	Department of Computer Science and Engineering Faculty of Engineering, South Eastern University of Sri Lanka		
	Subject	**CS53003: Data Structure and Algorithms**	
	Batch	**E18**	**Semester**	**5**

Lab no and title : Hands-on Lab 9 – Stack and Queue
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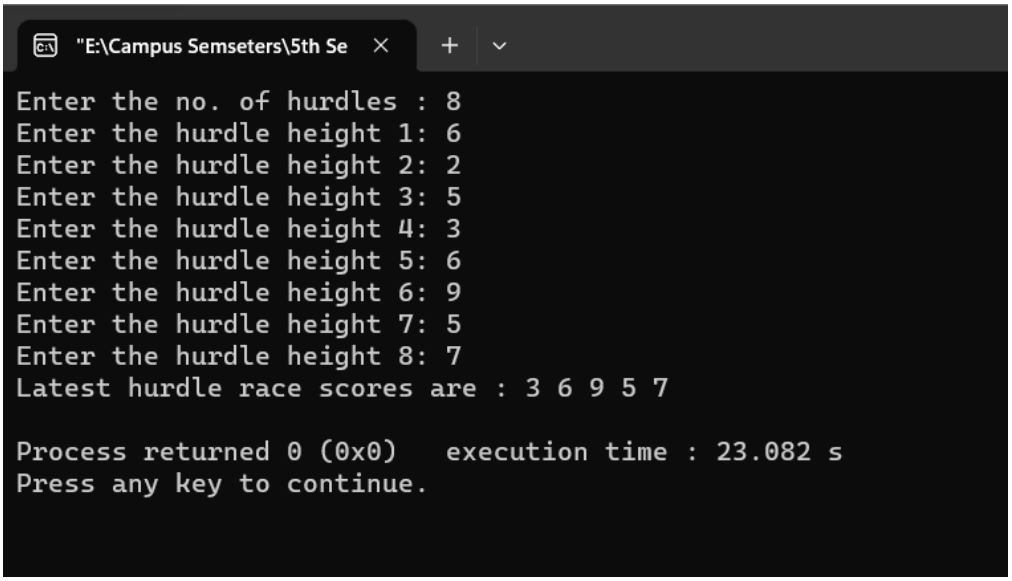
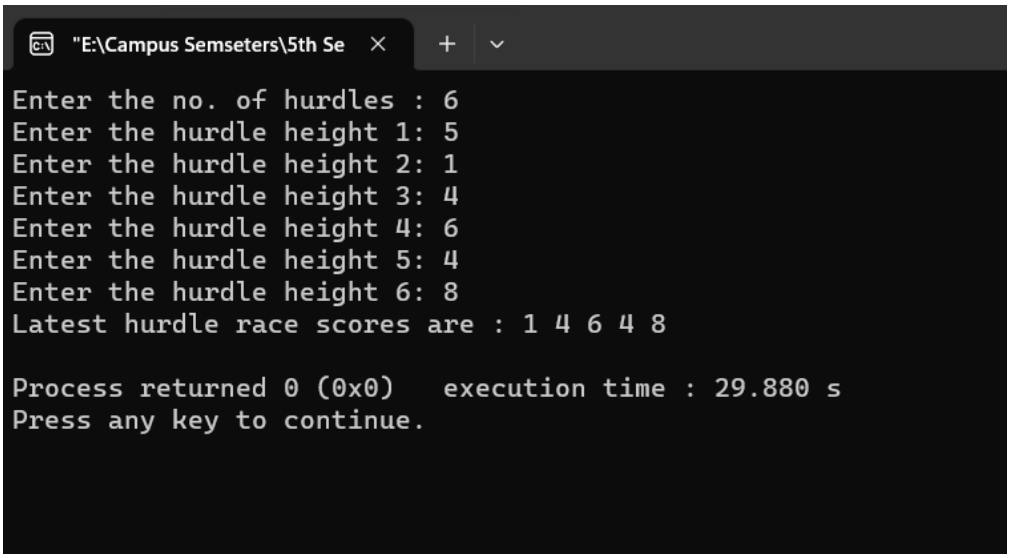
Reg No : SEU-IS-18-EG-013
Submission Date : 08-03-2023

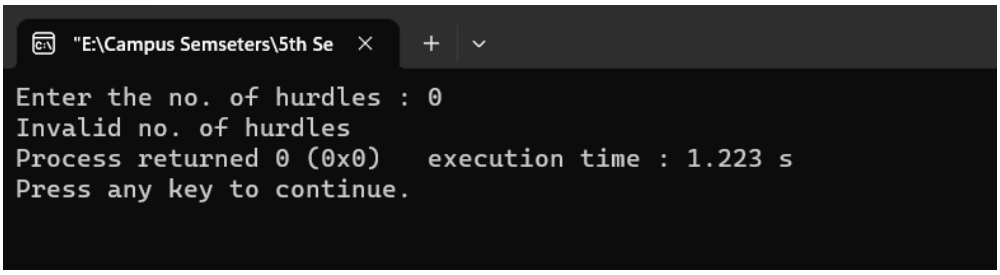
01.

