HexGrid.java

A program to illustrate object oriented programming

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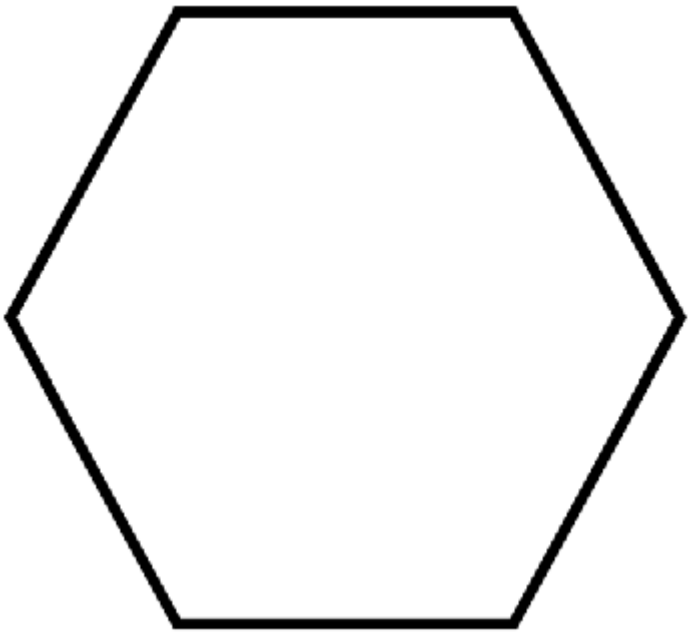
November 22, 2009



Goal:

Create a framework for a wargame board for later use in a two player strategy wargame which consists of a map designer.

Analysis:

Design a hexagon class that defines a hexagon object and draw an array of these hexagon objects on a panel. Include methods for filling the hexagons with a color of the user's choice by clicking on the the hexagon with the mouse.

Design:

Hexagon class - Includes all the math for drawing a hexagon. The constructor's formal parameters should include an x and y coordinate and the length of one of the hex's sides. Include all necessary accessor and mutator methods for class variables. Create a method for drawing the hexagon on the string by drawing lines from the points that were instantiated by the constructor. Include a method for filling the hexagon with color by drawing a series of smaller hexagons using recursion.

HexGridPanel class – JPanel child class that creates and draws any number of hexagon objects. Define class variables for the width and height of window, length of a hexagon side, number of hexagons per window by using the length of a hexagon side, and the current color. Constructor should load a two-dimensional array with new hexagon objects of specified side length. The paintComponent method should draw this array on the screen row by row, and moving each even row over by a set amount to make a honey comb pattern. Add a MouseListener class that waits for mouse clicks within the grid and then loads that grid coordinate into another two dimensional array of x and y coordinates. Create an if-statement in the paint component method that determines if there is something in the array of filled hexes and fills each hex with color. Add buttons for selecting a color.

HexGrid class – JFrame child class that holds the HexGridPanel class.

Implementation:

I First looked up the math to draw a hexagon and used that math to make the hexagon class. I built the framework for the HexGridPanel and HexGrid classes and after a bit of testing was able to display the array of hexagons. I added a MouseListener class and went about loading each hexagon that was clicked into an array of “filled” hexagons and painted them on the screen. I then wrote a method for filling the hexagon with color by drawing a series of successively smaller hexagons within the “filled” hexagon. I found that this did not work because I was casting floating points into integers and loosing precision which created holes in my hexes. I decided that it would be far simpler to just draw a hexagon with the drawPolygon method of the Graphics class with the points calculated in the constructor of the hexagon class. After the hexagon class drew the hexagons correctly I decided that the array of filled hexes was not really necessary and to instead change a color value of the hexagon object. Now instead of

Implementation (Continued):

loading an array of hexes and redrawing the hexagons on the screen, the mouse click defines the hexagon of the set color and repaints the screen.

Along the way I also decided to add the HexGridPanel class to another panel class called GamePanel, added the ability to drag the color across the screen, provided a color chooser dialog box to pick any color the user desires, and cleaned up the remaining bits of code that remained from previous builds.

All in all this was a very satisfying project, and now that it is done I see that I have a perfect framework for my next project. I learned many things along the way, but the most important thing I have learned is to draw up a UML diagram before going into the project. I realized part way through that I would have saved myself quite a bit of time if I had laid all my functions out in front of me and organized them in a logical manner. I remember quite well being told that it was a very important first step, but I guess learning by experience was necessary.

