Operations on Circular Queue

The following are the operations that can be performed on a circular queue:

- **Front:** It is used to get the front element from the Queue.
- **Rear:** It is used to get the rear element from the Queue.
- **enQueue(value):** This function is used to insert the new value in the Queue. The new element is always inserted from the rear end.
- **deQueue():** This function deletes an element from the Queue. The deletion in a Queue always takes place from the front end.

Applications of Circular Queue

The circular Queue can be used in the following scenarios:

- **Memory management:** The circular queue provides memory management. As we have already seen that in linear queue, the memory is not managed very efficiently. But in case of a circular queue, the memory is managed efficiently by placing the elements in a location which is unused.
- **CPU Scheduling:** The operating system also uses the circular queue to insert the processes and then execute them.
- **Traffic system:** In a computer-control traffic system, traffic light is one of the best examples of the circular queue. Each light of traffic light gets ON one by one after every jinterval of time. Like red light gets ON for one minute then yellow light for one minute and then green light. After green light, the red light gets ON.

Enqueue operation

The steps of enqueue operation are given below:

- First, we will check whether the Queue is full or not.
- Initially the front and rear are set to -1. When we insert the first element in a Queue, front and rear both are set to 0.
- When we insert a new element, the rear gets incremented, i.e., ***rear=rear+1***.

Scenarios for inserting an element

There are two scenarios in which queue is not full:

- **If rear != max - 1**, then rear will be incremented to **mod(maxsize)** and the new value will be inserted at the rear end of the queue.
- **If front != 0 and rear = max - 1**, it means that queue is not full, then set the value of rear to 0 and insert the new element there.

There are two cases in which the element cannot be inserted:

- When **front ==0** && **rear = max-1**, which means that front is at the first position of the Queue and rear is at the last position of the Queue.
- front== rear + 1;

Algorithm to insert an element in a circular queue

Step 1: IF (REAR+1)%MAX = FRONT
Write " OVERFLOW "
Goto step 4
[End OF IF]

Step 2: IF FRONT = -1 and REAR = -1
SET FRONT = REAR = 0
ELSE IF REAR = MAX - 1 and FRONT ! = 0
SET REAR = 0
ELSE
SET REAR = (REAR + 1) % MAX
[END OF IF]

Step 3: SET QUEUE[REAR] = VAL

Step 4: EXIT

Dequeue Operation

The steps of dequeue operation are given below:

- First, we check whether the Queue is empty or not. If the queue is empty, we cannot perform the dequeue operation.
- When the element is deleted, the value of front gets decremented by 1.

- If there is only one element left which is to be deleted, then the front and rear are reset to -1.

Algorithm to delete an element from the circular queue

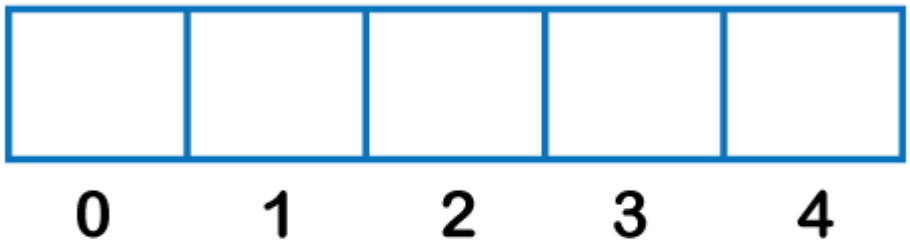
Step 1: IF FRONT = -1
Write " UNDERFLOW "
Goto Step 4
[END of IF]

Step 2: SET VAL = QUEUE[FRONT]

Step 3: IF FRONT = REAR
SET FRONT = REAR = -1
ELSE
IF FRONT = MAX -1
SET FRONT = 0
ELSE
SET FRONT = FRONT + 1
[END of IF]
[END OF IF]

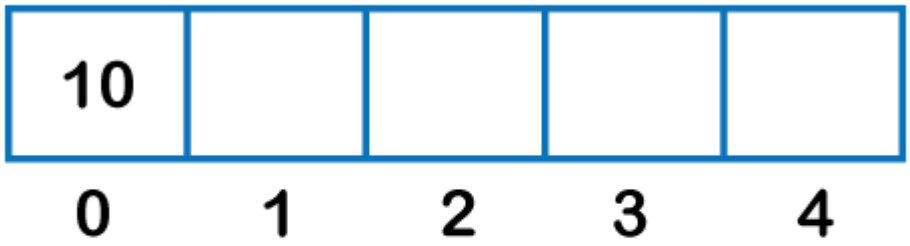
Step 4: EXIT

Let's understand the enqueue and dequeue operation through the diagrammatic representation.



