



Subject: EBGN

Number: 698A

Course Title: Computational Economics

Section: A

Semester/year: Fall 2014

Instructor or Coordinator: Prof. Jared Carbone

Contact information (Office/Phone/Email): EH 311 / x2175 / jcarbone@mines.edu

Office hours: TR, 3:30 – 5p

Class meeting days/times: TR, 2-3:15p

Class meeting location: Green Center 263

Web Page/Blackboard link (if applicable): http://www.mines.edu/~jcarbone/ebgn_698_f14

Teaching Assistant (if applicable):

Contact information (Office/Phone/Email):

Instructional activity: 37.5 hours lecture 0 hours lab 3.0 semester hours

Course designation: Common Core Distributed Science or Engineering
 Major requirement Elective Other (please describe _____)

Course description from Bulletin:

This course is about learning the skills required to construct and manipulate numerical models as an instrument of economic research. It is also about learning when the use of numerical models is appropriate and, if so, what type. The first part of the course is focused on putting economic equilibrium modeling in context by exploring the theory and numerical implementation of mathematical optimization. We will learn about basic classes of optimization problems — linear programming, non-linear programming and complementarity problems — as ways to operationalize models of individual choice and decentralized equilibrium behavior from economics. A complementary activity will be to get basic facility with writing and debugging computer programs and using the GAMS software package. In the second part of the course, we will focus on the techniques used specifically in computable general equilibrium (CGE) analysis and developing applications of CGE models to topics in energy, environmental and natural resource economics (as well as parts of international trade, public and urban economics that overlap with these fields.) Successfully completing the course will leave you with a working knowledge of how to formulate your own economic models on the computer and use them to conduct theoretical or quantitative counterfactual analysis.

The course is open to both Master's and PhD students in the Mineral and Energy Economics program. I will assume that you have successfully completed at least one graduate course in microeconomic theory and that you are comfortable with the standard mathematical tools used in economics: multivariate calculus, constrained optimization and linear algebra. You should have basic familiarity with the use of Windows-based computers. You do not need to have a background in programming to enroll in the course but you should be prepared to put in the effort needed to acquire basic programming skills early in the semester.

Textbook and/or other requirement materials:

Required text: None

Other required supplemental information: Course materials distributed via the course website or as books on reserve at Arthur Lakes Library.

Student learning outcomes: At the conclusion of the class students will...

1. Understand basic classes of mathematical programming problems.
2. Be able to formulate and solve economic models on the computer.
3. Be able to calibrate numerical models for quantitative economic analysis.

Brief list of topics covered:

1. Theory of mathematical programming
2. Use of the GAMS numerical modelling software
3. Numerical implementation of economic models of optimization and equilibrium

Policy on academic integrity/misconduct: The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining and fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every student's academic achievements, and giving credence to the university's educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times.

Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization, or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.

The complete policy is [online](#).

Grading Procedures:

Homework assignments and exams are marked on a numerical (percentage) basis, then converted to letter grades. The course grade is then calculated using the weights indicated above. As a guide to determining standing, the following letter grade equivalence will generally apply:

A+	97-100	B	83-86	C-	70-72
A	93-96	B-	80-82	D+	67-69
A-	90-92	C+	77-79	D	60-66
B+	87-89	C	73-76	F	<60

Students must successfully complete all components of the course to successfully complete the course. At the instructor's prerogative, remedial assignments for partial credit may be requested of students who have attempted term work without achieving passing grades. Any work which is not attempted and submitted will be assigned a grade of zero.

A 24-hour take-home final examination will be scheduled by the instructor during the final exam period. Tests and exams will not involve multiple choice questions.

Notes:

- Students seeking reappraisal of a piece of graded term work (term paper, essay, etc.) should discuss their work with the Instructor *within 15 days* of the work being returned to the class.

