Programming Lab

Assignment 3

Question :-

1. Write a program to implement a stack data structure using an array. 2. Implement a system which can handle more than one stack (n stacks) using arrays.

3. Write a Boolean function to return true if two stacks are equal.

4. Write a program for dynamic implementation (using link list) of stacks (n stacks).

5. Write a program to implement queue data structure using an array.

6. Implement a system which can handle more than one queue (n queues) using arrays.

7. A Boolean function to return true if two queues are equal.

8. Write a program for dynamic implementation (using link list) of a queues (n queues).

9. Implement a priority queue using linked list (any type)

Program 1:-

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

void push(int *arr,int *top,int val,int n){
    if(*top + 1 == n){
        printf("stack is full\n");
    }
    else{
        *top = *top + 1;
        arr[*top] = val;
        printf("Element inserted\n");
    }
}

int pop(int *arr,int *top,int n){
    if(*top == -1){
        printf("stack is empty");
        return -1;
    }
    else{
        int x = arr[*top];
        *top = *top - 1;
        return x;
    }
}

void display(int arr[],int top){
    int i;
    for(i=0;i<=top;i++){
        printf("%d ",arr[i]);
    }
    printf("\n");
}

int main(){
    int n,top=-1;
    printf("Enter the maximum number of element you want in the stack\n");
    scanf("%d",&n);
    int arr[n],op,x;
    printf("1 for inserting an element\n2 for deleting an element\n3 for displ
aying the elements\n");
    while(1){
        printf("Enter your operation\n");
        scanf("%d",&op);
        switch (op)
        {
        case 1:
            printf("Enter the element to be inserted\n");
            scanf("%d",&x);
            push(arr,&top,x,n);
            break;
        case 2:
            x = pop(arr,&top,n);
            if(x >= 0){
                printf("%d has been deleted\n",x);
            }
            break;
        case 3:
            printf("Elements in the stack are\n");
            display(arr,top);
            break;
        default:
            exit(0);
        }
    }
}
```

Program 2 and 3 :-

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

void push(int *arr,int *top,int val,int size){
    if(*top + 1 == size){
        printf("stack is full\n");
    }
    else{
        *top = *top + 1;
        arr[*top] = val;
        printf("Element inserted\n");
    }
}

void pop(int *arr,int *top){
    if(*top == -1){
        printf("stack is empty");
    }
    else{
        *top = *top - 1;
        printf("Element deleted\n");
    }
}

void is_same(int arr1[],int top1,int arr2[],int top2){
    if(top1 != top2){
        printf("These two stack are not same\n");
    }else{
        int flag = 1;
        for(int i=0;i<=top1;i++){
            if(arr1[i]!=arr2[i]){
                flag = 0;
                break;
            }
        }
        if(flag == 1){
            printf("These two stack are same\n");
        }else{
            printf("These two stack are not same\n");
        }
    }
}

void display(int arr[],int top){
    int i;
    for(i=0;i<=top;i++){
        printf("%d ",arr[i]);
    }
    printf("\n");
}

int main(){
    int n,size;
    printf("Enter the number of stacks to be created\n");
    scanf("%d",&n);
    printf("Enter the size of each stacks\n");
    scanf("%d",&size);

    int arr[n][size],top[n],op,x,no,n1,n2;

    for(int i=0;i<n;i++){
        top[i] = -1;
    }

    printf("1 for inserting an element\n2 for deleting an element\n3 for displ
aying the elements\n4 for comparing wo stacks\n");
    while(1){
        printf("Enter your operation\n");
        scanf("%d",&op);
        switch (op)
        {
        case 1:
            printf("Enter the stack no...\n");
            scanf("%d",&no);
            printf("Enter the element to be inserted\n");
            scanf("%d",&x);
            push(arr[no-1],&top[no-1],x,size);
            break;
        case 2:
            printf("Enter the stack no...\n");
            scanf("%d",&no);
            pop(arr[no-1],&top[no-1]);
            break;
        case 3:
            printf("Enter the stack no...\n");
            scanf("%d",&no);
            printf("Elements in the stack %d are\n",no);
            display(arr[no-1],top[no-1]);
            break;
        case 4:
            printf("Enter the 1st stack no...\n");
            scanf("%d",&n1);
            printf("Enter the 2nd stack no...\n");
            scanf("%d",&n2);
            is_same(arr[n1-1],top[n1-1],arr[n2-1],top[n2-1]);
            break;
        default:
            exit(0);
        }
    }
}
```

Program 4 :-

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

struct node
{
    int data;
    int pos;
    struct node *next;
};

void push(struct node **head,int val,int size){
    struct node *newnode = (struct node *)malloc(sizeof(struct node));
    newnode->data = val;
    struct node *temp = *head;
    if(temp == NULL){
        newnode->pos = 0;
        temp = newnode;
        temp->next = NULL;
```

```c
        *head = temp;
    } else{
        while(temp->next != NULL){
            temp = temp->next;
        }
        if(temp->pos + 1 == size){
                printf("stack is full\n");
        }else{
            newnode->pos = temp->pos + 1;
            temp->next = newnode;
            temp= newnode;
            temp->next = NULL;
        }
    }
    printf("Element inserted\n");
}

void pop(struct node **head){
    struct node *temp = *head;
    if(temp == NULL){
        printf("stack is empty\n");
    }
    else{
        while(temp->next->next != NULL){
            temp = temp->next;
        }
        temp->next = NULL;
        printf("Element deleted\n");
    }
}

void display(struct node *list){
    struct node *temp = list;
    while(temp != NULL){
        printf("->%d",temp->data);
        temp = temp->next;
    }
    printf("\n");
}

int main(){
    int n,size;
    printf("Enter the number of stacks to be created\n");
    scanf("%d",&n);
    printf("Enter the size of each stack\n");
    scanf("%d",&size);
    struct node *stacks[n];
    for(int i=0;i<n;i++){
        stacks[i] = NULL;
    }

    int op,x,no;

