Econ 704: Macroeconomic Theory I

Jeremy Greenwood

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- **Grading**: Three Assignments

- **TA**: Jonathan Arnold

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- **Classes**: The lectures will be asynchronous. They will be posted on Canvas in a timely fashion using Panopto.

- **Office Hours via Zoom**: Wednesdays, 3pm–email Jonathan before noon of that day so he knows to be online. You may also post questions on the discussion board in Canvas.

Description

This course will study some of the numerical methods that are used in modern macroeconomics. The class will learn how to solve nonlinear equations, maximization problems, difference equations, dynamic programming problems, differentiate functions numerically, integrate functions numerically, construct Markov chains, interpolate functions, smooth data, and conduct Monte Carlo simulations on the computer. This will be done while studying economic problems, such as the determination of labor supply, economic growth, and business cycle analysis. The MATLAB programming language will be used.

The course will be evaluated on the basis of three take-home assignments. *No* colloboration with *any* person (either in or out of the class) is allowed for the take-home exams. You are also not allowed to use programs from the web. The assignments will be graded on a mixture of the skills you show in economics, mathematics and programming. A penality is assessed for each day an assignments is late: 15% for the first day and 10% for each day thereafter. The course will also be graded on the errors in economic logic, mathematics, and computer code that you find in the class notes—-keep such errors to yourself.

- **Textbook:** Greenwood, Jeremy. *Numerical Methods for Macroeconomists.*

  - http://www.jeremygreenwood.net/papers/numericalmethods.pdf

- **Programming Language**: MATLAB (from Mathworks)–must be used for assignments.

1 Nonlinear Equations

1.1 Methods

- Bisection Method

- Newton's Method

1.2 Application, Labor-leisure choice

- Edward C Prescott (2004). "Why Do Americans Work So Much More Than Europeans?" *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 28, No. 1: 2–13.

2 Maximization (and Minimization)

- Golden Section Search

- Discrete Maximization

- Particle Swarm Optimization

3 Graphing

- Jonathan A. Schwabish, "An Economist's Guide to Visualizing Data," *Journal of Economic Perspectives*, 28 (Winter 2014): 209-34.

4 Deterministic Dynamics

4.1 Method

- Extended path method

- Multiple shooting

4.2 Application, the neoclassical growth model

- Gary D. Hansen and Edward C. Prescott, "Malthus to Solow," *American Economic Review*, 92 (September 2002): 1205-17.

5   Numerical Approximations

- Numerical Differentiation

- Numerical Integration

- Random Number Generators and Monte Carlo Simulation

- Markov Chains

- Interpolation

5.1   Applications

- Welfare Cost of Business Cycles

- Welfare Gain from Personal Computers

- The Equity Premium Puzzle

6   Stochastic Dynamics

6.1   Methods

- Linearization Techiques

- Dynamic Programming

    - Discrete State Space
    - Quadratic Approximation
    - Coleman Algorithm

6.2   Application, business cycles

- Edward C. Prescott (1986). "Theory ahead of business cycle measurement," *Federal Reserve Bank of Minneapolis Quarterly Review*, 9-22.

- Jeremy Greenwood, Zvi Hercowitz and Gregory W. Huffman (1988). "Investment, Capacity Utilization, and the Real Business Cycle," *American Economic Review,* v. 78, 3: 402-417.