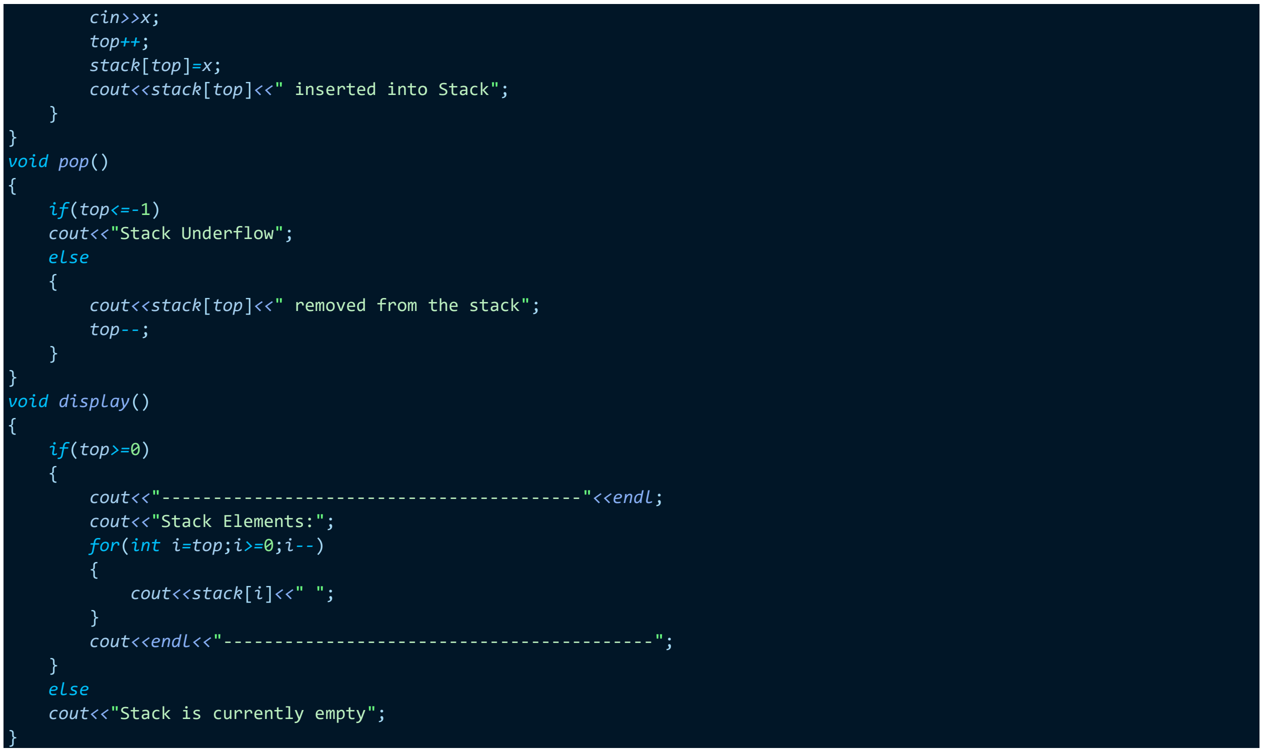
Neeraj Kumar [21MCF1R27]
DS Lab Assignment : 4 [20-02-2022]
Tasks : [1 to 10]

Program 1. Write a program to implement stack using arrays.

Source Code

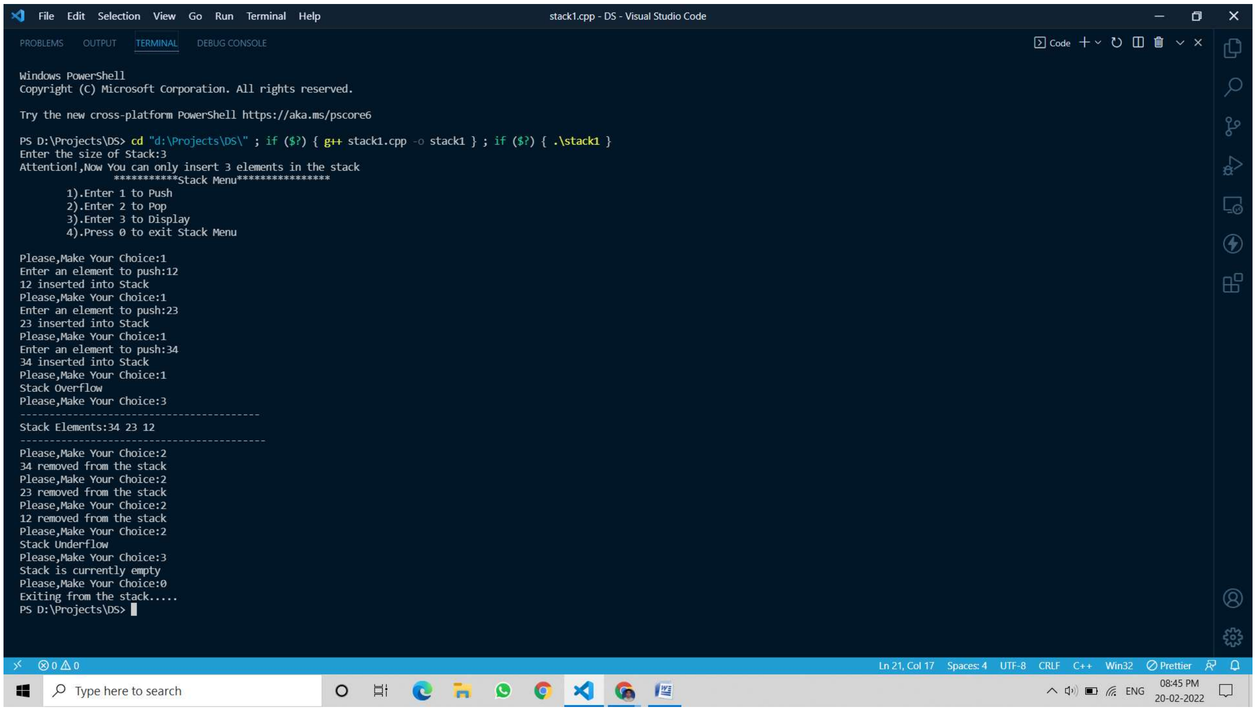
```
#include<iostream>
using namespace std;
int stack[1000],n,top=-1;
void push();
void pop();
void display();
int main()
{
    int ch;
    cout<<"Enter the size of Stack:";
    cin>>n;
    cout<<"Attention!,Now You can only insert "<<n<<" elements in the stack"<<endl;
    cout<<"\t\t***********Stack Menu****************"<<endl;
    cout<<"\t1).Enter 1 to Push"<<endl;
    cout<<"\t2).Enter 2 to Pop"<<endl;
    cout<<"\t3).Enter 3 to Display"<<endl;
    cout<<"\t4).Press 0 to exit Stack Menu"<<endl;
    do{

        cout<<endl<<"Please,Make Your Choice:";
        cin>>ch;
        switch(ch)
        {
            case 1:
            push();
            break;
            case 2:
            pop();
            break;
            case 3:
            display();
            break;
            case 0:
            {
                cout<<"Exiting from the stack....."<<endl;
                exit(0);
            }
            break;
            default:
            cout<<"Invalid Choice";
        }
    }while(ch!=0);
    return 0;
}
void push()
{
    if(top>=n-1)
    cout<<"Stack Overflow";
    else{
        int x;
        cout<<"Enter an element to push:";
```



```
        cin>>x;
        top++;
        stack[top]=x;
        cout<<stack[top]<<" inserted into Stack";
    }
}
void pop()
{
    if(top<=-1)
    cout<<"Stack Underflow";
    else
    {
        cout<<stack[top]<<" removed from the stack";
        top--;
    }
}
void display()
{
    if(top>=0)
    {
        cout<<"-----------------------------------------"<<endl;
        cout<<"Stack Elements:";
        for(int i=top;i>=0;i--)
        {
            cout<<stack[i]<<" ";
        }
        cout<<endl<<"------------------------------------------";
    }
    else
    cout<<"Stack is currently empty";
}
```

Output:



```
Windows PowerShell
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PS D:\Projects\DS> cd "d:\Projects\DS\" ; if ($?) { g++ stack1.cpp -o stack1 } ; if ($?) { .\stack1 }
Enter the size of Stack:3
Attention!,Now You can only insert 3 elements in the stack
                *********** Stack Menu****************
        1).Enter 1 to Push
        2).Enter 2 to Pop
        3).Enter 3 to Display
        4).Press 0 to exit Stack Menu

Please,Make Your Choice:1
Enter an element to push:12
12 inserted into Stack
Please,Make Your Choice:1
Enter an element to push:23
23 inserted into Stack
Please,Make Your Choice:1
Enter an element to push:34
34 inserted into Stack
Please,Make Your Choice:1
Stack Overflow
Please,Make Your Choice:3
-----------------------------------------
Stack Elements:34 23 12
------------------------------------------
Please,Make Your Choice:2
34 removed from the stack
Please,Make Your Choice:2
23 removed from the stack
Please,Make Your Choice:2
12 removed from the stack
Please,Make Your Choice:2
Stack Underflow
Please,Make Your Choice:3
Stack is currently empty
Please,Make Your Choice:0
Exiting from the stack.....
PS D:\Projects\DS> 
```

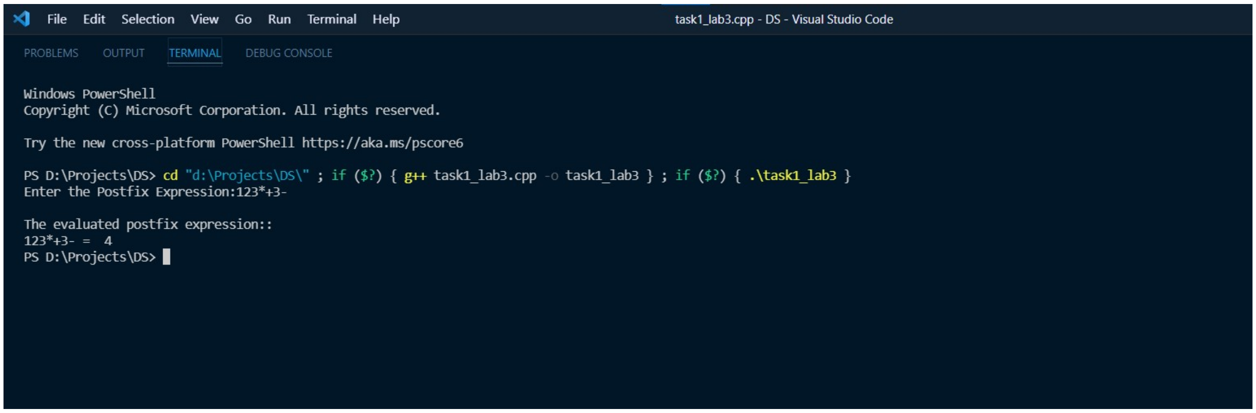
Program 2. Write a program to evaluate a given postfix expression using stacks.

