This course provides an introduction to computational economics for graduate students. It will cover the application of computational methods to economic models in fields such as sectoral economics, environmental economics, macroeconomics, financial economics, growth theory and others. The computational methods will include both simulation and optimization approaches as well as databases. A variety of computer languages will be used including MATLAB, GAMS and Mathematica.

Previous knowledge in economics, mathematics and computational methods is useful though strength in one or two of these areas can more than accommodate for little or no background in one or two of the others.

There are weekly computer exercises as well as a short paper at mid-term and a long paper at the end of the term.

The textbook for this course is


The web site associated with the book is

http://eco.utexas.edu/compeco
This site has pointers to input files for most of the models that we will be using in the course, to the software packages, etc.

Also, there are three packets of materials for this course at Central Duplicating in GSB 3.136. The first is a collections of articles, the second is some chapters from the *User’s Guide* for the Duali software and the third is the first seven chapters from my *Stochastic Control for Economic Models (2nd ed)* book.

You should buy the first packet. The second packet is optional. There is an older version available on the Web and you can find it by going to my home page at

http://www.eco.utexas.edu/faculty/Kendrick/

and navigating from there. The third packet is also optional. It is available on my web site for reading online or downloading.

Also some of the materials for the course can be found at the web site for this course which is

http://www.eco.utexas.edu/compeco/courses/index392.html

Optional Texts

See DK about gaining access to these.


http://www.gams.com

Outline

I. First Pass

Growth

1. Chakravarty in Excel

2. Chakravarty in GAMS
Transportation and Industrial Modeling

1. Transportation Model in GAMS
2. Small Mexican Steel

Databases

1. U.S. Data in Access

Financial Modeling

1. Portfolio Model in MATLAB

Game Theory

1. Genetic Algorithms and Evolutionary Games in MATLAB

II. Second Pass

Financial Modeling

1. Genetic Algorithms and Portfolio Models in MATLAB

Dynamic Optimization

1. Dynamic Optimization in MATLAB

Agent Based

1. Agent-Based Models in MATLAB

Personal Financial Planning

1. Thrift Model in GAMS

Macroeconomics

1. Hall and Taylor in GAMS
2. Taylor Multicountry Model in GAMS

Environmental

1. Global Warming in GAMS

Partial Equilibrium Models

1. Partial Equilibrium in Mathematica
Computable General Equilibrium

1. CGE Models in GAMS

Control Theory

1. Deterministic Control in Duali
2. Stochastic Control in Duali

Neural Nets

1. Neural Nets in Excel

Rational Expectations

1. Rational Expectations Macro in Duali

Dynamic Programming

1. Discrete State Space
2. Value Function Iteration

Game Theory

1. Cournot Duopoly in Mathematica
2. Stackelberg Duopoly in Mathematica

Growth

1. Judd and Guu in Mathematica
2. Kendrick and Taylor in GAMS

Reading List

I. First Pass

Growth

1. Chakravarty in Excel

   KMA Ch. 1 “Growth Model in Excel”

2. Chakravarty in GAMS

   Notes in Packet #1

Transportation and Industrial Investment

1. Transportation Model in GAMS

   KMA Ch. 4 “Transportation in GAMS”

2. Small Mexican Steel


Databases in Access

1. U.S. Data

   KMA Ch. 5 "Databases in Access"

Financial Modeling

1. Portfolio Model in MATLAB

   KMA Ch. 7 “Portfolio Model in MATLAB”

Game Theory

1. Genetic Algorithms and Evolutionary Games in MATLAB

   KMA Ch. 11 “Genetic Algorithms and Evolutionary Games in MATLAB”

II. Second Pass
Financial Modeling

1. Genetic Algorithms and Portfolio Models in MATLAB
   KMA Ch. 12 “Genetic Algorithms and Portfolio Models in MATLAB”
   KMA Ch. 14 “Agent-based Models in MATLAB”

Dynamic Optimization

1. Dynamic Optimization in MATLAB
   KMA Ch. 16 “Dynamic Optimization in MATLAB”

Agent Based

1. Agent-Based Models in MATLAB

Personal Financial Planning

1. Thrift Model in GAMS
   KMA Ch. 6 “Thrift in GAMS”

Macroeconomics

1. Hall and Taylor in GAMS
2. Taylor Multicountry Model in GAMS
   Mercado and Kendrick (1997), "TAYGAMS: John Taylor's Two-Country Model in GAMS" - in Packet #1

Environmental

1. Global Warming in GAMS
Partial Equilibrium Models

1. Partial Equilibrium – Ch. 3 in KMA

Computable General Equilibrium

1. CGE Models in GAMS

KMA Ch. 8 “General Equilibrium Models in GAMS”

use Orani and also Seung Rae Kim’s model

Control Theory

1. Deterministic Control in Duali

Use this software to learn some Windows programming.

