



Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)



Department of Information Technology

COURSE CODE: DJS22ITL302

DATE: 25-10-23

COURSE NAME: Data Structure Laboratory

CLASS: II-Batch1

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ROLL NO.: 1025

Experiment No. 4

CO/LO: CO1

Aim: Implementation of Circular Queue and DEQueue.

Theory: A Circular Queue is an extended version of a normal queue where the last element of the queue is connected to the first element of the queue forming a circle. The operations are performed based on FIFO principle. It is also called 'Ring Buffer'.

Operations on Circular Queue

- o Front :- Get the front element from the queue.
- o Rear :- Get the last item from the queue.
- o enqueue : The function is used to insert an element in Circular Queue.
- o dequeue : It is used to delete an element from the circular Queue.

In a circular Queue the element is always deleted from Front position.

* Dequeue or Doubly Ended Queue is a generalized version of the Queue data structure that allows insertion and deletion at both ends.

Operations on Deque.

- o insert Front : Adds item to the front of Dequeue.
- o insert Rear : Adds an item at the rear of Deque.



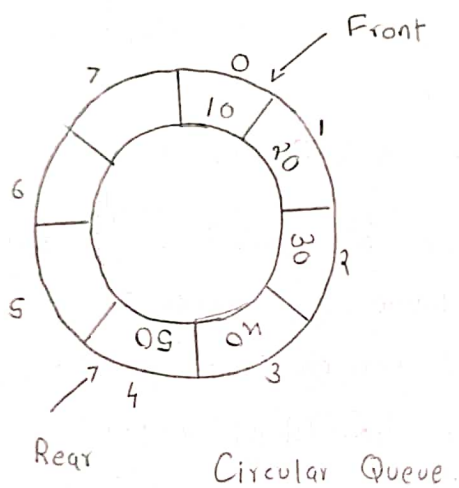
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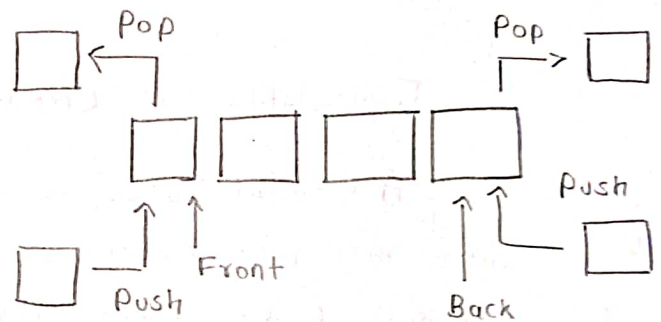
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- o delete Front : deletes item from front of Deque
- o delete Rear : deletes item from rear of Deque.

Output :



Circular Queue.



Deque

Conclusion : I learnt the implementation of Circular Queue and Dequeue and performed various operation on it.

References : Geeks For Geeks -> Theory
Self implemented the code.



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PROGRAM OF CIRCULAR QUEUE:

```
#include<stdio.h>
#include<stdlib.h>
#define SIZE 5

int front=-1 , rear=-1, arr[SIZE];

void insert(){
    int data;
    printf("Enter data to be inserted ");
    scanf("%d",&data);
    if((rear==SIZE-1 && front==0) || (front!=0 && (rear%SIZE)==front-1)){
        printf("Queue is Full\n \n");
        return;
    }
    else if (front==--1 && rear==--1)
    {
        rear=front=0;
        arr[rear]=data;
    }
    else if (front!=0 && rear==SIZE-1)
    {
        rear=0;
        arr[rear]=data;
    }
    else{
        rear++;
        arr[rear]=data;
    }
    printf("%d is inserted \n \n", data);
}

void delete(){
    if (front==--1){
        printf("Queue is empty \n \n");
        return;
    }
    else if (front==rear)
    {
        printf("%d is deleted \n \n",arr[front]);
        front=rear=-1;
    }
}
```



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```
        else if (front==SIZE-1)
        {
            printf("%d is deleted \n \n",arr[front]);
            front=0;
        }
        else
        {
            printf("%d is deleted \n \n",arr[front]);
            front++;
        }
    }

void display(){
    int i;
    if (front<=rear)
    {
        for ( i = front; i <= rear; i++)
        {
            printf("%d ",arr[i]);
        }
        printf("\n \n");
    }
    else{
        for ( i = front; i < SIZE; i++)
        {
            printf("%d ",arr[i]);
        }
        for ( i = 0; i <= rear; i++)
        {
            printf("%d ",arr[i]);
        }
        printf("\n \n");
    }
}

int main()
{
    int choice=-1;
    while(choice!=0){
        printf("Enter 1 to insert \nEnter 2 to delete \nEnter 3 to display\nEnter 0 to exit\n");
        scanf("%d",&choice);
```



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```
        if(choice==1){
            insert();
        }
        else if (choice==2)
        {
            delete();
        }
        else if (choice==3)
        {
            display();
        }
        else if (choice==0)
        {
            break;
        }
    }
return 0;
}
```

