Queue Implementation Using Array

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Aim: To implement a Queue using array

Data Structure used : Queue, Array

Algorithms

1. Algorithm for enqueue

Input: An Array implementation of Queue (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 Queue with the element E inserted at the rear

Data Structure: Queue

Steps:

```
Step 1: if(rear == SIZE) 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: Q[++rear] = E
Step 3: EndIf
```

2. Algorithm for dequeue

Input: An Array implementation of Queue (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 form the front of the queue

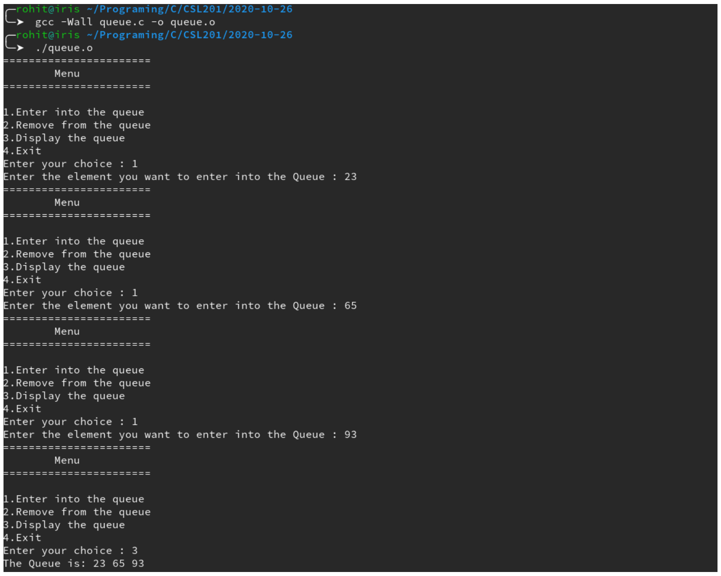
Steps

```
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--
        Step 4: endif
Step 3: endif
```

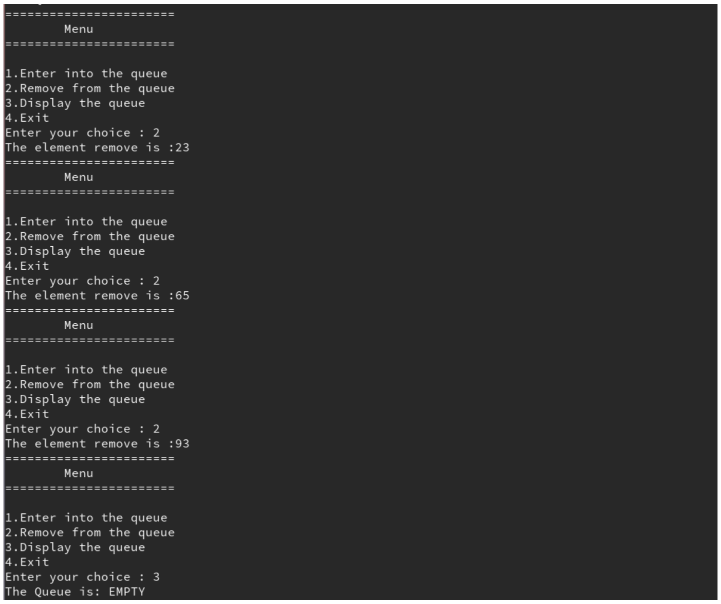
Program code:

```
/* Queue implemetation using dynamic array
 *  Done By : Rohit Karuankaran
 * */


#include <stdlib.h>
#include <stdio.h>
//#define SIZE 50


typedef struct queue_structure_datatype
{
    int *Q;
    int size;
    int front;
    int rear;
}queue;

void initQueue(queue *q)
{
    q->size = 16;
    q->Q = (int*) malloc(q->size*sizeof(int));
    q->front = -1;
    q->rear = -1;
}

void delQueue(queue *q)
{
    free(q->Q);
}

void incrSize(queue *q)
{
    q->size = 2*(q->size);
    int *tmp = (int*) realloc (q->Q,q->size*sizeof(int));
    if(tmp==NULL)
    {
        printf("Heap is full memory not available");
    }
    else
    {
        q->Q = tmp;
    }
}


void enQueue(queue *q,int elem)
{
    if(q->rear>=q->size)
    {
       // printf("The Queue is full Inseriton not possible\n");
        incrSize(q);
    }
    else
    {
        if(q->front==-1)
        {
            q->front=q->front+1;
        }
        q->rear = q->rear+1;
        q->Q[q->rear] = elem;
        return;
    }
}

int deQueue(queue *q)
{
    if(q->front == -1)
    {
        printf("QUEUE IS EMPTY THERE IS NO ELEMENT TO DELETE\n");
        return -1;
    }

    else
    {
        int elem = q->Q[q->front];

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

        else
            q->front=q->front+1;
        return elem;
    }
}

void displayQueue(queue *q)
{
    int i = q->front;
    if(q->front)
    {
        printf("EMPTY");
        return;
    }
    while(i>=0&&i<=q->rear)
    {
        printf("%d ",q->Q[i]);
        i++;
    }

}

int main()
{
    queue *myQueue = (queue*) malloc(sizeof(queue));
    int RUN = 1;
    int elem;
    int choice;
    initQueue(myQueue);
    while(RUN)
    {
        printf("=======================\n");
        printf("        Menu\n");
        printf("=======================\n\n");
        printf("1.Enter into the queue\n");
        printf("2.Remove from the queue\n");
        printf("3.Display the queue\n");
        printf("4.Exit\n");
        printf("Enter your choice : ");

        scanf("%d%*c",&choice);
        switch(choice)
        {
            case 1: printf("Enter the element you want to enter into the Queue : 
");
                    scanf("%d%*c",&elem);
                    enQueue(myQueue,elem);
                    break;

            case 2: elem = deQueue(myQueue);
                    printf("The element remove is :%d\n",elem);
                    break;

            case 3: printf("The Queue is: ");
                    displayQueue(myQueue);
                    printf("\n");
                    break;
            case 4: RUN = 0;
                    break;
            default: printf("Enter a valid input\n\n");
        }
    }

    /*
    insert(myQueue,32);
    insert(myQueue,21);
    displayQueue(myQueue);
    */
    delQueue(myQueue);
    printf("\nExiting.....\n");

}
```

