Xiaoxi Zheng
CAP3027
Section 1927
9/25/15
HW05

Cover Page

*I, Xiaoxi Zheng*___ affirm that the work submitted is my own and that the Honor Code was neither bent nor broken.

The easiest part of this HW is the setup of this project, since the structure of code was quite straight forward. The more difficult parts of the HW is buried within working around with JPanel and the way it displays things, and the exact way setline() method is use so not just the last stem is displayed. I also spend some time creating a color array object and an array object to store the float value of basic strokes.
I believe the objective of this assignment was for us to understand and implement setting lines using BufferedImage's Graphic2D "tool" set. While given us some general practice for methods interacting together.

Xiaoxi Zheng
CAP3027
Section 1927
9/25/15
HW05

CODES:

```
import java.awt.*;
import java.awt.event.*;
import java.awt.image.*;
import java.io.*;
import javax.imageio.*;
import javax.swing.*;
import javax.swing.JOptionPane;
import java.util.Random;
import java.lang.Math.*;
import java.lang.Math;
import java.awt.Graphics;
import java.awt.Graphics2D;
import java.awt.geom.*;
import java.awt.geom.Line2D;

public class hw05a{

        private static final int WIDTH = 401;
        private static final int HEIGHT = 401;

        public static void main( String[] args){
                JFrame frame = new ImageFrame(WIDTH, HEIGHT);
                frame.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE);
                frame.setVisible(true);
        }
}

//###############################################################################
class ImageFrame extends JFrame{
        ///private final JFileChooser chooser;
        private BufferedImage image = null;
        private Random rand = new Random();
        private double randX;

        private int size;
        private double x;
        private double y;
        private int stems;
        private  int stepsPerStem;
        private  int steps;
        private double alpha;
        private double beta;
        private double theta;
        private double deltaTheta;
        private int rho;
        private int deltaRho;
        private int direction;
        private double tao;

        private int endColor;
        private int startColor;

        private Color [] colorArray;
        private float [] basicStrokeWeight;


        //========================
        public ImageFrame(int width, int height){
                //setup the frame's attributes

                this.setTitle("CAP 3027 2015 - HW05a -XiaoxiZheng");
                this.setSize( width, height );

                //initialize start and end colors as black and green
                startColor = 0xf4a460;
                endColor = 0x32cd32;
                addMenu();////add a menu to the frame

                //setup the file chooser dialog
                //chooser = new JFileChooser();
                //chooser.setCurrentDirectory(new File("."));
        }
        private void addMenu(){
                //setup the frame's munu bar
                //File menu
                JMenu fileMenu = new JMenu("File");

                //===Crystal on Toroid plane
                JMenuItem directedRW = new JMenuItem("Directed random walk plant");
                directedRW.addActionListener( new ActionListener(){
                    public void actionPerformed( ActionEvent event){
                        CreateBufferedImageT();
                    }
                }   );
                fileMenu.add(directedRW);

                JMenuItem setColor = new JMenuItem("Set starting and end color");
                setColor.addActionListener( new ActionListener(){
                    public void actionPerformed( ActionEvent event){
                        promptForSettingStartColor();
                        promptForSettingEndColor();
                    }
                }   );
                fileMenu.add(setColor);
                //Exit
                JMenuItem exitItem = new JMenuItem("Exit");
                exitItem.addActionListener( new ActionListener(){
                    public void actionPerformed(ActionEvent event){
                        System.exit( 0 );
                    }
                }   );
                fileMenu.add( exitItem);

                //attach menu to a menu bar
                JMenuBar menuBar = new JMenuBar();
                menuBar.add( fileMenu);
                this.setJMenuBar( menuBar);
        }
        private void CreateBufferedImageT(){
                size = promptForSize();
                stems = promptForStems();
                stepsPerStem = promptForStepsPerStem();
                alpha = promtForTransmiteProb();
                deltaTheta = promptForMaxRotation();
                deltaRho = promptForMaxGrowthSegment();
                BufferedImage image = new BufferedImage(size,size,BufferedImage.TYPE_INT_ARGB);
                RenderingHints hint =
                 new RenderingHints( RenderingHints.KEY_ANTIALIASING,
                     RenderingHints.VALUE_ANTIALIAS_ON);

                Graphics2D target = (Graphics2D)image.createGraphics();


                target.setRenderingHints( hint );
                setBG_black(size,image);

                for(int i = 0; i<stems;i++){

                    Color[] colorArray = new Color[stepsPerStem];
                    float [] basicStrokeWeight = new float[stepsPerStem];

                    colorArray = interpolateColor(stepsPerStem,startColor,endColor);
                    basicStrokeWeight = interpolateWeight(stepsPerStem,6.0,0.5);
```