Source Code:

```
#include<iostream>
#include<string.h>
using namespace std;
#define n 100
int top=-1,stack[n];
void push(int e)
{
    top++;
    stack[top]=e;
}
float pop()
{
    float x;
   x= stack[top--];
   return x;

}
int main()
{
    char exp[n];
    float a,b,c;
    int i=0;
    cout<<"Enter the Postfix Expression:";
    cin>>exp;
    while(i<=strlen(exp))
    {
        if(exp[i]==' ')
        continue;
        else if(isdigit(exp[i]))
        {
            push(exp[i]-48);
        }
        else
        {
          a=pop();
          b=pop();
          switch(exp[i])
          {
              case '+':
              c=b+a;
              break;
               case '-':
              c=b-a;
              break;
               case '*':
              c=b*a;
              break;
               case '/':
               if(a==0)
               cout<<"Cannot divide by zero";
               else
              c=b/a;
              break;
          }
          push(c);
        }
        i++;
    }
    cout<<endl<<"The evaluated postfix expression::"<<endl;
    cout<<exp<<" =  "<<stack[top];
}
```

Output:


File Edit Selection View Go Run Terminal Help
task1_lab3.cpp - DS - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE

```
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PS D:\Projects\DS> cd "d:\Projects\DS\" ; if ($?) { g++ task1_lab3.cpp -o task1_lab3 } ; if ($?) { .\task1_lab3 }
Enter the Postfix Expression:123*+3-

The evaluated postfix expression::
123*+3- =  4
PS D:\Projects\DS> 
```
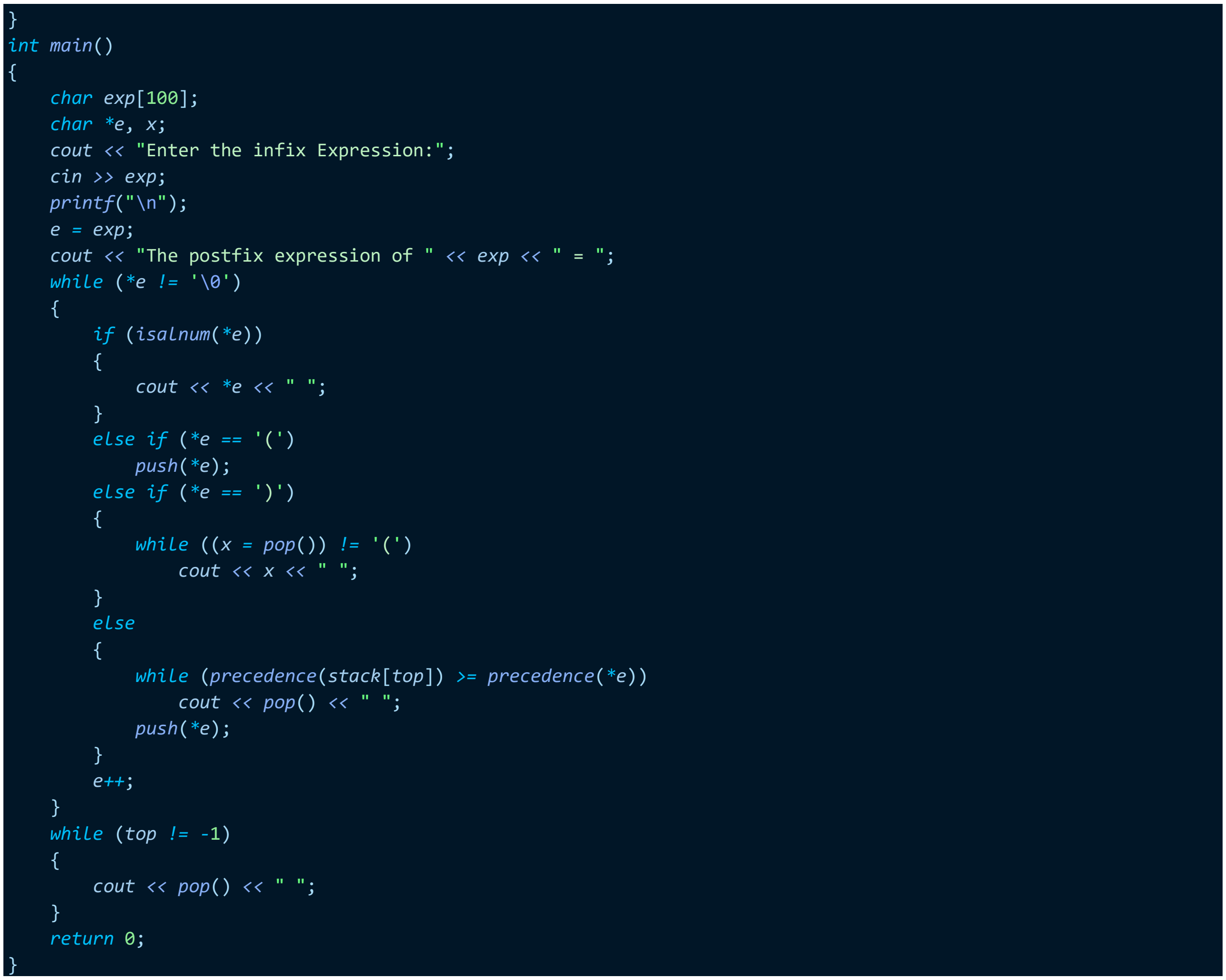

Program 3. Write a program to convert a given infix expression to postfix form using stacks.

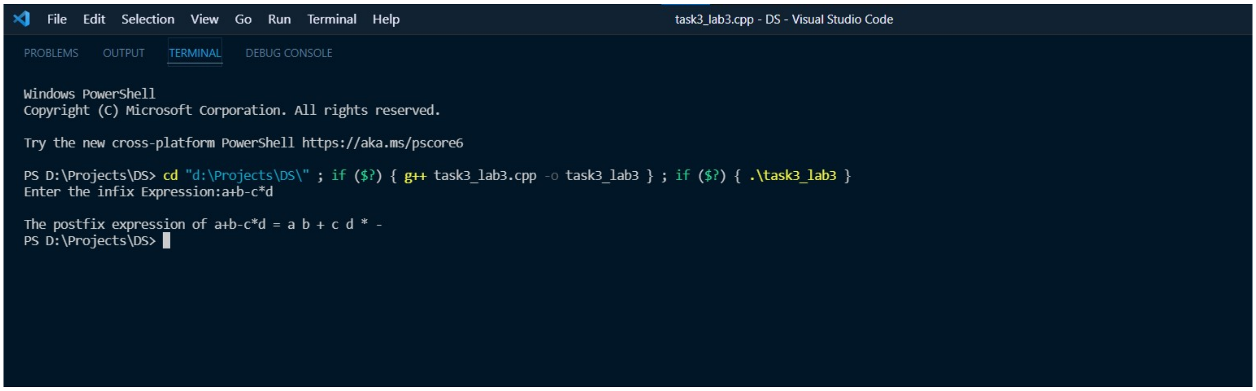
Source Code:

```
#include <iostream>
#define n 100
using namespace std;
char stack[n];
int top = -1;
void push(char c)
{
    stack[++top] = c;
}
char empty()
{
    return stack[top--];
}
char pop()
{
    char ch = stack[top];
    top--;
    return ch;
}
int precedence(char symbol)
{
    if (symbol == '(')
        return 0;
    if (symbol == '+' || symbol == '-')
        return 1;
    if (symbol == '*' || symbol == '/')
        return 2;
    return 0;
```



```
}
int main()
{
    char exp[100];
    char *e, x;
    cout << "Enter the infix Expression:";
    cin >> exp;
    printf("\n");
    e = exp;
    cout << "The postfix expression of " << exp << " = ";
    while (*e != '\0')
    {
        if (isalnum(*e))
        {
            cout << *e << " ";
        }
        else if (*e == '(')
            push(*e);
        else if (*e == ')')
        {
            while ((x = pop()) != '(')
                cout << x << " ";
        }
        else
        {
            while (precedence(stack[top]) >= precedence(*e))
                cout << pop() << " ";
            push(*e);
        }
        e++;
    }
    while (top != -1)
    {
        cout << pop() << " ";
    }
    return 0;
}
```

Output:



```
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Projects\DS> cd "d:\Projects\DS\" ; if ($?) { g++ task3_lab3.cpp -o task3_lab3 } ; if ($?) { .\task3_lab3 }
Enter the infix Expression:a+b-c*d

The postfix expression of a+b-c*d = a b + c d * -
PS D:\Projects\DS> 
```
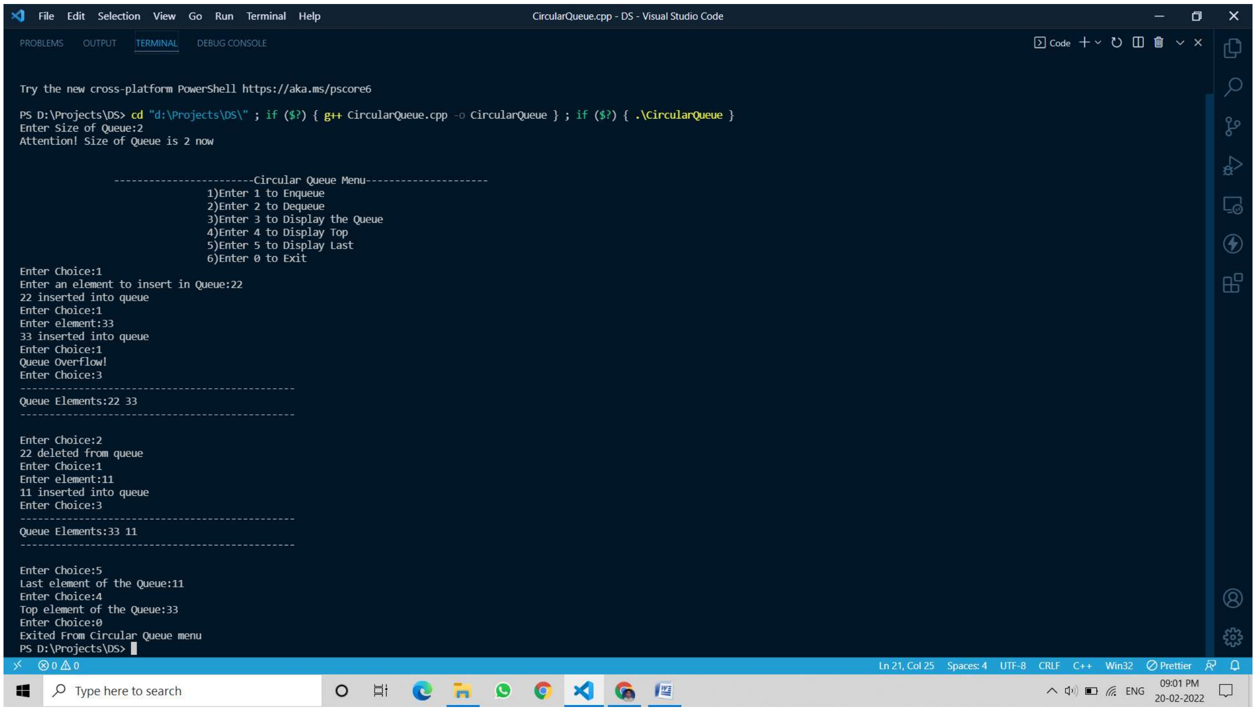

Program 4. Write a program to implement circular queue using arrays

Source Code:

```
#include <iostream>
using namespace std;
int queue[1000], n, front = -1, rear = -1;
void insertion();
void deletion();
void display();
void top();
void last();
int main()
{
    cout << "Enter Size of Queue:";
    cin >> n;
    cout << "Attention! Size of Queue is " << n << " now" << endl;
    int ch;
    cout << "\n\n\t\t------------------------Circular Queue Menu---------------------";
    cout << "\n\t\t\t\t1)Enter 1 to Enqueue";
    cout << "\n\t\t\t\t2)Enter 2 to Dequeue";
    cout << "\n\t\t\t\t3)Enter 3 to Display the Queue";
    cout << "\n\t\t\t\t4)Enter 4 to Display Top";
    cout << "\n\t\t\t\t5)Enter 5 to Display Last";
    cout << "\n\t\t\t\t6)Enter 0 to Exit";
    while (ch != 0)
    {
        cout << "\nEnter Choice:";
        cin >> ch;
        switch (ch)
        {
        case 1:
            insertion();
            break;
        case 2:
            deletion();
            break;
        case 3:
            display();
            break;
            case 4:
            top();
            break;
            case 5:
            last();
            break;
        case 0:
        {
            cout << "Exited From Circular Queue menu";
            exit(0);
        }
        break;
        default:
            cout << "Invalid Respnse";
        }
    }
    return 0;
}
void insertion()
{
    int data;
    if ((rear + 1) % n == front)
    {
        cout << "Queue Overflow!";
    }
    else if (front == -1 && rear == -1)
    {
        front = rear = 0;
        cout << "Enter an element to insert in Queue:";
        cin >> data;
        queue[rear] = data;
        cout << data << " inserted into queue";
    }

    else
    {
        cout << "Enter element:";
        cin >> data;
        rear = (rear + 1) % n;
        queue[rear] = data;
        cout << data << " inserted into queue";
    }
}
void deletion()
{
    if (front == -1)
    {
        cout << "Queue Underflow!";
    }
    else if (front == rear)
    {
        cout << queue[front] << " deleted from queue";
        front = rear = -1;
    }
    else
    {
        cout << queue[front] << " deleted from queue";
        front = (front + 1) % n;
    }
}
void top()
{
    cout<<"Top element of the Queue:"<<queue[front];
}
void last()
{
    cout<<"Last element of the Queue:"<<queue[rear];
}
void display()
{

    if (front == -1 && rear == -1)
    {
        cout << "Queue is empty Currently!";
    }
    else
    {
        cout << "-----------------------------------------------" << endl;
        cout << "Queue Elements:";

        for (int i = front; i != rear; i = (i + 1) % n)
        {
            cout << queue[i] << " ";
        }
        cout << queue[rear];
        cout << endl << "----------------------------------------------" << endl;
    }
}
```

Output:

