Agricultural Economics 652

Application of Quantitative Analysis: Mathematical Programming

Syllabus Spring 2007

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Prerequisites: Agricultural Economics 552 . As a substitute for 552, a thorough understanding of matrix algebra, differential calculus, and linear programming is a good substitute. If you have not had 552 or at least one course covering each of these topics, see the instructor to discuss your background and possible supplementary material.

Objectives: The focus of the course will be on the theory and practical aspects of mathematical programming and on the formulation of mathematical models with a primary focus on optimization models. Topics will include: a review of optimality conditions and convex analysis for nonlinear programming and a variety of approaches to modeling. The modeling section of the course will include models of the consumer, the producer, and the sector. Model features such as risk, dynamics, and approaches to incorporating government policies and private contractual arrangements will also be addressed. Topics related to non-parametric efficiency testing will be included. The course will involve a good deal of hands-on model formulation and construction. The tool for numerical model solution will be the GAMS modeling language, the features of which will be addressed during the course.

Lectures: Lectures will be delivered during regular class sessions. Expect to read the pages of the notes indicated in the attached schedule before class. Power Point materials will be available on the class WebCT Vista site prior to class.

Book: An extensive set of notes will be available. Reference Book – Brooke, A., D. Kendrick, and A. Meeraus, GAMS: User's Guide and GAMS Solver Manuals, Release 2.25, GAMS Development Corporation, Washington, D.C., 1996. (This reference material, along with a variety of other useful documents relevant to the GAMS language, is on the World Wide Web at http://www.gams.com/docs/document.htm.)

Added Reading: A reading list may be found on the Website that suggests optional readings.

Exams and Grades: Grades will be based on performance on a midterm examination (15%), a final examination (30%), homework and quizzes (30%), a class project (20%), and class participation (5%). The tentative date for the midterm is Thursday, March 9 during the regular class time. The final will be scheduled during finals week, will be two hours long and comprehensive.

Homework Policy: To be considered "on time," homework papers must be submitted by the time the instructor begins grading them. This will occur no earlier than 5:00 pm on the day that the papers are due, and may occur somewhat later. Check with the instructor for the grading schedule if you will be handing in a paper late. Papers that are turned in late, but are turned in before corrected papers and solutions have been distributed, will receive a 10% penalty. Papers turned in after corrected papers and solutions have been distributed will be marked, but no credit will be given.

Homework comprises a substantial portion of the grade for this course. Some of the homework will be difficult. Because the instructor believes that you learn a lot by working together and that figuring things out together does a good job of simulating the way you will operate in your research career, you are encouraged to discuss homework and strategy for solution. However, you are required to write up the homework (*including the programs*) independently. Violations of this rule will be dealt with harshly (see Academic Misconduct section below).

Academic Misconduct: University policy on academic dishonesty is clear – academic dishonesty in any form is strictly prohibited. Instances of academic dishonesty will be referred to the Dean of Students for disciplinary action. Penalties are severe and may include expulsion from the University. The risks associated with academic dishonesty far outweigh the perceived benefits. Academic dishonesty includes citing someone else's work as your own, using unauthorized "crib sheets" during exams, or sharing your exam answers with someone else. If you are unsure whether an action you are considering constitutes academic dishonesty, seek clarification from your instructor.

Computer Usage: Mathematical programming is pervasive in applied economics. It is used: as the basis for neoclassical economics, to simulate the implications of environmental change, evaluate policies and contracts, derive econometric problems to be estimated, estimate econometric problems, and to develop operational plans for farms and agribusinesses. For some purposes, these models have neat, closed-form solutions. One goal of this course is to help you understand when closed form solutions will exist, and when they will be tractable. However, many models are impractical, or even impossible to solve analytically. Numerical solution is often a stumbling

block for the applied economist. One of the goals of this course is to remove this stumbling block. Hence, the computer will be one of the primary tools of analysis for this course.

Each student will have to learn to use the GAMS programming language (access is available on the Department's computer network). You may also download the student version of GAMS from the Web at http://www.gams.com/download/. Use of GAMS will be *required* for the homework. Students should be familiar with the MS-Windows operating system. Operating system topics will not be addressed in the course.

Students with Disabilities: If you have a disability that requires some special accommodation, please make an appointment with the instructor within the first three weeks of the semester for an office visit to discuss the appropriateness of the instructional methods in this class, or any academic adjustments you may need. It has been possible to make adjustments in the past, but it is important that necessary accommodations are arranged at the beginning of the semester.

Agricultural Economics 652 Tentative Lecture Topics

Lecture #	Topic
1	Administrative Tasks and an Introduction to Mathematical Modeling (Notes Foreword and pp. 1-4)
2	Introduction to GAMS: An Example (Brooke et al. pp. 5-28)
3	Introduction to GAMS: Language Elements – Conventions and Sets (Notes pp. 5-13)
4	Introduction to GAMS: Language Elements – Parameters and Data Manipulation (Notes pp. 13-24)
5	Introduction to GAMS: Language Elements – Variables, Equations, and Advanced Topics (Notes pp. 24-33)
6	Model Building Blocks: Convexity of Sets and Functions, and Common Univariate Functions in Mathematical Models (Notes pp. 34-42)
7	Model Building Blocks: Univariate/Multivariate Functions Used in Mathematical Models, Composite Functions, and Nesting (Notes pp. 42-50)
8	Model Building Blocks: Nesting (cont'd.), Convexity of Composite Functions, Convex Programming, and Interpretation and Signs of

	Lagrange Multipliers (Notes pp. 50-58)
9	Numerical Methods: How Do They Work? Implications for Model Formulation (Notes pp. 216-224 – Appendix I)
10	Modeling Consumers: Primal/Dual Approaches and Benchmarking (Notes pp. 59-68)
11	Modeling Consumer Choices: Implicit Relationships, Nesting, and Modification of the Standard Utility Maximization Problem (Notes pp. 68-79)
12	Modeling Production Choices: Nonlinear and Linear Approaches (Notes pp. 79-89)
13	Nonparametric Efficiency Measurement (Notes pp. 89-100)
14	Nonparametric Efficiency Measurement (cont'd.) and Modifications of the Standard Profit Maximization Problem (Notes pp. 100-112)
15	Endogenous Price Models (Notes pp. 112-119)
16	Static Models with Risk (Notes pp. 120-131)
17	Static Models with Risk (cont'd.; Notes pp. 131-144)
18	Dynamic, Deterministic Models: Scheduling, Inventory, and Hybrids (Notes pp. 145-154)
19	Dynamic, Deterministic Models: Production Planning and Capacity Planning (Notes pp. 154-166)
20	Dynamic, Stochastic Models: Discrete Stochastic Programming (Notes pp. 167-175)
21	Dynamic, Stochastic Models: Discrete Stochastic Programming (Notes pp. 175-183)
22	Dynamic, Stochastic Models: Discrete Stochastic Programming (Notes pp. 183-190)
23	Beyond Optimization (Notes pp. 192-203)
24	Simple Equilibrium Models (Notes pp. 203-210)
25	Games and Market Imperfections (Notes pp. 210-214)
26	Numerical Nuisances: Scaling, Rules of Thumb, and Folklore (Notes pp. 225-234 – Appendix II)