Math 325 Final Project

Overview: The final project consists of an 8-10 page paper and a 15 minute in-class presentation on a modeling topic of your choice. The paper is due at the beginning of class on Monday, Dec. 10; the presentations will be from Monday, Dec. 3 until Monday, Dec. 10. The exact time of your presentation will be determined later, so you should be prepared to present as early as Dec. 3. Your project proposal is due Friday, Oct. 26; your outline and blbliography are due Wednesday, Nov. 28.

Content: The purpose of the project is that you learn to tackle a mathematical modeling problem with the following features:

- It should be a problem of interest to you and one that is fun to investigate.
- It should involve the mathematical techniques that you have studied in this class. It is also fine if it goes beyond what we have done in class and requires that you learn about some particular technique in greater depth.
- It would be nice (but not essential) if it required collecting and/or analyzing some "real data" in order to build and/or test the model.
- It is expected that you will have to use the library and identify relevent references in books and journals in order to do this project. Much useful information and data can also be found on the web.

The responsibility for finding a course project is yours, but I will be happy to give you feedback on ideas and some assistance in locating resources. If you cannot come up with anything new or innovative, reviewing a few papers written by other scientists and mathematicians is acceptable.

Paper: It should be 8-10 pages typed (longer if you have lots of figures and tables). For most of you the paper will include more information than you will be able to present (those 15 minutes will fly by!). The paper should be written in complete sentences, with correct grammar and punctuation. It should read like a research paper, not like a homework assignment. The format of the paper will depend on what type of model you are looking at, but here are some key components that most papers should contain:

(1) *Abstract.* This is a short overview of the paper, a miniature version of 100 words or so. Someone reading the abstract should get a good idea of what problem has been tackled, what types of techniques were used to solve it, and what sort of solution was found. Most professional papers start with an abstract. It is very valuable for the potential reader, to help decide whether the paper is of interest and, if so, to get an overview of the whole picture before starting to read the details.

(2) *Problem description.* Present the problem you are attempting to solve. Give some background. Explain why it is important or interesting. Outline the questions that you would like to answer.

(3) *Simplifications.* You will probably need to simplify the problem in order to obtain a model that is appropriate for this project. Explain the ways in which you simplified the original problem and outline the assumptions that underlie these simplifications. Justify the assumptions, if possible, or discuss the limitations that are imposed on your model by your assumptions and simplifications.

(4) *Mathematical model.* How did you turn the simplified problem into a mathematical model? Is there a standard mathematical paradigm that you are using, e.g., linear programming or Newtonian mechanics? Or is it a problem of a different sort? How does it relate to standard problems? Define all of your variables, explain your notation, etc.

(5) *Solution of the mathematical problem.* What techniques did you use to solve the mathematical problem? Were you able to use standard techniques, e.g., the simplex method for linear programming and linear analysis for differential equations? Did you need to develop a new analytical method and/or algorithm to solve the problem? Did you use a technique from the literature that we havent discussed in class? Explain in detail.

(6) *Results.* What were your results in solving the mathematical problem? How are these results interpretable in terms of the original problem? Are the results reasonable? If not, what are the failings of the model that led to poor results? If your model leads to a large problem that you cannot solve, try to formulate a smaller version that leads to reasonable results.

(7) *Improvement.* How can you improve the model or solution technique so as to yield better results? How easy or difficult is it to implement these improvements.

(8) *Conclusions.* Summarize what you have done and what you have learned.

(9) *References.* Please include a bibliography if you have used any references, e.g., books, journal articles, web pages. Put a citation in the paper if you refer to a reference. Be aware of Agnes Scott's strict policy on plagiarism!

Presentation: Each presentation should last 15 minutes. Your presentation can be as high- or low-tech as you'd like. Feel free to use the chalkboard, the computer projector, the document camera, the internet, Powerpoint, physical demonstrations, etc. You have a lot of freedom. Be sure to practice before you give your talk; you may find it more difficult than you expect, especially the timing.

Your presentation will be graded on the following criteria:

(1) *Overview:* Do you make clear at the beginning what questions you're addressing and how you'll address them?
(2) *Content:* Do you address all the issues in the assignment?
(3) *Clarity:* Is all new terminology and notation defined? Are your tables and graphs clear? Do you have a good balance between oral and visual information?
(4) *Style and organization:* Is the talk polished? Does it look like you have practiced it? Is the talk well organized and well planned?

Hint #1: It's a good idea to visit the Speaking Center while you're planning your presentation.

Hint #2: One of the most common mistakes that students make in presentations is rushing through the introduction. Make sure to spend plenty of time setting up the problem. Remember, the audience won't care about the answers you're giving if they don't understand the questions.

Proposal: Proposals should be emailed to me by 3:30 pm on Friday, 10/26.

Your proposal should include:

- The modeling problem that you'll analyze.
- The techniques that you'll use to analyze it.
- Potential difficulties that you anticipate.
- A preliminary list of sources.

Timeline:

- **Friday, 10/26.** Email me project proposals by 3:30 pm.
- **Wednesday, 11/28.** Outline and bibliography due.
- **Monday, 12/3 - Monday, 12/10.** In-class presentations.
- **Monday, 12/10.** Papers due at the beginning of class.