Assignment 7

DSA LAB

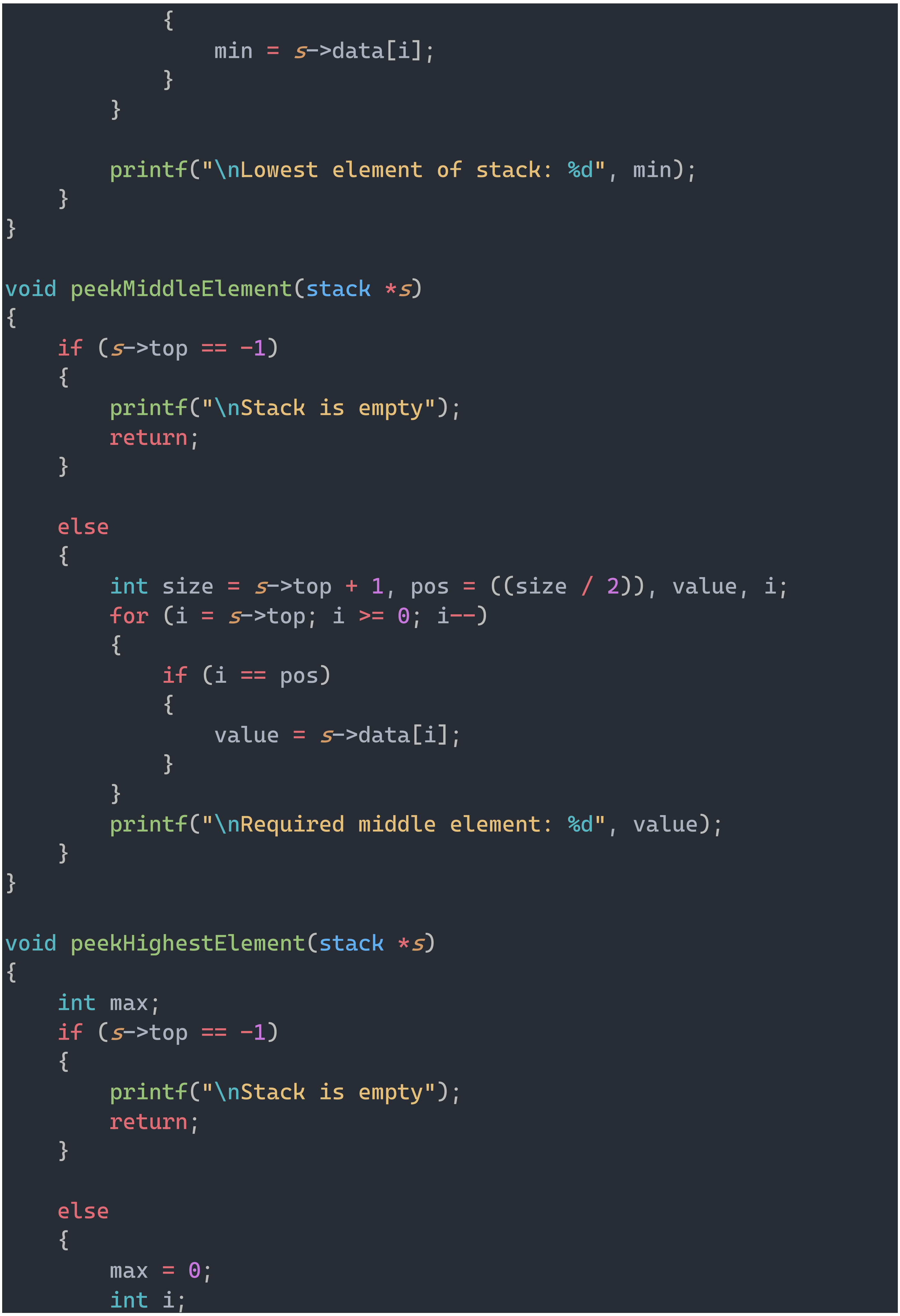
2029196

Adarsh Kumar

Q1. WAP to implement a stack which will support three additional operations in addition to push and pop:
a) peekLowestElement - return the lowest element in the stack without removing it from the stack
b) peekHighestElement - return the highest element in the stack without removing it from the stack
c) peekMiddleElement - return the (size/2+1)th lowest element in the stack without removing it from the stack.

