Mohammad Ali Jinnah University

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Assignment 1

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Id: FA19-BSSE-0014

Subject: Data Structures and Algorithms Lab (CS 2511)

Section: AM

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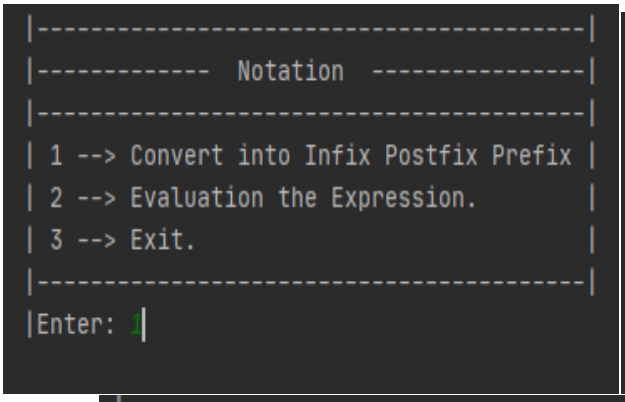
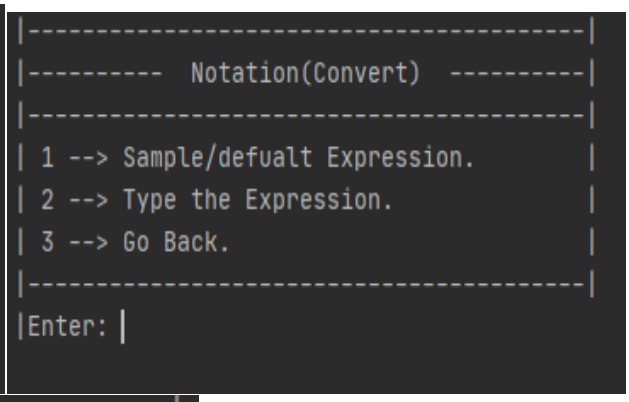
Date: Sunday, December 20, 2020

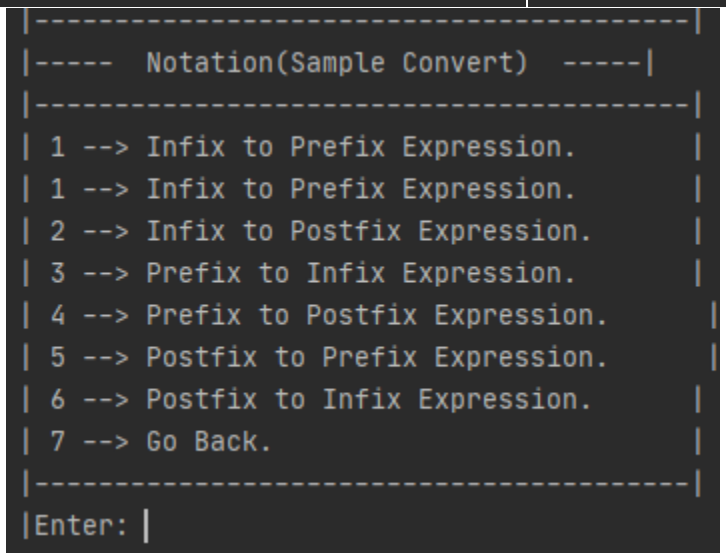
Task:

Present Polish notations (Prefix & Postfix) implementation using Stack.

Output:


|---------- Notation ----------|
| 1 --> Convert into Infix Postfix Prefix |
| 2 --> Evaluation the Expression. |
| 3 --> Exit. |
|Enter: 1


|---------- Notation(Convert) ----------|
| 1 --> Sample/defualt Expression. |
| 2 --> Type the Expression. |
| 3 --> Go Back. |
|Enter:


|----- Notation(Sample Convert) -----|
| 1 --> Infix to Prefix Expression. |
| 1 --> Infix to Prefix Expression. |
| 2 --> Infix to Postfix Expression. |
| 3 --> Prefix to Infix Expression. |
| 4 --> Prefix to Postfix Expression. |
| 5 --> Postfix to Prefix Expression. |
| 6 --> Postfix to Infix Expression. |
| 7 --> Go Back. |
|Enter:

```
|------------------------||-------------------------|
|          Infix         ||       Stack(Prefix)     |
|------------------------||-------------------------|
|  a+b*(c^d-e)^(f+g*h)-i ||  [a]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, c]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, c]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, c, d]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, ^cd]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, ^cd, e]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde, f]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde, f]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde, f, g]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde, f, g]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde, f, g, h]
|  a+b*(c^d-e)^(f+g*h)-i ||  [a, b, -^cde, +f*gh]
|  a+b*(c^d-e)^(f+g*h)-i ||  [+a*b^-^cde+f*gh]
|  a+b*(c^d-e)^(f+g*h)-i ||  [+a*b^-^cde+f*gh, i]
|------------------------||-------------------------|
```

And other are Example are given in the code.

