Economics 613a  
Advanced Macroeconomics I  
Computational Methods for Macroeconomics  
Fall 2006

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Office Hours: By Appointment  
Course Time: Tuesdays and Thursdays 2:00-3:30pm  
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Grading:
- Assignments
- Project/Presentation

Course Description

The primary goal of the course is to equip students with the numerical tools necessary to tackle interesting questions in macroeconomics. The course has two main focuses. The first is the study of numerical methods and algorithms pertinent to solving and analyzing macro models. The second is the study of good examples of their application by macroeconomists. While this is not a computer programming course, the course work will be computational in nature. Students should be familiar with some programming language such as Matlab, Fortran, or C. While all the course work can be completed with Matlab, my recommendation to students who are serious about macroeconomics is to use this course as an opportunity to learn either Fortran or C.

Useful Textbooks


  Also *Numerical Recipes in Fortran 77, Numerical Recipes in Fortran 90, and Numerical Recipes in C++.*
All but C++ are available at http://www.library.cornell.edu/nr/index.html.


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**Course Outline**

1. **Motivation**
   - Kydland and Prescott (1996)

2. **Numerical Analysis**
   - Computing Basics
     - Towards good programming
     - Sources of error
     - Conditioning and stability
     - Iteration
     - Judd (1998) Ch. 2
     - Press (1996) Ch. 1
   - Nonlinear Equation Solving
     - One dimensional root-finding methods
     - Solving systems of nonlinear equations
   - Function Approximation and Interpolation
     - Schumaker (1983)
   - Numerical Differentiation and Integration
     - Approximating derivatives
     - Some classical quadrature
     - Gaussian quadrature
   - Optimization
     - Unconstrained optimization
gradient-based methods
* non gradient-based methods
  - Constrained optimization
  * penalty methods

3. **Computation of Discrete Time Dynamic Models**

  - Discrete state space dynamic programming
    - Computing deterministic DGE models
      * Value function iteration
      * Policy function iteration
    - Computing stochastic DGE models
      * Markov chains
        - Tauchen (1986)
  - Continuous state space dynamic programming
    - Projection Methods
      * McGrattan (1999)
      * Judd (1992)
    - Parameterized expectations
      * Den Haan and Marcet (1990)
      * Marcet and Lorenzoni (1999)
  - Comparing Methods

4. **Calibration**

  - Cooley and Prescott (1995)
  - Gomme and Rupert (2005)
  - Prescott (Fall 1986)

5. **Transition Paths**

  - Extended path method
  - Selected Papers:
    - Galor and Weil (2000)
    - Greenwood and Seshadri (2002)
    - Greenwood, Seshadri and Yorukoglu (2005)

6. **Heterogeneous Agent Models**

  - Aiyagari (1994)
  - Hansen and Imrohoroglu (1992)
  - Rios-Rull (1996)
  - Chatterjee, Corbae, Nakajima and Rios-Rull (2005)
7. Additional Topics (time permitting)

- Computational methods for continuous time modeling
- Estimating DGE Models

Papers


**Chatterjee, Satyajit; Dean Corbae; Makoto Nakajima; and Jose-Victor Rios-Rull.** 2005. “A Quantitative Theory of Unsecured Consumer Credit with Risk of Default.”


