DATA STRUCTURES & ALGORITHM
FINAL PROJECT

Section: 1-BSCS-.2

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---BINARY SEARCH TREE---

SOURCE CODE

```
package final_Project;


import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.util.Scanner;
import java.util.concurrent.TimeUnit;


import javax.swing.JButton;
import javax.swing.JFrame;
import javax.swing.JLabel;
import javax.swing.JPanel;
import javax.swing.JTextField;


public class BSCS2_Marasigan_Lumabos_DelosSantos_FinalProject
{
		public static Scanner in = new Scanner(System.in);
		//A + ( ( B - C ) * D ) / F //test sample
		//A ^ B ^ C + D + F //test sample
		//1 ^ 20 ^ 14 + 9 + -1 //test sample


		public static void main(String[] args)
		{
		    new GUI();
		    GUI.show();
		}
```

```
static void UserVersion(String expression)
{
    Element[] prefix = Converter.toPrefix(expression);
    Tree binaryTree = new Tree(prefix);

    Tools.PrintHorizontally("Creating the Tree, Please Wait", 20);
    Tools.PrintHorizontally(".....\n", 800);
    System.out.println();
    Tools.PrintVertically(binaryTree.verticalTree, 100);

    new PrefixCalculator(Converter.reversedPrefix);
    Tools.end();
}

static void DeveloperVersion(String expression, int  choice)
{
    Element[] prefix = Converter.toPrefix(expression);
    Tree xpTree = new Tree(prefix);

    do
    {
            System.out.print("[1] Infix     [2] Reversed Infix\n"
                            + "[3] Prefix    [4] Reversed Prefix\n"
                            + "[5] TreeH     [6] TreeV\n"
                            + "[7] 2DArrInfo [8] Calculate\nChoice: ");
            choice = in.nextInt();

            switch (choice)
            {
            case 1: Tools.ArrayInformation(Converter.infix, "Element"); break;
            case 2: Tools.ArrayInformation(Converter.reversedInfix, "Element"); break;
            case 3: Tools.ArrayInformation(Converter.prefix, "Element"); break;
            case 4: Tools.ArrayInformation(Converter.reversedPrefix, "Element"); break;
            case 5: xpTree.printTreeHorizontal();  break;
            case 6: xpTree.printTreeVertical();break;
```

```
                             case 7: Tools.ArrayInformation2D(xpTree.tree, "Classification"); break;
                             case 8: new PrefixCalculator(Converter.reversedPrefix); break;
                             }
                             System.out.println();

                   }while (choice != 9);
                }
}

class Element
{
                String element;
                String classification;
                int plvl;

                //special characteristic for tree printing
                int treeLevel;
                double value;

                Element(String element, String classification, int plvl)
                {
                   this.element = element;
                   this.classification = classification;
                   this.plvl = plvl;
                }

                //information printing for testing purposes
                void ShowCharacteristics(Element a)
                {
                   System.out.println("Element name : " + a.element);
                   System.out.println("Classificaion: " + a.classification);
                   System.out.println("Precedence:    " + a.plvl);
                   System.out.println("Tree Level:    " + a.treeLevel);
                }
                static String classification(String element)
                {
                    String classification = "Leaf";

                    if (element.equals("+") || element.equals("-") || element.equals("*") || element.equals("/") ||
element.equals("^"))
                              classification = "Node";

                    if (element.equals(")") || element.equals("("))
                              classification = "Prnthss";

                    return classification;
                }

                static int plvl (String element)
                {
                    int plvl = 0;
                    if(element.equals("+") || element.equals("-"))
                              plvl = 1;

                    if(element.equals("*") || element.equals("/"))
                              plvl = 2;

                    if(element.equals("^"))
                              plvl = 3;

                    if(element.equals(")") || element.equals("("))
                              plvl = 4;

                    return plvl;
                }
}

class Tree
{
```

```
Tree(Element[] array)
{
    TreeAnalysis(array, 0);
    TreeLevelCompiler(max_level, array);
    FormattedVerticalPrinting(tree, indentAndSpace(), 0);
}

int level = 1;
int scannedLeaf = 0;
int leaf = 0;
int node = 0;
int max_level = 0;

//Holds data about the created tree
Element[][] tree = {};
String horizontalTree = "";
String verticalTree = "";

//ESSENTIAL TOOLS
void TreeAnalysis(Element[] array, int index)
{
    if (index<array.length)
    {
                //the String (horizontalTree) records the events that happens in the recursion
                horizontalTree += "    " + level +"\t|";
                TabH(level);
                if(array[index].classification.equals("Node"))
                {

                            leaf = 0;
                            node++;
                            horizontalTree+="(" + array[index].element + ")\n";
                            array[index].treeLevel = level;
                            level++;
                }
```

```
            else
            {
                scannedLeaf++;
                leaf++;
                array[index].treeLevel = level;
                horizontalTree += "(" + array[index].element + ")\n";

            }

            if (leaf==2)
            {
                leaf--;
                level--;

                if(node-1 == scannedLeaf && array[index-scannedLeaf].classification == "Leaf")
                {
                    node = 1;
                    level--;
                    scannedLeaf = 0;
                }
            }

            if (level>max_level)
                max_level = level;

            TreeAnalysis(array, index+1);
        }

        return;
    }
    void TreeLevelCompiler(int level, Element[] array)
    {
        tree = Tools.ArrayMaker(level);
```

```
          for(int index1 = 0; index1<tree.length; index1++)
          {   //Level stage
              int scanned = 0; int arrayIndex = 0;
              for(int index2 = 0; index2<tree[index1].length; index2++)
              {   //array stage
                  for (; arrayIndex<array.length && scanned<tree[index1].length;
arrayIndex++)
                  {   //Scans array details
                      if(array[arrayIndex].treeLevel == index1+1)// index+1 refers to
the level
                      {
                          scanned++;
                          tree[index1][index2] = array[arrayIndex];
                          arrayIndex++;
                          break;
                      }
                  }
              }
          }
          //The loop only records the data to the 2Darray based only on the tree levels
          tree = TreeFix(tree);
        }
        static Element[][] TreeFix(Element[][] array)
        {
          Element[][] fixed = array;

          for (int count =1; count<array.length; count++)
          {
              Element[] adjust = new Element[array[count].length];
              int adjustIndex = 0;

              for(int count2 =0, index =0; count2<array[count-1].length; count2++)
              {
                  if (array[count-1][count2] != null)
                  if (array[count-1][count2].classification == "Node")
                  {//record 2 child -=Binary Tree Rule=-
```

```
                adjust[adjustIndex] = array[count][index];
                adjust[adjustIndex+1] = array[count][index+1];
                index += 2;
            }