Code:

```java
package com.company.Linkedlist;

import java.io.IOException;
import java.util.Scanner;
import java.util.Stack;
import java.util.Timer;
import java.util.TimerTask;

class Converter{
    // PostFix to exp Infix
    boolean isOperand(char charAt) {
        return (charAt >= 'a' && charAt <= 'z') || (charAt >= 'A' && charAt <= 'Z');
    }
    int Prec(char ch) {
        switch (ch) {
            case '+':
            case '-':
```

```
            return 1;

        case '*':
        case '/':
            return 2;

        case '^':
            return 3;
    }
    return -1;
}

//Infix Operation
String InToPost(String exp){
    String result = "";
    char c;
    Stack<Character> stack = new Stack<>();

    for (int i = 0; i < exp.length(); ++i){
        c = exp.charAt(i);

        if (Character.isLetterOrDigit(c))
            result += c;

        else if (c == '(')
            stack.push(c);

        else if (c == ')'){
            while (!stack.isEmpty() && stack.peek() != '(')
                result += stack.pop();

            stack.pop();
        }
        else {
            while (!stack.isEmpty() && Prec(c) <= Prec(stack.peek()))
                result += stack.pop();

            stack.push(c);
        }
        System.out.println("|  "+exp+" ||  "+result);
    }

    while (!stack.isEmpty()){
        if(stack.peek() == '(')
            return "Invalid Expression";
        result += stack.pop();
    }

    return result;
}
String inToPre(String exp) {
    Stack<Character> operators = new Stack<Character>();
    Stack<String> operands = new Stack<String>();
    String op1,op2;
    char op, c;
```

```
    for (int i = 0; i < exp.length(); i++) {
        c = exp.charAt(i);
        if (c == '(')
            operators.push(c);

        else if (c == ')') {
            while (!operators.empty() && operators.peek() != '(') {
                op1 = operands.pop();
                op2 = operands.pop();
                op = operators.pop();

                operands.push(op + op2 + op1);
            }
            operators.pop();
        }

        else if (isOperand(c))
            operands.push(c + "");
        else {
            while (!operators.empty() && Prec(c) <= Prec(operators.peek())) {
                op1 = operands.pop();
                op2 = operands.pop();
                op = operators.pop();

                operands.push(op + op2 + op1);
            }

            operators.push(c);
        }
        System.out.println("|  "+exp+" ||  "+operands.toString());
    }

    while (!operators.empty()){
        op1 = operands.pop();
        op2 = operands.pop();
        op = operators.pop();

        operands.push(op + op2 + op1);
    }
    return operands.peek();
}

//PostFix Operation
String PostToIn(String exp){
    Stack<String> s = new Stack<String>();
    char c;
        for(int i = 0; i < exp.length(); i++){
            c = exp.charAt(i);
            if (isOperand(c)){
                s.push(c + "");
            }
            else{
                String b = s.pop();
                String a = s.pop();
                s.push("(" + a + c + b + ")");
            }
```

```
            System.out.println("|  "+exp+" ||  "+s.toString());
        }

        return s.peek();
}
String PostToPre(String exp) {
    Stack<String> s = new Stack<>();
    String op2,op1;
    char c;

    for (int i = 0; i < exp.length(); i++) {
        c = exp.charAt(i);
        if (!isOperand(c)) {
            op1 = s.pop();
            op2 = s.pop();

            s.push(c + op2 + op1);
        }
        else
            s.push(c+ "");

        System.out.println("|   "+exp+"    ||  "+s.toString());
    }

    return s.toString();
}

//Prefix Operation
String PreToIn(String exp){
    Stack<String> s = new Stack<>();
    char c;
    String op1 ,op2;
    for(int i = exp.length()-1; i >= 0; i--){
        c = exp.charAt(i);

        if (!isOperand(c)) {
            op1 = s.pop();
            op2 = s.pop();

            s.push(")" + op2 + c + op1 + "(");
        }

        else s.push(c + "");
        System.out.println("|     "+exp+"       ||     "+(new StringBuilder(s.toString()).reverse())+"\b");
    }

    StringBuilder temp = (new StringBuilder(s.peek())).reverse();

return temp.toString();
}
String PreToPost(String exp){
    Stack<String> s = new Stack<>();
    char c;
    String op1 ,op2;
    for(int i = exp.length()-1; i >= 0; i--){
```

```
            c = exp.charAt(i);

            if (!isOperand(c)) {
                op1 = s.pop();
                op2 = s.pop();

                s.push(  op1 +op2+ c );
            }

            else s.push(c + "");
            System.out.println("|      "+exp+"       ||  "+s.toString());
        }

        return s.peek();
    }

    int calculatePost(String exp){
        Stack<Integer> stack = new Stack<>();
        char c;
        int oper1, oper2;

        for (int i = 0; i < exp.length(); i++) {
            c = exp.charAt(i);

            if(Character.isDigit(c))
                stack.push(Integer.parseInt(String.valueOf(c)));
            else {
                oper1 = stack.pop();
                oper2 = stack.pop();

                stack.push((c == '+'?(oper2+oper1):(c == '-'?(oper2-oper1):(c == '*'?(oper2*oper1):(c ==
'/'?(oper2/oper1):0)))));
            }

        }

        return stack.pop();
    }
    int calculatePre(String exp){
        Stack<Integer> stack = new Stack<>();
        char c;
        int oper1, oper2;

        for (int i = exp.length()-1; i >= 0; i--) {
            c = exp.charAt(i);

            if(Character.isDigit(c))
                stack.push(Integer.parseInt(String.valueOf(c)));
            else {
                oper1 = stack.pop();
                oper2 = stack.pop();

                stack.push((c == '+'?(oper1+oper2):(c == '-'?(oper1-oper2):(c == '*'?(oper1*oper2):(c ==
'/'?(oper1/oper2):0)))));
