

Syllabus for CS 111, Operating Systems Principles

Winter 20223

Peter Reiher

CS 111, Operating System Principles is meant to provide you with a solid grounding in the basic principles of operating system design. This grounding will give you a deeper understanding of how a vital piece of system software operates and introduce you to important concepts that are frequently used in large software systems you are likely to encounter in your future work.

CS 111 has prerequisites of CS 32, 33, and 35L. The class involves serious programming and would be extremely challenging for anyone without a programming background. It also assumes knowledge of many fundamental tools used in software development, particularly in Linux/Unix environments. If you have not taken these courses or otherwise acquired this background, you are likely to find CS 111 very difficult.

CS 111 is widely held to be one of the hardest courses in the undergraduate Computer Science catalog, due to:

- the amount of reading
- the number of new and subtle concepts to be mastered
- the complexity of the principles that must be applied
- the amount of work involved in the projects

People who have had little difficulty with previous Computer Science courses are often surprised by the workload in this course. Keeping up in this course requires considerable work and discipline. Catching up after falling behind is extremely difficult.

Class Format

The winter 2023 offering of CS 111 will be offered in hybrid mode. Classes will be taught in person, in Engineering VI's Mong Learning Center. They will be streamed online via Zoom, as well, and recordings will be posted on the class' Bruin Learn web page. Attendance is not required, but I recommend that if you do not attend or listen live via Zoom, you carefully listen to the recorded versions. I will provide a Zoom link to all enrolled students before the start of the class.

We will not be holding live lectures in the Mong Learning Center on Tuesday February 7, since that facility is booked for another purpose on that day. We will, however, have a lecture on February 7, via Zoom, at the normal time. Again, the recorded lecture for that day will be posted on the class' Bruin Learn page. It is possible that other conflicts with scheduling of the Mong Learning Center will require some classes to be offered only via Zoom. If so, they will be announced ahead of time.

Note: The ongoing strike by UCLA TAs may impact how this class is run in the winter quarter. Any adjustments based on this issue will be announced at the start of the class.

Textbook and Readings

Most of the readings for this course will come from [Remzi Arpaci-Dusseau's *Operating Systems in Three Easy Pieces*](#). This is a free on-line textbook, so you will not need to purchase a book for this class. However, the course covers certain topics that are not discussed in this textbook. These topics will be covered from alternative readings (all available freely on-line). These readings will be posted on the class web site before the class in question. Tests will cover material from both lectures and all assigned readings. Exam questions WILL assume you have read and understood all assigned readings, so if you don't read them, you are likely to do poorly on the exams.

Projects

There will be a total of five projects for this class. The projects relate to important concepts and system components that you should understand after taking this class. The projects will require substantial programming and are intended to be challenging. All projects are to be performed individually.

The projects will be supervised primarily by the TAs. Questions about projects should be directed to them, rather than me, unless the TAs have already failed to address your question. The TAs for the Winter 2023 offering are Rustem Can Aygun , Victor Zhang, Yadi Cao, Salekh Parkhati, and Sruthi Srinarasi. The TAs will provide instructions on performing the labs in their recitation sections.

Tests

There will be a midterm and final exam for this class. The tests will be administered online, via Bruin Learn. The midterm will be held on Thursday April 28. The final exam will be held during our scheduled final day, which is June 9. Students will be permitted to take the tests during any time during the full twenty four hours of the day being given, to accommodate students currently in different time zones. The tests will be open book, open notes. More details on the coverage of the tests will be given in the week before the test is scheduled.

Academic Honesty

I expect all students to follow the [UCLA Student Conduct Code](#) . This code prohibits cheating, fabrication, multiple submissions, and facilitating academic dishonesty. The [Office of the Dean of Students](#) offers a [workshop on academic integrity](#) if you wish to understand UCLA's policies on this issue more thoroughly.

Group study is often useful and is encouraged, but projects are to be performed by each student individually. You are not permitted to use any other students' code or written material in your projects, and you should not give your code or written material to any other students. You are not permitted to post your code to Github or to other web sites, nor may you use copies of any of the projects you find on the Internet. In cases where multiple projects show signs of plagiarism, all involved parties will be reported to the Dean, so even if it was your work that was copied, you could still face consequences.