    printf("1 for inserting an element\n2 for deleting an element\n3 for displ
aying the elements\n");
    while(1){
        printf("Enter your operation\n");
        scanf("%d",&op);
        switch (op)
        {
        case 1:
            printf("Enter the stack no...\n");
            scanf("%d",&no);
            printf("Enter the element to be inserted\n");
            scanf("%d",&x);
            push(&stacks[no-1],x,size);
            break;
        case 2:
            printf("Enter the stack no...\n");
            scanf("%d",&no);
            pop(&stacks[no-1]);
            break;
        case 3:
            printf("Enter the stack no...\n");
            scanf("%d",&no);
            printf("Elements in the stack %d are\n",no);
            display(stacks[no-1]);
            break;
        default:
            exit(0);
        }
    }
}
```

Program 5 :-

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

void push(int *arr,int *top,int val,int n){
    if(*top + 1 == n){
        printf("queue is full\n");
    }
    else{
```

```c
        *top = *top + 1;
        arr[*top] = val;
        printf("Element inserted\n");
    }
}

int pop(int *arr,int *top,int n){
    if(*top == -1){
        printf("queue is empty");
        return -1;
    }
    else{
        int x = arr[0];
        for(int i=1;i<=*top;i++){
            arr[i-1] = arr[i];
        }
        *top = *top - 1;
        return x;
    }
}

void display(int arr[],int top){
    int i;
    for(i=0;i<=top;i++){
        printf("%d ",arr[i]);
    }
    printf("\n");
}

int main(){
    int n,top=-1;
    printf("Enter the maximum number of element you want in the queue\n");
    scanf("%d",&n);
    int arr[n],op,x;
    printf("1 for inserting an element\n2 for deleting an element\n3 for displ
aying the elements\n");
    while(1){
        printf("Enter your operation\n");
        scanf("%d",&op);
        switch (op)
        {
        case 1:
            printf("Enter the element to be inserted\n");
            scanf("%d",&x);
            push(arr,&top,x,n);
            break;
        case 2:
            x = pop(arr,&top,n);
            if(x >= 0){
                printf("%d has been deleted\n",x);
            }
            break;
        case 3:
            printf("Elements in the queue are\n");
            display(arr,top);
            break;
        default:
            exit(0);
        }
    }
}
```

Program 6 and 7 :-

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

void push(int *arr,int *top,int val,int size){
    if(*top + 1 == size){
        printf("queue is full\n");
    }
    else{
        *top = *top + 1;
        arr[*top] = val;
        printf("Element inserted\n");
    }
}

void pop(int *arr,int *top){
    if(*top == -1){
        printf("queue is empty");
    }
    else{
        int x = arr[0];
        for(int i=1;i<=*top;i++){
            arr[i-1] = arr[i];
        }
        *top = *top - 1;
        printf("Element deleted\n");
    }
}

void is_same(int arr1[],int top1,int arr2[],int top2){
    if(top1 != top2){
        printf("These two stack are not same\n");
    }else{
        int flag = 1;
        for(int i=0;i<=top1;i++){
            if(arr1[i]!=arr2[i]){
                flag = 0;
                break;
            }
        }
        if(flag == 1){
            printf("These two stack are same\n");
        }else{
            printf("These two stack are not same\n");
        }
    }
}

void display(int arr[],int top){
    int i;
    for(i=0;i<=top;i++){
        printf("%d ",arr[i]);
    }
    printf("\n");
}

int main(){
    int n,size;
    printf("Enter the number of queues to be created\n");
    scanf("%d",&n);
    printf("Enter the size of each queues\n");
    scanf("%d",&size);

    int arr[n][size],top[n],op,x,no,n1,n2;

    for(int i=0;i<n;i++){
        top[i] = -1;
    }

    printf("1 for inserting an element\n2 for deleting an element\n3 for displ
aying the elements\n4 for comparing wo queues\n");
    while(1){
        printf("Enter your operation\n");
        scanf("%d",&op);
        switch (op)
        {
        case 1:
            printf("Enter the queue no...\n");
            scanf("%d",&no);
            printf("Enter the element to be inserted\n");
            scanf("%d",&x);
            push(arr[no-1],&top[no-1],x,size);
            break;
        case 2:
            printf("Enter the queue no...\n");
            scanf("%d",&no);
            pop(arr[no-1],&top[no-1]);
            break;
        case 3:
            printf("Enter the queue no...\n");
            scanf("%d",&no);
            printf("Elements in the queue %d are\n",no);
            display(arr[no-1],top[no-1]);
            break;
        case 4:
            printf("Enter the 1st queue no...\n");
            scanf("%d",&n1);
            printf("Enter the 2nd queue no...\n");
            scanf("%d",&n2);
            is_same(arr[n1-1],top[n1-1],arr[n2-1],top[n2-1]);
            break;
        default:
            exit(0);
        }
    }
}
```

Program 8 :-

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

struct node
{
    int data;
    int pos;
    struct node *next;
};

void push(struct node **head,int val,int size){
    struct node *newnode = (struct node *)malloc(sizeof(struct node));
    newnode->data = val;
    struct node *temp = *head;
    if(temp == NULL){
        newnode->pos = 0;
        temp = newnode;
        temp->next = NULL;
        *head = temp;
    } else{
```

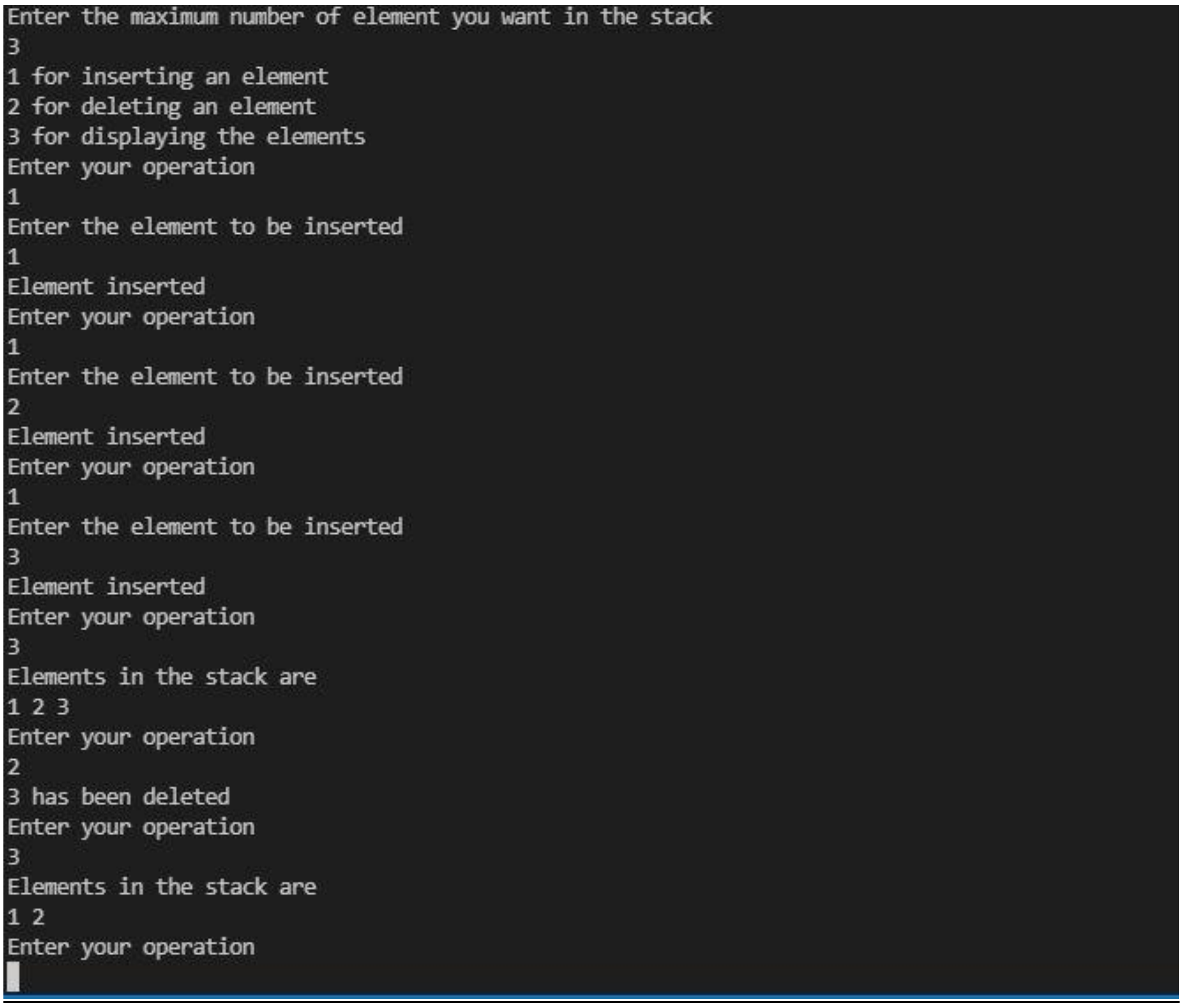
```c
        while(temp->next != NULL){
            temp = temp->next;
        }
        if(temp->pos + 1 == size){
                printf("Queue is full\n");
        }else{
            newnode->pos = temp->pos + 1;
            temp->next = newnode;
            temp= newnode;
            temp->next = NULL;
        }
    }
    printf("Element inserted\n");
}

void pop(struct node **head){
    struct node *temp = *head;
    if(temp == NULL){
        printf("Queue is empty\n");
    }
    else{
        temp = temp->next;
        *head = temp;
        while(temp != NULL){
            temp->pos = temp->pos - 1;
            temp = temp->next;
        }
        printf("Element deleted\n");
    }
}

void display(struct node *list){
    struct node *temp = list;
    while(temp != NULL){
        printf("->%d",temp->data);
        temp = temp->next;
    }
    printf("\n");
}

int main(){
    int n,size;
    printf("Enter the number of queues to be created\n");
    scanf("%d",&n);
    printf("Enter the size of each queue\n");
    scanf("%d",&size);
    struct node *queues[n];
    for(int i=0;i<n;i++){
        queues[i] = NULL;
    }

    int op,x,no;

    printf("1 for inserting an element\n2 for deleting an element\n3 for displ
aying the elements\n");
    while(1){
        printf("Enter your operation\n");
        scanf("%d",&op);
        switch (op)
        {
        case 1:
            printf("Enter the queue no...\n");
            scanf("%d",&no);
            printf("Enter the element to be inserted\n");
            scanf("%d",&x);
            push(&queues[no-1],x,size);
            break;
        case 2:
            printf("Enter the queue no...\n");
            scanf("%d",&no);
            pop(&queues[no-1]);
            break;
        case 3:
            printf("Enter the queue no...\n");
            scanf("%d",&no);
            printf("Elements in the queue %d are\n",no);
            display(queues[no-1]);
            break;
        default:
            exit(0);
        }
    }
}
```

