

COMP 116, Fall 2014 Introduction to Scientific Programming

Class Hours:

Section 1	MWF 2:00 P.M. - 2:50 P.M by Marc Niethammer
	Instruction on Mon. and Wed., labs/recitation on Fridays. It is recommended that you bring your laptop to all class sessions. It is essential that you bring your laptop to quizzes and exams!
Class Room	GS G100 (Genome Science Building, Room G100)



Instructors:

Marc Niethammer

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Catalog Description: **COMP 116** Introduction to Scientific Programming (3).

An introduction to programming for computationally oriented scientists. Fundamental programming skills, using MATLAB and another imperative programming language (such as C). Problem analysis and algorithm design, with examples drawn from simple numerical and discrete problems. *Students can only receive credit for one of COMP 110, **COMP 116**, or COMP 121.*

Prerequisites: Please contact us if you are concerned about whether you have the background required for this course.

MATH 231: We assume familiarity with univariate differential and integral calculus, and the ability to manually solve a system of simultaneous linear equations.

Computer Literacy: Basic proficiency with using a personal computer, using a mouse and keyboard, word processing, email, and finding information off the internet is assumed.

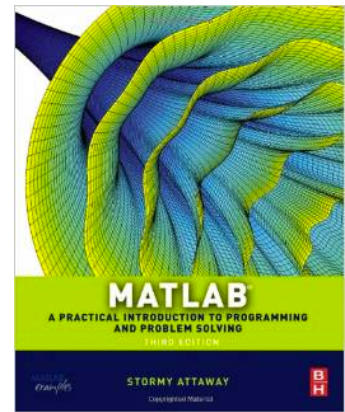
Laptop: Each student needs their own laptop computer for installing and using the MATLAB software during the course of the semester **as well as to take quizzes and exams.**

Postrequisites: **COMP 116** satisfies the *General Education, Quantitative Reasoning* requirement of 3 credit hours. For students interested in computer science as a major or minor, most upper level and graduate classes in computer science, assume that the student has learned basic programming by taking one of the following courses: COMP 110, **COMP 116**, or COMP 121.

Disabilities: If you have a physical or learning disability, please let us know about your special requirements. For more information, see the following website: <http://disabilityservices.unc.edu/>

Text Book: *MATLAB: A Practical Introduction to Programming and Problem Solving*, by Stormy Attaway, 3rd edition; Publisher: Elsevier, Inc, 2013.

Web Site: We use the Sakai web site, <http://sakai.unc.edu>, for access to handouts, email and discussion boards. You need your ONYEN to log into Sakai. (See <http://onyen.unc.edu> if you do not have an onyen. Forgotten passwords can be changed at the [IT Response center](#) in the basement of the House undergrad library, make sure to bring your student ID.)



MATLAB software: We will help students install MATLAB on their laptops, during the first Friday session. UNC has a site license that makes MATLAB available to all interested UNC students.

Installation Requirements:

- A Laptop to install MATLAB software on with a working DVD reader (internal or external)
- 700 MB - 2 GB free disk space on your laptop's hard drive.
- Internet access from your laptop
- A valid Onyen and password to login to the UNC MATLAB installation website
- A valid UNC email address <myname@mail.unc.edu> and password to register your academic MathWorks account.
- a valid MATLAB Media CD, we will hand these out during our class on Friday (Aug. 22th).

Course Objectives: After taking this class, students will learn to do...

Numerical Computation: Use MATLAB for doing numerical computation: including arithmetic, algebra, calculus, working with Matrices, and solving systems of linear equations.

Programming: Create programs to solve scientific problems using MATLAB.

Fundamentals: Learn the fundamentals common to many programming languages (variables, data types, flow of control, modular design, etc.).

Debugging: Avoid and track down bugs using defensive programming techniques

I/O: Work with user input (or file input) and transform it into 2D & 3D graphics (or file output).

Invitation: Computers are powerful tools because of their flexibility. They can be programmed to deal with numerous tasks. Once people have learned how to write one program, they can, often with a little more programming, effectively use their area of expertise to best effect. For many modern programming languages, including Java, C++, Python, Tcl/Tk, and Visual Basic, a key principle is to be able to write small fragments of code that interact with sophisticated tools that others have written.

This course introduces basics of programming that are common to many languages. Lectures and assignments draw examples from many scientific disciplines and focus on tasks like reading and analyzing data files and interacting with sophisticated analysis tools.

We focus on the programming language intrinsic to MATLAB, a common tool in mathematics and the sciences. MATLAB makes it easy to work with matrices, graphs, images, and sophisticated mathematical functions. This will allow us to do sophisticated computation (on images, protein molecules, terrain models, etc.) in realistic scenarios as we develop the fundamentals of programming.

Learning a programming language is like learning a spoken language -- *this has several implications:*

Hands-on learning: In our experience, texts and lectures alone are insufficient; one must spend time using a language to make it one's own. The weekly quizzes are to encourage practice in MATLAB.

