AEM 700
Independent Study in Applied Economics and Management
System Dynamics Applications (3 Credits)
Spring 2005

Instructor:
Chuck Nicholson
316 Warren Hall
4-4901
Email: cfn1@cornell.edu

Class Hours

Wednesday,1:30-3:30 pm, 153 Warren Hall (conference room inside 154 Warren)

A tentative schedule for the course material is found on the following page. The schedule may be modified as necessary during the semester. There may be weeks in which I am unable to be present for class. If so, we will either modify the schedule by mutual consent, or I will arrange for a "guest presider" to be present for the class.

Office Hours

By appointment

Required Text

There is no required text for this course. Many of the reading assignments will be from Sterman (2000), and I assume that you already own or have access to a copy. A packet of readings not from Sterman will be provided in advance of the course start date.

Course Objectives and Description

The overall learning objective of this course is to further develop your knowledge and skills in system dynamics modeling, through implementation of the five steps of the modeling process in Sterman (2000) for a research problem of interest to you. As a part of this course you will:

1) Review basic principles of research methodology[1] and the research process;
2) Explore the advantages and disadvantages of simulation modeling as a research tool;
3) Review the standard modeling process using SD outlined in Sterman;
4) Develop statements articulating your research problem and an explanatory dynamic hypothesis;
5) Develop a Vensim® simulation model specific to your research problem;
6) Evaluate your simulation model using various criteria;

[1] The term 'methodology' in this course means "the study of the general approach to inquiry in a given field", in contrast to 'methods', which are defined as "the specific techniques, tools, or procedures applied to achieve a given objective."

7) Use your simulation model for basic policy analysis

To facilitate the process of developing the simulation models, we will review basic concepts of differential equations and numerical integration, learn more about the nature of aging chains of stocks and co-flow concepts that may be useful for the development of your model, practice using various more advanced elements of Vensim® (using data and subscripts, sensitivity analysis, optimization and model consistency checking tools), and explore how to initialize SD models in dynamic equilibrium (which is often how analysis with SD models is done).

Because you will be required to develop a simulatable model of a problem of your own interest throughout the course, it may be helpful to have the direct involvement of a major professor or other knowledgeable individual as you work to develop your model structure. (Another way of saying this is that due to my lack of subject-matter knowledge about each of your areas of interest, I may not be able to suggest appropriate structure in some cases.) *Note that a potential challenge of involving another individual, particularly if they are a "non-modeler," is that you will probably need to wrestle with what an appropriate level of abstraction is from the various suggestions that individual makes to you.*

The course will consist of a minimal amount of lecturing on my part; each class meeting will be primarily a guided discussion of the readings, practical exercises with Vensim and presentation of your own modeling efforts. Thus, more so than with most courses, what you get out of this course will depend to a large extent on your doing the assigned readings for each week prior to class, and being prepared to discuss the key points from your perspective. For some class meetings, the principal activity will be for you to present the current status of your model to the class and benefit from the input of the group. This will be useful practice for presentation of future models to other researchers (and possibly for presentation research proposals involving modeling to potential funding agencies).

At the end of the course, you will have a simluatable model that, if not yet fully suitable to address your specific research problem, has improved your thinking about important issues relating to system structure, priority data needs and potential management or policy options.

Assignments

Nearly every week, there will be **assigned readings**, and as noted above, it will be very important to ***carefully review each of the assigned readings*** and be prepared to discuss them in class. I will often try to provide you with questions that I would like for you to think about or answer through your readings. These questions will typically be the basis for our discussions in class.

In addition, there will be **six written assignments** during the course of the semester, which will be both iterative and cumulative. That is, you will begin with a written problem articulation, receive comments and suggestions from me and then revise and re-submit this section as a part of the next written assignment (e.g., on your dynamic

hypothesis). This process of revision and addition will continue throughout the semester, until you have a nearly completed project report. In most cases, I have given you at least two weeks between written assignments to allow you time to revise previous sections and draft new ones. Beginning with the written assignment on your simulation model (March 30th) you will also need to submit your model structure and progressively modify it as well. I will provide you with more specific criteria for the assignments well before each is due.

One week after our last class (May 11th), a **final project report** that includes all of the previously drafted and modified sections will be due.

Grading

Your grade in the course will be determined based on the following:

Class participation (whether you have read the assigned readings and are prepared to discuss them in class and(or) are prepared to present your model)..... 20%

Six written assignments (10% each)..... 60%

Final project report..... 20%

S/U grading is an option if you wish.