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#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <ctype.h>
#include <math.h>

#define max 100

void strrev(char *str)
{
    int i, j;
    char temp;
    for (i = 0, j = strlen(str) - 1; i < j; i++, j--)
    {
        temp = str[i];
        str[i] = str[j];
        str[j] = temp;
    }
}

int whitespace(char ch)
{
    if (ch == ' ' || ch == '\t' || ch == '\n')
        return 1;
    else
        return 0;
}

int isOperator(char c)
{
    if (c == '+' || c == '-' || c == '*' || c == '/' || c == '^')
        return 1;
    else
        return 0;
}

int precedence(char c)
{
    if (c == '^')
        return 3;
    else if (c == '*' || c == '/' || c == '%')
        return 2;
    else if (c == '+' || c == '-')
        return 1;
    else
        return 0;
}

int instack_priority(char c)
{
    if (c == '^')

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        return 4;
    else if (c == '*' || c == '/' || c == '%')
        return 2;
    else if (c == '+' || c == '-')
        return 1;
    else
        return 0;
}

void push(char *stack, int *top, char c)
{
    if (*top == max - 1)
        printf("Stack Overflow");
    else
    {
        *top = *top + 1;
        stack[*top] = c;
    }
}

char pop(char *stack, int *top)
{
    char c;
    if (*top == -1)
        printf("Stack Underflow");
    else
    {
        c = stack[*top];
        *top = *top - 1;
    }
    return c;
}

char peek(char *stack, int top)
{
    if (top == -1)
        return ' ';
    else
        return stack[top];
}

void infixToPostfix(char *infix, char *postfix)
{
    char stack[max];
    int top = -1, i = 0, j = 0;
    char c;
    for(int i = 0; i < strlen(infix); i++)
    {
        if (infix[i] == '(')
        {
            push(stack, &top, infix[i]);

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    }
    else if (infix[i] == ')')
    {
        while ((c = pop(stack, &top)) != '(')
        {
            postfix[j] = c;
            j++;
        }
    }
    else if (isOperator(infix[i]) == 1)
    {
        while (precedence(infix[i]) <= precedence(peek(stack, top)) && top != -
1)
        {
            postfix[j] = pop(stack, &top);
            j++;
        }
        push(stack, &top, infix[i]);
    }
    else if (whitespace(infix[i]) == 0)
    {
        postfix[j] = infix[i];
        j++;
    }
}
while (top != -1)
{
    postfix[j] = pop(stack, &top);
    j++;
}
postfix[j] = '\0';
}

void infixToPrefix(char *infix, char *prefix)
{
    char stack[max];
    int top = -1, i = 0, j = 0;
    char c;
    for(i=strlen(infix)-1; i>=0; i--)
    {
        if (infix[i] == ')')
        {
            push(stack, &top, infix[i]);
        }
        else if (infix[i] == '(')
        {
            while ((c = pop(stack, &top)) != ')')
            {
                prefix[j] = c;
                j++;
            }
        }
    }
}

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    }
    else if (isOperator(infix[i]) == 1)
    {
        while (precedence(infix[i]) < instack_priority(peek(stack, top)) && top
!= -1)
        {
            prefix[j] = pop(stack, &top);
            j++;
        }
        push(stack, &top, infix[i]);
    }
    else if (whitespace(infix[i]) == 0)
    {
        prefix[j] = infix[i];
        j++;
    }
}
while (top != -1)
{
    prefix[j] = pop(stack, &top);
    j++;
}
prefix[j] = '\0';
strrev(prefix);
}

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int operate(int a, int b, char c)
{
    switch (c)
    {
        case '+':
            return a + b;
        case '-':
            return b - a;
        case '*':
            return a * b;
        case '/':
            return b/a;
        case '%':
            return b%a;
        case '^':
            return pow(b,a);
        default:
            return 0;
    }
}

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int evaluatePostfix(char *postfix)

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{
    long int a,b,temp,result;
    int top = -1;
    char stack[max];
    for (int i = 0; i < strlen(postfix); i++)
    {
        if (isdigit(postfix[i]))
        {
            push(stack, &top, postfix[i] - '0');
        }
        else if (isOperator(postfix[i]) == 1)
        {
            a = pop(stack, &top);
            b = pop(stack, &top);
            temp = operate(a, b, postfix[i]);
            push(stack, &top, temp);
        }
    }
    result = pop(stack, &top);
    return result;
}

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int evaluatePrefix(char *prefix)
{
    long int a,b,temp,result;
    int top = -1;
    char stack[max];
    for(int i=strlen(prefix)-1; i>=0; i--)
    {
        if(isdigit(prefix[i]))
        {
            push(stack, &top, prefix[i]-'0');
        }
        else if(isOperator(prefix[i])==1)
        {
            a=pop(stack, &top);
            b=pop(stack, &top);
            temp=operate(b, a, prefix[i]);
            push(stack, &top, temp);
        }
    }
    result=pop(stack, &top);
    return result;
}

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int main()
{
    char infix[max], postfix[max], prefix[max];
    int result;
    //menu

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while(1)
{
    printf("\n1.Infix to Postfix");
    printf("\n2.Infix to Prefix");
    printf("\n3.Evaluate Postfix");
    printf("\n4.Evaluate Prefix");
    printf("\n5.Exit");
    printf("\nEnter your choice: ");
    int choice;
    scanf("%d", &choice);
    switch (choice)
    {
        case 1:
            printf("\nEnter infix expression: ");
            scanf("%s", infix);
            infixToPostfix(infix, postfix);
            printf("\nPostfix expression: %s", postfix);
            break;
        case 2:
            printf("\nEnter infix expression: ");
            scanf("%s", infix);
            infixToPrefix(infix, prefix);
            printf("\nPrefix expression: %s", prefix);
            break;
        case 3:
            printf("\nEnter postfix expression: ");
            scanf("%s", postfix);
            result = evaluatePostfix(postfix);
            printf("\nResult: %d", result);
            break;
        case 4:
            printf("\nEnter prefix expression: ");
            scanf("%s", prefix);
            result = evaluatePrefix(prefix);
            printf("\nResult: %d", result);
            break;
        case 5:
            exit(0);
        default:
            printf("\nInvalid choice");
    }
}
return 0;
}

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