Appendix A: The Code

```
//Hexagon.java
//Evan Cummings
//11.10.9

import java.awt.Graphics;
import java.awt.Point;
import java.awt.Color;
import java.awt.Polygon;

public class Hexagon
{
	private int h, r, b, a, s, x, y;
	private Polygon p;
	private int[] xPts;
	private int[] yPts;
	private Color c = new Color(0, 150, 0);

	// Constructor.
	public Hexagon(int x, int y, int s)
	{
		this.s = s;
		this.x = x;
		this.y = y;

		h = (int)((float)Math.sin(Math.PI/6) * s);
		r = (int)((float)Math.cos(Math.PI/6) * s);
		b = s + 2 * h;
		a = 2 * r;

		int p1X, p2X, p3X, p4X, p5X, p6X;
		int p1Y, p2Y, p3Y, p4Y, p5Y, p6Y;

		p1X = x;
		p2X = x+r;
		p3X = x+2*r;
		p4X = x+2*r;
		p5X = x+r;
		p6X = x;

		p1Y = y+h;
		p2Y = y;
		p3Y = y+h;
```

Hexagon.java (Continued):

```
            p4Y = y+h+s;
            p5Y = y+2*h+s;
            p6Y = y+h+s;

            int []xPts = {p1X, p2X, p3X, p4X, p5X, p6X};
            int []yPts = {p1Y, p2Y, p3Y, p4Y, p5Y, p6Y};

            this.xPts = xPts;
            this.yPts = yPts;

            p = new Polygon(xPts, yPts, 6);
    }

    public int getB()
    {
            return b;
    }

    public int getA()
    {
            return a;
    }

    public int getH()
    {
            return h;
    }

    public int getR()
    {
            return r;
    }

    public int getS()
    {
            return s;
    }

    public int getX()
    {
            return x;
    }
```

Hexagon.java (Continued):

```
	public int getY()
	{
		return y;
	}

	public Color getColor()
	{
		return c;
	}

	public void setColor(Color c)
	{
		this.c = c;
	}

	// Draws hexagon polygon object.
	public void drawHex(Graphics page)
	{
		fillHex(page, c);
		page.setColor(Color.black);
		page.drawPolygon(p);
	}

	// Fills hexagon polygon object.
	public void fillHex(Graphics page, Color c)
	{
		this.c = c;
		page.setColor(c);
		page.fillPolygon(p);
	}

	public String toString()
	{
		String str = "";

		str += "Side: " + Integer.toString(s);
		str += "\nH: " + Integer.toString(h);
		str += "\nR: " + Integer.toString(r);
		str += "\nA: " + Integer.toString(b);
		str += "\nB: " + Integer.toString(a);

		return str;
	}
}
```

```
//HexGridPanel.java
//Evan Cummings
//11.10.9

import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
import java.util.ArrayList;

public class HexGridPanel extends JPanel
{
	// Screen and hex side dimensions.
	private final int WIDTH = 640;
	protected static final int HEIGHT = 480;
	private final int S = 20;

	//	Example hex object for calculations.
	private Hexagon hexEx = new Hexagon(0, 0, S);

	// Hex calculations.
	private int h = hexEx.getH();
	private int r = hexEx.getR();
	private int b = hexEx.getB();
	private int a = hexEx.getA();
	private int s = hexEx.getS();
	private int x = hexEx.getX();
	private int y = hexEx.getY();

	// Gradient of angled hex edge.
	float m = (float)h / r;

	// Number of hexagons on the screen.
	private int numRow = HEIGHT / (h + S);
	private int numCol = WIDTH / a;

	// 2D array of hex objects.
	private Hexagon [][] grid = new Hexagon [numRow][numCol];

	// point used for display of x, y coordinates.
	private Point p = null;

	// Dimension of reference grid.
	private int sectX, sectY;

	// Coordinates within reference grid.
	private int sectPxlX, sectPxlY;
```

