Syllabus

The course follows a bottom up construction of a general-purpose operating system beginning with the hardware interface and ending with the user interface. Specific topics covered include concurrent processes, process management, I/O, virtual memory, file management, resource scheduling, and performance measurement. Students are assumed to be familiar with general machine architecture, functions of system software (compilers, loaders, editors, etc.), data structures, and to have some experience with UNIX or another multiprogramming operating system.

The class is dual-listed as an undergraduate (COS 450) and graduate course (COS 550); graduate students will have additional reading and must prepare a presentation for the class (see below).

Instructor

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Course Objectives

After completing this course, you should be able to:

- Describe what the purpose of an operating system is.
- Describe the major challenges in an operating system design and implementation.
- Describe the major functional components of an operating

system.
- Describe the typical architectures of operating systems.
- Describe how an operating system is designed and implemented.
- Develop code that extends an existing operating system.
- Evaluate operating system designs and functions.

The course is designed to meet the following program outcomes of the Computer Science program at the University. While, your work will be assessed within the program against these outcomes they are not used in grading your work.

- An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
- An understanding of professional, ethical, legal, security and social issues and responsibilities
- An ability to use current techniques, skills, and tools necessary for computing practice.

Prerequisites and Expectations

- COS 285 Data Structures
- COS 251 Systems Programming

The course involves a fair amount of independent learning, experimentation, and work. Internet resources on network programming are plentiful and class time is limited. You will be expected to read (or at least skim and absorb) enough of these materials to be prepared for class.

Textbook

You will use the textbook in and out of class. The examinations will

combine material from in-class discussion and the textbook. The textbook is the reference for the course. All textbook material may not be covered during in-class discussions, yet you will still be responsible to demonstrate an understanding of it on the examinations.

Operating System Concepts Essentials 2nd Edition 2013, Silberschatz, Galvin, and Gagne.

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ISBN-13: 978-1118804926
ISBN-10: 1118804929
Publisher: John Wiley & Sons
Book Website: http://os-book.com
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NOTE: *Operating System Concepts 9th edition* is an acceptable, but more expensive substitute. The Essentials version has the same but fewer chapters. We will only be covering material that is in the Essentials version.

In addition to the textbook, you will need the Pintos Documentation to complete the assignments in the course.

Projects

The course is partially project-based. There will be three (3) required programming projects. The projects will require you to implement key operating system components within an existing operating system. They will be graded on solving the problem at hand and your design approach documentation. The projects are complex and time consuming. Do not underestimate the time and thought needed to complete them. Start early, work often.

Each project consist of two parts; implementing features and a design document. Each part is 50% of the project grade. The feature

implementation requires that you write code to implement features in the Pintos operating system. There is an automated test and grading infrastructure to assist you in your work. The `DESIGNDOC` is a guided writing exercise. There are several questions about your design that you are required to document. Within the guided questions are hints about good implementation decisions for the project.

Schedule of Projects

Project	Project	Possible Points
1	Threads	100
2	User Programs	100
~~3~~	Virtual Memory	100

Your code will be submitted (checked in/pushed) on GitHub to an assignment for each project. Details on what needs to be submitted will be included with each assignment. In all cases, you should submit only source code as directed, no binary executable files.

Your code must compile and run on systems other than your own, specifically the instructor's system as described in the Pintos documentation. Be diligent not to include absolute paths or other common mistakes that prevent your code being compiled and executed on other systems.

Code should work and be your own creation. There are numerous sources of information on the Internet, including code. However, your submissions should be your own work not that of others cut-and-pasted into your projects or that of your classmates. Plagiarism is a serious offence and will be treated accordingly.

Project Grading Rubric

Score	Grade	Notes
90-100	A	Passes all tests, design complete and well thought out
80-89	B	Passes most tests and/or design mostly complete
60-79	C	Passes some tests and/or design flaws
50-59	D	Passes only a few tests and/or design flaws
<50	F	Does not pass enough tests, does not satisfy the requirements, did not attempt

Quizzes and Live Class Sessions

The course includes two required quizzes each week and attendance at weekly live class sessions.

