DSA LAB

Week 5 Lab Submission

Swamiraju Satya Praveen Varma

200905044

Batch B1

10

1) **Implement a circular queue of integers. Include functions insertcq, deletecq and displaycq.**

Source Code:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#define max_size 10
typedef struct
{
   int **arr;
   int front, rear;
} QUE;

void initialize(QUE *cq)
{
   int i;
   cq->front = -1;
   cq->rear = -1;
```

```
    cq->arr = malloc(sizeof(int *) * max_size);
    for (i = 0; i < max_size; i++)
    {
        cq->arr[i] = malloc(sizeof(int));
    }
}

void insertcq(QUE *cq, int *num)
{
    if (cq->front == cq->rear && cq->rear == -1)
    {
        cq->rear = cq->front = 0;
        cq->arr[cq->rear] = num;
        return;
    }
    if (cq->front == ((cq->rear) + 1) % max_size)
    {
        printf("Queue is full\n");
        return;
    }
    cq->rear = ((cq->rear) + 1) % max_size;
    cq->arr[cq->rear] = num;
}

void deletecq(QUE *cq)
{
```

```
    int *ele;
    if (cq->front == cq->rear)
    {
        printf("Queue underflow\n");
        return;
    }

    else
    {
        ele = cq->arr[cq->front];
        printf("Deleted integer: %d\n", *ele);
        cq->front = ((cq->front) + 1) % max_size;
    }
}
void display(QUE *cq)
{
    int i;
    if (cq->rear == cq->front)
    {
        printf("Queue is empty\n");
        return;
    }
    else
    {
        for (i = cq->front; i != cq->rear; i = (i + 1) % max_size)
        {
```

```
            printf("%d ", cq->arr[i]);
        }
        printf("%d\n", cq->arr[i]);
    }
}
int main()
{
    QUE cq;
    initialize(&cq);
    int n;
    int *x;
    do
    {
        printf("\n1.Insert\n2.Delete\n3.Display\n4.Exit\n");
        printf("Enter your choice\n");
        scanf("%d", &n);
        switch (n)
        {
        case 1:
            printf("Enter an integer\n");
            scanf("%d", x);
            insertcq(&cq, x);
            break;
        case 2:
            deletecq(&cq);
            break;
```

```
        case 3:
            display(&cq);
            break;
        case 4:
            exit(5);
        }
    } while (n != 4);
    return 0;
}
```

SAMPLE INPUT/OUTPUT:

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\praveenvarma\OneDrive\Documents\Desktop\DSAL> gcc -o q1 q1.c
PS C:\Users\praveenvarma\OneDrive\Documents\Desktop\DSAL> ./q1

1.Insert
2.Delete
3.Display
4.Exit
Enter your choice
1
Enter an integer
14

1.Insert
2.Delete
3.Display
4.Exit
Enter your choice
1
Enter an integer
54

1.Insert
2.Delete
3.Display
4.Exit
```

```
Windows PowerShell
4.Exit
Enter your choice
1
Enter an integer
14

1.Insert
2.Delete
3.Display
4.Exit
Enter your choice
1
Enter an integer
54

1.Insert
2.Delete
3.Display
4.Exit
Enter your choice
2
Deleted integer: 54

1.Insert
2.Delete
3.Display
4.Exit
Enter your choice
4
PS C:\Users\praveenvarma\OneDrive\Documents\Desktop\DSAL>
```

2) **Implement two circular queues of integers in a single array where first queue will run from 0 to N/2 and second queue will run from N/2+1 to N-1 where N is the size of the array.**

Source Code:

```
#include <stdio.h>
#include <stdlib.h>
#define MAX_QUEUE_SIZE1 3
#define MAX_QUEUE_SIZE2 3
#define MAX_QUEUE_SIZE 6
typedef struct
{
   int front1, rear1, front2, rear2;
   int array[MAX_QUEUE_SIZE1 + MAX_QUEUE_SIZE2];
} Queue;
void display1(Queue q)
{
   if (q.front1 == q.rear1)
   {
      printf("\nThe queue is empty, nothing to print");
   }
   else
```

