

Circular Queue Implementation Using Array

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Aim: To implement a circular queue using array

Data Structure used : Queue, Array

Algorithms

1. Algorithm for enqueue

Input: An Array implementation of Circular Queue (C_Q[SIZE]), with front pointing to the first element and rear pointing to the last element in and an element E to be inserted into the queue.

Output: The Circular Queue with the element E inserted at the front

Data Structure: Circular Queue

Steps:

Step 1: if((rear+1)%SIZE == front) then

Step 1: print("The queue is full insertion not possible")

Step 2: exit(1)

Step 2: else

Step 1: if(rear == -1) then

Step 1: front ++

Step 2: EndIf

Step 3: rear = (rear+1)%SIZE

Step 4: C_Q[rear] = E

Step 3: EndIf

2. Algorithm for dequeue

Input: An Array implementation of Circular Queue (C_Q[SIZE]), with front pointing to the first element and rear pointing to the last element in the queue.

Output: The element E which is removed from the circular queue

Steps:

Step 1: if(front == -1) then

Step 1: print("The Queue is empty")

Step 2: exit(1)

Step 2: else

Step 1: E = Q[front]

Step 2: if(front == rear) then

Step 1: front = -1

Step 2: rear = -1

Step 3: else
Step 1: front = (front+1)%SIZE
Step 4: endif
Step 3: endif

Description of the Algorithm:

Program code:

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

//Create a struct for our queue
typedef struct CQueue{
    int* Q;
    int front;
    int rear;
    int size;
} CQueue;

CQueue* initializeQueue(){
    int size = 2;

    //Create a pointer to stack
    CQueue *a = (CQueue*) malloc (sizeof(CQueue));
    if(a == NULL){
        printf("An Overflow error has occurred while creating the CircularQueue\n");
        exit(1);
    }

    //create the array that will contain our stack
    a->Q = (int*)malloc(size*sizeof(int));
    if(a->Q == NULL){
        printf("An Overflow error has occurred while creating the Circular Queue
array\n");
        exit(1);
    }

    a->front = -1;
    a->rear = -1;
    a->size = size;
    return a;
}

void deleteQueue(CQueue *a){
    free(a->Q);
    free(a);
}

void enqueue(CQueue *a,int item){
    if((a->rear+1)%a->size == a->front){
```

```

        a->size = a->size*2;
        a->Q = realloc(a->Q,a->size);
        //printf("CircularQueue is Full \n");
        //flush(stdout);
        if(a->Q == NULL){
            printf("An Overflow Error has occurred while reallocating the array\
nEXITING!!!!!!!!\n");
            exit(1);
        }
    }

    if(a->front == -1){
        a->front = 0;
    }

    a->rear = (a->rear +1)%a->size;
    a->Q[a->rear] = item;
}

int deQueue(CQueue *a){
    if(a->front == -1){
        printf("You have made a grave mistake, the CQueue was empty\n\n");
        deleteQueue(a);
        exit(1);
        return -1;
    }
    else{
        int item = a->Q[a->front];
        if(a->front == a->rear){
            a->front = -1;
            a->rear = -1;
        }
        else{
            a->front = (a->front+1)%a->size;
        }
        return item;
    }
}

void displayQueue(CQueue *a){
    int i = a->front;

    while(i!=(a->rear+1)%a->size){
        printf("%d ",a->Q[i]);
        i = (i+1)%a->size;
    }
    printf("\n");
}

int menu(CQueue *a){
    int RUN=1;
    int c;        //For the corresponding choice

```

```

int item;    //To receive the item to push or pop from the array
while (RUN){
    printf("\n");
    printf("-----\n");
    printf("Circular Queue Implementation using structure\n");
    printf("-----\n");
    printf("1.Insert\n");
    printf("2.Delete\n");
    printf("3.Print the queue\n");
    printf("4.Exit\n");
    printf("Enter the required choice --> ");
    scanf("%d%c",&c);

    switch(c){
        case 1:printf("Enter the element to be inserted into the queue -->
");
                scanf("%d%c",&item);
                enqueue(a,item);
                break;

        case 2:item = dequeue(a);
                printf("Item removed is  is --> %d\n",item);
                break;

        case 3:printf("The Circular Queue is --> ");
                displayQueue(a);
                break;

        case 4: RUN=0;
                break;

        default:printf("Entered command is unknown");
    }

    }
    deleteQueue(a);

    printf("Finished excecuting the code ALL DONE\n");
    return RUN;
}

int main(){
    CQueue *a;
    a = initializeQueue();
    return menu(a);
}

```

Sample input/Output:

```
rohit@iris ~/Programing/C/CSL201/2020-11-05
➤ gcc -Wall circ_queue.c -o circ_queue.o
rohit@iris ~/Programing/C/CSL201/2020-11-05
➤ ./circ_queue.o

-----
Circular Queue Implementation using structure
-----
1.Insert
2.Delete
3.Print the queue
4.Exit
Enter the required choice --> 1
Enter the element to be inserted into the queue --> 12

-----
Circular Queue Implementation using structure
-----
1.Insert
2.Delete
3.Print the queue
4.Exit
Enter the required choice --> 1
Enter the element to be inserted into the queue --> 54

-----
Circular Queue Implementation using structure
-----
1.Insert
2.Delete
3.Print the queue
4.Exit
Enter the required choice --> 1
Enter the element to be inserted into the queue --> 73

-----
Circular Queue Implementation using structure
-----
1.Insert
2.Delete
3.Print the queue
4.Exit
Enter the required choice --> 2
Item removed is is --> 12
```

```
-----
Circular Queue Implementation using structure
-----
1.Insert
2.Delete
3.Print the queue
4.Exit
Enter the required choice --> 2
Item removed is is --> 54

-----
Circular Queue Implementation using structure
-----
1.Insert
2.Delete
3.Print the queue
4.Exit
Enter the required choice --> 3
The Queue is --> 73

-----
Circular Queue Implementation using structure
-----
1.Insert
2.Delete
3.Print the queue
4.Exit
Enter the required choice --> 2
Item removed is is --> 73

-----
Circular Queue Implementation using structure
-----
1.Insert
2.Delete
3.Print the queue
4.Exit
Enter the required choice --> 2
You have made a grave mistake, the Queue was empty

rohit@iris ~/Programing/C/CSL201/2020-11-05
➤
```

Result: The Program was compiled successfully and the desired output was obtained.