Matlab Programming for Behavioral Scientists

Syllabus Fall 2018

Instructor

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Course Information

Course number: 01:830:403
Class time and location: Course will meet once a week. Mondays 12PM-3PM, Psychology Building Busch Campus room 105
Credit hours: 3
Prerequisite: None

Course Description

What is Matlab?

Matlab is a high-level programming language and mathematical software package for solving quantitative problems often encountered in experimental psychology. Matlab supports both the development of programs using basic program constructs, and functions that can be added to the students own programs to design sophisticated experimental interfaces, statistical analysis, and graphic visualization of data.

Why learn Matlab programming?

As Psychology moves towards a technology based research field, programming is about as essential a skill as one can conceive of. Behavioral data collection is becoming automated and programming skills are needed to develop experimental interfaces, to analyze and visualize data, etc. Any student pursuing a graduate degree in psychology will find programming to be an essential skill.

Aims of this course

The aims of this course are to introduce computer programming through the MATLAB software package. In this course students will learn to solve problems often encountered in experimental psychology, including designing experimental interfaces for presenting stimuli and solicit subject responses, record and organize data, read in and visualize experimental data, and basic statistical analysis.

This course requires and assumes no previous experience in computer programming. However, the course is programming intensive.

Structure

The emphasis of this course will be on hands on lecture-lab format where students get both rigorous instruction and hands-on experience. Student-centered teaching is an effective format for a programming class because it allows students to do self-study under the guidance of the instructor, and to implement smaller structured projects from beginning to end (Zhang & Wang, 2010). Emphasis will be heavily placed on in-class programming. During each class, a different topic in programming is introduced and discussed, followed by programming exercises of a project that demonstrates the principles underlying the topic.

The course has two primary themes: to develop good programming habits and to gain hands-on experience by programming essential aspects of data collection and analysis, such as building experimental interfaces that span a range of research topics in cognitive psychology – from visual and auditory stimuli to surveys and interactive response formats.

The lab component requires students to use their new knowledge as a resource to solve problems and provides feedback from the instructor. Students will practice and reflect on what they learned each week by writing short programs.

There will be assigned readings from the textbook, with lectures providing information on additional topics.

Lectures will be conducted in a computer lab equipped with MATLAB. There should usually be at least one machine available for student use. Therefore it is not necessary to bring a laptop to class. However, access to a computer is necessary for the completion of the course assignments. Importantly, students are recommended to store their program files on an external drive (flash drive), so that they will not be tied to a specific machine, or erased between lectures.

Outcomes

At the end of the course students will have gained the technical skills, should be confident about using MATLAB, to implement their own project work. The goal is for the student to be able to build their own experimental interface, apply them to their own data collection, analyze their data, and visualize the results.

Course Materials

Student access to Matlab outside of the classroom

The university has made Matlab available to Undergraduate students.
Follow the link below:

https://software.rutgers.edu/
Activation key of 12470-53451-38632-03673-08334

Students can access Matlab in the on campus public labs. Students can also point their browser at http://apps.rutgers.edu/ from their personal computer whether they are coming from anywhere on campus (including RUWireless) or from high speed network connections at home. To review basic documentation for Apps, click here. This outlines the steps for service activation as well as the login process which includes trusting the self-signed certificate, enabling Java, and mobile access. For more information, contact oirt @rutgers.edu.

Textbook

There is no textbook assigned to this course. However, there are a number of good books available. I have used:
Marc Herniter “programming in Matlab”
http://books.google.com/books/about/Programming_in_MATLAB.html?id=KvRQAAAAMAAJ

Brian hunt, Ronald Lipsman & Jonathan Rosenberg “A guide to Matlab for beginners and experienced users”
http://www.amazon.com/Guide-MATLAB-Beginners-Experienced-Users/dp/0521615658

Additional Readings

Additional readings will be posted on Sakai

Exercises

A lab manual containing the lab exercises and instructions for each programming activity will be poster on Sakai.

Lecture Slides

Partial lecture slides will be posted on Sakai. These slides will not include all of the materials presented during lectures. It is important that you are present for class and actively engaged in note taking and programming.

Assessment

Attendance

Attendance in this course is mandatory. It is not possible to learn the material without attending lectures.

