

CS 212: Operating Systems

Syllabus – Fall 2020

Instructor: Nathan Sommer

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Office Location: Taylor 313

Office Hours: See course web site

Meeting Time: MWF 2:15 PM to 3:05 PM in Taylor 302 or on Microsoft Teams

Course Web Site: <http://csweb.wooster.edu/nsommer/cs212>

Course Description

A survey of the structure and organization of modern operating systems. Topics include process management, memory management, concurrency, interrupts, file systems, I/O devices, and system calls. Programming projects will involve using operating system services as well as writing modules for the Linux kernel.

Course Goals

Upon completion of this course, a successful student will be able to:

- Describe the essential components of an operating system and their respective responsibilities.
- Recognize how different algorithms for core operating system components affect the performance of application software.
- Write modules for the Linux kernel using the C programming language.
- Design and implement software consisting of components that operate concurrently.

Textbook

The main text for this course is *Operating Systems: Three Easy Pieces* by Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau. The book is available for free online at <http://ostep.org>. If you want a physical copy you may order one from the same site, but that is not required.

Other resources will be made available as needed.

Learning Amidst COVID-19

The current pandemic obviously has a dramatic effect on how we will conduct classes this semester. I will do my best to create a conducive environment for learning in the face of this challenge, but this

environment is new to us all and some adjustments to the course may be made as we go along. Let us all practice patience and kindness towards one another as we figure things out together.

Hybrid Format

This class is offered as a hybrid of synchronous and asynchronous learning. Once the College starts allowing us to meet in person, students will have the option of attending in person synchronous class sessions. However, we will not all be able to be in the classroom at the same time due to social distancing. Additionally, there are a number of remote students in the course who are in time zones that make it difficult to remotely attend during our regular time slot.

Because of this, the initial plan is to have everyone attend one synchronous session per week starting in the second week, but splitting the class into groups such that each group meets synchronously once per week either in person or remotely at an alternate time that works for all remote students. These sessions will consist of discussions and activities that benefit from working as a group.

Asynchronous content will be in the form of videos and reading.

Recording of Classes

I plan to record some of our class sessions within Teams so that students can review the content at a later time, and students who have to miss class for exceptional circumstances can catch up more easily. These recordings will only be accessible by class participants, and they may not be distributed beyond this class in any form without the permission of all participants. You will be notified when recording is taking place.

Updated Pass-Fail Option

Due to the current circumstances, the College has broadened its pass-fail grading policies this semester:

- Students may elect a Pass-Fail grading option for any course (including those in a major/minor)
- Special note on transcript noting unique policy changes specific to Fall Semester 2020 regarding pass-fail counting toward the major.
- Students may elect as many courses as they wish on a Pass-Fail grading structure. Courses elected as Pass-Fail for Fall Semester 2020 will not count toward the maximum number of Pass-Fail courses that a student may take at Wooster.
- The deadline for electing a Pass-Fail grading option is Friday, Dec. 18, 2020 @ 4 p.m.

See here for additional information about updates to academic policies:

<https://www.wooster.edu/info/fall-2020-guide/2020-21-calendar/>

Outline of Topics

- Introduction
 - The role of modern operating systems
- Background and Review
 - Important C concepts
 - Binary integer representation
- Processes
 - Creation
 - Control
 - Scheduling
- Memory Management
 - Addressing
 - Paging
- Concurrency
 - Threads
 - Locks
 - Semaphores
 - Deadlock
- Input/Output
 - Interrupts
 - Drivers
 - Hardware
- Data Storage
 - Storage devices
 - Files and directories
 - File system implementation
- As Time Permits...
 - Virtualization
 - Security

Assignments and Tests

Your grade will be calculated based on the following items:

- **Quizzes** – There will be regular quizzes on Moodle to assess whether or not you are engaging with the materials outside of class, and to highlight important takeaways from the material. Quizzes will typically close at 2 PM on class days to encourage everyone to complete readings and watch videos before synchronous sessions when applicable.
- **Attendance and Engagement** – You are expected to attend your group’s synchronous class sessions as you are able and to participate in activities and group discussion.
- **Homework** – There will be regular homework assignments throughout the semester. Assignments in this category will generally be assigned on one class day and due the next. Homework will consist of some combination of small programming tasks, written exercises, short answer questions, and reading responses.

Most assignments will be collected through git-keeper. You are responsible for ensuring that assignments are submitted correctly. For assignments collected through git-keeper you will always receive an email when your submission has been received successfully. If you do not receive an email and you are certain you pushed your submission and there were no errors on your end, contact me.

- **Programming Projects** – Various programming projects will be assigned throughout the semester. These projects will be more involved than the homework assignments and you will be given more time to complete them. Completion time and grading will vary from project to project.
- **Midterm Exam** – There will one midterm exam during the semester. See the schedule on the class web site for the timing of the exam. This will be a take-home exam and will consist of a set of questions on Moodle and a programming problem submitted through git-keeper.
- **Final Exam** – There will be a cumulative final exam given during the College’s final exam period. The format will be similar to the midterm exam.

Grading

Grades will be weighted as follows:

- 10% Quizzes
- 5% Attendance and Engagement
- 50% Homework and Programming Projects
- 15% Midterm Exam
- 20% Final Exam

I will use the standard 90, 80, 70, 60 grading scale with pluses and minuses. I may relax these standards as necessary but I will not raise them.

Communication

Feel free to talk to me about any issues that may arise. The preferred means of communication about course material is via direct message on Microsoft Teams. If you are struggling with specific programming assignments, it is generally most effective to talk via a video call so that you can share your screen with me.

