Weatherhead School of Management
Department of Economics

ECON 380: Computational Economics

Fall 2020, 08/24/2020 – 12/04/2020

Instructor Information:

Sining Wang
Office Hours: by appointments
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Class Details:

Classroom: Synchronous Online Instruction
Meeting Time: Tue&Thur 2:35 pm - 3:45 pm

Prerequisites:

Either ECON 102 or ECON 103 AND either OPRE 207, STAT 243, STAT 312, or STAT 312R
Prior programming experience (e.g. Python, R, Matlab, Stata) is recommended but not required.

Course Description:

Over the past two decades, computational methods have become an indispensable tool in social science studies. The goal of this course is to introduce undergraduate students to numerical methods and computer implementations for conducting modern quantitative research in economics and social sciences. At the conclusion of this course, students will:

- be able to effectively apply quantitative solution methods and agent-based modeling and simulation to a wide range of economic, financial, and business issues;
- learn Python and develop your programming skills. The learned programming skills will be readily applicable out of classroom;
- distinguish themselves on the job-market — The course will be highly useful for students who plan to go to graduate school in either economics, business, finance or statistics as well as for students who plan to work in an environment that requires strong quantitative data/ computational skills.

Course Materials:

Textbook: There is no required text for this course. The lecture notes are fully self-contained.

Programming Software: The course will focus on Python. Python is one of the most popular programming languages. It is open source (and therefore free) and platform independent. You will be required to complete your exercises in Python. Learning the basics in Python will help you learn R, Matlab, STATA, SAS, C++, Julia, or any other language you may prefer later.

Recommended materials:

While we will cover the basics of Python in the first two weeks of classes, I would recommend you to get familiar with Python and learn some of the basic programming techniques. The easiest way to install Python and all sorts of other useful packages for scientific computing is to install Python via the Anaconda distribution from: https://store.continuum.io/cshop/anaconda/ This is a simple one click installation process which works for Linux/Windows/Mac and it installs everything!

For those who are new to programming, I would recommend you the book *Learn Python the hard way* by Zed A. Shaw. This book is very friendly to new programmers and therefore should be a good start. This book is available for free at https://learnpythonthehardway.org/book/. It also comes with short video tutorials (10 -15 mins for each tutorial, free available at https://www.youtube.com/watch?v=F9kC70vhRnw).

Moreover, you can find many detailed and interactive tutorial practices from the book *How to think like a computer scientists*. by Allen Downey, Jeffrey Elkner and Chris Meyers. This book can help you gradually build confidence in programming. Again, both of the book and short video tutorials are available for free at https://runestone.academy/runestone/books/published/thinkcspy/index.html.

I will also recommend Dr. Susan Athey's paper "*Machine Learning Methods Economists Should Know About*" as a general advice. This paper listed some commonly used machine learning techniques in economic studies. The paper is available for download at https://www.gsb.stanford.edu/gsb-cmis/gsb-cmis-download-auth/476281.

In addition, assignment readings for each of the topics will be possted along the way. Most assignment readings will focus on the theoretical background of the learning topics.

Grading:

A student's grade will be determined according to the following criteria and percentages.

- Weekly Projects   50%
- Final Exam   20%
- Term Project   20%
- Quizzes   5%
- Group study reports   5%

Explanation of the evaluation criteria:
- **Weekly Projects:** There will be 12 projects through the semester. Usually you will have approximately a week working it. In each of the projects, you will need to use computational methods to solve specific questions. Students are encouraged to work together on the projects, but are required to submit independent work.

- **Final Exam:** The final exam will be a take-home problem set. You will have 2 days working on it. No make-up or extension will be granted.

- **Term Project:** Term project will be completed in groups. You will start working on the project from week 2. A group need to report the progress every week. By the end of the term, you will hand-in a complete paper and present your research in class. The detailed criteria are as follow:
Research Proposal	5%
Progress Reporting	5%
Research Paper	10%

- **Quizzes:** We will have 12 quizzes through the term. Each quiz will take 5 - 10 mins. Only 10 of them will count for your final grade. The lowest two will be dropped.

- **Group Study Reports:** All groups need to submit a group study report every week. The report will demonstrate what you have learned from the group study session, and lists questions in common. I'll read your report carefully and get back to you. Each group only need to submit one copy of the report. Late submission will result a grade of zero for all group members.