Xiaoxi Zheng
CAP3027
Section 1927
9/25/15
HW05

```
//initial
target.setColor(colorArray[0]);
BasicStroke stroke = new BasicStroke(6);
target.setStroke( stroke );

theta = Math.PI/2;
rho = 1;
beta = 1-alpha;
x = size/2;
y = size/2;
double rand1 = rand.nextDouble();
if (rand1>=0.5){
	direction = -1;
} else {
	direction = 1;
}
double[] coord = new double[2];
coord = toCartesian(rho,theta*direction);
//Line2D line2d = new Line2D.Double(x,y,x,y-coord[1]);
Line2D line2d = new Line2D.Double(x, y, x, y+rho);
//System.out.println(x);
target.draw(line2d);

x = line2d.getX2();
y = line2d.getY2();

for (int j=0;j<stepsPerStem;j++) {

	System.out.println("color at the step: " + colorArray[j]);
	System.out.println("stroke at the step: " + basicStrokeWeight[j]);
	BasicStroke stroke_ = new BasicStroke( basicStrokeWeight[j]);
	target.setStroke( stroke_ );
	target.setColor(colorArray[j]);

	if (direction == -1) {
		tao = alpha;
	} else {
		tao = beta;
	}
	randX = rand.nextDouble();
	if (randX>tao) {
		direction = 1;
	} else {
		direction = -1;
	}
```

```
                //compute offset
                double randT = rand.nextDouble();
                rho=rho+deltaRho;
                theta = (deltaTheta*randT*direction)+theta;

                double[] newCoord = new double[2];
                newCoord = toCartesian(rho, theta);

                line2d.setLine(x, y, x+newCoord[0], y-newCoord[1]);
                target.draw(line2d);

                x = line2d.getX2();
                y= line2d.getY2();
            }
        displayFile(image);
    }
    //displayFile(image);
}
    private Color[] interpolateColor(int stepsPerStem_,int startColor,int endColor){
        Color [] colorArray_ = new Color [stepsPerStem_];

        double[] colorInfoStart = extraction(startColor);
        double[] colorInfoEnd = extraction(endColor);

        double deltaRGen = (colorInfoEnd[1] - colorInfoStart[1])/stepsPerStem_; //[1]--channel
for red
        double deltaGGen = (colorInfoEnd[2] - colorInfoStart[2])/stepsPerStem_; //[2]--channel
for green
        double deltaBGen = (colorInfoEnd[3] - colorInfoStart[3])/stepsPerStem_; //[3]--channel
for blue

        double redGeneral = colorInfoStart[1]; //start paiting @ left
        double greenGeneral = colorInfoStart[2]; //start paiting @ left
        double blueGeneral = colorInfoStart[3]; //starting paiting @ left

        for(int x = 0; x<stepsPerStem_ ;x++){
            redGeneral = redGeneral + deltaRGen;  //bc red starts from the left
            greenGeneral = greenGeneral + deltaGGen;
            blueGeneral = blueGeneral + deltaBGen;
                //clamping
                if(redGeneral>255){
                    redGeneral = 255;
                }
                if(redGeneral<0){
                    redGeneral = 0;
                }
                if(greenGeneral>255){
                    greenGeneral = 255;
                }
                if(greenGeneral<0){
                    greenGeneral = 0;
                }
                if(blueGeneral>255){
                    blueGeneral = 255;
                }
                if(blueGeneral<0){
                    blueGeneral = 0;
                }
            colorArray_[x] = new Color((int)redGeneral,(int)greenGeneral,(int)blueGeneral);
        }
        return colorArray_;
    }
    private float [] interpolateWeight(int stepsPerStem_,double startWeight_, double endWeight_){
        float [] basicStrokeWeight_ = new float [stepsPerStem_];
        float strokeW = (float)startWeight_;
        float deltaStrokeW = (float)(startWeight_ - endWeight_)/stepsPerStem_ ;
        for(int i = 0; i<stepsPerStem_ ;i++){
            strokeW = strokeW - deltaStrokeW;  // bc start stroke is actually bigger than end
stroke
            basicStrokeWeight_[i] = strokeW;
        }
        return basicStrokeWeight_ ;
    }

    private static double[] extraction(int ARGB_){
        double[] extractionArray;
        extractionArray = new double[4];
        //extractionArray -- extraction[0] = alpha values;
                            //extraction[1] = red values; & etc with ARGB
        extractionArray[0] = ARGB_>>>24;
        extractionArray[1] = (ARGB_<<8) >>> 24;
        extractionArray[2] = (ARGB_<<16)>>>24;
        extractionArray[3] = (ARGB_<<24)>>>24;
        return (extractionArray);
    }
    private double[] toCartesian(double rho_, double theta_){
        double [] tempA = new double[2];
        double x = Math.cos(theta_)*rho;
        double y = Math.sin(theta_)*rho;
        tempA[0] = x;
        tempA[1] = y;
        return tempA;
    }
    private int promptForSize(){ //helper method to bufferedIMage methods
        //try catch statement for non int inputs.