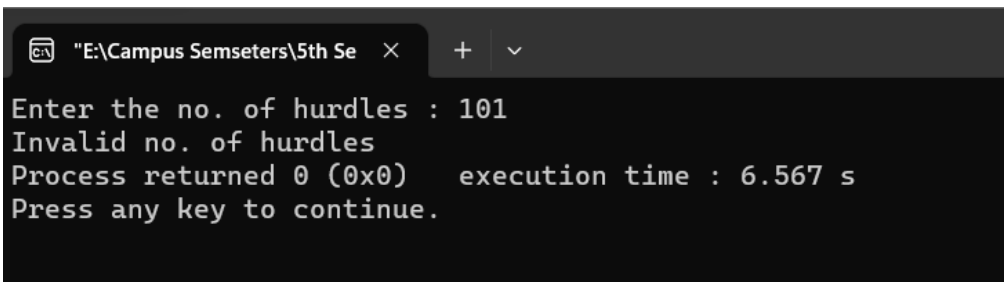
Start here | CodeTemplate_Ex1.cpp | CodeTemplate_Ex2.cpp | CodeTemplate_Ex3.cpp | CodeTemplate_Ex4.cpp | CodeTemplate_Ex

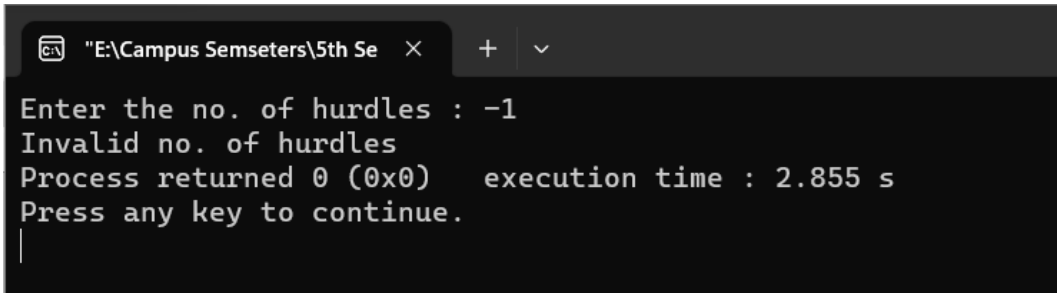
```cpp
//DO NOT CHANGE THE GIVEN CODE TEMPLATE. WRITE YOUR CODE IN THE PROVIDED PLACES ALONE.
//If required, you can add additional functions or header files.

#include<iostream>
#include<stack>

using namespace std;

int main(){
    // stack:
    int hur,height;
    stack<int> Score;
    cout << "Enter the no. of hurdles : ";
    cin >> hur;
    if (hur <=0 || hur>= 101){
        cout << "Invalid no. of hurdles";
    }
    else{
        for (int i=0; i<hur; i++){
            cout << "Enter the hurdle height " << i+1<<": ";
            cin >> height;
            Score.push(height);
        }
        cout << "Latest hurdle race scores are : ";

        int last_five[5];
        for (int i=0; i<5; i++){
            last_five[i] = Score.top();
            Score.pop();
        }

        for (int i = 4; i >=0; i--){
            cout << last_five[i] << " ";
        }
        cout << endl;
    }

    return 0;
}
```


"E:\Campus Semseters\5th Se
Enter the no. of hurdles : 8
Enter the hurdle height 1: 6
Enter the hurdle height 2: 2
Enter the hurdle height 3: 5
Enter the hurdle height 4: 3
Enter the hurdle height 5: 6
Enter the hurdle height 6: 9
Enter the hurdle height 7: 5
Enter the hurdle height 8: 7
Latest hurdle race scores are : 3 6 9 5 7
Process returned 0 (0x0) execution time : 23.082 s
Press any key to continue.


"E:\Campus Semseters\5th Se
Enter the no. of hurdles : 6
Enter the hurdle height 1: 5
Enter the hurdle height 2: 1
Enter the hurdle height 3: 4
Enter the hurdle height 4: 6
Enter the hurdle height 5: 4
Enter the hurdle height 6: 8
Latest hurdle race scores are : 1 4 6 4 8
Process returned 0 (0x0) execution time : 29.880 s
Press any key to continue.


"E:\Campus Semseters\5th Se
Enter the no. of hurdles : 0
Invalid no. of hurdles
Process returned 0 (0x0) execution time : 1.223 s
Press any key to continue.


"E:\Campus Semseters\5th Se
Enter the no. of hurdles : 101
Invalid no. of hurdles
Process returned 0 (0x0) execution time : 6.567 s
Press any key to continue.



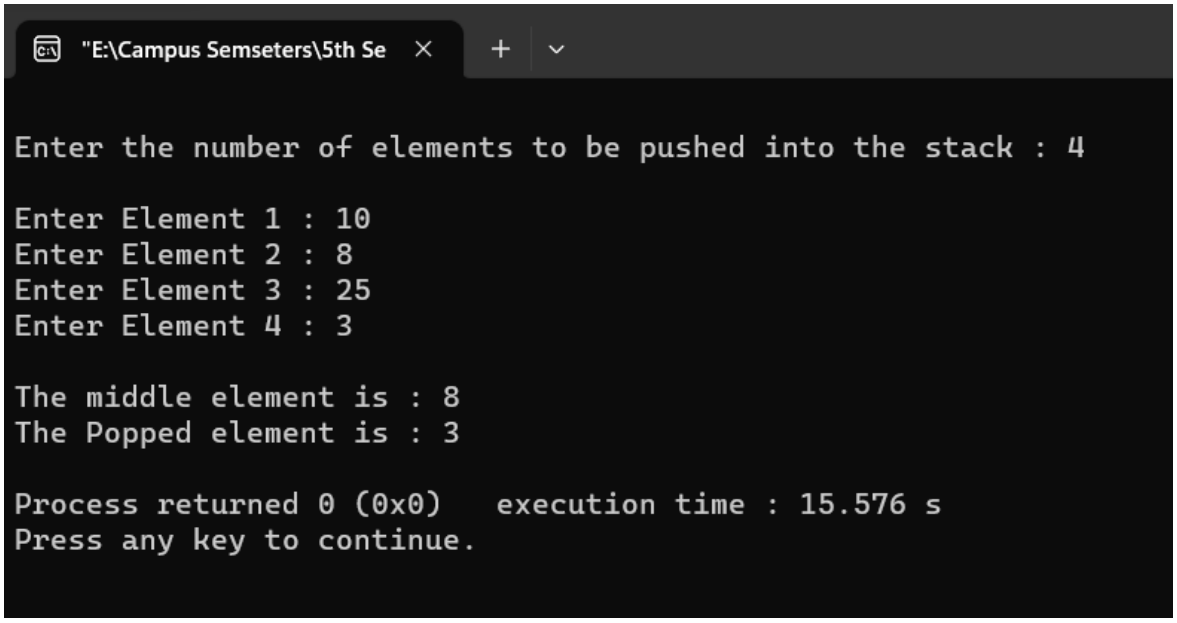
02.

