DSA LAB – 7

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Question1:

Code:

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

template <class S>
class Stack
{

        struct Node
    {
            S data;
            Node *next;
    };
        Node *top;

        public:
                Stack();
                void push(S);
                S pop();
                S ele_top();
                int is_empty();
                void eval_reverse();
                void show_exp();

};

template <class S>
Stack<S>::Stack()
{
        top=NULL;
}

template <class S>
void Stack<S>::push(S x)
{
        Node *new_node;
        new_node=new Node;

        new_node->data=x;
        new_node->next=top;
        top=new_node;
}

template <class S>
S Stack<S>::pop()
{
        S x;
        Node *temp;
        temp=top;
        x=temp->data;
        top=top->next;
        delete temp;
        return x;
}

template <class S>
S Stack<S>::ele_top()
{
        return top->data;
}

template <class S>
```

```
int Stack<S>::is_empty()
{
	if(top==NULL)
		return 1;
	return 0;
}

template <class S>
void Stack<S>::eval_reverse()
{
	Node *prev,*current;

	if(top!=NULL)
	{
		prev=top;
		top=top->next;
		current=top;
		prev->next=NULL;

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

template <class S>
void Stack<S>::show_exp()
{
	Node *temp;
	temp=top;
	while(temp!=NULL)
	{
		cout<<temp->data<<" ";
		temp=temp->next;
	}
	cout<<"\n";
}


class expression
{
	char infix[40],postfix[40],prefix[40];

	public:
		expression();
		int sequence(char);
		void prefixexp();
		void postfixexp();
		void prefixeval();
		void postfixeval();
		void strrev(char []);
};

expression::expression()
{
	infix[0]='\0';
	prefix[0]='\0';
	postfix[0]='\0';
}


void expression::prefixexp()
{
	char ch;
	Stack<char> s;
	int i, j = 0;
```

```
        cout<<"Enter the infix expression : ";
        cin.ignore();
        cin.getline(infix,20);

        for (i=strlen(infix)-1;i>=0;i--)
        {
                switch (infix[i])
                {
                        case ')':
                                s.push(')');
                                break;
                        case '+':
                        case '-':
                        case '/':
                        case '*':
                        case '%':
                        case '^':
                                while (!s.is_empty() && sequence(s.ele_top()) >= sequence(infix[i]))
                                {
                                        prefix[j] = s.pop();
                                        j++;
                                }
                                s.push(infix[i]);
                                break;
                        case '(':
                                ch = s.pop();
                                while (ch != ')')
                                {
                                        prefix[j] = ch;
                                        j++;
                                        ch = s.pop();
                                }
                                break;
                        default:
                                prefix[j] = infix[i];
                                j++;
                }
        }
        while (!s.is_empty())
        {
                prefix[j] = s.pop();
                j++;
        }
        prefix[j] = '\0';
        strrev(prefix);
        cout<<"Prefix expression is : "<<prefix<<endl;
}


void expression::postfixexp()
{
        char ch;
        Stack<char> s;
        int i, j = 0;
        cin.ignore();
        cout<<"Enter the infix expression : ";
        cin.getline(infix,20);

