

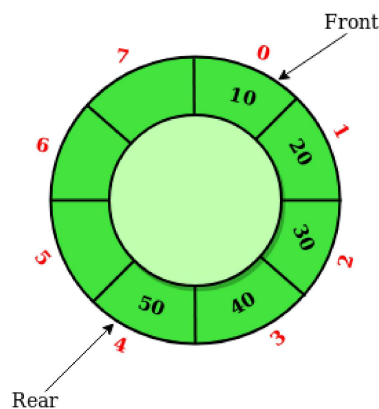
Experiment no 5

Aim: To implement Circular Queue ADT using array

Objective:

Circular Queue offer a quick and clean way to store FIFO data with maximum size

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 (First In First Out) principle. In a normal Queue, we can insert elements until queue becomes full. But once queue becomes full, we can not insert the next element even if there is a space in front of queue.



Algorithm:

1. INIT(Queue, FRONT, REAR, COUNT)
2. INSERT-ITEM(Queue, FRONT, REAR, MAX, COUNT, ITEM)
3. REMOVE-ITEM(Queue, FRONT, REAR, COUNT, ITEM)
4. FULL-CHECK(Queue, FRONT, REAR, MAX, COUNT, FULL)
5. EMPTY-CHECK(Queue, FRONT, REAR, MAX, COUNT, EMPTY)

INIT(Queue, FRONT, REAR, COUNT)

This algorithm is used to initialize circular queue.

1. FRONT := 1;
2. REAR := 0;
3. COUNT := 0;

4. Return;

INSERT-ITEM(QUEUE, FRONT, REAR, MAX, COUNT, ITEM)

This algorithm is used to insert or add item
into circular queue.

1. If (COUNT = MAX) then
 - a. Display "Queue overflow";
 - b. Return;
2. Otherwise
 - a. If (REAR = MAX) then
 - i. REAR := 1;
 - b. Otherwise
 - i. REAR := REAR + 1;
 - c. QUEUE(REAR) := ITEM;
 - d. COUNT := COUNT + 1;
3. Return;

REMOVE-ITEM(QUEUE, FRONT, REAR, COUNT, ITEM)

This algorithm is used to remove or delete item
from circular queue.

1. If (COUNT = 0) then
 - a. Display "Queue underflow";
 - b. Return;
2. Otherwise
 - a. ITEM := QUEUE(FRONT)
 - b. If (FRONT = MAX) then
 - i. FRONT := 1;
 - c. Otherwise
 - i. FRONT := FRONT + 1;
 - d. COUNT := COUNT + 1;

3. Return;

EMPTY-CHECK(Queue,FRONT,REAR,MAX,COUNT,EMPTY)

This is used to check queue is empty or not.

1. If(COUNT = 0) then

a. EMPTY := true;

2. Otherwise

a. EMPTY := false;

3. Return ;

FULL-CHECK(Queue,FRONT,REAR,MAX,COUNT,FULL)

This algorithm is used to check queue is full or not.

1. If (COUNT = MAX) then

a. FULL := true;

2. Otherwise

a. FULL := false;

3. Return ;

Circular Queue implementation in C:

```
#include <stdio.h>
```

```
#define SIZE 5
```

```
int items[SIZE];
```

```
int front = -1, rear = -1;
```

```
// Check if the queue is full
```

```
int isFull() {
```

```
    if ((front == rear + 1) || (front == 0 && rear == SIZE - 1)) return 1;
```

```
    return 0;
}
```

```
// Check if the queue is empty
```

```
int isEmpty() {
    if (front == -1) return 1;
    return 0;
}
```

```
// Adding an element
```

```
void enqueue(int element) {
    if (isFull())
        printf("\n Queue is full!! \n");
    else {
        if (front == -1) front = 0;
        rear = (rear + 1) % SIZE;
        items[rear] = element;
        printf("\n Inserted -> %d", element);
    }
}
```

```
// Removing an element
```

```
int dequeue() {
    int element;
    if (isEmpty()) {
        printf("\n Queue is empty !! \n");
        return (-1);
    } else {
        element = items[front];
```

```

if (front == rear) {
    front = -1;
    rear = -1;
}

// Q has only one element, so we reset the
// queue after dequeing it. ?
else {
    front = (front + 1) % SIZE;
}

printf("\n Deleted element -> %d \n", element);
return (element);
}
}

