Astronomy 98

Introduction to Python DeCal

Spring 2022

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Faculty Sponsor: Eugene Chiang

Time & Place: Mondays & Wednesdays in 131 Campbell 3-4pm

Office Hours: James Sunseri: TBD
Emily Ma: TBD
Ayla Weitz: TBD
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Megan Joseph: TBD

Course Number: 98

Units: 2 units, P/NP

Prerequisites: Physics 7A recommended but not required

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 may also be explored. This course also briefly covers the essentials of the typesetting system LaTeX 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 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, etc. 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 will have a Piazza site (https://piazza.com/berkeley/spring2022/astro98/home) 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

Participation	10%
Homework	60%
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 at 131 Campbell Hall, **Monday and Wednesday from 3:00 PM to 4:00 PM**. On Mondays and Wednesdays we will have lecture to introduce new material and have hands-on examples for you to learn through practice. There may be weeks where we finish the lectures on Wednesday, in those cases we will provide workshops for you to work on Friday's class time.

We do accommodate for asynchronous learning and all lectures will be recorded and uploaded onto bCourses. Since not everyone is able to attend the lectures synchronously, weekly quizzes will be posted on bCourses to make sure that you do watch the lectures - they will be due at the same time as the homeworks. You will earn the 10% participation grade by completing the quizzes. Other forms of participation such as posting/answering questions on Piazza could also contribute to the participation grade.

Homework

Homework will be assigned weekly covering the topics we discuss in lectures. Homework will be released on Wednesdays after class and will be due before class (3pm) on the next Wednesday unless otherwise noted, so you will have a week to work on it. All homeworks are to be submitted on bCourses. 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 three days late.

Projects

There will only be one final project over the semester and it is intended for you to demonstrate your ability in understanding the class material. The final project is required to pass the course, and it will involve a brief presentation as well. Further information will be disseminated closer to when the project is 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 Climate Advisor: Michelle Lee (minjoo.lee.63@berkeley.edu)
- Undergraduate Representative 1: James Sunseri (jamessunseri@berkeley.edu)
- Undergraduate Representative 2: Lister Chen (listerchen391@berkeley.edu)
- Undergraduate Faculty Advisor: Professor Eugene Chiang (echiang@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.

There will be no instruction on the first week. First lecture starts on January 19th, 2022.

Week	Lecture	Lecture/Lab	Topics Resources
1	—	1/19	• Syllabus overview and logistics • Installing Python on Computer • Text editors, the command line
2	1/24	1/26	• Data types • Functions
3	1/31	2/2	• Conditional statement • While loops and for loops • Dictionaries
4	2/7	2/9	• Data manipulation (e.g. NumPy) • (Recursions)
5	2/14	2/16	• Plotting Basics
6	—	2/23	• Advanced Plotting • Curve Fitting • Root Finding
7	2/28	3/2	• Numerical Differentiation • Numerical Integration • Libraries!
8	3/7	3/9	• LaTeX • Final project proposal
9	3/14	3/16	• Special Topics • Proposal due
10	—	—	• Spring Break
11	3/28	3/30	• Animation • Differential Equations
12	4/4	4/6	• Research-Oriented lecture + CV Development • Simulations!
13	4/11	4/13	• Personal Web page Development • Real Data Workshop
14	4/18	4/20	• Machine Learning/Extra Miscellaneous • Final Project Assistance Workshop
15	4/25	4/27	• Final project presentations