CSCI 3753: Design & Analysis of Operating Systems
Spring 2023

Instructor

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- Office Hours: Monday: 3:00 – 4:00 PM; Tuesday: 1:00 – 2:00 PM

Teaching Assistants

- Name: Akshay Abhyankar
  Email: Akshay *DOT* Abhyankar *AT* Colorado *DOT* EDU
  Recitation: Friday: 11:15 AM – 12:05 PM
  Office hours: Monday: 4:00 – 5:00 PM and Wednesday: 4:00 – 5:00 PM

- Name: Sreeram Ganesan
  Email: srga8641 *AT* Colorado *DOT* EDU
  Recitations: Friday: 12:20 - 1:10 PM
  Office hours: Tuesday: 4:00 – 5:00 PM; Thursday: 4:00 – 5:00 PM

- Name: Nisha Murarka
  Email: Nisha *DOT* Murarka *AT* Colorado *DOT* EDU
  Recitations: Friday: 10:10 – 11:00 AM
  Office hours: Tuesday: 3:00 – 4:00 PM and Thursday: 3:00 – 4:00 PM

  NOTE: All recitations will be held in KOBL 330. All TA office hours will be held online; zoom links will be posted on the course page on Canvas

Course Assistants

- Name: Isabel Anaya
  Email: Isabel *DOT* Anaya *AT* Colorado *DOT* EDU
  Office hours: TBD
  Office-hours location: TBD

- Name: Jeffery Mitchell
  Email: Jeffery *DOT* Mitchell *AT* Colorado *DOT* EDU
  Office hours: Wednesday: 11:00 AM – 2:00 PM; Saturday: 8:00 AM – 12:00 Noon
  Office-hours location: CSEL on Wednesday and on Zoom on Saturday

- Pranav Subramanian
  Email: Pranav DOT Subramanian AT Colorado DOT EDU
  Office hours: TBD

Office-hours location: TBD

Course Description

Operating systems play a major role in determining the performance and usability of a computing system. This course introduces the key concepts in the design, implementation and evaluation of an operating system. While the field of operating systems has been undergoing rapid change, the key concepts remain firmly clear. The course covers these concepts comprised of device management, process management, memory management and network management.

Prerequisites

- CSCI 2270: Data Structures or CSCI 2275: Programming and Data Structures
- CSCI 2400: Computer Systems or ECEN 3350: Programming Digital Systems
- Minimum grade for all prerequisite courses is C-
- These are firm prerequisites. No exceptions, except at the instructor's discretion

Reading Material

- Required textbook: Abraham Silberschatz, Peter Galvin and Greg Gagne. Operating Systems Concepts. Wiley. Ninth or Tenth Edition.
- Other useful books: 1. Tanenbaum and Bos. Modern Operating Systems. Prentice Hall.
  2. Stallings. Operating Systems. Prentice Hall.

Class Web site

- All of your course interactions will be available through Canvas (http://canvas.colorado.edu).
- Assignments, lecture slides, and announcements can be found there.

Class and Recitation Attendance

- You are expected to attend all lectures and recitations, and stay up-to-date with the material posted on the class webpage. If you miss a lecture or a recitation, you are responsible for finding out the material covered.

Grading

- Exams: 45%
- Programming assignments: 40%
- Quizzes, problem sets and recitation assignments: 15%

Exams

- There will be two midterm exams and a final exam. All exams will be closed-book, closed-notes, in-class exams. You must take the exam in class as per exam schedule. If you miss an exam, a grade of zero will be assigned. Extensions will not be granted except at the instructor's discretion in documented cases of extreme hardship or emergencies.

Programming Assignments

- Programming Assignment (PA) grades will be based on the code submitted and interview grading. You are highly encouraged to submit running programs that have partially completed functionality to get partial credit. Code that doesn't compile or crashes will most likely receive a zero.
- PAs must be submitted by uploading your code to Canvas by the due date. All code must be written in C and compiled for execution in the specified environment.
- Grading of all programming assignments will be done via interview grading. An interview grading scheduler will be posted on Canvas just before an assignment is due. Each student must sign up for an interview grading slot and attend in person. If you do not show up for your assigned grading time slot on time, we reserve the right to assign you a grade of zero for the entire assignment.
- It is your responsibility to make sure that your assignment gets graded and a grade is assigned on Canvas within a week of your interview grading. If you do not see a grade assigned on Canvas or if there is a grade discrepancy, please contact the TAs or the instructor with in a week to resolve the issue. No new grade change request will be accepted after one week.
- All programming assignments should be your original work, unless otherwise noted. You may help others only to the extent of answering typical questions that arise during compiling, debugging, and executing your programming assignments. The code that you write should be your own.
- Late work is not accepted without a documented personal, family, or medical emergency. If you submit your assignment late, you will receive a zero for the assignment.