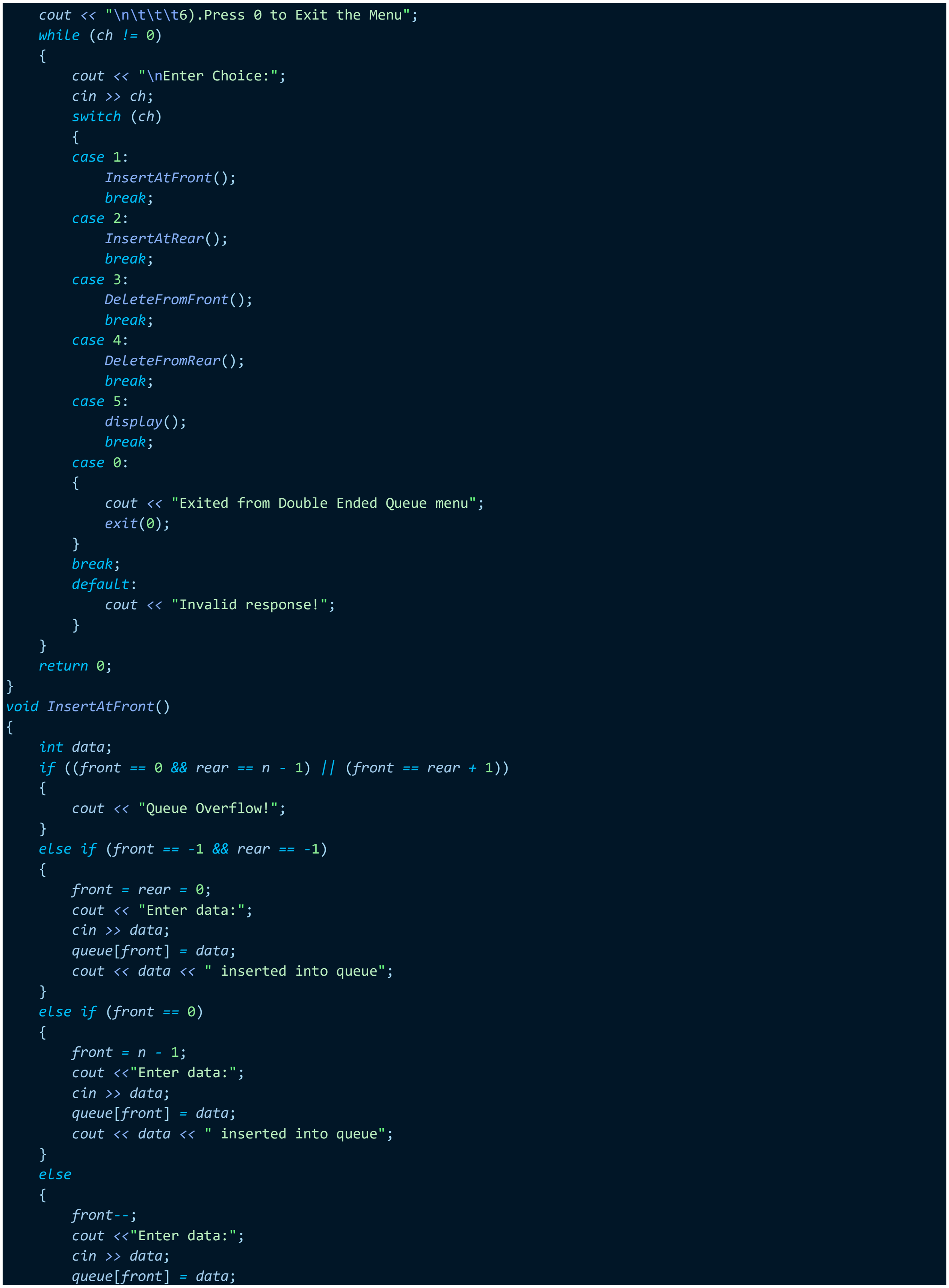


```
Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Projects\DS> cd "d:\Projects\DS\" ; if ($?) { g++ CircularQueue.cpp -o CircularQueue } ; if ($?) { .\CircularQueue }
Enter Size of Queue:2
Attention! Size of Queue is 2 now


                ------------------------Circular Queue Menu--------------------
                                1)Enter 1 to Enqueue
                                2)Enter 2 to Dequeue
                                3)Enter 3 to Display the Queue
                                4)Enter 4 to Display Top
                                5)Enter 5 to Display Last
                                6)Enter 0 to Exit
Enter Choice:1
Enter an element to insert in Queue:22
22 inserted into queue
Enter Choice:1
Enter element:33
33 inserted into queue
Enter Choice:1
Queue Overflow!
Enter Choice:3
-----------------------------------------------
Queue Elements:22 33
-----------------------------------------------

Enter Choice:2
22 deleted from queue
Enter Choice:1
Enter element:11
11 inserted into queue
Enter Choice:3
-----------------------------------------------
Queue Elements:33 11
-----------------------------------------------

Enter Choice:5
Last element of the Queue:11
Enter Choice:4
Top element of the Queue:33
Enter Choice:0
Exited From Circular Queue menu
PS D:\Projects\DS>
```

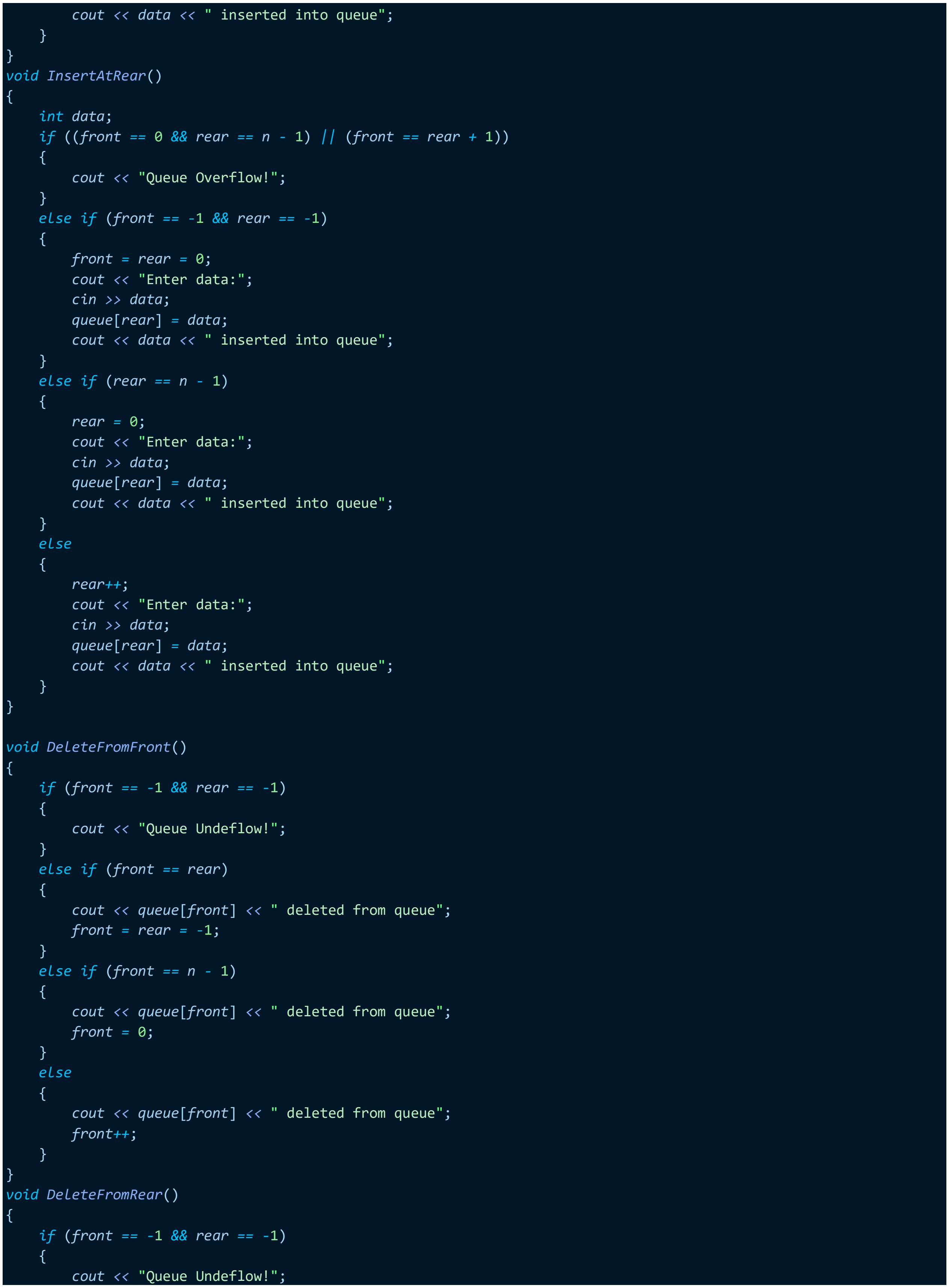
Program5. Write a program to implement double ended queue (de queue) using arrays.

Source Code:

```
#include <iostream>
using namespace std;
int queue[1000],n ,front = -1, rear = -1;
void InsertAtFront();
void InsertAtRear();
void DeleteFromFront();
void DeleteFromRear();
void display();

int main()
{
    cout<<"Enter the size of Queue:";
    cin>>n;
    int ch;
    cout << "\n\n\t\t\t-------------Double Ended Queue Menu---------------";
    cout << "\n\t\t\t1).Insert element At the front side";
    cout << "\n\t\t\t2).Insert element At the rear side";
    cout << "\n\t\t\t3).Delete element from the front side";
    cout << "\n\t\t\t4).Delete element from the rear side";
    cout << "\n\t\t\t5).Display";
```