Program 9 :-

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

struct node{
    int data;
    int priority;
    struct node *next;
};
```

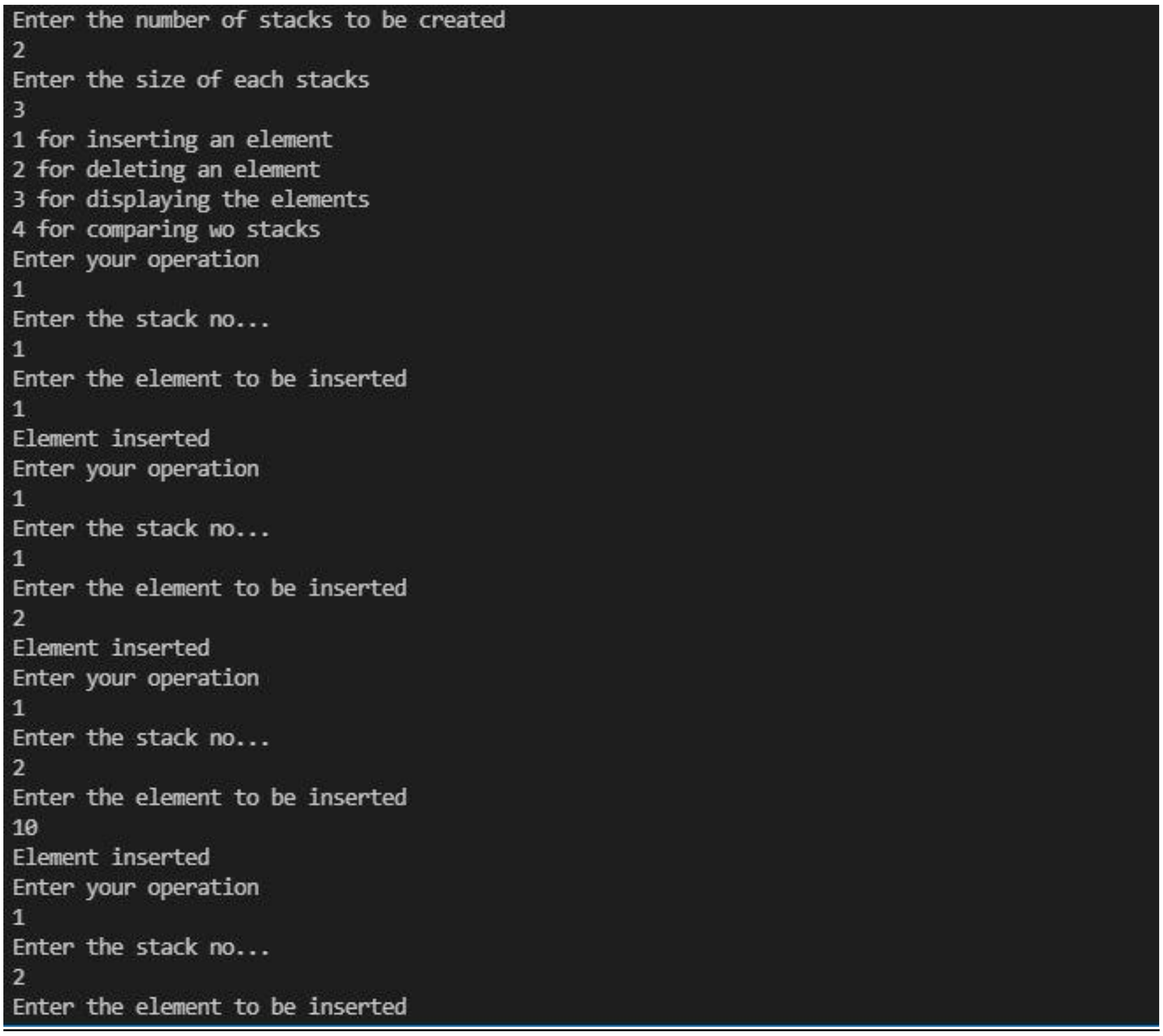
```c
struct node *head = NULL;
int size=0,max_size;

