# CECS 524 Unit 9 Assignment 1

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## Code:

```
import java.io.File;
import java.io.FileNotFoundException;
import java.util.*;
import java.util.regex.Matcher;
import java.util.regex.Pattern;
public class Expression
{
   public static class Line_Memory{
      int lineNumber;
      String line;
   }

   private static ArrayList<Line_Memory> program=new ArrayList<Line_Memory>() ; /*the
entire SIL program is in this array*/
   private static int curr_line; /*the current line that is executing*/
   private static boolean mEOL, mEOF;

   public static  HashMap<String,Integer> memory=new HashMap<String,Integer>();
   public static Stack<Integer> st=new Stack<Integer>(); /*Stack to store Integer values*/
   public static Stack<Integer> lln=new Stack<Integer>(); /* Stack to store the last line number*/

   public static void main(String[] args) throws FileNotFoundException {
      String in;
      int k=0;
      Scanner sc = new Scanner(new File("C://Users//mspur//IdeaProjects//unit 6//Input.txt"));

      while (sc.hasNextLine()) {
         in=sc.nextLine().toUpperCase();

         Expression.Line_Memory lm=new Expression.Line_Memory();
         lm.lineNumber=Integer.parseInt(in.substring(0, in.indexOf(' ')));
```

```
    lm.line=in.substring(in.indexOf(' ')+1);
    program.add(lm);
  }

 parseProgram();


}
public static void parseProgram()
{
  int end_line=program.size();
  int i=0,low,high;
  while(i!=end_line)
  {

    curr_line=program.get(i).lineNumber;
    int x=parse(program.get(i).line,curr_line,i);

    if(x==curr_line)
    {

      i++;
    }

    else if(x<curr_line)
    {
      low=0;
      high=i;
      i=search(x, low,high);
      curr_line=program.get(i).lineNumber;

    }
    else
    {
      low=i;
      high=program.size()-1;
      i=search(x, low,high);

      curr_line=program.get(i).lineNumber;

    }
    }

}

public static void takeInput(String [] vars)
{
    Scanner sc = new Scanner(System.in);
    String p=sc.nextLine();
    String [] nums=p.split(" ");
    int [] values=new int[nums.length];

    for(int i=0;i<nums.length;i++)
        values[i]=Integer.parseInt(nums[i]);
    if(vars.length!=values.length||values.length==0)
        System.err.println("Line n missing input value");
    else {
        for (int i = 0; i < vars.length; i++) {
            memory.put(vars[i], values[i]);
        }

    }
}
public static int parse(String in,int ln,int index)
{

   in.trim();

    if(in.equals("END"))
    {

        System.exit(0);
    }
    if(in.equals("RET"))
    {

        return lln.pop();
    }
    String ins = in.substring(0, in.indexOf(' '));
    String str = in.substring(in.indexOf(' ') + 1);
```

```
if(ins.equals("LET"))
{

   String [] vals=str.split("=");
   memory.put(vals[0].trim(),expr(vals[1].trim()));
}
if(ins.equals("PUSH"))
{

   st.push(expr(str));

}
if(ins.equals("POP"))
{
   memory.put(str,st.pop());

}
if(ins.equals("GOSUB"))
{

   int x=search(Integer.parseInt(str),0,program.size());
   if(x==-1)
   System.out.println("Line Number not found:  "+program.get(x).lineNumber);
   lln.push(program.get(index+1).lineNumber);
      return  Integer.parseInt(str);
}

if(ins.equals("INPUT"))
{

   takeInput(str.split(","));

}
if(ins.equals("GOTO"))
{

   return Integer.parseInt(str);



}
```

```
if(ins.equals("IF"))
{
   String condition = str.split("THEN")[0];
   String action= in.split("THEN")[1];

   String op="";
   if(condition.contains("="))
      op="=";
   else if(condition.contains("<"))
      op="<";
   else if(condition.contains(">"))
      op=">";
   else if(condition.contains("!"))
      op="!";

   int  x= calculate(expr(condition.split(op)[0]),expr(condition.split(op)[1]),op);

   if(x==1)
   {

      int p=  parse(action.trim(),curr_line,index);
      return p;

   }


   return curr_line;
}

if(ins.equals("INTEGER"))
{
   String [] variables=str.split(",");
   for(int i=0;i<variables.length;i++)
   {
      memory.put(variables[i].trim(),0);
   }

}


if(ins.equals("PRINTLN"))
```

```
{
   Pattern p = Pattern.compile("\"([^\"]*)\"");
   String res="";
   Matcher m = p.matcher(str);
   while (m.find()) {
      res=m.group(1);
   }
   if (memory.containsKey(str)) {

      System.out.println(expr(str));
   }
  else if(str.length()-2==res.length())
   {

         System.out.println(res);
   }
   else
   {

      String rem = str.replace(res,"");
      String exp=rem.split(",")[1];
      System.out.print(res);
      System.out.println(expr(exp));
   }


   }
```

```
if(ins.equals("PRINT"))
{
   Pattern p = Pattern.compile("\"([^\"]*)\"");
   String res="";
   Matcher m = p.matcher(str);
   while (m.find()) {
      res=m.group(1);
   }
```

```
        if (memory.containsKey(str))
            System.out.print(expr(str));
     if(str.length()-2==res.length())
     {
             System.out.print(res);
     }
      else
      {

        String rem = str.replace(res,"");

        String exp=rem.split(",")[1];
        System.out.print(expr(exp));
       }

    }
    return curr_line;
}

public static int search(int target,int low,int high)
{


    int mid=low  + ((high - low) / 2);
    while(low<=high)
    {
        mid=low  + ((high - low) / 2);
        if(program.get(mid).lineNumber==target)
            return mid;
        else if(program.get(mid).lineNumber<target)
            low=mid+1;
        else
            high=mid-1;

    }
    return -1;
}
public static int expr(String s)
{
    Stack<Integer> v=new Stack<Integer>();
    Stack<String> op=new Stack<String>();
```

```
int i=0;
while(i<s.length())
{
   String p=toString(s.charAt(i));
   if(isNumeric(p))
   {
      String num="";
      int in=i;
      while(in<s.length()&&isNumeric(s.substring(in,in+1)))
      {

         num+=s.charAt(in);
         in++;
      }
      i=in-1;
      v.push(Integer.parseInt(num));


   }

   else if(memory.containsKey(p))
   {

      v.push(memory.get(p));

   }

   else if(s.charAt(i)=='(')
   {
      String brac="";
      int x=i+1;
      while(x<s.length()&&s.charAt(x)!=')')
      {
         brac+=s.charAt(x);

         x++;
      }
      i=x;

      if(isNumeric(brac))
         v.push(Integer.parseInt(brac));
```

```
            else
                v.push(expr(brac));

        }


        else  if(isOperand(p))
        {

            while(op.size()>0&&precedence(op.peek(),p))
            {

                String c=op.pop();
                int op1=v.pop();
                int op2=v.pop();
                v.push(calculate(op1,op2,c));
            }
            op.push(p);

        }
        i++;
    }
    while(op.size()>0)
    {
        String c=op.pop();
        int op1=v.pop();
        int op2=v.pop();
        v.push(calculate(op1,op2,c));
    }

    return v.pop();

}


public static int atom(String s)
{



    if(isNumeric(s))
```

```
        return Integer.parseInt(s);
    else if(memory.containsKey(s))

        return memory.get(s);




    else
        return expr(s);

}

public static String toString(char ch)
{
    return Character.toString(ch);
}

public static  boolean isNumeric(String s)
{

    try
    {
        Integer.parseInt(s);
        return true;
    }
    catch( Exception e )
    {
        return false;
    }
}


public static boolean isOperand(String s)
{




    if(s.contains("+")||s.contains("-")||s.contains("*")||s.contains("/"))
        return true;
    return false;
}
```