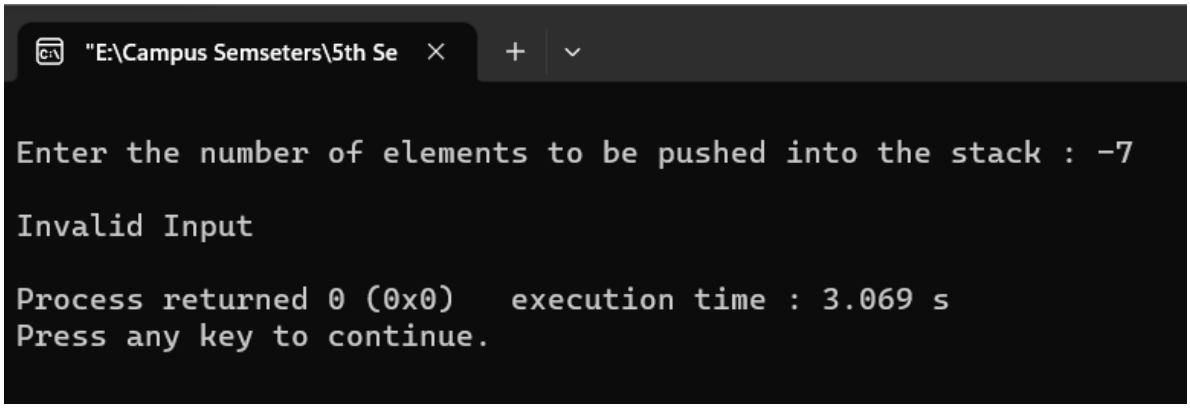
Start here | CodeTemplate_Ex1.cpp | CodeTemplate_Ex2.cpp | CodeTemplate_Ex3.cpp | CodeT

```cpp
//DO NOT CHANGE THE GIVEN CODE TEMPLATE. WRITE YOUR CODE IN TH

#include<iostream>
using namespace std;
#define MAX 50

class Stack {
    int top;
    int mid;
    public:
      char stk[MAX];
      Stack() {
          top = -1;
        }
      void push(int data);
      int findMiddle();
      int pop();
};

void Stack::push(int data) {
    if(top >= MAX-1){
        cout<<"Stack overflow"<<endl;
        return;
    }
     stk[++top]=data;
     if(top == 0){
        mid = 0;
     }
     else if(top % 2 == 0){
        mid++;
     }
}

int Stack::pop(){
    if (top < 0){
        cout<<"Stack overflow"<<endl;
        return -1;
    }
    int data = stk[top];
    top--;
    if(top % 2 == 1){
        mid--;
    }
    return data;
```

```
45  }
46
47  int Stack::findMiddle() {
48      if(mid == -1){
49              cout<<"Stack is empty"<<endl;
50              return -1;
51      }
52      return stk[mid];
53  }
54
55  int  main() {
56        int no;
57        Stack st;
58        cout<<"\nEnter the number of elements to be pushed into the stack : ";
59        cin>>no;
60        cout<< endl;
61
62        if(no <= 0){
63         cout<< "Invalid Input" << endl;
64         return 0;
65        }
66        for(int i = 0; i<no; i++){
67         int data;
68         cout<<"Enter Element "<< i + 1 <<" : ";
69         cin >> data;
70         st.push(data);
71        }
72        cout<< "\nThe middle element is : " << st.findMiddle();
73        cout<< "\nThe Popped element is : " << st.pop()<<endl;
74
75        return 0;
76  }
77
```

```
"E:\Campus Semseters\5th Se

Enter the number of elements to be pushed into the stack : 5

Enter Element 1 : 10
Enter Element 2 : 8
Enter Element 3 : 25
Enter Element 4 : 8
Enter Element 5 : 3

The middle element is : 25
The Popped element is : 3

Process returned 0 (0x0)   execution time : 218.261 s
Press any key to continue.
```

