Fractal Paper

You must choose a topic for this paper by next Friday, 3/7/03
Papers are due Monday, 4/7/03

Your second formal essay will be about fractals. You will be required to do some experimentation with fractal software or to create you own fractals for this paper. Choose a topic from this list:

1. L-System fractals first created by Aristid Lindenmayer
2. The game of Life created by John H. Conway
3. Fractal collages. You will create fractals yourself. Michael Barnsley is famous for using fractals to create objects similar to those of every day life. Investigate his work.
4. Mandelbrot and/or Julia sets. Benoit Mandelbrot first used computer graphics to display the image we now call the Mandelbrot set. Gaston Julia first discovered Julia sets.

In your paper you are to
- Discuss the scientist mentioned with your topic. Try to learn a little about him personally as well as about his work.
- Discuss what led this scientist to develop the area. Try to include an entire page or at least ½ a page on your mathematician.
- Use the computer software programs discussed in class (Fractint and the packages provided by our text’s authors as well as others you may find on the web) to create examples of your system. For choice 3 (fractal collages), create several fractals using the collage method of copying, reducing, and pasting to create fractals. For instructions, see our text, pages 434 to 444. You will incorporate the images you create into your paper.
- Explain in detail how one iteration of your fractal is derived from the previous iteration.
- Meet the specific requirements for each topic as listed below.

1. L-System fractals first created by Aristid Lindenmayer (section 6.3)
   - Use Fractint (or other software) to create several L-system fractals in stage 0, 1, 2, and a higher order. Use L-systems that we did not cover in class. Save copies of these stages and include the images in your paper.
   - Create an L-system fractal yourself by writing the computer file that contains the instructions. Include the instructions you used and pictures of your L-system in your paper.
   - Explain the rule for replacement as you move from order 0 to 1 and from 1 to 2 for each L-system.
   - Discuss the dimension of the fractals that you have created.

2. The game of Life created by John H. Conway (section 6.2)
   - Investigate the game of life using some software available on the web.
   - List the rules and show how these rules apply as you move from one generation to the next. You might use graph paper and show the first and second iteration, explaining how
the second iteration is derived from the first. (Make up your own examples, do not use the ones in the text.)

- Try to discover which original population conditions leads to the population dying, becoming stable, growing larger, becoming gliders, etc. Include the results in your paper.
- Save a picture of the screen as you begin each of these populations, after one iteration, and then after the population has had a chance to change over time. Incorporate these into your paper.

3. A fractal collage. You will create these fractals yourself. (section 6.3, pages 434 to 444)
   - Read about creating collage fractals by reducing an image.
   - Create several collage fractals. Incorporate the copies of each stage into your paper.  
   - Try to have one of these images look like a tree, a fern, or some other common object.
   - Give the rules you use for each reduction in your collage.
   - Estimate the fractal dimension of your image.

4. Mandelbrot and/or Julia sets named after Benoit Mandelbrot who first used computer graphics to display the Mandelbrot set and Gaston Julia who discovered Julia sets. (section 6.4)
   - Choose either Benoit Mandelbrot or Gaston Julia as appropriate for your paper.
   - Explain the mathematics behind the Mandelbrot and/or Julia sets that you are going to show.
   - Explain what the Mandelbrot and/or Julia sets are.
   - Use software available on the web to find some of the interesting features of the Mandelbrot set and/or Julia sets.
   - If you show repeated zooming on the Mandelbrot set or a Julia set, show the pervious view and then use a rectangle to how the area that you are zooming. Try to explain how much you have zoomed.
   - For each Julia set you show, give the complex point that corresponds to this set.
   - If you are discussing the relationship between the Mandelbrot set and a particular Julia set, show both sets and the location of the point on the Mandelbrot set.

Be careful to read enough about your mathematician so that you can write about him without referring directly to your notes. If you copy information directly from a source, or just restate the information that a source provides, you will need to provide a reference for this information. End notes are appropriate. In general, provide a citation for
   - Information taken directly from one source
   - Other’s views of the importance of this mathematician or his work
   - Quotes from the mathematician.