Software Engineering for Scientists

CSCI 4/6118, Fall 2021

Lectures: Tuesday/Thursday from 2:30pm to 3:45pm
Location: JSCBB B231
Remote: https://cuboulder.zoom.us/j/99087359523 (PW: swefs)

Instructor: Jacob Stanley (he/him) jacob.stanley@colorado.edu
Office hours: Mon. 12:15--1:15pm (B432) Wed. 10--11am (B231)
(or remotely by appointment)

Class Assistant: Kristen Schneider (she/her) kristen.schneider@colorado.edu
Office hours: Wednesday 12:45--1:45pm (E225)

Keybase: A secure messaging and file-sharing platform which will be used to share and organize class materials, coordinate project groups, and communicate with students.
Please install and sign up (free) at: https://keybase.io/

Canvas: All course materials will be posted to Canvas (including lecture recordings). Please make sure that you have access to the course page and inform the instructor if you do not.

Coding environment: We will primarily be using the CS department's Computer Science Education Lab for our coding activities (both in class and for homework). Please make sure you can log on to it at https://coding.csel.io/. We will be using the "Default" coding environment.

GitHub: Homework assignments and group projects will be managed through GitHub. Please make an account if you do not already have one (https://github.com/). You will need to provide the instructor with your GitHub user ID.

Software Engineering for Scientists is a course for upper-level undergraduates and graduate students in the sciences who want to enhance their research by developing custom software. This class will build off basic programming skills to enable the development of robust and reliable software for reproducible science. These skills will sample core elements from both software engineering (e.g., version control, testing and continuous integration, debugging, benchmarking, documentation, distribution) and software design (e.g., algorithm analysis, sorting and searching, file input and output, text parsing, basic data structures), and will be organized around the ingestion and processing of data for many different scientific domains.

Tentative schedule (topics subject to change)

Week	Dates	Topic
1	Aug. 24, 26	intro/overview, dev environments, conda
2	Aug. 31, Sept. 2	Bash, Version control, Git, and GitHub
3	Sept. 7, 9	GitHub, Python primer
4	Sept. 14, 16	Python primer
5	Sept. 21, 23	Python best practices (PEP8, modular coding, commenting/documentation)
6	Sept. 28, 30	Python best practices (arg/configparser, exception handling, error logging)
7	Oct. 5, 7	Python best practices (exception handling)
8	Oct. 12, 14	Unit testing
9	Oct. 19, 21	Test Driven Development, Continuous Integration
10	Oct. 26, 28	GitHub Actions (CI), Code review
11	Nov. 2, 4	Optimization (GNU time, timeit, getsizeof)
12	Nov. 9, 11	cProfile, GitHub revisited
13	Nov. 16, 18	Project code review reflection
14	Nov. 23, 25	FALL BREAK
15	Nov. 30, Dec. 2	Project presentations
16	Dec. 7, 9	Project presentations

Grading

Your grade in this class is based on two components: weekly homework assignments (60% of grade) and the semester group project (40% of grade). The group project will be evaluated on the initial proposal (10% of project grade), final presentation (40% of project grade), and the overall content of the project code (50% of project grade).

Class Structure

This class is the first of its kind at CU Boulder and we will be flexible with the pace of topics and assignments. While attendance is not required, this is a hands-on class and lectures will be interactive. Supporting documents will be provided, but many details will only be covered in class.

Projects

All graduate students must propose and submit a project. Each project can have up to two team members. Projects can address any scientific question and must incorporate all of the software engineering and software design topics covered in class. The question does not need to be novel, but all contributions must be original. Teams are encouraged, but not required, to meet with me about their topic. A short in-class proposal will focus on the scientific question and a longer final presentation will focus on the resulting software product and any results. Undergraduates are encouraged to either join a team (max one undergrad per team, does not count against max team size) or develop their own project. Any undergraduate CS students in the group are expected to take on a lead technical role and to contribute more sophisticated technical components to the group project than non-CS students.

Classroom Behavior

Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the policies on classroom behavior and the Student Conduct & Conflict Resolution policies.

Requirements for COVID-19

As a matter of public health and safety due to the pandemic, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements and all public health orders in place to reduce the risk of spreading infectious disease. Students who fail to adhere to these requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the “Accommodation for Disabilities” statement on this syllabus.

As of Aug. 13, 2021, CU Boulder has returned to requiring masks in classrooms and laboratories regardless of vaccination status. This requirement is a temporary precaution during the delta surge to supplement CU Boulder’s COVID-19 vaccine requirement. Exemptions include individuals who cannot medically tolerate a face covering, as well as those who are hearing-impaired or otherwise disabled or who are communicating with someone who is hearing-impaired or otherwise disabled and where the ability to see the mouth is essential to communication. If you qualify for a mask-related accommodation, please follow the steps in the

“Accommodation for Disabilities” statement on this syllabus. In addition, vaccinated instructional faculty who are engaged in an indoor instructional activity and are separated by at least 6 feet from the nearest person are exempt from wearing masks if they so choose.

Students who have tested positive for COVID-19, have symptoms of COVID-19, or have had close contact with someone who has tested positive for or had symptoms of COVID-19 must stay home. In this class, if you are sick or quarantined, please notify the instructor via email as soon as possible.

Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code academic integrity policy. Violations of the Honor Code may include, but are not limited to: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the Honor Code website.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

The University of Colorado Boulder (CU Boulder) is committed to fostering an inclusive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, or protected-class discrimination or harassment by or against members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or email cureport@colorado.edu. Information about OIEC, university policies, reporting options, and the campus resources can be found on the OIEC website.

Please know that faculty and graduate instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about their rights, support resources, and reporting options.

Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this event, please email the instructor so that accommodations can be made.

See the campus policy regarding religious observances for full details.