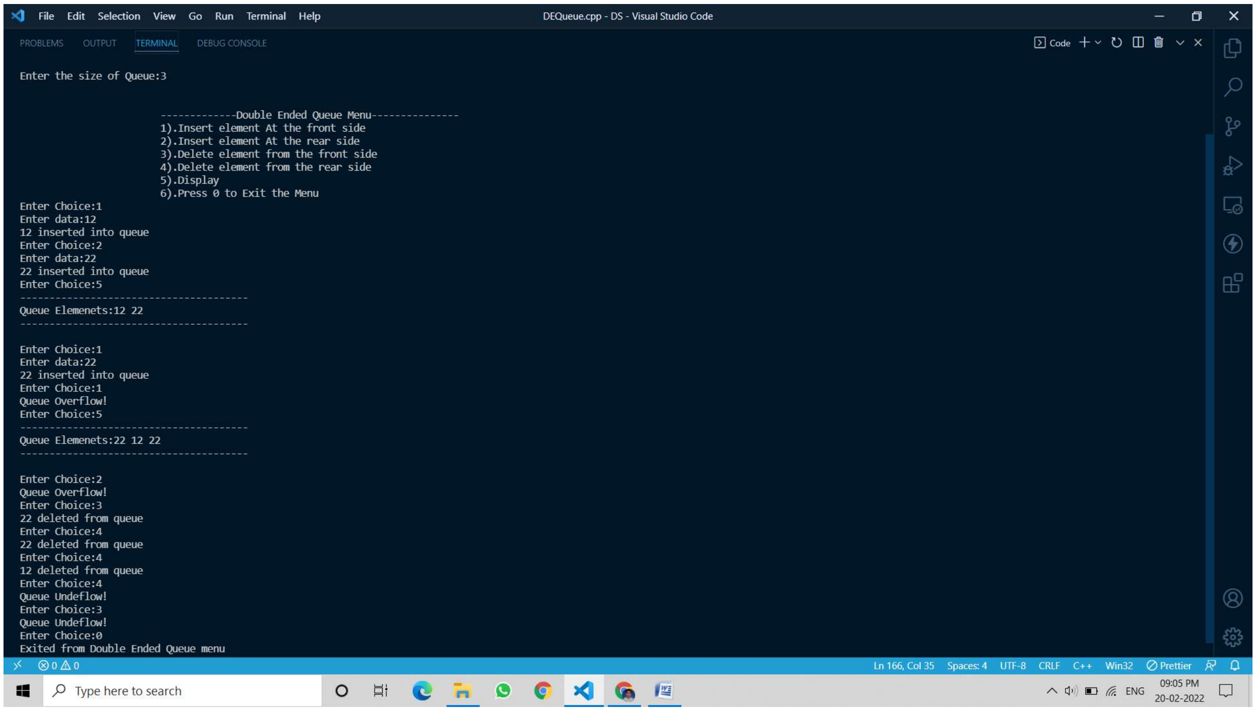


```
    cout << "\n\t\t\t6).Press 0 to Exit the Menu";
    while (ch != 0)
    {
        cout << "\nEnter Choice:";
        cin >> ch;
        switch (ch)
        {
        case 1:
            InsertAtFront();
            break;
        case 2:
            InsertAtRear();
            break;
        case 3:
            DeleteFromFront();
            break;
        case 4:
            DeleteFromRear();
            break;
        case 5:
            display();
            break;
        case 0:
        {
            cout << "Exited from Double Ended Queue menu";
            exit(0);
        }
        break;
        default:
            cout << "Invalid response!";
        }
    }
    return 0;
}
void InsertAtFront()
{
    int data;
    if ((front == 0 && rear == n - 1) || (front == rear + 1))
    {
        cout << "Queue Overflow!";
    }
    else if (front == -1 && rear == -1)
    {
        front = rear = 0;
        cout << "Enter data:";
        cin >> data;
        queue[front] = data;
        cout << data << " inserted into queue";
    }
    else if (front == 0)
    {
        front = n - 1;
        cout <<"Enter data:";
        cin >> data;
        queue[front] = data;
        cout << data << " inserted into queue";
    }
    else
    {
        front--;
        cout <<"Enter data:";
        cin >> data;
        queue[front] = data;
```



```
        cout << data << " inserted into queue";
    }
}
void InsertAtRear()
{
    int data;
    if ((front == 0 && rear == n - 1) || (front == rear + 1))
    {
        cout << "Queue Overflow!";
    }
    else if (front == -1 && rear == -1)
    {
        front = rear = 0;
        cout << "Enter data:";
        cin >> data;
        queue[rear] = data;
        cout << data << " inserted into queue";
    }
    else if (rear == n - 1)
    {
        rear = 0;
        cout << "Enter data:";
        cin >> data;
        queue[rear] = data;
        cout << data << " inserted into queue";
    }
    else
    {
        rear++;
        cout << "Enter data:";
        cin >> data;
        queue[rear] = data;
        cout << data << " inserted into queue";
    }
}

void DeleteFromFront()
{
    if (front == -1 && rear == -1)
    {
        cout << "Queue Undeflow!";
    }
    else if (front == rear)
    {
        cout << queue[front] << " deleted from queue";
        front = rear = -1;
    }
    else if (front == n - 1)
    {
        cout << queue[front] << " deleted from queue";
        front = 0;
    }
    else
    {
        cout << queue[front] << " deleted from queue";
        front++;
    }
}
void DeleteFromRear()
{
    if (front == -1 && rear == -1)
    {
        cout << "Queue Undeflow!";
    }
    else if (front == rear)
    {
        cout << queue[rear] << " deleted from queue";
        front = rear = -1;
    }
    else if (rear == 0)
    {
        cout << queue[rear] << " deleted from queue";
        rear = front - 1;
    }
    else
    {
        cout << queue[rear] << " deleted from queue";
        rear--;
    }
}
void display()
{
    if (front == -1 && rear == -1)
    {
        cout << "Queue Undeflow!";
    }
    else
    {
        cout << "---------------------------------------" << endl;
        cout << "Queue Elemenets:";
        for (int i = front; i != rear; i = (i + 1) % n)
        {
            cout << queue[i] << " ";
        }
        cout << queue[rear];
        cout << endl<< "---------------------------------------" << endl;
    }
}
```

Output:



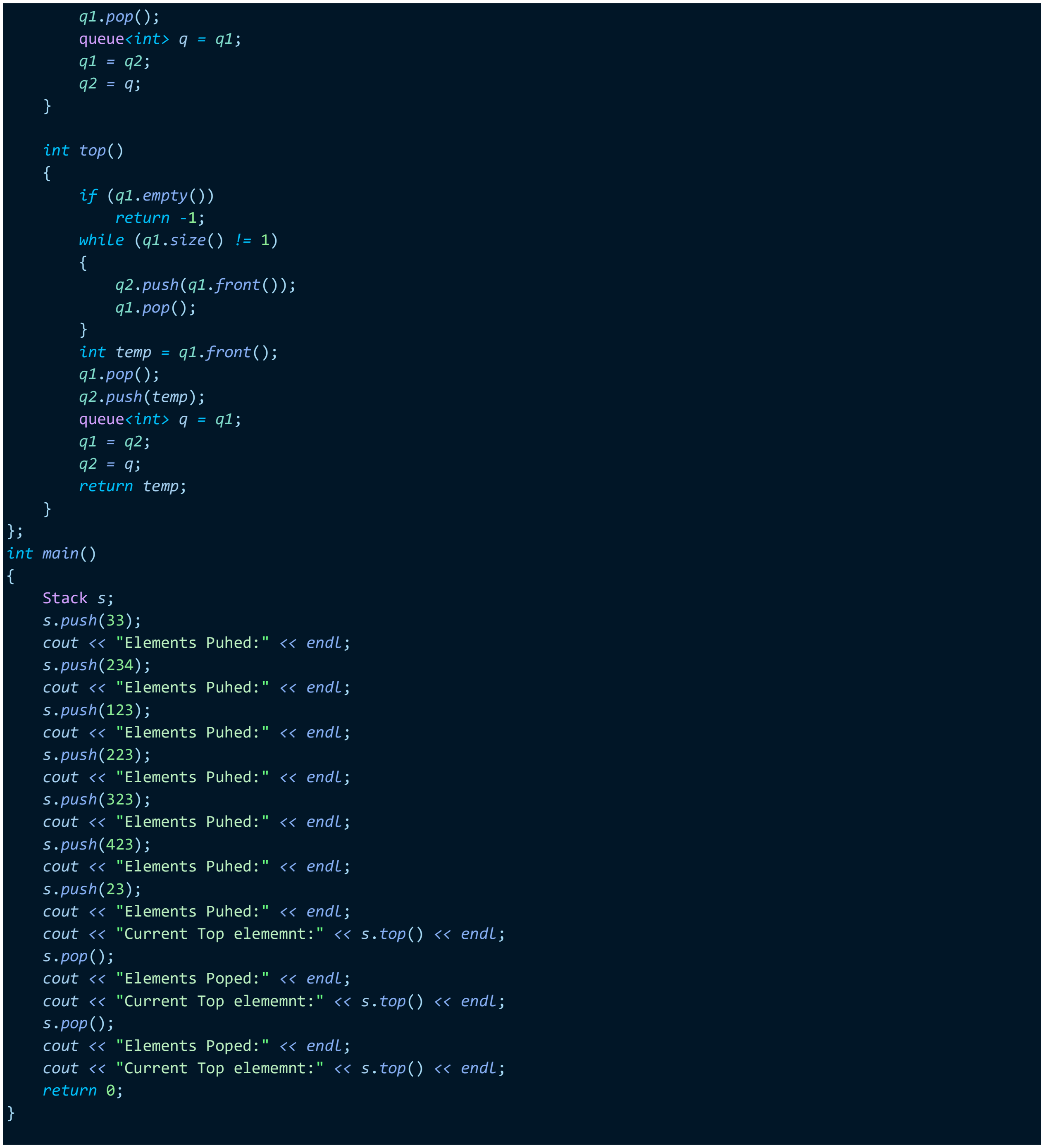
File Edit Selection View Go Run Terminal Help
DEQueue.cpp - DS - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
Code
Ln 166, Col 35 Spaces: 4 UTF-8 CRLF C++ Win32 Prettier
Type here to search
ENG
09:05 PM
20-02-2022

```
Enter the size of Queue:3


                        ------------Double Ended Queue Menu--------------
                        1).Insert element At the front side
                        2).Insert element At the rear side
                        3).Delete element from the front side
                        4).Delete element from the rear side
                        5).Display
                        6).Press 0 to Exit the Menu
Enter Choice:1
Enter data:12
12 inserted into queue
Enter Choice:2
Enter data:22
22 inserted into queue
Enter Choice:5
---------------------------------------
Queue Elemenets:12 22
---------------------------------------

Enter Choice:1
Enter data:22
22 inserted into queue
Enter Choice:1
Queue Overflow!
Enter Choice:5
---------------------------------------
Queue Elemenets:22 12 22
---------------------------------------

Enter Choice:2
Queue Overflow!
Enter Choice:3
22 deleted from queue
Enter Choice:4
22 deleted from queue
Enter Choice:4
12 deleted from queue
Enter Choice:4
Queue Undeflow!
Enter Choice:3
Queue Undeflow!
Enter Choice:0
Exited from Double Ended Queue menu
```

Program6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.

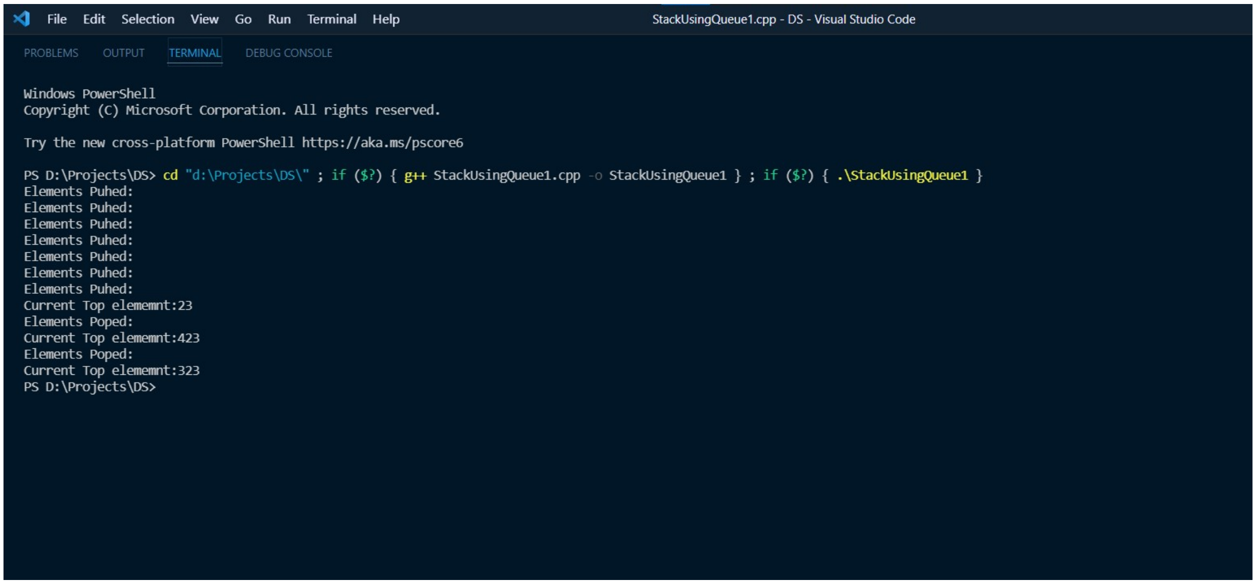
Source Code:

```
#include <bits/stdc++.h>
using namespace std;
class Stack
{
    queue<int> q1, q2;
    int curr_size;

public:
    void push(int x)
    {
        q1.push(x);
    }
    void pop()
    {
        if (q1.empty())
            return;
        while (q1.size() != 1)
        {
            q2.push(q1.front());
            q1.pop();
        }
```



```
        q1.pop();
        queue<int> q = q1;
        q1 = q2;
        q2 = q;
    }

    int top()
    {
        if (q1.empty())
            return -1;
        while (q1.size() != 1)
        {
            q2.push(q1.front());
            q1.pop();
        }
        int temp = q1.front();
        q1.pop();
        q2.push(temp);
        queue<int> q = q1;
        q1 = q2;
        q2 = q;
        return temp;
    }
};
int main()
{
    Stack s;
    s.push(33);
    cout << "Elements Puhed:" << endl;
    s.push(234);
    cout << "Elements Puhed:" << endl;
    s.push(123);
    cout << "Elements Puhed:" << endl;
    s.push(223);
    cout << "Elements Puhed:" << endl;
    s.push(323);
    cout << "Elements Puhed:" << endl;
    s.push(423);
    cout << "Elements Puhed:" << endl;
    s.push(23);
    cout << "Elements Puhed:" << endl;
    cout << "Current Top elememnt:" << s.top() << endl;
    s.pop();
    cout << "Elements Poped:" << endl;
    cout << "Current Top elememnt:" << s.top() << endl;
    s.pop();
    cout << "Elements Poped:" << endl;
    cout << "Current Top elememnt:" << s.top() << endl;
    return 0;
}
```