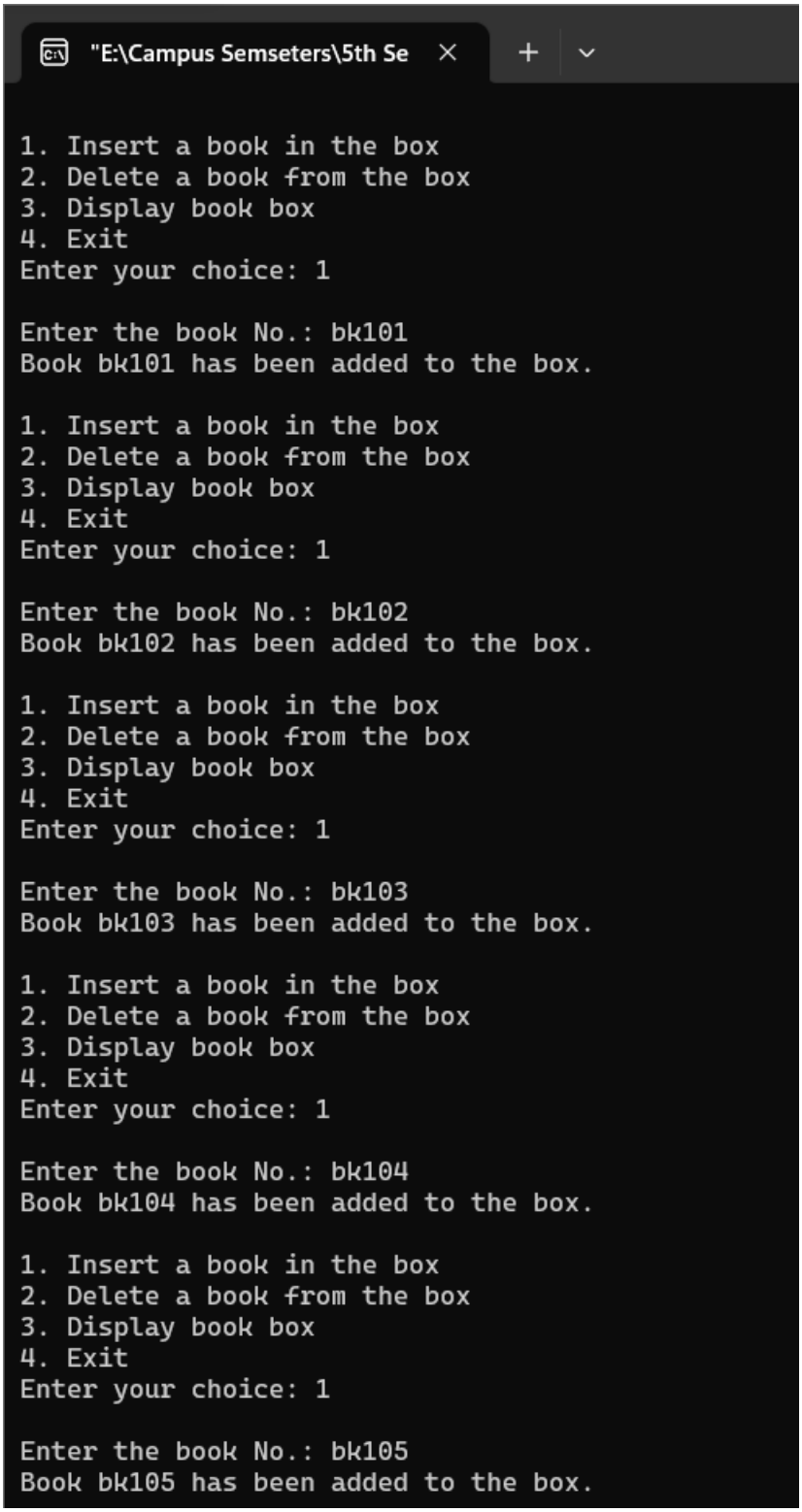

"E:\Campus Semseters\5th Se
Enter the number of elements to be pushed into the stack : 4
Enter Element 1 : 10
Enter Element 2 : 8
Enter Element 3 : 25
Enter Element 4 : 3
The middle element is : 8
The Popped element is : 3
Process returned 0 (0x0) execution time : 15.576 s
Press any key to continue.

