CS 314 - Operating Systems FALL 2023

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Office Hours: I will be available via Zoom, in my office, or both, MW 11:30-1:00pm. I'm also available for appointments if those times don't work with your schedule or if you need to talk outside of office hours. In these cases, send me an email and we'll set up a meeting at a mutually convenient time. You can also just stop by my office and knock.

About This Course: This course will be taught in person, although recordings of lectures will be provided by prior arrangement with me to those with a legitimate need for a temporary absence from class or with approved accomodations through ACCESS. All resources for this course will reside online and will be provided via moodle (at classes.cs.siue.edu). Important announcements will be made during the lecture, via email, and via moodle. Be sure to set up some sort of alert for incoming emails about the class or make it a daily habit to check your email and the course Moodle page.

If you are ill or exhibiting symptoms of a transmissible disease, DO NOT COME TO CLASS – stay home, send me an email, and I will give you access to the relevant lecture recordings.

Textbooks:

- Arpaci-Dusseau & Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", `http://pages.cs.wisc.edu/~remzi/OSTEP/` (required)
- Andrew S. Tanenbaum, "Modern Operating Systems (Third Edition)". (not required; alternate treatment of same material)
- Adam Hoover, "System Programming with C and Unix". (required)
- B. W. Kernighan and D. M. Ritchie, "The C Programming Language". (optional, but highly recommended)

Prerequisites: CS 286 or equivalent (minimum grade of C).*

Course Description: This course introduces the fundamental concepts that form the building blocks of all modern operating systems. The first half of the course focuses on the essential abstractions that are, by necessity, present in modern, general-purpose operating systems: processes (design, concurrency, threads, scheduling), memory management (design, virtual memory, dynamic address translation, demand paging), file systems (storage devices, disk management and scheduling, directories, protection), and I/O (design, tradeoffs). The second half of the course covers additional topics, such as energy management, virtual machines, security, and design.

The practical work consists of a set of homework assignments (requiring concept synthesis, analysis, and simple illustrative programming) and four projects (deep dives requiring implementations of system calls, synchronization primitives, process scheduling, virtual memory management, etc.). The four projects may be performed as additions or modifications to existing instructional operating systems, such as DLXOS, Nachos, or Pintos, or as standalone programs. Lastly, readings,

*If you have not taken 286 or an equivalent course, we'll need to talk about whether it is appropriate for you to continue the course.

homeworks, and projects may be bookended by quizzes or written assignments, requiring an understanding of the material, such as design and implementation issues and solutions, where applicable. Detailed instructions and grading criteria will be part of each assignment.

Grade Policy:

Coursework	Weight	Final Grade	Percentage
HW/Quiz	20%	A	90+
Labs	40%	B	80-89
Exams	40%	C	70-79
		D	60-69
		F	0-59

- Assignments are due at the beginning of the class meeting of the designated due date or at the time designated on Moodle.
- Late assignments are not accepted for credit (unless an extension is approved in advance of the due date).

Student Learning Objectives:

- Describe the overall design of a typical operating system using the fundamental abstractions introduced by the course.
- Identify the use of the fundamental abstractions in real-world operating systems solutions.
- Review and compare specific aspects of existing implementations of several operating systems.
- Evaluate the tradeoffs inherent in various system design decisions.
- Design and implement advanced solutions to replace naive implementations of basic operating system components.

Technical Requirements and Support: Expect to become proficient in C programming (Makefiles, gcc, gdb) and the Unix environment (bash shell, shell scripting). A Linux server (os.cs.siue.edu) is available exclusively for use in this class.

Problems with Moodle availability may be addressed by email to cs-support@siue.edu. Availability or general setup issues regarding the course server should be addressed to the instructor.

Communication Policy: Use common sense when posting in the class forums:

- Be professional.
- Be respectful to others.
- No flame wars.
- Do not share your code or solutions (pseudocode is fine when necessary to illustrate a question or answer).

Aside from an office visit, email is a convenient and effective way to contact me. Keep emails short and to the point. Indicate that you have done some thinking before posing the question. Provide supporting documentation/code when needed. Follow common-sense rules for curteous and professional communication. Proof-read your emails.

Academic Honesty: Academic Honesty is a serious issue at SIUE, in the School of Engineering, in the Department of Computer Science, and with me. Penalties for dishonest behavior will be severe. Even a single occurrence of plagiarism of English text, or program code, within a graded activity (e.g., homework, project, blog post, or exam) is grounds for academic discipline and a letter grade of F for the course. Reuse or superficial adaptation of text or code found on the web is considered plagiarism.