Exam and Homework Policies

Typically no extensions or make-up homework or exams will be granted. If you anticipate having to miss homework or exams due to reasons out of your control, please contact your Navigator to arrange for accommodations. Note that travel plans are not an acceptable reason to reschedule exams. It is the responsibility of students to ensure that they write exams in the location, date, and time as scheduled.

Academic Integrity

A sound education is built on intellectual honesty. Students at Case Western Reserve University are required to uphold the highest ethical standards of academic conduct. All members of the campus community are responsible for preserving the standards of academic integrity and supporting the practices that promote a fair and just process. Please read the University Policy carefully at https://bulletin.case.edu/undergraduatestudies/academicintegrity/.

Academic Accommodation

Academic accommodations are available to students with documented disabilities. In order to access the accommodations for which you may be qualified, please register with the Office of Disability Resources (Sears 470) 216.368.5230 (https://case.edu/studentlife/healthcounseling/disability-resources). Their staff will verify your need for specific accommodations and provide you with a memo to inform me of your needs. Once you have received this memo, please make an appointment to see me privately to discuss your needs. Please be aware that any needed accommodations cannot be implemented retroactively; therefore, timely notification of your needs is in your best interest. You must notify me of your accommodations for each exam at least two days before an exam (i.e. where you will take the exam and other accommodation required). If you fail to do so, I cannot guarantee I can make the accommodations, since I may have to schedule a room and find a proctor.

Mental Health Support

All of us need a support system. I encourage you to seek out mental health supports if they are needed. University Health and Counseling Services (UHCS) has improved access to counseling services with Walk In visits during all office hours. We have made the process of accessing care more efficient and have eliminated the wait. It is as straightforward as this: If you would like to see a counselor, walk in. For more detail, please visit the University Counseling Service Website (https://case.edu/studentlife/healthcounseling/counseling-services).

Tentative Schedule

WEEK	CONTENTS	SCHEDULE
Week 1 Aug 25, 27	Welcome to Computational Economics	Aug 25: welcome Aug 27: Group study session
Week 2 Sep 01, 03	Will you marry me ? Stable marriage problem and the Gale-Shapley Algorithm	Sep 01: Stable matching problem and its application Sep 03: Group study session
Week 3 Sep 08, 10	The pandemic of COVID-19 and policy evaluation (1)	Sep 08: the SIR model on an isolated island Sep 10: Group study session
Week 4 Sep 15, 17	The pandemic of COVID-19 and policy evaluation (2)	Sep 15: the SIR model with O-D flow Sep 17: Group study session
Week 5 Sep 22, 24	Object Oriented Programming	Sep 22: function, class, and OOD Sep 24: Group study session
Week 6 Sep 29, Oct 01	What an Utopian society would be like? Simulating people's cooperation decisions and consequences.	Sep 29: public goods and cooperation Oct 01: Group study session
Week 7 Oct 06, 08	Consumer Choice Theory and Optimization (1)	Oct 06: Optimization (1) Oct 08: Group study session
Week 8 Oct 13, 15	Consumer Choice Theory and Optimization (2)	Oct 13: Optimization (2) Oct 15: Group study session
Week 9 Oct 20, 22	Student Presentations (research proposal)	Oct 20: Student Presentation (research proposal) Oct 22: Student Presentation (research proposal)
Week 10 Oct 27, 29	Apply Optimization to Acheieve Sustainable Development	Oct 27: Application in Reource Economics Oct 29: Group study session
Week 11 Nov 03, 05	What determines growth? Solow's Growth Model	Nov 03: Growth Model in Macroeconomics Nov 05: Group study session
Week 12 Nov 10, 12	Working with data (1)	Nov 10: Data manipulation with Pandas Nov 12: Group study session
Week 13 Nov 17, 19	Working with data (2)	Nov 17: First lession in Machine Learning Nov 19: Group study session
Week 14 Nov 24, 26	Thanksgiving Holidays	Nov 24: Thanks-giving break Nov 26: Thanks-giving break
Week 15 Dec 01, 03	Student Presentations	Nov 24: Student presentations (final project) Nov 24: Student presentations (final project)