Bi 199: Introduction to MatLab

Tuesdays and Thursday's, 1:30 to 3:00 PM in 100 Powell-Booth. The goal of this one term class is to introduce biology and chemistry graduate students to MatLab and its applications in biology and biochemistry. Advanced undergraduates are permitted to enroll. Class size is limited to 20.

Instructors:

Mary B. Kennedy
Davis Professor of Biology
Email: kennedym@its.caltech.edu

Ciro Donalek (Ph.D. in Applied Math and Computational Science
Postdoctoral Fellow in Astronomy
Email: donalek@astro.caltech.edu

Alexandre Cuna (Ph.D. in Computational Science and Engineering)
Staff of Moore Cell Center (CACR)
Email: cunha@cacr.caltech.edu

Shirley Pepke (Ph.D. in Physics)
Staff of Moore Cell Center (CACR)
Email: spepke@cacr.caltech.edu

Santiago Lombeyda (M.S. in Computer Science)
Staff of CACR (Specialist in Data Visualization)
Email: slombey@cacr.caltech.edu

Required Text:

Getting Started with MatLab A quick introduction for scientists and engineers (2010, updated for version 7.8 release 2009a) by Rudra Pratap, Oxford University Press. The book will be available through the Caltech web bookstore.

Required Software:

Caltech has a large number of site licenses for MatLab. These licenses work only when you are connected to a Caltech URL. Before the first class, please visit the Caltech Online Software Center: http://elms05.e-academy.com/caltech/ to download a copy of MatLab onto your laptop computer. The software uses a network based licensing method that permits its use on campus. BRING YOUR LAPTOPS TO EACH CLASS.

General Plan:

About 30 -45 minutes of each class will be devoted to lecture/demonstrations. The remaining 45 - 60 minutes will be used by the students to work through problem sets and exercises on their own. There will be two or three instructors available during the entire class to answer questions and help.

Over the first 3 weeks, Dr. Kennedy will lead the students through several of the introductory tutorials in the required Textbook. For the remainder of the course, the book

Introduction to MatLab

will serve as a general reference only. Dr. Donalek will provide more in depth training on several of the central aspects of MatLab that were introduced in the tutorials. Dr. Cunha will introduce the Image Analysis Toolbox and its applications in biological research. Dr. Pepke will cover the use of MatLab for setting up and solving ODE's related to biochemical research and she will introduce Mathematica as an alternative tool for this purpose. Finally, Mr. Lombeyda will introduce other useful programs and methods for visualization of biological and biochemical data.

Grading Policy

Graduate students will be graded on a Pass/Fail basis. The grade will be based on attendance and participation in working out exercises. To receive a passing grade, students may miss no more than two classes. If it is necessary for a student to miss more than two classes, the student will need to do extra work to make up for the missed classes. However, in any case, no more than 4 classes can be missed. Undergraduates will receive a B based on the performance above, and an A for successfully completing a project of their choosing.

All students will be encouraged to pick a project to work on (ie. creation of a script, and/or function) that will (ideally) be useful in their research. The project is not required for a passing grade, but is strongly encouraged. There will be time in class for questions about, and help with, the project.

Approximate Schedule (We will be flexible with the schedule.):

Week 1	Jan 5, 2010	*Kennedy*: Introduction, Check Installations, Lesson 1 and associated problems (page 17) TA: *Pepke*
	Jan 7, 2010	*Kennedy*: Lesson 2 (Arrays and Numbers), and associated problems (page 21) TAs: *Cunha* and *Pepke*
Week 2	Jan 12, 2010	*Kennedy*: Lesson 3 (Simple Plots; page 25), and Lesson 4 (Script Files; page 29). and associated problems TAs: *Donalek* and *Cunha*
	Jan 14, 2010	*Kennedy*: Lesson 5 (Function Files), and associated problems (page 33) TAs: *TBD*
Week 3	Jan 19, 2010	*Kennedy*: Lesson 6 (Working with Arrays and Matrices; page 39) and lesson 9 (Importing and Exporting Data; page 51), and associated problems TAs: *TBD*
	Jan 21, 2010	*Kennedy*: Lesson 10 (Files and Directories; page 55) and Lesson 11 (Publishing Reports; page 58) , and associated problems (page 39) TAs: *TBD*

Introduction to MatLab

Week 4	Jan 26, 2010	*Donalek*: Data Structures, matrices and variables, and associated exercises. TAs: *Kennedy* and *Cunha*
	Jan 28, 2019	*Donalek*: Other data structures: multidimensional arrays, structures, cell arrays, and associated exercises. TAs: *Kennedy and TBD*
Week 5	Feb 2, 2010	*Donalek*: M-files: functions and scripts. Importing data, and associated exercises. *TAs: Kennedy and TBD*
	Feb 4, 2010	*Donalek*: Flow control: loops and conditionals, vectorization, and associated exercises. TAs: *Kennedy and TBD*
Week 6	Feb 9, 2010	*Donalek*: Plotting data, adding simple statistics, and associated exercises. TAs: *TBD*
	Feb 11, 2010	*Donalek*: Build your own GUI interface, and associated exercises. TAs: *Kennedy and TBD.*
Week 7	Feb 16, 2010	*Cunha*: Image Processing: Formats and Intensity Transformations, and associated exercises. TAs: *Kennedy and TBD*
	Feb 18, 2010	*Cunha*: Image Processing: Filtering and Restoration., and associated exercises. TAs: *Kennedy and TBD*
Week 8	Feb 23, 2010	*Cunha*: Image Processing: Mathematical Morphology, Segmentation, and associated exercises. TAs: *Kennedy and TBD*
	Feb 25, 2010	*Pepke*: Ordinary Differential Equation Models in MatLab, and associated exercises. TAs: *Kennedy and TBD*
Week 9	Mar 2, 2010	*Pepke*: Ordinary Differential Equation Models in Mathematica, continue exercises from previous class. TAs: *Kennedy and TBD*
	Mar 4, 2010	*Lombeyda*: Advanced Data Visualization Programs TAs: *Kennedy and TBD*
Week 10	Mar 9, 2010	*Lombeyda*: Advanced Data Visualization Techniques TAs: *Kennedy and TBD*
	Mar 11, 2010	Projects *All*