Recitation Assignments

- There will be some simple assignments given during your recitations based on lectures. You must complete and submit these assignments during your recitation hour. Extensions will not be granted except at the instructor's discretion in documented cases of extreme hardship or emergencies.

Problem Sets

- Problem sets will consist of end-of-chapter exercises assigned by the instructor. You must submit your completed homework in class on the due date. Extensions will not be granted except at the instructor's discretion in documented cases of extreme hardship or emergencies. Problem sets will be lightly graded, mostly for completion.

Quizzes

- Due on Thursday of most weeks at 11:55 PM, there will be a quick quiz on Canvas, designed to gauge learning of the topics covered that week. Grading will be done automatically, to the extent that it is possible.

Use of Online Sources

- You must use your judgement in using any online tools/material for your assignments. Use of online tutors, AI tools, course material repositories, etc for any of your assignments is strictly prohibited. These include sources such as Course Hero, Github CoPilot, ChatGPT, course material available on Github, Chegg, etc. Any use of such sources for your assignments will result in a grade of F for the course and will be reported to the Student Conduct & Conflict Resolution (honor@colorado.edu).

Policies

- Please see an accessible online version at https://www.colorado.edu/academicaffairs/policies-customs-guidelines/required-syllabus-statements
- 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 classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.
- REQUIREMENTS FOR COVID-19
  As a matter of public health and safety, 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. CU Boulder currently requires COVID-19 vaccination and boosters for all faculty, staff and students. Students, faculty and staff must upload proof of vaccination and boosters or file for an exemption based on medical, ethical or moral grounds through the MyCUHealth portal.

  The CU Boulder campus is currently mask-optional. However, if public health conditions change and masks are again required in classrooms, students who fail to adhere to masking 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.

If you feel ill and think you might have COVID-19, if you have tested positive for COVID-19, or if you are unvaccinated or partially vaccinated and have been in close contact with someone who has COVID-19, you should stay home and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). If you are fully vaccinated and have been in close contact with someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). Please alert the instructional faculty via email about any absences due to illness or quarantine. Note that you do not need to state the nature of your illness when alerting the faculty.

- 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. 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 Student Conduct & Conflict Resolution (honor@colorado.edu); 303-492-5550). Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to 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
  CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits sexual

misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, protected-class discrimination and harassment, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources can be found on the OIEC website.

Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of any issues related to these policies regardless of when or where they occurred to ensure that individuals impacted receive information about their rights, support resources, and resolution options. To learn more about reporting and support options for a variety of concerns, visit Don't Ignore It.

- 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.
  See the campus policy regarding religious observances for full details.

Course Content

1. Introduction to Operating Systems (Chapter 1)
2. Design Issues (Chapter 2)
   - System Boot
   - Protecting OS
   - System Call API
3. Device Management (Chapter 13)
   - System Architecture Review
   - I/O System Call Interface
   - Device Drivers
4. Kernel Programming (Class notes)
   - Proc file system
   - Kernel debugging support
   - Loadable Kernel Modules (LKM)
5. Process Management (Chapters 3, 4, 5, 6 and 7)
   - Processes and threads
   - Interprocess communication and synchronization
   - Classic synchronization problems
   - Process scheduling
   - Deadlocks
6. Memory Management (Chapters 8 and 9)
   - Memory hierarchy
   - Main memory allocation
   - Paging and segmentation
   - Virtual memory
7. Mass Storage (Chapter 10)
   - Disk storage
   - Flash memory
   - RAID
8. File Systems (Chapters 11 and 12)
   - Mounting file systems
   - Virtual file systems
   - File system implementation
   - File system performance
   - Reliability and recovery
9. Security and Protection (Chapters 14 and 15)
   - Authorization
   - Program threats
   - Symmetric key cryptography
   - Asymmetric key cryptography
   - Authentication
   - SSH
10. Distributed systems