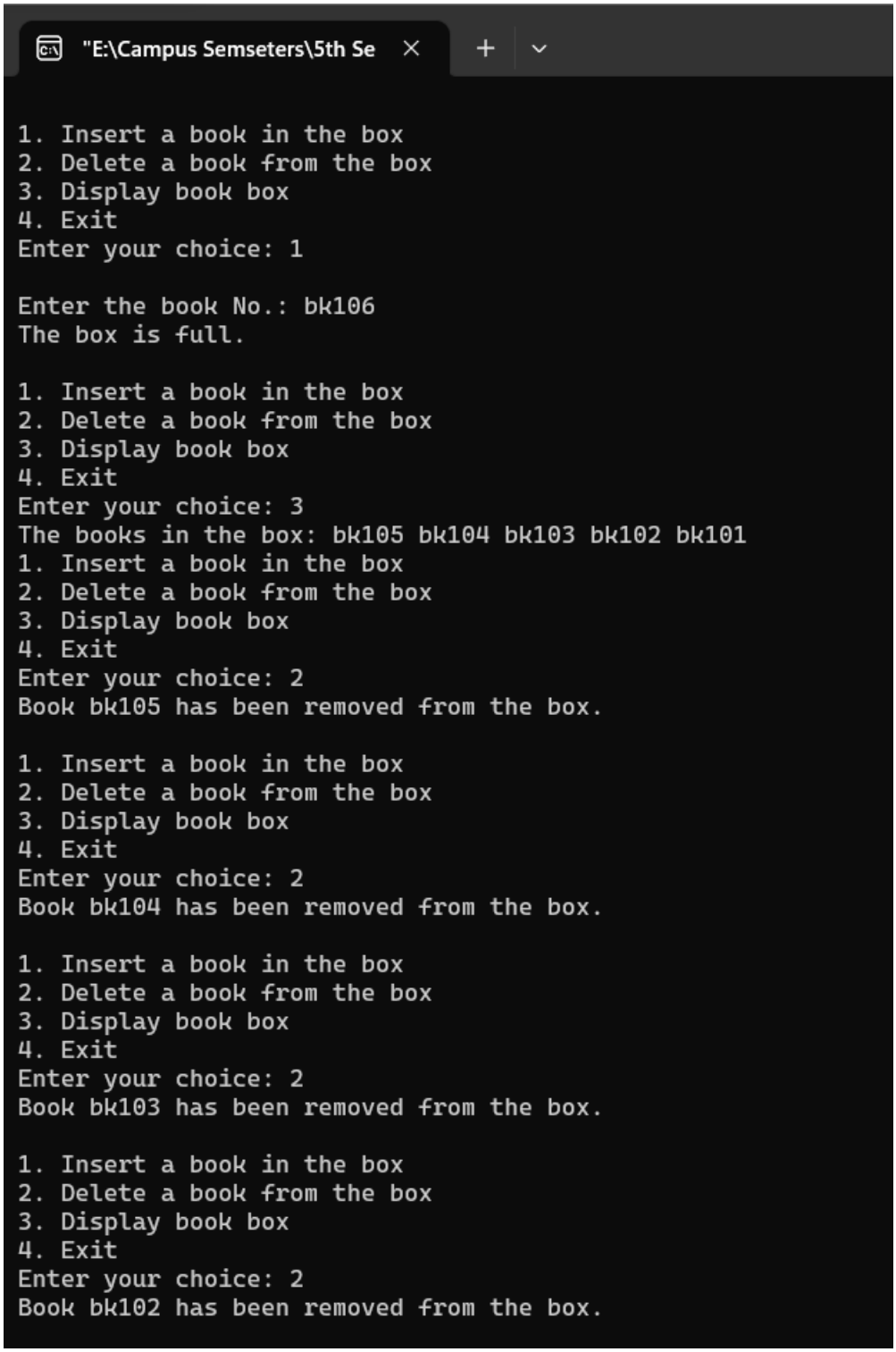

"E:\Campus Semseters\5th Se
Enter the number of elements to be pushed into the stack : -7
Invalid Input
Process returned 0 (0x0) execution time : 3.069 s
Press any key to continue.

03.

Start here | CodeTemplate_Ex1.cpp | CodeTemplate_Ex2.cpp | CodeTemplate_Ex3.cpp | CodeTemplate_Ex4.cpp | CodeTem

```cpp
//DO NOT CHANGE THE GIVEN CODE TEMPLATE. WRITE YOUR CODE IN THE PROVIDED PLACES AL
//If required, you can add additional functions or header files.

#include <iostream>
#include<string.h>
using namespace std;

class Stack {
    int top;
    public:
       char box[5][10];
       Stack() {
           top = -1;
        }
       void push(char bkNo[]);
       void pop();
       void display();
};
void Stack::push(char bkNo[]) {
    if(top == 4){
        cout<< "The box is full."<<endl;
    }
    else{
        top++;
        strcpy (box[top], bkNo);
        cout << "Book "<<bkNo<<" has been added to the box."<<endl;
    }
}
void Stack::pop() {
    if (top==-1){
        cout<< "The box is empty"<< endl;
    }
    else {
        char bkNo[10];
        strcpy(bkNo,box[top]);
        top--;
        cout<< "Book "<< bkNo<< " has been removed from the box." << endl;
    }
}
void Stack::display(){
    if(top == -1){
        cout<< "The box is empty."<<endl;
    }
    else{
```


"E:\Campus Semseters\5th Se
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 1
Enter the book No.: bk101
Book bk101 has been added to the box.
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 1
Enter the book No.: bk102
Book bk102 has been added to the box.
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 1
Enter the book No.: bk103
Book bk103 has been added to the box.
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 1
Enter the book No.: bk104
Book bk104 has been added to the box.
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 1
Enter the book No.: bk105
Book bk105 has been added to the box.


"E:\Campus Semseters\5th Se
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 1
Enter the book No.: bk106
The box is full.
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 3
The books in the box: bk105 bk104 bk103 bk102 bk101
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 2
Book bk105 has been removed from the box.
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 2
Book bk104 has been removed from the box.
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 2
Book bk103 has been removed from the box.
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 2
Book bk102 has been removed from the box.

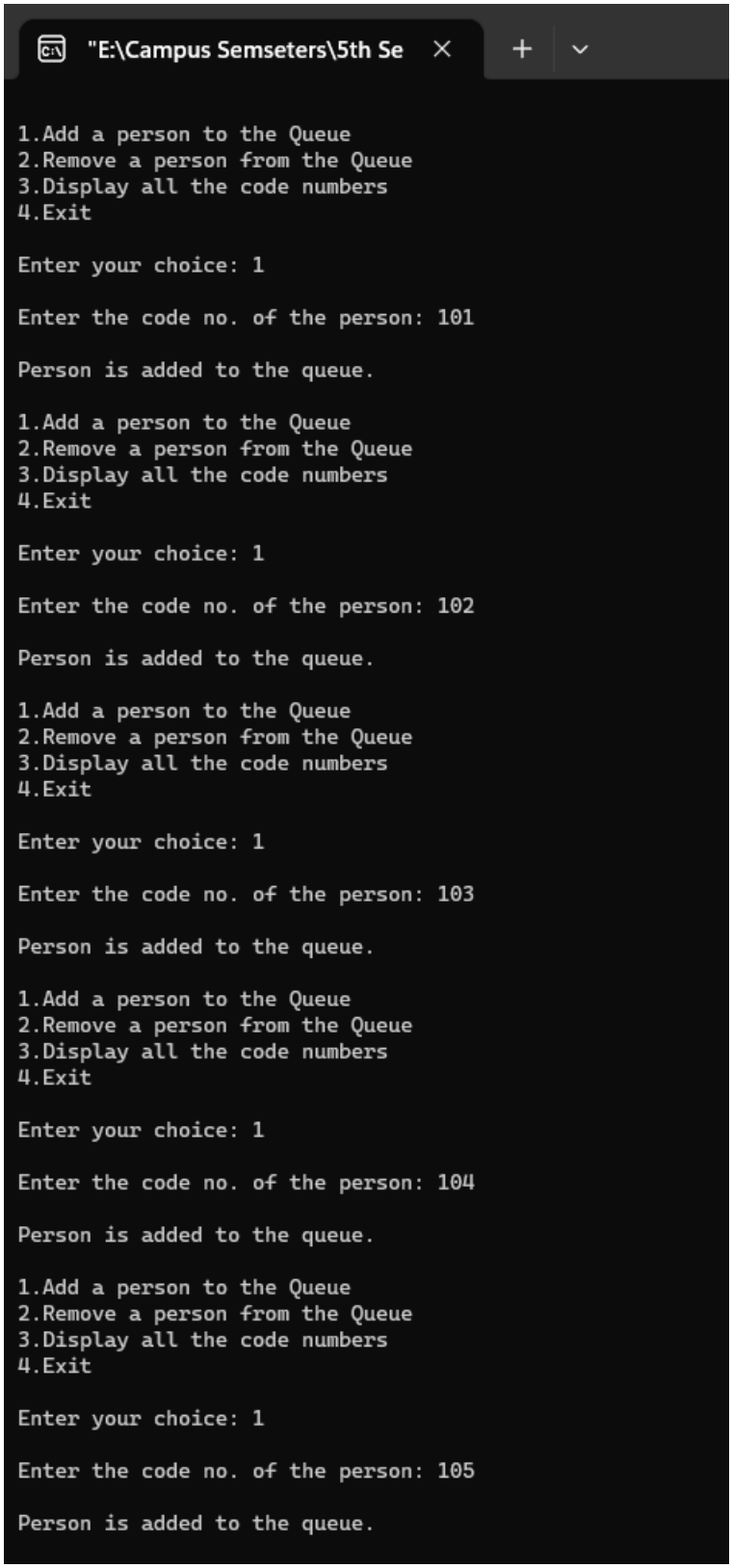
```
1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 2
Book bk101 has been removed from the box.

1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 2
The box is empty

1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 7
Invalid option

1. Insert a book in the box
2. Delete a book from the box
3. Display book box
4. Exit
Enter your choice: 4

Process returned 0 (0x0)   execution time : 70.735 s
Press any key to continue.
```