Brief quotations from other sources are sometimes acceptable in project submissions, but submissions should be predominantly your own original work. If you include any material in your project submissions that is obtained from an online source, book, or other place, you must specify the sources for these parts of your submitted work.

Information about the midterm and final exam will be announced before each test, but generally you must take the test yourself, you may not talk to or consult anyone else during the test (except to ask questions of the instructor and TAs), and you must follow the rules outlined in the test description on what materials or devices, if any, you may use to take the test.

If you have questions about the academic honesty policy, please discuss them with me. Be warned that we take academic honesty very seriously. We look for plagiarism in various ways. If you are able to find project solutions on line, we are likely to find them, too. I report all suspected cases of cheating on projects or tests to the Dean of Student's Office, as university policy requires. Once reported, the matter is in the hands of the Dean, and I cannot further influence it. I strongly advise that you take no chances on academic honesty issues. If an issue of this kind is unclear to you, talk to me or to the TAs.

Grading

Grading will be based on scores on the tests, and labs, with the following breakdown:

Class Evaluation	1%
Midterm	20%
Final Exam	26%
Lab 0	9%
Labs 1-4	11% each

You will receive 1% credit for this class merely for filling out the class evaluations for both instructor and TA, which will be made available online in the final week of classes. How you evaluate the class will have no bearing on the credit; merely submitting complete evaluations for both the instructor and TA will earn the 1%. I urge you to submit the evaluation. In the past, students have received lower letter grades than they otherwise would have because they neglected to submit evaluations.

I do not have a formal curve for my classes, but I tend to adjust grades relative to the performance of other students in the class. There is no guarantee that any particular percentage of credit will result in any particular grade. It will depend on your performance relative to the overall class performance.

The TAs will be in charge of late policies and makeup policies for the labs. I will enforce the policies they announce. Makeups or alternate times for exams will only be possible with consent of the instructor prior to the exam date. Any special accommodations you require for taking a test must be discussed with and obtained through UCLA's Center for Accessible Education.

Lecture Plans

The dates and lecture topics indicated here represent my current plans, and may alter based on circumstances.

Week 1

Tuesday, January 10: Introduction

Thursday, January 12: OS Services

Week 2

Tuesday, January 17: OS Abstractions

Thursday, January 19: Processes

Friday, January 20: Project 0 due

Week 3

Tuesday, January 24: Scheduling

Thursday, January 26: Basic Memory Management

Week 4

Tuesday, January 31: Swapping, Paging, and Virtual Memory

Thursday, February 2: Threads and Interprocess Communications

Friday, February 3: Project 1 due

Week 5

Remember, we will NOT be holding Tuesday's lecture in the Mong Learning Center. It will be on line via Zoom, only.

Tuesday, February 7: Asynchronous Completion and Mutual Exclusion

Thursday, February 9 : Semaphores and Locking

Week 6

Tuesday, February 14: Midterm

Thursday, February 16: Deadlocks

Friday, February 17: Project 2 due

Week 7

Tuesday, February 21: Devices, Device Drivers, and I/O

Thursday, February 23: File Systems

Friday, February 24: Project 3 due

Week 8

Tuesday, February 28: File System Naming, Performance, and Reliability

Thursday, March 2: Virtual Machines

Week 9

Tuesday, March 7: Operating Systems Security

Thursday, March 9: Distributed Systems Architectures

Friday, March 10: Project 4 due

Week 10:

Tuesday, March 14: Distributed Systems: Synchronization, Consensus, and Security

Thursday, March 16: Remote Data Architectures

Final Exam

The final exam will be held on Friday March 24. Details on format and time will be announced before the start of finals week.

Other useful information:

UCLA Counseling and Psychological Services (CAPS) provides mental health care and resources for all registered students, including short-term individual and/or group treatment, urgent services and referrals when needed. Your well-being is the #1 priority of UCLA CAPS. Counselors available by phone at (310) 825-0768 24/7. Learn more at <http://www.counseling.ucla.edu>