Output:



```
Windows PowerShell
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PS D:\Projects\DS> cd "d:\Projects\DS\" ; if ($?) { g++ StackUsingQueue1.cpp -o StackUsingQueue1 } ; if ($?) { .\StackUsingQueue1 }
Elements Puhed:
Elements Puhed:
Elements Puhed:
Elements Puhed:
Elements Puhed:
Elements Puhed:
Elements Puhed:
Current Top elememnt:23
Elements Poped:
Current Top elememnt:423
Elements Poped:
Current Top elememnt:323
PS D:\Projects\DS>
```
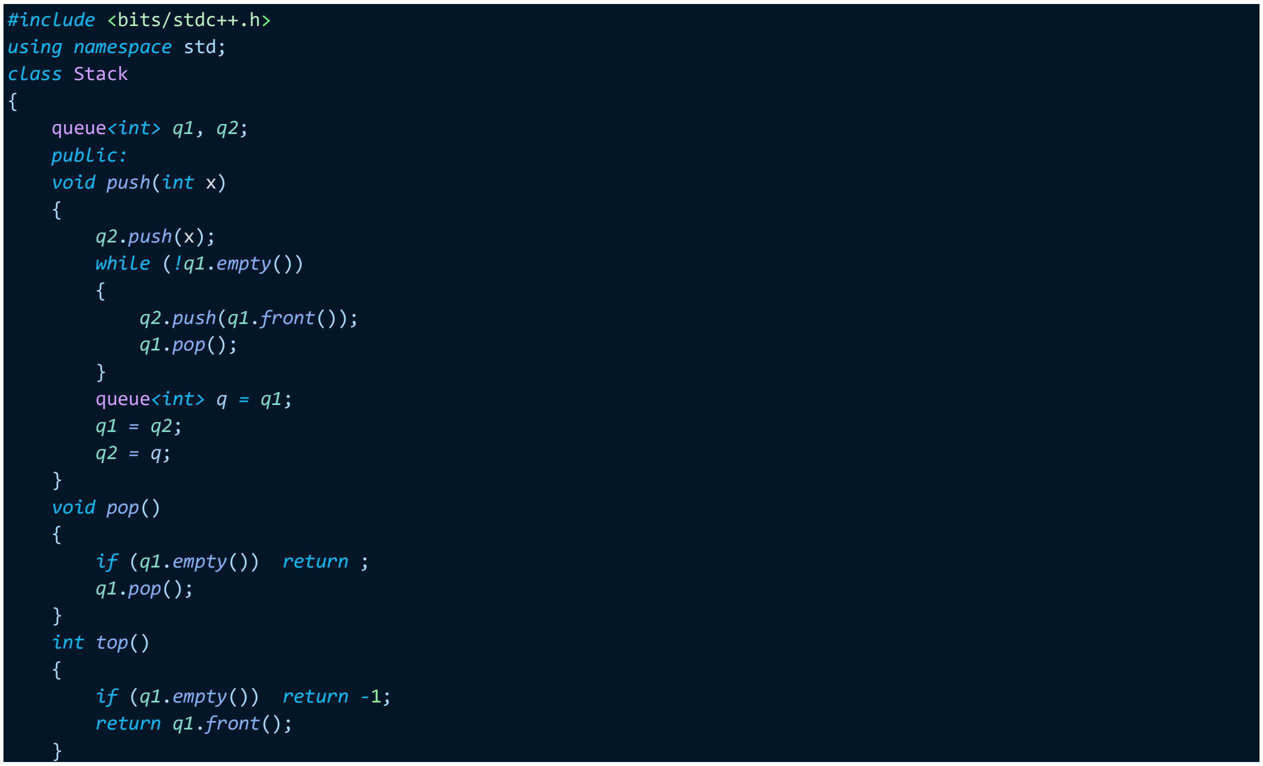
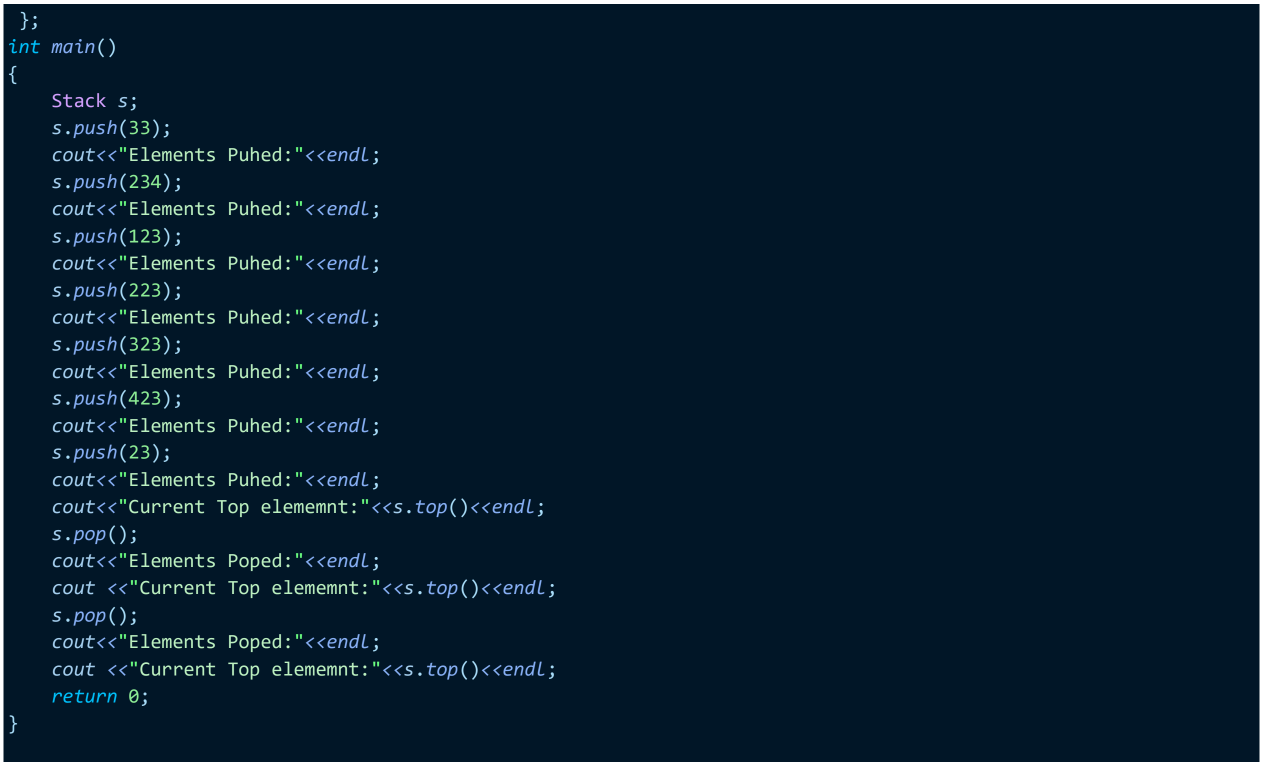

Program7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time.

Source Code:

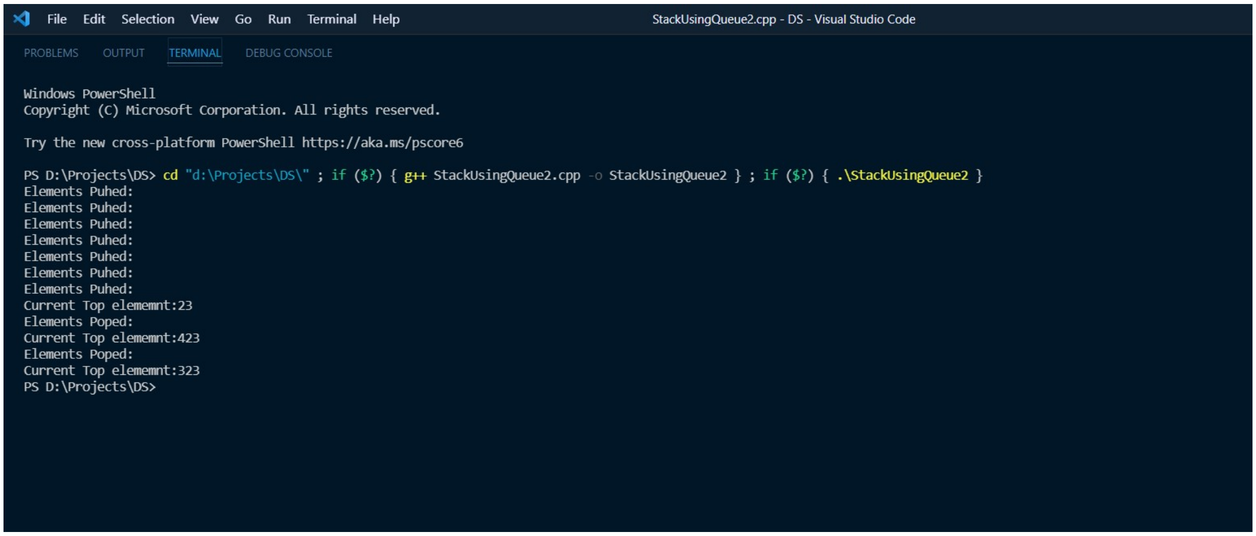


```cpp
#include <bits/stdc++.h>
using namespace std;
class Stack
{
    queue<int> q1, q2;
    public:
    void push(int x)
    {
        q2.push(x);
        while (!q1.empty())
        {
            q2.push(q1.front());
            q1.pop();
        }
        queue<int> q = q1;
        q1 = q2;
        q2 = q;
    }
    void pop()
    {
        if (q1.empty())  return ;
        q1.pop();
    }
    int top()
    {
        if (q1.empty())  return -1;
        return q1.front();
    }
```



```
 };
int main()
{
    Stack s;
    s.push(33);
    cout<<"Elements Puhed:"<<endl;
    s.push(234);
    cout<<"Elements Puhed:"<<endl;
    s.push(123);
    cout<<"Elements Puhed:"<<endl;
    s.push(223);
    cout<<"Elements Puhed:"<<endl;
    s.push(323);
    cout<<"Elements Puhed:"<<endl;
    s.push(423);
    cout<<"Elements Puhed:"<<endl;
    s.push(23);
    cout<<"Elements Puhed:"<<endl;
    cout<<"Current Top elememnt:"<<s.top()<<endl;
    s.pop();
    cout<<"Elements Poped:"<<endl;
    cout <<"Current Top elememnt:"<<s.top()<<endl;
    s.pop();
    cout<<"Elements Poped:"<<endl;
    cout <<"Current Top elememnt:"<<s.top()<<endl;
    return 0;
}
```

Output:



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Projects\DS> cd "d:\Projects\DS\" ; if ($?) { g++ StackUsingQueue2.cpp -o StackUsingQueue2 } ; if ($?) { .\StackUsingQueue2 }
Elements Puhed:
Elements Puhed:
Elements Puhed:
Elements Puhed:
Elements Puhed:
Elements Puhed:
Elements Puhed:
Current Top elememnt:23
Elements Poped:
Current Top elememnt:423
Elements Poped:
Current Top elememnt:323
PS D:\Projects\DS>
```

Program8. Write a program to implement a queue using two stacks such that the enqueue operation runs in constant time and the dequeue operation runs in linear time.

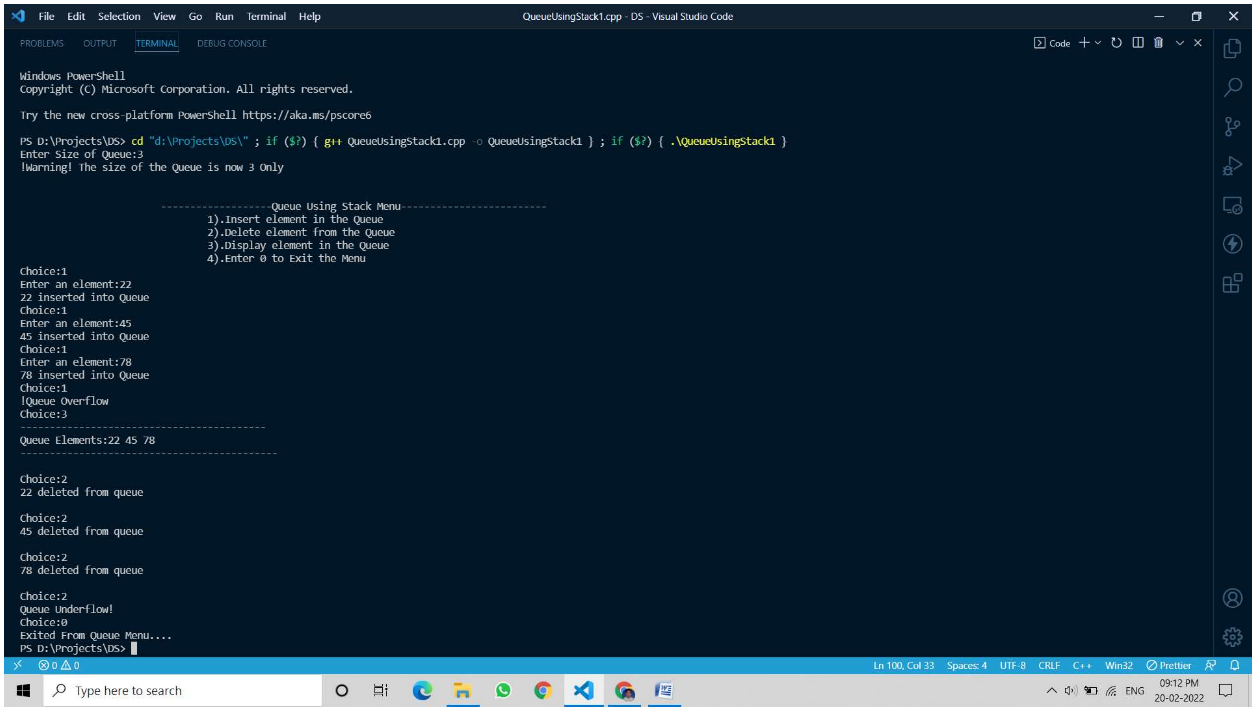
Source Code:

