Experiment No.5
Implement Circular Queue ADT using array
Name:Ayush Gupta
Roll No:14
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:

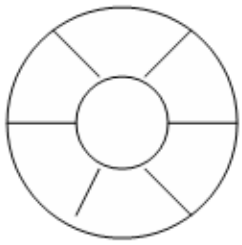
Circular queue is an data structure in which insertion and deletion occurs at an two ends rear and front respectively. Eliminating the disadvantage of linear queue that even though there is a vacant slots in array it throws full queue exception when rear reaches last element. Here in an circular queue 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.

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

```
    If front = 0
            Print "Queue is empty"
            Exit
    else
            item = Q[front]
            if front = rear then
                rear = 0
                front=0
```

```
            else
                front = front+1
            end if
        end if
    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:

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

The Josephus Problem is a theoretical scenario that involves a group of people standing in a circle waiting to be executed. The problem revolves around determining the last remaining person in the circle after every \(k\)th person is executed. Circular queues can be used to simulate this problem.

Here's how the Josephus Problem can be resolved using a circular queue:

1. Setup: Place all the people in a circular queue, simulating the circle in which they stand.

2. Operation

- Start with the first person in the queue.

- Remove the first \(k-1\) people from the queue and add them back to the end of the queue, simulating the process of counting and executing every \(k\)th person.

- The next person in the queue is the \(k\)th person from the initially removed set. Remove this person from the queue.

- Continue this process until only one person remains in the queue.

This operation is typically implemented using the following steps:

- Enqueue: Add a person to the circular queue.

- Dequeue: Remove and return the \(k\)th person from the queue, simulating their execution.

- Rotate: Rotate the queue to the left by \(k-1\) positions, simulating the counting process.

- Peek: View the current person at the front of the queue without removing them.

- IsEmpty: Check if the queue is empty.

- Size: Return the number of people remaining in the queue.

By repeatedly rotating the circular queue and dequeueing the \(k\)th person, the Josephus Problem can be simulated and resolved. The last person remaining in the queue is the survivor of the execution process. Circular queues are instrumental in providing an efficient way to model and solve this problem.