Experiment 16
Queue Implementation Using Linked List

Date : 12-11-2020

Aim: To implement a Queue using Linked List

Data Structure used : Queue, Linked List

Algorithms

1. Algorithm for Enqueue

Input: An Array implementation of Queue (Q), with Front pointing to the first element and Rear pointing to the last element in and an element ITEM to be inserted into the queue.

Output: The Queue with the element ITEM inserted at the rear

Data Structure: Queue, Linked List

Steps:

```
Step 1: Start
Step 2: new = GetNode(Node)
Step 3: if(new == NULL)
        Step 1: Print(“Can nont Insert a new node”)
        Step 2: Exit(1)
Step 4: else
        Step 1: new→data = ITEM
        Step 2: new→ Link = NULL
        Step 3: if(Front==NULL) then
                Step 1: Front = new
        Step 4: else
                Step 1: Rear→ link = new
        Step 5: endif
        Step 6: Rear = new
Step 5: endif
Step 6: Stop
```

2. Algorithm for dequeue

Input: An Array implementation of Queue (Q), with Front pointing to the first element and Rear pointing to the last element in the queue.

Output: The element ITEMwhich is removed form the Front of the queue

Steps

```
Step 1: if(front == NULL) then
        Step 1: print(“The Queue is empty”)
        Step 2: exit(1)
Step 2: else
        Step 1: ITEM = Front→data
        Step 2: rem = Front
        Step 3: if(Front==Rear)then
                Step 1:Rear =NULL
                Step 2: Front = NULL
        Step 4:else
                Step 1: Front = Front→link
```

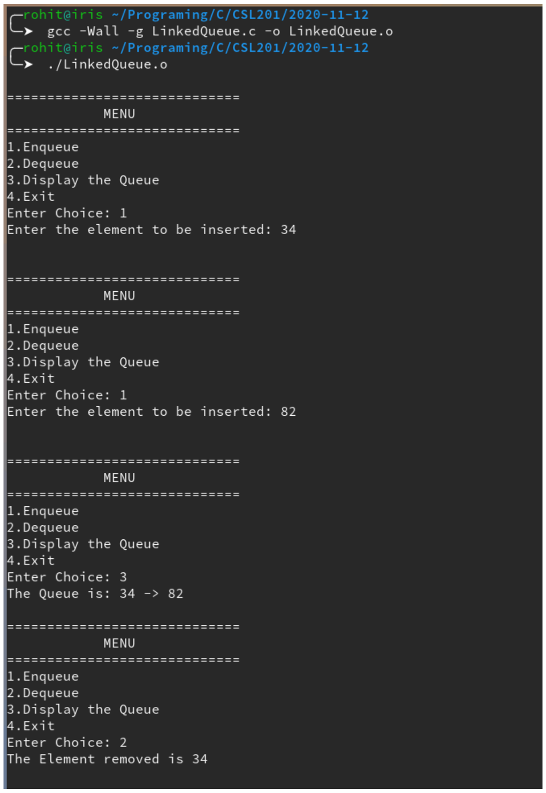
```
            Step 5:endif
            Step 6: ReturnNode(rem)
            Step 7: return ITEM
      Step 3: endif
      Step 4: Stop
```