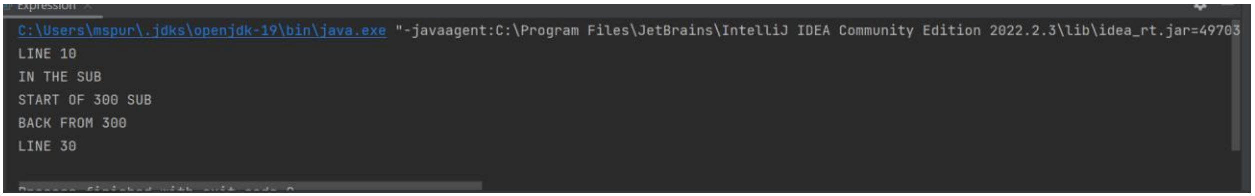
```
public static boolean containsOperand(String s)
{



   if(s.contains("+")||s.contains("-")||s.contains("*")||s.contains("/"))
      return true;
   if(s.contains("THEN"))
      if(s.contains("<")||s.contains(">")||s.contains("=")||s.contains("!"))
         return true;
   return false;
}

public static int calculate(int op2,int op1,String op)
{


   if(op.equals("+"))
      return op1+op2;
   else if(op.equals("-"))
      return op1-op2;
   else if(op.equals("*"))
      return op1*op2;
   else if(op.equals("/"))
      return op1/op2;
   else if(op.equals("<"))
      return (op2<op1)?1:0;

   else if(op.equals(">"))
      return (op2>op1)?1:0;
   else if(op.equals("="))
      return (op1==op2)?1:0;
   else
      return (op1!=op2)?1:0;
}

public static boolean precedence(String op1,String op2)
{
   HashMap<String,Integer> hm=new HashMap<String,Integer>();
   hm.put("+",1);
   hm.put("-",1);
```

```
        hm.put("*",2);
        hm.put("/",2);

        if(hm.get(op1)-hm.get(op2)>0)
           return true;
        else
           return false;

    }

}
```

