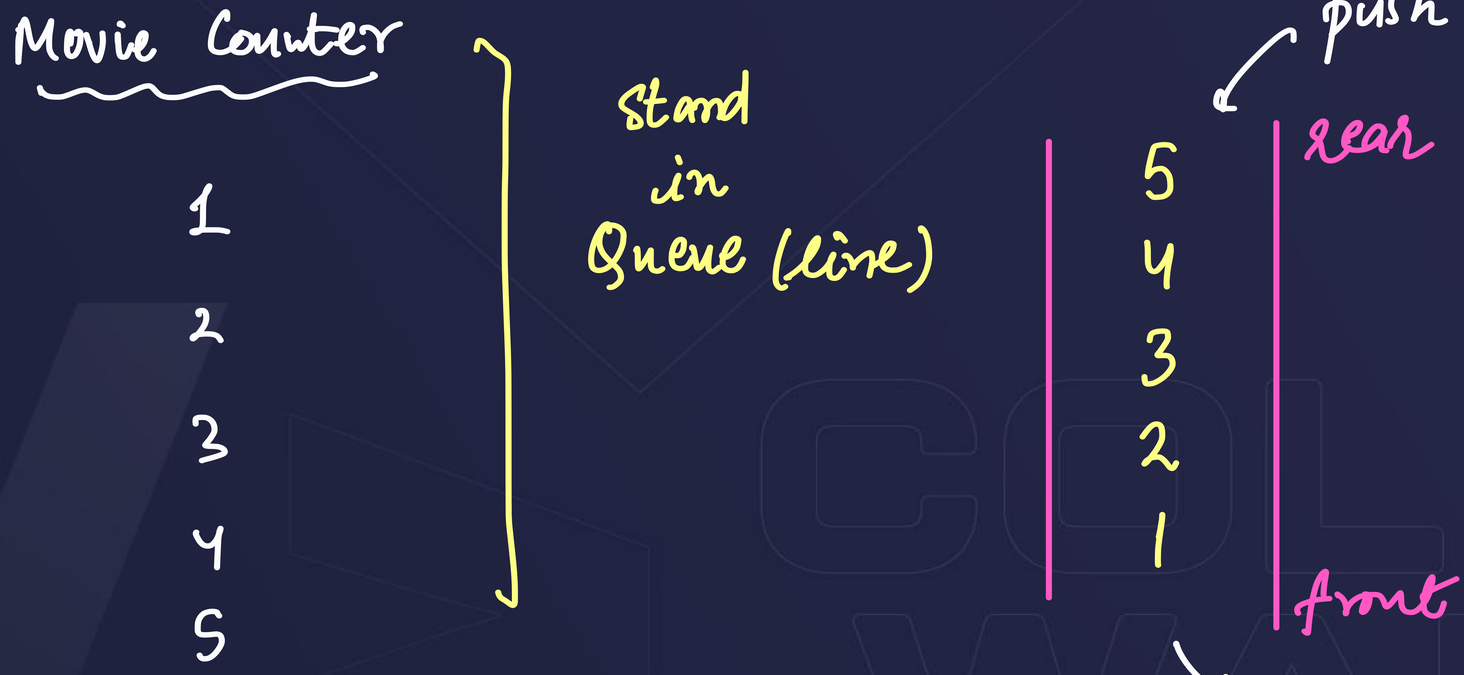
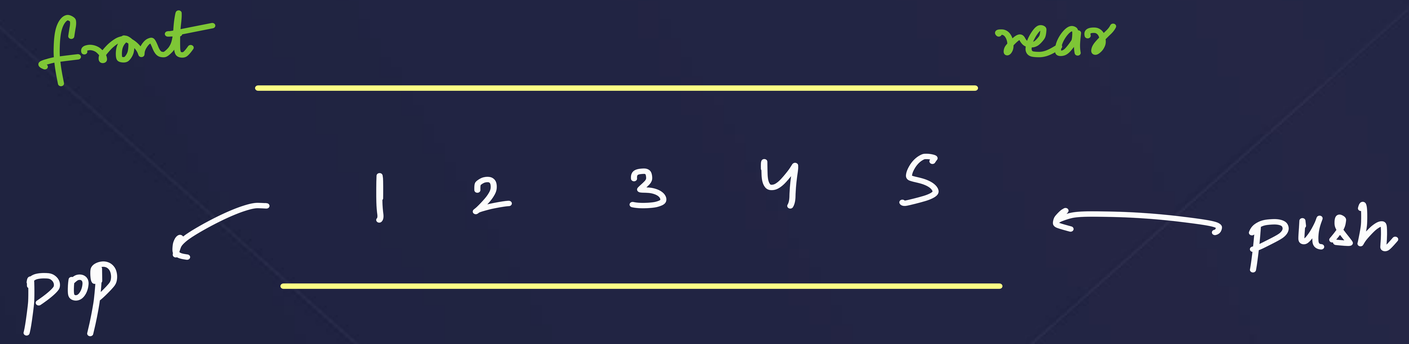
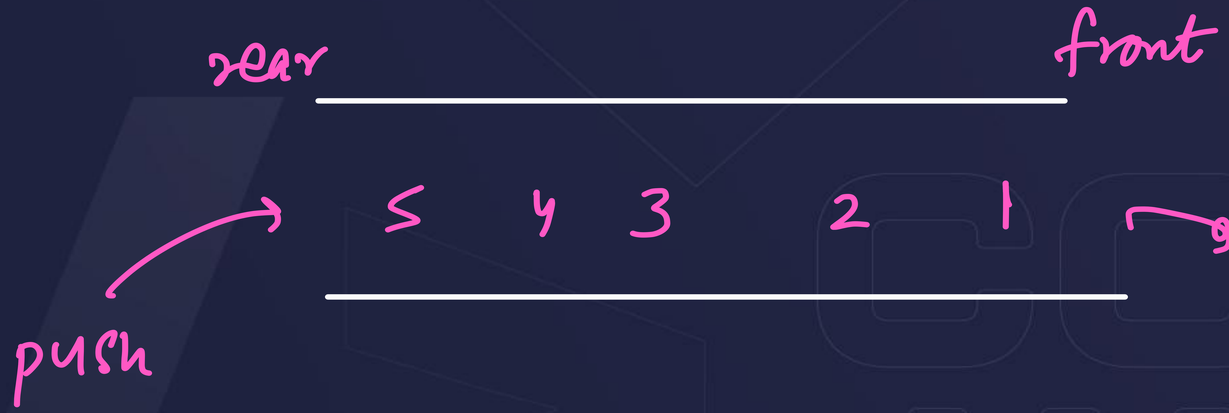
Introduction

