

CSCI 432: Operating Systems

Spring 2009

General Info

Instructor:	Jeannie Albrecht
Email:	jeannie@cs.williams.edu
Office:	TCL 304
Office Hours:	M 1:30pm - 3pm, Th 9:30am - 11am, or by appt
Class Meetings:	MWF 12:00 - 12:50 in TPL 205
Webpage:	http://www.cs.williams.edu/~jeannie/cs432/index.html
Recommended Textbook:	<i>Modern Operating Systems</i> , 3rd ed., by Andrew Tanenbaum (This book is not available in the bookstore.)

Course Description

This course explores the design and implementation of computer operating systems. Topics include historical aspects of operating systems development, systems programming, process scheduling, synchronization of concurrent processes, virtual machines, memory management and virtual memory, I/O and file systems, system security, and distributed operating systems. The concepts in this course are not limited to any particular operating system or hardware platform. We will discuss examples that are drawn from historically significant and modern operating systems including Unix, Windows, Mach, and the various generations of Mac OS.

The objective of this course is threefold: to demystify the interactions between the software you have written in other courses and hardware, to familiarize you with the issues involved in the design and implementation of modern operating systems, and to explain the more general systems principles that are used in the design of all computer systems.

Grading Details

Grades will be computed as follows:

- 10% Class Participation
- 15% Written Homework
- 45% Programming Projects
- 30% Exam(s)

Each of these items are explained in detail in the following sections.

Class Participation

Lectures are mandatory and you are expected to attend regularly. One goal of this course is to promote discussion of the issues in operating systems among all class members. As such, you

are encouraged to ask questions, point out weaknesses, and make observations during class. If you need to miss class for any reason, please let me know in advance.

Written Homework

The homework portion of your grade will be determined by short problems sets and/or written evaluations of a number of technical papers that we will read during the course of the semester. For each assigned paper, you will submit a 1-2 page evaluation that includes: (i) a high level summary that highlights the most important points addressed by the paper, (ii) the most glaring problem with the paper, and (iii) the conclusions you draw after reading the paper about building operating systems. Evaluations must be turned in at the beginning of class on the day the paper is assigned. (Please print it out and bring it to class.) Late homework will not receive credit for any reason.

Programming Projects

There will be approximately 4 programming projects. Details will be available on the course webpage. The first project is simple, and is only meant to help you gain some experience with C++. The other projects will require a **substantial time commitment** on your part. However, you will be given approximately 2-3 weeks to complete each one. It is essential that you start the assignments early and not wait until the last minute!

You get 3 flex days to use on programming projects during the semester. You can allocate these days in any way you see fit. For example, you can turn in one assignment three days late, or three assignments one day late. Beyond these three flex days, you will be penalized 25% of their value for each day late.

To complete the projects in this course, you will need the ability to develop software programs using C/C++. If you have not used C/C++ recently (or at all), you may want to refresh your knowledge using one of the many good books on the topic. In particular I recommend the classic, *The C Programming Language*, by Kernighan and Ritchie, because it is short and simple. I have a few reference books in my office that you are welcome to use. There are also many online tutorials that Google can help you find. If you feel that need extra help, please come see me.

We will primarily use the Computer Science Department's UNIX computers for the programming projects. If you are not familiar with the UNIX computing environment, talk to me as soon as possible so we can bring you up to speed on what you need to know.

Exams

There will be one or two written examinations in this course. There will definitely be a midterm exam, and possibly a final exam as well. The exam(s) will be closed book, closed notes, and will stress conceptual understanding of the material. More details about the structure of the exams and required material will be discussed during class.

Collaboration

Homework assignments and examinations are to be completed individually. You are allowed to work in groups of 2-3 on programming assignments. I encourage collaboration and assistance in understanding course material (especially if you have limited experience with C/C++), but not in developing solutions. Please be sure to give explicit credit for any help received. If you have any doubts about this, ask me whether or not collaboration is appropriate. Uncredited collaborations will be considered a violation of the honor code and will be handled appropriately. The computer science honor code and computer usage policy applies to all material in this class. Please review <http://www.cs.williams.edu/resources/usage.pdf>.

Calendar

The following calendar is a (very) tentative schedule of topics that we will cover in class. This schedule will likely change, so you should check the course webpage frequently for an updated calendar and the associated reading assignments. (MOS is an abbreviation for your textbook. See course website for more information on assigned papers.)

Date	Topic
Feb 6	Course Overview (MOS Ch 1) Paper: Lampson83
Feb 9–13	Processes, Threads, and Atomic Actions (MOS Ch 2) Project 0 out. Paper: Ritchie74
Feb 16–20	Scheduling and Synchronization: Ordering and Locks Project 0 due. <i>Feb 20: WINTER CARNIVAL</i>
Feb 23–27	Synchronization: Implementing Threads and Locks Project 1 out. Paper: Savage97
Mar 2–6	Deadlock and Concurrency (MOS Ch 6) <i>Mar 6: CLASS CANCELED</i>
Mar 9–13	Memory Management and Address Translation (MOS Ch 3) Project 1 due.
Mar 16–20	Memory Management and Midterm <i>Mar 18: MIDTERM</i>
Apr 6–10	Dual Mode Operation and Virtual Memory Project 2 out.
Apr 13–17	Virtual Machines Paper: Barham03
Apr 20–24	Networks/Distributed Computing and Security (MOS Ch 8-9) Project 2 due.
Apr 27–May 1	Files, I/O, and Storage (MOS Ch 4-5) Project 3 out.
May 4–8	File systems, Google, etc. Paper: TBD
May 11–15	Wrapup and Review Project 3 due.