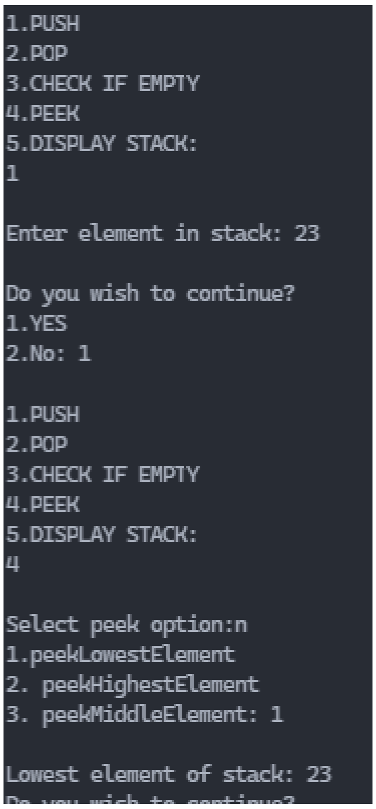
```c
#include <stdio.h>
#define MAX 15

typedef struct
{
    int data[MAX];
    int top;
} stack;

void push(stack *s, int value);
void pop(stack *s, int *temp);
void display(stack *s);
int isEmpty(stack *s);
void peek(stack *s);
int input();
void peekLowestElement(stack *s);
void peekHighestElement(stack *s);
void peekMiddleElement(stack *s);

void init(stack *s)
{
    s->top = -1; // initially we take top to be -1
}

int main(void)
{
    int cont = 1, value, b;
    stack s1;
    init(&s1);
    do
    {
        printf("\n1.PUSH\n2.POP\n3.CHECK IF EMPTY\n4.PEEK\n5.DISPLAY STACK:\n");
        int choice = input();
        switch (choice)
        {
        case 1:
        {
            printf("\nEnter element in stack: ");
            scanf("%d", &value);
            push(&s1, value);
            break;
        }

        case 2:
        {
            printf("\nPopping an item: ");
            pop(&s1, &b);
            break;
        }

        case 3:
        {
            printf("\nChecking if the stack is empty: ");
            int resp = isEmpty(&s1);
            if (resp != 1)
            {
                printf("NOT EMPTY\n");
            }
            break;
        }
        case 4:
        {
            printf("\nSelect peek option:n\n1.peekLowestElement\n2.peekHighestElement\n3. peekMiddleElement: ");
            int select = input();
            switch (select)
            {
            case 1:
            {
                peekLowestElement(&s1);
                break;
            }
            case 2:
```

```c
            {
                peekHighestElement(&s1);
                break;
            }
            default:
            {
                peekMiddleElement(&s1);
                break;
            }
            }
            break;
        }
        default:
        {
            printf("\nStack entered: top-> ");
            display(&s1);
            break;
        }
        }
        printf("\nDo you wish to continue?\n1.YES\n2.No: ");
        int r;
        scanf("%d", &r);
        if (r != 1)
        {
            cont++;
        }
    } while (cont == 1);

    printf("\nDo you wish to go again?\n1.YES\n2.No: ");
    int r;
    scanf("%d", &r);
    if (r != 1)
    {
        cont == 1;
    }
}

void push(stack *s, int val)
{
    if (s->top == MAX - 1)
    {
        printf("\nOVERFLOW. STACK IS ALREADY FULL.");
        return;
    }
    else
    {
        s->top++;
        s->data[s->top] = val;
        return;
    }
}

void pop(stack *s, int *temp)
{
    if (s->top == -1)
    {
        printf("\nUNDERFLOW");
        return;
    }
    else
    {
        *temp = s->data[s->top];
        printf("\nPopped item: %d\n", *temp);
        s->top--;
        return;
    }
}

int isEmpty(stack *s)
{
    if (s->top == -1)
    {
        printf("\nStack is empty");
        return 1;
    }
    else
    {
        return 0;
    }
}

void display(stack *s)
{
    if (s->top == -1)
    {
        printf("\nStack is empty");
        return;
    }
    else
    {
        int i;
        for (i = s->top; i >= 0; i--)
        {
            printf("\t%d\t", s->data[i]);
        }
    }
}
int input()
{
    int num;
    scanf("%d", &num);
    return num;
}
void peek(stack *s)
{
    if (s->top == -1)
    {
        printf("\nStack is empty");
        return;
    }
    else
    {
        printf("\ntop-> %d", s->data[s->top]);
    }
}

void peekLowestElement(stack *s)
{
    int min;
    if (s->top == -1)
    {
        printf("\nStack is empty");
        return;
    }

    else
    {
        min = s->data[s->top];
        int i;
        for (i = s->top; i >= 0; i--)
        {
            if (s->data[i] < min)
```



```c
            {
                min = s->data[i];
            }
        }

        printf("\nLowest element of stack: %d", min);
    }
}

void peekMiddleElement(stack *s)
{
    if (s->top == -1)
    {
        printf("\nStack is empty");
        return;
    }

    else
    {
        int size = s->top + 1, pos = ((size / 2)), value, i;
        for (i = s->top; i >= 0; i--)
        {
            if (i == pos)
            {
                value = s->data[i];
            }
        }
        printf("\nRequired middle element: %d", value);
    }
}

void peekHighestElement(stack *s)
{
    int max;
    if (s->top == -1)
    {
        printf("\nStack is empty");
        return;
    }

    else
    {
        max = 0;
        int i;
        for (i = s->top; i >= 0; i--)
        {
            if (s->data[i] > max)
            {
                max = s->data[i];
            }
        }

        printf("\nHighest element of stack: %d", max);
    }
}
```