void push(int val,int priority){
    if(size == max_size){
        printf("Queue is full...\n");
    }else{
        struct node *newnode = (struct node *)malloc(sizeof(struct node));
        newnode->data = val;
        newnode->priority =priority;
        newnode->next = NULL;
        if(head == NULL){
            head = newnode;
        }else{
            if(head->priority < priority){
                newnode->next = head;
                head = newnode;
                size++;
            }else{
                struct node *temp = head;
                while(temp->next && temp->next->priority > priority){
                    temp = temp->next;
                }
                newnode->next = temp->next;
                temp->next = newnode;
                size++;
            }
        }
        printf("Element inserted...\n");
    }
}

void pop(){
    if(size == 0){
        printf("Queue is empty...\n");
    }else{
        struct node *temp = head;
        head = head->next;
        free(temp);
        size--;
        printf("Element deleted...\n");
    }
}

void display(){
    struct node *temp = head;
    while(temp != NULL){
        printf("->%d",temp->data);
        temp = temp->next;
    }
    printf("\n");
}

int main(){
    printf("Enter the max size of the priority queue\n");
    scanf("%d",&max_size);

    int op,val,priority;
    printf("1 for inserting an element\n2 for deleting an element\n3 for displ
aying the elements\n");
    while(1){
        printf("Enter your operation\n");
        scanf("%d",&op);
        switch (op)
        {
        case 1:
            printf("Enter the element to be inserted\n");
            scanf("%d",&val);
            printf("Enter the priority...\n");
            scanf("%d",&priority);
            push(val,priority);
            break;
        case 2:
            pop();
            break;
        case 3:
            printf("Elements in the queue are...\n");
            display();
            break;
        default:
            exit(0);
        }
    }
}
```

Output 1 :-

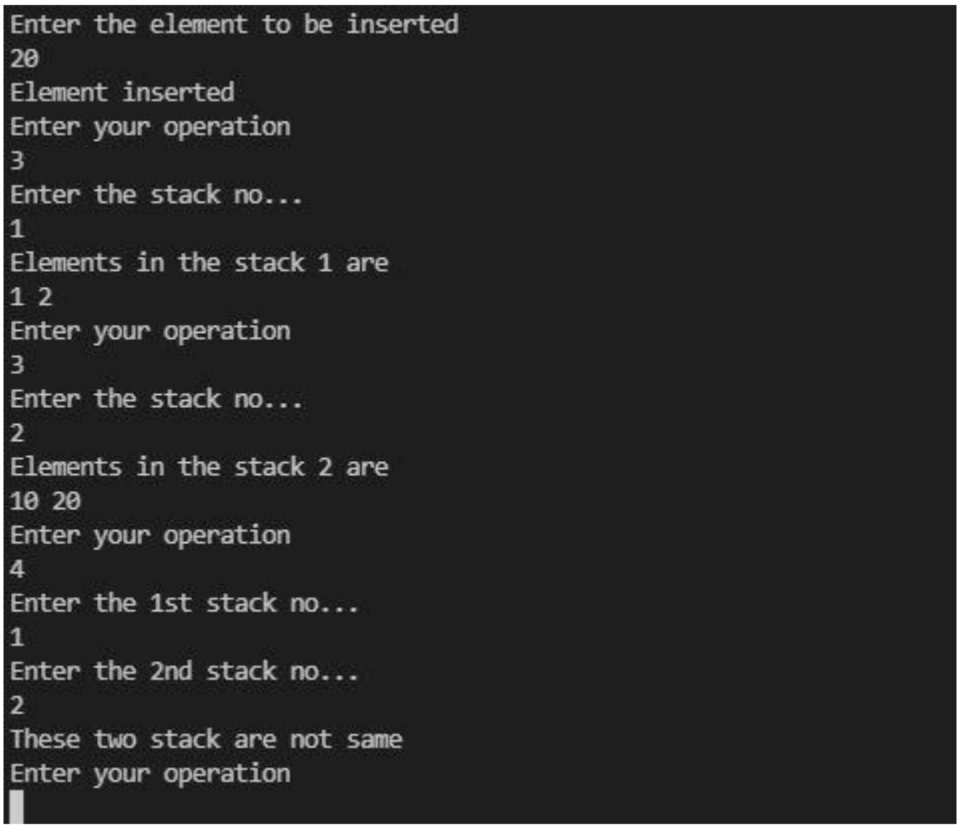


```
Enter the maximum number of element you want in the stack
3
1 for inserting an element
2 for deleting an element
3 for displaying the elements
Enter your operation
1
Enter the element to be inserted
1
Element inserted
Enter your operation
1
Enter the element to be inserted
2
Element inserted
Enter your operation
1
Enter the element to be inserted
3
Element inserted
Enter your operation
3
Elements in the stack are
1 2 3
Enter your operation
2
3 has been deleted
Enter your operation
3
Elements in the stack are
1 2
Enter your operation
```

<u>Output 2 and 3 :-</u>

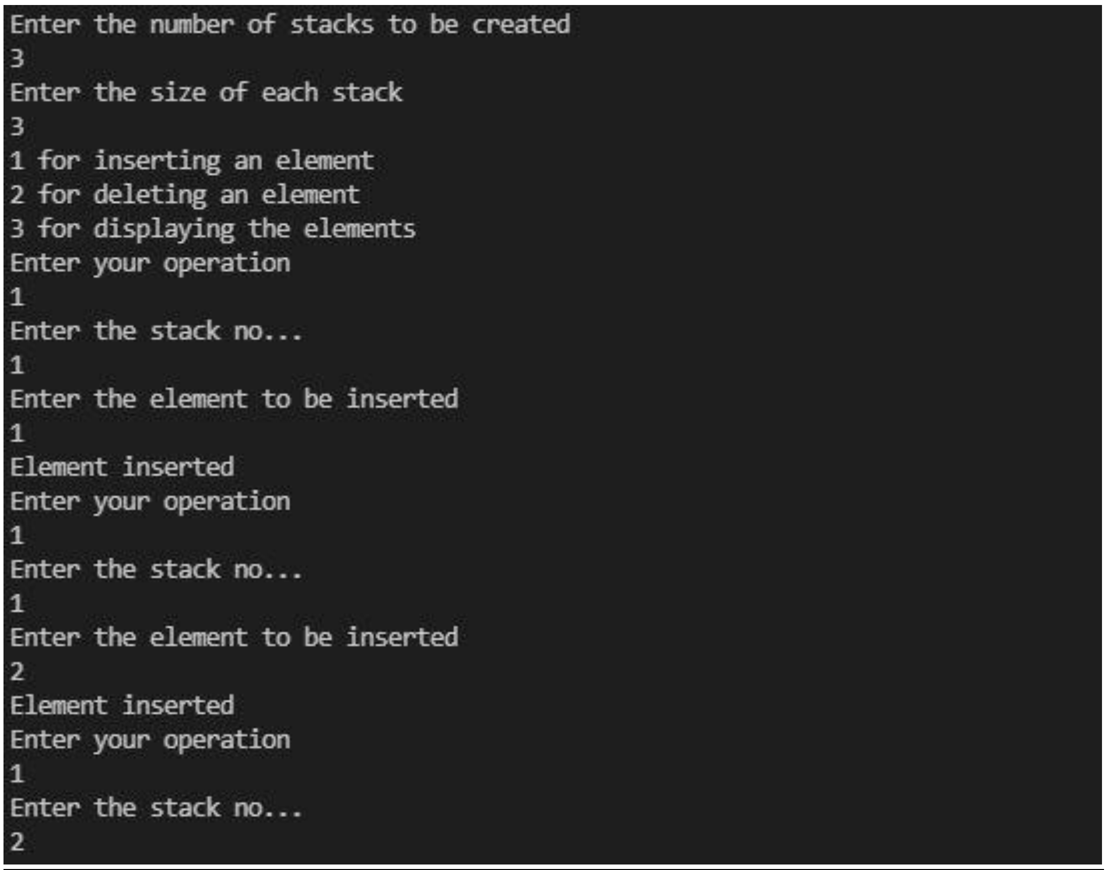