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

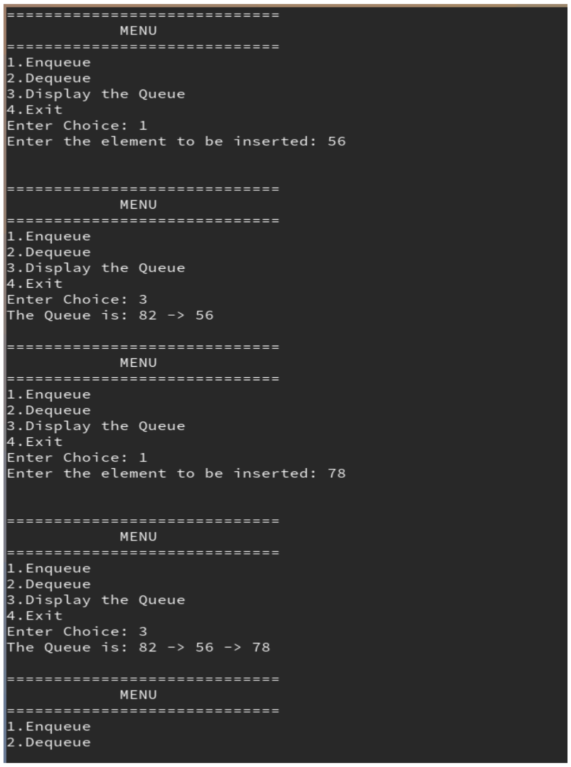
Program code:

```
/******************************************
 * Queue Implementation Using Linked List
 * Done By: Rohit Karunakaran
 * ****************************************/


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

typedef struct Linked_List_Node
{
    struct Linked_List_Node *link;
    int data;
}Node;

typedef struct Linked_Queue
{
    Node* Front;
    Node* Rear;
}Queue;

Queue* initQueue()
{
    Queue *q = (Queue*) malloc (sizeof(Queue));
    q->Front = NULL;
    q->Rear = NULL;
    return q;
}


//Insertion Algorithm
void enQueue(Queue *q,int val)
{
    Node *new_node = (Node*) malloc(sizeof(Node));

    if(new_node!=NULL)
    {
        new_node->link=NULL;
        new_node->data = val;
        if(q->Rear == NULL)
        {
            q->Front = new_node;
        }
        else
        {
             q->Rear->link = new_node;
        }
        q->Rear = new_node;
    }
    else
    {
        printf("Queue Is Full");
        exit(1);
    }
    return ;
}

//Deletion Algorithm
int deQueue(Queue *q){
    if(q->Front == NULL)
    {
        printf("Queue Is Empty");
        exit(0);
        return 0;
    }
    else
    {
        Node* ptr = q->Front;
        q->Front = q->Front->link;
        int elem = ptr->data;
        free(ptr);
        return elem;
    }
}

void displayQueue(Queue *q){
    Node* ptr = q->Front;
    if(ptr!=NULL)
    {
        printf("The Queue is: ");
        while(ptr!=NULL)
        {
            printf("%d",ptr->data);
            ptr=ptr->link;
        }
        printf("\n");
    }
    else
    {
        printf("The Queue is empty\n");
    }
}

int menu(Queue* q){
    int RUN = 1;
    while(RUN)
    {
        printf("\n");
        printf("=============================\n");
        printf("            MENU             \n");
        printf("=============================\n");
        printf("1.Enqueue\n");
        printf("2.Dequeue\n");
        printf("3.Display the Queue\n");
        printf("4.Exit\n");
        printf("Enter Choice: ");
        int choice;
        int elem;
        scanf("%d%*c",&choice);

        switch(choice)
        {
            case 1: printf("Enter the element to be inserted: ");
                    scanf("%d%*c",&elem);
                    enQueue(q,elem);
                    printf("\n");
                    break;
            case 2: elem = deQueue(q);
                    printf("The Element removed is %d",elem);
                    printf("\n");
                    break;
            case 3: displayQueue(q);
                    break;
            case 4: RUN=0;
                    break;
            default: printf("Enter a valid choice\n");
                     printf("\n");
                     break;

        }

    }
    printf("Exiting........");
    return RUN;
}

int main(){
    Queue *q = initQueue();
    return menu(q);
}
```

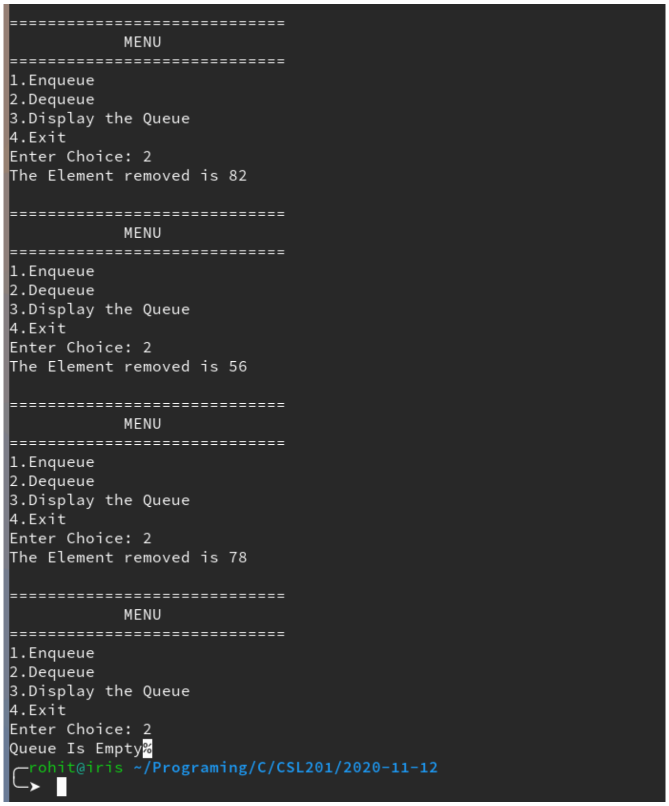
Sample Input/Output



```
╭─rohit@iris ~/Programing/C/CSL201/2020-11-12
╰─➤  gcc -Wall -g LinkedQueue.c -o LinkedQueue.o
╭─rohit@iris ~/Programing/C/CSL201/2020-11-12
╰─➤  ./LinkedQueue.o

=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 1
Enter the element to be inserted: 34


=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 1
Enter the element to be inserted: 82


=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 3
The Queue is: 34 -> 82

=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 2
The Element removed is 34
```



```
=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 1
Enter the element to be inserted: 56


=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 3
The Queue is: 82 -> 56

=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 1
Enter the element to be inserted: 78


=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 3
The Queue is: 82 -> 56 -> 78

=============================
            MENU
=============================
1.Enqueue
2.Dequeue
```



```
=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 2
The Element removed is 82

=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 2
The Element removed is 56

=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 2
The Element removed is 78

=============================
            MENU
=============================
1.Enqueue
2.Dequeue
3.Display the Queue
4.Exit
Enter Choice: 2
Queue Is Empty%
╭─rohit@iris ~/Programing/C/CSL201/2020-11-12
╰─➤  █
```