Math 447 Capstone Project

You will be responsible for a Capstone Project which involves a written report and an oral presentation. You will be assigned to a group, although I am willing to consider both requests for teammates and a reasonable number of requests to opt out of teamwork altogether. Grades will be assigned individually based on your team's performance, my observation of individual contribution to the team effort, your written summaries of the division of team work, and individual input from you regarding the proportion of the final project due to each individual on your team.

Topic Selection: You need to give the matter of selecting a topic careful consideration. A good topic will be one in which at least one team member has a great deal of interest, one where the work required for your analysis can be split fairly among team members, and one for which the modeling tools taught in this class allow you to understand the situation in ways that you could not otherwise understand it. You should have actual data. In some cases, simulating data is appropriate. In other cases, you can gather data from the WEB or from the research literature. In some cases, you can collect your own data. In any event, you should be able to describe the data and its source thoroughly. You may use the existing literature as a basis for a project if you want. You must cite all of your sources, of course.

Topic Description Approval: You should select your topic as soon as possible. A brief description of the topic you select, usually a page or less including any references you have, is due by November 5, 2008. You should describe the general setting you propose to study, your specific problem, what you propose to accomplish in your research, the concepts and techniques you plan to use, and the references you have identified. It is important for you to be sure that you have (or can obtain) the data you need and that you can handle the mathematical ideas and techniques needed in your study.

Division of Labor: By November 19, you will submit a more detailed outline of your proposed research, you will provide a list of the tasks involved and an assignment of those tasks to individual team members (multiple team members may participate in each task if that is desired or beneficial), and you will create a timetable for the completion of the required tasks. Those teams who want to complete their projects before Finals Week should plan for it at this point and we will arrange an earlier presentation. Those teams who want the extra time should say so now and will be required to attend our exam period and give their presentation then. I will create a schedule accommodating your requests as best as possible. After that, the teams will be free to trade their time-slots amongst themselves as long as I am informed each time a trade is made so that I can update the schedule.

Progress Report: By December 3, you will submit a progress report and a revised task list and timetable.

Presentations and Reports: Each team will give a presentation to the class (50 points) and prepare a written report (100 points). The written report will be graded on the quality of the situation being modeled and of the research questions posed (1/3), the soundness and quality of the modeling employed to address the research question(s) (1/3), and the clarity of the writing (1/3). The presentations will be twenty minutes each with 5 minutes for questions (as long as I can schedule the presentations reasonably) and will be given during class or during our scheduled final exam period. Written reports should be ten to fifteen pages and are due Monday, December 15 at noon. The rough outline of a typical written report would be:

1. Abstract (one paragraph)
2. Description of the situation to be modeled
3. Assumptions and rationale for the assumptions
4. Analysis and results (what you learned by using mathematics)
5. Evaluation of your model and a discussion of its strengths and weaknesses
6. Summary and conclusions

Project Examples

1. Analysis of proportional representation voting in Germany. pros: well within the scope of this course, requires little to no programming; cons: goals of the project are vague, historical data exists but might be difficult to collect and require many sources

2. Analyzing the benefits of card counting in blackjack. pros: project is clear, data will be simulated; cons: will require substantial programming skills

3. Analyzing the benefits of a portfolio containing a risky and a safe investment of your choosing versus either single investment. pros: project goals are fairly clear, data easy to collect from Yahoo; cons: requires some independently gained mathematical knowledge - what does a stock's beta mean?

4. Modeling the risk of developing lung cancer based on radon exposure in your home. pros: data readily available, goals clear; cons: project is a little simplistic but involves analyses that might not be discussed in class.

5. Modeling the best overbooking strategy for flights by airlines. pros: well within the scope of this class, fairly clear goals; cons: may require some programming and how do you collect data on this subject?