```
Enter the number of stacks to be created
2
Enter the size of each stacks
3
1 for inserting an element
2 for deleting an element
3 for displaying the elements
4 for comparing wo stacks
Enter your operation
1
Enter the stack no...
1
Enter the element to be inserted
1
Element inserted
Enter your operation
1
Enter the stack no...
1
Enter the element to be inserted
2
Element inserted
Enter your operation
1
Enter the stack no...
2
Enter the element to be inserted
10
Element inserted
Enter your operation
1
Enter the stack no...
2
Enter the element to be inserted
```

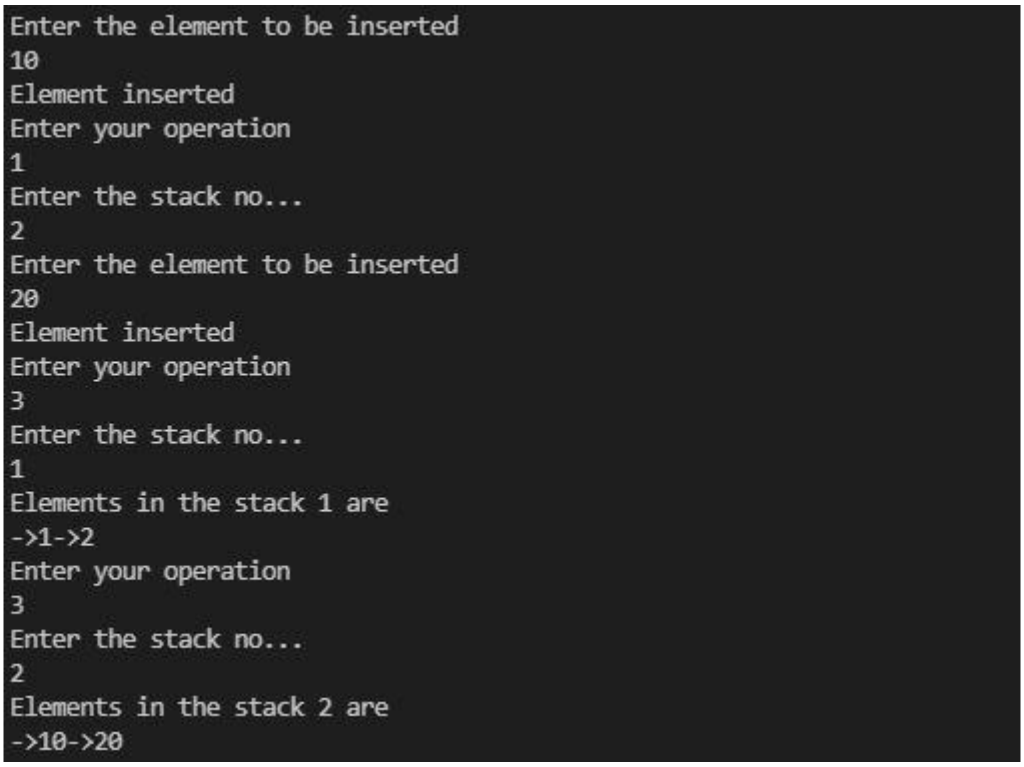


```
Enter the element to be inserted
20
Element inserted
Enter your operation
3
Enter the stack no...
1
Elements in the stack 1 are
1 2
Enter your operation
3
Enter the stack no...
2
Elements in the stack 2 are
10 20
Enter your operation
4
Enter the 1st stack no...
1
Enter the 2nd stack no...
2
These two stack are not same
Enter your operation
```

Output 4 :-

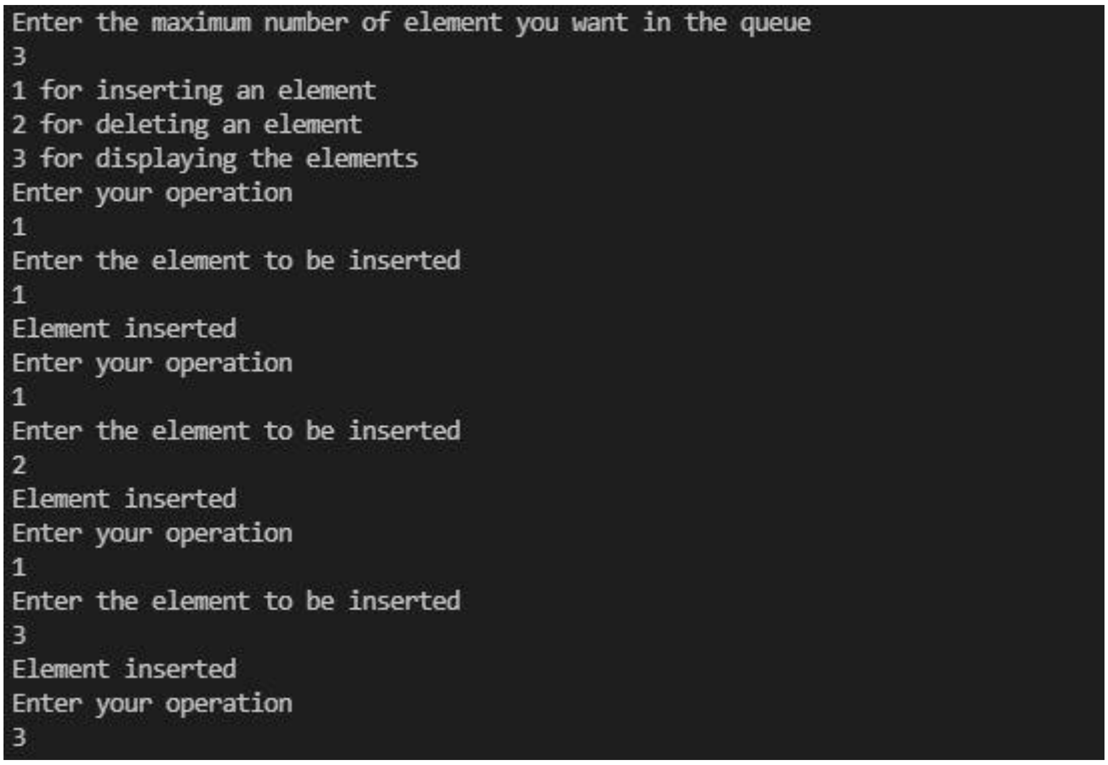