HexGridPanel.java (Continued):

```
// Type of reference Box.
private char sectTyp = ' ';

// Final hex array coordinates.
private int arrayX, arrayY;

// Color to fill.
protected Color color = Color.cyan;

// Constructor
public HexGridPanel()
{
	setPreferredSize(new Dimension(WIDTH -8, HEIGHT +13));
	setBackground(Color.black);

	MyMouseListener mListener = new MyMouseListener();
	addMouseMotionListener (mListener);
	addMouseListener (mListener);

	System.out.println(hexEx);
	System.out.println("\nNumRows: " + numRow +
		"\nNumCols: " + numCol);

	// array loader
	for (int r = 0; r < numRow; r++)
	{
		for (int c = 0; c < numCol; c++)
		{
			int PxX = c * 2 * this.r + (r & 1) * this.r;
			int PxY = r * (h + s);
			grid[r][c] = new Hexagon(PxX, PxY, S);
		}
	}
}

// Draw each individual hexagon object
public void paintComponent(Graphics page)
{
	super.paintComponent(page);

	// draw hexes
	page.setColor(new Color(50,50,50));
	for (int r = 0; r < numRow; r++)
	{
```

HexGridPanel.java (Continued):

```
                        for (int c = 0; c < numCol; c++)
                        {
                                grid[r][c].drawHex(page);
                        }
                }

                // print out coordinates for testing
        /*      if (p != null)
    {
      page.setColor (Color.yellow);

        if (p.x > WIDTH-42)
                        {
        page.drawString (p.x + " " + p.y, p.x-42, p.y);
                                page.drawString (sectX + " " + sectY, p.x-42, p.y-10);
                                page.drawString (sectPxlX + " " + sectPxlY, p.x-42, p.y-20);
                                page.drawString (arrayX + " " + arrayY, p.x-42, p.y);
                                page.drawString (Character.toString(sectTyp), p.x-42, p.y-40);
                }

      else
                        {
        page.drawString (p.x + " " + p.y, p.x, p.y);
                                page.drawString (sectX + " " + sectY, p.x, p.y-10);
                                page.drawString (sectPxlX + " " + sectPxlY, p.x, p.y-20);
                                page.drawString (arrayX + " " + arrayY, p.x, p.y);
                                page.drawString (Character.toString(sectTyp), p.x, p.y-40);
                        }
                } */
        }

        // Gets current color.
        public Color getColor()
        {
                return color;
        }

        // Sets color.
        public void setColor(Color c)
        {
                color = c;
        }
```

HexGridPanel.java (Continued):

```
// Evaluate Hex Coordinates.
public Point getHexCoord(Point p)
{
        sectX = (int)p.getX() / (2 * r);
        sectY = (int)p.getY() / (h + s);

        sectPxlX = (int)p.getX() % (2 * r);
        sectPxlY = (int)p.getY() % (h + s);

        if ((sectY & 1) == 0)
                sectTyp = 'A';
        else
                sectTyp = 'B';

        if (sectTyp == 'A')
        {
                // middle
                arrayY = sectY;
                arrayX = sectX;
                // left Edge
                if (sectPxlY < (h - sectPxlX * m))
                {
                  arrayY = sectY - 1;
                  arrayX = sectX - 1;
                }
                // right Edge
                if (sectPxlY < (-h + sectPxlX * m))
                {
                  arrayY = sectY - 1;
                  arrayX = sectX;
                }
        }

        if (sectTyp == 'B')
        {
                // right side
                if (sectPxlX  >= r)
                {
                        if (sectPxlY < (2 * h - sectPxlX * m))
                        {
                                arrayY = sectY - 1;
                                arrayX = sectX;
                        }
```

HexGridPanel.java (Continued):

```
                        else
                        {
                                arrayY = sectY;
                                arrayX = sectX;
                        }
                }
                // left side
                if (sectPxlX < r)
                {
                        if (sectPxlY < (sectPxlX * m))
                        {
                                arrayY = sectY - 1;
                                arrayX = sectX;
                        }
                        else
                        {
                                arrayY = sectY;
                                arrayX = sectX - 1;
                        }
                }
        }

        Point temp = new Point(arrayX, arrayY);
        return temp;
}

// Mouse input events.
private class MyMouseListener implements MouseListener,

  MouseMotionListener
{
        // Set color variable for hex coordinate.
        public void mousePressed(MouseEvent e)
        {
                p = e.getPoint();
                p = getHexCoord(p);

                int hexX = (int)p.getX();
                int hexY = (int)p.getY();

                if (hexY < numRow && hexX < numCol &&
                        hexY >= 0 && hexX >= 0)
                        grid[hexY][hexX].setColor(color);
```