        for (i=0; infix[i] != '\0'; i++)
        {
                switch (infix[i])
                {
                        case '(':
                                s.push('(');
                                break;
                        case '+':
                        case '-':
                        case '/':
                        case '*':
                        case '%':
                        case '^':
```

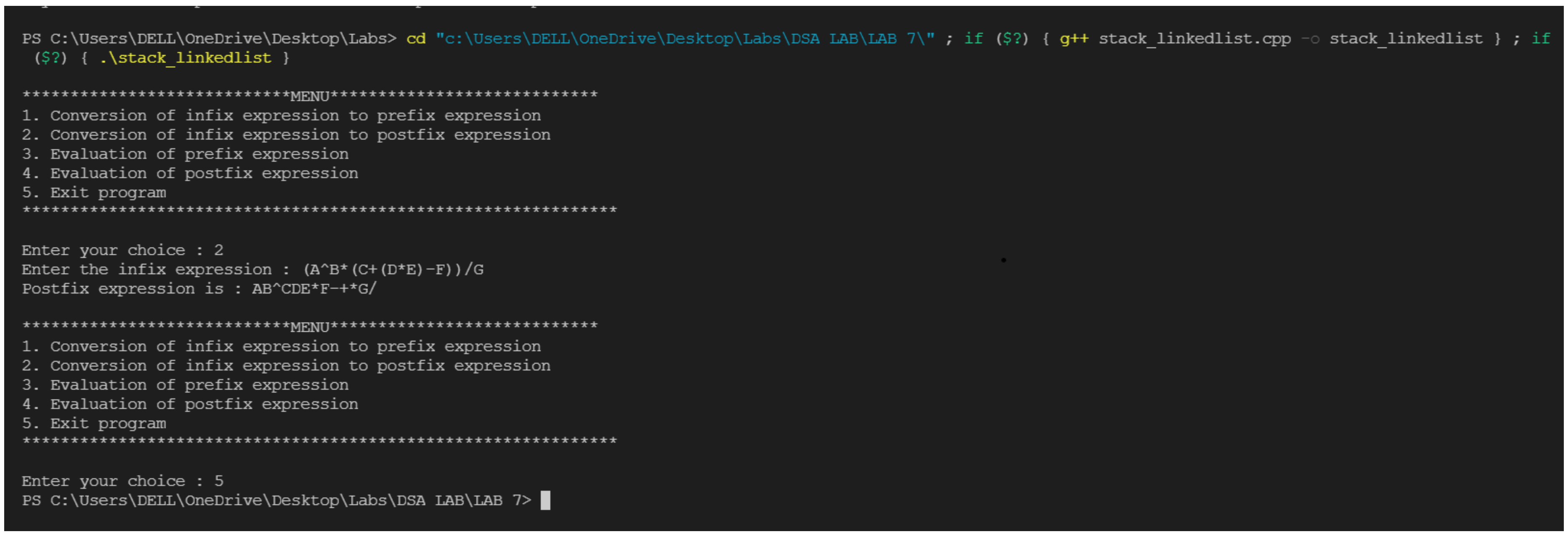
```
					while (!s.is_empty() && sequence(s.ele_top()) > sequence(infix[i]))
					{
						postfix[j] = s.pop();
						j++;
					}
					s.push(infix[i]);
					break;
				case ')':
					ch = s.pop();
					while (ch != '(')
					{
						postfix[j] = ch;
						j++;
						ch = s.pop();
					}
					break;
				default:
					postfix[j] = infix[i];
					j++;
			}
		}
		while (!s.is_empty())
		{
			postfix[j] = s.pop();
			j++;
		}
		postfix[j] = '\0';

		cout<<"Postfix expression is : "<<postfix<<endl;
}

void expression:: prefixeval()
{
		Stack<char> s;
		int i,j=0,op1,op2,vals[20];
		cin.ignore();
		cout<<"Enter the prefix expression : ";
		cin.getline(prefix,40);

		for(i=0;prefix[i]!='\0';i++)
		{
			if(isalpha(prefix[i]))
			{
				cout<<"Enter value for operand "<<prefix[i]<<": ";
				cin>>vals[j];
				j++;
			}
			if(isdigit(prefix[i]))
			{
				vals[j]=((int)prefix[i]-48);
				j++;
			}
		}
		j--;
		for(i=strlen(prefix)-1;i>=0;i--)
		{
			if(isalpha(prefix[i]))
			{
				s.push(vals[j]);
				j--;
			}
			else if(isdigit(prefix[i]))
			{
				s.push(vals[j]);
				j--;
			}
			else
			{
				op1 = s.pop();
				op2 = s.pop();
				if (prefix[i] == '+')
```