        String input = JOptionPane.showInputDialog("Please enter the size of your canvas");
        if(valideInput(input)){
            int size = Integer.parseInt(input);
            return size;
        }
        else{
            return promptForSize(); //if input was invalide, prompt for size again.
        }

    }
    private void promptForSettingStartColor(){
        String input = JOptionPane.showInputDialog("Please enter start color for the stem");
        try{
            int color_ = (int)Long.parseLong(input.substring(2,input.length()),16 );
            startColor =  color_;
        }
        catch(Exception e){
            JOptionPane.showMessageDialog(null, "Invalid Input", "alert",
            JOptionPane.ERROR_MESSAGE);
        }
    }

    private void promptForSettingEndColor(){ //helper method to bufferedIMage methods
        String input = JOptionPane.showInputDialog("Please enter end color for the stem");

        try{
            int color_ = (int)Long.parseLong(input.substring(2,input.length()),16 );
            endColor =  color_;
        }
        catch(Exception e){
            JOptionPane.showMessageDialog(null, "Invalid Input", "alert",
            JOptionPane.ERROR_MESSAGE);
        }

    }
    private int promptForStems(){ //helper method to bufferedIMage methods
        //try catch statement for non int inputs.
        String input = JOptionPane.showInputDialog("Please enter the number of stems");
        if(valideInput(input)){
            int stems_ = Integer.parseInt(input);
            return stems_;
        }
        else{
            return promptForStems(); //if input was invalide, prompt for size again.
        }
    }
    private int promptForStepsPerStem(){ //helper method to bufferedIMage methods
        //try catch statement for non int inputs.
        String input = JOptionPane.showInputDialog("Please enter the number steps per stem");
        if(valideInput(input)){
            int stepsPerStem_ = Integer.parseInt(input);
            return stepsPerStem_;
        }
        else{
            return promptForStepsPerStem(); //if input was invalide, prompt for size again.
        }
    }
    private double promtForTransmiteProb(){
        String input = JOptionPane.showInputDialog("Please enter transmittion probability");
        if(valideInputBetween0n1(input)){
            double probability_ = Double.parseDouble(input);
            return probability_;
        }
        else{
            return promtForTransmiteProb(); //if input was invalid, prompt for size again.
        }
    }
    private double promptForMaxRotation(){
        String input = JOptionPane.showInputDialog(
            "Please enter the maximum Rotation increment");
        if(valideInputBetween0n1(input)){
            double maxRotate_ =  Double.parseDouble(input);
            return maxRotate_;
        }
        else{
            return promptForMaxRotation(); //if input was invalid, prompt for size again.
        }
    }
    private int promptForMaxGrowthSegment(){
        String input = JOptionPane.showInputDialog("Please enter growth segment increment");
        if(valideInput(input)){
            int growthSeg_ = Integer.parseInt(input);
            return growthSeg_;
        }
        else{
            return promptForMaxGrowthSegment();                  }
    }
    private boolean valideInput(String input_){
        try{
            int num = Integer.parseInt(input_);
            if(num<0){
                JOptionPane.showMessageDialog(null, "Invalid Input", "alert",
                JOptionPane.ERROR_MESSAGE);
                return false;
            }
            return true;
        }
        catch(NumberFormatException e){
            JOptionPane.showMessageDialog(null, "Invalid Input", "alert",
            JOptionPane.ERROR_MESSAGE);
            return false;
        }
    }
    private boolean valideInputBetween0n1(String input_){
        try{
            double num = Double.parseDouble(input_);
            if(num<0 || num>1){
                JOptionPane.showMessageDialog(null, "Invalid Input", "alert",
                JOptionPane.ERROR_MESSAGE);
                return false;
            }
            return true;
        }
        catch(NumberFormatException e){
            JOptionPane.showMessageDialog(null, "Invalid Input", "alert",
            JOptionPane.ERROR_MESSAGE);
            return false;
        }
    }
    private void setBG_black(int size_, BufferedImage image_){
        for(int x = 0; x<size_; x++){
            for(int y =0; y<size_; y++){
                image_.setRGB(x,y,0xFF000000);
            }
        }
}



//just incase if there are any exceptions that wasn't caught in my prompt() method
```

