Experiment No.2
Convert an Infix expression to Postfix expression using stack ADT.
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Experiment No. 2: Conversion of Infix to postfix expression using stack ADT

Aim: To convert infix expression to postfix expression using stack ADT.

Objective:

1) Understand the use of Stack.

2) Understand how to import an ADT in an application program.

3) Understand the instantiation of Stack ADT in an application program.

4) Understand how the member functions of an ADT are accessed in an application program.

Theory:

Postfix notation is a way of representing algebraic expressions without parentheses or operator precedence rules. In this notation, expressions are evaluated by scanning them from left to right and using a stack to perform the calculations. When an operand is encountered, it is pushed onto the stack, and when an operator is encountered, the last two operands from the stack are popped and used in the operation, with the result then pushed back onto the stack. This process continues until the entire postfix expression is parsed, and the result remains in the stack.

Conversion of infix to postfix expression

Expression	Stack	Output
2	Empty	2
*	*	2
3	*	23
/	/	23*
(	/(	23*
2	/(	23*2
-	/(-	23*2
1	/(-	23*21
)	/	23*21-
+	+	23*21-/
5	+	23*21-/5
*	+*	23*21-/53
3	+*	23*21-/53
	Empty	23*21-/53*+

Algorithm:

Conversion of infix to postfix

```
Step 1: Add ")" to the end of the infix expression
Step 2: Push "(" on to the stack
Step 3: Repeat until each character in the infix notation is scanned
        IF a "(" is encountered,push it on the stack
        IF an operand (whether a digit or a character) is encountered, add it to the
          postfix expression.
        IF a ")" is encountered, then
           a. Repeatedly pop from stack and add it to the postfix expression until a
          "(" is encountered.
          b.Discard the "(". That is, remove the "(" from stack and do not
          add it to the postfix expression
       IF an operator 0 is encountered, then
        a. Repeatedly pop from stack and add each operator (popped from the stack) to t postfix
           expression which has the same precedence or a higher precedence than o
        b. Push the operator o to the stack
        [END OF IF]
Step 4: Repeatedly pop from the stack and add it to the postfix expression until the stack is
empty
Step 5: EXIT
```

Code:

```
 #include <stdio.h>

#include <ctype.h>

char stack[100];

int top = -1;

void push(char x) {

   stack[++top] = x;

}

char pop() {

   if (top == -1)

       return -1;

   else

       return stack[top--];
```

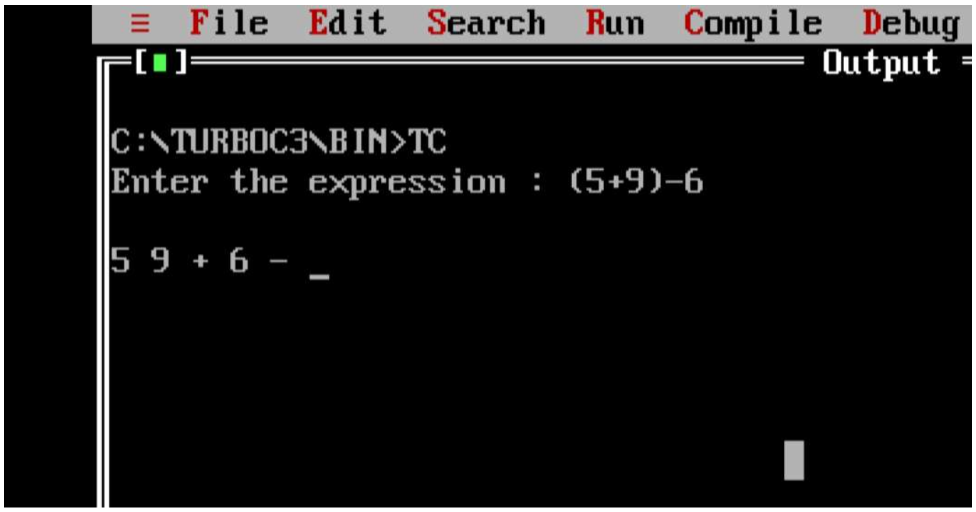
```
}
int priority(char x) {
    if (x == '(')
        return 0;
    if (x == '+' || x == '-')
        return 1;
    if (x == '*' || x == '/')
        return 2;
    return 0;
}

int main() {
    char exp[100];
    char *e, x;
    printf("Enter the expression : ");
    scanf("%s", exp);
    printf("\n");
    e = exp;

    while (*e != '\0') {
        if (isalnum(*e))
            printf("%c ", *e);
        else if (*e == '(')
            push(*e);
        else if (*e == ')') {
            while ((x = pop()) != '(')
            printf("%c ", x);
        } else {
            while (priority(stack[top]) >= priority(*e))
                printf("%c ", pop());
            push(*e);
        }
        e++;
    }

    while (top != -1) {
        printf("%c ", pop());
    }
    return 0;
}
```

Output:



```
C:\TURBOC3\BIN>TC
Enter the expression : (5+9)-6

5 9 + 6 - _
```

Conclusion:

Convert the following infix expression to postfix (A+(C/D))*B

- **Original Infix Expression:** A + (C / D) * B
- **Postfix Expression:** ACDB/*+

How many push and pop operations were required for the above conversion?

6 push operations and 4 pop operations

Where is the infix to postfix conversion used or applied?

- **Computer Programming:** Infix to postfix conversion is used for efficient evaluation of mathematical expressions in computer programs.
- **Compiler Design:** Compilers and interpreters use this conversion to process expressions in programming languages.
- **Calculator Software:** Many calculators employ postfix notation for mathematical expression evaluation.
- **Mathematical Software:** It simplifies symbolic mathematics and algebraic calculations.
- **Stack-Based Languages:** Stack-based languages like Forth and RPL rely on postfix notation for all operations.
- **Expression Parsing:** In data analysis and parsing, it aids in processing natural language or data.
- **Mathematical Proof Systems:** It's used for the manipulation of mathematical proofs and theorem provers.
- **Algorithm Design:** Postfix notation simplifies expression-related algorithms.