```
                    s.push(op1+op2);
                else if (prefix[i] == '-')
                    s.push(op1-op2);
                else if (prefix[i] == '*')
                    s.push(op1*op2);
                else if (prefix[i] == '/')
                    s.push(op1/op2);
                else if (prefix[i] == '%')
                    s.push(op1%op2);
                else
                    s.push(pow(op1,op2));
            }
        }
        cout<<"Result of evaluating expression is "<<(int)s.pop()<<endl;
}

void expression::postfixeval()
{
        Stack<char> s;
        int i,op1,op2,val;
        cin.ignore();
        cout<<"Enter the postfix expression : ";
        cin.getline(postfix,40);

        for(i=0;postfix[i]!='\0';i++)
        {
            if(isalpha(postfix[i]))
            {
                cout<<"Enter value for operand "<<postfix[i]<<": ";
                cin>>val;
                s.push(val);
            }
            else if(isdigit(postfix[i]))
            {
                val=(int(postfix[i])-48);
                s.push(val);
            }
            else
            {
                op2 = s.pop();
                op1 = s.pop();
                if (postfix[i] == '+')
                    s.push(op1+op2);
                else if (postfix[i] == '-')
                    s.push(op1-op2);
                else if (postfix[i] == '*')
                    s.push(op1*op2);
                else if (postfix[i] == '/')
                    s.push(op1/op2);
                else if (postfix[i] == '%')
                    s.push(op1%op2);
                else
                    s.push(pow(op1,op2));
            }
        }
        cout << "Result of evaluating expression is " << (int)s.pop() <<endl;
}


int expression::sequence(char ch)
{
        if (ch == '^' || ch == '$')
            return 6;
        if (ch == '/' || ch == '*' || ch == '%')
            return 5;
        if (ch == '+' || ch == '-')
            return 4;
        return 0;
}

void expression::strrev(char prefix[])
```

```
{
	Stack<char> s;
	int i;
	for(i=0;i<strlen(prefix);i++)
		s.push(prefix[i]);
	for(i=0;i<strlen(prefix);i++)
		prefix[i]=s.pop();
	prefix[i]='\0';
}

int main()
{
	expression e;
	Stack<char> s;
	int choice,result;

	while(1)
	{
		cout << "\n***************************MENU***************************"<< endl;
		cout << "1. Conversion of infix expression to prefix expression"<<endl;
		cout << "2. Conversion of infix expression to postfix expression"<<endl;
		cout << "3. Evaluation of prefix expression"<<endl;
		cout << "4. Evaluation of postfix expression"<<endl;
		cout << "5. Exit program"<<endl;
	cout << "**************************************************************"<< endl;
		cout<<"\nEnter your choice : ";
		cin>>choice;