Exams

There will be 2 exams for this class including the final exam. The final exam is cumulative, covering the entire semester. Both exams will be given in-class on the scheduled day.
Exams will be in the format of the weekly assignments. You will be given a programming exercise where you will demonstrate your skills by writing a program to solve a stated problem. The exam might also include a brief essay question asking you to explain a central concept. Exam questions will come from both the lecture and the readings.
You must take both exams. There are NO make-up exams. If you miss a scheduled class/exam you will need to provide a valid/documented excuse (see section below for authenticating your excuse). Any other tests will be given in the finals week and will be in the essay format.

Weekly Exercises

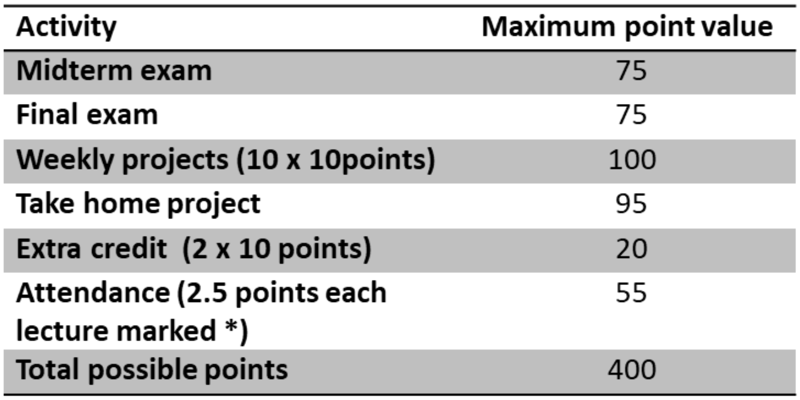
Each week a topic introduced during the lecture portion of the class will be further explored during the lab portion. The assignment tab on Sakai will outline each programming activity, and give step-by-step instructions on how to get started. Students will be responsible for finishing and submitting each programming exercise weekly.

Project

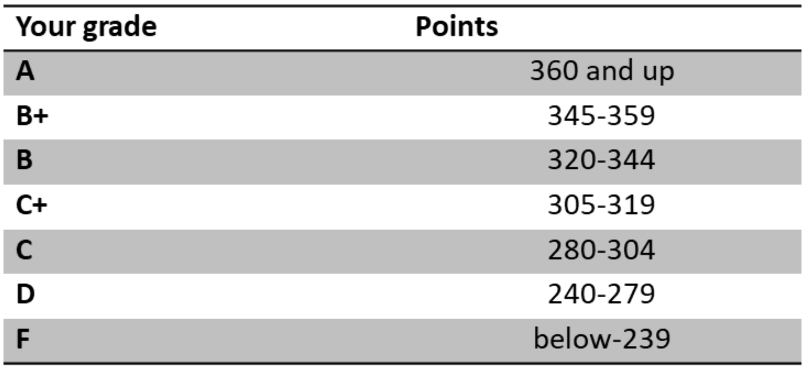
The programming project is a chance for you to apply the programming skills you have developed to your own research.
The project will have two components. The first should be relatively short (1-2 pages) summary of your research question and experimental design. The second should be a MATLAB program written by the student that implements this experiment. More details will be available on Sakai.

Grading

Your grade will be based on exams, a project, and the weekly exercises.



Activity	Maximum point value
Midterm exam	75
Final exam	75
Weekly projects (10 x 10points)	100
Take home project	95
Extra credit (2 x 10 points)	20
Attendance (2.5 points each lecture marked *)	55
Total possible points	400



Your grade	Points
A	360 and up
B+	345-359
B	320-344
C+	305-319
C	280-304
D	240-279
F	below-239

Schedule

Topics and chapters will be covered on the dates assigned in the schedule. Additional readings might be assigned. Please check Sakai for notices of additional readings.