            }
```

```
        }

        return stack.pop();
    }
}

public class Question2 {
    public static void main(String[] args) throws IOException, InterruptedException {
        Converter Menu = new Converter();
        Scanner scan = new Scanner(System.in);
        String exp;
        int k1,k2;
        boolean condition = true;
        while (condition){
            System.out.println("|----------------------------------------|");
            System.out.println("|------------  Notation  ----------------|");
            System.out.println("|----------------------------------------|");
            System.out.println("| 1 --> Convert into Infix Postfix Prefix |");
            System.out.println("| 2 --> Evaluation the Expression.        |");
            System.out.println("| 3 --> Exit.                             |");
            System.out.println("|----------------------------------------|");
            System.out.print("|Enter: ");
            k1 = scan.nextInt();
            switch (k1){
                case 3:
                    System.exit(0);
                case 2:
                    while (condition) {
                        System.out.println("|----------------------------------------|");
                        System.out.println("|---------  Notation(Evaluation)  --------|");
                        System.out.println("|----------------------------------------|");
                        System.out.println("| 1 --> Sample/defualt Expression.        |");
                        System.out.println("| 2 --> Type the Expression.              |");
                        System.out.println("| 3 --> Go Back.                          |");
                        System.out.println("|----------------------------------------|");
                        System.out.print("|Enter: ");
                        k2 = scan.nextInt();
                        switch (k2) {
                            case 3:
                                condition = false;
                                break;
                            case 1:
                                while (condition) {
                                    System.out.println("|----------------------------------------|");
                                    System.out.println("|-----  Notation(Sample Evaluation)  -----|");
                                    System.out.println("|----------------------------------------|");
                                    System.out.println("| 1 --> Sample Prefix Expression.         |");
                                    System.out.println("| 2 --> Sample Prefix Expression.         |");
                                    System.out.println("| 3 --> Go Back.                          |");
                                    System.out.println("|----------------------------------------|");
                                    System.out.print("|Enter: ");
                                    switch (scan.nextInt()){
                                        case 3:
                                            condition = !condition;
                                            break;
                                        case 2:
```

```
                        exp="+9*26";
                        System.out.println("postfix evaluation: "+Menu.calculatePre(exp));
                        break;
                    case 1:
                        exp="291*+8/";
                        System.out.println("postfix evaluation: "+Menu.calculatePost(exp));
                        break;
                    default:
                        System.out.println("Invalid Input! ");
                }
            }
            condition = true;
            break;
        case 2:
            while (condition) {
                System.out.println("|----------------------------------------|");
                System.out.println("|-----  Notation(Type to Evaluation)  ----|");
                System.out.println("|----------------------------------------|");
                System.out.println("| 1 --> Type Prefix Expression.          |");
                System.out.println("| 2 --> Type Prefix Expression.          |");
                System.out.println("| 3 --> Go Back.                         |");
                System.out.println("|----------------------------------------|");
                System.out.print("|Enter: ");
                switch (scan.nextInt()){
                    case 3:
                        condition = !condition;
                        break;
                    case 2:
                        exp = scan.nextLine();
                        System.out.println("postfix evaluation: "+Menu.calculatePre(exp));
                        break;
                    case 1:
                        exp = scan.nextLine();
                        System.out.println("postfix evaluation: "+Menu.calculatePost(exp));
                        break;
                    default:
                        System.out.println("Invalid Input! ");
                }
            }
            condition = true;
            break;
        default:
            System.out.println("Invalid Input! ");
    }
}
condition = true;
break;
case 1:
    while (condition){
        System.out.println("|----------------------------------------|");
        System.out.println("|----------  Notation(Convert)  ----------|");
        System.out.println("|----------------------------------------|");
        System.out.println("| 1 --> Sample/defualt Expression.       |");
        System.out.println("| 2 --> Type the Expression.             |");
        System.out.println("| 3 --> Go Back.                         |");
        System.out.println("|----------------------------------------|");
```

```
                System.out.print("|Enter: ");
                k2 = scan.nextInt();
                switch (k2) {
