

Math 2270-003

Projects

Complete one of the following projects, due on the last day of class. You may use Maple or another program of your choice. You must work independently.

You may also come up with your own project or do some variation of one of the suggestions, but you should consult me first.

1 Economics

Use the 2008 Summary Use Annual I-O Table found at http://www.bea.gov/industry/io_annual.htm to construct a consumption matrix as in Section 8.3. Was this economy productive?

Related: Section 8.3
[Sample Code and Data]

2 Linear Programming

Related: Section 8.4
[Sample Code and Data]

3 Music

Compare the waveforms of several musical instruments playing the same note. Compare their energy spectra.

Related: Lab 4, Section 8.5, Section 7.3, Section 10.3
[Sample Code and Data]

4 Statistics and Probability

Reconsider the height-weight data from Lab 3. Assume that each person underestimates their weight randomly by 2-4%. Use the weighted least squares method of Section 8.6 to find a more accurate model function for the height-weight data. Plot the data, new model, and old model together on the same set of axes. Pick a height (it was 5'10" in Lab 3) and compute the expected weight of a person of that height using the two different models.

Related: Lab 3, Section 8.6
[Sample Code and Data]

5 Computer Graphics

Take a 3-dimensional wireframe model and move it around using the techniques of Section 8.7.

Related: Section 8.7
[Sample Code and Data]

6 Image Compression

Take a bitmap image and compress it using two different methods, using the largest singular values of the SVD and using the largest values of the Fourier Transform. Experiment with how many values you must retain to have acceptable image quality.

Related: Section 6.7, Section 7.2, Section 10.3
[Sample Code and Data]

7 Discrete Dynamical Systems

We have talked a lot about discrete linear dynamical systems. Compute orbits for some discrete linear dynamical systems in the plane. Plot orbits for systems where the eigenvalues are real with absolute values less than one, one, and greater than one. Plot orbits for systems whose eigenvalues are complex with norm less than one, one, and greater than one.

Consider the non-linear discrete dynamical system that takes a point (x_i, y_i) in the plane and moves it to the point (x_{i+1}, y_{i+1}) where:

$$x_{i+1} = y_i + 1 - ax_i^2$$

$$y_{i+1} = bx_i$$

Try setting $a = 1.4$ and $b = .3$. Plot some orbits and discuss the results. What happens for different values of a and b ?

Related:
[Sample Code and Data]

8 Fractals

Make some fractals. See Part B of <http://www.math.utah.edu/~korevaar/2270fall109/mapleproj1.pdf>