Course Information

Principles of modern operating systems design: emphasis on concurrency including problems (nondeterminism), goals (synchronization, exclusion) and methods (semaphores, monitors); resource management including memory management and processor scheduling; file systems; interrupt processing.

In this course we examine the important problems in operating system design and implementation. The operating system provides a well-known, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. The operating system is responsible for allowing resources (e.g., disks, networks, and processors) to be shared, providing common services needed by many different programs (e.g., file service, the ability to start or stop processes, and access to the printer), and protecting individual programs from one another. The course will include a brief historical perspective of the evolution of operating systems over the last fifty years. Common components of operating systems will be covered, including the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems.

Assignments: midterm exam, final exam (70% on second half of course and 30% on first half), 8 written homeworks, 2 programming projects.

Prerequisites: CS 341L (and recursively CS 151L, CS 251L, EECE 238L)

3 credits (available for graduate credit to graduate students except graduate students in the computer science department)

Lectures: Tapy Hall 217, Tuesdays & Thursdays, 2:00-3:15

Instructor: Darko Stefanovic, office FEC 345C, phone 2776561, email darko@cs.unm.edu — office hours Tuesdays & Thursdays 5:00-6:00 or by appointment

Teaching assistant: Terry Van Belle, office FEC 302B, phone 2779212, email vanbelle@cs.unm.edu — office hours Mondays & Wednesdays 11:00-12:00 or by appointment

Textbook:

* W. Stallings: Operating Systems: Internals and Design Principles (3rd ed.) 1998 Prentice-Hall ISBN 0138874077

Other recommended textbooks:

* C. Crowley: Operating Systems: A Design-Oriented Approach 1996 Richard D. Irwin (Irwin imprint of McGraw Hill) ISBN 0256151512

* G. Nutt: Operating Systems: A Modern Perspective 1997 Addison-Wesley ISBN 0805312981

A. Silberschatz & P. Galvin: Operating System Concepts (5th ed.) 1999 John Wiley ISBN 0471364142

A. Silberschatz, P. Galvin & G. Gagne: Applied Operating System Concepts 2000 John Wiley ISBN 0471365084

A.S. Tanenbaum & A.S. Woodhull: Operating Systems: Design and Implementation (2nd ed.) 1997 Prentice-Hall ISBN 0136386776

The bookstore has the 3 books marked with *.

Grading: You are expected to attend class regularly, read the assigned reading before class, and participate in class discussions. The grade will be determined as follows:

Homeworks 30%

Programming projects 30%

Exams 45% (15% midterm exam, 30% final)

The excess 5% is intentional: you can do a little worse on any one grading component and still receive the top grade.

Homework assignment late policy: This course covers a lot of material and being late with assignments will hamper your ability to learn the next section of the course. Late programming assignments will be penalized $3n^2$%, where n is the number of days late. Homework is due on the date assigned, and no extensions will be granted. Assignments will be provided on-line as latex source, so that you can include them in your solutions without retyping. Hard-copy homework submissions must be printed, not handwritten; font size must be at least 11pt. Hand-drawn diagrams are OK. The preferred submission form is hard copy, but electronic submission is acceptable - send e-mail to darko@cs.unm.edu. Acceptable formats are plain text and Postscript as attachment. If Postscript, it is your responsibility to check that it prints correctly on the fec304 printer from a Unix account. Hard copy is due either in class (2:00-3:15), or during office hours (5:00-6:00). E-mail submissions must be received by 7:00. When an assignment asks you to write a program, that means that you must actually type it into a computer, compile, and run, and submit a listing of the program and its output.

Cooperation and cheating: Feel free to *discuss* homework and projects with classmates, the instructor, or the TA. However, *do not look at or copy another student's solution to a homework or project*. If a problem appears too difficult, or you lack the background to solve it, you are expected to talk to the instructor or the TA, and to do so early. Once you have the background necessary to solve a problem, you must provide your own solution. Exchanging homework or project solutions is cheating and will be reported to the University administration; students involved will not be permitted to continue in the class. Occasionally we will reuse problems that have been used in previous courses. Searching on the web for verbatim solutions is not the best application of your time, and you will receive no credit for it.