            adjustIndex += 2;
        }

        array[count] = adjust;
    }

    return fixed;
}

//PRINTING METHODS (for Testing)
void printTreeHorizontal()
{//Horizontal Manner for level provider tester
    HorizontalHeader(max_level);
    System.out.println(horizontalTree);
}
//only for horizontal tree printing as test
static void HorizontalHeader(int maxlvl)
{
    System.out.print("  LEVEL |");
    for (int level = 1; level <= maxlvl; level++)
    {
        System.out.print(" " + level + "\t");
    }
    System.out.print("\n--------+");
    for (; maxlvl>0; maxlvl--)
    {
        System.out.print("--------");
    }
    System.out.println();
}
void TabH(int count)
```

```
{
    for (; count>1; count--)
    {
        horizontalTree += "\t";
    }
}

//Tree printing 2.0 ragh!
void printTreeVertical()
{
    System.out.println(verticalTree);
}

void FormattedVerticalPrinting(Element[][] array, int[][] levelIS, int level)
{
    if (level < max_level)
    {
        int indent = levelIS[level][0], space = levelIS[level][1];
        //System.out.println("level " + (level+1) + ": " + levelIS[level][0]);
        //connection(array[level], levelIS[level], 3, 2);
        TabV(indent);

        for (int index = 0; index<array[level].length; index++)
        {
            if (array[level][index] != null)
            {
                this.verticalTree += "(" + array[level][index].element + ")";
            }
            else
            {
                this.verticalTree +=" ";
            }
            TabV(space);
        }
        this.verticalTree += "\n";
```

```
            if (level != max_level-1)
            {
                    connection(array[level], levelIS[level+1], 3, 2);
            }

            FormattedVerticalPrinting(array, levelIS, level+1);
    }
    else
            this.verticalTree +="\n";
            return;
}
void TabV(int count)
{
    for (; count>0; count--)
    {
            this.verticalTree += "\t";
    }
}
int[][] indentAndSpace()
{
    int[][] levelIS = new int[max_level][2];

    int indent = 0, space = 2;
    for (int level = max_level-1; level > -1; level--)
    {

            levelIS[level][0] = indent;// Indent of that level
            //System.out.println("level " + (level+1) + ": " + levelIS[level][0]);
            levelIS[level][1] = space; // spacing of that level
            //System.out.println("level " + (level+1) + ": " + levelIS[level][1]);
            indent = indent + space/2;
            space = space*2;
    }
    return levelIS;
```

```
}
void connection(Element[] array, int[] IS, int stairsUp, int stairsDown)
{

    //    -   -    E
    //  -      -   E
    // -         - E

    if (stairsUp > 0)
    {
            TabV(IS[0]);
            for(int index = 0; index < array.length; index++)
            {
                    if (array[index] != null && array[index].classification == "Node")
                    {
                            for(int count = stairsUp*IS[1]; count>0; count--)
                            {
                                    this.verticalTree += " ";
                            }
                            this.verticalTree += "-";

                            for(int count = stairsDown*IS[1]; count>0; count--)
                            {
                                    this.verticalTree += " ";
                            }
                            this.verticalTree += "-";

                            for(int count = stairsUp*IS[1]; count>2; count--)
                            {
                                    this.verticalTree += " ";
                            }
                    }
                    else
                    {
                            for(int count = stairsUp*IS[1]; count>0; count--)
                            {
                                    this.verticalTree += " ";
                            }
                            this.verticalTree += " ";

                            for(int count = stairsDown*IS[1]; count>0; count--)
                            {
                                    this.verticalTree += " ";
                            }
                            this.verticalTree += " ";

                            for(int count = stairsUp*IS[1]; count>2; count--)
                            {
                                    this.verticalTree += " ";
                            }
                    }

                    TabV(IS[1]);
            }

            this.verticalTree += "\n";
            connection(array, IS, stairsUp-1, stairsDown+2);
        }
        return;
    }
}
//A + B - C * D / F
class Converter
{
    static Element[] stack;
    static Element[] infix;
    static Element[] reversedInfix;
    static Element[] prefix;
    static Element[] reversedPrefix;
```

```
        static Element[] toPrefix(String expression)
        {
          infix = ArrayConverter(expression);
          reversedInfix = reverse(infix);

          stack = new Element[Tools.count(reversedInfix, "Operator")];
          reversedPrefix = new Element[reversedInfix.length - Tools.count(reversedInfix,
"Parenthesis")];
          stack[0] = new Element(" ", " ", 0);

          int top = -1, reversedPrefixIndex = 0, raiseLvl = 0, rIndex = -1;
          int[] reference = new int[Tools.count(reversedInfix, "Parenthesis")/2];
          //marks the index that the parenthesis started

          for (int index = 0; index<reversedInfix.length; index++)
          {
                //increase precedence level for parenthesis
                if (reversedInfix[index].element.equals(")"))
                {
                      rIndex++;
                      reference[rIndex] = top;
                      raiseLvl += 5;//make sure to prioritize those inside parenthesis
                      index++;
                      //System.out.println("Reference index: " + top);
                }
                if (reversedInfix[index].element.equals("("))
                {
                      raiseLvl = -5;//decreases level raiser depending on the ( encountered
                      index++;
                      //System.out.println("currentTop: " + top);
                      while (top > reference[rIndex]) //pops all operators within the parenthesis
                      {
                            reversedPrefix[reversedPrefixIndex] = stack[top];
                            reversedPrefixIndex++;
                            top--;
                }
                rIndex--;
            }
            if (index == reversedInfix.length)//breaks loop immediately after all elements are
scanned
                break;

            if (reversedInfix[index].classification == "Node")//if operator
            {
                //condition in reversedPrefix changes when multiple carets are
encountered
                if (reversedInfix[index].element.equals("^"))
                {
                    if (top == -1 || reversedInfix[index].plvl+raiseLvl > stack[top].plvl)
                    {
                        top++;
                        stack[top] = reversedInfix[index];
                    }
                    else
                    {
                        while (top != -1 && reversedInfix[index].plvl+raiseLvl <=
stack[top].plvl )
                        {
                            reversedPrefix[reversedPrefixIndex] =
stack[top];//pop
                            reversedPrefixIndex++;
                            top--;
                        }
                        top++;
                        stack[top] = reversedInfix[index];
                    }
                }
                else //if not "^"
                {
                        //stack empty or scanned is greater than top
                    if (top == -1 || reversedInfix[index].plvl+raiseLvl >= stack[top].plvl)
                    {
                        top++;