OUTPUT:

```
Enter 1 to insert
Enter 2 to delete
Enter 3 to display
Enter 0 to exit
3
10 20 30

Enter 1 to insert
Enter 2 to delete
Enter 3 to display
Enter 0 to exit
1
Enter data to be inserted 40
40 is inserted

Enter 1 to insert
Enter 2 to delete
Enter 3 to display
Enter 0 to exit
3
10 20 30 40
```

```
Enter 1 to insert
Enter 2 to delete
Enter 3 to display
Enter 0 to exit
3
10 20 30 40

Enter 1 to insert
Enter 2 to delete
Enter 3 to display
Enter 0 to exit
2
10 is deleted

Enter 1 to insert
Enter 2 to delete
Enter 3 to display
Enter 0 to exit
3
20 30 40
```




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```
        rear = front = 0;
        arr[rear] = data;
    }
    else if (front != 0 && rear == SIZE - 1){
        rear = 0;
        arr[rear] = data;
    }
    else{
        if (rear == -1) rear = 0;
        rear = (rear + 1) % SIZE; // Circular increment
        arr[rear] = data;
    }
    printf("%d is inserted at the rear\n \n", data);
}

void deleteFront(){
    if (front == -1){
        printf("Deque is empty \n \n");
        return;
    }
    else if (front == rear){
        printf("%d is deleted \n \n", arr[front]);
        front = rear = -1;
    }
    else if (front == SIZE - 1){
        printf("%d is deleted \n \n", arr[front]);
        front = 0;
    }
    else{
        printf("%d is deleted \n \n", arr[front]);
        front = (front + 1) % SIZE; // Circular increment
    }
}

void deleteRear(){
    if (front == -1){
        printf("Deque is empty \n \n");
        return;
    }
    else if (front == rear){
        printf("%d is deleted \n \n", arr[rear]);
        front = rear = -1;
    }
}
```



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```
}
else if (rear == 0){
    printf("%d is deleted \n \n", arr[rear]);
    rear = SIZE - 1;
}
else{
    printf("%d is deleted \n \n", arr[rear]);
    rear = (rear - 1 + SIZE) % SIZE; // Circular decrement
}
}

void display(){
    int i;
    if (front <= rear){
        for (i = front; i <= rear; i++)
            printf("%d ", arr[i]);
        printf("\n \n");
    }
    else{
        for (i = front; i < SIZE; i++)
            printf("%d ", arr[i]);
        for (i = 0; i <= rear; i++)
            printf("%d ", arr[i]);
        printf("\n \n");
    }
}

int main(){
    int choice = -1;
    while (choice != 0){
        printf("Enter 1 to insert at the front\nEnter 2 to insert at the rear\nEnter 3 to delete from the front\nEnter 4 to delete from the rear\nEnter 5 to display\nEnter 0 to exit\n");
        scanf("%d", &choice);
        switch (choice){
            case 1:
                insertFront();
                break;
            case 2:
                insertRear();
                break;
            case 3:
```



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```
        deleteFront();
        break;
    case 4:
        deleteRear();
        break;
    case 5:
        display();
        break;
    case 0:
        break;
    default:
        printf("Invalid choice\n");
    }
}
return 0;
}
```

OUTPUT:

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
5
10 20 30
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
1
Enter data to be inserted at the front: 100
100 is inserted at the front
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
5
100 10 20 30
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
5
100 10 20 30
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
2
Enter data to be inserted at the rear: 100
100 is inserted at the rear
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
5
100 10 20 30 100
```




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```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
```

```
5
100 10 20 30 100
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
```

```
3
100 is deleted
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
```

```
5
10 20 30 100
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
```

```
5
10 20 30 100
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
```

```
4
100 is deleted
```

```
Enter 1 to insert at the front
Enter 2 to insert at the rear
Enter 3 to delete from the front
Enter 4 to delete from the rear
Enter 5 to display
Enter 0 to exit
```

```
5
10 20 30
```