FIFO → first in first out



Introduction





Queue vs Stack

Queue	Stack
FIFO	LIFO
push & pop are done in opposite directions	push & pop are from same direction
push, front	top
pop,	pop
	push

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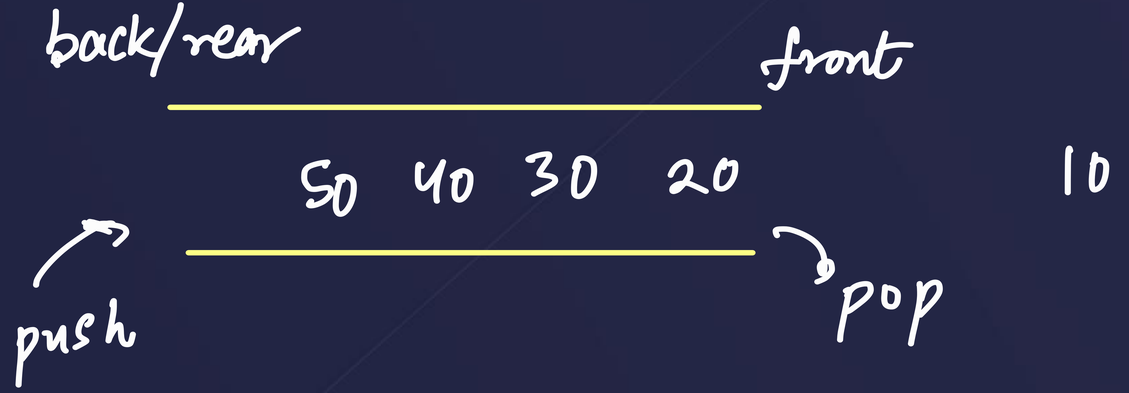
STL Operations performed on queue

```
q.push(10);
q.push(20);
q.push(30);
q.push(40);
q.push(50);
cout<<q.front();
```



