Introduction to Scientific Programming, Data Analysis, and Visualization for Physicists

PHYS 2001
Spring 2022

Instructor Contact

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Meeting Time, Room, and Course Structure

This course is a mixture of <u>lectures</u> and <u>mini-projects</u>. During the first phase of the course (usually first 2 weeks), lectures will be given during the regular class hours (Tue/Thu 2:20PM-3:35PM). During the 2nd phase (mini-projects), about a handful of mini-projects will be assigned in every (or two weeks) week. Example scripts (or code snippets) will be provided relevant to each mini-project. You need to study/examine these example codes and figure out <u>by yourself</u> on how to finish each mini-project.

During the mini-project phase, I will be available for Q/A through zoom (https://zoom.us/isong)

All relevant course material should be accessible from eLC.

Course Description

A hand-on introduction to practical computer programming, data analysis, and data visualization for physics/astronomy majors. Students learn the fundamentals of developing, debugging, and running programs in Python or another similar high-level programming language in a server environment as well as in a personal computer. Students will be exposed to multiple example problems of particular

importance to scientific programming and data visualization. No prior programming experience is assumed (but preferred).

Course Goals

- Start using Python as your daily calculation tool
- Installation of Python on "your computer"
- Exposure to the Python language
- Basic data I/O in python (Pandas, Astropy, matplotlib)
- Scientific calculations (e.g., best fitting and regression) using numpy and scipy
- Being able to create publishable quality data visualizations including a basic animation
- At the end of the semester, students should feel easy to use python as a day-2-day tool for ANY calculation/graphing needs

Textbook

None.

Relevant reading material and programming examples (including python scripts) will be provided. The 1st reading assignment (not graded) is [Python4Physicists.pdf](). Finish reading this during the 1st week before we jump into the rigor of programming lectures.

Prerequisite

If you are completely new to programming, you can read [What is programming?]() to get an introduction. This will not be covered in the course.

Course Outline

- Set up the python environment on your computer (install anaconda, ipython, matplotlib, numpy, scipy, and astropy)
- Basics of scientific programming
- Several fundamental python commands
- Some essential command-line tools for iOS, Windows, & Linux

- Read/write various scientific data in python
- Create a graph in python
- User defined function/class
- Several mini projects

Missed Assignments/Make-Ups

There is no exam in this course, but there will be several mini-projects. It is very important to keep up with mini-projects.

These mini-projects are not group projects. You can discuss about the project with your classmates, however, you cannot share your scripts with others. **Scripts that turn out to be shared/copied will receive only 70% of maximum possible credit, and a severe case will be reported to the University.**

Evaluation and Grading

There will be several (e.g., seven projects in the 2021 Spring semester) mini-projects. Final letter grades will be based on the number of successful, on-time completion of these mini-projects. Although the following grade guideline is likely changed as we go through the semester, a tentative grading plan is as follows.

- A: 100% completion of all mini-projects and assignments
- B: 1-2 missing mini-project(s)
- C: 3-4 missing mini-projects
- D: 5 or more missing mini-projects

Disability Statement

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For more information or to speak with a Disability coordinator, please call the Disability Resource Center at (706)542-8719, TTY only phone (706) 542-8778.

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Technical Issues

For TECHNICAL PROBLEMS with eLC or other issues, contact: UGA's Enterprise Information Technology Services (EITS) Help Desk at 706-542-3106, oremail at helpdesk@uga.edu. You can also submit at a helpdesk request online at https://eits.uga.edu/support/request.

Additionally, there will be a forum in the online course for students to post any issues or concerns. (*Including a forum for technical issues can be a great way to help your students and encourage them to help each other.*)