ECO 7938: Practical Computing in Economics
Syllabus

Instructor: Gunnar Heins
Email: gheins@ufl.edu
Office Hours: Mondays, 10-11:30 in MAT 320
Class Meeting Times: T & R, 3rd & 4th period (9:35 - 11:30)
Classroom: MAT 108
TA: TBD
TA Office Hours: TBD

Course Description

Computational skills have become more and more important in Economics. This course serves as an applied and hands-on introduction to computing and data analysis for graduate students in economics and beyond. The goals of this class are to acquire basic programming skills as well as a working knowledge of two of the most commonly software packages (R and Matlab), to practice working with and analyzing data, and to become familiar with commonly used datasets. This course further provides an introduction to numerical optimization, and UF's computing resources.

Class Modality

This is a fully in-person course. Lectures will not be streamed nor recorded. All exams will take place in person, during our scheduled class times.

Software and Prerequisites

This course will use two programming languages: R during the first half and Matlab during the second one. Prior knowledge of either is not necessary but certainly helpful. Please download and install both R and RStudio (a user interface for R) before the first session. R can be downloaded from *https://www.r-project.org/* and RStudio from *https://www.rstudio.com/*.

Please bring your laptop to each session and have it ready at the beginning of each class. I will for the most part be writing code in R and Matlab during each lecture and you should follow and understand each step by performing it yourself.

Textbooks and Readings

The course will build on multiple sources and does not follow a single textbook, especially for the second part. If you are thinking of getting a textbook on R or Matlab, I would recommend the book by Norman Matloff "The Art of R Programming - A Tour of Statistical Software Design" for the first part. It is useful as an introduction to R but also illustrates quite detailed how R functions compared to other languages. For the basics of Matlab, I recommend the book by Stormy Attaway "Matlab - A Practical Introduction to Programming and Problem Solving".

Exams, Homework, and Grading

Homeworks are an important part of this course and essential in order to learn and practice programming. Especially if you have no or little experience you should use the problem sets as practice for the exams, future courses and ultimately your research. There will be close to weekly homeworks which have to be submitted individually. You can discuss your solutions with others, but do not take over someone else's code.

There will also be three exams. Each exam will be an open-book exam and you will have to use your laptop and use R and Matlab to complete them. It is your responsibility to ensure that your laptop and both programs run properly during the exam. You might also for example want to start important and potentially time-consuming updates before the exam. The final grade will consist of:

Problem Sets	20 %
Participation	5 %
Exam 1	25 %
Exam 2	25 %
Exam 3	25 %
Total	100 %

Make-up assignments and exams will be arranged only for absences that are explicitly covered by the UF Attendance Policy. Whenever possible, you should reach out at least five business days in advance to arrange a make-up assignment or exam. Of course, this will not always be possible. Unforeseen absences and emergencies occur and can be excused without such advance notice. In most cases, you will be asked to provide evidence or documentation of an absence that is explicitly excused by the UF Attendance Policy. Absences related to religious holidays and worship do not require this documentation.

Professionalism and Honor Code:

Students are bound to not cheat or plagiarize, and are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: 'On my honor, I have neither given nor received unauthorized aid in doing this assignment.'"

You should familiarize yourself with the UF Student Honor Code. Cheating and plagiarism are not the only violations of this policy. Making false or misleading statements to procure an improper academic advantage, failing to properly cite quotations, and unauthorized collaboration or consultation of resources are also violations. Importantly, ignorance of a policy is not a valid reason for violating it.

Generative Artificial Intelligence:

The Department of Economics faculty assume that all work that is submitted for grading is written by the student whose name it bears, and that it represents their ideas and work. Accordingly, students are not permitted to use generative AI when completing assignments, quizzes, exams, or other graded work unless their instructor has expressly granted that permission. Unauthorized use of generative AI may constitute cheating and/or plagiarism. Such violations of the UF Student Honor Code will be reported to the UF Dean of Students Office and will be subject to severe sanctions.

Students Requiring Accommodations:

Students with disabilities requesting accommodations should first register with the Disabilities Resource Center (392-8565; https://disability.ufl.edu/), providing appropriate documentation. Once registered, students will receive an accommodation letter that can be presented to the instructor when requesting accommodations. Please register at the beginning of the course if seeking accommodations.

Tentative Course Schedule

PART I: PRACTICAL COMPUTING IN R

Week 1

    - Course introduction and outline

    - Introduction to R and RStudio

    - A first R session, Vectors in R

    - Loops, Matrices and Lists in R

Week 2

    - Installing and using packages

    - Working with data: The data.table package

    - Importing and saving data

    - Summary statistics

    - Merging datasets

    - Introduction to regression analysis

    - Standard errors

    - Exporting results

Week 3

    - Dummy Variables

    - Instrumental Variables, 2SLS

    - Bootstrap

    - Plots & Data Visualization

    - The ggplot2 package

Week 4

    - tidyverse

    - Simulation

    - Applied Empirical Research in Practice

    - Further useful R packages, Advantages and Disadvantages of R

Week 5

    - tidyverse (cont.)

    - Review

    - **September 26: Exam 1**

PART II: PRACTICAL COMPUTING IN MATLAB

Week 6

- Introduction to Matlab, Differences to R, a first Matlab session
- Matrices, Loops, and Functions in Matlab

Week 7
- Solving linear equations
- Solving nonlinear equations: Linearization
- Solving nonlinear equations
- Unconstrained Optimization

Week 8
- Unconstrained Optimization (cont.)
- Constrained Optimization
- Speeding up your code, UF's computing resources, HiPerGator

Week 9
- Review
- **October 29: Exam 2**

PART III: AN INTRODUCTION TO APPLIED EMPIRICAL METHODS IN ECONOMICS

Week 10
- Empirical Design
- Causality and Identification
- Diff-in-diff

Week 11
- Instrumental Variables
- Regression Discontinuity Design

Week 12
- Matching
- Panel Data

Week 13
- Quasi-Random Assignment
- Event Studies

Week 14
- **December 3: Exam 3**