q.pop();

cout << q.front();

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push() /add()

↓

insertion happens only at the back/rear. → O(1)

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pop()

↓

only happens at front → O(1) T.C.

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PW SKILLS

front() / top()

↓

we can access the front of the queue → O(1)

back()

↓

we can also access the rear element → O(1)

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size()

↓

returns the size of queue

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empty()

↓

it returns true if size() == 0

else it returns false

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Overflow and Underflow

- Only happens if we implement the queue via an array if you fill the array
- You are out of memory

- Whenever the queue is empty & we try to use these functions
  - pop(), front(), back(),

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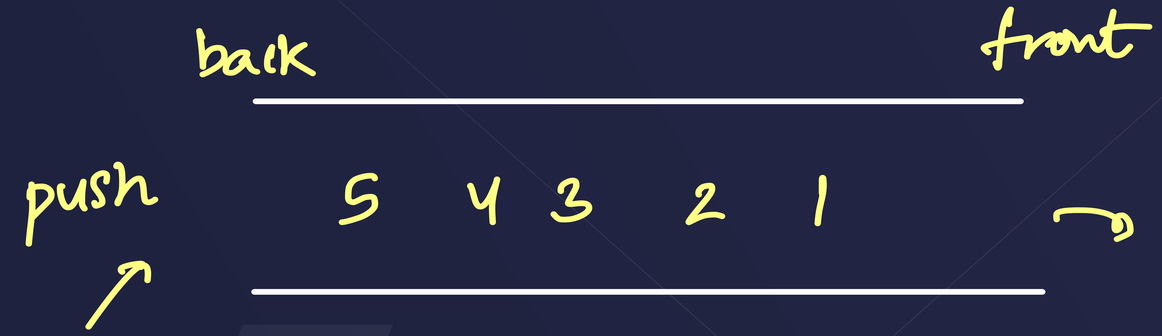
Display :

T.C. = O(n)

S.C. = O(1)



