CSE303: Operating Systems Design

Instructors:
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Time: MW 1:35 pm - 2:50 pm (NV001)
Office Hours:
Discussion Forum: (Piazza Signup)
Course Description:

Process and thread programming models, management, and scheduling. Resource sharing and deadlocks. Memory management, including virtual memory and page replacement strategies. I/O issues in the operating system. File system implementation. Multiprocessing. Computer security as it impacts the operating system.
This course focuses on what an operating system does, and why. It turns out that the five most important things that an operating system does are not unique to operating systems only. They matter to pretty much all code. Thus we will explore five themes that are important to any computer system: Security, Concurrency, Virtualization, Persistence, and Resource Management.

Course Prerequisite

CSE109 and (ECE201 or CSE202)

Required Textbook

Operating Systems: principles and Practice, Second Edition
Thomas Anderson and Michael Dahlin, Recursive Books, 2014

Student Learning Outcomes

At the end of this course, students should be able to:

1. Implement C/C++ code that interacts directly with the operating system
2. Describe how the five themes (security, concurrency, virtualization, persistence, and resource management) apply to all sorts of software applications
3. Apply the concepts related to the five themes (security, concurrency, virtualization, persistence, and resource management) to all sorts of software applications

Grading

The final course grade is calculated based on the following assessment items:

Programming Assignments (5)	**55%**
In person Quizzes (6)	**35%**
Attendance and Participation	**10%**

Attendance

Attendance is required. The participation grade is based on the class attendance and the class/piazza participation.

Programming Assignments

The programming assignments are an essential component of the student learning in this class. They should be submitted before the deadline. 10 points will be deducted for every day late up to 2 days (20 points max). Homework submitted after 48 hours will not be graded and will receive a zero. Extensions on any assignment may be granted upon justified requests.

Tools

Students may use any Integrated Development Environment (IDE) for this class. We recommend ***Visual Studio Code***. Students will use **Docker containers** to guarantee a uniform and consistent environment used by the students and the instructors. ***Github*** and **git** will be used to submit the programming assignments.

Statement on Academic Integrity

It is the duty and obligation of students to meet and uphold the highest principles and values of personal, moral and ethical conduct. Students and faculty share the responsibility for promoting and helping to ensure an environment of academic integrity. You are expected to complete all academic course work in accordance with the standards set forth by the faculty and in compliance with the University's Code of Conduct (Lehigh's Code of Conduct for Academic Integrity).

You should treat the internet as a "read-only" resource. When working on the assignments in this class, you should never ask questions on StackOverflow or other public web sites, but it is OK to read from StackOverflow and other public web sites. You should never copy code from the internet. While you are not forbidden from discussing basic concepts and strategies with friends and classmates currently enrolled in CSE 303, the copying or sharing of solutions to programming assignments, in whole or in part, is never acceptable. It is also not acceptable to discuss the assignment with students who have taken this course in previous semesters. You also should not use generative AI, such as ChatGPT, to solve the programming assignments. Violations of these rules will be referred to the University Committee on Discipline and, if found guilty, you may be given the failing grade WF in the course. You should keep in mind that computer programs exhibit an individual's "style" just as much as other forms of authorship. Changing variable names, editing comments, or making other trivial updates in an attempt to hide plagiarism is rarely effective. If you have questions about this policy at any point

throughout the semester, ask. It is not better to ask for forgiveness than to ask for permission when your academic career is at stake.

The Principles of Our Equitable Community:

Lehigh University endorses The Principles of Our Equitable Community (www.lehigh.edu/diversity). We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

Accommodations for Students with Disabilities:

Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors as early in the semester as possible. For more information or to request services, please contact Disability Support Services in person in Williams Hall, Suite 301, via phone at 610-758-4152, via email at indss@lehigh.edu, or online at https://studentaffairs.lehigh.edu/disabilities.

Lehigh University Policy on Harassment and Non-Discrimination

Lehigh University upholds The Principles of Our Equitable Community and is committed to providing an educational, working, co-curricular, social, and living environment for all students, staff, faculty, trustees, contract workers, and visitors that is free from harassment and discrimination on the basis of age, color, disability, gender identity or expression, genetic information, marital or familial status, national or ethnic origin, race, religion, sex, sexual orientation, or veteran status. Such harassment or discrimination is unacceptable behavior and will not be tolerated. The University strongly encourages (and, depending upon the circumstances, may require) students, faculty, staff or visitors who experience or witness harassment or discrimination, or have information about harassment or discrimination in University programs or activities, to immediately report such conduct. **If you have questions** about Lehigh's Policy on Harassment and Non-Discrimination or need to report harassment or discrimination, contact the Equal Opportunity Compliance Coordinator (Alumni Memorial Building / 610.758.3535 / eocc@lehigh.edu

Course Outline (This outline may be subject to change at the instructor's discretion**)**

Week	Topic	Readings	Quizzes[1]	Programming Assignments[2]
Week 1 Aug 26 – Aug 30	Introduction to the course Operating System Basics	**Chapter 1**		**PA0 assigned**
Week 2 Sep 2 – Sep 6	Processes	**Chapter 2**		**PA0 due**
Week 3 Sep 9 – Sep 13	Process Management, IO, IPC, and Virtual Machines	**Chapter 3**	**Quiz 1**	
Week 4 Sep 16 – Sep 20	Security Principles	**Material provided**		**PA1 assigned**
Week 5 Sep 23 – Sep 27	Threads	**Chapter 4**	**Quiz 2**	
Week 6 Sep 30 – Oct 4	Mutual Exclusion and Condition Synchronization	**Chapter 5**		**PA1 due, PA2 assigned**
Week 7 Oct 7 – Oct 11	Lock Design Patterns	**Chapter 6**		
Week 8 Oct 14 –Oct 18	File Systems and Storage Devices **(Pacing Break, no lecture on Monday)**	**Chapters 11-12**	**Quiz 3**	
Week 9 Oct 21 – Oct 25	Files, Directories, and Reliable Storage	**Chapters 13-14**		
Week 10 Oct 28 – Nov 1	Uniprocessor and Multiprocessor Scheduling	**Chapter 7**		**PA2 due** **PA3 assigned**
Week 11 Nov 4 – Nov 8	Queueing Theory		**Quiz 4**	
Week 12 Nov 11 – Nov 15	Segmentation and Paging	**Chapter 8**		**PA3 due** **PA 4 assigned**
Week 13 Nov 18 – Nov 22	Caching, Translation, and Memory Protection	**Chapter 9**	**Quiz 5**	
Week 14 Nov 25 – Nov 29	Cloud Computing			
Week 15 Dec 2 – Dec 6	Open Session		**Quiz 6**	**PA4 due** **PA5 assigned**
Dec 10 - Dec 18	**Final Exam Period**			**PA5 due**

[1] Quizzes are completed in person on Wednesday
[2] Programming Assignments are released on Monday and due on Friday before 11:59 pm.