		switch(choice)
		{
			case 1:
				e.prefixexp();
				break;
			case 2:
				e.postfixexp();
				break;
			case 3:
				e.prefixeval();
				break;
			case 4:
				e.postfixeval();
				break;
			case 5:
				return 0;
			default:
				cout<<"\nError in choice, try again"<<endl;
		}
	}
	return 0;
}
```

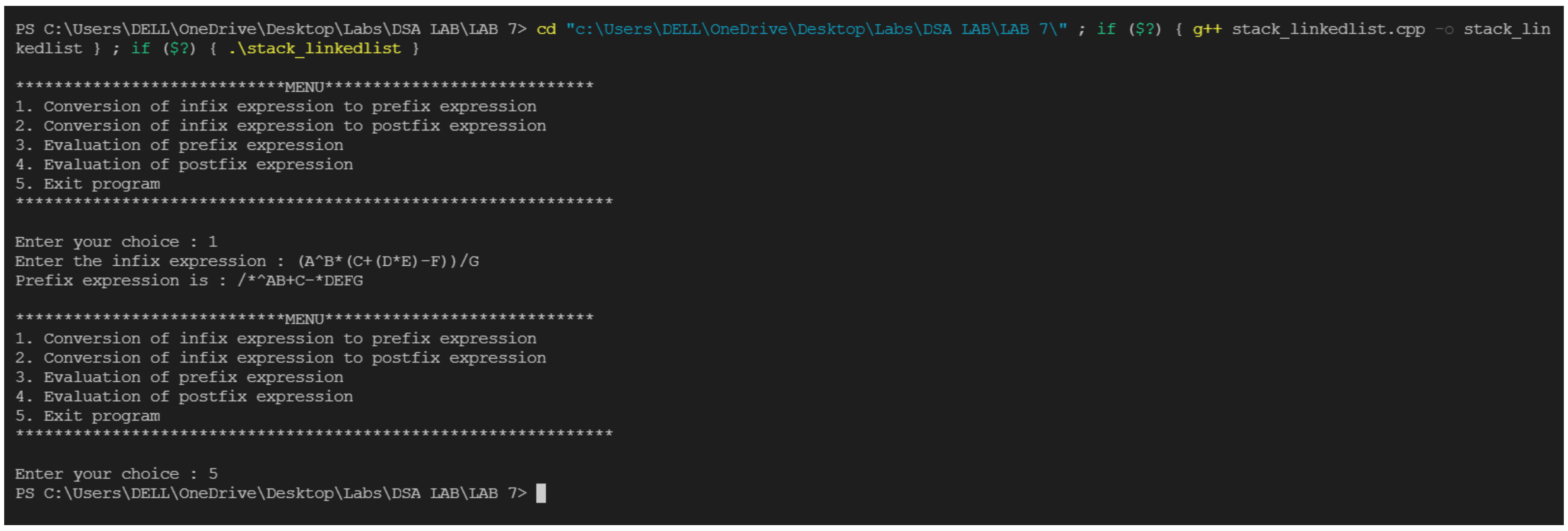
Input & Output:

INFIX TO POSTFIX



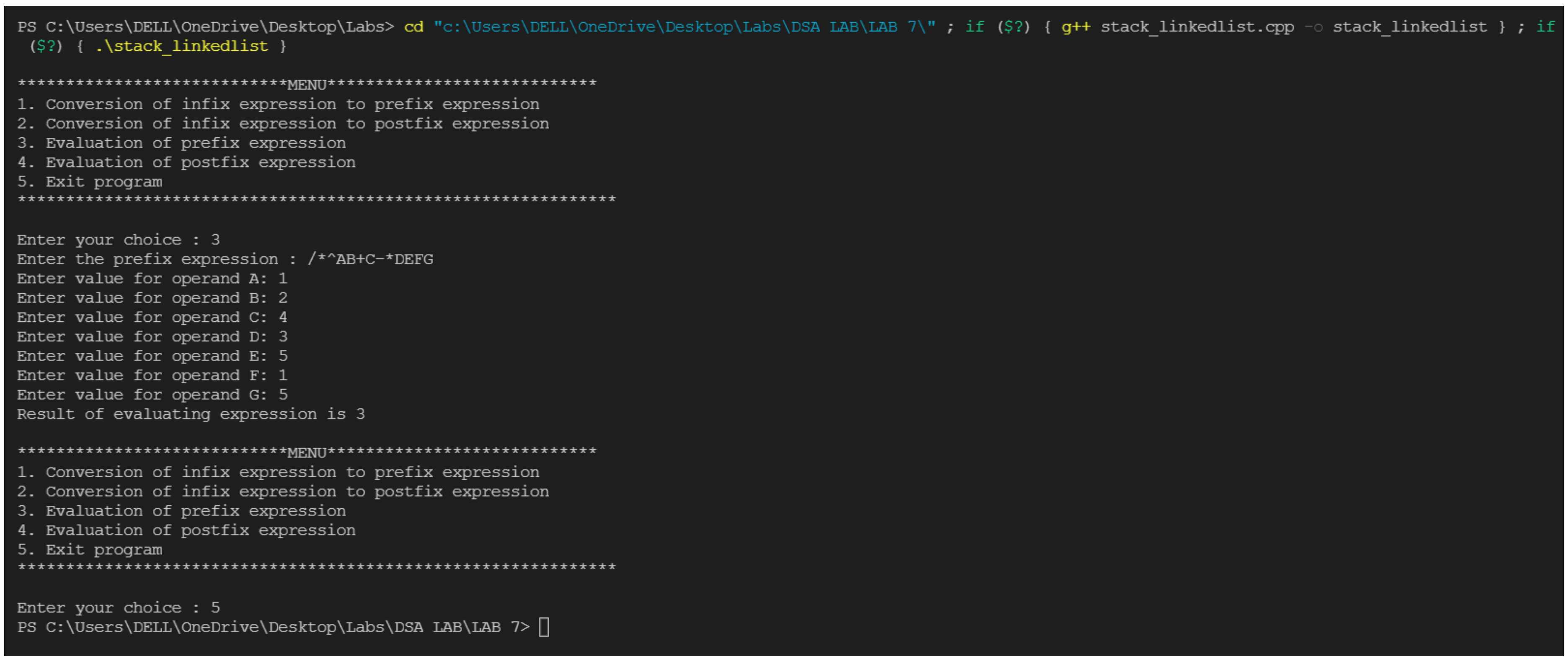
```
PS C:\Users\DELL\OneDrive\Desktop\Labs> cd "c:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7\" ; if ($?) { g++ stack_linkedlist.cpp -o stack_linkedlist } ; if
 ($?) { .\stack_linkedlist }

