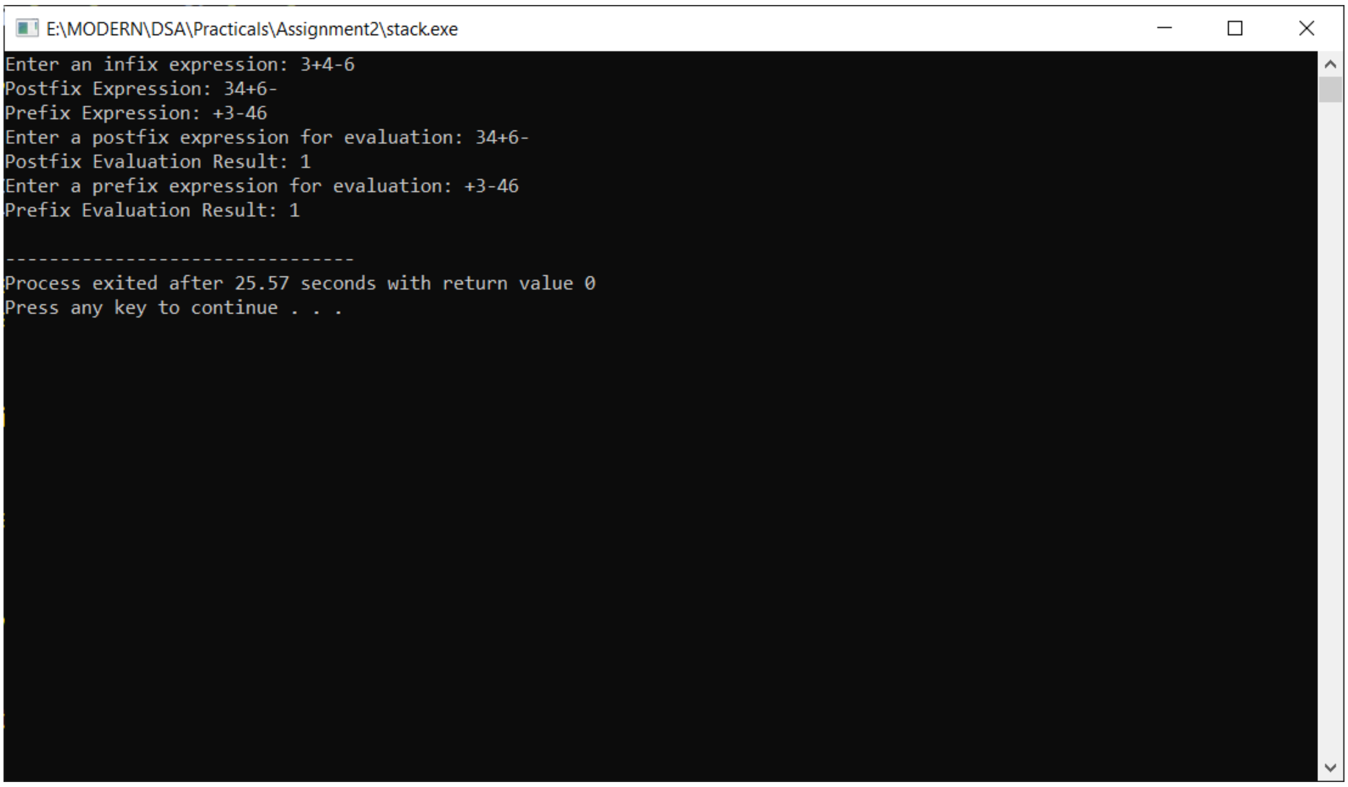
```
 /*
                           ASSIGNMENT NO. 2
NAME- ABRAR SHAIKH                                   ROLL NO. - 23570
                           TOPIC- Stack using linked-list
*/
#include <iostream>
using namespace std;

// Node class for the linked list
class Node {
public:
    int data;
    Node* next;

    Node(int data) {
        this->data = data;
        this->next = NULL;
    }
};

// Stack ADT using singly linked list
class Stack {
private:
    Node* top; // Pointer to the top of the stack

public:
    Stack() {
        top = NULL;
    }
    // Push an element to the stack
    void push(int value) {
        Node* newNode = new Node(value);
        if (top == NULL) {
            top = newNode;
        } else {
            newNode->next = top;
            top = newNode;
        }
    }

    // Pop an element from the stack
    int pop() {
        if (top == NULL) {
            cout << "Stack Underflow!" << endl;
            return -1;  // returning an error value
        } else {
            Node* temp = top;
            top = top->next;
            int poppedValue = temp->data;
            delete temp;
            return poppedValue;
        }
    }

    // Peek at the top element of the stack
    int peek() {
        if (top == NULL) {
            cout << "Stack is empty!" << endl;
            return -1;
        }
        return top->data;
    }

    // Check if the stack is empty
    bool isEmpty() {
        return top == NULL;
    }
};

// Function to check if the character is an operator
bool isOperator(char c) {
    return (c == '+' || c == '-' || c == '*' || c == '/' || c == 
'^');
}

// Function to get precedence of operators
int precedence(char c) {
    if (c == '^')
        return 3;
    else if (c == '*' || c == '/')
        return 2;
    else if (c == '+' || c == '-')
        return 1;
    else
        return -1;
}

// Function to convert infix expression to postfix
void infixToPostfix(char infix[], char postfix[]) {
    Stack s;
    int j = 0;

    for (int i = 0; infix[i] != '\0'; i++) {
        char c = infix[i];

        // If the character is an operand, add it to the output
        if (c >= '0' && c <= '9') {
            postfix[j++] = c;
        }
        // If the character is '(', push it to the stack
        else if (c == '(') {
            s.push(c);
        }
        // If the character is ')', pop and output until '(' is
encountered
        else if (c == ')') {
            while (s.peek() != '(') {
                postfix[j++] = s.pop();
            }
            s.pop(); // Remove '(' from stack
        }
        // If the character is an operator
        else if (isOperator(c)) {
            while (!s.isEmpty() && precedence(c) <=
precedence(s.peek())) {
                postfix[j++] = s.pop();
            }
            s.push(c);
        }
    }
    // Pop all the operators from the stack
    while (!s.isEmpty()) {
        postfix[j++] = s.pop();
    }

    postfix[j] = '\0'; // Null terminate the postfix expression
}

// Function to convert infix expression to prefix
void infixToPrefix(char infix[], char prefix[]) {
    Stack s;
    char reversedInfix[100], reversedPostfix[100];

    // Reverse the infix expression
    int length = 0;
    for (int i = 0; infix[i] != '\0'; i++) {
        length++;
    }

    for (int i = 0; i < length; i++) {
        if (infix[length - i - 1] == '(')
            reversedInfix[i] = ')';
