INDIANA UNIVERSITY

Department of Economics

ECON E402: Computational Methods in Macroeconomics

Spring 2025

All times are EST

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1 Basic Information

Instructor:	Ali Zarifhonarvar
E-mail:	alizarif@iu.edu
Class:	MTuWThF, 2:00 PM–3:15 PM - 5/13/2025–6/20/2025
Zoom Link:	`https://iu.zoom.us/j/85799827514`
Office Hours:	Mondays 12:30 PM - 1:30 PM and by appointment (`https://iu.zoom.us/my/alizarif`)
Teaching Assistant	TBA (`TBA`)

2 Course Objective

Economic analyses are increasingly performed on computers. In particular, economists use computers to examine data, solve models, and conduct experiments on simulated economies. In this class, we will use Python, a popular programming language, to perform these three types of analyses. No prior programming experience is assumed; the class will provide an introduction to Python.

Using Python and other analytical tools, we will answer a wide range of economic questions. Examples of questions to be addressed include: How can an economy continue to grow on a per-capita basis (Solow Growth Model and Endogenous Growth Model)? What are the aggregate ramifications of individuals having preferences to live near people who are similar in terms of race, social class or education level (Schelling Model)? How can we model transitions between employment and unemployment (McCall Search and Lake Model)?

3 Class Structure

This course will be taught in synchronous online lectures over Zoom. We will meet every day Monday-Friday, so the class will move quickly. Most classes will be composed of two parts: lecture and practice problems. The lecture will consist of me teaching new coding tools or models to the class. Then, I will pose a coding question to the class. Everyone will spend 5 to 10 minutes working on it. Solutions to the practice problems will be posted after class. Practice problems will not be graded. Engaging with the practice problems will be crucial to your learning in this course. Unlike other courses you may have taken, only reading the lecture notes will not suffice. To learn how to code, you must practice coding!

My goal is to create, facilitate and protect the learning environment for yourself and your classmates. Any action or behavior that interferes with my ability to add value to you or your fellow classmates is unacceptable. This includes, but is not limited to, distracting others during class.

4 Learning Materials

There is no textbook for this class. The majority of the class will be based on Thomas Sargent and John Stachurski's QuantEcon for Python (`https://python.quantecon.org/`). It is a free online resource. At times, there may be additional readings or examples. I will provide these references as necessary.

5 Grading

You will be evaluated on the basis of assignments, midterms, and a final project.

Assignments (20%): Throughout the semester, I will assign several homeworks (approximately 5). I will keep you posted through Canvas on new assignments, due dates, grades and any other relevant assignment-related information. Follow the course page on Canvas frequently.

⇒ **Important:** There will be a Custom GPT available to help you with the assignments. I strongly recommend to only use this specific one:
`https://chatgpt.com/g/g-67f89b4315f88191a1b4b5e026a87423-e402-ai-assistant`

When using this GPT, you will need to explain the prompts you used in your interactions with it. This helps demonstrate your understanding of how to effectively communicate with AI tools. There will be more information provided about this requirement in each assignment when it is posted.

Exams (50%): There will be two in-class exams. The first exam is tentatively scheduled for May 28 and is worth 20% of the class grade. The second exam is tentatively scheduled for June 12 and is worth 30% of the class grade. The dates are subject to change depending on how the class progresses.

Final Project (30%): Each student will conduct an independent final computational economics project for the class. The topic will be up to the student, but will need pre-approval. The final submission of the project is due by 11:59pm on Friday, June 20 and should include the python code used and a write-up of results. Further details about the final project will be discussed in the first few weeks of class.

Grades will be determined according to the following scale:

93-100% A	83-86% B	73-76% C	63-66% D
90-92% A-	80-82% B-	70-72% C-	60-62% D-
87-89% B+	77-79% C+	67-69% D+	<60% F

Important Dates

- **Exam 1 :** Wednesday, May 28, 2025
- **Project Proposal:** Wednesday, June 4, 2025
- **Exam 2 :** Thursday, June 12, 2025
- **Final Project:** Friday, June 20, 2025 (11:59pm)

6 Outline of Topics

The following is the tentative outline of topics we will cover. Some portions may be expanded or omitted depending on time constraints.

Introduction

- Introduction to the class
- Why Py?
- Setting up Python and Jupyter Notebooks

Basics

- Data types
- Iterating
- Logic operators
- Object-oriented programming
- Useful libraries (NumPy, Matplotlib, Pandas)
- How to write 'good' code

Introductory Macroeconomics Applications

- Labor market equilibrium: demand and supply
- Solow Growth Model

Data and Empirics

- Pandas for panel data
- Linear regression

Dynamic Programming

- Shortest paths and dynamic programming
- McCall Search Model
- Permanent Income Model

Multiple Agent Models

- Schelling Model of Segregation
- Lake Model of Employment and Unemployment

Additional Topics

- Tools and approaches to forecasting macroeconomic data
- Black-Scholes asset pricing
- Costly information, signal extraction, and beliefs

7 Policies

Students are required to read the syllabus by the second week of class and are responsible for adhering to the policies enclosed.

7.1 E-mail

Feel free to contact me with questions or concerns via e-mail at `alizarif@iu.edu`. Please include E402 in the subject line and a brief description of your question. Failure to include E402 in the subject line will result in a slower response time from me (since the e-mail will be routed to an incorrect folder).