04.

Start here | CodeTemplate_Ex1.cpp | CodeTemplate_Ex2.cpp | CodeTemplate_Ex3.cpp | CodeTemplate_Ex4.cpp | CodeTe

```cpp
//DO NOT CHANGE THE GIVEN CODE TEMPLATE. WRITE YOUR CODE IN THE PROVIDED PLACES A
#include <iostream>
using namespace std;

class Queue {
    public:
        int front, rear;
        int personQueue[5];
        Queue() {
            front=rear=-1;
        }
        void enQueue(int codeNumber);
        void deQueue();
        void display();
};

void Queue::enQueue(int codeNumber)  {
    if(rear == 4){
        cout<<"\nCurrently, the Queue is full.\n";
        return;
    }
    else if (front == -1){
        front =0;
    }
    rear++;
    personQueue[rear] = codeNumber;
    cout<< "\nPerson is added to the queue." <<endl;
 }

void Queue:: deQueue() {
    if(front == -1){
        cout << "\nThe Queue is empty.\n";
        return;
    }
    int removedCodeNumber = personQueue[front];
    if (front == rear){
        front = rear = -1;
    }
    else{
        front++;
    }
    cout << "\nThe person removed from the queue."<<removedCodeNumber<< endl;
}

```

```
45  void Queue::display(){
46      if(front == -1){
47          cout << "\nThe queue is empty.\n";
48          return;
49      }
50      cout <<"\nThe person in the queue : \n";
51      for (int i = front; i<= rear; i++){
52          cout << personQueue[i]<<endl;
53      }
54  }
55
56
57  int main() {
58      Queue q;
59      int codeNumber;
60      int choice;
61      do{
62          cout<<"\n1.Add a person to the Queue";
63          cout<<"\n2.Remove a person from the Queue";
64          cout<<"\n3.Display all the code numbers";
65          cout<<"\n4.Exit"<<endl;
66          cout<<"\nEnter your choice: ";
67          cin>>choice;
68          switch(choice) {
69              case 1:
70                  cout<<"\nEnter the code no. of the person: ";
71                  cin>>codeNumber;
72                  q.enQueue(codeNumber);
73                  break;
74
75              case 2:
76                  q.deQueue();
77                  break;
78
79              case 3:
80                  q.display();
81                  break;
82
83              case 4:
84                  return 0;
85
86              default:
87                  cout<<"Invalid option\n";
88          }
89
90      }while(true);
91
92      return 0;
93  }
94
95
```


"E:\Campus Semseters\5th Se
1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit
Enter your choice: 1
Enter the code no. of the person: 101
Person is added to the queue.
1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit
Enter your choice: 1
Enter the code no. of the person: 102
Person is added to the queue.
1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit
Enter your choice: 1
Enter the code no. of the person: 103
Person is added to the queue.
1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit
Enter your choice: 1
Enter the code no. of the person: 104
Person is added to the queue.
1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit
Enter your choice: 1
Enter the code no. of the person: 105
Person is added to the queue.

```
1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice: 1

Enter the code no. of the person: 106

Currently, the Queue is full.

1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice: 2

The person removed from the queue.101

1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice: 3

The person in the queue :
102
103
104
105

1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice: 2

The person removed from the queue.102

1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice: 2

The person removed from the queue.103
```