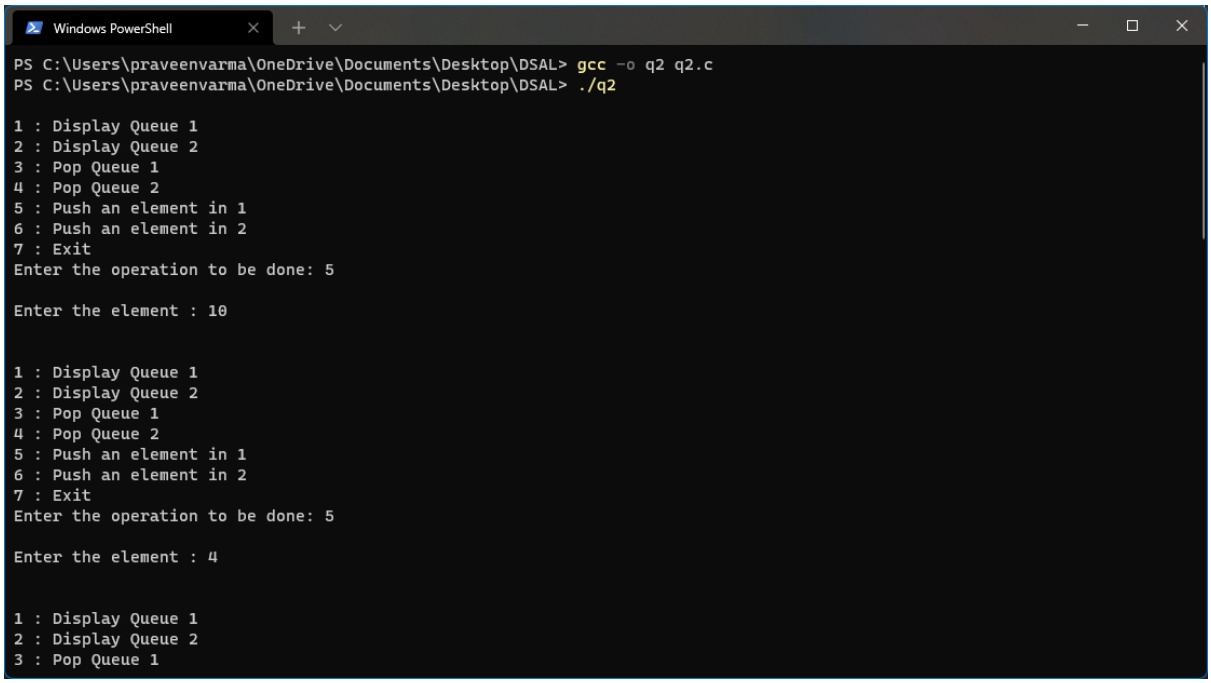
```
    {
        printf("\n");
        for (int i = (q.front1 + 1) % MAX_QUEUE_SIZE1; i != (q.rear1 + 1) %
                                                MAX_QUEUE_SIZE1;
            i = (i + 1) % MAX_QUEUE_SIZE1)
        {
            printf("%d\t", q.array[i]);
        }
    }
}
void display2(Queue q)
{
    if (q.front2 == q.rear2)
    {
        printf("\nThe queue is empty, nothing to print");
    }
    else
    {
        printf("\n");
        for (int i = (q.front2 + 1) % MAX_QUEUE_SIZE; i != (q.rear2 + 1) %
MAX_QUEUE_SIZE;
            i = (i + 1) % MAX_QUEUE_SIZE)
        {
            printf("%d\t", q.array[i]);
        }
    }
}
void push1(Queue *q, int key)
{
    if ((q->rear1 + 1) % MAX_QUEUE_SIZE1 == q->front1)
    {
        printf("\nThe queue is full, cannot push");
    }
    else
    {
        q->rear1 = (q->rear1 + 1) % MAX_QUEUE_SIZE1;
        q->array[q->rear1] = key;
```

```
    }
}
void push2(Queue *q, int key)
{
    if (((q->rear2 + 1) % MAX_QUEUE_SIZE) + MAX_QUEUE_SIZE2 == q-
>front2)
    {
        printf("\nThe queue is full, cannot push");
    }
    else
    {
        q->rear2 = (q->rear2 + 1) % MAX_QUEUE_SIZE;
        q->array[q->rear2] = key;
    }
}
int pop1(Queue *q)
{
    int temp = q->array[(q->front1 + 1) % MAX_QUEUE_SIZE1];
    q->front1 = (q->front1 + 1) % MAX_QUEUE_SIZE1;
    return temp;
}
int pop2(Queue *q)
{
    int temp = q->array[(q->front2 + 1) % MAX_QUEUE_SIZE];
    q->front2 = (q->front2 + 1) % MAX_QUEUE_SIZE;
    return temp;
}
int main()
{
    Queue q;
    q.front1 = 0;
    q.rear1 = 0;
    q.front2 = MAX_QUEUE_SIZE2;
    q.rear2 = MAX_QUEUE_SIZE2;
    int ch = 0, ele;
    while (ch < 7)
    {
```

```
    printf("\n1 : Display Queue 1 \n2 : Display Queue 2 \n3 : Pop Queue
1 \n4 : Pop Queue 2 \n5 : Push an element in 1\n6 : Push an element in
2\n7 : Exit");
    printf("\nEnter the operation to be done: ");
    scanf("%d", &ch);
    switch (ch)
    {
    case 1:
      display1(q);
      break;
    case 2:
      display2(q);
      break;
    case 3:
      if (q.front1 == q.rear1)
      {
        printf("\nThis queue is empty");
      }
      else
      {
        ele = pop1(&q);
        printf("\nThe popped element is %d", ele);
      }
      break;
    case 4:
      if (q.front2 == q.rear2)
      {
        printf("\nThis queue is empty");
      }
      else
      {
        ele = pop2(&q);
        printf("\nThe popped element is %d", ele);
      }
      break;
    case 5:
      printf("\nEnter the element : ");
```

```
            scanf("%d", &ele);
            push1(&q, ele);
            break;
        case 6:
            printf("\nEnter the element : ");
            scanf("%d", &ele);
            push2(&q, ele);
            break;
        }
        printf("\n");
    }
    return 0;
}
```