Lecture Plan

Tuesday 22 August: Lecture 1: Introduction. Homework 0 handed out.

Thursday 24 August: Lecture 2: OS and Architecture. Homework 0 due. Homework 1 handed out. Reading: Stallings Ch 1.

Tuesday 29 August: NO CLASS (instructor conference travel).

Thursday 31 August: NO CLASS (instructor conference travel).

Tuesday 5 September: Lecture 3: OS Structure and Functionality. Reading: Stallings Ch 2.

Thursday 7 September: Lecture 4: Processes & Threads. Homework 1 due. Homework 2 handed out. Reading: Stallings Ch 3.

Monday 11 September: no TA office hours.

Tuesday 12 September: Lecture 5: Implementing Threads. Reading: Stallings Ch 3 & 4.

Thursday 14 September: Lecture 6: CPU Scheduling. Homework 2 due. Reading: Stallings Ch 9.

Tuesday 19 September: Lecture 7: Synchronization. Homework 3 handed out. Reading: Stallings Ch 5.

Thursday 21 September: Lecture 8: Hardware Support for Synchronization. Reading: Stallings Ch 5.3.

Tuesday 26 September: Lecture 9: Synchronization: Semaphores. Homework 3 due. Reading: Stallings Ch 5.4.

Thursday 28 September: Lecture 10: Synchronization: Monitors. Homework 4 handed out. Programming project 1 handed out. Reading: Stallings Ch 5.5.

Tuesday 3 October: Lecture 11: Deadlock. Reading: Stallings Ch 6.

Thursday 5 October: Lecture 12: Homework 4 due. Deadlock. Review for mid-term exam (lectures 1-11).

Tuesday 10 October: Programming project progress review. Review for mid-term exam (lectures 1-11).

Thursday 12 October: NO CLASS (Fall break).

Tuesday 17 October: TA precept for mid-term exam (in Tapy 217).

Thursday 19 October: MID-TERM EXAM (in Tapy 217).

Tuesday 24 October: Lecture 13: Memory Hierarchy & Address Translation. Programming project 1 due. Programming project 2 handed out. Homework 5 handed out. Reading: Stallings Ch 7.

Thursday 26 October: Lecture 14: Paging. Reading: Stallings Ch 7.3.

Tuesday 31 October: Lecture 15: Segmentation & Paging. Homework 5 due. Reading: Stallings Ch 7.4.

Thursday 2 November: Lecture 16: Demand Paged Virtual Memory. Homework 6 handed out. Reading: Stallings Ch 8.

Tuesday 7 November: Lecture 17: Page Replacement Algorithms. Reading: Stallings Ch 8.2.

Thursday 9 November: Lecture 18: File Systems. Homework 6 due. Reading: Stallings Ch 12.

Tuesday 14 November: Lecture 19: File System Implementation. Homework 7 handed out. Reading: Stallings Ch 12.

Thursday 16 November: Lecture 20: Secondary Storage. Reading: Stallings Ch 11 & 12.

Tuesday 21 November: Lecture 21: I/O Management. Homework 7 due. Reading: Stallings Ch 11.

Thursday 23 November: NO CLASS (Thanksgiving).

Tuesday 28 November: Lecture 22: I/O Management. Homework 8 handed out.

Thursday 30 November: Lecture 23: Access Control and Security. Reading: Stallings Ch 15. Programming project 2 due.

Tuesday 5 December: Lecture 24: User Interfaces and Administration. Homework 8 due.

Wednesday 6 December: TA precept for final exam (classroom TBA)

Thursday 7 December: Review for final exam (lectures 1-24) & Course evaluation.

Date and location TBD, during finals week: FINAL EXAM.

Note: additional class meetings may be called during the semester, if the need arises.