                        stack[top] = reversedInfix[index];
                    }
                    else
                    {
                        while (top != -1 && reversedInfix[index].plvl+raiseLvl <
stack[top].plvl )
                        {
                            reversedPrefix[reversedPrefixIndex] =
stack[top];//pop
                            reversedPrefixIndex++;
                            top--;
                        }
                        top++;
                        stack[top] = reversedInfix[index];
                    }
                }
            }
            else if (reversedInfix[index].classification == "Leaf")//if operand
            {
                reversedPrefix[reversedPrefixIndex] = reversedInfix[index];//pop
                reversedPrefixIndex++;
            }

        }
        //insert all remaining elements in the stack
        while (top > -1)
        {
            reversedPrefix[reversedPrefixIndex] = stack[top];
            reversedPrefixIndex++;
            top--;
        }

        prefix = reverse(reversedPrefix);

        return prefix;
      }

      static Element[] reverse(Element[] expression)
      {
        Element[] reverse = new Element[expression.length];
        for (int count = expression.length-1, index = 0; count>=0; count--, index++)
        {
            reverse[index] = expression[count];
        }
        return reverse;
      }

      static Element[] ArrayConverter(String expression)
      {
        String reference[] = Tools.stringToArray(expression);
        Element[] elementArray = new Element[reference.length];

        for (int index = 0; index<reference.length; index++)
        {
            elementArray[index] = new Element(reference[index],
Element.classification(reference[index]), Element.plvl(reference[index]));
        }
        return elementArray;
      }
}

class PrefixCalculator
{
      Scanner in = new Scanner(System.in);
      Element[] expression;
      Element[] stack;
      Element[] calculated;
      PrefixCalculator(Element[] reversedPrefix)
      {
        expression = reversedPrefix;
```

```
    for (int index = expression.length-1; index>-1; index--)
    {
        if (expression[index].classification == "Leaf")
        {
            System.out.print("  Enter value of " + expression[index].element + ": ");
            expression[index].value = in.nextDouble();
            expression[index].element = Double.toString(expression[index].value);
        }
    }
    //System.out.println(Tools.count(expression, "Operand"));
    stack = new Element[Tools.count(expression, "Operand")];
    int recurse = Tools.count(reversedPrefix, "Operator")-1;

    Tree binaryExpression = new Tree(Converter.reverse(expression));
    Tools.PrintVertically(binaryExpression.verticalTree, 100);
    Element[] calculatedPrefix = Calculate(expression);
    binaryExpression = new Tree(calculatedPrefix);
    Tools.PrintVertically(binaryExpression.verticalTree, 100);
    calculatedPrefix = Converter.reverse(calculatedPrefix);

    for (; recurse > 0; recurse--)
    {
    calculatedPrefix = Calculate(calculatedPrefix);
    binaryExpression = new Tree(calculatedPrefix);
    Tools.PrintVertically(binaryExpression.verticalTree, 100);
    calculatedPrefix = Converter.reverse(calculatedPrefix);
    }

    Tools.PrintHorizontally("  FINAL ANSWER: " + calculatedPrefix[0].element, 50);
}

Element[] Calculate(Element[] expression)
{
    int top = -1;
int index = 0;
for (; index<expression.length; index++)
{
        if (expression[index].classification == "Leaf")
        {
                top++;
                stack[top] = expression[index];
        }
        else
        {
                if (expression[index].element.equals("+"))
                {
                        expression[index].value = stack[top].value + stack[top-1].value;
                }
                else if (expression[index].element.equals("-"))
                {
                        expression[index].value = stack[top].value - stack[top-1].value;

                }
                else if (expression[index].element.equals("*"))
                {
                        expression[index].value = stack[top].value * stack[top-1].value;

                }
                else if (expression[index].element.equals("/"))
                {
                        expression[index].value = stack[top].value / stack[top-1].value;

                }
                else if (expression[index].element.equals("^"))
                {
                        double result=stack[top].value;
                        for (double limit = stack[top-1].value; limit>1; limit--)
                        {
                                result = result*stack[top].value;
```

```
                    }
                    expression[index].value = result;
                }
                expression[index].classification = "Leaf";
                expression[index].element = Double.toString(expression[index].value);
                top -=2;
                break;
            }
        }
        //System.out.println("Index : " + index);
        calculated = new Element[expression.length - 2];

        //System.out.println("size: " + (expression.length - 2));
        int newIndex = 0;
        for (int stackIndex=0; stackIndex<top+1; newIndex++, stackIndex++)
        {
            calculated[newIndex] = stack[stackIndex];
        }

        for (; index < expression.length && newIndex < calculated.length; index++, newIndex++)
        {
            calculated[newIndex] = expression[index];
        }

        return Converter.reverse(calculated);
        //Tools.ArrayInformation(calculated, "Value");
        //System.out.println("\nNewIndex: " + newIndex);
        //System.out.println(); //for tests only

       }

}

class Tools
{
```

```
static String[] stringToArray(String expression)
{
    String array[];
    array = expression.split(" ");
    return array;
}

static void ArrayInformation(Element[] array, String characteristic)
{
    switch (characteristic)
    {
    case "Element":
            System.out.print("Element name:\t");
            for (int index = 0; index<array.length; index++ )
            {
                    if (array[index] == null)
                            System.out.print("\t");
                    else
                    System.out.print(array[index].element + "\t");
            }
            System.out.println();
            break;

    case "PLVL":
            System.out.print("Precedence lvl:\t");
            for (int index = 0; index<array.length; index++ )
            {
                    if (array[index] == null)
                            System.out.print("\t");
                    else
                    System.out.print(array[index].plvl + "\t");
            }
            System.out.println();
            break;
    case "Classification" :
        System.out.print("Classification:\t");
        for (int index = 0; index<array.length; index++ )
        {
            if (array[index] == null)
                System.out.print("\t");
            else
            System.out.print(array[index].classification + "\t");
        }
        System.out.println();
        break;

    case "TLVL":
        System.out.print("\nTreeLevel:\t");
        for (int index = 0; index<array.length; index++ )
        {
            if (array[index] == null)
                System.out.print("\t");
            else
            System.out.print(array[index].treeLevel + "\t");
        }
        break;
    case "Value":
        System.out.print("\nValue:\t");
        for (int index = 0; index<array.length; index++ )
        {
            if (array[index].value == 0.0)
                System.out.print(array[index].element + "\t");
            else
            System.out.print(array[index].value + "\t");
        }
        break;
    }
}
```

