

AAEC 6305: Economic Optimization – Fall 2019

Instructor Information

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Meeting Times: MW 1:00 – 2:20 pm @ AGRI202
Office Hours: MW 2:30 – 3:30 pm or any other time with an appointment

Course Objective

The purpose of the course is to study the applications of optimization models in economics. Our focus of study is to develop the ability to formulate economizing problems as well-defined optimization problems, solve them algebraically or with the aid of optimization software, and interpret the solutions. Theoretical development of optimization techniques is not emphasized in this course.

Reference Books

Mario J. Miranda and Paul L. Fackler. *Applied Computational Economics and Finance*. The MIT Press. 2002.
Simon, C. P. and L. Blume. *Mathematics for Economists*. W.W Norton & Company, Inc. 1994
Sundaram, R.K. *A First Course in Optimization Theory*. Cambridge University Press. 1996.
Winston, Wayne L. *Operations Research: Applications and Algorithms*. 4th edition: Thompson Publishing. 2004.

Software and Computer

In this course every student needs to have a laptop installed with a computing software called MATLAB. Bring your laptop to each lecture. This will allow you to work on programming drills in the class. Following are the steps for you to obtain MATLAB for your laptop.

1. Go to <https://www.mathworks.com/login?uri=https%3A%2F%2Fwww.mathworks.com%2F>
2. Login if they have a Mathworks account or click Create Account if they do not have one.
3. After login click on their login name in the upper right corner and select My Account.
4. This will generate a list of licenses. Select 714225 Student.
5. Click Download on the next page and R2017a on the subsequent page.
6. Select the appropriate operating system and the download will start.
7. Run the downloaded file.

Many of the examples we study in this class will be taken from Miranda and Fackler's book *Applied Computational Economics and Finance*. The model solvers developed by those authors and MATLAB scripts for solving examples in the book can be downloaded as a package "CompEcon Toolbox" from the authors' website <http://www4.ncsu.edu/~pfackler/compecon/>.

Course Content

1. Getting Started with MATLAB

Week 1-2: Introduction to MATLAB and Optimization Routine (HW1)

2. Introduction to Optimization Models

Week 3: Optimization models

3. Static Optimization Models for LP and NLP Problems

Week 4: Linear and Nonlinear Static models (HW2)

4. Deterministic Dynamic Models

Week 5: Mining problem and Asset Replacement

5. Stochastic Dynamic Models

Week 6: Water management and bio-economics (HW3)

Week 7: Renewable resource and Livestock feeding

Week 8: Economic growth model (midterm)

6. Machine Learning

Expected Learning Outcomes

- Be able to formulate economizing problems as an optimization or mathematical programming models;
- Be able to master the MATLAB scripts provided to you for solving an essential set of optimization models widely used in economics;
- Be able to interpret the economic implications of an optimization model's solutions.

Methods for Assessing Expected Learning Outcomes

The course is composed of two consecutive sessions, one for lectures and the other for student presentations. In the lecture session, I will cover the topics listed above. Homework will be assigned to you to help you develop modeling and programming techniques. A midterm exam will be given to you, right after the lectures are finished, to assess your overall learning outcomes in the lecture session.

An important component of this class is to develop a term project in which you are to identify and study an important economic problem which can be formulated as an optimization problem. *You should start conceiving your term project from the very beginning of the class.* During the lecture session you will be exposed to various optimization models and their applications in economics. You may think of these models as templates for operationalizing your own project. Once the midterm exam is over, the class meetings will be completely devoted to project development. In this session each of you will make two presentations to the class. Your first presentation (15 minutes) is to discuss the body of literature closely related to your own project, and your own project plan. Your presentation will be followed by 5 minute Q&A session. The second presentation reports the final results of your project. Each of you will have 25 minutes to present your research results, leaving 10 minutes for questions and comments. The final product of the project is a term paper summarizing your research. The research paper is due on December 12, a week after the last day of class.

Specific Requirements for the term paper:

The project must deal with a meaningful economic problem. The importance of the problem is determined by its relevance to the society and its contribution to the literature. A simple way

of evaluating the importance of your project is to ask yourself whether there are people in the society who are interested to know the answer to your question. And you need to conduct a careful review of the past work in order to evaluate the contributions of your own work.

Although you are not required to solve your optimization model with real world data, you should strive to get such data. You may use roughly estimated data using information from reliable sources. In that case, explain in your term paper how you obtain such data. You need to submit your MATLAB code and data along with your research paper, so that I will be able to replicate your analysis if needed.

Your term paper should be within 15 double-spaced pages. It should be in the standard format of an economics journal article. That is, it should consist of an introduction section motivating your research questions, a complete review of related literature, a description of your data, model, and results, conclusions, and the reference list. You can use equations, charts, and tables to illustrate your work, but do not include in the paper your MATLAB code.

Grade Components

Homework 10%

Midterm exam 20%

Presentation I 10%

Presentation II 10%

Presentation III 10%

Term paper 40%

Tentative Course Timeline

Lecture session: Aug 28 – Oct 11

Midterm exam: Oct 11

Presentation session: Oct 16 – Dec 6

Term paper due: December 12

ACADEMIC INTEGRITY

Academic integrity is taking responsibility for one's own class and/or course work, being individually accountable, and demonstrating intellectual honesty and ethical behavior. Academic integrity is a personal choice to abide by the standards of intellectual honesty and responsibility. Because education is a shared effort to achieve learning through the exchange of ideas, students, faculty, and staff have the collective responsibility to build mutual trust and respect. Ethical behavior and independent thought are essential for the highest level of academic achievement, which then must be measured. Academic achievement includes scholarship, teaching, and learning, all of which are shared endeavors. Grades are a device used to quantify the successful accumulation of knowledge through learning. Adhering to the standards of academic integrity ensures grades are earned honestly. Academic integrity is the foundation upon which students, faculty, and staff build their educational and professional careers. [Texas Tech University ("University") Quality Enhancement Plan, Academic Integrity Task Force, 2010]

IMPORTANT NOTICE

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office in 335 West Hall or 806-742-2405.

"Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Texas Tax Code §11.20. A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. A student who is excused under section 2 may not be

penalized for the absence; however, the instructor may respond appropriately if the student fails to complete the assignment satisfactorily.