Students are reminded that the expectations and academic standards outlined in the Student Academic Code (3C2) apply to all courses, field experiences and educational experiences at the University, regardless of modality or location. The full text of the policy can be found at the following link: `https://www.siue.edu/policies/3c2.shtml`.

Course assignments are intended for you to practice what you've learned and you will get the most out of the course if you do the assignments yourself. That said, use of ChatGPT or other LLM-based chatbots is allowed, unless otherwise stated on the assignment. However, if you do use these systems to help you produce code, it is required that you submit the chat transcripts along with the assignment.

University Attendance Policy: Students are expected to attend classes regularly. Attendance may be taken. A student who incurs an excessive number of absences (5+) may be withdrawn from the class at the discretion of the instructor. Exceptions may be made on an ad hoc basis.

Cougar Care: I fully support every person's decisions to prioritize mental health. Students have access to counseling services on campus (Student Success Center, 0222). You can make an appointment by visiting `https://cougarcare.siue.edu` or by calling 618-650-2642.

Diversity and Inclusion: SIUE is committed to respecting everyone's dignity at all times. In order to learn, exchange ideas, and support one another, our virtual and physical classrooms must be places where students and teachers feel safe and supported. Systems of oppression permeate our institutions and our classrooms. All students and faculty have the responsibility to co-create a classroom that affirms inclusion, equity, and social justice, where racism, sexism, classism, ableism, heterosexism, xenophobia, and other social pathologies are not tolerated. Violations of this policy will be enforced in line with the SIUE Student Conduct Code. The Hub `https://www.siue.edu/csdi` is an excellent resource for students for support and community. Any person who believes they have experienced or witnessed discrimination or harassment can contact Ms. Jamie Ball, Director in the Office of Equal Opportunity, Access and Title IX Coordination at (618) 650-2333 or jball@siue.edu. There is also an online form for reporting bias incidents at `https://cm.maxient.com/reportingform.php?SIUEdwardsville&layout_id=10`

Services for Students Needing Accommodations It is the policy and practice of Southern Illinois University Edwardsville to create inclusive learning environments. If there are aspects of the instruction or design of this course that result in barriers to your inclusion or to accurate assessment of achievement—such as time-limited exams, inaccessible web content or the use of non-captioned videos—please contact Accessible Campus Community and Equitable Student Support (ACCESS) as soon as possible. In order to properly determine reasonable accommodations, students must register with ACCESS either online at siue.edu/access or in person in the Student Success Center, Room 1203. You can also reach the office by emailing us at myaccess@siue.edu or by calling 618-650-3726.

If you feel you would need additional help in the event of an emergency situation, please notify me to discuss your specific needs.

Important Dates (All unofficial dates are tentative.): [†]

Labor Day	Sep. 4
Midterm Exam	Oct. 11
Thanksgiving Break	Nov. 20-24
Final Exam	See registrar web page.[†]

Tentative Course Schedule:

Introduction, C/Unix	week 1+
Processes	week 2
Threads	week 2
Synchronization and Scheduling (Project 1 assigned)	week 3
Deadlocks	week 4
Memory (Project 2 assigned)	week 4
Virtual Memory	week 5-6
Page Replacement	week 7
Paging Design/Implementation	week 7
Segmentation (Project 3 Assigned)	week 8
Files	week 8
Midterm Exam	Oct. 11
Directories	week 9
File System Implementation	week 10
I/O Hardware/Software	week 10
Interrupts/DMA/Applications	week 11
Disk Drives (Project 4 Assigned)	week 12
Power Management	week 13
Multiprocessors	week 13
Shared Memory	week 14
Software DSM	week 15
Security	week 16
Final Exam	See registrar web page.[†]

Subject to Change Notice: All material (including this syllabus), assignments, and deadlines are subject to change with prior notice. It is your responsibility to stay in touch with your instructor, review the course site regularly, keep current with emails, communicate with other students, and to adjust as needed if assignments or due dates change.

Recordings of Class Content Faculty recordings of lectures and/or other course materials are meant to facilitate student learning and to help facilitate a student catching up who has missed class due to illness or quarantine. As such, students are reminded that the recording, as well as replicating or sharing of any course content and/or course materials without the express permission of the instructor of record, is not permitted, and may be considered a violation of the University's Student Conduct Code (3C1). The relevant student conduct policy can be viewed at the following URL: `https://www.siue.edu/policies/3c1.shtml`.

[†] `https://www.siue.edu/registrar/services/academic-scheduling/final-exam-scheduling.shtml`