Experiment No.5
Implement Circular Queue ADT using array
Name: Pratik Sanjay Avhad
Roll No: 01
Date of Performance:
Date of Submission:
Marks:
Sign:

Experiment No. 5: Circular Queue

Aim: To Implement Circular Queue ADT using array

Objective:

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

Theory:

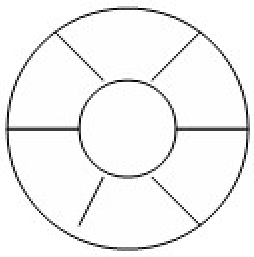
Circular queue is an data structure in which insertion and deletion occurs at an two ends rear and front respectively. Eliminating the disadvantage of linear queue that even though there is a vacant slots in array it throws full queue exception when rear reaches last element. Here in an circular queue if the array has space it never throws an full queue exception. This feature needs an extra variable count to keep track of the number of insertion and deletion in the queue to check whether the queue is full or not.Hence circular queue has better space utilization as compared to linear queue. Figure below shows the representation of linear and circular queue.

Linear queue

Front rear

0	…	…		n

Circular Queue



Algorithm

Algorithm : ENQUEUE(Item)

Input : An item is an element to be inserted in a circular queue.

Output : Circular queue with an item inserted in it if the queue has an empty slot.

Data Structure : Q be an array representation of a circular queue with front and rear pointing to the first and last element respectively.

```
1. If front = 0
       front = 1
       rear =1
       Q[front] = item
2. else
       next=(rear mod length)
       if next!=front then
           rear = next
           Q[rear] = item
       Else
           Print "Queue is full"
       End if
   End if
```

```
3.  stop
```

Algorithm : DEQUEUE()

Input : A circular queue with elements.

Output :Deleted element saved in Item.

Data Structure : Q be an array representation of a circular queue with front and rear pointing to the first and last element respectively.

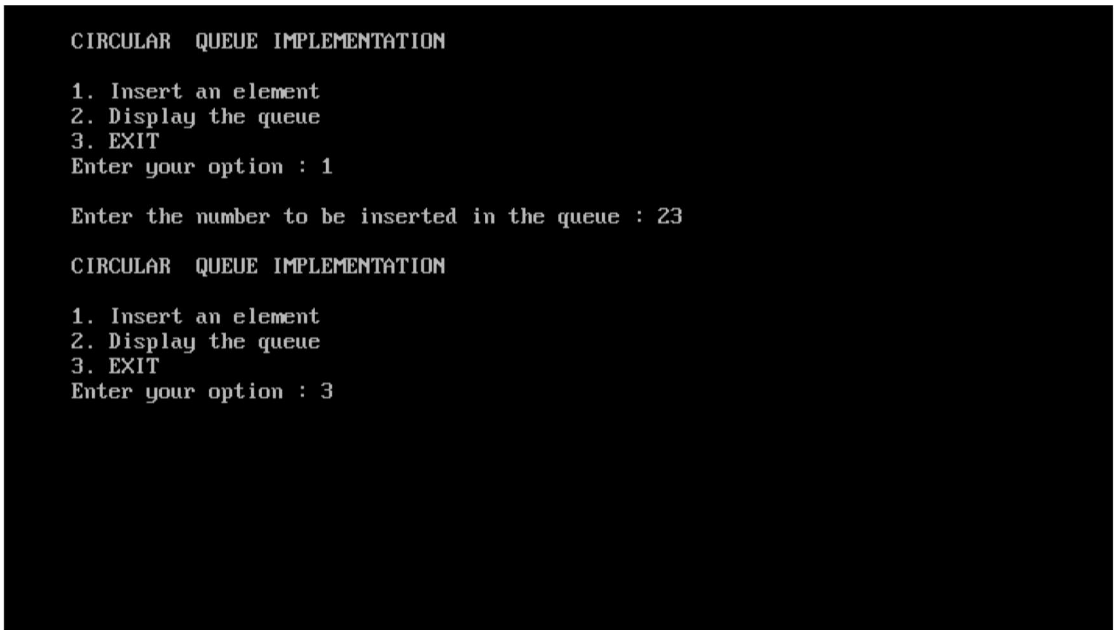
```
1.  If front = 0
        Print "Queue is empty"
        Exit
2.  else
        item = Q[front]
        if front = rear then
            rear = 0
            front=0
        else
            front = front+1
        end if
    end if
3.  stop
```