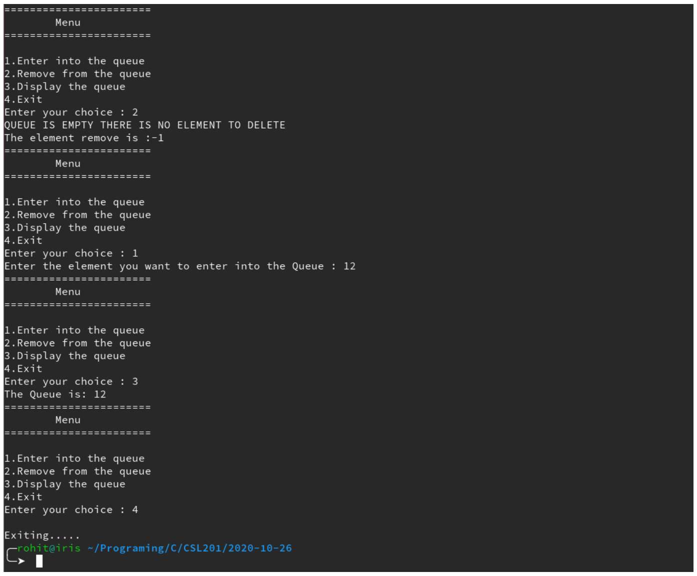
Sample input/Output:



```
┌rohit@iris ~/Programing/C/CSL201/2020-10-26
└➤  gcc -Wall queue.c -o queue.o
┌rohit@iris ~/Programing/C/CSL201/2020-10-26
└➤  ./queue.o
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 1
Enter the element you want to enter into the Queue : 23
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 1
Enter the element you want to enter into the Queue : 65
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 1
Enter the element you want to enter into the Queue : 93
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 3
The Queue is: 23 65 93
```



```
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 2
The element remove is :23
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 2
The element remove is :65
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 2
The element remove is :93
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 3
The Queue is: EMPTY
```



```
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 2
QUEUE IS EMPTY THERE IS NO ELEMENT TO DELETE
The element remove is :-1
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 1
Enter the element you want to enter into the Queue : 12
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 3
The Queue is: 12
=======================
        Menu
=======================

1.Enter into the queue
2.Remove from the queue
3.Display the queue
4.Exit
Enter your choice : 4

Exiting.....
┌rohit@iris ~/Programing/C/CSL201/2020-10-26
└➤  █
```

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