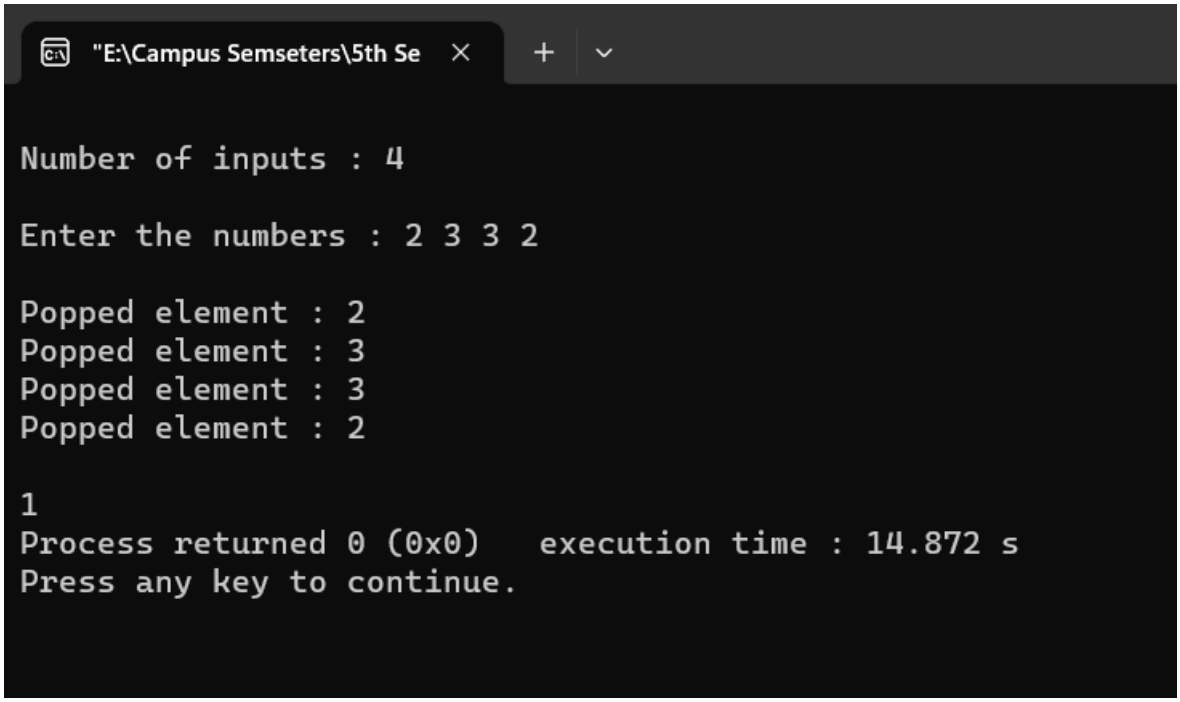
```
1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice: 2

The person removed from the queue.104

1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice: 2

The person removed from the queue.105

1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice: 2

The Queue is empty.

1.Add a person to the Queue
2.Remove a person from the Queue
3.Display all the code numbers
4.Exit

Enter your choice:
```

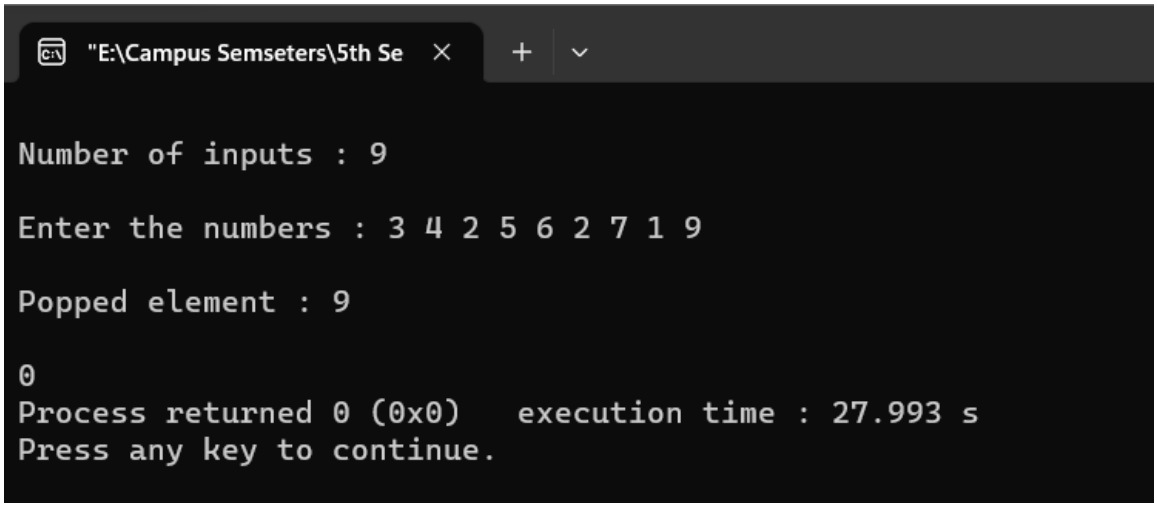
05.

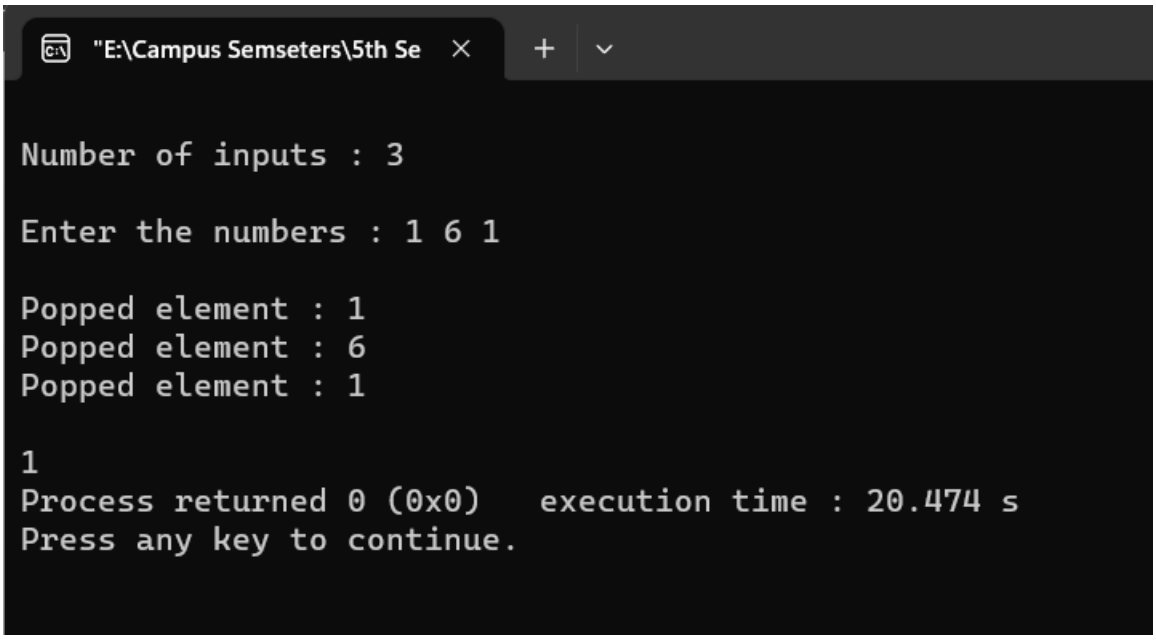
Start here | CodeTemplate_Ex1.cpp | CodeTemplate_Ex2.cpp | CodeTemplate_Ex3.cpp | CodeTempl