You may book a time to meet with me during my office hours using the booking link on the course web site. If there are no spots free or you cannot make my normal office hours, let me know and we can figure out another time to meet.

Course Policies

- **Assignment Submission** – Most homework assignments and programming projects will be distributed through git-keeper. For these assignments, submission through git-keeper will be the only acceptable means of submission unless I indicate otherwise.
- **Late Policy** – I will do my best to grade and return assignments to you as soon as I can. Late submissions make timely grading much more difficult. As such, any submissions I receive after I have started grading an assignment will be subject to a 25% penalty for each day that it is late, starting as soon as I start grading the assignment.

If an assignment's due date has passed and I want to start grading submissions but *nobody* has submitted, the 25% penalty starts at that point regardless of the fact that there is nothing to grade.

Exceptions to this policy will be granted in special circumstances. You must let me know *before* the due date if you feel you have a valid reason why you cannot turn an assignment in on time.

- **Extensions** – I will extend an assignment's due date for the entire class if it is clear that the original time frame was unreasonable. If you are going to bring up the possibility of a due date extension for a programming project, be prepared to demonstrate that you have already made substantial progress on the project.

I will grant personal extensions under the right circumstances. If you would like an extension for personal reasons, send me an email or come see me in my office.

- **Absences** – You are expected to attend each of your group's synchronous sessions, but I understand that occasionally there may be exceptional circumstances. If you miss a class or know that you will miss an upcoming class, please contact me as soon as possible to explain the situation. You will still be expected to keep up with assignments and class content.
- **Academic Honesty** – You are encouraged to discuss homework assignments and programming projects with other students. However, any uncited work you turn in must be your own.

Software similarity is a tricky thing as some similarities between code submissions are inevitable. I draw the line at submissions that contain a significant amount of code that is either identical to someone else's code or submissions where the only differences are purely cosmetic

(i.e. variable and function names have been changed to hide code copying). If in doubt, put a comment in your code citing a source or acknowledging collaboration. Contact me if you have any doubts about what is permissible.

Dishonesty in any of your academic work is a serious breach of the Code of Academic Integrity and is grounds for an F for the entire course. Such violations include turning in another person's work as your own, copying from any source without proper citation, crossing the boundary of what is allowed in a group project, submitting an assignment produced for a course to a second course without the authorization of all the instructors, and lying in connection with your academic work. You will be held responsible for your actions.

You are expected to know and abide by the rules of the institution as described in *The Scot's Key* and the *Handbook of Selected College Policies*. These policies are available here:

<https://www.wooster.edu/academics/affairs/policies/>

- **Final Exam** – No final examinations are to be given during the last week of classes or on reading days. Students who wish to reschedule a final exam must petition the Dean for Curriculum and Academic Engagement in writing in advance of the examination. The student must confer with the instructor before submitting a petition, and the instructor should indicate to the Dean if he or she supports the petition.

Normally, such petitions are granted only for health reasons. If other reasons necessitate a request for a change in a final exam, the request must be submitted three weeks in advance of the examination.

- **Conflicts with Academic Responsibilities** – The College of Wooster is an academic institution and its fundamental purpose is to stimulate its students to reach the highest standard of intellectual achievement. As an academic institution with this purpose, the College expects students to give the highest priority to their academic responsibilities. When conflicts arise between academic commitments and complementary programs (including athletic, cultural, educational, and volunteer activities), students, faculty, staff, and administrators all share the responsibility of minimizing and resolving them.

As a student you have the responsibility to inform the faculty member of potential conflicts as soon as you are aware of them, and to discuss and work with the faculty member to identify alternative ways to fulfill your academic commitments without sacrificing the academic integrity and rigor of the course.

- **Recording Classroom Activities** – No student may record or tape or photograph any classroom activity without the express written consent of the course instructor.

The Learning Center: Academic Support and Disabilities

The Learning Center, which is in APEX (Gault library) offers a variety of academic support services, programs and 1:1 meetings available to all students. Popular areas of support include time management techniques, class preparation tips and test taking strategies. In addition, the Learning Center coordinates peer-tutoring for several academic departments. Students are encouraged to schedule an appointment at the APEX front desk or visit the Learning Center Website for additional options.

An additional support that the Learning Center offers is English Language Learning. Students can receive instruction or support with English grammar, sentence structure, writing, reading comprehension, reading speed, vocabulary, listening comprehension, speaking fluency, pronunciation, and American culture through 1:1 meetings with the Learning Center staff, ELL Peer Tutoring, ELL Writing Studio courses, and other programming offered throughout the year. Students seeking ELL support are encouraged to visit the APEX front desk.

The Learning Center also coordinates accommodations for students with diagnosed disabilities. At the beginning of the semester, students should contact the Learning Center (ext. 2595) to make arrangements for securing appropriate accommodations. Although the Learning Center will notify professors of students with documented disabilities and the approved accommodations, students are encouraged to speak with professors during the first week of each semester. If a student does not request accommodations or does not provide documentation to the Learning Center, faculty are under no obligation to provide accommodations.

Title IX Reporting Policy

The College of Wooster is committed to fostering a campus community based on respect and nonviolence. In accordance with Title IX, Wooster is legally obligated to investigate incidents of sexual harassment and sexual assault that occur on our campus. Faculty who become aware of any incident of sexual violence, including harassment, rape, sexual assault, relationship violence, or stalking, are required by law to notify Wooster's Title IX Coordinator. For more information about your rights and reporting options at Wooster, including confidential and anonymous reporting options, please visit <http://www.wooster.edu/offices/title-ix/>.

The details of this syllabus are subject to change based on our progress through the material and the ever evolving COVID-19 situation.