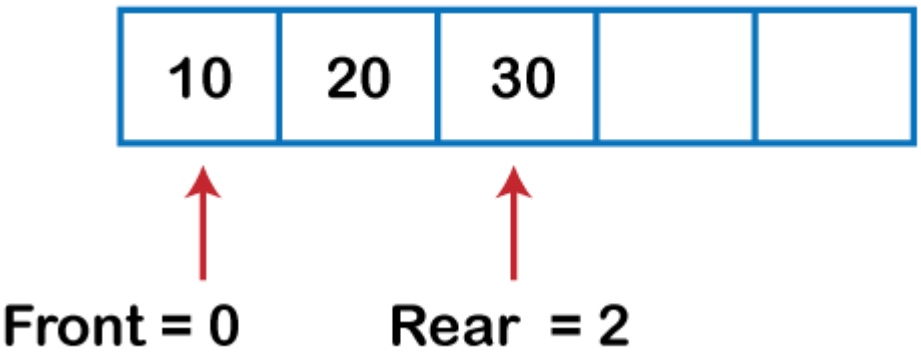
Front = -1

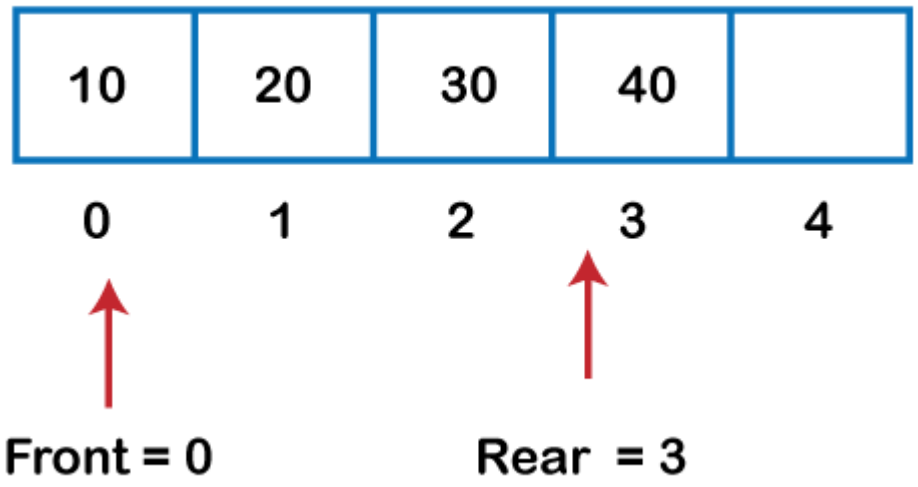
Rear = -1

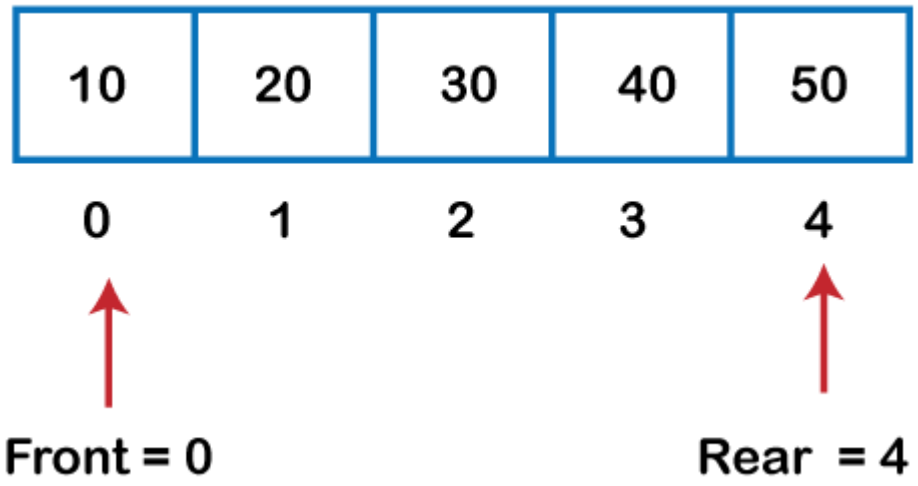


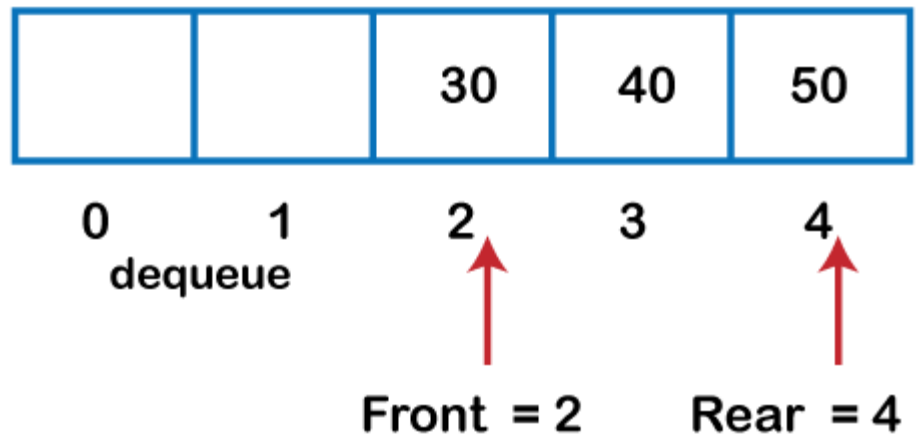
Front = 0

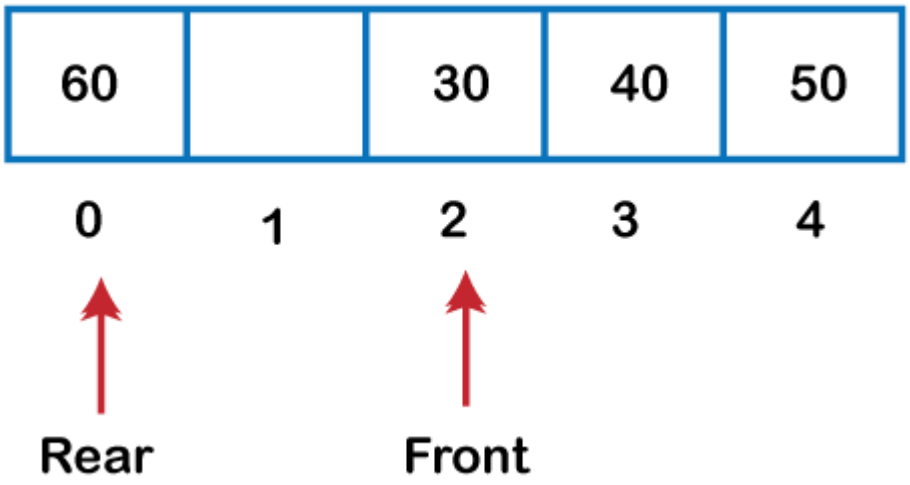
Rear = 0

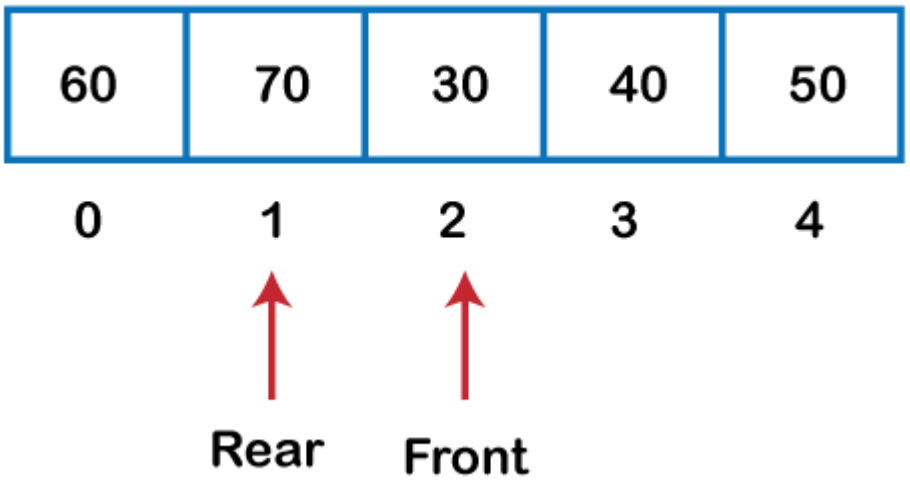



10
20
30
40
0
1
2
3
4
Front = 0
Rear = 3


10
20
30
40
50
0
1
2
3
4
Front = 0
Rear = 4


30
40
50
0
1
2
3
4
dequeue
Front = 2
Rear = 4





Implementation of circular queue using Array

```
#include <stdio.h>

# define max 6
int queue[max];  // array declaration
int front=-1;
int rear=-1;

// function to insert an element in a circular queue
void enqueue(int element)
{
```

```
    if(front==-1 && rear==-1)   // condition to check queue is empty
    {
     front=0;
     rear=0;
     queue[rear]=element;
    }
    else if((rear+1)%max==front)  // condition to check queue is full
    {
     printf("Queue is overflow..");
    }
    else
    {
     rear=rear+1;       // rear is incremented
     queue[rear]=element;     // assigning a value to the queue at
the rear position.
    }
}

// function to delete the element from the queue
void dequeue()
{
    if((front==-1) && (rear==-1))  // condition to check queue is
empty
    {
     printf("\nQueue is underflow..");
    }
 else if(front==rear)
{
   printf("\nThe dequeued element is %d", queue[front]);
   front=-1;
   rear=-1;
}
else
{
    printf("\nThe dequeued element is %d", queue[front]);
   front=front+1;
}
```

```
}

// function to display the elements of a queue
void display()
{
    int i=front;
    if(front==-1 && rear==-1)
    {
     printf("\n Queue is empty..");
    }
    else
    {
     printf("\nElements in a Queue are :");
     while(i<=rear)
     {
         printf("%d,", queue[i]);
         i=i+1;
     }
     getch();
    }
}

int main()
{
    int choice=1,x;   // variables declaration

    while(choice<4 && choice!=0)   // while loop
    {
    printf("\n Press 1: Insert an element");
    printf("\nPress 2: Delete an element");
    printf("\nPress 3: Display the element");
    printf("\nEnter your choice");
    scanf("%d", &choice);

    switch(choice)
    {
```

```
      case 1:
        printf("Enter the element which is to be inserted");
        scanf("%d", &x);
        enqueue(x);
        break;
      case 2:
        dequeue();
        break;
      case 3:
        display();

    }}
    return 0;
}
```