Lab 3: Fractals

DUE: Monday, October 29, online on Blackboard by 2pm.
(Your report should be in Word format with a *.doc or *.docx extension.)

In this lab you will investigate using L-systems to create a new fractal of your own designing.

1. Design your fractal on paper, defining an initial shape (e.g., a single line, as in the Koch curve) and an iteration rule to apply to that shape. Draw a few iterations of your fractal to include in your writeup.

2. Calculate the fractal dimension of your fractal. Show your work.

3. Using the alphabet {F, f, +, −}, as discussed in class, define an L-system (i.e., an "axiom" and production rules) that will produce your fractal. Show via drawings that your L-system indeed produces your fractal.

4. Download "NewLSystemFractals.nlogo" from the class web page (right-click on the link and select "Save Link As". Open it in the same directory in which you downloaded Netlogo. Using the procedures "to kochSetup" and "tokochCurve" (as discussed in class), as models, define procedures to create your fractal. Create a new button on the interface that will set-up your fractal, and using the "go-once" button, iterate your fraction three or four times. After each iteration, right-click on the "view" window (where your fractal is displayed) and select "Export view" to save a .png file with the image in it.

Your lab writeup should include: your work on paper from steps 1−3, your three or four pictures from step 4 (you can insert these pictures directly into your .doc file if you're using Word), and the new Netlogo procedures you wrote to create your fractal.

See next page [back side] for more information.

More L-systems information for the Fractals Lab

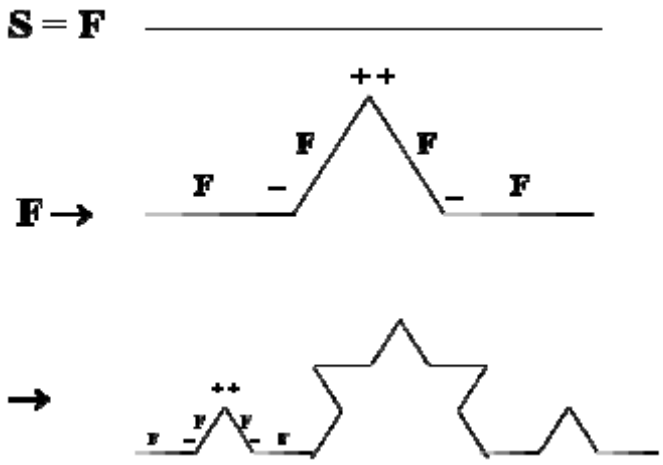
F Move forward one step while drawing a line
f Move forward one step without drawing a line
− Turn counterclockwise by a specified angle q
+ Turn clockwise by a specified angle q

Example: Koch curve
Axiom: S = F (where S is start state)
Production rules:

F ➔ F − F + + F − F
\+ ➔ +
− ➔ −

Set q to 60 degrees.
At each iteration, shrink step size by 1/3.

Here is how this L-system generates the Koch curve:



Netlogo version of L-System
F = "ahead len"
f = "skip len"
− = l [letter "l degrees" for left turn a number of degrees]
+ = r [letter "r degrees" for right turn a number of degrees]
(t creates a new turtle with same heading as parent; d causes current generation of turtles to die)

to kochSetup: creates a single turtle and places it on the screen heading right. Sets "len" to 55.

```
to kochCurve
  ask turtles [set new? false pd]
  t ahead len l 60 t ahead len r 120 t ahead len l 60 t ahead len d
  set len (len / 3)
end
```