OUTPUT:-



```
1.PUSH
2.POP
3.CHECK IF EMPTY
4.PEEK
5.DISPLAY STACK:
1

Enter element in stack: 23

Do you wish to continue?
1.YES
2.No: 1

1.PUSH
2.POP
3.CHECK IF EMPTY
4.PEEK
5.DISPLAY STACK:
4

Select peek option:n
1.peekLowestElement
2. peekHighestElement
3. peekMiddleElement: 1

Lowest element of stack: 23
Do you wish to continue?
```

Q2. Write a menu driven program to implement queue operations such as Enqueue, Dequeue, Peek, Display of elements, IsEmpty, IsFull using static array.

```c
#include <conio.h>
#include <stdio.h>
#define MAX_SIZE 5

int deque_arr[MAX_SIZE];
int Left = -1;
int Right = -1;

void InsertRight()
```

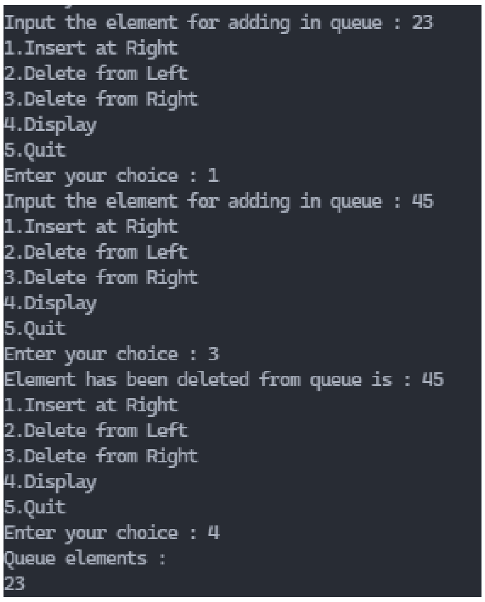
```
{
    int added_item;
    if ((Left == 0 && Right == MAX_SIZE - 1) || (Left == Right + 1))
    {
        printf("Queue Overflow\n");
        return;
    }
    if (Left == -1)
    {
        Left = 0;
        Right = 0;
    }
    else if (Right == MAX_SIZE - 1)
        Right = 0;
    else
        Right = Right + 1;
    printf("Input the element for adding in queue : ");
    scanf("%d", &added_item);
    deque_arr[Right] = added_item;
}

void InsertLeft()
{
    int added_item;
    if ((Left == 0 && Right == MAX_SIZE - 1) || (Left == Right + 1))
    {
        printf("Queue Overflow \n");
        return;
    }
    if (Left == -1)
    {
        Left = 0;
        Right = 0;
    }
    else if (Left == 0)
        Left = MAX_SIZE - 1;
    else
        Left = Left - 1;
    printf("Input the element for adding in queue : ");
    scanf("%d", &added_item);
    deque_arr[Left] = added_item;
}

void DeleteLeft()
```

```
{
    if (Left == -1)
    {
        printf("Queue Under-flow\n");
        return;
    }
    printf("Element has been deleted from queue is : %d\n",
deque_arr[Left]);
    if (Left == Right)
    {
        Left = -1;
        Right = -1;
    }
    else if (Left == MAX_SIZE - 1)
        Left = 0;
    else
        Left = Left + 1;
}

void DeleteRight()
{
    if (Left == -1)
    {
        printf("Queue Under flow\n");
        return;
    }
    printf("Element has been deleted from queue is : %d\n",
deque_arr[Right]);
    if (Left == Right)
    {
        Left = -1;
        Right = -1;
    }
    else if (Right == 0)
        Right = MAX_SIZE - 1;
    else
        Right = Right - 1;
}

void Display()
{
    int fpos = Left, rpos = Right;
    if (Left == -1)
    {
```

```c
        printf("Queue is empty\n");
        return;
    }
    printf("Queue elements :\n");
    if (fpos <= rpos)
    {
        while (fpos <= rpos)
        {
            printf("%d ", deque_arr[fpos]);
            fpos++;
        }
    }
    else
    {
        while (fpos <= MAX_SIZE - 1)
        {
            printf("%d ", deque_arr[fpos]);
            fpos++;
        }
        fpos = 0;
        while (fpos <= rpos)
        {
            printf("%d ", deque_arr[fpos]);
            fpos++;
        }
    }
    printf("\n");
}

void Input()
{
    int Option = 0;
    do // while(Option<0 || Option>5)
    {
        printf("1.Insert at Right\n");
        printf("2.Delete from Left\n");
        printf("3.Delete from Right\n");
        printf("4.Display\n");
        printf("5.Quit\n");
        printf("Enter your choice : ");
        scanf("%d", &Option);

        switch (Option)
        {
```

```c
        case 1:
            InsertRight();
            break;
        case 2:
            DeleteLeft();
            break;
        case 3:
            DeleteRight();
            break;
        case 4:
            Display();
            break;
        case 5:
            break;
        default:
            printf("Wrong Option\n");
        }
    } while (Option != 5);
}
void Output()
{
    int Option = 0;
    do // while(Option<=0 || Option>5)
    {
        printf("1.Insert at Right\n");
        printf("2.Insert at Left\n");
        printf("3.Delete from Left\n");
        printf("4.Display\n");
        printf("5.Quit\n");
        printf("Enter your choice : ");
        scanf("%d", &Option);
        switch (Option)
        {
        case 1:
            InsertRight();
            break;
        case 2:
            InsertLeft();
            break;
        case 3:
            DeleteLeft();
            break;
        case 4:
            Display();
            break;
        case 5:
            break;
        default:
            printf("Wrong Option\n");
        }
    } while (Option != 5);
}
main()
{
    int Option = 0;
    printf("1.Input restricted dequeue\n");
    printf("2.Output restricted dequeue\n");
    printf("Enter your choice : ");
    scanf("%d", &Option);
    switch (Option)
    {
    case 1:
        Input();
        break;
    case 2:
        Output();
        break;
    default:
        printf("Wrong Option\n");
    }
}
```