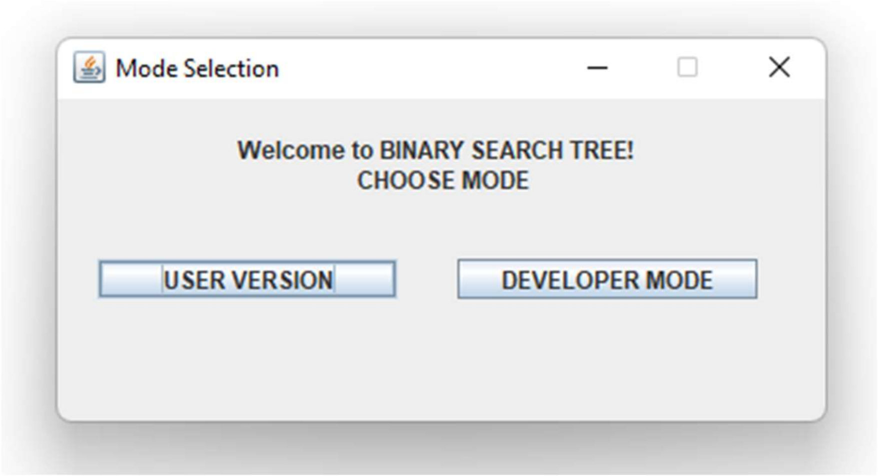
```
static void ArrayInformation2D(Element[][] array, String characteristic)
{
  for(int index1 = 0; index1<array.length; index1++)
  {
        System.out.print("LVL " + (index1+1) + ": ");
        for(int index2 = 0; index2<array[index1].length; index2++)
        {
                if (array[index1][index2] == null)
                {
                        System.out.print("\t");
                }
                else
                {
                        switch (characteristic)
                        {
                        case "Element":
                                System.out.print(array[index1][index2].element + "\t");
                                break;
                        case "PLVL":
                                System.out.print(array[index1][index2].plvl + "\t");
                                break;
                        case "Classification":
                                System.out.print(array[index1][index2].classification +
"\t");
                                break;
                        case "TLVL":
                                System.out.print(array[index1][index2].treeLevel + "\t");
                                break;
                        }
                }
        }
        System.out.println();
  }
}
```

```
static int count(Element[] array, String characteristic)
{
   int counter = 0;
   for(int index = 0; index<array.length; index++)
   {
            switch(characteristic)
            {
            case "Operator":
                     if (array[index].classification == "Node")
                              counter++;
                     break;
            case "Operand":
                     if (array[index].classification == "Leaf")
                              counter++;
                     break;
            case "Parenthesis":
                     if (array[index].classification == "Prnthss")
                              counter++;
                     break;
            }
   }
   return counter;
}

static Element[][] ArrayMaker(int level)
{
   Element[][] lines = new Element[level][];
   int size2D = 1;
   for(int index = 0; index<level; index++)
   {
            lines[index] = new Element[size2D];
            size2D = size2D*2;
   }
   return lines;
}
```

```
static void PrintVertically(String s, int speed)
{
    try
    {
            for (int index = 0; index<s.length(); index++)
            {
                    if (s.charAt(index) == '\n')
                    {
                            TimeUnit.MILLISECONDS.sleep(speed);
                    }
                    System.out.print(s.charAt(index));
            }
    }
    catch (Exception  e) {}
}

static void PrintHorizontally(String s, int speed)
{
    try
    {
            for (int index = 0; index<s.length(); index++)
            {
                    TimeUnit.MILLISECONDS.sleep(speed);
                    System.out.print(s.charAt(index));
            }
    }
    catch (Exception  e) {}
}

static void end()
{
    String end = "\n\n\n\n\n\n\n\n\n\n\n\n"
                    + "\t                *      ,1111111.              *\r\n"
                    + "\t                      11111111111     .\r\n"
                    + "\t                  1111111111111\r\n"
                    + "\t      *           1111111111111\r\n"
                    + "\t                  1111111111111\r\n"
                    + "\t                  '11111111111'\r\n"
                    + "\t                    '1111111'      *\r\n"
                    + "\t            |\\___/|      -\r\n"
                    + "\t            )     (              .              '\r\n"
                    + "\t           =\\     /=\r\n"
                    + "\t             )===(       *\r\n"
                    + "\t            /     \\\r\n"
                    + "\t            |     |\r\n"
                    + "\t           /       \\\r\n"
                    + "\t           \\       /\r\n"
                    + "\t   _/\\_/\\_/\\__  _/_/\\_/\\_/\\_/\\_/\\_/\\_/\\_/\\_/\\_\r\n"
                    + "\t   |  |  |  |( (  |  |  |  |  |  |  |  |  |  |\r\n"
                    + "\t   |  |  |  | ) ) |  |  | THANK YOU PO |  |  |\r\n"
                    + "\t   |  |  |  |(_(  |  |  |  |  |  |  |  |  |  |\r\n"
                    + "\t   |  |  |  |  |  | BY: VEM AIENSI MARASIGAN |\r\n"
                    + "\t   |  |  |  |  |  |  |  | NICKIE LUMABOS  |  |\n"
                    + "\t   |  |  |  |  |  | ALLEN CHRIS DELOS SANTOS |\n"
                    + "\n\n\n\n\n\n\n\n\n";

          String credits = "\t                ASCII art is from: \n"
                    + "\t http://user.xmission.com/~emailbox/ascii_cats.htm\n";


          Tools.PrintVertically(end, 100);
          Tools.PrintHorizontally(credits, 20);
        }
}

class GUI extends BSCS2_Marasigan_Lumabos_DelosSantos_FinalProject
{
        static JFrame mainWindow = new JFrame();
        static String expression;
        static String Mode;
static JFrame ask = new JFrame();
static JTextField infix = new JTextField();

static void show()
{
    ActionListener pass = new ActionListener()
    {
public void actionPerformed(ActionEvent e)
{
    JLabel note = new JLabel("Note:  Please include spaces in between elements");
    note.setBounds(80, 80, 300, 20);

    JLabel label = new JLabel("Please Type Infix Expression: ");
    label.setBounds(20, 10, 300, 50);

    infix.setBounds(50, 60, 400, 20);

    JButton submit = new JButton("SUBMIT");
    submit.setBounds(150, 110, 170, 20);
    ActionListener proceed = new ActionListener() {
                public void actionPerformed(ActionEvent e)
        {
                            expression = infix.getText();
                            mainWindow.setVisible(false);
                            if (Mode == "DEV")
                                        DeveloperVersion(expression, 0);
                            else
                                        UserVersion(expression);
        }
        };
    submit.addActionListener(proceed);

    JPanel panel2 = new JPanel();
    panel2.setLayout(null);
    panel2.add(infix);
    panel2.add(label);
    panel2.add(submit);
    panel2.add(note);

    mainWindow.add(panel2);
    mainWindow.setTitle("Binary Search Tree");
    mainWindow.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    mainWindow.setSize(500, 210);
    mainWindow.setResizable(false);
    mainWindow.setVisible(true);
}
    };

    JPanel panel = new JPanel();
    JLabel welcome = new JLabel("Welcome to BINARY SEARCH TREE!");
    welcome.setBounds(90, 15, 300, 20);

    JLabel mode = new JLabel("CHOOSE MODE");
    mode.setBounds(150, 30, 150, 20);

    JButton user = new JButton("USER VERSION");
    user.setBounds(20, 80, 150, 20);
    ActionListener User = new ActionListener() {
                public void actionPerformed(ActionEvent e)
        {
                        Mode = "USER";
                        ask.setVisible(false);
        }
       };
    user.addActionListener(User);
    user.addActionListener(pass);

    JButton dev = new JButton("DEVELOPER MODE");
    dev.setBounds(200, 80, 150, 20);
    ActionListener developer = new ActionListener() {
```

