Fall 2016  
PSY8219: Scientific Computing for Psychological and Brain Sciences  
Mondays 1:00-3:50  
Wilson Hall 316

Instructor

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Office Hours: Mon 12:00-1:00 or by appointment

Course Overview

This course is an introduction to scientific computing for psychological and brain sciences. The target audience is first or second year graduate students in Psychological Science, Neuroscience, and related disciplines as well as advanced undergraduates who are planning to pursue a PhD in one of those disciplines. The goal of the course is for students to develop some proficiency in designing, writing, and debugging computer programs to control experiments, perform data analyses, and simulate simple neural and psychological mechanisms. We will discuss some combination of computer programming methods, algorithms and data structures, computational and numerical methods, web-based techniques, and high performance computing techniques as applied to common problems in psychological and brain sciences. Our focus will be on Matlab but we may reference other programming languages from time-to-time, such as Javascript, Python, or R.

Prerequisites

For graduate students, no previous formal coursework in computer programming is required. I will assume that students have some familiarity with what a computer program is and ideally be familiar with basic programming concepts common to many programming language. Students who have no prior programming experience at all will need to do some extra work outside of class to familiarize themselves with these basic concept. While this is a graduate course, I often permit undergraduate students to enroll; I do require that undergraduates have at least one semester of computer programming (e.g., CS1101 or CS1103). I will try to adjust the pace of the course depending on the amount of computer programming and mathematics background students have had. To do that, I encourage students to let me know if the material is going by too quickly or too slowly.
Laptops

Students are strongly encouraged to bring laptops to class. I may distribute any example code before class that will be used during class. I will ask that people refrain from using their laptops for any non-class purposes during class time.

Course Requirements and Grading

Homework assignments (90%) handed each week will be used throughout the course to allow students the opportunity to put the scientific computing tools into practice. There will be no exams. Attendance and class participation (10%) are also expected. Final letter grades will be based on percentages as follows:

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While I strongly encourage students to help each other out on conceptual confusions, all homework assignments must ultimately be completed individually. Unexcused late assignments will be penalized 10% for every 24 hours late, starting from the time class ends, for a maximum of two days, after which they will earn a 0.

You will turn in homework assignments using Blackboard (see below). I ask two things: First, that you submit it as a single ZIP file or some other standard compressed format rather than multiple files. Second, that you make sure that you send me everything that’s needed for the program to run successfully, which includes not only files you created but copies of any files I might have given you as part of the assignment.

Any student auditing the course is expected to attend class and can participate in discussion in a way commensurate with the amount of work they do on class assignments.

Textbook

Optional Text:

*MATLAB: A practical introduction to programming and problem solving, 4th Edition*

Stormy Attaway

Elsevier Publishing

Folks will generally be fine if they use the older 3rd edition (which might be available purchased as cheap used copy online or borrowed from another student who took this course before); just note that there may be a few aspects of Matlab, whose language and interface are constantly evolving, that are incorrect in older editions.
Matlab

We will use Matlab in this course. Vanderbilt has a site license that users contribute to by purchasing individual licenses; I anticipate that many graduate students will have access to Matlab through a license purchased for them by their research advisor.

Students without laboratory access can buy Matlab for themselves by:
1. Going to http://softwarestore.vanderbilt.edu
2. Clicking on the Software Store Login
3. Logging in with their VUnet ID and password
4. Placing an order by credit card

We will talk about how to install Psychophysics Toolbox later in the course.

Course Web Site

All course materials (powerpoints slides, homework assignments, example code, solutions) will be posted on the lab web site:
http://catlab.psy.vanderbilt.edu/palmeri/psy319/

Blackboard

We will use the Assignments feature on Blackboard (https://blackboard.vanderbilt.edu). You can turn in an assignment more than once, but I will only look at and grade the last one you turn in.

You can also view your grades and my comments on your assignments within Blackboard.

Tentative Course Schedule

The following course schedule is subject to change. The most up-to-date schedule will be posted on the course web site.

Week 1: Mon Aug 29
Introduction to Matlab, Variables, Numeric Types, Mathematical Operators, Logical Operations
Attaway Chapter 1

Week 2: Mon Sep 5
Strings, Arrays, Cell Arrays, Structures, Vectors and Matrices
Attaway Chapter 2, 7, and 8

Week 3: Mon Sep 12
Control Flow, Conditional Statements, Loops
Attaway Chapters 3, 4, and 5
Week 4: Mon Sep 19  
*Random Number Generators*
Attaway Chapter 1

Week 5: Mon Sep 26  
*Functions and Procedural Programming*
Attaway Chapter 3

Week 6: Mon Oct 3  
*Programming Techniques*
Attaway Chapters 6 and 10

Week 7: Mon Oct 10  
*Graphing*
Attaway Chapter 11 and 12

Week 8: Mon Oct 17  
*Images, Image and Signal Processing*
Attaway Chapter 13

Week 9: Mon Oct 24  
*Psychophysics Toolbox*

Week 10: Mon Oct 31  
*Psychophysics Toolbox (Continued)*

Week 11: Mon Nov 7  
*File I/O and GUIs*
Attaway Chapter 9

Week 12: Mon Nov 14  
*Basics of Optimization and Curve Fitting*
Attaway Chapter 14

Week 13: Mon Nov 28  
*Web-based Experiments*

Week 14: Mon Dec 5  
*Miscellaneous Topics*

*Vanderbilt’s Honor Code Governs All Work in this Course*