OUTPUT:-



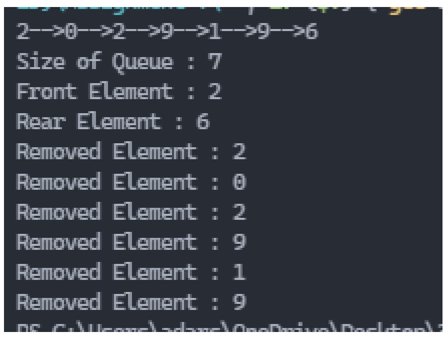
```
Input the element for adding in queue : 23
1.Insert at Right
2.Delete from Left
3.Delete from Right
4.Display
5.Quit
Enter your choice : 1
Input the element for adding in queue : 45
1.Insert at Right
2.Delete from Left
3.Delete from Right
4.Display
5.Quit
Enter your choice : 3
Element has been deleted from queue is : 45
1.Insert at Right
2.Delete from Left
3.Delete from Right
4.Display
5.Quit
Enter your choice : 4
Queue elements :
23
```

Q3 Write a menu driven program to implement queue operations such as Enqueue, Dequeue, Peek, Display of elements, IsEmpty using linked list.

```c
#include <stdio.h>
#include <stdlib.h>
struct node
{
    int data;
    struct node *next;
} * front, *back;

void initialize()
{
    front = back = NULL;
}
int getQueueSize()
{
    struct node *temp = front;
    int count = 0;

    if (front == NULL && back == NULL)
        return 0;

    while (temp != back)
    {
        count++;
        temp = temp->next;
    }
    if (temp == back)
        count++;

    return count;
}
int getFrontElement()
{
    return front->data;
}
int getBackElement()
{
    return back->data;
}
void isEmpty()
{
    if (front == NULL && back == NULL)
        printf("Empty Queue\n");
    else
```