Journal: Keep a record of things you learn in the lab, lecture, and recitation sections. Whether this is a formal lab notebook, a small diary, or jotted down notes on a word processor. Find a way that works for you to record your insights and ideas.

Reading: Students are strongly encouraged to keep current by reading and reviewing the assigned chapters, handouts, and in-class presentations. This is good preparation for the weekly quizzes, midterms, and the final. There is a lot to cover and learn. Cramming at the end of the semester is an unsuccessful strategy for this class.

Elegance: There is always more than one way to say something, but some ways will be more "elegant" than others. You will learn to recognize elegant expressions as you become more familiar with a language and to use them as you become more skilled.

Seeking Help: Language classes are cumulative; don't fall behind. Ask for assistance from your fellow students, the TA's, or from the Instructor, especially if you find yourself struggling.

Attendance: Attendance is recommended in order to stay on top of the material. Lectures and Exams will start promptly at the beginning of each class. Quizzes will start promptly 10 minutes before the end of each class. If you must be absent for an extended period of time due to reasons like an extended illness, please contact us to make arrangements to receive in-class handouts and assignments.

Grading: Your course grade is based on your cumulative performance on programming assignments, team project, quizzes, and exams as follows:

<i>Quizzes:</i>	18%	<i>Assignments:</i>	18%
<i>Midterms:</i>	34%	<i>Final Exam:</i>	30%

You will be provided *instant* feedback during quizzes, assignments, midterms, and for the final exam if your solution is potentially correct. This will be done by provided test code. At the very least you should be able to write syntactically correct Matlab code. Matlab code that does not run (for quizzes, assignments, midterms, and exams) will receive 0 points: no partial credits will be assigned for code that cannot be executed.

Quizzes (9 x 2% = 18%): There will be a 10 minute quiz at the end of almost every Wednesday class for a total of ten quizzes taken. No makeup is given for missed quizzes, but the lowest quiz score will be dropped at the end of the term for a total of nine graded quizzes. The quizzes occur regularly to encourage students to stay up to date on learning the material. *These quizzes will be taken and submitted online.* We will offer a practice tutorial on how to do this some time before the first quiz so that everybody will be familiar with it.

Assignments (6 x 3% = 18%): There are a total of 7 programming assignments. Typically every other week there will be an assignment to write a program. Doing the assignments is essential for learning how to program. Your lowest scoring assignment will be dropped for a total of 6 scored assignments. No makeup is given for missed assignments. Assignments must be submitted before midnight on their

due date, which is typically on a Wednesday. Assignments need to be turned in online. A matlab script to do so will be provided and you will receive instructions during class on how to use it. Late assignments will not be accepted and will receive a score of zero. Remember that programs communicate with people, not just the computer, so write readable code, use brief comments to clarify your intentions and to explain how you solved the assignment.

Exams (2 mid-terms x 17% = 34%, Final = 30%): There will be two mid-terms in class and one comprehensive final exam. You will be allowed to make use of Matlab during these exams as they will also be submitted online. If the campus is closed for any reason during a scheduled exam, then the exam will be given during the next scheduled class instead.

Academic Honesty: Refer to UNC's honor code at <http://instrument.unc.edu/> for a discussion on Academic Honesty. If you are in doubt about any aspect of the honor code, please ask us.

Collaboration: Collaboration on assignments IS encouraged. However, what you hand in must be your own writing / typing. Good scholarship requires that all collaboration must be acknowledged. Thus, if you collaborate on the solution of a problem set, we expect that you list your collaborators in the comment section of your submitted code. Collaboration on in-class evaluations (quizzes, midterms, the final exam) is, of course, a violation of the Honor Code, see <http://www.cs.unc.edu/Admin/Courses/HonorCode.html>.

Plagiarism: Plagiarism will not be tolerated.

Cheating: Cheating in any form on assignments, quizzes, or exams will not be tolerated.

Civility: UNC places a priority on student learning. We value the inherent worth and dignity of every individual. We expect all to be civil to each other by

Etiquette: With the exception of laptops used to take notes or to run MATLAB, please keep all other electronic devices (IE cell-phones) turned off or silenced during class.

Respecting Others: Respect faculty, staff, students, guests, other people's private property, university property, policies, rules and regulations.

Being Responsible: Take responsibility for your choices and actions. Accept consequences for your inappropriate choices and actions.

Being Professional: Communicate in a professional and courteous manner in all forms, and at all times, whether verbal, non-verbal or written.

NOTE! The reading assignments below are **NOT** the only relevant sections in the textbook. You are encouraged to look for help on particular topics in various sections of the textbook. Also, the MathWorks has a comprehensive set of documentation on-line, as well as a vibrant on-line community. Please make use of these resources, within the bounds of your honor code.