Code:

```
#include <stdio.h>

#include <conio.h>

#define MAX 10

int queue[MAX];
int front=-1, rear=-1;

void insert(void);


void display(void);

int main()

{

int option;

clrscr();

do

{

 printf("\n CIRCULAR  QUEUE IMPLEMENTATION ");

 printf("\n");

 printf("\n 1. Insert an element");

 printf("\n 2. Display the queue");

 printf("\n 3. EXIT");

 printf("\n Enter your option : ");

 scanf("%d", &option);

switch(option)

 {

 case 1:

 insert();

break;

case 2:

 display();

break;
```

```
 }
}while(option!=3);
getch();
return 0;
}
void insert()
{
int num;
printf("\n Enter the number to be inserted in the queue : ");
scanf("%d", &num);
if(front==0 && rear==MAX-1)
 printf("\n OVERFLOW");
else if(front==-1 && rear==-1)
{
front=rear=0;
 queue[rear]=num;
}
else if(rear==MAX-1 && front!=0)
{
rear=0;
 queue[rear]=num;
}
else
{
 rear++;
 queue[rear]=num;
}
}
void display()
{
int i;
printf("\n");
if (front ==-1 && rear==-1)
 printf ("\n QUEUE IS EMPTY");
else
{
 if(front<rear)
 {
 for(i=front;i<=rear;i++)
 printf("\t %d", queue[i]);
 }
 else
 {
 for(i=front;i<MAX;i++)
 printf("\t %d", queue[i]);
for(i=0;i<=rear;i++)
 printf("\t %d", queue[i]);
 }
}
}
```

Output:



```
CIRCULAR  QUEUE IMPLEMENTATION

1. Insert an element
2. Display the queue
3. EXIT
Enter your option : 1

Enter the number to be inserted in the queue : 23

CIRCULAR  QUEUE IMPLEMENTATION

1. Insert an element
2. Display the queue
3. EXIT
Enter your option : 3
```

Conclusion:

Q. Explain how Josephus Problem is resolved using circular queue and elaborate on operation used for the same.

The Josephus Problem is a famous theoretical problem and a common programming exercise. It goes like this: N people (usually represented as a circle) are standing in a circle, and they are required to count off in turn around the circle. Every M-th person is eliminated from the circle and the process continues until only one person remains. The goal is to find the position of the last person standing.

One way to solve the Josephus Problem efficiently is by using a circular queue.

Here's how you can resolve the Josephus Problem using a circular queue:

1. Initialize the Circular Queue:
    - Create a circular queue of size N to represent the N people in the circle.

- Fill the circular queue with values from 1 to N, representing the positions of the people in the circle.

2. Start the Elimination Process:
    - Set a variable **count** to 0 to keep track of the number of people eliminated.
    - While there is more than one person left in the queue (i.e., the size of the queue is greater than 1):
        - Dequeue (remove) the person at the front of the circular queue.
        - Increment the **count** by 1.
        - If **count** is equal to M (the person to be eliminated), do the following:
            - Remove the person from the circle (i.e., do not enqueue them back into the circular queue).
            - Reset the **count** to 0.
        - If **count** is not equal to M, enqueue the person back into the circular queue.
3. The Last Person Standing:
    - After all eliminations, there will be only one person left in the circular queue.
    - The position of this person is the solution to the Josephus Problem.

The key to this approach is the circular nature of the queue, which allows you to efficiently simulate the process of going around the circle and eliminating people. The time complexity of this solution is O(N*M), where N is the number of people and M is the counting interval.