I. Course Objectives

- To develop an intuitive understanding of dynamic economic problems including (discrete and continuous, deterministic and stochastic).
- To understand applications of dynamic economic analysis in the areas of agricultural and natural resource economics.
- To become competent in the process of setting up and solving dynamic optimization problems, both analytically and numerically, and to understand the strengths and weaknesses of alternative methods.
- To be able to read and understand papers in which dynamic optimization plays a central role.

II. Grading

The course grade will be determined based on an equal weighting of your performance on the two parts of AGEC 637.

The purpose of grades is to provide a signal to you, the department, the university, future employers, and others. Here is what I believe those signals should indicate for a graduate-level course:

A - Thorough understanding of the material, and demonstrated ability to apply the concepts to problems beyond the scope of the course.
B - Good understanding of the material but unclear whether the student would be able to extend the concepts beyond the course.
C - Failed to achieve of the objectives noted above.
D - A lot worse than C.
F - Forgot to withdraw from the class.

That said, the critical point is how you will demonstrate these skills. Your final grade will be based on your average grade on the problem sets (35%), exam (55%), and participation (10%).

Homeworks: Each homework assignment will contain a mathematical or computational component and a component of interpretation. These two components will be given approximately equal weight. Hence, interpretation of the results is just as important as getting the right numbers and/or equations. The mathematical or computational component of your homeworks should be commented, that is, each important part of your analysis or computer code should be explained so that I can easily follow what you are doing. For example, an answer that consists on only a series of equations with no explanation of the objective of a sequence of equations is not acceptable. Similarly, computer programs need to be written in such a way that even someone entirely unfamiliar with the language can understand the logic of the program. In your interpretation, clarity of writing will be taken into account.

I expect your assignments to be neat, well formatted, and should be written in a manner that communicates to the reader. **Do not turn in unformatted computer printout with your homework.** Rather, your results should be in well-prepared tables or (better) figures and should be specifically referred to in your discussion of your results. All computer programs used in solving your program should be submitted electronically.

Finally, please, answer the assigned questions.

Exam: A two-part final exam will be given. The in-class exam will be given on July 2, to be followed by a take-home portion in which the student must write a computer program to solve a dynamic programming problem, this is due on Thursday, July 3 at 5:00 p.m.
Extensions: Extensions are not in the best interest of either the student or the instructor and will be granted only in special conditions related to complete surprises.

Writing skills: The clarity of your writing will be considered in the evaluation of your work. Spelling and grammatical errors will be penalized. Always use a spell and grammar checker before submitting typed work.

Working with others: Anything you hand in for this class must reflect your own understanding. On homework assignments, you may work with others, but you must understand what is finally handed in. The algebra or computer programs might be identical, but the discussion, explanation of the steps, and comments in your computer code should be written independently. It is strictly forbidden to obtain assistance from anyone else on the take-home final. It is also strictly forbidden to use computer code or homework from students who have taken this course in previous years. I’ve got copies of their assignments – don’t try it.

III. How to have fun and succeed in AGEC 637

To get the most out of this class and not be overwhelmed by stress, I have one simple piece of advice: plan ahead.

Read ahead. Complete lecture are available before each class. You should print and read the lecture notes that we will be presented in class. Since the lecture notes are available in advance, we will make best use of our time if people indicate questions that they have before class begins and I will make sure that all those questions are addressed. We will work to develop a system by which questions can be submitted before class. In addition, if there is an assigned reading, do it in advance.

Work ahead. Start on the problem sets as soon as possible. This will give you an opportunity to ask questions when you have time to process the answers. I am very willing to help out if you ask questions well in advance after you've made a good faith effort to find the solution, but am much more reluctant to help out when the deadline is hours away.

Work in groups: I encourage you to help each other. Asking another student for help will usually benefit both of you. However, there are limits to this. First, be considerate of other students' time. If you are asking questions because you procrastinated, then the student who worked hard for many hours is under no obligation to help you. Moreover, help that is only one-way is pathway to failure. If you find that you're always on the receiving end of the advice line, then you need to start worrying. The way to address this is with the next assignment, get started well in advance and ask me for help, then you can provide assistance to your classmates. Finally, work you turn in must reflect your own understanding. Turning in work that you have copied from another student that you do not understand is plagiarism and is a very serious offense. See the discussion about this in section II above.