The quizzes cover the material being discussed in class each week. The first one is preparation for our weekly live class sessions and is graded not on your answers but on completion only. The second one is graded based on correct answers. Quizzes are due on Tuesday's and Friday's respectively. Quizzes are open-book, open-notes but *not collaborative* (e.g. do them on your own, by yourself). Each quiz is built at the time you take it from a pool of applicable questions, so it is very unlikely that any two will be the same. The quizzes and will be conducted within Brightspace (courses.maine.edu).

Live Class Sessions will be each Wednesday from 6-7pm (during our assigned meeting time for the course). During these sessions you will be working on exercises and engaging in discussion of the material. For this reason it is imperative that you have completed the weekly prep quiz, read the relevant sections of the textbook, and viewed the associated

videos before the class meeting.

There are 15 weeks in the semester

Item	Possible Points	Notes
Weekly Prep Quiz	4	Due Each Tuesday at midnight
Live Class Attendance	4	Wednesday 6-7pm
Weekly Quiz	12	Due Each Friday at midnight
Weekly TOTAL	20 each week	
OVERALL	300	(20 points x 15 weeks)

Schedule

The following is a broad view of the schedule for the course. Topic coverage and due dates may change based on progress, snow-days, holidays, and other events. Please refer to the weeks/modules within Brightspace for the detailed list of what needs to be completed and when.

WEEK	TOPIC	READING	NOTES & LINKS
Week 1	Course Overview & Introduction Pintos Introduction	Ch. 1	Pintos Documentation
Week 2	Operating System Structures Project 1 - Threads	Ch. 2	Project 1 - You should have completed any partner selection, gotten your environment up and running and be working on

	Session		the Alarm Clock part of the project.
Week 3	Processes	Ch. 3	
Week 4	Threads	Ch. 4	Project 1 - You should have Alarm Clock complete and be working on the schedulers.
Week 5	Process Synchronization	Ch. 5	
Week 6	CPU Scheduling	Ch. 6	Project 1 - Threads Due
Week 7	Project 2 - User Programs Session		
Week 8	Main Memory	Ch. 7	
Week 9	Virtual Memory	Ch. 8	
Week 10	Mass Storage Systems	Ch. 9	
Week 11	Project 3 - Virtual Memory Session		Project 2 - User Programs Due
Week 12			
Week 13	File System Interface & Implementation	Ch. 10 & 11	
Week	I/O Systems	Ch. 12	

14			
Week 15	Protection & Security	Ch. 13 & 14	
Finals			Project 3 - Virtual Memory Due

Grades

Grades for the course will be based on an accumulation of points from the weekly quizzes, live class sessions, and projects.

Schedule of Point Accumulation for Final Grade:

COS 450 Points	COS 550 Points	% Score	Grade
540-600	630-700	90-100%	A
480-539	560-629	80-89%	B
360-479	420-559	60-79%	C
300-359	350-419	50-59%	D
0-299	0-349	0-50%	F

Late Policy

For projects, you are granted three (3) "late days" to use at your discretion. These can be used all on one project, to hand in three days late with no penalty. Or they could be used one day late on each of three projects, again with no penalty. You are however required to indicate you are using late day(s) to the instructor by email prior to or on the original due date. The subject of the email should be "COS 450 Late Submission Project __" and fill in the project number.

Other extensions on projects and any extension on examinations will not be granted except in the case of an emergency. Technical difficulties do not constitute an emergency. Late submissions will be penalized.

Accommodations and Inclement Weather

Should you need services or accommodations due to a disability to fully participate in the class, please speak with the instructor or contact the Office of Academic Support for Students With Disabilities, Luther Bonney 242 on the Portland Campus.

Class cancellations are posted on USM's website (http://usm.maine.edu) and on the Storm Line at 780-4800. You can also receive cancellations and emergency information from the USM Alert text messaging system (http://usm.maine.edu/usmalert).