

University of Minnesota,
Department of Economics

Numerical Methods for Ph. D Students in Economics
Summer 2007

Instructor: Yuichiro Waki (Office: 1069 Heller Hall)
Grader: Maryam Saeedi

Time: July 23 – August 17, MTWThF, 9:30 a.m. - 12:00 p.m.
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Course website: <http://www.econ.umn.edu/~ywaki/teaching/nm07.htm>

Course Description

The goal of this course is that all students become able to write programs to solve various kinds of problems. These problems range from simple calculus problems, such as the computation of derivatives, to some economic and econometric problems, such as the computation of equilibria and the simulation-based estimation. All students must write own programs in solving these problems.

In the first week, we will study how to tackle problems using simple examples. On each Monday after the first week, one of professors Tim Kehoe, Ellen McGrattan, and Pat Bajari will give a lecture and assignment. (For details, see “Course Outline and Reading Lists” below.) We will spend the rest of each week for solving these assignments. If time allows we may cover some other related topics.

Suggested Readings:

1. Numerical methods
Richard L. Burden and J. Douglas Faires, *Numerical Analysis*, BROOKS/COLE
2. Programming in Matlab
Lecture slides for Chapters 2 and 3 from Gerald Recktenwald, *Numerical Methods with MATLAB: Implementations and Applications*
<http://web.cecs.pdx.edu/~gerry/nmm/course/>

Course Outline and Reading Lists

WEEK 1

1. Introduction to programming
2. Introduction to Matlab
3. Numerical derivatives
4. Nonlinear equations solving (Bisection and Newton’s method)
- (5. Numerical optimization, random number generator, etc.)

WEEK 2

1. Linear Programming and the Simplex Method

Timothy J. Kehoe, David K. Levine, and Edward C. Prescott, "Lotteries, Sunspots, and Incentive Constraints," *Journal of Economic Theory*, 107 (2002), 39-69.

Dimitris Bertsimas and John N. Tsitsiklis, *Introduction to Linear Programming*, Ch. 3.

2. Newton's Method and Economies with Infinitely Lived Consumers

Juan Carlos Conesa, Timothy J. Kehoe, and Kim J. Ruhl, "Modeling Great Depressions: The Depression in Finland in the 1990s."

Timothy J. Kehoe, David K. Levine, and Paul M. Romer, "On Characterizing Equilibria of Economies with Externalities and Taxes as Solutions to Optimization Problems," *Economic Theory*, 2 (1992), 43-68.

3. Newton's Method and Overlapping Generations Economies

Questions 3, 4, and 5 on Problem Set #1, Econ 8107, Spring 2005.

<http://www.econ.umn.edu/~tkehoe/classes/8107-05.html>

Laurence J. Kotlikoff, Kent Smetters, and Jan Walliser, "Privatizing Social Security in the United States: Comparing the Options," *Review of Economic Dynamics*, 2 (1999), 532-574.

WEEK 3

1. Computing Equilibria in Near-Linear Economies

2. Computing Equilibria in Nonlinear Economies

3. Maximum Likelihood Estimation

Chapters 3, 4 and 5 from Ellen's notes and the references therein:

<ftp://ftp.mpls.frb.fed.us/pub/research/mcgrattan/minho07/minho1.pdf>

Ramon Marimon and Andrew Scott, *Computational Methods for the Study of Dynamic Economies*, Oxford University Press

WEEK 4 (Preliminary)

1. Mixed Logit

2. Simulation Based Methods

A. Colin Cameron and Pravin K. Trivedi, *Microeconometrics: Methods and Applications*.

Nevo, A "A Practitioner's Guide to Estimation of Random Coefficients Logit Models of Demand," *Journal of Economics & Management Strategy*, 9(4), 513-548, 2000.

Petrin, A. "Quantifying the Benefits of New Products: The Case of the Minivan," *Journal of Political Economy*, 110:705-729, 2002.