                    case 3:
                        condition = false;
                        break;
                    case 1:
                        while (condition) {
                            System.out.println("|---------------------------------------|");
                            System.out.println("|-----  Notation(Sample Convert)  -----|");
                            System.out.println("|---------------------------------------|");
                            System.out.println("| 1 --> Infix to Prefix Expression.      |");
System.out.println("| 1 --> Infix to Prefix Expression.      |");
                            System.out.println("| 2 --> Infix to Postfix Expression.     |");
                            System.out.println("| 3 --> Prefix to Infix Expression.      |");
                            System.out.println("| 4 --> Prefix to Postfix Expression.    |");
                            System.out.println("| 5 --> Postfix to Prefix Expression.    |");
                            System.out.println("| 6 --> Postfix to Infix Expression.     |");
                            System.out.println("| 7 --> Go Back.                         |");
                            System.out.println("|---------------------------------------|");
                            System.out.print("|Enter: ");
                            switch (scan.nextInt()){
                                case 7:
                                    condition = !condition;
                                    break;
                                case 6:
                                    //      part 1B in which the postfix Convert in to infix(parameterized)
                                    exp = "abcd^e-fgh*+^*+i-";
                                    System.out.println("|----------------------||-----------------------|");
                                    System.out.println("|       PostFix        ||       Stack(Infix)    |");
                                    System.out.println("|----------------------||-----------------------|");
                                    exp = Menu.PostToIn(exp);
                                    System.out.println("|----------------------||-----------------------|");
                                    System.out.println("\nFinal output: "+exp);
                                    break;
                                case 5:
                                    //      part 2B in which the postfix Convert in to prefix
                                    exp = "abcd^e-fgh*+^*+i-";
                                    System.out.println("|----------------------||-----------------------|");
                                    System.out.println("|       PostFix        ||       Stack(Prefix)   |");
                                    System.out.println("|----------------------||-----------------------|");
                                    exp = Menu.PostToPre(exp);
                                    System.out.println("|----------------------||-----------------------|");
                                    System.out.println("\nFinal output: "+exp);
                                    break;
                                case 4:
                                //      part 2C in which the prefix Convert in to postfix
                                    exp = "-+a*b^-^cde+f*ghi";
                                    System.out.println("|----------------------||-----------------------|");
                                    System.out.println("|       PreFix         ||      Stack(Postfix)   |");
                                    System.out.println("|----------------------||-----------------------|");
                                    exp = Menu.PreToPost(exp);
                                    System.out.println("|----------------------||-----------------------|");
                                    System.out.println("\nFinal output: "+exp);
                                    break;
                                case 3:
```

```
//                                  part 1C in which the prefix Convert in to Infix
                                    exp = "-+a*b^-^cde+f*ghi";
                                    System.out.println("|----------------------||-------------------------|");
                                    System.out.println("|       Prefix         ||       Stack(Infix)     |");
                                    System.out.println("|----------------------||-------------------------|");
                                    exp = Menu.PreToIn(exp);
                                    System.out.println("|----------------------||-------------------------|");
                                    System.out.println("\nFinal output: "+exp);
                                    break;
                                case 2:
//                                  part 2A in which the infix(parameterized) Convert in to Prefix
                                    exp = "a+b*(c^d-e)^(f+g*h)-i";
                                    System.out.println("|----------------------||-------------------------|");
                                    System.out.println("|         Infix        ||      Stack(Prefix)    |");
                                    System.out.println("|----------------------||-------------------------|");
                                    exp = Menu.inToPre(exp);
                                    System.out.println("|----------------------||-------------------------|");
                                    System.out.println("\nFinal output: "+exp);
                                    break;
                                case 1:
//                                  part 1A in which the infix(parameterized) Convert in to postfix
                                    exp = "a+b*(c^d-e)^(f+g*h)-i";