```
#include <iostream>
using namespace std;
int stk1[1000], stk2[1000], n, top1 = -1, top2 = -1, count = 0;
void stack1_push(int a);
int stack1_pop();
void stack2_push(int a);
int stack2_pop();
void queue_insert();
void queue_delete();
void display();
int main()
{
    cout << "Enter Size of Queue:";
    cin >> n;
    cout<<"!Warning! The size of the Queue is now "<<n<<" Only"<<endl;
    cout << "\n\n\t\t\t-------------------Queue Using Stack Menu-------------------------";
    cout << "\n\t\t\t\t1).Insert element in the Queue";
    cout << "\n\t\t\t\t2).Delete element from the Queue";
    cout << "\n\t\t\t\t3).Display element in the Queue";
    cout << "\n\t\t\t\t4).Enter 0 to Exit the Menu";

    int ch;
    while (ch != 0)
    {
        cout <<"\nChoice:";
        cin >> ch;
        switch (ch)
        {
        case 1:
            queue_insert();
            break;
        case 2:
            queue_delete();
            break;
        case 3:
            display();
            break;
        case 0:
        {
            cout<<"Exited From Queue Menu....";
            exit(0);
        }
        break;
        default:
        {
            cout << "Invalid";
        }
        }
    }
    return 0;
}
void stack1_push(int data)
{
    if (top1 == n - 1)
        cout << "!Overflow";
    else
    {
        top1++;
        stk1[top1] = data;
    }
}
int stack1_pop()
{
    if (top1 == -1)
        cout << "underflow!";
    else
    {
        int p = stk1[top1];
        top1--;
        return p;
    }
}
void stack2_push(int data)
{
    if (top2 == n - 1)
        cout << "Overflow!";
    else
    {
        top2++;
        stk2[top2] = data;
    }
}
int stack2_pop()
{
    if (top2 == -1)
        cout << "underflow!";
    else
    {
        int p = stk2[top2];
        top2--;
        return p;
    }
}
void queue_insert()
{
     if (top1 == n - 1)
        cout << "!Queue Overflow";
        else{
    int e;
    cout << "Enter an element:";
    cin >> e;
    cout << e << " inserted into Queue";
    stack1_push(e);
    count++;
        }
}
void queue_delete()
{
    if (top1 == -1 && top2 == -1)
        cout << "Queue Underflow!";
    else
    {
        for (int i = 0; i < count; i++)
        {
            int x = stack1_pop();
            stack2_push(x);
        }
        int b = stack2_pop();
```

```cpp
        cout << b << " deleted from queue";
        cout << endl;
        count--;
        for (int i = 0; i < count; i++)
        {
            int y = stack2_pop();
            stack1_push(y);
        }
    }
}
void display()
{
    if (top1 == -1 && top2 == -1)
        cout << "Queue is empty currently";
    else
    {
        cout << "------------------------------------------" << endl;
        cout << "Queue Elements:";
        for (int i = 0; i <= top1; i++)
        {
            cout << stk1[i] << " ";
        }
        cout << endl
             << "--------------------------------------------" << endl;
    }
}
```

Output:



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Projects\DS> cd "d:\Projects\DS\" ; if ($?) { g++ QueueUsingStack1.cpp -o QueueUsingStack1 } ; if ($?) { .\QueueUsingStack1 }
Enter Size of Queue:3
!Warning! The size of the Queue is now 3 Only


                        ------------------Queue Using Stack Menu------------------------
                                1).Insert element in the Queue
                                2).Delete element from the Queue
                                3).Display element in the Queue
                                4).Enter 0 to Exit the Menu
Choice:1
Enter an element:22
22 inserted into Queue
Choice:1
Enter an element:45
45 inserted into Queue
Choice:1
Enter an element:78
78 inserted into Queue
Choice:1
!Queue Overflow
Choice:3
------------------------------------------
Queue Elements:22 45 78
--------------------------------------------

Choice:2
22 deleted from queue

Choice:2
45 deleted from queue

Choice:2
78 deleted from queue

Choice:2
Queue Underflow!
Choice:0
Exited From Queue Menu....
PS D:\Projects\DS>
```
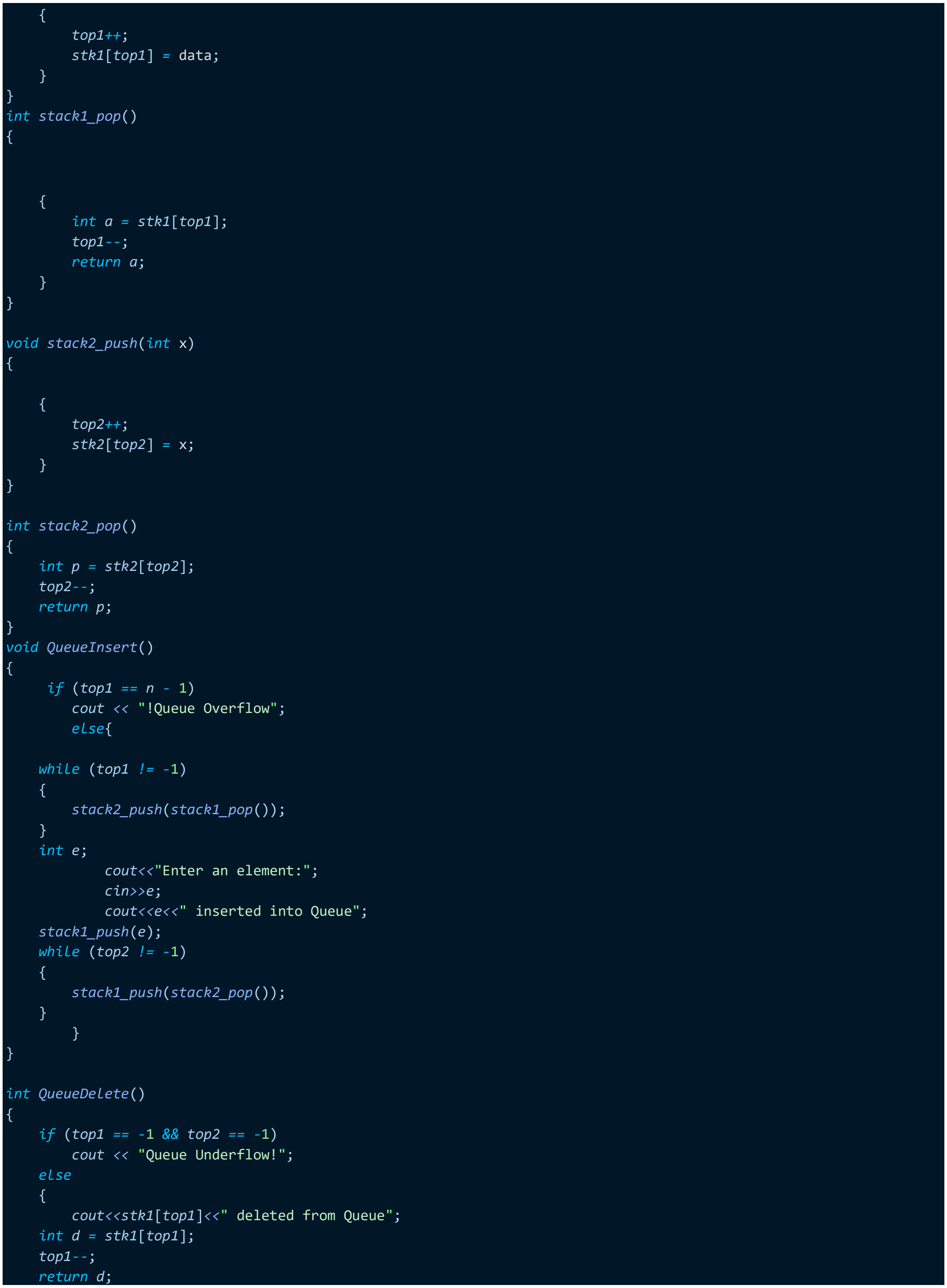

Program9. Write a program to implement a queue using two stacks such that the enqueue operation runs in linear time and the dequeue operation runs in constant time.

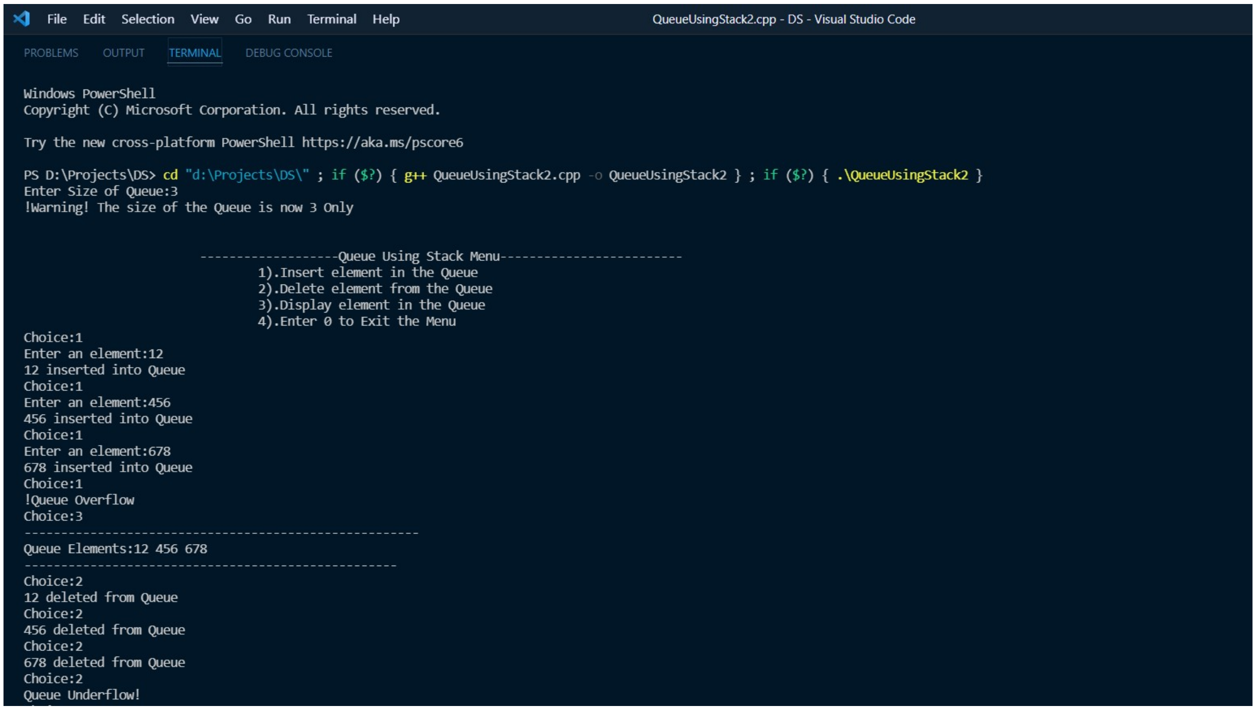
Source Code:

```
#include <iostream>
using namespace std;
int stk1[1000], stk2[1000],n;
int top1 = -1, top2 = -1;
void stack1_push(int data);
int stack1_pop();
void stack2_push(int x);
int stack2_pop();
void QueueInsert();
int QueueDelete();
void display();

int main()
{
       cout << "Enter Size of Queue:";
    cin >> n;
    cout<<"!Warning! The size of the Queue is now "<<n<<" Only"<<endl;
    cout << "\n\n\t\t\t-------------------Queue Using Stack Menu-------------------------";
    cout << "\n\t\t\t\t1).Insert element in the Queue";
    cout << "\n\t\t\t\t2).Delete element from the Queue";
    cout << "\n\t\t\t\t3).Display element in the Queue";
    cout << "\n\t\t\t\t4).Enter 0 to Exit the Menu";

    int ch;
    while (ch != 0)
    {
        cout << endl
             << "Choice:";
        cin >> ch;
        switch (ch)
        {
        case 1:
        {
            QueueInsert();
        }
            break;
        case 2:
            QueueDelete();
            break;
        case 3:
            display();
            break;
        case 0:
            exit(0);
            break;
        default:
            cout << "Invalid";
        }
    }
    return 0;
}
void stack1_push(int data)
{
```



```
    {
        top1++;
        stk1[top1] = data;
    }
}
int stack1_pop()
{


    {
        int a = stk1[top1];
        top1--;
        return a;
    }
}

void stack2_push(int x)
{

    {
        top2++;
        stk2[top2] = x;
    }
}

int stack2_pop()
{
    int p = stk2[top2];
    top2--;
    return p;
}
void QueueInsert()
{
     if (top1 == n - 1)
        cout << "!Queue Overflow";
        else{

    while (top1 != -1)
    {
        stack2_push(stack1_pop());
    }
    int e;
            cout<<"Enter an element:";
            cin>>e;
            cout<<e<<" inserted into Queue";
    stack1_push(e);
    while (top2 != -1)
    {
        stack1_push(stack2_pop());
    }
        }
}

int QueueDelete()
{
    if (top1 == -1 && top2 == -1)
        cout << "Queue Underflow!";
    else
    {
        cout<<stk1[top1]<<" deleted from Queue";
    int d = stk1[top1];
    top1--;
    return d;
    }
}

void display()
{
    if (top1 == -1 && top2 == -1)
    {
        cout << "Queue is empty now!";
    }
    else
    {
        cout<<"------------------------------------------------------"<<endl;
        cout<<"Queue Elements:";
        for (int i = top1; i >= 0; i--)
        {
            cout << stk1[i] << " ";
        }
        cout<<endl<<"---------------------------------------------------";
    }
}
```