SAMPLE INPUT/OUTPUT:



```
Enter the element : 4


1 : Display Queue 1
2 : Display Queue 2
3 : Pop Queue 1
4 : Pop Queue 2
5 : Push an element in 1
6 : Push an element in 2
7 : Exit
Enter the operation to be done: 1

10      4

1 : Display Queue 1
2 : Display Queue 2
3 : Pop Queue 1
4 : Pop Queue 2
5 : Push an element in 1
6 : Push an element in 2
7 : Exit
Enter the operation to be done: 5

Enter the element : 20

The queue is full, cannot push

1 : Display Queue 1
2 : Display Queue 2
```

```
Enter the element : 20

The queue is full, cannot push

1 : Display Queue 1
2 : Display Queue 2
3 : Pop Queue 1
4 : Pop Queue 2
5 : Push an element in 1
6 : Push an element in 2
7 : Exit
Enter the operation to be done: 4

This queue is empty

1 : Display Queue 1
2 : Display Queue 2
3 : Pop Queue 1
4 : Pop Queue 2
5 : Push an element in 1
6 : Push an element in 2
7 : Exit
Enter the operation to be done: 3

The popped element is 10

1 : Display Queue 1
2 : Display Queue 2
3 : Pop Queue 1
```

```
Windows PowerShell
4 : Pop Queue 2
5 : Push an element in 1
6 : Push an element in 2
7 : Exit
Enter the operation to be done: 6

Enter the element : 24


1 : Display Queue 1
2 : Display Queue 2
3 : Pop Queue 1
4 : Pop Queue 2
5 : Push an element in 1
6 : Push an element in 2
7 : Exit
Enter the operation to be done: 2

42      24

1 : Display Queue 1
2 : Display Queue 2
3 : Pop Queue 1
4 : Pop Queue 2
5 : Push an element in 1
6 : Push an element in 2
7 : Exit
Enter the operation to be done: 7

PS C:\Users\praveenvarma\OneDrive\Documents\Desktop\DSAL>
```

3) **Implement a queue with two stacks without transferring the elements of the second stack back to stack one. (use stack1 as an input stack and stack2 as an output stack).**

Source Code:

