L-Systems/Fractal Assignment

What's It All About?

This assignment affords you an opportunity to generate a musical composition via an L-system of your own design, to generate an image via an L-system of your own design, to simulate a Barnett Newman line via a given L-system, to consider fractals as cognitive infrastructure, and to consider fractals in science and technology.

Problem 1: MxM Facilitated L-System Composition

Simply generate one L-system composition by mimicking the method that I demonstrated in class, and that I recounted in L-system Lesson 3 "Compositional Method with MxM for L-Systems", which summarizes the sanctioned L-system composition method. When you turn in your work for this composition, you need to do two things:

1. Incorporate the following things within your main solution document for this problem set, in a section pertaining to your composition:
   (a) A title for your composition
   (b) A description (in terms of symbols and productions and start symbol) of your L-System.
   (c) The sequence of generations up to and including the one you determined to work with.
   (d) The Clay code for your composition.
   (e) A reference to the MP3 file for your composition.
2. Create an MP3 file for your composition, and attach it to your submission email as a sibling to your main solution document.

Reminder: Go to `http://www.cs.oswego.edu/~blue/software/` to find and download the `MxM` program.

Problem 2: TGR Rendered L-System Image

Perform the following tasks that pertain to creating an L-system, evolving a few generations, defining a mapping from L-system symbols to Turtle graphics commands, and rendering images corresponding to the generations that you evolved:

1. Craft a simple L-system of your own design, using just the four symbols {A, B, C, D} as your vocabulary. Then evolve a small number of generations. You might like to make use of MxM as a tool for doing this.
2. Define a mapping from the four L-system vocabulary symbols (A and B and C and D) to four Turtle graphics commands that are available in the Turtle Graphics Renderer program.
3. Using the Turtle graphics renderer, generate an image for each of the first few generations of your L-system. Take a "snapshot" of each image, and then save it.

Note: Your images need not be all that impressive! But please do your best to make images that are at least a little bit interesting.

Incorporate the following things within your main solution document for this problem set, in a section pertaining to your L-system image creation work:

1. A definition of your L-system.
2. A small number of generations.
3. A definition of your mapping from the L-system symbols to the Turtle graphic command symbols.
4. The images corresponding to the small number of generations.

Reminder: Go to `http://www.cs.oswego.edu/~blue/software/` to find and download he "Turtle Graphics Renderer" program.

Problem 3: L-System Simulation of a Barnett Newman Line

Setup

Barnett Newman is famous for his nonrepresentational images consisting of colored panes separated by vertical lines. But his lines are anything but pristine! In this little question, L-systems and Turtle graphics are used to suggest how one might simulate Barnett Newman lines.

Consider the following L-system:

- Alphabet: {L, M, R}
- Start: M
- Producions:
    1. L $\longrightarrow$ M L
    2. M $\longrightarrow$ R M
    3. R $\longrightarrow$ L R

Tasks

There are two things for you to do, one pertaining to generation, the other to interpretation:

1. Write down the fifth generation of this L-system.
2. Draw the fifth generation L-system image corresponding to a screen creature with a pen (like the Logo Turtle has) that executes three instructions, R and M and L, according to the following semantics. These semantics are based on the creature moving forward along a vertical line that is (conceptually, at least) segmented with unit markers, and a square with side length equal to the unit. (For the line, think about the positive Y-axis beginning at the origin.)

    - L: draw the unit square to the left of the creature, and then move forward one unit on the line
    - M: draw the unit square around the creature, and then move forward one unit on the line
    - R: draw the unit square to the right of the creature, and then move forward one unit on the line

Problem 4: Fractals as a Cognitive Infrastructure

Write a 1-2 page essay, prepended with the title "Fractals as a Cognitive Infrastructure", which suggests that fractals are a thing with respect to our cognitive infrastructure. (The term "cognitive infrastructure" refers to the basic physical and organizational structures needed for the operation of cognition.)

Proceed in the following fashion:

1. Spend a little time with the following two sources, mainly reading the first, and mainly listenting to the second, being mindful the fact that you will be mining these sources for information to satisfy the required scaffolding constraints, for the writing of your essay, that are presented below. Also, please be sure to keep the title in mind as you read/listen to the sources.)

    (a) "Is Consciousness Fractal"
    http://nautil.us/issue/47/consciousness/is-consciousness-fractal

    (b) Ira Flatow interview with Richard Taylor: "Jackson Pollack Fractals"
    https://www.npr.org/transcripts/6631149

2. Write down 6 questions (Q1, Q2, Q3, Q4, Q5, Q6) that you think you can write compelling answers to by synthesizing knowledge from the two sources, 3 questions from the first source, and three questions from the second source. The idea for you is not simply to lift large clumps of words from the sources, although you are encouraged to quote from them. Rather, you are to perform an artful synthesis of the ideas presented in the sources. Furthermore, please do your best to think of "the big picture" for at least the majority of your questions.
3. Write down your answers to the questions (A1, A2, A3, A4, A5, A6).
4. Finally, having completed the three preceding tasks, compose your essay! Do so by artfully weaving together a narrative which incorporates, at least partially, the answers to each of the 6 questions that you posed. Be sure to title your essay (with the given title), and be sure to list the two sources, your only two sources for this essay, after your essay.
5. In your presentation for this section of your solution document, please include the questions and the answers, as well as your essay (with its title the very short list of resources).

Problem 5: L-Systems in Science and Technology

For a bit of balance, search the world for four representative applications of fractals that have a scientific or technological flavor. For this section of your solution document, simply write down a short paragraph of description to accompany your articulate of each of the four applications.

Due date

Wednesday, March 23, 2022. Any time of the day will due.