Course Schedule (subject to minor changes):

DOW	Date	Lesson / Lab / Event	Readings / Handouts / Tests / Quizzes / Notes
Wed	8/20	Intro to Course Intro to MATLAB	
Fri	8/22	MATLAB Installation Recitation	Reading: 1.1 - 1.5 Assign #1 Handout: Image Filtering Handout: Variable Naming
Mon	8/25	Assignment, Variables, and Expressions	Handout: Scripts, Workspaces, Functions
Wed	8/27	Plotting & Publishing Intro. to Matrices & Vectors	Test "Quiz": This is not a real quiz, but simply to check that everybody knows how to use the software to take the quizzes and exams. Problems will be addressed if needed also on Friday 8/29. Assign #2 Handout: Water Statistics (plotting)
Fri	8/29	Recitation Help on Assign #1	Reading: Ch. 11.1, 2.1-2.6 Handouts: MATLAB Reference
Mon	9/1	Labor Day (Holiday)	<No Class>
Wed	9/3	Matrices & Indices	Quiz #1: Matlab as a Calculator & Vectors & Plotting
Fri	9/5	Recitation Help on Assign #2	Assign #1 Due: Image Filtering Handout: Coding Guidelines
Mon	9/8	Matrices, Computations, & Linear Systems	Reading: Ch. 14.3
Wed	9/10	Least Squares & Linear Systems	Quiz #2: Matrix Indexing Assign #3 Handout: Solving Linear Systems
Fri	9/12	Recitation Help on Assign #2	Assign #2 Due: Drought Statistics (plotting)
Mon	9/15	Conditional Logic	Reading: Ch. 1.6 & Ch. 4
Wed	9/17	Input / Output	Quiz #3: Matrices
Fri	9/19	Recitation Help on Assign #3	Reading: Ch. 2 & Ch. 3 Review for 1st midterm
Mon	9/22	Midterm #1 Review	
Wed	9/24	1st Mid-term	1st Mid-term (material covered from 8/20 - 9/19 inclusive)
Fri	9/26	Recitation Results for 1st Midterm Help on Assign #3	Assign #3 Due: Solving Linear Systems Assign #4 Handout: Binary Image
Mon	9/29	Functions	Reading: Ch. 3 & Ch. 6.1,6.2
Wed	10/1	Function Challenges	Quiz #4: Conditional Logic
Fri	10/3	Recitation Help on Lab Assignment #4	Handout: Error handling & Debugging
Mon	10/6	Floating Point Robustness	Assign #5 Handout: Terrain Modeling

Wed	10/8	Loops (For & While)	Quiz #5: Functions Reading: Ch. 5
Fri	10/10	Recitation Help on Assignment #4	Assign #4 Due: Binary Image
Mon	10/13	Common Idioms	
Wed	10/15	Strings Text Manipulation	Quiz #6: Functions & Floating Point Fall Break begins at 5:00 PM
Fri	10/17	Fall Break	Reading: Ch. 7 <No Classes>
Mon	10/20	File I/O	Reading: Ch. 3.6 & Ch. 9
Wed	10/22	Debugging	Quiz #7: 'while' & 'for' logic Assign #6 Handout: Protein Data Bank
Fri	10/24	Recitation Help on Lab Assignment #5	Assign #5 Due: Terrain Modeling Reading: Ch. 6.5
Mon	10/27	Cell Arrays & Structures	Reading: Ch. 8
Wed	10/29	Pointers, references, & memory storage (in other languages)	Quiz #8: Strings & File I/O
Fri	10/31	Recitation Help on Lab Assignment #6	Reading: Ch. 7
Mon	11/3	Review for 2nd Midterm	
Wed	11/5	2nd Mid-term	(Material covered from 9/29 - 10/29 inclusive)
Fri	11/7	Recitation Results for 2nd Midterm Help on Assign #6	Assign #6 Due: Protein Data Bank Assign #7 Handout: Simulation
Mon	11/10	Advanced Functions	Reading: Ch. 10
Wed	11/12	Intro to Diff. Equations	Quiz #9: Cell Arrays & Structures
Fri	11/14	Recitation Help on Assign #7	
Mon	11/17	More Differential Equations	
Wed	11/19	Interpolation Numerical Integration Numerical Differentiation	Quiz #10: Differential Equations Reading: Ch. 14.5
Fri	11/21	Recitation Help on Lab Assignment #7	
Mon	11/24	Visualization	Reading: Ch. 11
Wed	11/26	Thanksgiving Recess	<No Classes>
Fri	11/28	Thanksgiving Recess	<No Classes>
Mon	12/1	3D Plotting Intro. to GUI Programming	Handout: Defensive Programming
Wed	12/3	Review for Final Exam 1-3, 4.3 - 4.4, 5 - 7, 10.4	Assign #7 Due: Simulation Last Day of class
		Reading Days	<No classes> (12/10-12/15)
Fri	12/5	Comprehensive Final Exam (4:00 PM - 7:00 PM)	Comprehensive Final Exam (4:00 PM - 7:00 PM)

Exam Schedule from: <http://registrar.unc.edu/academic-calendar/final-examination-schedule-fall/>