Output

1
2
3
4
5

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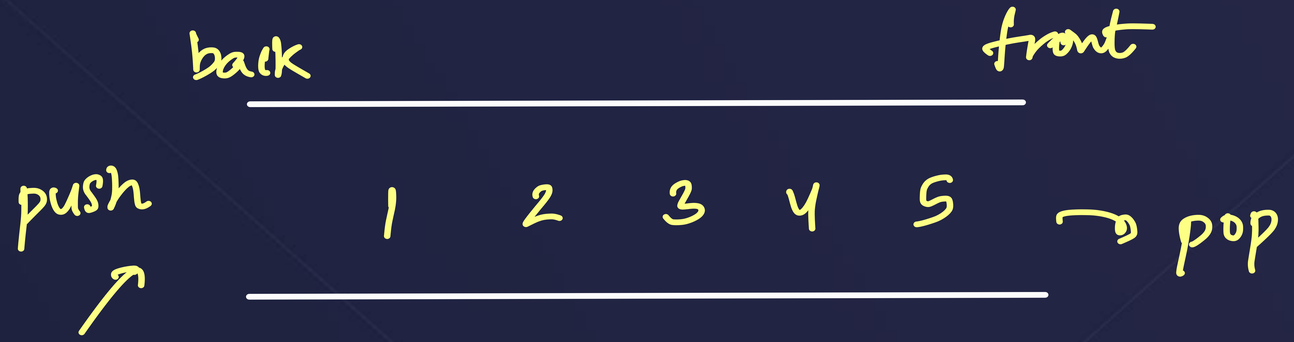
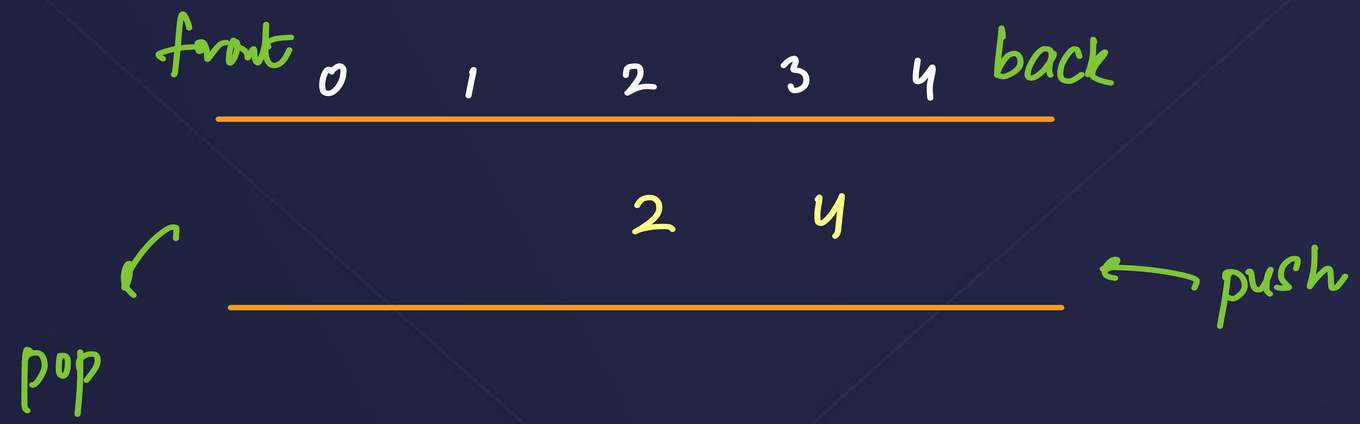
Ques: Reverse the queue using a stack.