Output:



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Projects\DS> cd "d:\Projects\DS\" ; if ($?) { g++ QueueUsingStack2.cpp -o QueueUsingStack2 } ; if ($?) { .\QueueUsingStack2 }
Enter Size of Queue:3
!Warning! The size of the Queue is now 3 Only


                          ------------------Queue Using Stack Menu-------------------------
                                  1).Insert element in the Queue
                                  2).Delete element from the Queue
                                  3).Display element in the Queue
                                  4).Enter 0 to Exit the Menu
Choice:1
Enter an element:12
12 inserted into Queue
Choice:1
Enter an element:456
456 inserted into Queue
Choice:1
Enter an element:678
678 inserted into Queue
Choice:1
!Queue Overflow
Choice:3
------------------------------------------------------
Queue Elements:12 456 678
---------------------------------------------------
Choice:2
12 deleted from Queue
Choice:2
456 deleted from Queue
Choice:2
678 deleted from Queue
Choice:2
Queue Underflow!
```
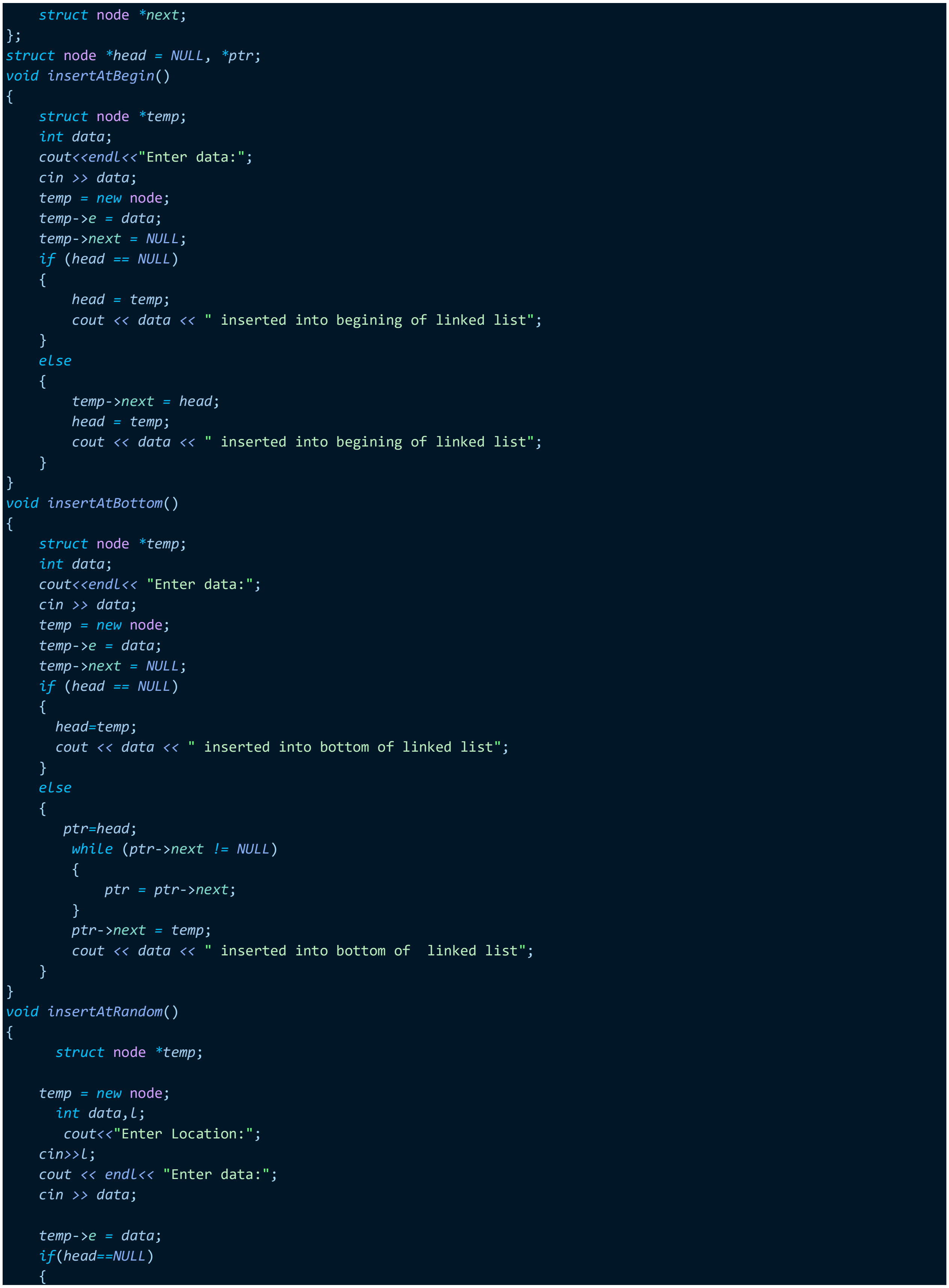

Program10. Write program to implement the Single linked list

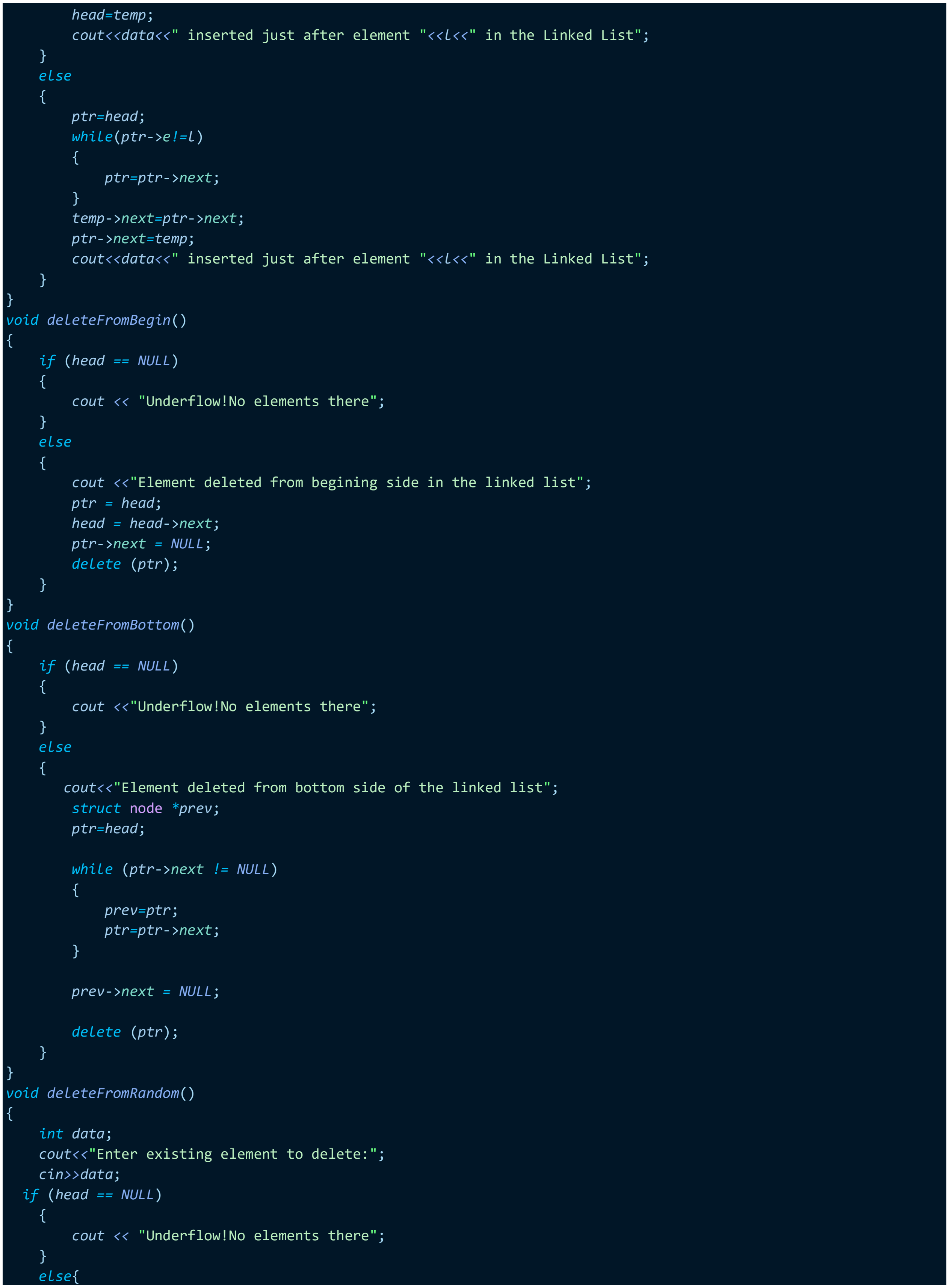
Source Code:

Output:

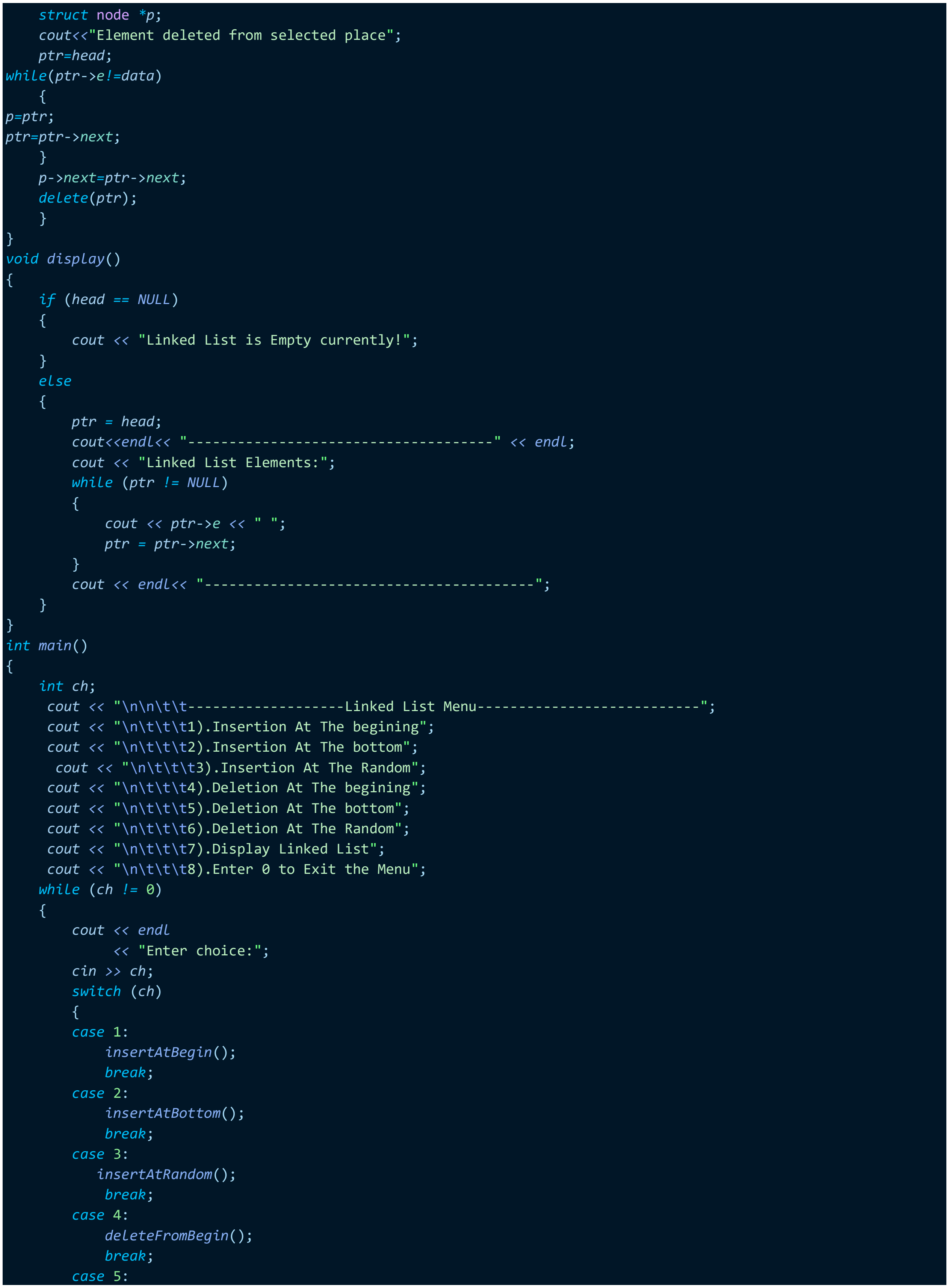
```
#include <iostream>
using namespace std;
struct node
{
    int e;
```



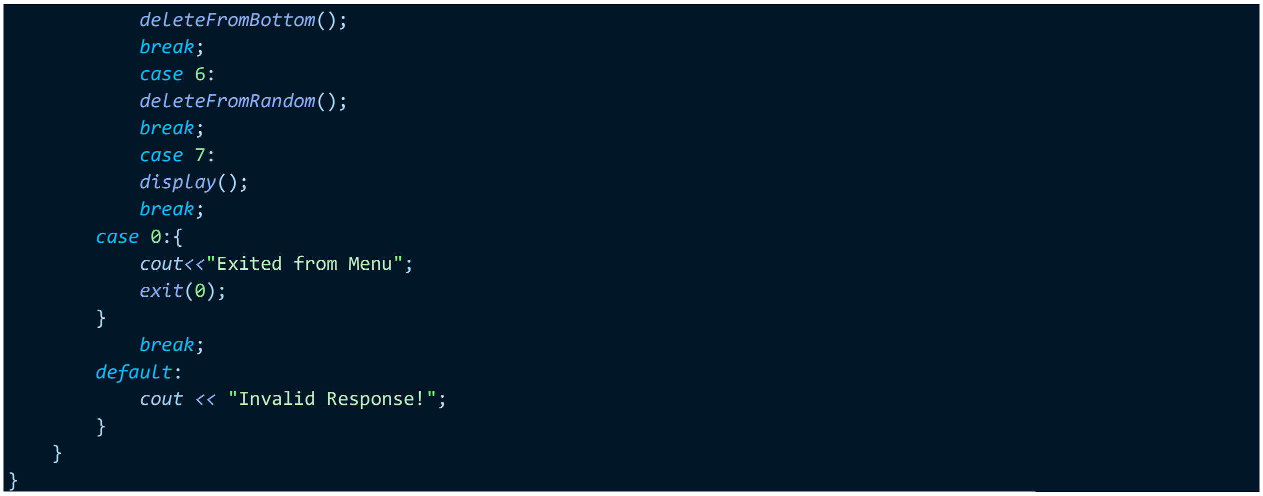
```
    struct node *next;
};
struct node *head = NULL, *ptr;
void insertAtBegin()
{
    struct node *temp;
    int data;
    cout<<endl<<"Enter data:";
    cin >> data;
    temp = new node;
    temp->e = data;
    temp->next = NULL;
    if (head == NULL)
    {
        head = temp;
        cout << data << " inserted into begining of linked list";
    }
    else
    {
        temp->next = head;
        head = temp;
        cout << data << " inserted into begining of linked list";
    }
}
void insertAtBottom()
{
    struct node *temp;
    int data;
    cout<<endl<< "Enter data:";
    cin >> data;
    temp = new node;
    temp->e = data;
    temp->next = NULL;
    if (head == NULL)
    {
      head=temp;
      cout << data << " inserted into bottom of linked list";
    }
    else
    {
       ptr=head;
        while (ptr->next != NULL)
        {
            ptr = ptr->next;
        }
        ptr->next = temp;
        cout << data << " inserted into bottom of  linked list";
    }
}
void insertAtRandom()
{
      struct node *temp;