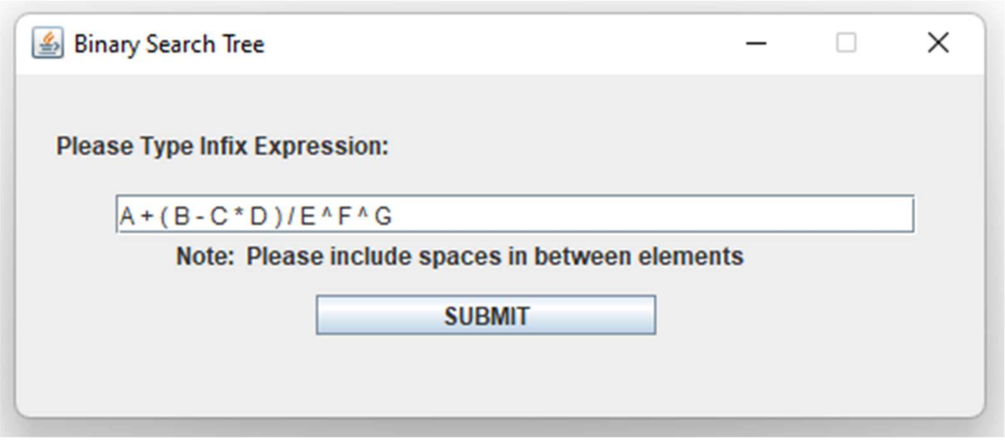
```
                    public void actionPerformed(ActionEvent e)
                {
                            Mode = "DEV";
                            ask.setVisible(false);
                }
               };
            dev.addActionListener(developer);
            dev.addActionListener(pass);

            panel.setLayout(null);
            panel.add(mode);
            panel.add(user);
            panel.add(dev);
            panel.add(welcome);

            ask.setTitle("Mode Selection");
            ask.setVisible(true);
            ask.add(panel);
            ask.setSize(400, 200);
            ask.setDefaultCloseOperation(1);
            ask.setResizable(false);
        }
}
```