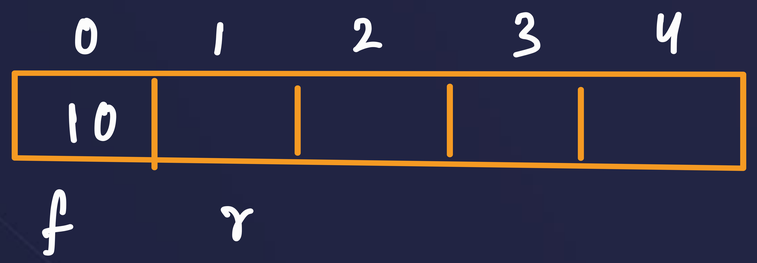


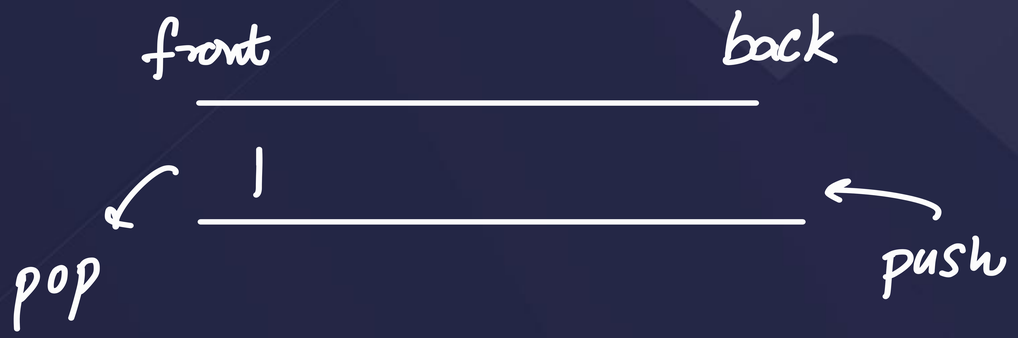
Ques: Remove all the elements present at even positions in queue. Consider 0-based indexing.




```
for(i=0; i<q.size(); i++){
    if(i%2 == 0) q.pop();
    else {
        int x = q.front();
        q.pop()
        q.push()
    }
}
```

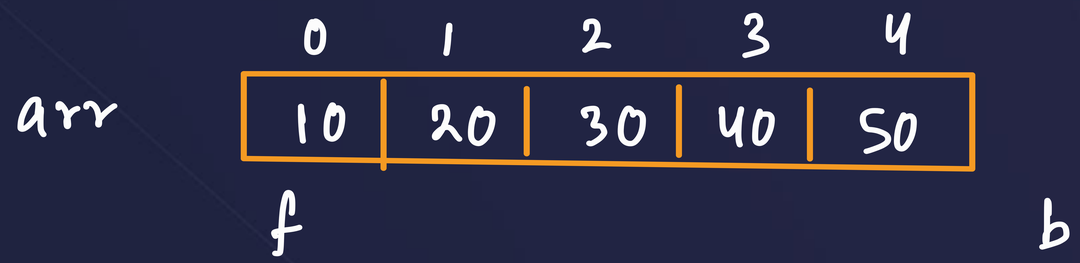
Array implementation of queue





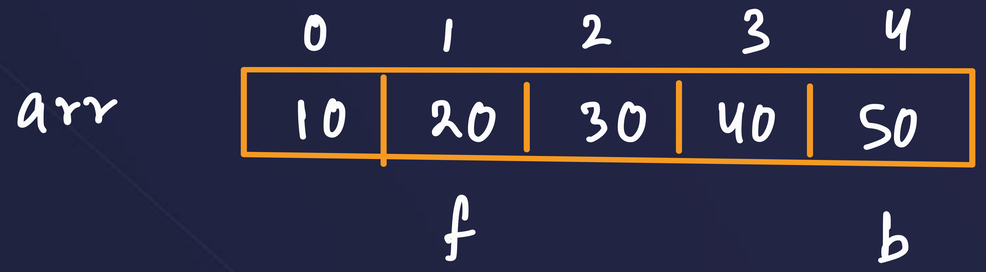

```
q.push(10) ; // push happens at rear
```

Implementing push()




```
void push(int val){
    if(b == arr.size()) cout << "queue is Full"; return
    arr[b] = val;
    b++;
}
```

Implementing pop()




```
void pop() {
    if (size() == 0) return;
    f++;
}
```

Implementing front() , back()

```
int front(){
    if(size()==0) return -1;
    return arr[f];
}
```

```
int back(){
    if(size()==0) return -1;
    return arr[b-1]
}
```

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Implementing size()

```
int size(){
  return b-f;
}
```

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Implementing empty()

```
bool empty(){
    if(size()==0) return true;
    else return false;
}
```