Readings and Problem Sets

The readings and problem sets will be posted on the course website at least a week in advance of day they are due. The problem sets are a critical tool for learning how to master the course material. Many of the problem sets are challenging. The fact of the matter is that coding and debugging your programs is time-consuming and detailed work. The best way to learn is the struggle through these assignments and do them yourself in their entirety. You may consult your classmates or me if you get stuck but it is in your own best interest to spend a few hours on your own with the problem set before you resort to these options. A good working routine might look something like this:

1. Sit on your hands for a couple hours and think conceptually about how to formulate the problems in the problem set.
2. Spend a couple hours in front of the computer coding and debugging.
3. If you are stuck, consult your classmates.
4. If you are still stuck, send me an email.
5. Spend another hour at the computer trying to fix the problem.
6. If things are still broken, write up what you have and a few sentences explaining what parts of which problems tripped you up.

The answers to the programming exercises on the exam should be submitted to me as a set of clearly labelled GAMS-readable files, each containing the solution to one of the problem-set questions. Homework will not be accepted if turned in late. If there are exceptional circumstances that prevent you from doing this, you must make arrangements with me in advance of the posted due date. Similarly, if exceptional circumstances will cause you to be absent during a scheduled exam, you must schedule a make-up time before the schedule exam date.

Exams

There will be one 24-hour take-home exam in mid semester. I will post the exam sheet on the course website at 9am on the day of the exam and you will submit your answers to me by 9am the following day. This should be ample time to complete the exam if you have studied properly. You may consult your notes and other class materials during the exam but not your classmates or other individuals and not the internet. You can consult me if you need clarification on what I expect you to do on a particular exam question. The exam will be a mix of short answer questions where you will write a short paragraph or derive some formal result and programming problems where I will give a problem based on the ones you have seen in problem sets or in class and you will be asked to write the GAMS code to solve the problem.

The answers to the programming exercises on the exam should be submitted to me as a set of clearly labelled GAMS-readable files, each containing the solution to one of the exam questions.

Evaluation

Your final grade is based on the problem sets (30%), the midterm exam (30%) and the final exam (40%).

Coursework Return Policy:

Graded coursework will be returned to students within two weeks of the date it is submitted for evaluation.

Absence Policy (e.g., Sports/Activities Policy): You are required to attend lecture. Notification of planned absences must be given to the instructor in advance.

Common Exam Policy (if applicable): N/A

Preliminary Class Schedule:

• Weeks 1 – 2, August 19 - 28:

- Introductions, Course Overview
- Introduction to Linear Programming (LP)
- Introduction to GAMS
- Applications of LP — The Transportation Problem

• Weeks 3 – 4, September 2 – 11:

- Applications of LP — Strategic Petroleum Reserve Problem
- Duality of LP
- Applications of LP Duality — The Transportation Problem Revisited

Homework #1 assigned Sept. 11, due Sept. 18

• Weeks 5-6, September 16 - 25:

- Non-Linear Programming (NLP)
- Applications of NLP — The Ramsey Growth Model
- Applications of NLP — Maximum Likelihood Estimation

Homework #2 assigned Sept. 25, due Oct. 2

• Weeks 7 – 8, September 30 – October 9:

- Mixed Complementarity Problems (MCP)
- Applications of MCP — The Ramsey Model Revisited
- Applications of MCP — The von Theunen Land Model

No class Oct. 14

Take-home Midterm Exam, Oct. 16

• Weeks 10, October 21 – 23:

- Applications of MCP — Wheaton (1973) Housing Market Equilibrium Problem
- Applications of MCP — Spatial Equilibrium Problem
- Applications of MCP — A 2x2x2 General Equilibrium Model from Shoven and Whalley (1984)

Homework #3 assigned Oct. 23, due Oct. 30

- Weeks 11 – 13, October 28 – November 13:

- CGE Modelling with GAMS
 - Calibration and functional forms
 - MPSGE

Homework #4 assigned Nov. 13, due Nov. 20

- Weeks 14 – 17, November 18 – December 4 (No class November 27):

- Applications of CGE analysis to topics in environmental, energy and resource economics

Take-home final exam to be scheduled during the final exam period.