SCREENSHOTS



Mode Selection

Welcome to BINARY SEARCH TREE!
CHOOSE MODE

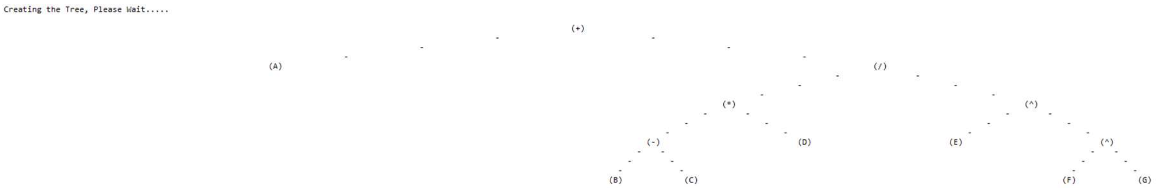


Binary Search Tree

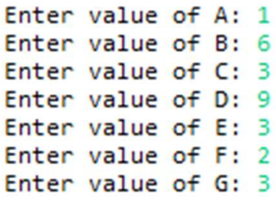
Please Type Infix Expression:

A + (B - C * D) / E ^ F ^ G

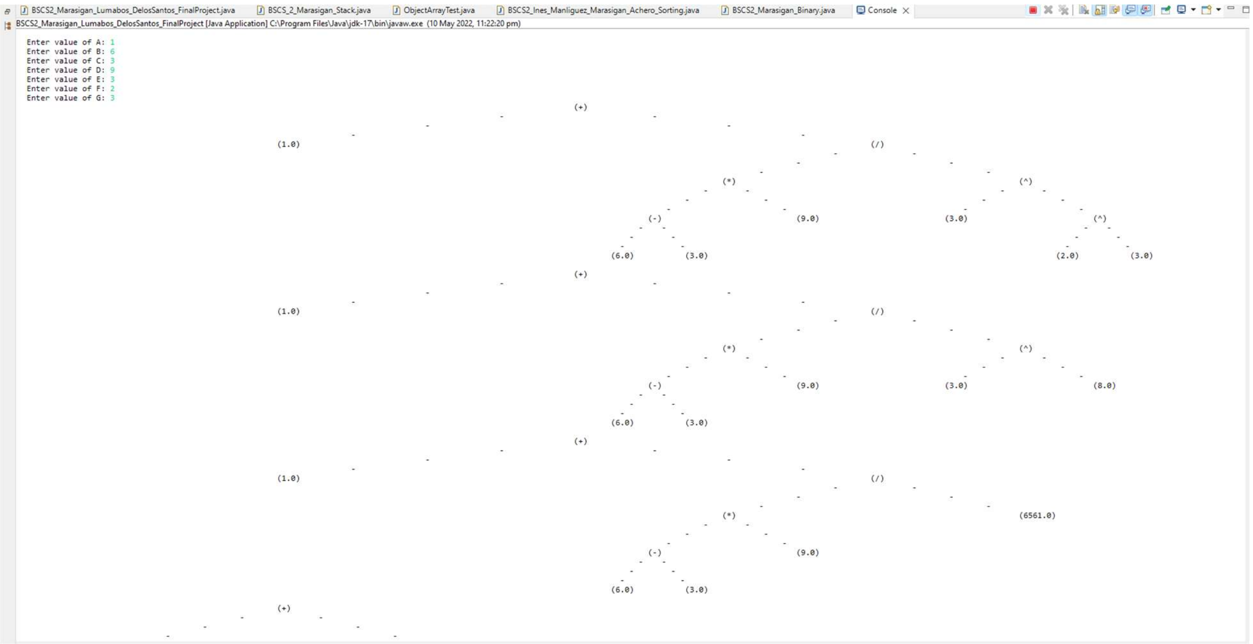
Note: Please include spaces in between elements



```
Creating the Tree, Please Wait.....
```