        else if (infix[length - i - 1] == ')')
            reversedInfix[i] = '(';
        else
            reversedInfix[i] = infix[length - i - 1];
    }
    reversedInfix[length] = '\0';
    // Convert the reversed infix to postfix
    infixToPostfix(reversedInfix, reversedPostfix);

    // Reverse the postfix to get the prefix
    for (int i = 0; reversedPostfix[i] != '\0'; i++) {
        prefix[i] = reversedPostfix[length - i - 1];
    }
    prefix[length] = '\0'; // Null terminate the prefix expression
}

// Function to evaluate a postfix expression
int evaluatePostfix(char postfix[]) {
    Stack s;

    for (int i = 0; postfix[i] != '\0'; i++) {
        char c = postfix[i];

        // If the character is an operand, push it to the stack
        if (c >= '0' && c <= '9') {
            s.push(c - '0');
        }
        // If the character is an operator
        else if (isOperator(c)) {
            int val1 = s.pop();
            int val2 = s.pop();

            switch (c) {
                case '+': s.push(val2 + val1); break;
                case '-': s.push(val2 - val1); break;
                case '*': s.push(val2 * val1); break;
                case '/': s.push(val2 / val1); break;
            }
        }
    }

    return s.pop();
}

//function for prefix evaluation
int evaluatePrefix(char prefix[]) {
    Stack s;
    int length = 0;

    // Find the length of the prefix expression
    for (int i = 0; prefix[i] != '\0'; i++) {
        length++;
    }

    // Traverse the prefix expression from right to left
    for (int i = length - 1; i >= 0; i--) {
        char c = prefix[i];

        // If the character is an operand, push it to the stack
        if (c >= '0' && c <= '9') {
            s.push(c - '0');  // Convert char to int
        }
        // If the character is an operator
        else if (isOperator(c)) {
            int val1 = s.pop();
            int val2 = s.pop();
            switch (c) {
                case '+': s.push(val1 + val2); break;
                case '-': s.push(val1 - val2); break;
                case '*': s.push(val1 * val2); break;
                case '/': s.push(val1 / val2); break;
            }
        }
    }

    // The final result will be the only element left in the stack
    return s.pop();
}

int main() {
    char infix[100], postfix[100], prefix[100];

    cout << "Enter an infix expression: ";
    cin >> infix;

    infixToPostfix(infix, postfix);
    infixToPrefix(infix, prefix);

    cout << "Postfix Expression: " << postfix << endl;
    cout << "Prefix Expression: " << prefix << endl;

    char postfixEval[100];
    cout << "Enter a postfix expression for evaluation: ";
    cin >> postfixEval;
    cout << "Postfix Evaluation Result: " <<
evaluatePostfix(postfixEval) << endl;


    char prefixEval[100];

    cout << "Enter a prefix expression for evaluation: ";

    cin >> prefixEval;


    cout << "Prefix Evaluation Result: " <<
evaluatePrefix(prefixEval) << endl;


    return 0;

}
```



E:\MODERN\DSA\Practicals\Assignment2\stack.exe

```
Enter an infix expression: 3+4-6
Postfix Expression: 34+6-
Prefix Expression: +3-46
Enter a postfix expression for evaluation: 34+6-
Postfix Evaluation Result: 1
Enter a prefix expression for evaluation: +3-46
Prefix Evaluation Result: 1

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Process exited after 25.57 seconds with return value 0
Press any key to continue . . .
```

Github Repository - https://github.com/abssha/DSA.git