```

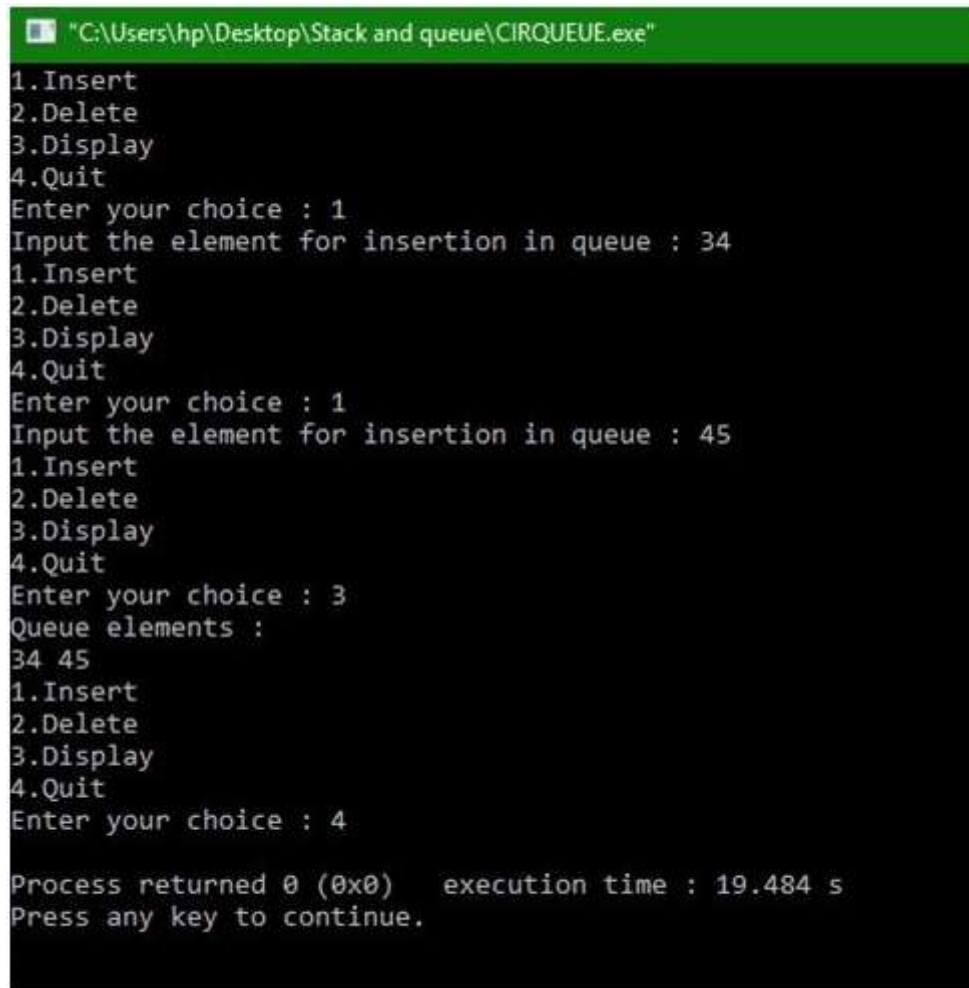
```

// Display the queue
void display() {
    int i;
    if (isEmpty())
        printf("\n Empty Queue\n");
    else {
        printf("\n Front -> %d ", front);
        printf("\n Items -> ");
        for (i = front; i != rear; i = (i + 1) % SIZE) {
            printf("%d ", items[i]);
        }
        printf("%d ", items[i]);
        printf("\n Rear -> %d \n", rear);
    }
}
}

```

```
int main() {  
    // Fails because front = -1  
    deQueue();  
  
    enqueue(1);  
    enqueue(2);  
    enqueue(3);  
    enqueue(4);  
    enqueue(5);  
  
    // Fails to enqueue because front == 0 && rear == SIZE - 1  
    enqueue(6);  
  
    display();  
    deQueue();  
  
    display();  
  
    enqueue(7);  
    display();  
  
    // Fails to enqueue because front == rear + 1  
    enqueue(8);  
  
    return 0;  
}
```

Output:



```
"C:\Users\hp\Desktop\Stack and queue\CIRQUEUE.exe"
1.Insert
2.Delete
3.Display
4.Quit
Enter your choice : 1
Input the element for insertion in queue : 34
1.Insert
2.Delete
3.Display
4.Quit
Enter your choice : 1
Input the element for insertion in queue : 45
1.Insert
2.Delete
3.Display
4.Quit
Enter your choice : 3
Queue elements :
34 45
1.Insert
2.Delete
3.Display
4.Quit
Enter your choice : 4

Process returned 0 (0x0)   execution time : 19.484 s
Press any key to continue.
```

Conclusion:

The Circular Queue is similar to a Linear Queue in the sense that it follows the FIFO (First In First Out) principle but differs in the fact that the last position is connected to the first position, replicating a circle.