Astronomy 98/198

Python for Astronomers DeCal

Spring 2019

Facilitators:	Nicholas Rui (nrui@berkeley.edu), Sabrina Berger (sabrinaberger@berkeley.edu), Orion Lyau (orion.lyau@berkeley.edu), Aini Xu (aini.xu@berkeley.edu), Alexander Ye (alexander.ye7@berkeley.edu), Ryan Dana (ryanjdana@berkeley.edu)
Faculty Sponsor:	Daniel Weisz
Time & Place:	Tuesday 5:00 PM to 6:00 PM in 131 Campbell Hall Thursday 5:00 PM to 6:00 PM in ~~541 Campbell Hall~~ 131 Campbell Hall
Office Hours:	Nicholas Rui: Friday 9:00 AM to 10:00 AM in LeConte Reading Room Alexander Ye: Wednesday 12:00 PM to 1:00 PM in LeConte Reading Room Aini Xu: Wednesday 4:00 PM to 5:00 PM in LeConte Reading Room Ryan Dana: Tuesday 3:00 PM to 5:00 PM in LeConte Reading Room
Course Number:	21618 (lower division), 21624 (upper division)
Units:	2 units, P/NP
Prerequisites:	None

Course Description

This course provides an introduction to the Python programming language with a focus on data analysis and research in astronomy, physics, and other sciences. Primary emphasis is placed on astronomy and physics in preparation for upper division laboratory courses and research. Students will be exposed to the command line, Git version control, and Python software development. More advanced skills, such as image manipulation and data analysis techniques, will also be explored. This course also briefly covers the essentials of the typesetting system LaTeX, and provides a short introduction to web development, which are often useful in academic settings.

The primary audience for this course are those who have no prior experience with programming. As such, if you are already well versed in software development, this may not be the class for you. However, in order to learn the wide variety of technical material we cover in the short amount of time we have, it will take time and practice. As a consequence, some—especially those new to programming—may find the workload heavier than most DeCals.

Learning Objectives

Students will be introduced to basic programming concepts with the goal of becoming comfortable and proficient with using the Python programming language in research settings. Using Python, students will demonstrate understanding of software structure and control flow by creating a project of their choosing. Given a set of data, students will be able to manipulate, process, analyze, and create data visualizations using Python and associated libraries such as AstroPy, NumPy, and Matplotlib. Additionally, students will be able to use LaTeX to typeset simple documents.

Materials

Students are expected to bring and use their own computers. If you are unable, please let us know and we can try to arrange accommodations. Additionally, there is an optional course text written by the previous facilitators, Imad Pasha

and Christopher Agostino, available at prappleizer.github.io/textbook.pdf.

Course Resources

Class related files and notifications will be posted on bCourses unless otherwise specified. Additionally, we have a Piazza forum where you can ask questions and receive answers from both the course staff and your peers. We encourage you to use Piazza rather than email, as it allows us to provide a more expedient response, and may also benefit classmates with similar questions.

Course Expectations & Grading

Attendance	30%
Homework	20%
Midterm Project	20%
Final Project	30%

A grade of 70% or above and an attempt on the final project is required to pass the class.

Attendance

Class will meet twice a week, **Tuesday and Thursday from 5:00 PM to 6:00 PM in 131 Campbell Hall**. On Tuesdays we will typically have a lecture to introduce new material, and on Thursdays we will typically have hands-on examples for you to learn through practice. Attendance is required on both days.

Homework

Homework will be assigned weekly covering the topics we discuss in lecture. All homeworks are to be submitted on bCourses and will be due on Tuesday before class unless otherwise noted. You are encouraged to work with other students, but everyone must submit their own individual work. Late homework will be accepted for a maximum of 50% credit up to one week late.

Projects

There will be two projects throughout the semester. Both projects are intended for you to demonstrate your ability in understanding the class material taught up through that point. The final project will additionally involve a brief presentation, and is required in order to pass the course. Further information will be disseminated closer to when the projects are assigned.

Academic Misconduct

As with all classes, cheating, plagiarism, and other forms of academic dishonesty will not be tolerated. First violations will result in a zero on the assignment, and any subsequent violations may result in administrative action in accordance with the UC Berkeley Astronomy Department Policy on Academic Misconduct.

Department Resources

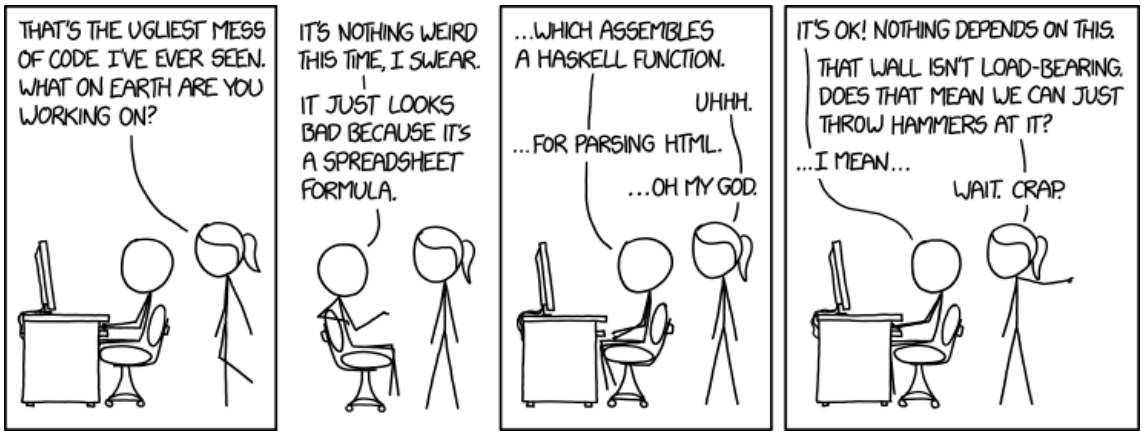
- Diversity and Climate: astro.berkeley.edu/about/diversity-and-climate
- Reporting Harassment or Discrimination: astro.berkeley.edu/department-resources/reporting-harassment
- Astronomy Undergraduate Wiki: kartp.astro.berkeley.edu
- Undergraduate Astro Climate Advisor: Hayley Williams (hwilliams@berkeley.edu)
- Undergraduate Astro Representative: Nick Choksi (nchoksi@berkeley.edu)

- Undergraduate Faculty Advisor: Professor Mariska Kriek (mkriek@berkeley.edu, 317 Campbell Hall)
- Academic Advisor: Amber Banayat (abanayat@berkeley.edu, 501E Campbell Hall)

Schedule

Below is a schedule of class meetings along with a (tentative) curriculum.

Week	Lecture	Laboratory	Topics
1	1/29	1/31	• Syllabus overview and logistics • Installing a Python distribution • Text editors, the command line, and `git`
2	2/5	2/7	• Data types • Functions
3	2/12	2/14	• Conditional statements • `for` and `while` loops • Recursion
4	2/19	2/21	• Data manipulation • File input/output and array manipulation
5	2/26	2/28	• Data analysis • Plotting and regression
6	3/5	3/7	• Object oriented programming
7	3/12	3/14	• Matrix mathematics with NumPy
8	3/19	3/21	• Special topics
9	4/2	4/4	• Special topics
10	4/9	4/11	• Typesetting with LaTeX
11	4/16	4/18	• Overview of web development
12	4/23	4/25	• Final project showcase
13	4/30	—	• (tentative) Final project presentations



credit: Randall Munroe, xkcd.com/1926