

AECN 827A
Static Optimization with Mathematical Programming
Fall 2009

MWF 12:00–12:50 p.m.
113 Chase Hall

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Description

AECN 827A (Static Optimization with Mathematical Programming) is a two-credit course intended to provide students the knowledge and skills necessary to formulate and solve economic optimization problems and interpret their solutions. The first part of the course covers the mathematical concepts that form the foundation for solving optimization problems. Topics covered in the first part include classical programming, including the Lagrange multiplier method; nonlinear programming, including Kuhn-Tucker conditions; and linear programming. The second part of the course focuses on using the GAMS (General Algebraic Modeling System) software to formulate and solve a broad variety of programming problems. This part covers such topics as linear programming, integer programming, quadratic programming, and nonlinear programming, including various models and applications.

AECN 896, Sec. 2 (Nonlinear Programming): In conjunction with AECN 827A, a one-credit AECN 896 (Special Topics in Agricultural Economics) is also offered during the Fall 2009 semester. This course consists of an extended laboratory on nonlinear programming, nonlinear regression, and additional instruction in GAMS. Students who desire a total of three credits and/or additional training in mathematical programming and GAMS should register for AECN 896, Sec. 2 (Nonlinear Programming) in addition to AECN 827A. AECN 896, Sec. 2 (Nonlinear Programming) will begin after AECN 827A is completed, and its call number is 0243. AECN 827A is a co-requisite for AECN 896, Sec. 2, i.e., you must enroll in AECN 827A in order to enroll in AECN 896, Sec. 2 (but not the other way around).

Prerequisite

ECON/AECN 815 (Analytical Methods in Economics and Business) or permission of instructor.

Schedule

Class meets at 12:00–12:50 p.m. on Mondays, Wednesdays, and Fridays in 113 Chase Hall. Because AECN 827A is a two-credit course consisting of 30 contact hours, it should be completed approximately ten weeks into the semester. The balance of the semester will be used for AECN 896, Sec. 2 (Nonlinear Programming), for those who choose to enroll in it.

Objectives

After completing this course, students should:

1. Be able to formulate an optimization problem, solve it, and interpret the solution in an effective manner.
2. Be familiar with a broad variety of models and applications and be able to choose from among the models to select the one most appropriate for a specific problem.
3. Have a basic understanding of the GAMS framework and be able to write GAMS programs for solving optimization problems of moderate complexity.
4. Be familiar with various source and support materials and know where to locate information necessary for developing advanced GAMS applications.
5. Understand the mathematical concepts that form the foundation for solving optimization problems.

Course Outline

Part I. The Mathematics of Optimization

- A. Classical programming, including the Lagrange multiplier method
- B. Nonlinear programming, including Kuhn-Tucker conditions
- C. Linear programming

Part II. Computer Applications

- A. Introduction to GAMS
- B. Linear programming
- C. Integer programming
- D. Quadratic programming
- E. Special models and applications (e.g., multiple criteria and goal programming; stochastic programming).

Part III. Nonlinear Programming (AECN 896, Sec. 2)

This is an optional part of the course intended to provide students experience in nonlinear programming and additional instruction in GAMS. It consists of an extended laboratory exercise based on a series of nonlinear regressions and involves more data manipulation than the problems covered in Part II. Because of the nature of the problems, students will gain some familiarity with statistical concepts related to nonlinear regression, including criteria for comparing models. Students who want to participate in Part III must enroll in AECN 896 (Special Topics in Agricultural Economics), Sec. 2.

Methods

Classes will be conducted as a combination of lectures and laboratories. Part I will consist primarily of lectures; Parts II and III will consist primarily of laboratories with supplementary lectures. There will be no examinations or quizzes. Instead, there will be regular and frequent homework assignments, upon which the course grade will be based. The homework assignments for Part I will consist of problem sets. The homework for Part II will consist of using LINDO and GAMS to solve applied optimization problems. The UNL Blackboard Learning System (<http://my.unl.edu>) will be used for posting announcements and distributing class materials.

Readings

The readings will be offered primarily to help students understand the material presented in class. Most, but not all, readings will be taken from the following books:

Intriligator, Michael D. 2002. *Mathematical Optimization and Economic Theory*. Philadelphia: Society for Industrial and Applied Mathematics.

Chaing, Alpha C., and Wainwright, Kevin. 2005. *Fundamental Methods of Mathematical Economics*, 4th ed. Boston: McGraw-Hill Irwin.

All reading assignments, lecture notes, and problem sets will be available in pdf form on Blackboard.

In addition to these materials, students may want to acquire a copy of the GAMS user's guide:

Brooks, Anthony, David Kendrick, Alexander Meeraus, and Ramesh Raman. 2008. *GAMS: A User's Guide*. Washington, D.C.: GAMS Development Corp.

The user's guide and *A GAMS Tutorial* by Richard E. Rosenthal can both be downloaded from the GAMS website at <http://www.gams.com>.

Mathematical Review

Part I of this course requires a basic understanding of differential calculus and matrix algebra. If you need to review these topics, it is recommended that you study chapter 2 (pp. 9–31) of *Introduction to Mathematical Programming* by N. K. Kwak and Marc J. Schniederjans (Malabar, Fla.: Robert E. Krieger Publishing Co., 1987).

Software

We will use two software packages: GAMS Distribution 23.2 (for Windows 32-bit architectures) and LINDO 6.1. Student versions can be downloaded from <http://www.gams.com> and <http://www.lindo.com> respectively. These are restricted versions, i.e., the problems they can solve are limited in size, but they will be adequate for the purposes of this course.

Assignments

Although students are encouraged to work together in conceptualizing problems and formulating approaches for solving them, each student is individually responsible for independently solving all problems and reporting the solutions. Moreover, all computer programs written as part of a homework assignment are to be individually authored. The sharing of completed homework assignments or computer programs with other students is prohibited. Any sharing of completed work or submission of another student's work will be considered academic dishonesty under the UNL Code of Student Conduct and dealt with accordingly.

Homework assignments should be turned in on time. If a student anticipates difficulty in completing an assignment because of travel, schedule conflicts, or other reasons, arrangements for turning the assignment in late should be made with the instructor when the assignment is given. At the instructor's discretion, the grade earned for an assignment may be reduced by 10 percentage points for each week, or portion of a week, the assignment is late.

Incompletes

University policy regarding incomplete grades will be followed. According to this policy, an incomplete grade should be given only when a student is unable to complete the requirements of the course during the term because of illness, military service, hardship, or death in the immediate family.

Availability

By appointment.