Xiaoxi Zheng
CAP3027
Section 1927
9/25/15
HW05

```
private void displayFile(BufferedImage image_){
                try{
                        displayBufferedImage(image_);
                }
                catch(Exception exception){
                        JOptionPane.showMessageDialog(null, "ERRR", "alert",
                        JOptionPane.ERROR_MESSAGE);
                }
        }

//display BufferedImage
public void displayBufferedImage( BufferedImage image){
                this.setContentPane( new JScrollPane(new JLabel(new ImageIcon(image))));
                this.validate();
 }

}
```

===

QUESTIONS

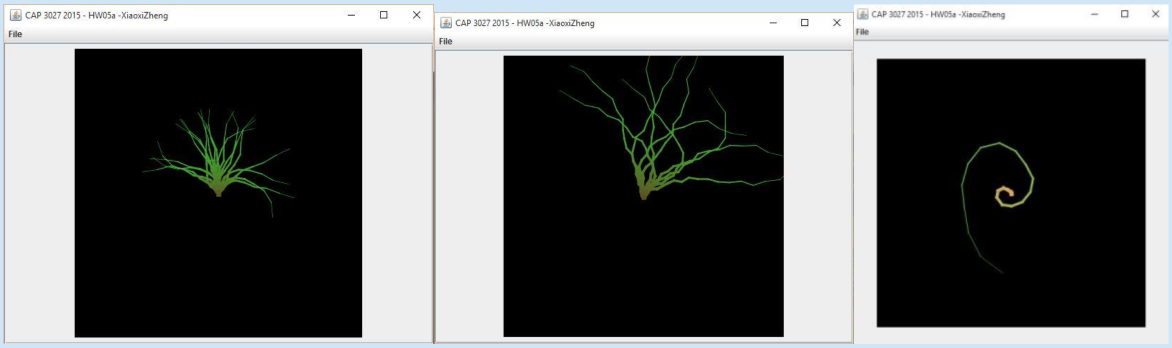
1. Does the program compile without errors?
Yes.
2. Does the program compile without warnings?
Yes
3. Does the program run without crashing?
Yes
4.Describe how you tested the program.
I ran several test cases with different user inputs. I gave couple illegal test cases when users input negative canvas size, and char/string inputs. I gave big and small test value inputs to make sure everything is working. I also gave user inputs that are greater than the size of image to make sure it produces the single giant circle in the middle.
5. Describe the ways in which the program does not meet assignment's specifications.
None.
6. Describe all known and suspected bugs.
There are no known bugs.
7. Does your program run correctly?

Yes

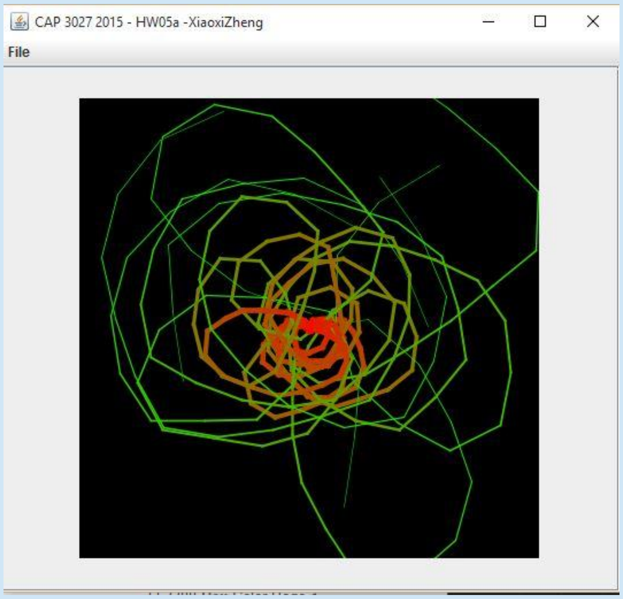
Xiaoxi Zheng
CAP3027
Section 1927
9/25/15
HW05

SCREENSHOTS

Default color: Brown → Green


CAP 3027 2015 - HW05a -XiaoxiZheng
File
CAP 3027 2015 - HW05a -XiaoxiZheng
File
CAP 3027 2015 - HW05a -XiaoxiZheng
File

User Input colors: Red(0xFFFF0000) → Green(0xFF00FF00)


CAP 3027 2015 - HW05a -XiaoxiZheng
File