    temp = new node;
      int data,l;
       cout<<"Enter Location:";
    cin>>l;
    cout << endl<< "Enter data:";
    cin >> data;

    temp->e = data;
    if(head==NULL)
    {
```



```
        head=temp;
        cout<<data<<" inserted just after element "<<l<<" in the Linked List";
    }
    else
    {
        ptr=head;
        while(ptr->e!=l)
        {
            ptr=ptr->next;
        }
        temp->next=ptr->next;
        ptr->next=temp;
        cout<<data<<" inserted just after element "<<l<<" in the Linked List";
    }
}
void deleteFromBegin()
{
    if (head == NULL)
    {
        cout << "Underflow!No elements there";
    }
    else
    {
        cout <<"Element deleted from begining side in the linked list";
        ptr = head;
        head = head->next;
        ptr->next = NULL;
        delete (ptr);
    }
}
void deleteFromBottom()
{
    if (head == NULL)
    {
        cout <<"Underflow!No elements there";
    }
    else
    {
       cout<<"Element deleted from bottom side of the linked list";
        struct node *prev;
        ptr=head;

        while (ptr->next != NULL)
        {
            prev=ptr;
            ptr=ptr->next;
        }

        prev->next = NULL;

        delete (ptr);
    }
}
void deleteFromRandom()
{
    int data;
    cout<<"Enter existing element to delete:";
    cin>>data;
  if (head == NULL)
    {
        cout << "Underflow!No elements there";
    }
    else{
```

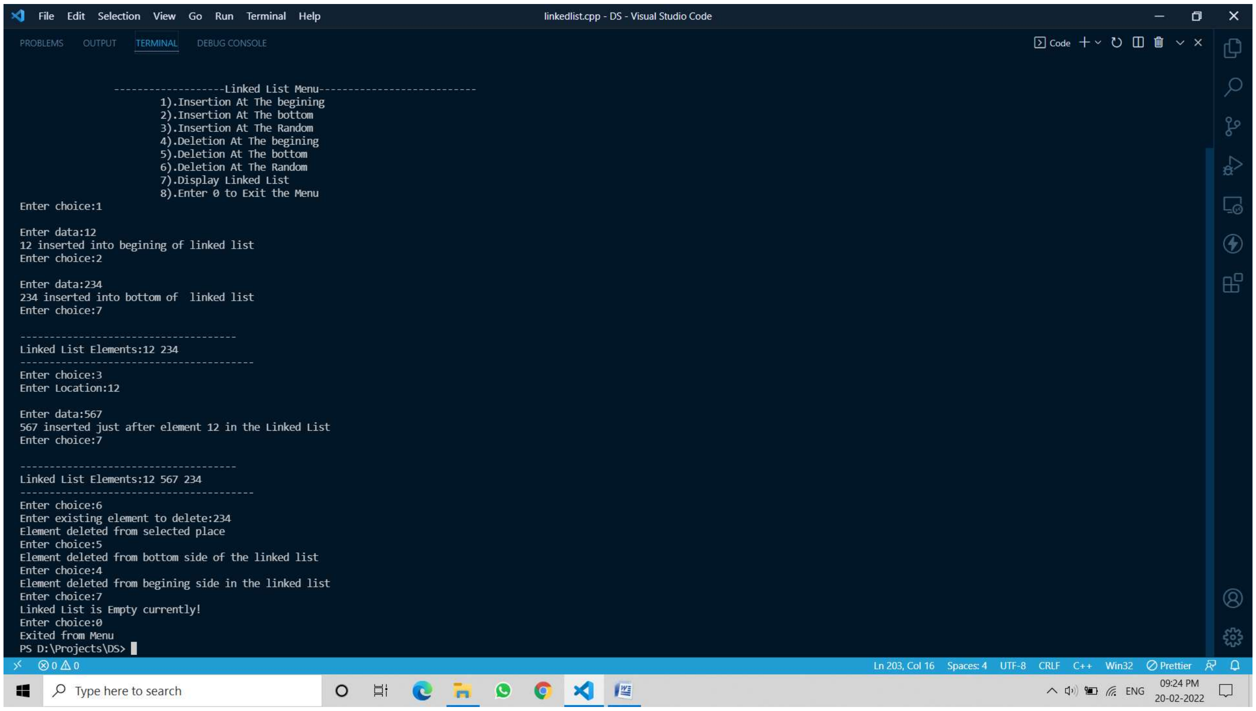


```
    struct node *p;
    cout<<"Element deleted from selected place";
    ptr=head;
while(ptr->e!=data)
    {
p=ptr;
ptr=ptr->next;
    }
    p->next=ptr->next;
    delete(ptr);
    }
}
void display()
{
    if (head == NULL)
    {
        cout << "Linked List is Empty currently!";
    }
    else
    {
        ptr = head;
        cout<<endl<< "-------------------------------------" << endl;
        cout << "Linked List Elements:";
        while (ptr != NULL)
        {
            cout << ptr->e << " ";
            ptr = ptr->next;
        }
        cout << endl<< "----------------------------------------";
    }
}
int main()
{
    int ch;
     cout << "\n\n\t\t-------------------Linked List Menu---------------------------";
     cout << "\n\t\t\t1).Insertion At The begining";
     cout << "\n\t\t\t2).Insertion At The bottom";
      cout << "\n\t\t\t3).Insertion At The Random";
     cout << "\n\t\t\t4).Deletion At The begining";
     cout << "\n\t\t\t5).Deletion At The bottom";
     cout << "\n\t\t\t6).Deletion At The Random";
     cout << "\n\t\t\t7).Display Linked List";
     cout << "\n\t\t\t8).Enter 0 to Exit the Menu";
    while (ch != 0)
    {
        cout << endl
             << "Enter choice:";
        cin >> ch;
        switch (ch)
        {
        case 1:
            insertAtBegin();
            break;
        case 2:
            insertAtBottom();
            break;
        case 3:
           insertAtRandom();
            break;
        case 4:
            deleteFromBegin();
            break;
        case 5:
```



```
            deleteFromBottom();
            break;
            case 6:
            deleteFromRandom();
            break;
            case 7:
            display();
            break;
        case 0:{
            cout<<"Exited from Menu";
            exit(0);
        }
            break;
        default:
            cout << "Invalid Response!";
        }
    }
}
```

Output:



File Edit Selection View Go Run Terminal Help
linkedlist.cpp - DS - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
Code
Ln 203, Col 16 Spaces: 4 UTF-8 CRLF C++ Win32 Prettier
Type here to search
09:24 PM
20-02-2022
ENG

```
                  -------------------Linked List Menu--------------------------
                          1).Insertion At The begining
                          2).Insertion At The bottom
                          3).Insertion At The Random
                          4).Deletion At The begining
                          5).Deletion At The bottom
                          6).Deletion At The Random
                          7).Display Linked List
                          8).Enter 0 to Exit the Menu
Enter choice:1

Enter data:12
12 inserted into begining of linked list
Enter choice:2

Enter data:234
234 inserted into bottom of  linked list
Enter choice:7

-------------------------------------
Linked List Elements:12 234
----------------------------------------
Enter choice:3
Enter Location:12

Enter data:567
567 inserted just after element 12 in the Linked List
Enter choice:7

-------------------------------------
Linked List Elements:12 567 234
----------------------------------------
Enter choice:6
Enter existing element to delete:234
Element deleted from selected place
Enter choice:5
Element deleted from bottom side of the linked list
Enter choice:4
Element deleted from begining side in the linked list
Enter choice:7
Linked List is Empty currently!
Enter choice:0
Exited from Menu
PS D:\Projects\DS>
```