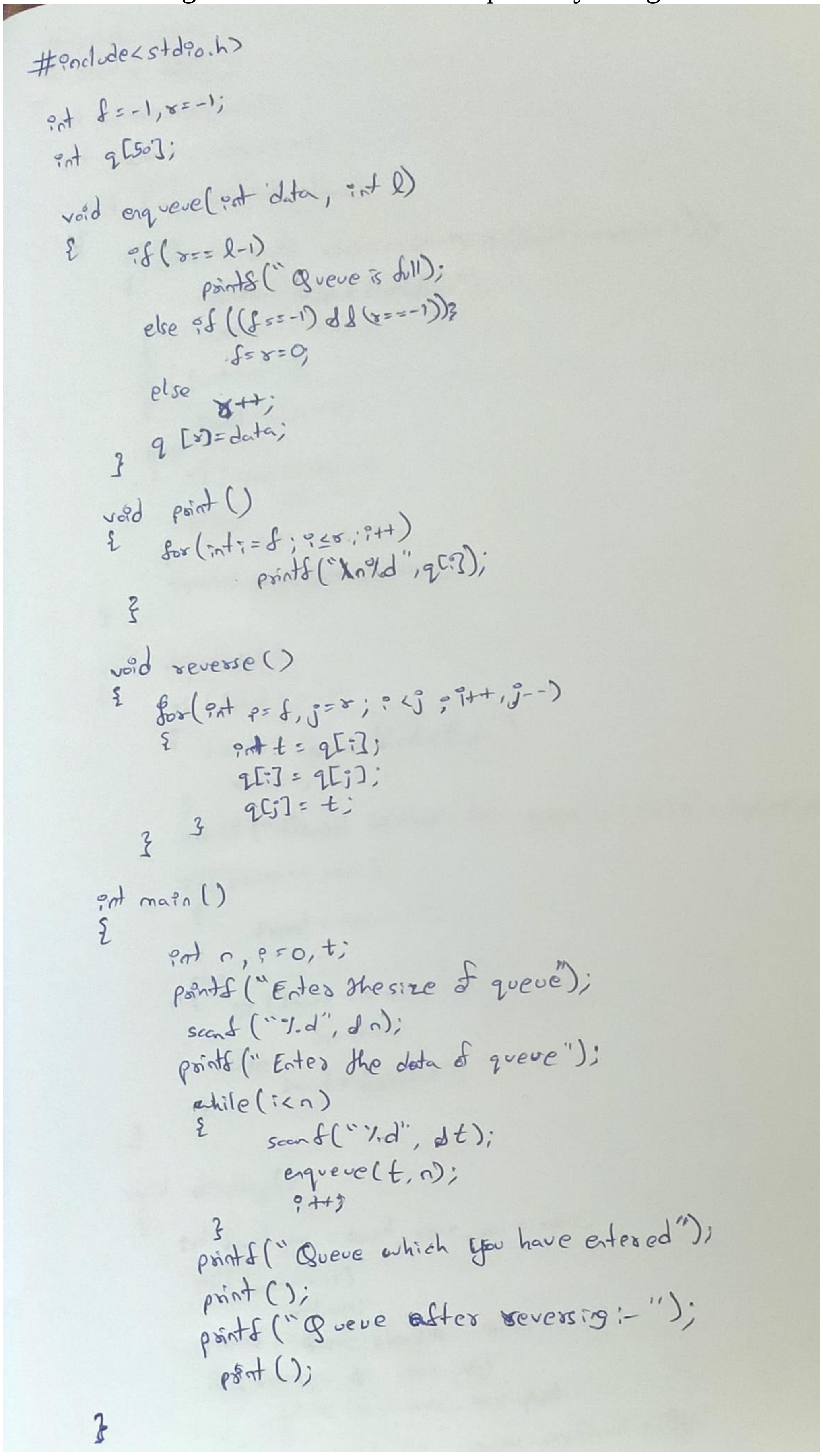
```c
        printf("Queue is not Empty\n");
}
void enqueue(int num)
{
    struct node *temp;
    temp = (struct node *)malloc(sizeof(struct node));
    temp->data = num;
    temp->next = NULL;

    if (back == NULL)
    {
        front = back = temp;
    }
    else
    {
        back->next = temp;
        back = temp;
    }
}

void dequeue()
{
    struct node *temp;
    if (front == NULL)
    {
        printf("\nQueue is Empty \n");
        return;
    }
    else
    {
        temp = front;
        front = front->next;
        if (front == NULL)
        {
            back = NULL;
        }
        printf("Removed Element : %d\n", temp->data);
        free(temp);
    }
}
void printQueue()
{
    struct node *temp = front;
    if ((front == NULL) && (back == NULL))
    {
        printf("Queue is Empty\n");
        return;
    }
    while (temp != NULL)
    {
        printf("%d", temp->data);
        temp = temp->next;
        if (temp != NULL)
            printf("-->");
    }
}
int main()
{
    initialize();
    enqueue(2);
    enqueue(0);
    enqueue(2);
    enqueue(9);
    enqueue(1);
    enqueue(9);
    enqueue(6);
    printQueue();
    printf("\nSize of Queue : %d\n", getQueueSize());
    printf("Front Element : %d\n", getFrontElement());
    printf("Rear Element : %d\n", getBackElement());
    dequeue();
    dequeue();
    dequeue();
    dequeue();
    dequeue();
    dequeue();

    return 0;
}
```

