

## Lab Exercise #8 – Drawing with Graphics, Recursion, and Koch Curves

*Computer Science 2334*

Due by: Friday, April 16, 2010, 5:30 pm

Members:

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### ***Objectives:***

1. To gain practice using the Graphics class to draw figures.
2. To learn how to implement recursive methods.
3. To demonstrate this knowledge through the completion of a simple exercise.

### ***Instructions:***

This lab exercise requires a laptop with an Internet connection. Once you have completed the exercises in this document, your team will submit it for grading.

Make sure you read this lab description and look at all of the source code posted on the class website for this lab exercise before you begin working.

### ***Assignment:***

Recursion is an important programming concept that allows for efficient ways of writing clean and readable code for complex problems. Carefully inspect how it works and the documentation comments included in the code.

1. Download the `Lab8-Eclipse.zip` project archive from the class website. Import the project into your Eclipse workspace using the slides from Lab #2. You will submit the modified project archive when you are finished.
2. Review the source code posted on the class website.
3. Read through the source code of the `KochPanel` class and note the comments provided in the source code that give hints as to what needs to be done in the program and to determine the function of all of the helper methods.
4. The `Point` class is an easy way of keeping track of (x, y) coordinates for a graph, and it provides useful functions, such as determining distance in the `paintLine(Point, Point, Graphic)` method and translating a point in the `nextPoint(Point, double, double[])` method. Note that the x and y variables are doubles.

5. Recursive methods are defined as having a base case, which defines when a method ends, and the recursive case, which makes one or more calls to itself with the variables in its parameters increased or reduced towards the base case.

For this exercise, you will be employing recursion to draw a special fractal image: the Koch curve. Below is an example of three Koch curves

6. The first element of recursion is determining the base case. For this image, the base case depends on the length of a line segment. The **if** statement defines when the base case happens. You need to replace the **true** statement with a statement that evaluates to true iff a single line should be drawn.

7. Complete the base case by drawing a line between the begin and end points with the Graphic object. This should be done with a single method call. Note that some number manipulation will have to be done.

8. If you reset the **if** statement back to **true** and run the program, a triangle should appear.

9. Complete the rest of the recursive case. The recursive case is all inside of the **else** statement and is defined in the documentation.

10. Notice how, with the **MIN\_DIST** variable set to 25, some of the lines of smaller triangles do not line up across from each other. Change **MIN\_DIST** to 27. Some triangles do not show up now. Explain *in detail* why this occurs.

11. Ensure that there are no warnings generated for your code. **Do not suppress warnings.** Fix your code so that warnings are not necessary.
12. Submit the **project archive** following the steps given in the **Submission Instructions** by **April 16, 5:30pm** through D2L (<http://learn.ou.edu>).
13. Turn in this lab handout (with completed answers) to your lab instructor during lab hours or by bringing it to Professor Hougen's office by **April 16, 5:30pm** and handing it to him or sliding it under his office door if he is not there.