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 lectures and mini-projects. 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 by yourself 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

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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, or email 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.)