Additionally, please do not send me messages through Canvas. I do not regularly check these.

7.2 Canvas

I will post homework, lectures, and announcements on Canvas. Please monitor the Canvas site closely. It is your responsibility to make sure you have access to the site. If you do not, please let me as soon as possible.

7.3 Missed Exams or Late Assignments

- Assignments submitted late will incur a 10% penalty for up to 24 hours after the due date. After 24 hours, late assignments will not be accepted.
- If an exam is missed for a legitimate reason, please provide the relevant documentation as soon as possible. An alternative plan will be arranged depending on the given situation.
- No extensions on the final project will be granted; please plan in advance.

7.4 Regrade Requests

Challenges to a grade may be presented in writing, explaining why you believe you deserve a different grade. I reserve the right to regrade the entire exam or assignment, in which case your grade may be raised or lowered. All disputes must be submitted within 7 days of the initial return of the assignment.

7.5 Accessible Education

If you require special accommodations, it is your responsibility to register with Accessible Educational Services (AES) and notify the instructor as soon as possible. The Department of Economics, in conjunction with Accessible Educational Services, will provide appropriate accommodations.

7.6 Academic Integrity

You should read the Code of Student Rights, Responsibilities, and Conduct because you are expected to adhere to its standards while you are a student at IU. Holding all students to the standards outlined in the Code ensures the value of the degree that you are earning from IU and is important training for maintaining ethical standards in the work that you will do in the future.

Academic misconduct is "any activity that tends to undermine the academic integrity of the institution" (Code, II: Responsibilities B,1). Academic integrity violations include cheating, fabrication, plagiarism, interference, violation of course rules, facilitating academic dishonesty, and

research misconduct. When you submit an assignment with your name on it, you are signifying that the work contained therein is yours, unless otherwise cited or referenced. Any ideas or materials taken from another source must be fully acknowledged. Students should not share their completed work with other students. If plagiarism or cheating occurs, all students involved will be considered responsible even if the student sharing their work was unaware that academic misconduct would occur or had occurred. Ignorance of what constitutes academic misconduct is not a valid excuse.

All suspected violations of the Code will be reported to the Dean of Students (Office of Student Conduct). Sanctions for academic misconduct in this course may include a failing grade on the assignment, a reduction in your final course grade, or a failing grade in the course, among other possibilities. If you are unsure about the expectations for completing an assignment or taking a test or exam in this course, speak with your instructor.

7.7 Generative AI

Cheating is "using, providing, or attempting to use or provide unauthorized assistance, materials, information, or study aids in any form." (Code, II: Responsibilities B,4,a). Cheating includes the use of artificial intelligence. You must not use generative AI platforms like ChatGPT (except the one that is provided to you) for any work for this class without permission of the instructor. Unauthorized use of generative AI in this course will constitute academic misconduct; there will be an academic sanction and the incident will be reported.

7.8 Selling and Uploading Course Materials

Various commercial services have approached students regarding selling course materials (e.g., instructor's notes, study guides, assignment descriptions). You are not permitted to sell the instructor's materials or upload materials to a third-party site – even after the course has ended. Violations of this policy will be reported to the Dean of Students (Office of Student Conduct) as academic misconduct; there will be an academic sanction and the incident will be reported. Additionally, you should know that selling a faculty member's course materials using IU email or other IU systems may also constitute a violation of IU information technology and IU intellectual property policies; additional consequences may result.

8 Tentative Schedule

Date	Topic
Tuesday, May 13, 2025	Overview of the Class
Wednesday, May 14, 2025	Introduction 1
Thursday, May 15, 2025	Introduction 2
Friday, May 16, 2025	Python Essentials 1 (Data Types)
Monday, May 19, 2025	Python Essentials 2 (Loops)
Tuesday, May 20, 2025	Python Essentials 3 (Logic Operators)
Wednesday, May 21, 2025	Python Essentials 4 (Functions and Class)
Thursday, May 22, 2025	OOP 1
Friday, May 23, 2025	OOP 2
Monday, May 26, 2025	No Class (Memorial Day)
Tuesday, May 27, 2025	Review Session for Exam 1
Wednesday, May 28, 2025	Exam 1
Thursday, May 29, 2025	Solow 1
Friday, May 30, 2025	Solow 2
Monday, June 2, 2025	Libraries (numpy1)
Tuesday, June 3, 2025	Libraries (numpy2)
Wednesday, June 4, 2025	Libraries (pandas1)
Thursday, June 5, 2025	Libraries (pandas2)
Friday, June 6, 2025	Black-Scholes Model
Monday, June 9, 2025	Libraries (matplotlib)
Tuesday, June 10, 2025	Libraries (scipy)
Wednesday, June 11, 2025	Review Session for Exam 2
Thursday, June 12, 2025	Exam 2
Friday, June 13, 2025	Schelling Model
Monday, June 16, 2025	Dynamic Programming 1
Tuesday, June 17, 2025	Dynamic Programming 2
Wednesday, June 18, 2025	Other Topics 1
Thursday, June 19, 2025	Other Topics 2
Friday, June 20, 2025	Review Session and Q&A