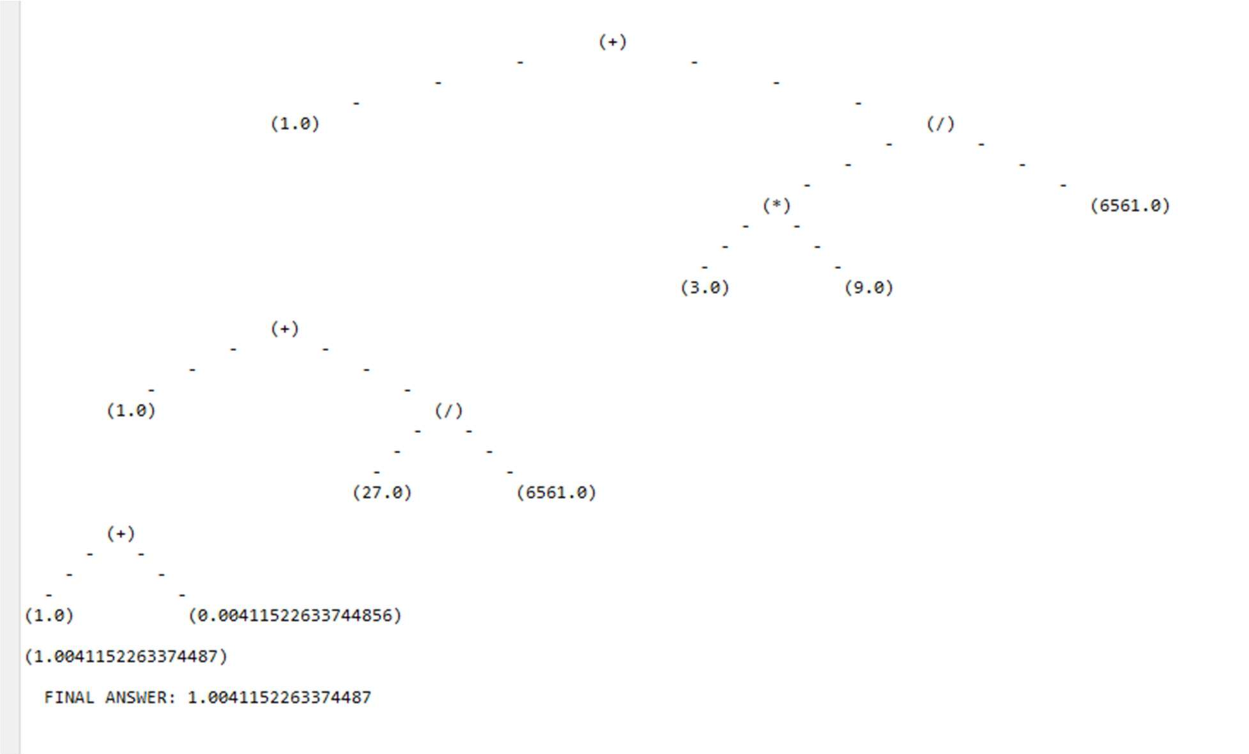


```
Enter value of A: 1
Enter value of B: 6
Enter value of C: 3
Enter value of D: 9
Enter value of E: 3
Enter value of F: 2
Enter value of G: 3
```

