

Syllabus

BIL 113E - Introduction to Sci. & Eng. Computing

2017-2018 Spring

Description

This course is intended for students with no prior programming experience who are expected to use MATLAB, Python, and R in economics courses. Throughout the course, our initial focus will be on MATLAB specific topics (e.g. matrix operations, data visualization, scripts/functions) and basic programming concepts (e.g. simple I/O operations, control statements, data structures). Next, we will concentrate on several major data sources and the use of econometrics softwares such as Python and R, along their applications.

Instructors

For MATLAB Part

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Office Hours: By appointment (D615)

Python & R Part

Research Assistant Ali Furkan Kalay, kalaya@itu.edu.tr

Office Hours: By appointment (D615)

Textbooks

- There is no any assigned textbook for MATLAB part of the course. However this website, <http://www.mathworks.com/help/matlab>, is quite useful.
- There is no any assigned textbook for Python part of the course. However, you may utilize the following link: http://scholar.harvard.edu/files/ambell/files/python_for_economists.pdf

Grading (Tentative)

- MATLAB Assignments: 30% (6 assignments, each 5%)
- MATLAB Final Project: 20%
- Python/R Assignments: 30% (4 Quizzes 20%, 1 Homework 10%)
- Python/R Final Project: 20%

Assignments

For the first part of the course, there will be weekly assignments, each involving computational exercises in MATLAB. You are encouraged to collaborate on the assignments with your classmates, but the final writeup (including MATLAB code) must be your own. At the end of each lecture, an assignment will be given, and the due date of that assignment will be the next lecture day (Tuesday). Late homeworks will not be accepted.

Course Objectives

- To familiarize students with the fundamentals of scientific computing concepts
- To develop problem solving skills
- To develop skills in constructing an algorithm
- To train students how to use problem solver program in economic calculations
- To train students to visualize their results and prepare written reports

Course Outline (Tentative)

MATLAB

Lecture 1 (Feb. 9)

- What is MATLAB? Why MATLAB?
- MATLAB Environment
- Variables, basic commands and formats
- Saving your work, m-files
- Arithmetic, relational, and logical operators
- Arrays and matrices
- Using built-in functions
- Elementary math functions (common computations, rounding functions, discrete math)
- Trigonometric Functions

Lecture 2 (Feb. 16)

- Data analysis functions (statistical functions)
- Random numbers
- Complex numbers
- Matrix operations and functions (transpose, dot product, mult., powers, inverse, det., cross prod.)
- Elementary matrix manipulations
- Special matrices (zeros, ones, diag, fliplr, flipud etc.)
- Solutions of systems of linear equations

Lecture 3 (Feb. 23)

- Two dimensional plots (titles, labels, grids, line styles coors)
- Creating multiple plots
- Axis scaling and annotating plots
- Subplots
- Polar plots, logarithmic plots, bar graphs, pie charts, histograms
- X-Y graphs with two Y axis
- Function plots

- Three dimensional plotting
- Editing plots from the menu bar

Lecture 4 (Mar. 2)

- User-defined functions
- Functions with multiple inputs and outputs
- Creating your own toolbox of functions
- Anonymous functions and function handles
- Function functions
- Subfunctions

Lecture 5 (Mar. 9)

- User-defined input
- Output options (display, fprintf, sprintf)
- Graphical input
- Import/Export data
- Debugging

Lecture 6 (Mar. 16)

- The if/else structure
- The elseif structure
- Switch and Case
- For loops
- While loops
- Break and continue
- Nested loops
- Improving efficiency of loops

Lecture 7 (Mar. 23)

- Data types
- Multidimensional arrays
- Character arrays
- Cell arrays
- Structure arrays

PHYTON

Lecture 8 (Apr. 6)

Introduction to Python I

- Why Python?
- Anaconda Environment
- Variables and variable types
- Math Operations
- Collections: List, Tuple, Dictionary, Set
- String and String Operations

Lecture 9 (Apr. 13)

Introduction to Python II

- Logical Operators
- If statement
- While and For Loops
- Functions
 - Quiz 1

Lecture 10 (Apr. 20)

Introduction to Numpy and Pandas

- Python Libraries
- How to install library
- Numpy and some operations
- Pandas and some operations

Lecture 11 (Apr. 27)

Data Visualization

- Data Retrieval
- Data cleaning
- Matplotlib
- Plotting with Pandas
 - Quiz 2

Lecture 12 (May. 4)

- Applications
 - Quiz 3
 - Homework

R

Lecture 13 (May. 11)

Introduction to R Programming and Rstudio

- Why R?
- R for advanced studies
- Basic R commands
- Resources for R Programming and applications

Lecture 13 (May. 18)

- Applications
 - Quiz 4