****************************MENU****************************
1. Conversion of infix expression to prefix expression
2. Conversion of infix expression to postfix expression
3. Evaluation of prefix expression
4. Evaluation of postfix expression
5. Exit program
**************************************************************

Enter your choice : 2
Enter the infix expression : (A^B*(C+(D*E)-F))/G
Postfix expression is : AB^CDE*F-+*G/

****************************MENU****************************
1. Conversion of infix expression to prefix expression
2. Conversion of infix expression to postfix expression
3. Evaluation of prefix expression
4. Evaluation of postfix expression
5. Exit program
**************************************************************

Enter your choice : 5
PS C:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7>
```

INFIX TO PREFIX



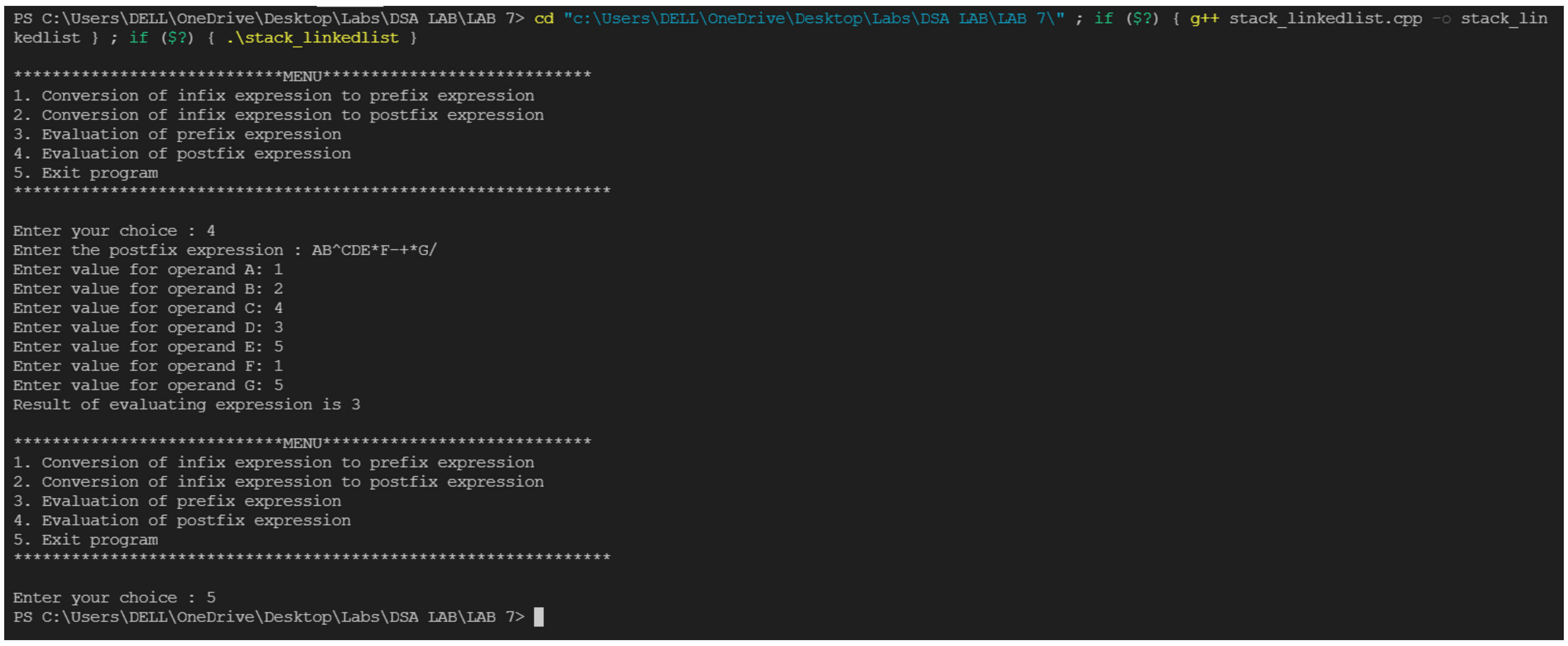
```
PS C:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7> cd "c:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7\" ; if ($?) { g++ stack_linkedlist.cpp -o stack_lin
kedlist } ; if ($?) { .\stack_linkedlist }