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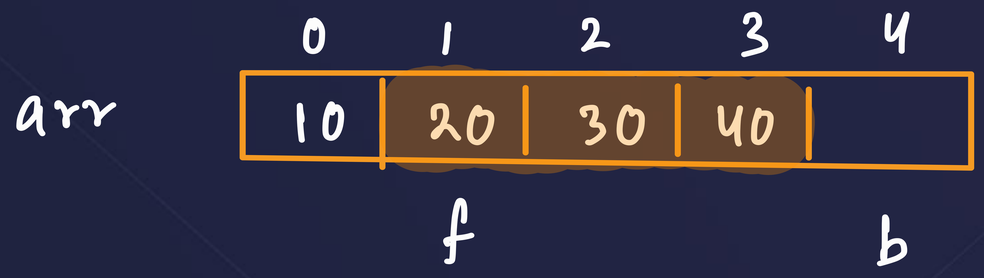
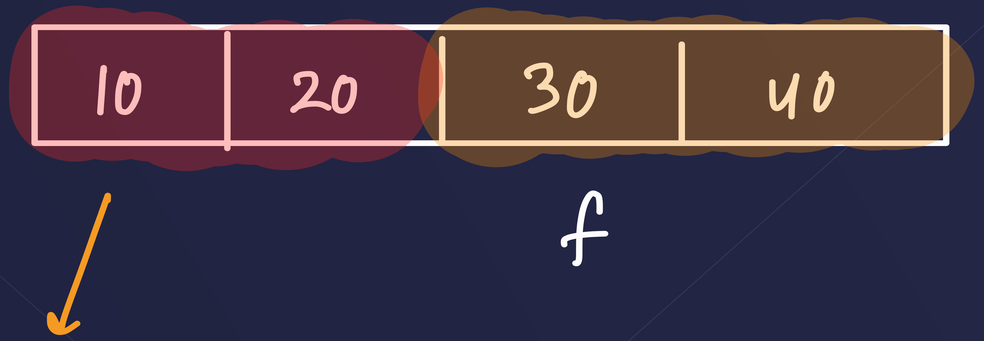
Implementing display()




```
for(int i=f;  i<b ; i++){
    cout << arr[i] << " ";
}
```

3

Problems in Array Implementation of Queue



wastage of space

Solution : Circular Array

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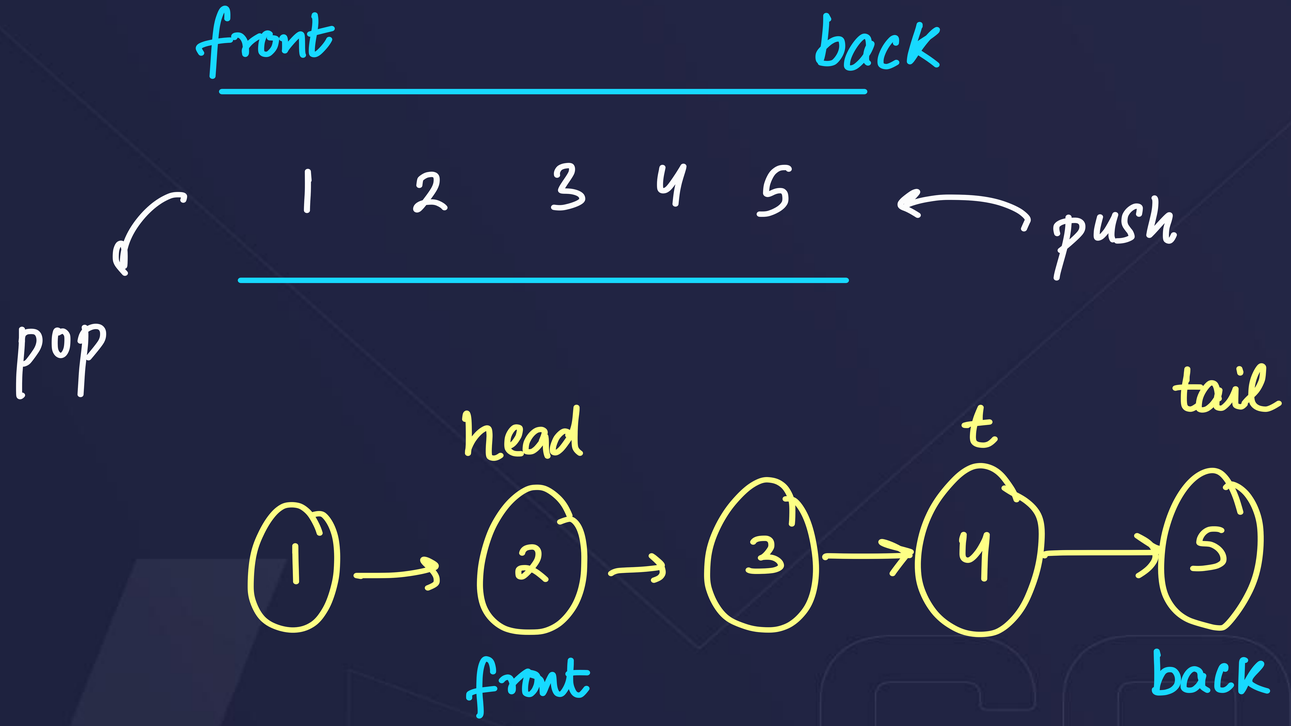
Linked list implementation of queue