Lecture 1. Introduction to Programming

1.1. Components of a computer
1.2. Working with numbers
1.3. Machine code
1.4. Software hierarchy
1.5. Programming Environment: MATLAB Windows
1.6. A First Program
1.7. Expressions, Constants
1.8. Variables and assignment statement
1.9. Arrays

Lecture 2. Graph Plots

2.1. Basic plotting
2.2. Built in functions
2.3. Load and save
2.4. Get input
2.5. Help function
2.6. Subplot

Lecture 3. Loops and conditional statements

3.1. Logical expressions
3.2. Conditional statements: If, Else, Elseif
3.3. Repetition statements: While, For
3.4. For statement
3.5. Nested loops
3.6. Switch case
3.7. Strcmp

Topic 4. Debugging

4.1. General practices
4.2. Breaking out of unresponsive code
4.3. Locating the error
4.4. Common errors – typing related
4.5. Inserting error traps

Lecture 5. Advanced plotting and text manipulation

5.1. Writing to a text file
5.2. Reading from a text file
5.3. Randomizing and sorting a list
5.4. Searching a list
5.5. Working with Objects
5.6. Generating waveforms
5.7. Sound replay, load and save

Topic 6. Procedures and Functions

6.1 Local versus global memory
6.1. Syntax
6.1. Arguments and return values
6.2. M-files
6.3. Formatted console input-output
6.4. String handling

Topic 7. GUI Interface

7.1. Elements of a graphical user interface

Topic 8. Functions part II

8.1. Syntax
9.2. Attaching buttons to actions
9.3. Getting Input
9.4. Setting Output

Topic9. GUI Interface part II

9.1. UI controls
9.2. Attaching buttons to actions
9.3. Getting Input
9.4. Setting Output

Topic 10. Working with keyboard input and RT

10.1. Taking input from keyboard
10.2. Recording response time
10.3. Randomizing trial sequences

Topic 11. Complex data structures

11.1. Complex strings
11.2. Cell arrays
11.3. Structures

Topic 12. Building Separate Sections of an Experiment & Visualizing results

12.1. Instructions
12.2. Randomizing trial sequences
12.3. Run Block
12.4. Recording input
12.5. "Waitfor" stimuli loading
12.6. Programming a classic experiment from Psychology

OTHER possible topics:

Working with sound
Model fitting
Basic statistical analysis

Please note that the schedule will change over the course of the semester. Any updates will be posted here.

Date	Topic	Assignments
Sept 10	Introduction: A first program	Exercise set 1 + homework 1
Sept 17	Scripts and basic plotting	Exercise set 2
Sept 24	Conditional statements – if and for	Exercise set 3
Oct 1	Debugging	Exercise set 4
Oct 8	String handling; Save to file	Exercise set 5
Oct 15	Functions; review	Exercise set 6
Oct 22	In class mid-term	Mid-term revision
Oct 29	Elements of a Graphical User Interface (GUI)	Exercise set 7
Nov 5	Sound and more GUIs; Functions part 2	Exercise set 8
Nov 12	User input	Exercise set 9
Nov 19	Complex data structures—cell arrays	Exercise set 10
Nov 26	No class	
Dec 3	Project presentation	
Dec 10	Project presentation; Review	
Dec 20	Final exam	

NOTE

Any and all information contained in this syllabus is subject to change. Any changes will be announced in class and/or via email notification. Updates to the syllabus will also be posted on Sakai.

Authentication of Absence

To provide the documentation for a valid excused absence, you will need to get your note authenticated by the Dean of Students Office (this is to protect your medical confidentiality) by following the directions below:
On the Rutgers website
http://sasundergrad.rutgers.edu/academics/courses/registration-and-course-policies
under the heading in the left column:
Attendance and Cancellation of Classes
http://sasundergrad.rutgers.edu/academics/courses/registration-and-course-policies/attendance-and-cancellation-of-class
You will find the following policy:
"Students may obtain a note from the Office of the Dean of Students to authenticate an extended absence that is supported by appropriate documentation".
There is also a link to the Office of the Dean of Students by clicking on the highlighted text.

Academic Honesty Policies

Cheating, plagiarism or any other violations of the university's policy on academic integrity will not be tolerated in this class.

Please visit this link to view the university's Academic Honesty Policies **Academic Honesty Policies**

Students with Disabilities

Our community values diversity and seeks to promote meaningful access to educational opportunities for all students. If you believe that you need accommodations for a disability, please follow these procedures outlined at http://disabilityservices.rutgers.edu/request.html
Since accommodations may require early planning and are not provided retroactively, please initiate this process as soon as possible.