****************************MENU****************************
1. Conversion of infix expression to prefix expression
2. Conversion of infix expression to postfix expression
3. Evaluation of prefix expression
4. Evaluation of postfix expression
5. Exit program
**************************************************************

Enter your choice : 1
Enter the infix expression : (A^B*(C+(D*E)-F))/G
Prefix expression is : /*^AB+C-*DEFG

****************************MENU****************************
1. Conversion of infix expression to prefix expression
2. Conversion of infix expression to postfix expression
3. Evaluation of prefix expression
4. Evaluation of postfix expression
5. Exit program
**************************************************************

Enter your choice : 5
PS C:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7>
```

EVALUATION OF PREFIX EXPRESSION



```
PS C:\Users\DELL\OneDrive\Desktop\Labs> cd "c:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7\" ; if ($?) { g++ stack_linkedlist.cpp -o stack_linkedlist } ; if
 ($?) { .\stack_linkedlist }

****************************MENU****************************
1. Conversion of infix expression to prefix expression
2. Conversion of infix expression to postfix expression
3. Evaluation of prefix expression
4. Evaluation of postfix expression
5. Exit program
**************************************************************

Enter your choice : 3
Enter the prefix expression : /*^AB+C-*DEFG
Enter value for operand A: 1
Enter value for operand B: 2
Enter value for operand C: 4
Enter value for operand D: 3
Enter value for operand E: 5
Enter value for operand F: 1
Enter value for operand G: 5
Result of evaluating expression is 3

****************************MENU****************************
1. Conversion of infix expression to prefix expression
2. Conversion of infix expression to postfix expression
3. Evaluation of prefix expression
4. Evaluation of postfix expression
5. Exit program
**************************************************************

Enter your choice : 5
PS C:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7>
```

EVALUATION OF POSTFIX EXPRESSION



```
PS C:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7> cd "c:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7\" ; if ($?) { g++ stack_linkedlist.cpp -o stack_lin
kedlist } ; if ($?) { .\stack_linkedlist }

****************************MENU****************************
1. Conversion of infix expression to prefix expression
2. Conversion of infix expression to postfix expression
3. Evaluation of prefix expression
4. Evaluation of postfix expression
5. Exit program
**************************************************************

Enter your choice : 4
Enter the postfix expression : AB^CDE*F-+*G/
Enter value for operand A: 1
Enter value for operand B: 2
Enter value for operand C: 4
Enter value for operand D: 3
Enter value for operand E: 5
Enter value for operand F: 1
Enter value for operand G: 5
Result of evaluating expression is 3

****************************MENU****************************
1. Conversion of infix expression to prefix expression
2. Conversion of infix expression to postfix expression
3. Evaluation of prefix expression
4. Evaluation of postfix expression
5. Exit program
**************************************************************

Enter your choice : 5
PS C:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 7>
```