Amman, Hans M. and David A. Kendrick, "The
Duali/Dualpe Software for Optimal Control
in Economics, TP 92-03, revised Dec. 1999 - in Packet #2

Ch. 4 model from Kendrick (2002), Stochastic

Control for Economic Models, 2nd Ed., available

at http://www.eco.utexas.edu/faculty/Kendrick

Also in Packet #3.
2. Stochastic Control in Duali

   KMA Ch. 17 “Stochastic Control in Duali” Sections 3 thru 6

   OLF from Ch. 6 of Stochastic Control book

   MacRae model from Ch. 7 of Stochastic Control book

CE vs OLF – paper by Amman & Kendrick in packet

   or find it at the Computational Economics journal web site beginning from the Springer web site at

   http://www.springerlink.com

Mitigation of the Lucas critique – paper by Amman and Kendrick in the packet or find it at the Elsevier web site for the JEDC journal beginning from

   http://www.sciencedirect.com

Neural Nets

1. Neural Nets in Excel

   KMA Ch. 2 "Neural Nets in Excel"

Rational Expectations

1. Rational Expectations Macro in Duali

   KMA Ch. 18 “Rational Expectations Macro in Duali”

Dynamic Programming


2. Ch. 20 “Dynamic Programming with Value Function Iteration”
Game Theory

1. Cournot Duopoly in Mathematica
   KMA Ch. 9 “Cournot Duopoly in Mathematica”

2. Stackelberg Duopoly in Mathematica
   KMA Ch. 10 “Stackelberg Duopoly in Mathematica”

Growth

1. Judd and Guu in Mathematica
   "Perturbation Solution Methods for Economic Growth Models" by Kenneth Judd and Sy-Ming Guu, Ch. 4
   in Hal Varian (ed), Economic and Financial Modeling
   with Mathematica, TELOS/Springer Verlag, 1993.

2. Kendrick and Taylor in GAMS
   Kendrick (1990) Models for Analyzing Comparative Advantage Ch. 5
   Mercado, Lin and Kendrick (2003), “Modeling Economic Growth with GAMS” Ch. 2, pp. 31-51 in festschrift for Lance Taylor, i.e. Amitava Krishna Dutt and Jaime Ros (eds)
   (2003), Development Economics and Structuralist Macroeconomics, Edward Elgar, Northampton, MA.

 Schedule

Jan  25  Lecture
Lab Preparation

modify and solve either (1) the Chakravarty growth model in Excel or GAMS, (2) the multi-sectoral growth model in GAMS or (3) the transport model or the small static Mexican steel model in GAMS

Feb 1 Lecture

KMA Ch. 5 "Databases in Access"

KMA Ch. 7 “Portfolio Model in MATLAB”

Also we will use as an alternative the portfolio model in GAMS in App. 7C.

Lab Preparation

Using ACCESS on UNIX Terminals

Using MATLAB on UNIX Terminals

Portfolio model in MATLAB and in GAMS
Access and useco.mdb on CARE or UNIX machines

Portfolio model in MATLAB and in GAMS

Due

Exercise on (1) the Chakravarty growth model in Excel or GAMS,
(2) the multi-sectoral growth model, (3) the transport model
or (4) the small static Mexican steel model.

Feb 8 Lecture

KMA Ch. 11 “Genetic Algorithms and Evolutionary Games in MATLAB”

KMA Ch. 12 “Genetic Algorithms and Portfolio Models in MATLAB”

Lab Preparation

Genetic Algorithms in evolutionary games or in portfolio models

Lab

Genetic Algorithm in evolutionary games or in portfolio
eexample in MATLAB

Due

Exercise on database systems or portfolio model.

Feb 15 Lecture

QLP from Ch. 2 of Kendrick *Stochastic Control for Economic Models* book

KMA Ch. 16 “Dynamic Optimization in MATLAB”

Lab Preparation

MATLAB for QLP

Lab

MATLAB
Exercise on genetic algorithms applied to either evolutionary games or to portfolio models.

Feb 22 Lecture

Agent-based Models

KMA Ch. 14 “Agent-based Models in MATLAB”

Lab

Agent-based Model in MATLAB

Due

Exercise on QLP in MATLAB

Mar 1 Lecture

Financial Modeling from Michael Evanchik and Genevieve Solomon

KMA Ch. 6 “Thrift in GAMS”

Hall and Taylor Model in GAMS – KMA Ch. 13 “Macroeconomic in GAMS”

Lab

Student Financial Model in GAMS

HTGAMS

Due

Exercise on agent based models.

Mar 8 Lecture

John Taylor’s multicountry models

Intro to John Taylor’s Rational Expectations Model
KMA Ch. 18 “Rational Expectations Macro in Duali”

Sections 1 and 2

Taylor Model in GAMS

Lab

TAYGAMS, i.e. tay01.gms etc.