OUTPUT:-



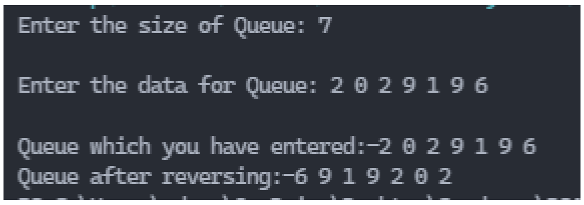
```
2-->0-->2-->9-->1-->9-->6
Size of Queue : 7
Front Element : 2
Rear Element : 6
Removed Element : 2
Removed Element : 0
Removed Element : 2
Removed Element : 9
Removed Element : 1
Removed Element : 9
```

Q4. WAP using a function to reverse a queue by using stack..



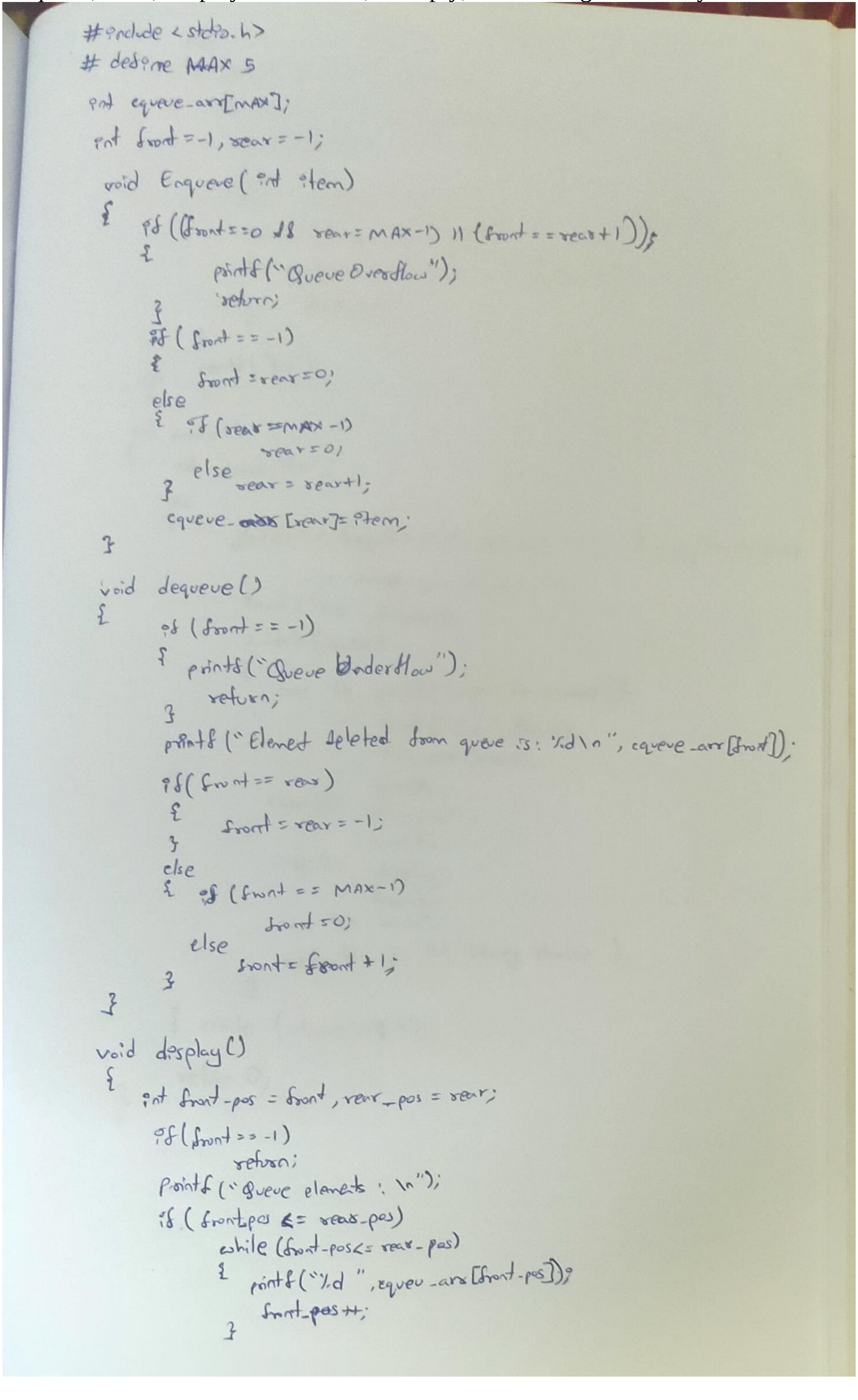
```
#include<stdio.h>
 int f=-1,r=-1;
 int q[50];
 void enqueue(int data, int l)
 {    if(r== l-1)
          printf("Queue is full");
      else if((f==-1)&&(r==-1)){
          f=r=0;
      else
          r++;
      q [r]=data;
   }
   void print ()
   {   for(int i=f; i<=r; i++)
            printf("\n%d",q[i]);
   }
   void reverse()
   {  for(int i=f, j=r; i<j ;i++,j--)
      {     int t = q[i];
            q[i] = q[j];
            q[j] = t;
      }
   }
  int main()
  {
       int n, i=0, t;
       printf("Enter the size of queue");
        scanf("%d", &n);
       printf(" Enter the data of queue");
       while(i<n)
       {     scanf("%d", &t);
              enqueue(t,n);
              i++}
       }
       printf("Queue which you have entered");
       print ();
       printf("Queue after reversing:-");
        print ();
  }
```

