Institute of Computer Technology
B. Tech Computer Science and Engineering
Subject: DS (2CSE302)

PRACTICAL-5

AIM: - To learn applications of stack using ***infix*** to ***postfix*** conversion and ***postfix*** expression evaluation.

1. Rohan is a 7th semester, who is studying at GUNI-ICT. During his "Compiler Design" course, his course faculty explained him that compiler work differently while it does evaluation of an expression due to below reasons:

- **Infix expressions are readable and solvable by humans because of easily distinguishable order of operators, but compiler doesn't have integrated order of operators.**
- **Hence to solve the Infix Expression compiler will scan the expression multiple times to solve the sub-expressions in expressions orderly which is very in-efficient.**
- **To avoid this traversing, Infix expressions are converted to postfix expression before evaluation.**

a) Write the c program to convert below infix expression into postfix using stack.

i. a-b*c

ii. (a-b)*c+(d+f)

Hint:

- Infix expression can be represented with C+D, the operator is in the middle of the expression.
- In postfix expression, the operator will be at end of the expression, such as CD+
- Use isalnum() function, which checks whether the given character is alphanumeric or not. **isalnum**() function defined in **ctype.h** header file.
- Alphanumeric: A character that is either a letter or a number
- Postfix expression conversion

- **Input**: a-b*c , **Output**: a b c * -
- **Input**: (a-b)*c+(d+f), **Output**: a b - c * d f + +

SOLUTION

```
#include <stdio.h>
#include <ctype.h>

char Yash[100];
int top = -1;
void push(char a)
{
```

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```
        Yash[++top] = a;
}
char pop()
{
        if (top == -1)
        {
                return -1;
        }
        else
        {
                return Yash[top--];
        }
}
int priority(char a)
{
        if (a == '(')
        {
                return 0;
        }
        if (a == '+' || a == '-')
        {
                return 1;
        }
        if (a == '*' || a == '/')
        {
                return 2;
        }
        return 0;
}
int main()
{
        char arr[100];
        char *e, x;
        printf("Enter The Expression: ");
        scanf("%s", arr);
        e = arr;
        printf("Postfix Expression: ");
        while (*e != '\0')
        {
                if (isalnum(*e))
                printf("%c ", *e);
                else if (*e == '(')
                push(*e);
                else if (*e == ')')
```

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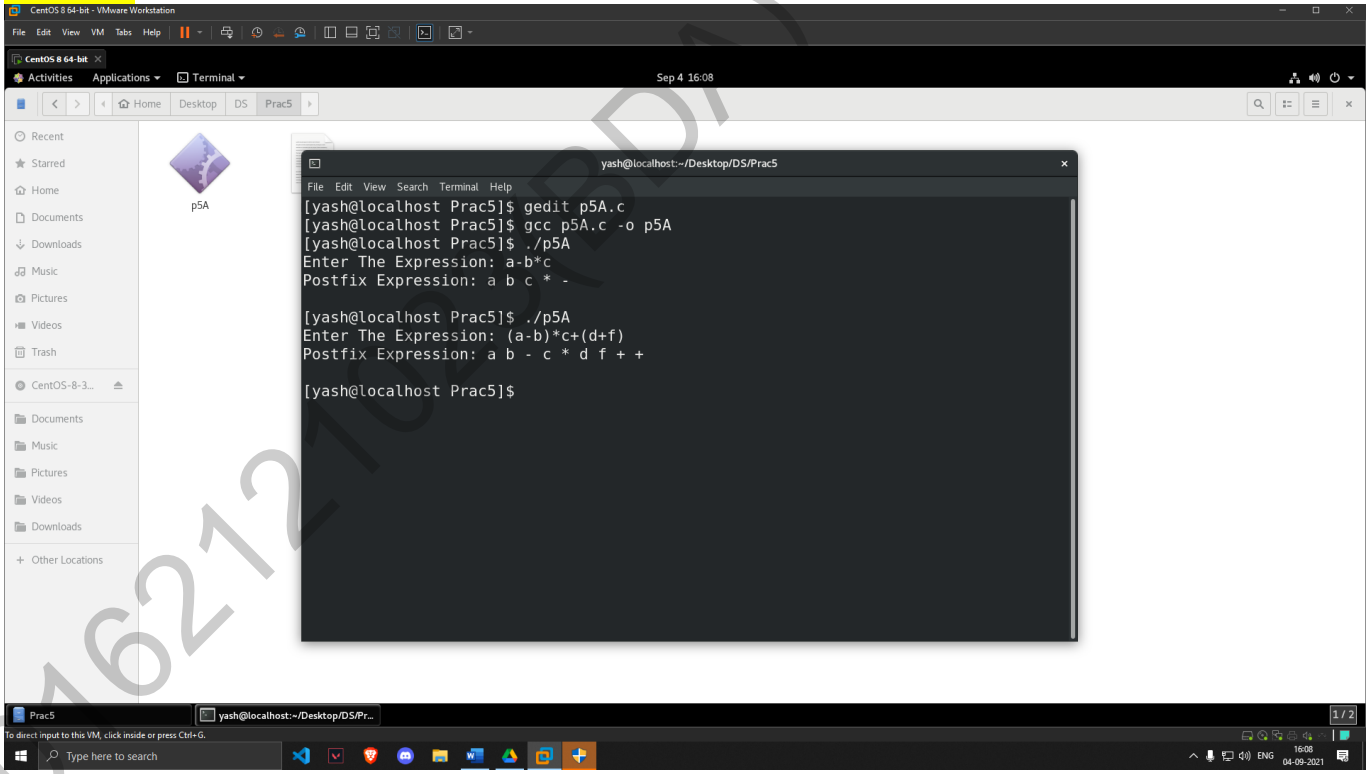
```
            {
                while ((x = pop()) != '(')
                printf("%c ", x);
            }
            else
            {
                while (priority(Yash[top]) >= priority(*e))
                printf("%c ", pop());
                push(*e);
            }
            e++;
        }
        while (top != -1)
        {
            printf("%c ", pop());
        }
        printf("\n\n");
        return 0;
}
```

OUTPUT



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b) Rohan understood that why the conversion of the infix expression to postfix expression is important. Then, his friend Shyam asked him to evaluate the below postfix expression using stack using c program.

i. 237+*

ii. 53-8*13+/

Hint:

- Postfix expression evaluation
  - **Input**: 237+*, **Output**: 20
  - **Input**: 53-8*13+/, **Output**: 4

SOLUTION