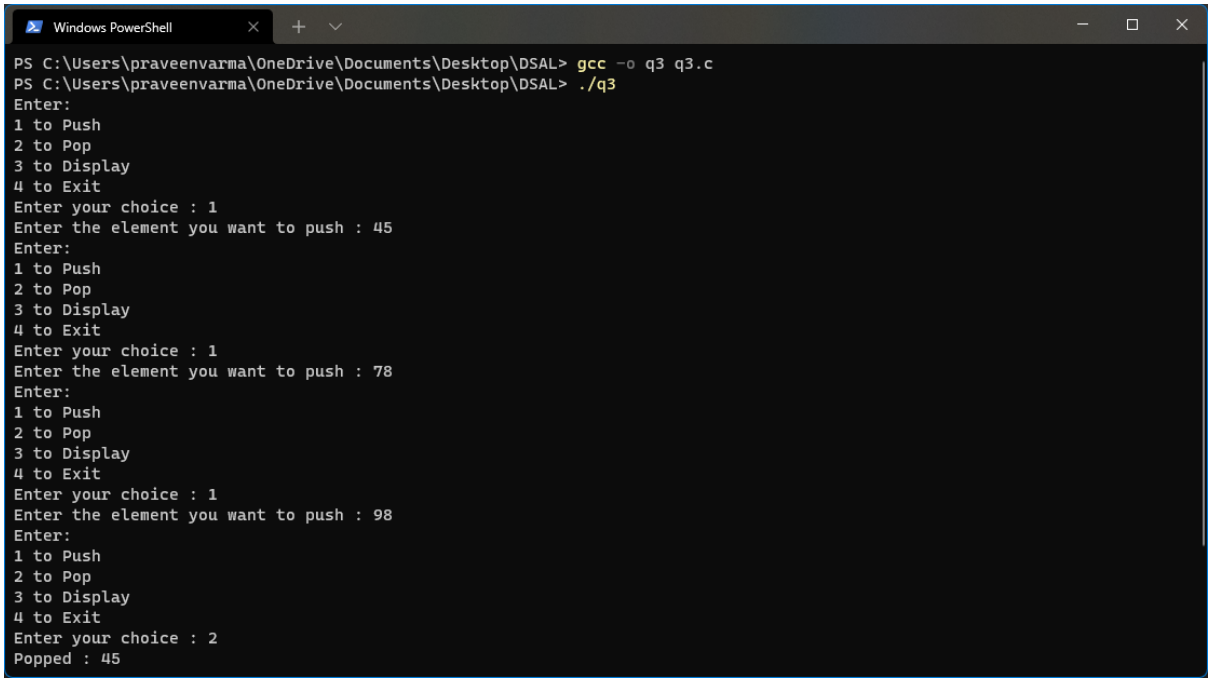
```
#include <stdio.h>

#include <stdlib.h>

#define MAX 5

typedef struct Stack

{

   int arr[MAX];

   int top;

} Stack;

int isEmpty(Stack *s)

{

   if (s->top == -1)

      return 1;

   return 0;
```

```
}
void push(Stack *s, int ch)
{
   if ((s->top + 1) < MAX)
      s->arr[++(s->top)] = ch;
   else
      printf("Overflow!\n");
}
int pop(Stack *s)
{
   if (isEmpty(s))
      return -1;
   return s->arr[(s->top)--];
}
int main()
{
   Stack s1, s2;
   s1.top = s2.top = -1;
   int ch, n;
   int i = 0;
   while (1)
   {
      printf("Enter:\n1 to Push\n2 to Pop\n3 to Display\n4 to Exit\nEnter your
choice : ");
      scanf("%d", &ch);
      switch (ch)
      {
```

```
case 1:
    printf("Enter the element you want to push : ");
    scanf("%d", &n);
    push(&s1, n);
    break;
case 2:
    if (isEmpty(&s2))
    {
        while (!isEmpty(&s1))
        {
            push(&s2, pop(&s1));
        }
        n = pop(&s2);
        if (n != -1)
            printf("Popped : %d\n", n);
        else
            printf("Underflow\n");
    }
    else
    {
        n = pop(&s2);
        if (n != -1)
            printf("Popped : %d\n", n);
        else
            printf("Underflow\n");
    }
```

```
        break;
    case 3:
        for (int i = 0; i < MAX; i++)
        {
            printf(" %d", s2.arr[i]);
        }
        printf("\n");
        break;
    case 4:
        exit(0);
    }
  }
  return 0;
}
```

SAMPLE INPUT/OUTPUT:



```
Windows PowerShell
Enter your choice : 1
Enter the element you want to push : 45
Enter:
1 to Push
2 to Pop
3 to Display
4 to Exit
Enter your choice : 1
Enter the element you want to push : 78
Enter:
1 to Push
2 to Pop
3 to Display
4 to Exit
Enter your choice : 1
Enter the element you want to push : 98
Enter:
1 to Push
2 to Pop
3 to Display
4 to Exit
Enter your choice : 2
Popped : 45
Enter:
1 to Push
2 to Pop
3 to Display
4 to Exit
Enter your choice : 4
PS C:\Users\praveenvarma\OneDrive\Documents\Desktop\DSAL>
```

THANK YOU!