Term Work - 2

Problem Definition:

Consider a calculator that needs to perform checking correctness of paranthesized arithmetic & convertid the same postfix expression for evaluation. Develop & execute a program in C using suitable DS to perform the same & print both expressions. The input expression consists of a single character operands & binary operators.

Aim:

Aim of this TW is to learn the implementation of Stacks in solving problems.

Theory:

* Stacks : stack is a linear data structure which follows a particular order in which the operations are performed. The order may be LIFO or FIFO

* Mainly following basic operations are performed in Stack
  - → Push : Adds an item in stack. If stack is full then it is said to overflow
  - → Pop : Removes an item from stack. If stack is empty, then stack is said to underflow
  - → Peek : Returns top element of stack.
  - → isEmpty : Returns true if the stack is empty

Program:

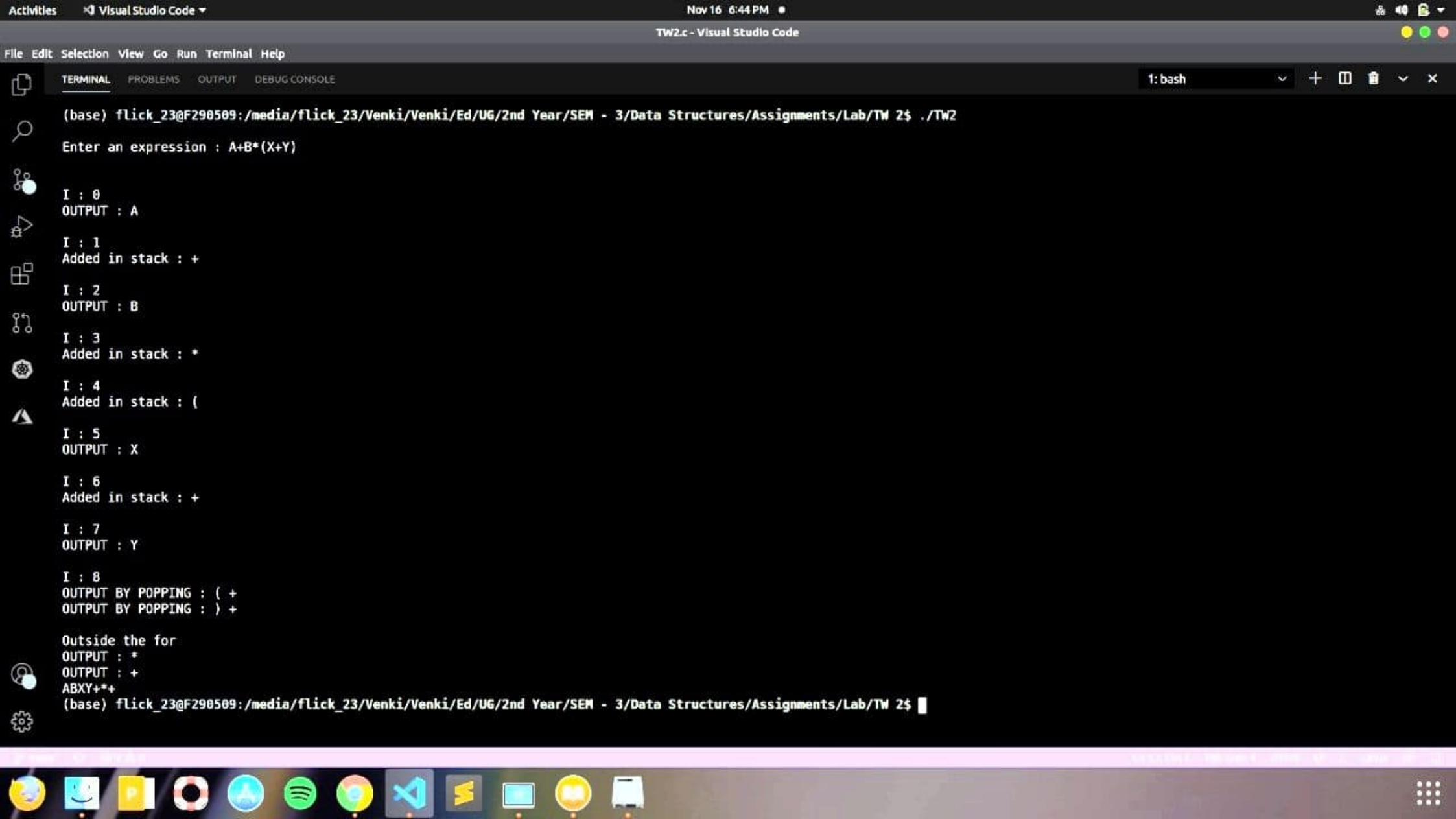
```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>

struct Stack {
    int top, capacity;
    int *a;
}
int isEmpty (struct Stack *s) {
    return s->top == -1
}
char peek (struct Stack *s) {
    return s->top s->a[s->top];
}
char pop (struct Stack *s) {
    if (! isEmpty (s))
        return s->a[s->top--];
    return '$';
}
void push (struct Stack *s, char op) {
    s->a[++s->top];
}
int isOperand (char ch) {
    return (ch >='a' && ch<='z') || (ch >='A' && ch <='Z');
}
```

```
int Prec (char ch) {
  switch (ch) {
    case '+' :
    case '-' ;   return 1 ;
    case '*' :
    case '/'  :  return 2;
    case '^'  :  return 3;
  }
  return -1;
}
int infixToPostfix (char *exp) {
  struct stack *s = (struct stack*)malloc (sizeof (struct stack));
  s→top = -1 ;     int i, k=0 ;
  s→ capacity = strlen (exp);
  s→a = (int *) malloc (s→ capacity * sizeof (int));
  if (!s)
     return -1;
  for (i=0, k=-1 ; i<l; ++i) {
     printf("\n\n  if (isOperand (exp [i])
                       exp [++k]= exp[i];
     else if (exp[i] =='(')
            push (s, exp [i]);
     else if (exp[i] == ')') {
          while (!isEmpty (s) && peek(s) != '(')
                 exp [++k]= pop(s)
     }    if (!isEmpty (s) && peek(s) != '(')
                 return -1 ;
          else
                 pop (s);
  }
```

```
    else {
        while (!isEmpty(s) && Prec(exp[i]) <= Prec(peek(s)))
            exp[++k] = pop(s);
        push(s, exp[i]);
    }
}
while (!isEmpty(s))
    exp[++k] = pop(s);
exp[++k] = '\0';
    printf("\n %s \n", exp);
}
int main() {
    char *exp;
    exp = (char*)malloc(1000*sizeof(char));
    printf("\n Enter an expression : ");
    scanf("%s", exp);
    infixToPostfix(exp);
    return 0;
}

// Written & executed in VS Code, Ubuntu 20.04.1 env.
```

TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE 1: bash

```
(base) flick_23@F290509:/media/flick_23/Venki/Venki/Ed/UG/2nd Year/SEM - 3/Data Structures/Assignments/Lab/TW 2$ ./TW2

Enter an expression : A*B-D+C


I : 0
OUTPUT : A

I : 1
Added in stack : *

I : 2
OUTPUT : B

I : 3
OUTPUT BY POPPING : OP *
Added in stack : -

I : 4
OUTPUT : D

I : 5
OUTPUT BY POPPING : OP -
Added in stack : +

I : 6
OUTPUT : C

Outside the for
OUTPUT : +
AB*D-C+
(base) flick_23@F290509:/media/flick_23/Venki/Venki/Ed/UG/2nd Year/SEM - 3/Data Structures/Assignments/Lab/TW 2$
```


Activities
Visual Studio Code
Nov 16 6:44 PM
TW2.c - Visual Studio Code
File Edit Selection View Go Run Terminal Help
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
1: bash
(base) flick_23@F290509:/media/flick_23/Venki/Venki/Ed/UG/2nd Year/SEM - 3/Data Structures/Assignments/Lab/TW 2$ ./TW2
Enter an expression : A+B*(X+Y)
I : 0
OUTPUT : A
I : 1
Added in stack : +
I : 2
OUTPUT : B
I : 3
Added in stack : *
I : 4
Added in stack : (
I : 5
OUTPUT : X
I : 6
Added in stack : +
I : 7
OUTPUT : Y
I : 8
OUTPUT BY POPPING : (+
OUTPUT BY POPPING :) +
Outside the for
OUTPUT : *
OUTPUT : +
ABXY+*+
(base) flick_23@F290509:/media/flick_23/Venki/Venki/Ed/UG/2nd Year/SEM - 3/Data Structures/Assignments/Lab/TW 2$

References

Books:

* Richard F Gilberg, Behrouz A Fourouzan, Data Structures: A Pseudo Code Approach with C, Cengage 2007.

* Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, Universe Press 2nd Edition.

E-Resources:

* https://geeksforgeeks.org/

Conclusion.

In this TW, I learnt about stacks, basic operations of stacks & their implementation to solve problems. We also learned basic problem solving techniques & programming paradigms.