OUTPUT:-



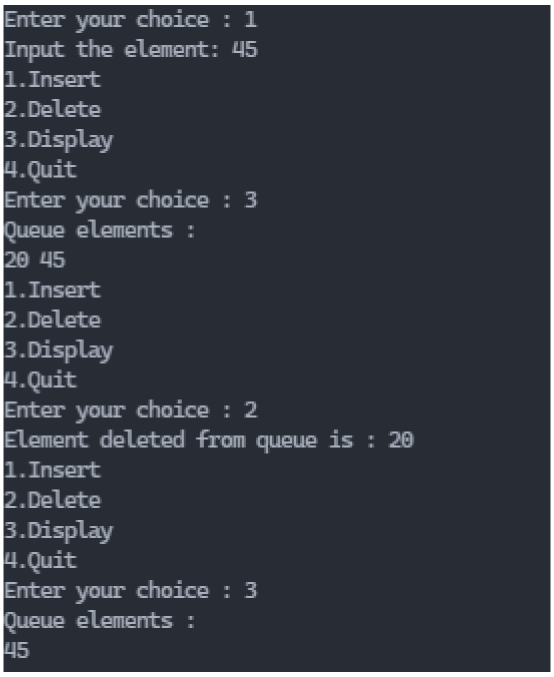
```
Enter the size of Queue: 7

Enter the data for Queue: 2 0 2 9 1 9 6

Queue which you have entered:-2 0 2 9 1 9 6
Queue after reversing:-6 9 1 9 2 0 2
```

Q5. Write a menu driven program to implement circular queue operations such as Enqueue, Dequeue, Peek, Display of elements, IsEmpty, IsFull using static array.



```
#include <stdio.h>
# define MAX 5
int cqueue_arr[MAX];
int front=-1, rear=-1;
 void Enqueue( int item)
 {
      if ((front==0 && rear=MAX-1) || (front==rear+1));
      {
            printf("Queue Overflow");
            return;
      }
      if ( front == -1)
      {
           front =rear=0;
      else
      {  if (rear ==MAX -1)
                  rear=0;
           else
                  rear = rear+1;
      }
      cqueue_~~arr~~ [rear]= item;
 }

 void dequeue ()
 {
         if (front == -1)
         {
            printf("Queue Underflow");
              return;
         }
         printf ("Element deleted from queue is: %d\n", cqueue_arr[front]);
         if( front == rear)
          {
               front = rear = -1;
          }
         else
         {  if (front == MAX-1)
                    front =0;
            else
                    front= front +1;
         }
 }

void display()
 {
      int front_pos = front, rear_pos = rear;
      if(front == -1)
             return;
      printf ("Queue elements : \n");
      if ( front_pos <= rear_pos)
            while (front_pos<= rear_pos)
            {  printf("%d ",cqueu_arr[front_pos]);
                front_pos ++;
            }
else
{   while (front_pos <= MAX-1)
    {   printf("%d ",cqueue_arr[front_pos]);
        front_pos++;
    }
    front_pos =0;
    while (front_pos ≤ rear_pos)
    {   printf("%d ", cqueue_arr[front_pos]);
        front_pos++;
    }
  }
  printf("\n");
}

int main()
{   int choice,item;
    do
    {
        printf("1. Enqueue\n 2. Dequeue \n 3. Display \n 4. Exit
                \n Enter your choice: ");
       scanf("%d", &choice);
       switch (choice)
       {
          case 1: printf("Input the element:");
                  scanf("%d", &item);
                  enqueue(item);
                  break;
          case 2: dequeue();
                  break;
          case 3: display;
                  break;
          case 4: break;
          default: printf("Wrong choice");
       }
    } while (choice!=4);
    return 0;
}
```

