Introduction to Scientific Programming

Bulletin Description

An introduction to programming for computationally oriented scientists. Fundamental programming skills, typically using MATLAB or Python. Problem analysis and algorithm design with examples drawn from simple numerical and discrete problems. Students can receive credit for only one of COMP 110 and 116.

General Course Info

Term:	2017 Summer Session 1
Department:	COMP
Course Number:	116
Section Number:	001
Time:	M-F 11:30AM-1:00PM
Location:	FB009
Website:	Sakai: COMP116.001.S117

Instructor Info

Name:	Auston Sterling
Office:	SN335
Email:	austonst@cs.unc.edu
Phone:	(909) 518-2904
Web:	http://www.cs.unc.edu/~austonst
Office Hours:	M-F 2:00-4:00PM

Textbooks and Resources

No textbook is required for this course, as there is a variety of free information available online. Python and NumPy are both popular, and resources can be easily found through Google.
Assignments, worksheets, and exams will be downloaded and submitted through Sakai. Additional resources can be found on Sakai, including videos and notebooks for review.

Course Description

In this course students will learn the basics of programming as applicable for a student in the sciences. As compared to a more standard introductory computer science course (COMP 110), this course emphasizes learning how to write code to interact with and analyze collected scientific data. Students will specifically learn to use Python, but the principles will be general enough to apply to other languages such as MATLAB.

Target Audience

This course is targeted at students in the sciences who want to use computers to enhance their studies or research. The target student has little to no experience with programming, and would like to learn such skills as data analysis, visualization, and automation.

Prerequisites

MATH 231 is a prerequisite for this course. Students will be expected to be familiar with univariate integrals, derivatives, and systems of equations. This course in intended for a general audience, so no further restrictions are in place.

Goals and Key Learning Objectives

Upon completion of this course, students should be able to use programming to answer high-level scientific questions about datasets. Students should be able to select an appropriate visualization for a dataset and effectively design and create it. Students should be able to write basic algorithms to perform mathematical operations on data.

Course Requirements

To successfully complete the course, students must complete scheduled assignments and examinations. Students are also expected to participate in class discussions and activities. Students are expected to have laptop computers available for each class session.

Key Dates

Midterm #1: 5/31/17 (Wednesday)
Midterm #2: 6/9/17 (Friday)
Final Exam: 6/21/17 11:30AM-2:30PM (Wednesday)

Grading Criteria

40% Assignments (5 x 8%)
15% Midterm 1
15% Midterm 2
30% Final Exam
+4% Worksheets (8 x 0.5%)

Assignments 40% = 5 x 8%: Assignments are regularly scheduled (see schedule below), and are downloaded and uploaded from/to Sakai. Assignments are due at the start of class (11:30AM) on the day of the deadline. All assignments are in the form of Jupyter notebooks, and the specific instructions will be covered in class. Some problems will be auto-graded, providing automatic and instant feedback, but also allowing for no partial credit. Once graded assignments are returned, they may be corrected and resubmitted once within a week to gain up to half of the points lost from the first submission.

Worksheets +4% = 8 x 0.5%: Worksheets are optional and provide additional problems for review and practice. All worksheets are due at the start of class on the last day of class before the final exam. Each submitted worksheet may add up to 0.5% of your final course percentage. All worksheet problems are auto-graded: you will know your score before you submit.
Exams (2 x 15% + 30%): Midterms will be held during regular class hours, while the final exam is at a different defined time. Exams will be downloaded, completed, and submitted in the same manner as the assignments, albeit with no collaboration.

Attendance and Participation

Attendance will not be recorded and no participation grade will be assigned. However, students are strongly encouraged to attend class sessions, as they are the best opportunity to get experience working through problems. Office hours are held for multiple hours each day, but don't expect much help if you haven't even been attending class sessions.

Course Policies

Remember: bring your laptop to each class session.
Each student has **2** late days that can be used to postpone assignment deadlines. Any assignments turned in late without spare late days will receive a grade of 0.
The course final is given in compliance with UNC final exam regulations and according to the UNC Final Exam calendar.

Honor Code

All assignments and worksheets are open to use of any resources, including books and the internet. Collaboration is encouraged, but your final answers should be your own code. That is, you may not copy and paste a collaborator's code, but you may discuss the ideas behind it or help debug it.
During exams, there should be no collaboration with other students. You are free to use the internet to review Python and NumPy documentation as well as previous class materials.

Course Schedule

Date	*Topics*	*Preparation/Assignments*
5/17 (W)	Introduction, Setup	**Assignment 0:** Setup and Variables
5/18 (R)	Variables, Math	
5/19 (F)	Strings, Lists	**Worksheet A**
5/22 (M)	1-D NumPy Arrays	**Assignment 0 due**
5/23 (T)	Advanced 1-D Arrays, Operations	**Assignment 1:** Sequences
5/24 (W)	2-D Arrays and More Operations	**Worksheet B**
5/25 (R)	Intro to Visualizations	**Assignment 2:** Visualizations
5/26 (F)	Advanced & Effective Visualizations	**Assignment 1 due** **Worksheet C (?)**
5/29 (M)	Holiday - **no class!**	
5/30 (T)	Midterm #1 Review	**Assignment 0 corrections due** **Assignment 2 due**
5/31 (W)	**Midterm #1**	
6/1 (R)	Functions	
6/2 (F)	Conditionals, Loops	**Assignment 3:** Programming **Assignment 1 corrections due Saturday 6/3** **Worksheet D**
6/5 (M)	Advanced Flow Control	
6/6 (T)	Programming Challenges & Idioms	
6/7 (W)	Counting, Any/All	**Assignment 2 corrections due** **Worksheet E**
6/8 (R)	Midterm #2 Review	**Midterm #1 corrections due** **Assignment 3 due**
6/9 (F)	**Midterm #2**	
6/12 (M)	Programming for Science	
6/13 (T)	Dictionaries, Sets	**Assignment 4:** Applications

		Worksheet F
6/14 (W)	Fancy Math	**Worksheet G**
6/15 (R)	Statistics and Linear Algebra	**Assignment 3 corrections due**
6/16 (F)	Image Manipulation	**Worksheet H**
6/19 (M)	Final exam review	**Assignment 4 due** **- No corrections!**
6/20 (T)	Reading day - **no class!**	
6/21 (W)	**Final Exam** (11:30AM - 2:30PM)	

Disclaimer

The instructor reserves to right to make changes to the syllabus, including project due dates and test dates. These changes will be announced as early as possible.