ECON 6257-U90 : Applied Computational Economics

Spring 2019
Tuesday, 5:30 – 8:15 pm
Center City 906

Contact Information

Instructor:	Dr. Hwan C. Lin
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Course Description

This course introduces computational approaches for solving economic models. Topics include: interpolation and approximation techniques, numerical optimization, numerical solutions to systems of nonlinear equations, quadrature formulas for numerical integration, Monte Carlo simulation, and basic solution algorithms for economic dynamics. Graduate Credit (3). On Demand. Prerequisites: ECON 6201 & ECON 6202.

Course Objectives

The primary objective of the course is to teach how to compute equilibriums in economic models that cannot be solved analytically. It requires students to learn to formulate economic problems in computationally tractable forms, and then use numerical analysis techniques to solve them. After this class, students should be able to formulate economic models, design solution algorithms, calibrate models, and perform simulations and policy experiments.

Instructional Method

The course is offered with classroom lectures. A wide range of numerical methods and their applications to economic models will be discussed. Students are required to learn computer programming to implement numerical methods to solve economic problems.

Computer Programming Language

Students need to understand and use some programming languages. My suggestion is for students to learn Python, which is an open-source general-purpose programming language. With clear and simple syntax, Python is powerful for scientific computation. For computational purposes, you will need to download the following four core components:

Python (http://python.org/),
Numpy, Scipy (http://www.scipy.org/Download)
Matplotlib (http://matplotlib.sourceforge.net/).

Installing the above Python components individually may be difficult to most students. Instead, you can download a comprehensive Python package including many more components from either of the following two Python distribution websites:

Continuum Analytics Anaconda: https://store.continuum.io/cshop/anaconda/
Enthought Canopy: https://store.enthought.com/

Please be advised that Python 2.7 is a preferred version, although Python 3.5 is also available. You can consult any one of many online tutorials. Do a google search for "python tutorial."

Textbook

- Judd, K. (1998). *Numerical Methods in Economics*. MIT Press

Other Books Useful for Computation Economics and Finance include

- Langtangen, H. P. (2012). *A Primer for Scientific Programming with Python*. Springer.
- Kiusalaas, J. (2010). *Numerical Methods in Engineering with Python*. Cambridge University Press.
- Stewart, J. M. (2014). *Python for Scientists*. Cambridge University Press.
- McKinney, W. (2012). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. O'Reilley Media.
- Chiang, A. (1992). *Elements of Dynamic Optimization*. McGraw
- Dixit, A. K. (1990). *Optimization in Economic Theory*. 2nd Ed. Oxford University Press.
- Ljungqvist, L. and Sargent, T. (2004). *Recursive Macroeconomic Theory*. MIT Press.
- Miranda, M. & Fackler, P. (2002). *Applied Computational Economics and Finance*. MIT Press
- Stokey, N. & Lucas, R. (1989). *Recursive Methods in Economics Dynamics*. Harvard University Press
- McCandless, George (2008). *The ABCs of RBCs: An Introduction to Dynamic Macroeconomic Models.* Harvard University Press.
- Miao, Jianjun (2014). Economic Dynamics in Discrete Time. MIT Press.

Lecture Outline (subject to changes, adjustments)

I. INTRODUCTION
1. Introduction to Python

II. BASICS FROM NUMERICAL ANALYSIS
2. Linear Equations and Iterative Methods
3. Error Analysis and Iterative Methods
4. Numerical Differentiation and Nonlinear Equations
5. Continuation Methods for Nonlinear Equations
6. Optimization: One Dimensional Problems
7. Optimization: Multidimensional Unconstrained and Constrained Problems
8. Numerical Integration

III. NUMERICAL METHODS FOR FUNCTIONAL PROBLEMS
9. Finite-Difference Methods for Dynamical Systems (Differential Equations)
10. Projection Methods for Dynamical Systems (Differential Equations)
11. Numerical Dynamic Programming
12. Stochastic Recursive Methods for Economic Growth Models

Attendance:
Students are expected to attend every class on time and not to leave early. Please notice that in general there is an unambiguous positive relationship between class attendance and course grades. If you miss classes, you will easily get lost in class and will tend to a lower semester grade in the end.

All cell phones and pagers must either be turned off before class begins or placed in silent mode.

While important announcements will be posted in the University's **Canvas** website (https://canvas.uncc.edu), you may still miss some class announcements in your absence. It is your responsibility to ask other students, rather than the instructor, for the class announcement you missed.

Grading Policy

1) The course grade is based on homework assignments only. There are no exams.
2) Course Grade: A = 90% or above, B = 80% - 89%, C = 70% - 79%, U = 70% below.
3) You must turn in your completed homework on the due date. To do so, you should upload your completed homework to **Canvas**, as required. You will earn zero point from any overdue homework.
4) Homework assignments are available online in the University's **Canvas** website (https://canvas.uncc.edu). You shall notice that while group discussions are welcome, your completed homework shall not be a duplicated copy of any other student's work. Should such things be found, both your homework/project score and the original author's will be reduced by 50%.

Disability Services

UNC Charlotte is committed to access to education. If you have a disability and need academic accommodations, please provide a letter of accommodation from Disability Services early in the semester. For more information on accommodations, contact the Office of Disability Services at 704-687-0040 or visit their office at Fretwell 230.

Important Dates

First day of classes – Tuesday, January 15, 2019
Last day of classes – Tuesday, April 30, 2019

Academic Integrity

Students have the responsibility to know and observe the requirements of The UNC Charlotte Code of Student Academic Integrity (Catalog, page 275). This code forbids cheating, fabrication or falsification of information, multiple submissions of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty. Any special requirements or permission regarding academic integrity in this course will be stated by the instructor and are binding on the students. Academic evaluations in this course include a judgment that the student's work is free from academic dishonesty of any type; and grades in this course therefore should be and will be adversely affected by academic dishonesty. Students who violate the code can be expelled from UNC Charlotte. The normal penalty for a first offense is zero credit on the work involving dishonesty and further substantial reduction of the course grade. In almost all cases, the course grade is reduced to F. Copies of the code can be obtained from the Dean of Students Office. Standards of academic integrity will be enforced in this course. Students are expected to report cases of academic dishonesty to the course instructor.

Statement on Diversity

The Belk College of Business strives to create an inclusive academic climate in which the dignity of all individuals is respected and maintained. Therefore, we celebrate diversity that

includes, but is not limited to ability/disability, age, culture, ethnicity, gender, language, race, religion, sexual orientation, and socio-economic status.