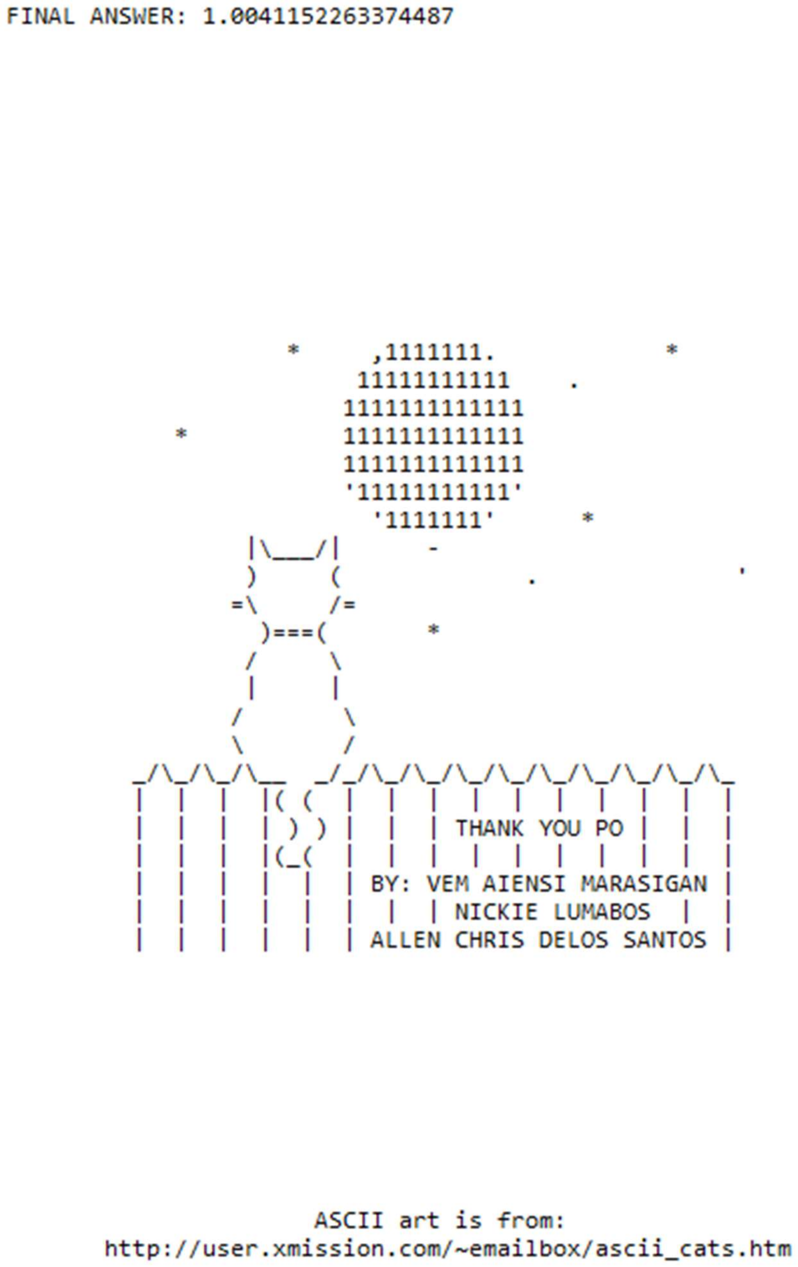

BSCS2_Marasigan_Lumabos_DelosSantos_FinalProject.java
BSCS_2_Marasigan_Stack.java
ObjectArrayTest.java
BSCS2_Ines_Manliguez_Marasigan_Achero_Sorting.java
BSCS2_Marasigan_Binary.java
Console

BSCS2_Marasigan_Lumabos_DelosSantos_FinalProject [Java Application] C:\Program Files\Java\jdk-17\bin\javaw.exe (10 May 2022, 11:22:20 pm)

```
Enter value of A: 1
Enter value of B: 6
Enter value of C: 3
Enter value of D: 9
Enter value of E: 3
Enter value of F: 2
Enter value of G: 3
                                       (+)
                              -                   -
                        -                               -
                  -                                           -
          (1.0)                                                     (/)
                                                          -               -
                                                     -                         -
                                                -                                   -
                                            (*)                                        (^)
                                          -     -                                    -     -
                                       -           -                              -           -
                                    -                 -                        -                 -
                                 (-)                  (9.0)               (3.0)                    (^)
                                -   -                                                             -   -
                               -     -                                                           -     -
                            (6.0)    (3.0)                                                    (2.0)    (3.0)
                                       (+)
                              -                   -
                        -                               -
                  -                                           -
          (1.0)                                                     (/)
                                                          -               -
                                                     -                         -
                                                -                                   -
                                            (*)                                        (^)
                                          -     -                                    -     -
                                       -           -                              -           -
                                    -                 -                        -                 -
                                 (-)                  (9.0)               (3.0)                    (8.0)
                                -   -
                               -     -
                            (6.0)    (3.0)
                                       (+)
                              -                   -
                        -                               -
                  -                                           -
          (1.0)                                                     (/)
                                                          -               -
                                                     -                         -
                                                -                                   -
                                            (*)                                 (6561.0)
                                          -     -
                                       -           -
                                    -                 -
                                 (-)                  (9.0)
                                -   -
                               -     -
                            (6.0)    (3.0)
                    (+)
              -            -
        -                        -
```



```
                                  (+)
                          -                 -
                     -                           -
                -                                     -
          (1.0)                                             (/)
                                                        -         -
                                                   -                   -
                                              -                             -
                                           (*)                                 (6561.0)
                                         -     -
                                       -         -
                                     -              -
                                  (3.0)            (9.0)

                (+)
             -       -
          -             -
       -                   -
   (1.0)                    (/)
                          -      -
                        -          -
                      -               -
                  (27.0)            (6561.0)

   (+)
  -    -
 -        -
-            -
(1.0)           (0.00411522633744856)

(1.0041152263374487)

  FINAL ANSWER: 1.0041152263374487
```



```
FINAL ANSWER: 1.0041152263374487
```

```
           *     ,1111111.            *
                11111111111    .
               1111111111111
   *           1111111111111
               1111111111111
               '11111111111'
                 '1111111'      *
        |\___/|      -
        )     (             .              '
       =\     /=
         )===(       *
        /     \
        |     |
       /       \
       \       /
_/\_/\_/\__  _/_/\_/\_/\_/\_/\_/\_/\_/\_/\_
|  |  |  |( (  |  |  |  |  |  |  |  |  |  |
|  |  |  | ) ) |  |  | THANK YOU PO |  |  |
|  |  |  |(_(  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | BY: VEM AIENSI MARASIGAN |
|  |  |  |  |  |  |  | NICKIE LUMABOS  |  |
|  |  |  |  |  | ALLEN CHRIS DELOS SANTOS |
```

```
         ASCII art is from:
http://user.xmission.com/~emailbox/ascii_cats.htm
```

Running Video:

https://drive.google.com/file/d/1mRU4HnHHgwU5I030kondw2lYZHObXVBB/view?usp=sharing