```
Enter the number of stacks to be created
3
Enter the size of each stack
3
1 for inserting an element
2 for deleting an element
3 for displaying the elements
Enter your operation
1
Enter the stack no...
1
Enter the element to be inserted
1
Element inserted
Enter your operation
1
Enter the stack no...
1
Enter the element to be inserted
2
Element inserted
Enter your operation
1
Enter the stack no...
2
```

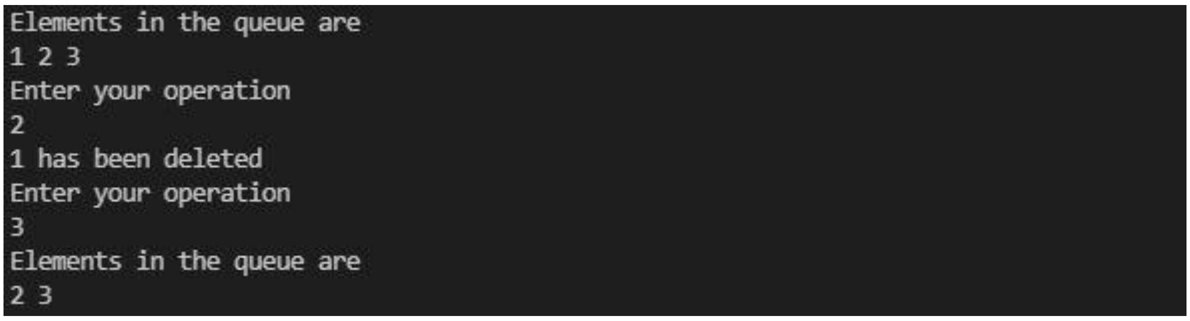


```
Enter the element to be inserted
10
Element inserted
Enter your operation
1
Enter the stack no...
2
Enter the element to be inserted
20
Element inserted
Enter your operation
3
Enter the stack no...
1
Elements in the stack 1 are
->1->2
Enter your operation
3
Enter the stack no...
2
Elements in the stack 2 are
->10->20
```

Output 5 :-

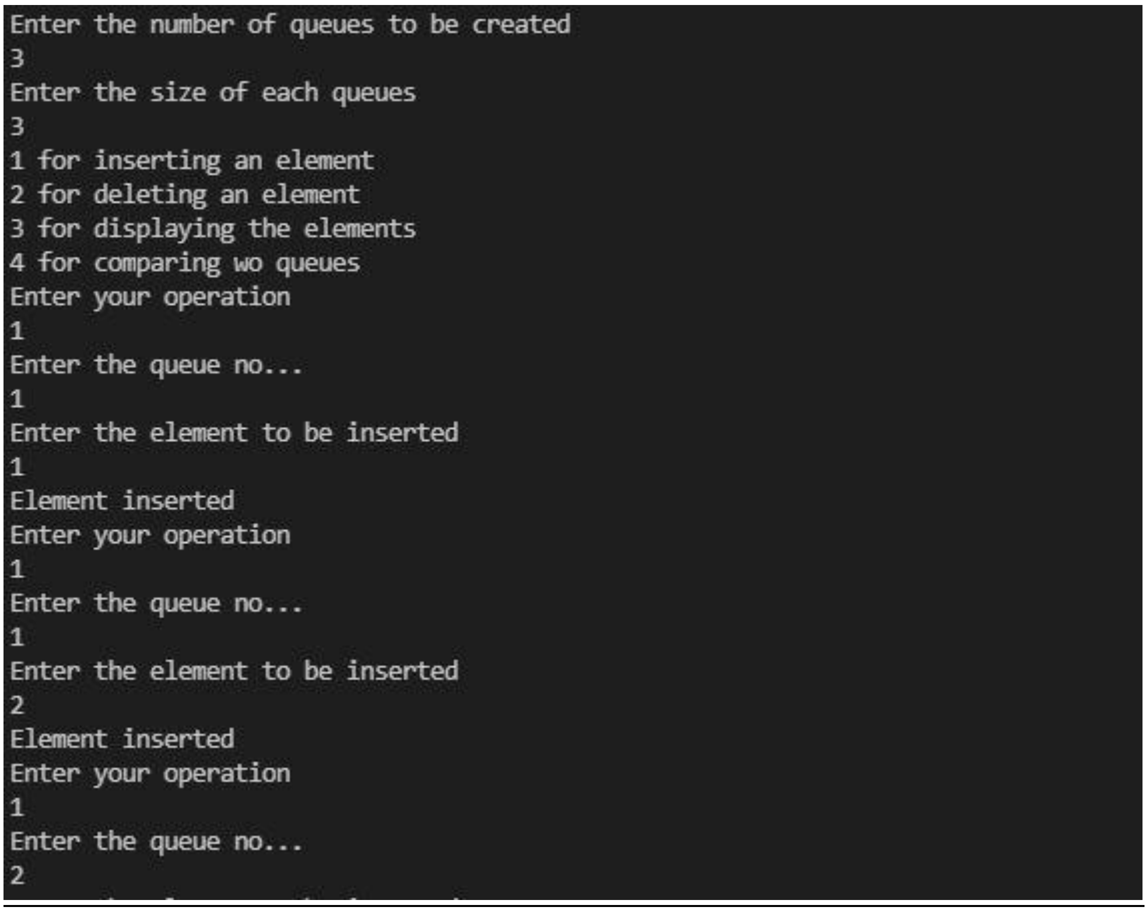