LL → push → insertAt Tail

pop → deleteAtHead

front = head→val

back = tail→val

size → LLsize

push(4)

push(5)

Implementing push()

↓

Insert At Tail

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Implementing pop()

↓

DeleteAtHead

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Implementing front() / back()

↓ head → val

↓ tail → val

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Implementing size()

L

size of LL

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Implementing empty()

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Implementing display()

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Advantage of Linked list implementation of queue over array implementation:

1) Unlimited size

2) Natural, It is like LL implementation

3) Wastage of size is not there

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Disadvantage of Linked list implementation of queue over array implementation:

1) For each element we have a Node → val , *Next

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Introduction to Deque → DLL se implement

d

doubly ended queue

O(1) T.C me hoti hai

Design a Deque

push Front() Back()

Implement addFront(), addRear(), getFront(), getRear(), deleteFront(), deleteRear(), size()

pop

Ek doubly LL

SLL

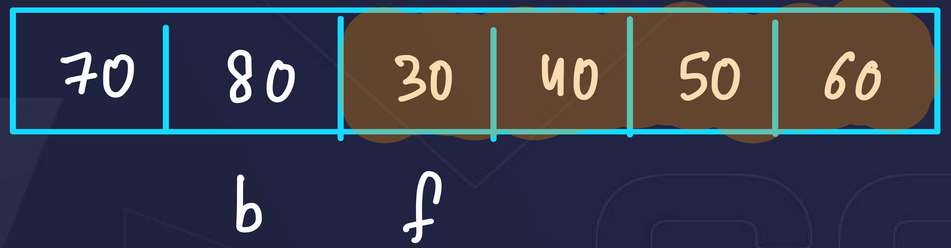
push front : O(1)
push back : O(1)
pop front : O(1)
pop back : O(n)

DLL

push front : O(1)
push back : O(1)
pop front : O(1)
pop back : O(1)

Introduction to Circular queue : We fully utilize the array

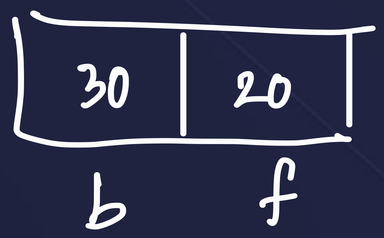
Array Implementation → back → array ke end
↓
jabki aage khali thi



30 40 50 60 70 80
f b

Ques: Design Circular Queue [Leetcode - 622]

↳ I will be given size (capacity) using vector/array



K = 2
C = 2

S = 0 1 2 1 2

push(10)
push(20)
pop()
push(30)
pop()

20 30

Implementing enQueue()

↓

push back

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Implementing deQueue()

popfront

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Implementing Front()

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Implementing Rear()

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Implementing isEmpty()

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Implementing isFull()

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THANK YOU!

↓

Next Lecture → Questions

Stack se Queue

Queue se Stack

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