Due

Short Paper

Mar 16 Spring Break

Mar 22 Lecture

Environmental Models - Nordhaus and Duraiappah

KMA Ch. 15 “Global Warming in GAMS”

Lab

Nordhaus DICE Model in GAMS

Due

Exercise on the thrift model or on

the Hall and Taylor Model in GAMS

or Taylor Model in GAMS

Mar 29 Lecture

Hall and Taylor model transformed to control theory form

Discuss HTGAMS paper and ht01.gms, ht02.gms, ht03.gms

Lab
HTGAMS, i.e. ht01.gms, ht02.gms, ht03.gms

Due

Exercise on the global warming model.

Apr 5 Lecture

CGE Models –
  KMA Ch. 3 – Partial Equilibrium
  KMA Ch. 8 “General Equilibrium Models in GAMS”

Lab

CGE in GAMS - use Mercado, Orani and also Seung Rae
Kim’s model

Due

Exercise on HTGAMS, i.e. ht01.gms, ht02.gms, ht03.gms

Apr 12 Lecture

Deterministic Control in Duali
  KMA Ch. 17 “Stochastic Control in Duali” Sections 1 and 2

Lab
  Hall and Taylor in Duali

Due

Exercise on the partial equilibrium or the general equil models.

Apr 19 Lecture

Stochastic Control in Duali
  OLF from Ch. 6 of Stochastic Control book
<table>
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<tr>
<th>Date</th>
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<tr>
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<td>MacRae model from Ch. 7 of <em>Stochastic Control</em> book</td>
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<td>KMA Ch. 17 “Stochastic Control in Duali” Sections 3 thru 6</td>
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<td>Lab</td>
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<td>MacRae in Duali or Taylor in Duali</td>
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<td>Exercise on Abel in Duali or Hall and Taylor in Duali</td>
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<td>Apr 26</td>
<td>Lecture</td>
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<td>KMA Ch. 2 &quot;Neural Nets in Excel&quot;</td>
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<td>Lab Preparation</td>
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<td>Using Microsoft Excel Solver on UNIX Terminal</td>
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<td>Lab</td>
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<td>Neural net example in Excel</td>
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<td>Due</td>
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<td>Progress Report on Long Paper</td>
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<td>May 3</td>
<td>Lecture</td>
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<td>KMA Ch. 18 “Rational Expectations Macro in Duali”</td>
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<td>CE vs OLF paper in Duali (Comp Eco)</td>
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<td>lqz models in Matlab for QZ decomposition (Macro Dyn)</td>
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<td>Mitigation of the Lucas Critique in MATLAB (JEDC)</td>
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<td>MATLAB with lqz and lqzolf</td>
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<td>Due</td>
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</table>
Exercise on MacRae or Hall and Taylor or other stochastic control model
with parameter uncertainty or on neural nets.

Extra Topic Lecture
Dynamic Programming with discrete state space
Dynamic programming with value function iteration
Lab Preparation
Discrete State Space in MATLAB
Value Function Iteration in MATLAB
Due
Nothing

Extra Topic Lecture
Game Theory materials from Dan Gaynor
KMA Ch. 9 “Cournot Duopoly in Mathematica”
KMA Ch. 10 “Stackelberg Duopoly in Mathematica”
Lab
Game Theory in Mathematica

Extra Topic Lecture
Growth Models - Judd-Guu and Kendrick-Taylor
Lab
Chak in Excel and Judd Guu in Mathematica
Kendrick and Taylor in GAMS
May 12 (Wed) Long Paper Due at 12 noon

Standing on the Shoulders

In addition to the GAMS Library there are model files available for a number of other studies. These are available from David Kendrick. These files include

- CHUNG  
  Korean Macroeconomics
- DURA  
  Global Warming
- HATHEWAY  
  U.S. Japan Macro Policy Coordination
- LETSON  
  Water Pollution Control
- LOFGREN  
  Egyptian Agriculture
- PARASUK  
  U.S. Macro and Control Theory

Also, there are more than thirty example models available in the Duali software. These models and the GAMS models offer a good starting point for the development of your own model.

Since there are a considerable number of weekly exercises (experiments) you can claim a “skip” on one of them during the semester by turning in that week a sheet with only your name the experiment name and the word “skip” on it. If you do not use the skip then the last exercise will be entered as skipped on the grade spreadsheet.

The University has a new policy which permits the assignment of plus and minus grades in graduate classes. I plan to make use of that option this spring.
Grades

1. Short Paper  
   30
2. Exercises  
   25
   10
4. Term Paper  
   35

Total  
100

I will make myself available to discuss appropriate academic accommodations that you may require as a student with a disability. Also students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259.