```
Enter the maximum number of element you want in the queue
3
1 for inserting an element
2 for deleting an element
3 for displaying the elements
Enter your operation
1
Enter the element to be inserted
1
Element inserted
Enter your operation
1
Enter the element to be inserted
2
Element inserted
Enter your operation
1
Enter the element to be inserted
3
Element inserted
Enter your operation
3
```

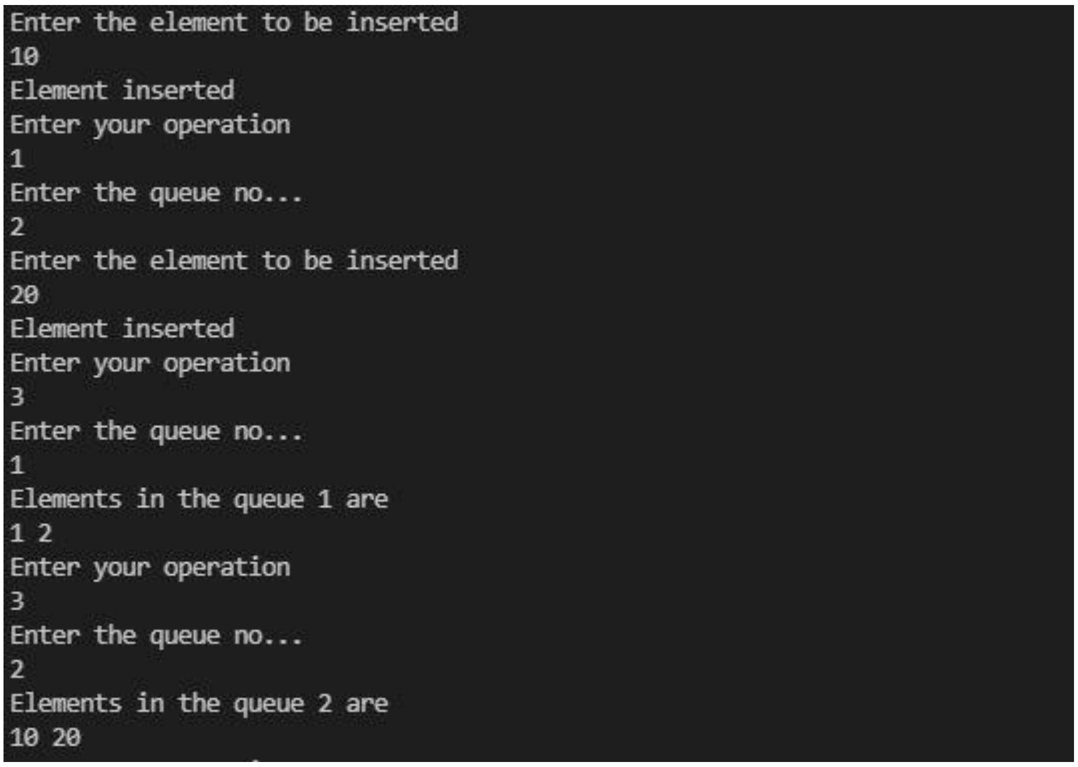


```
Elements in the queue are
1 2 3
Enter your operation
2
1 has been deleted
Enter your operation
3
Elements in the queue are
2 3
```

Output 6 and 7 :-

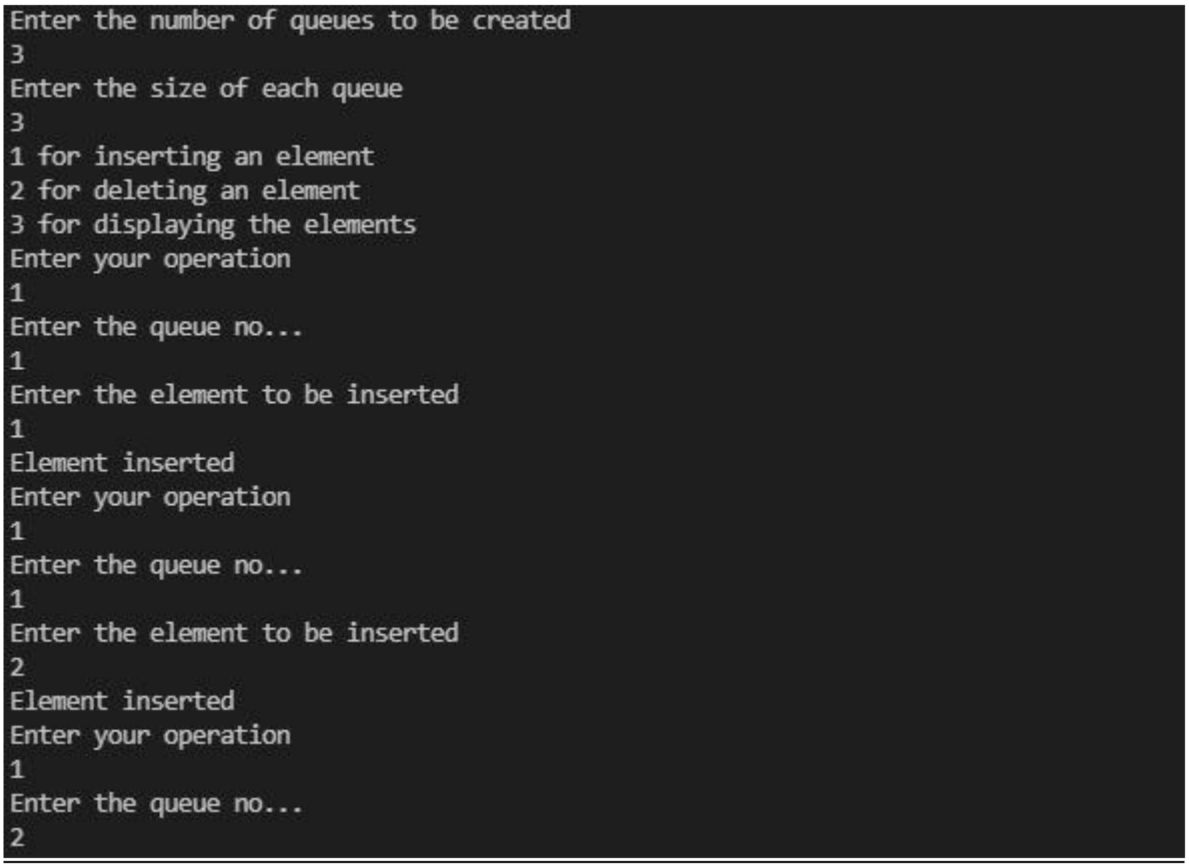


```
Enter the number of queues to be created
3
Enter the size of each queues
3
1 for inserting an element
2 for deleting an element
3 for displaying the elements
4 for comparing wo queues
Enter your operation
1
Enter the queue no...
1
Enter the element to be inserted
1
Element inserted
Enter your operation
1
Enter the queue no...
1
Enter the element to be inserted
2
Element inserted
Enter your operation
1
Enter the queue no...
2
```

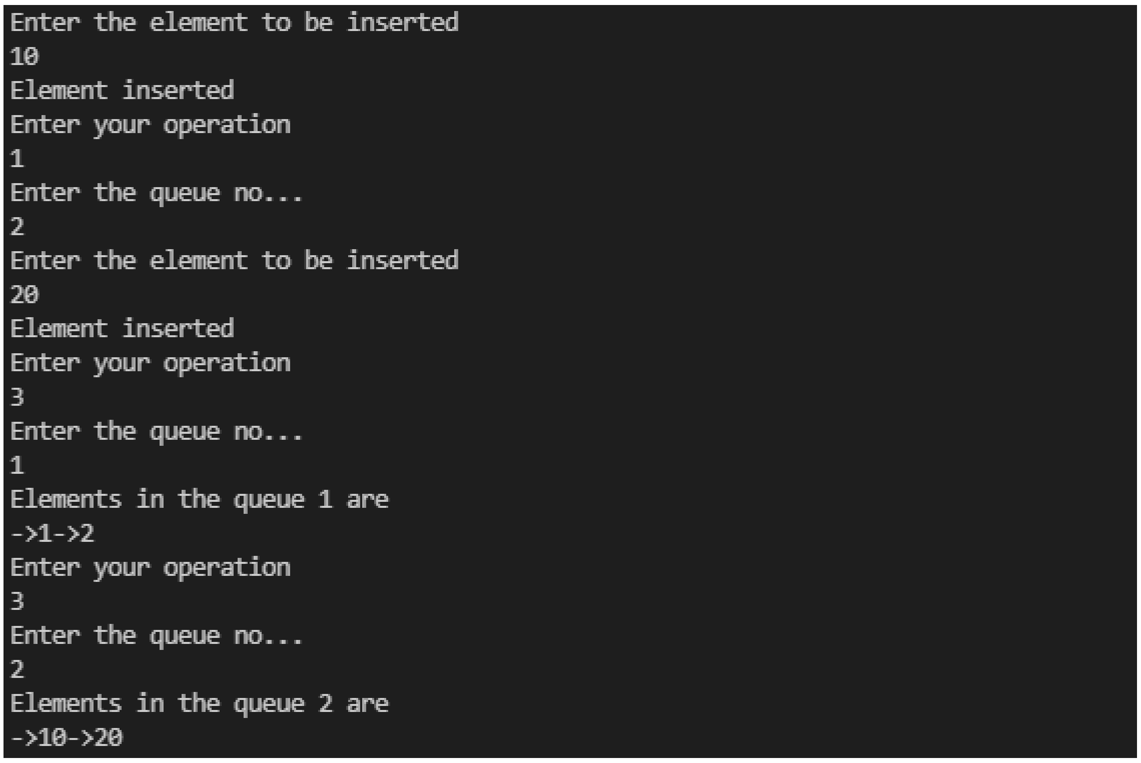