**Input 1**

```
10 println "line 10"
20 gosub 200
30 println "line 30"
40 end
200 println "in the sub"
210 gosub 300
220 println "back from 300"
230 ret
300 println "start of 300 sub"
310 ret
320 end
```

**Output 1**



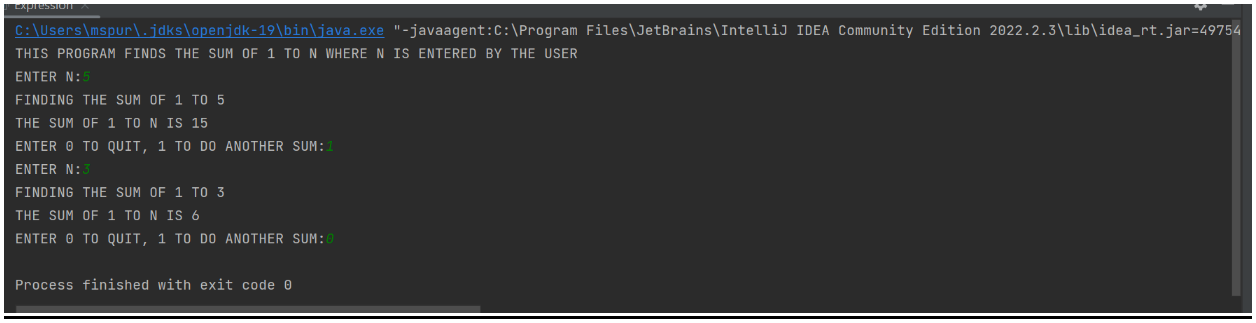
```
C:\Users\mspur\.jdks\openjdk-19\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2022.2.3\lib\idea_rt.jar=49703
LINE 10
IN THE SUB
START OF 300 SUB
BACK FROM 300
LINE 30

Process finished with exit code 0
```

**Input 2**

```
10 PRINTLN "This program finds the sum of 1 to n where n is entered by the user"
20 INTEGER N, S, I
30 PRINT "Enter n:"
40 INPUT n
50 GOSUB 100
60 PRINT "The sum of 1 to n is "
```

```
65 PRINTLN S
70 PRINT "Enter 0 to quit, 1 to do another sum:"
80 INPUT S
90 IF S = 1 THEN GOTO 30
95 END
100 PRINTLN "Finding the sum of 1 to ", n
105 LET S = 0
110 LET I = 1
120 IF I>N THEN GOTO 160
130 LET S = S + I
140 LET I = I + 1
150 GOTO 120
160 RET
170 END
```

## Output 2:



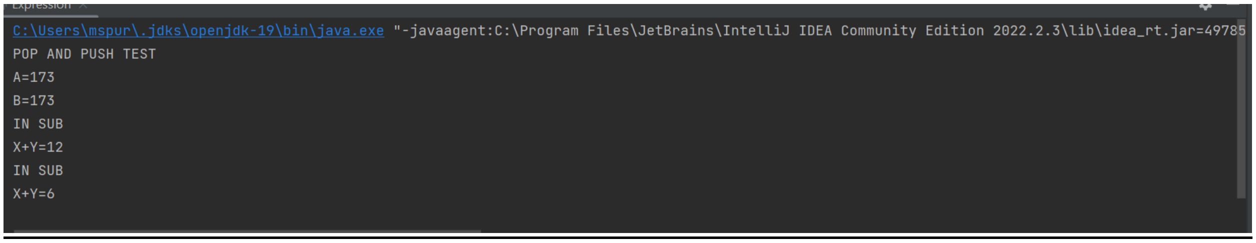
```
C:\Users\mspur\.jdks\openjdk-19\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2022.2.3\lib\idea_rt.jar=49754
THIS PROGRAM FINDS THE SUM OF 1 TO N WHERE N IS ENTERED BY THE USER
ENTER N:5
FINDING THE SUM OF 1 TO 5
THE SUM OF 1 TO N IS 15
ENTER 0 TO QUIT, 1 TO DO ANOTHER SUM:1
ENTER N:3
FINDING THE SUM OF 1 TO 3
THE SUM OF 1 TO N IS 6
ENTER 0 TO QUIT, 1 TO DO ANOTHER SUM:0

Process finished with exit code 0
```

## INPUT 3:

```
5 integer x, y
10 println "pop and push test"
15 integer b
18 let b = 23
20 push 50*3 + b
30 integer a
40 pop a
50 println "a=" , a
60 push a
70 pop b
80 println "b=",b
90 push 5
```

```
100 push 7
110 gosub 200
111 push 2
112 push 4
113 gosub 200
120 end
200 println "in sub"
210 pop y
220 pop x
230 println "x+y=", x+y
240 ret
250 end
```

## Output 3



```
C:\Users\mspur\.jdks\openjdk-19\bin\java.exe "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2022.2.3\lib\idea_rt.jar=49785
POP AND PUSH TEST
A=173
B=173
IN SUB
X+Y=12
IN SUB
X+Y=6
```