IV. Class home page

The class homepage is located at http://agecon.tamu.edu/faculty/woodward/637/. Notes, problem sets and other information relevant to the course will be available there. I will provide notes for each lecture on the web site at least 48 hours prior to each class. If for some reason I fail to post the notes at that time, I will supply printed copies in class.

V. Prerequisites

It will be assumed that you have a very strong understanding of calculus (constrained optimization and integration), linear algebra and fundamental principals of probability and statistics. You must also be comfortable with the basic microeconomic results of consumer and producer theory. Previous exposure to differential equations would be helpful, but is not assumed. Econometrics 669 satisfies the prerequisite requirements.

VI. Computer programming

The use of computers is central to applied economic analysis and will play a major role in this course. The only way to learn a foreign language is by practicing. The same rule holds for programming languages. I believe that you should look at each course you take as an opportunity to learn a new language. The more languages you “speak”, the more flexibility that you have as you try to solve a problem. On the other hand, learning a language can be time consuming and get in the way of learning
the economic concepts that are the focus of the course. So you must balance the associated benefits and costs based on your own interests, time constraints and talents.

We will have four computer labs during which students I will be available to assist in the use of programming languages that will be used to complete the homework assignments. Except for students that are taking only the dynamic optimization part of 637, these labs will be optional.

All of the computer homework assignments can, at least in theory, be completed using any one of a number of programs including GAMS, Fortran, Gauss, Matlab, or Visual Basic. Some of the problems could even be solved in Excel or other spreadsheets. You may use any acceptable program to complete the assignments for this course. However, the default language for the course will be Visual Basic. I can provide a compiler and support for anyone who wishes to use Fortran. We will have several sessions in which we spend some time working in the computer lab. There are a number of books that will help you learn to program using the book by Albright noted below.

VII. Outline of the course (This outline is substantive, not sequential)
A. Nature of Dynamics
B. Optimal control theory
  1. Derivation of optimal control necessary conditions, Hamiltonians
  2. Finite horizon problems
  3. Infinite horizon problems
  4. Economic Interpretation
  5. Bang-bang and most-rapid-approach-path solutions to optimal control
  6. Stochastic optimal control (Ito calculus)
C. Dynamic Programming
  1. Deterministic DP
  2. Stochastic DP
  3. Infinite horizon problem and convergence
  4. Case studies
D. Dynamic programming in planning, management and positive analysis
  1. Extension of DP using Markov Process Principles
  2. Using DP in econometric analysis

VIII. Texts
The following are optional texts and should be available at the book store. I would not recommend buying all of these books as the cost would be excessive and there is some repetition. You are welcome to look at my copies of these books before making a decision. For the nuts and bolts of numerical dynamic programming, the best available references are, in my opinion, the chapter by Rust (Handbook of Computational Economics, on reserve at in the reference lab) and a few chapters of the book by Judd.


IX. Acknowledgments
In developing the material for this course I will draw on numerous sources and I want to give the authors credit. I always attempt to indicate the source of material, though can only do this ex post when the material leads to homework problems. As a disclaimer, I claim the discovery of none of the material covered in the course. If you are unsure of the source for the material that I am presenting, simply ask and I will normally gladly provide the necessary citation, at least after the problem set has been handed in. Unpublished sources that I will be drawing on include:

Karp, Larry. Lecture notes on Methods of Dynamic Analysis and Control. University of California, Berkeley


X. Students with disabilities
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room 126 of the Koldus Building so your professor can best accommodate your needs. The phone number is 845-1637.

XI. Readings
A lengthy list of articles in the field of dynamic optimization is available in the complete version of this syllabus, available from the class home page. To avoid wasting paper, it is not reproduced here.
Selected dynamic reading list. This list has been derived from a number of sources and should be thought of as a resource which you can use to extend your knowledge of dynamic optimization. Papers that are assigned as reading will be available in the reference lab.