```
Enter the element to be inserted
10
Element inserted
Enter your operation
1
Enter the queue no...
2
Enter the element to be inserted
20
Element inserted
Enter your operation
3
Enter the queue no...
1
Elements in the queue 1 are
1 2
Enter your operation
3
Enter the queue no...
2
Elements in the queue 2 are
10 20
```

Output 8 :-

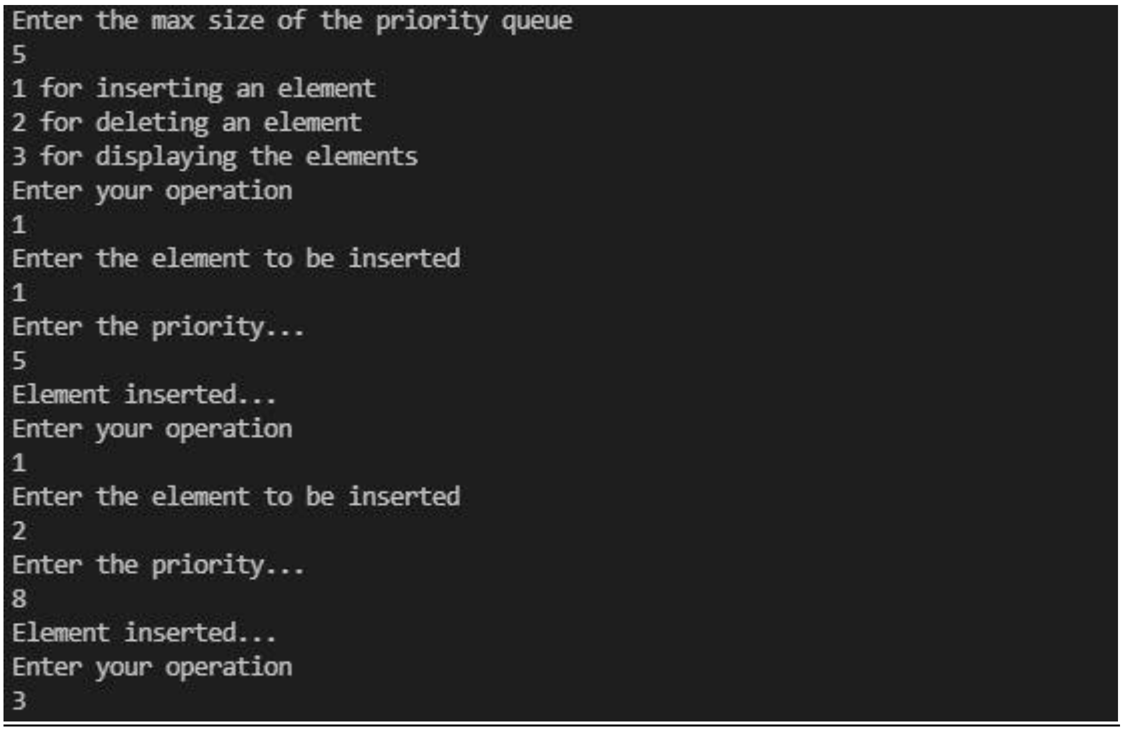


```
Enter the number of queues to be created
3
Enter the size of each queue
3
1 for inserting an element
2 for deleting an element
3 for displaying the elements
Enter your operation
1
Enter the queue no...
1
Enter the element to be inserted
1
Element inserted
Enter your operation
1
Enter the queue no...
1
Enter the element to be inserted
2
Element inserted
Enter your operation
1
Enter the queue no...
2
```

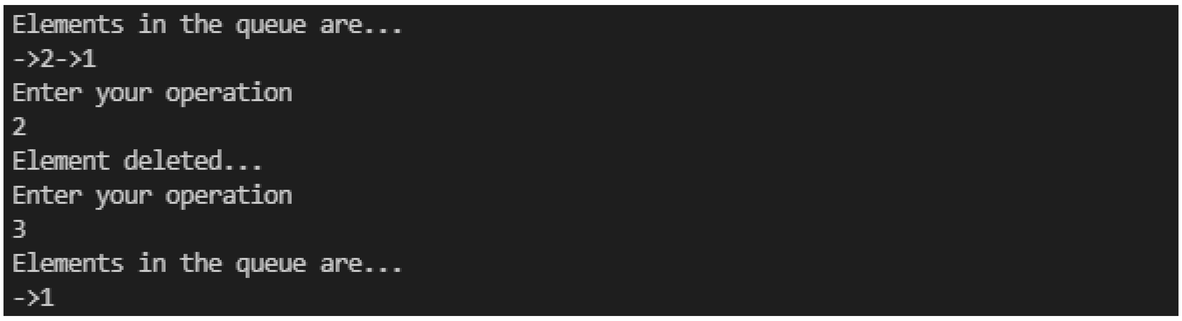


```
Enter the element to be inserted
10
Element inserted
Enter your operation
1
Enter the queue no...
2
Enter the element to be inserted
20
Element inserted
Enter your operation
3
Enter the queue no...
1
Elements in the queue 1 are
->1->2
Enter your operation
3
Enter the queue no...
2
Elements in the queue 2 are
->10->20
```

<u>Ouput 9 :-</u>



```
Enter the max size of the priority queue
5
1 for inserting an element
2 for deleting an element
3 for displaying the elements
Enter your operation
1
Enter the element to be inserted
1
Enter the priority...
5
Element inserted...
Enter your operation
1
Enter the element to be inserted
2
Enter the priority...
8
Element inserted...
Enter your operation
3
```


```
Elements in the queue are...
->2->1
Enter your operation
2
Element deleted...
Enter your operation
3
Elements in the queue are...
->1
```