

Math 300, Fall 2009  
**Mathematical Modeling**  
9:25 TT, CNS E204

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Web: <http://www.iwu.edu/~lstout>  
Texts: library resources (numerous texts in Ames)  
Journals: *Mathematical Scientist*  
*UMAP Journal*  
*SIAM Review*  
*Mathematical Biosciences*

## Course Description

Most mathematics courses are organized around a body of theory and technique which is then applied in typical situations. This course turns that pattern the other way around: we start with situations in which a mathematical model will help us solve a problem or understand some aspect of the situation better. We will make use of whatever mathematics might help: geometry, calculus, probability, algebra, differential equations, difference equations, simulation. Different mathematical models for a given situation will tell us about different aspects of the problem.

Making a mathematical model of a situation usually has several steps: start by gaining some understanding of the real world related to the matter and see what the interesting questions are that might have mathematical answers. Next decide on what relevant variables might be and determine how they are related. Start simple, limiting the number of things you put into your model. Make a toy model of the situation, then refine it and fit the parameters using real data. Try to make a model with testable results so you can see how well it matches reality.

If we were a consulting firm then the end product of our efforts would be a report. Typically that would give an executive summary of the problem,

main features of the model, and the results and recommendations it suggests. This would be followed by a more detailed description of the Assumptions made and the details of the model, how the parameters of the model were estimated, and what the results were in full. That would be followed by an analysis of the weaknesses in the model and how further refinements might take further factors into account.

We will be writing the reports in  $\text{\LaTeX}$  and using *Mathematica* to do a lot of the calculations.

## **Written work and grading:**

Since a big part of doing applied mathematics is recognition of problems for which mathematical models would be useful, each Tuesday you should give a problem description for two such problems from everyday life or other subjects you are taking.

We will be doing projects which result in written reports and oral presentations. Most of these will be done in working groups of three or four people. One of these will be completed approximately every two to three weeks.

There will also be two individual projects with written reports and an oral presentation at the time of the final.

## **Attendance Policy**

I expect you to read the relevant sections of the books before the class where we will be discussing them. Classes and office hours are what you pay tuition for, so take advantage of them.