```
#include<stdio.h>
#include<ctype.h>

int Yash[20];
int top = -1;

void push(int x)
{
   Yash[++top] = x;
}

int pop()
{
   return Yash[top--];
}

int main()
{
   char arr[20];
   char *digit;
        int diff=48;
   int num1,num2,num3,num;
   printf("Enter the expression: ");
   scanf("%s",arr);
   digit = arr;
   while(*digit != '\0')
        {
      if(isdigit(*digit))
      {
                        num = *digit - diff;
         push(num);
```

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```
        }
        else
        {
           num1 = pop();
           num2 = pop();

           switch(*digit)
           {
           case '+':
           {
              num3 = num1 + num2;
              break;
           }
           case '-':
           {
              num3 = num2 - num1;
              break;
           }
           case '*':
           {
              num3 = num1 * num2;
              break;
           }
           case '/':
           {
              num3 = num2 / num1;
              break;
           }
           }
           push(num3);
        }
        digit++;
     }
     printf("\nThe result of expression %s = %d\n",arr,pop());
     return 0;
  }
```

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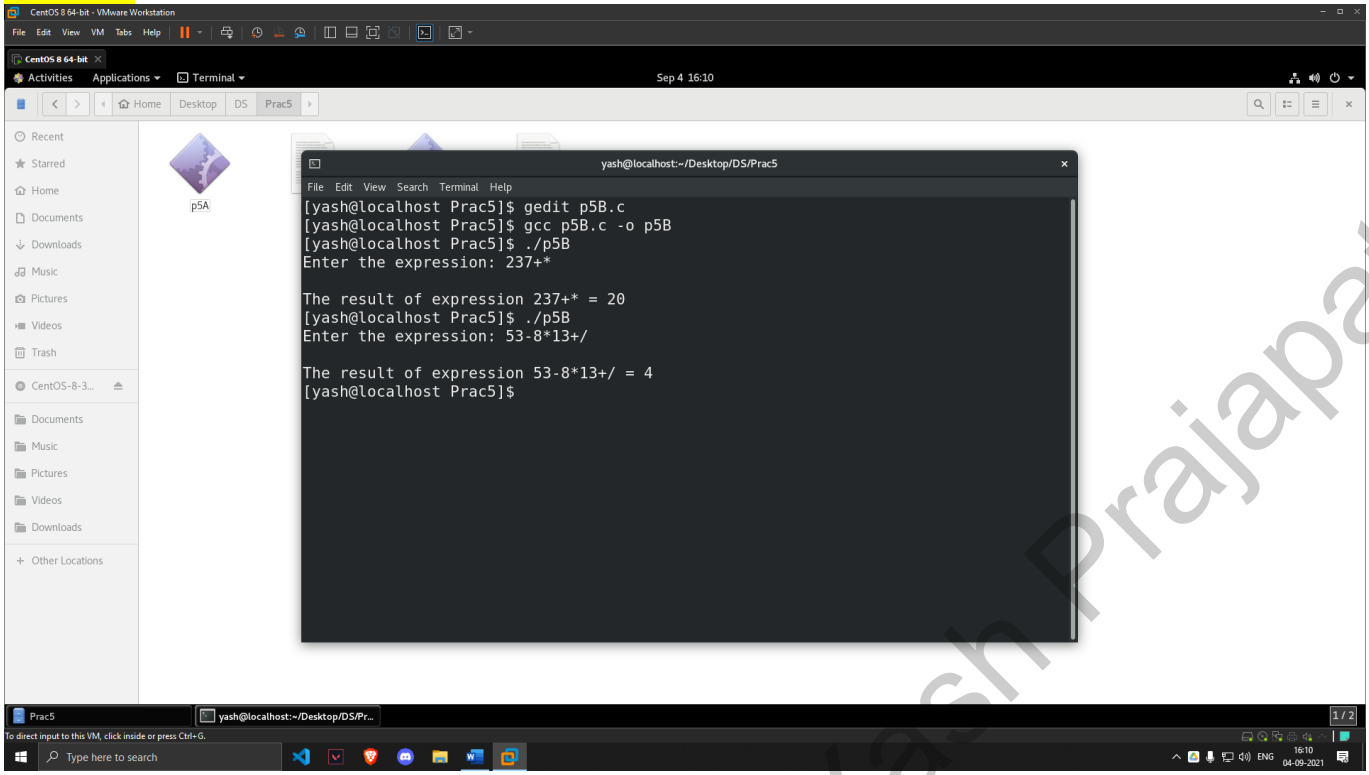
OUTPUT



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