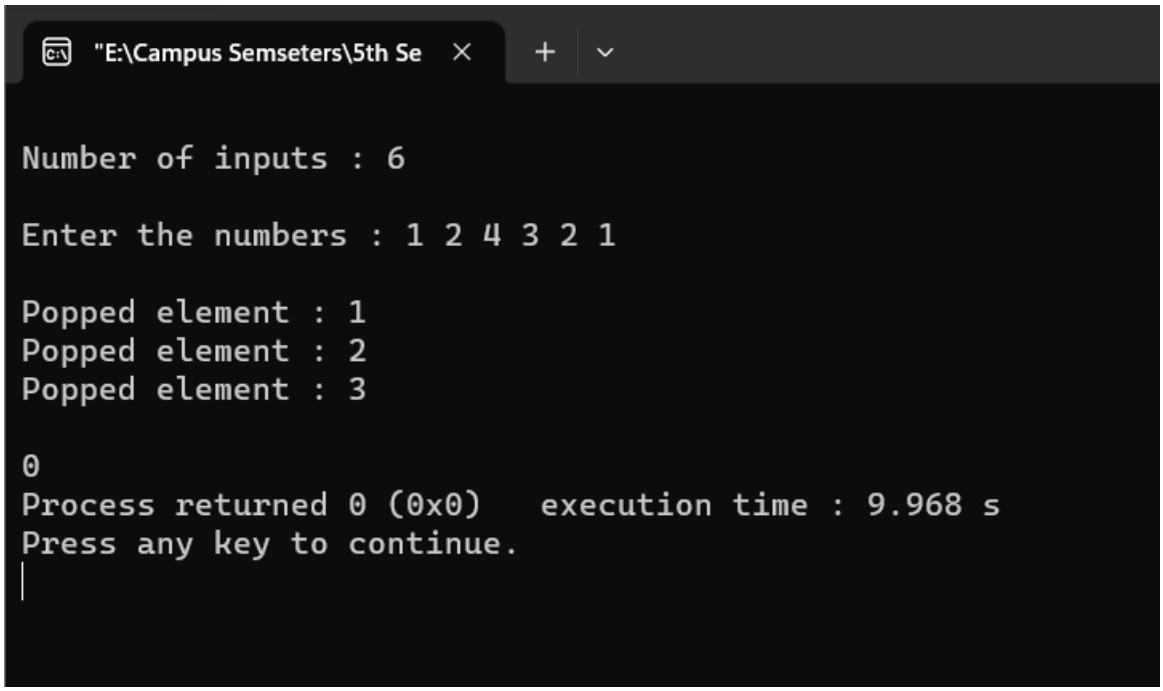
```cpp
//DO NOT CHANGE THE GIVEN CODE TEMPLATE. WRITE YOUR CODE IN THE P

#include<iostream>
using namespace std;

class Node {
      public:
          int data;
         Node *next;
};
class Stack{
   public:
        Node *top;
        Stack(){
            top=NULL;
         }
         void push(int data);
         int pop();
};

void Stack :: push(int data){
    Node*temp = new Node();
    temp->data = data;
    temp->next = top;
    top = temp;
}


int Stack ::pop(){
    if(top == NULL){
        return -1;
    }
    int data = top-> data;
    Node*temp = top;
    top = top->next;
    delete temp;
    return data;
}

```

```cpp
int checkPalindrome(Stack stk, int arr[],int size) {
    for(int i = 0; i < size; i++){
        int data = stk.pop();
        cout << "\nPopped element : "<< data;
        if (data != arr[i]){
            cout<<endl<<endl;
            return 0;
        }
    }
    cout<<endl<<endl;
    return 1;   //Change this return value according to the problem description
}

int main(){
    Stack stk;
    int size,i,data;

    cout << "\nNumber of inputs : ";
    cin >> size;
    if(size<2){
        cout<<"Invalid input";
        return 0;
    }

    int arr[size];
    cout << "\nEnter the numbers : ";
    for(i=0; i<size; i++){
       cin>>data;
        arr[i]=data;
        stk.push(data);
    }
    int isPalindrome = checkPalindrome(stk, arr, size);
    cout << isPalindrome;

    return 0;
}
```




"E:\Campus Semseters\5th Se
Number of inputs : 9
Enter the numbers : 3 4 2 5 6 2 7 1 9
Popped element : 9
0
Process returned 0 (0x0)   execution time : 27.993 s
Press any key to continue.


"E:\Campus Semseters\5th Se
Number of inputs : 3
Enter the numbers : 1 6 1
Popped element : 1
Popped element : 6
Popped element : 1
1
Process returned 0 (0x0)   execution time : 20.474 s
Press any key to continue.


"E:\Campus Semseters\5th Se
Number of inputs : 6
Enter the numbers : 1 2 4 3 2 1
Popped element : 1
Popped element : 2
Popped element : 3
0
Process returned 0 (0x0)   execution time : 9.968 s
Press any key to continue.