ECO 7938: PhD Computational Methods Core 2

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University of Florida
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Course Description

This course is designed to prepare PhD students to solve structural models with computers. Principally, you will learn tools used for solving economic models quantitatively, with a focus on recursive methods. You will become familiar with the solution methods and coding specifications. Lastly, you will become equipped to practice economic research for your own model projects.

Instructor & Teaching Assistants & Textbooks

- Instructor: Min Fang, Assistant Professor, Department of Economics, University of Florida
- Instructor Contact: (minfang@ufl.edu) — (MAT 327) — Office Hour: By Appointment.
- Lecture Time and Location: Monday/Wednesday From 09:35 to 11:00 AM; No Break; MAT 118
- Teaching Assistants: Qilin Zhang (qilin.zhang@ufl.edu) — (MAT 406) — Office Hour: TBA.
- Recitation for Tutorials/Assignments: Mostly Wednesday after class from 11:00 to 11:30 AM
- Textbook 1: Thomas J. Sargent and John Stachurski, Dynamic Programming, 2023 (https://dp.quantecon.org/)
- Textbook 2: Kenneth L. Judd, Numerical Methods in Economics
- Textbook 3: Jianjun Miao, Economic Dynamics in Discrete Time

Course Topics (We will code everything!)

Part I: Basics

1. Beyond Economics: How to code like a *Software Development Engineer*: GitHub, IDE, Config, etc...

2. Language Choices: Fast, easy, scalable, or just as long as it works
3. Mathematical Tools: How to turn equations into codes
4. MATLAB/Python/Julia Programming for Economics and Finance
5. Linear Dynamics, Probability and Distributions, Nonlinear Dynamics
6. Stochastic Dynamics, Optimization, Estimation (Basics)

Part II: Intermediate (Main Part)

1. Optimization Methods (Gradient or Gradient-Free)
2. Value Function Iteration, Policy Function Iteration, Endogenous Grid Method
3. Applications: Consumption/Saving/Investment, Job Search, Information, Asset Pricing, ...
4. Local Approximation: When Dynare would work

Part III: Advanced

1. Heterogeneous Agents/Firms Models
2. Structural Estimation: GMM, MLE
3. Parallel Computing and GPU Computing
4. Deep Learning for Model Solutions

Class Dates (Subject to changes)

1. Week 01: 01/13 & 01/15
2. Week 02: 01/22 (Project Proposal Present)
3. Week 03: 01/27 & 01/29
4. Week 04: 02/03 & 02/05
5. Week 05: 02/10 & 02/12
6. Week 06: 02/17 & 02/19
7. Week 07: 02/24 & 02/26 (Midterm)
8. Week 08: 03/03 & 03/05

9. Week 09: 03/10 & 03/12
10. Week 10: 03/24 & 03/26
11. Week 11: 03/31 & 04/02
12. Week 12: 04/07 & 04/09
13. Week 13: 04/14 & 04/16
14. Week 14: 04/21 & 04/23 (Project Defense)

Course Project Details

- I will prepare several project proposals based on some structural macro/IO/labor/finance papers that have codes that are publicly available. You just pick one project as a team of 2-3 people.
- The first stage is to just understand the paper and get familiar with the model structure.
- The second stage is to disassemble the model into a DAG (directed acyclic graph).
- The third stage is to fully replicate the original model.
- The final stage is to resolve a model extension and write a short paper.
- *An Example in Macro-finance (maybe too hard):* (1) Paper: Financial Heterogeneity and the Investment Channel of Monetary Policy (https://onlinelibrary.wiley.com/doi/abs/10.3982/ECTA15949); (2) Extension: How does equity issuance cost or corporate tax credit affects the main results?

Assignments, Exam, & Project

- **Assignments:** Problem sets will be assigned most weeks. Problem sets will always be assigned at least a week before they are due. I encourage you to work in small groups (< 4) to solve the problem sets. But be sure that you can understand and solve them individually. The exam problems will reflect, but not exactly resemble, those on the problem sets. Problem sets will account for 30% of your grade.
- **Exam:** One midterm exam will account for 30% of your grade.
- **Project:** One final project will account for 40% of your grade.

Boilerplate

Enrollment in this course constitutes acknowledgment of the following:

- 1) I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action, up to and including expulsion from the University. I will adhere to university copyright policies.
- 2) Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student, who must then provide this documentation to the instructor when requesting accommodation.
- Grading policies: https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/
- Attendance policies: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/
- Honor code: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/