                                    System.out.println("|----------------------||-------------------------|");
                                    System.out.println("|         Infix        ||      Stack(Postfix)   |");
                                    System.out.println("|----------------------||-------------------------|");
                                    exp = Menu.InToPost(exp);
                                    System.out.println("|----------------------||-------------------------|");
                                    System.out.println("\nFinal output: "+exp);
                                    break;
                                default:
                                    System.out.println("Invalid Input! ");
                            }
                        }
                        condition = true;
                        break;
                    case 2:
                        while (condition) {
                            System.out.println("|---------------------------------------|");
                            System.out.println("|-----  Notation(Type Convert)  -----|");
                            System.out.println("|---------------------------------------|");
                            System.out.println("| 1 --> Infix to Prefix Expression.     |");
System.out.println("| 1 --> Infix to Prefix Expression.     |");
                            System.out.println("| 2 --> Infix to Postfix Expression.    |");
                            System.out.println("| 3 --> Prefix to Infix Expression.     |");
                            System.out.println("| 4 --> Prefix to Postfix Expression.   |");
                            System.out.println("| 5 --> Postfix to Prefix Expression.   |");
                            System.out.println("| 6 --> Postfix to Infix Expression.    |");
                            System.out.println("| 7 --> Go Back.                        |");
                            System.out.println("|---------------------------------------|");
                            System.out.print("|Enter: ");
                            switch (scan.nextInt()){
                                case 7:
                                    condition = !condition;
                                    break;
                                case 6:
                                    //      part 1B in which the postfix Convert in to infix(parameterized)
```

```
                    exp = scan.nextLine();
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("|       PostFix        ||       Stack(Infix)     |");
                    System.out.println("|----------------------||----------------------|");
                    exp = Menu.PostToIn(exp);
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("\nFinal output: "+exp);
                    break;
                case 5:
                    //       part 2B in which the postfix Convert in to prefix
                    exp = scan.nextLine();
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("|       PostFix        ||       Stack(Prefix)    |");
                    System.out.println("|----------------------||----------------------|");
                    exp = Menu.PostToPre(exp);
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("\nFinal output: "+exp);
                    break;
                case 4:
                    //       part 2C in which the prefix Convert in to postfix
                    exp = scan.nextLine();
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("|       PreFix         ||       Stack(Postfix)    |");
                    System.out.println("|----------------------||----------------------|");
                    exp = Menu.PreToPost(exp);
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("\nFinal output: "+exp);
                    break;
                case 3:
//                      part 1C in which the prefix Convert in to Infix
                    exp = scan.nextLine();
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("|       Prefix         ||       Stack(Infix)     |");
                    System.out.println("|----------------------||----------------------|");
                    exp = Menu.PreToIn(exp);
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("\nFinal output: "+exp);
                    break;
                case 2:
//                      part 2A in which the infix(parameterized) Convert in to Prefix
                    exp = scan.nextLine();
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("|        Infix         ||       Stack(Prefix)    |");
                    System.out.println("|----------------------||----------------------|");
                    exp = Menu.inToPre(exp);
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("\nFinal output: "+exp);
                    break;
                case 1:
//                      part 1A in which the infix(parameterized) Convert in to postfix
                    exp = scan.nextLine();
                    System.out.println("|----------------------||----------------------|");
                    System.out.println("|        Infix         ||       Stack(Postfix)    |");
                    System.out.println("|----------------------||----------------------|");
                    exp = Menu.InToPost(exp);
                    System.out.println("|----------------------||----------------------|");
```

```
                                System.out.println("\nFinal output: "+exp);
                                break;
                            default:
                                System.out.println("Invalid Input! ");
                        }
                    }
                    condition = true;
                    break;
                default:
                    System.out.println("Invalid Input! ");
            }
        }
        condition = true;
        break;

    }

  }
 }
}
```