OUTPUT:-



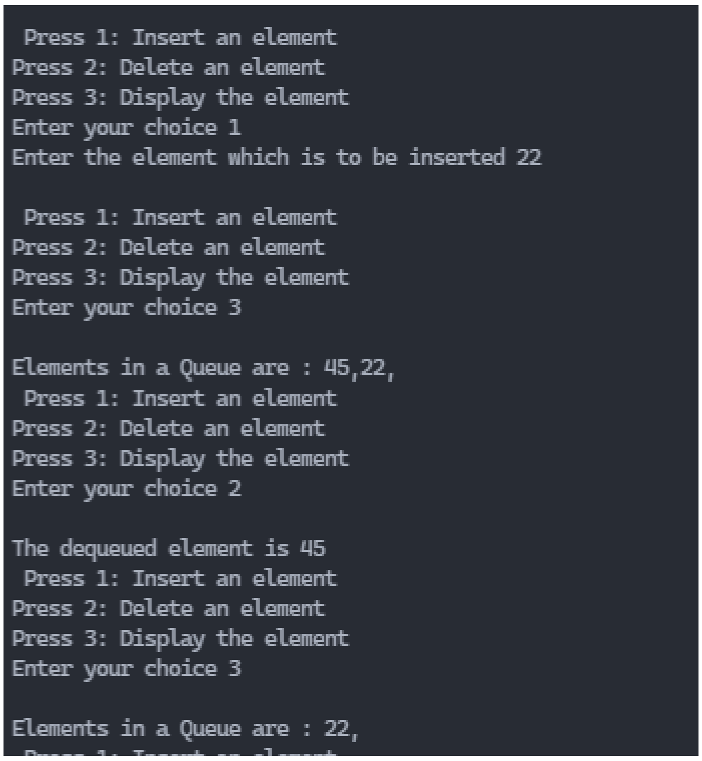
```
Enter your choice : 1
Input the element: 45
1.Insert
2.Delete
3.Display
4.Quit
Enter your choice : 3
Queue elements :
20 45
1.Insert
2.Delete
3.Display
4.Quit
Enter your choice : 2
Element deleted from queue is : 20
1.Insert
2.Delete
3.Display
4.Quit
Enter your choice : 3
Queue elements :
45
```

Q6. Write a menu driven program to implement circular queue operations such as Enqueue, Dequeue, Peek, Display of elements, IsEmpty using linked list.

```c
#include <stdio.h>

#define max 6
int queue[max];
int front = -1;
int rear = -1;

void enqueue(int element)
{
    if (front == -1 && rear == -1)
    {
        front = 0;
        rear = 0;
        queue[rear] = element;
    }
    else if ((rear + 1) % max == front)
    {
        printf("Queue is overflow..");
    }
    else
    {
        rear = (rear + 1) % max;
        queue[rear] = element;
    }
}
```

```c
int dequeue()
{
    if ((front == -1) && (rear == -1))
    {
        printf("\nQueue is underflow..");
    }
    else if (front == rear)
    {
        printf("\nThe dequeued element is %d", queue[front]);
        front = -1;
        rear = -1;
    }
    else
    {
        printf("\nThe dequeued element is %d", queue[front]);
        front = (front + 1) % max;
    }
}

void display()
{
    int i = front;
    if (front == -1 && rear == -1)
    {
        printf("\n Queue is empty..");
    }
    else
    {
        printf("\nElements in a Queue are : ");
        while (i <= rear)
        {
            printf("%d,", queue[i]);
            i = (i + 1) % max;
        }
    }
}
int main()
{
    int choice = 1, x;

    while (choice < 4 && choice != 0)
    {
        printf("\n Press 1: Insert an element ");
        printf("\nPress 2: Delete an element ");
        printf("\nPress 3: Display the element ");
        printf("\nEnter your choice ");
        scanf("%d", &choice);

        switch (choice)
        {

        case 1:

            printf("Enter the element which is to be inserted ");
            scanf("%d", &x);
            enqueue(x);
            break;
        case 2:
            dequeue();
            break;
        case 3:
            display();
        }
    }
    return 0;
}
```

OUTPUT:-



```
 Press 1: Insert an element
Press 2: Delete an element
Press 3: Display the element
Enter your choice 1
Enter the element which is to be inserted 22

 Press 1: Insert an element
Press 2: Delete an element
Press 3: Display the element
Enter your choice 3

Elements in a Queue are : 45,22,
 Press 1: Insert an element
Press 2: Delete an element
Press 3: Display the element
Enter your choice 2

The dequeued element is 45
 Press 1: Insert an element
Press 2: Delete an element
Press 3: Display the element
Enter your choice 3

Elements in a Queue are : 22,
```