HexGridPanel.java (Continued):

```
                repaint();
            }

            public void mouseReleased(MouseEvent e) {}
            public void mouseEntered(MouseEvent e) {}
            public void mouseExited(MouseEvent e) {}
            public void mouseClicked(MouseEvent e) {}

            // Display hex coordinates under mouse cursor.
            public void mouseMoved(MouseEvent e)
            {
                p = e.getPoint();
                repaint();
            }

            // Set color variable for hex coordinate.
            public void mouseDragged(MouseEvent e)
            {
                p = e.getPoint();
                p = getHexCoord(p);

                int hexX = (int)p.getX();
                int hexY = (int)p.getY();

                if (hexY < numRow && hexX < numCol &&
                    hexY >= 0 && hexX >= 0)
                    grid[hexY][hexX].setColor(color);

                repaint();
            }
        }
}
```

```
// GamePanel.java
// Evan Cummings
// 11.22.9

import javax.swing.*;
import java.awt.Dimension;
import java.awt.Color;
import java.awt.event.ActionListener;
import java.awt.event.ActionEvent;

public class GamePanel extends JPanel
{
	// Panel for the grid and controls.
	private JPanel controlPanel, colorPanel;
	private HexGridPanel hexGridPanel;

	private JButton green, blue, brown, chooser;

	private JLabel title;

	private int h;

	// Constructor
	public GamePanel()
	{
		MyListener listener = new MyListener();
		Dimension dim = new Dimension(80, 20);
		h = HexGridPanel.HEIGHT;

		hexGridPanel = new HexGridPanel();
		controlPanel = new JPanel();

		colorPanel = new JPanel();
		colorPanel.setPreferredSize(new Dimension(300, 100));

		controlPanel.setPreferredSize(new Dimension(100, h));
		controlPanel.setBackground(Color.black);

		title = new JLabel("Pick your Color");
		title.setForeground(Color.gray);

		brown = new JButton("BROWN");
		green = new JButton("GREEN");
		blue = new JButton("BLUE");
		chooser = new JButton("PICK");
```

GamePanel.java (Continued):

```
		brown.setPreferredSize(dim);
		green.setPreferredSize(dim);
		blue.setPreferredSize(dim);
		chooser.setPreferredSize(dim);

		brown.addActionListener(listener);
		green.addActionListener(listener);
		blue.addActionListener(listener);
		chooser.addActionListener(listener);

		controlPanel.add(title);
		controlPanel.add(brown);
		controlPanel.add(green);
		controlPanel.add(blue);
		controlPanel.add(chooser);

		this.add(hexGridPanel);
		this.add(controlPanel);
	}

	// ButtonListener
	private class MyListener implements ActionListener
	{
		public void actionPerformed(ActionEvent e)
		{
			if (e.getSource() == chooser)
			{
				Color shade = JColorChooser.showDialog(new JFrame(),

		"Pick a Color!",

		hexGridPanel.getColor());
					hexGridPanel.setColor(shade);
			}

			if (e.getSource() == brown)
			{
				hexGridPanel.setColor(new Color(102,51,0));
			}

			if (e.getSource() == green)
			{
				hexGridPanel.setColor(new Color(0,75,0));
			}
```

GamePanel.java (Continued):

```
                        if (e.getSource() == blue)
                        {
                                hexGridPanel.setColor(Color.cyan);
                        }
                }
        }
}
```

//HexGrid.java
//Evan Cummings
//11.10.9

```
import javax.swing.JFrame;
import java.awt.Toolkit;
import java.awt.Dimension;

public class HexGrid extends JFrame
{
        public static void main(String[]args)
        {
                Toolkit toolkit =  Toolkit.getDefaultToolkit ();
    Dimension dim = toolkit.getScreenSize();

                JFrame frame = new JFrame("Hex Grid");
                frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
                frame.getContentPane().add(new GamePanel());
                frame.setLocation((dim.width-640)/2, (dim.height-480)/2);
                frame.setResizable(true);
                frame.setVisible(true);
                frame.pack();
        }
}
```

Appendix B: Sources

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