CS-343 Operating Systems - Fall 2002

Syllabus and class information

Administrative Information

Professor

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Course Description

Operating systems control all the computer's resources and present users with the equivalents of virtual machines that are easier to program than their underlying hardware. The course is an introduction to basic operating

systems concepts: including operating systems structures, processes and thread, memory management, and file systems.

The course assumes familiarity with basic computer organization and data structures. You will need to be able to program in C (or C++) in UNIX systems to perform most of the assignments in the course.

Location and Time

Tuesdays and Thursdays Section 20: 9:30-10:50 and Section 21: 11-12:20.
Lectures will be held in 1890 Maple Room 381.

Course Prerequisites

- 725-311 Data structures and data management.
- Familiarity with basic computer architecture concepts and proficiency in C programming in UNIX systems.

Communication Channels

There are a number of communication channels set up for this class:

- We will use the course web site (`http://www.cs.northwestern.edu/~fabianb/cs-343-f02`) to post announcements related to the course. You should check this regularly for schedule changes, clarifications and corrections to assignments, and other course-related announcements.
- There is a newsgroup (cs.343, served off `news.acns.northwestern.edu`) intended to foster communication among you, the students. You'll find that someone else in the class will have thought of the same problem that you have and will perhaps have some valuable insight that will prove helpful. The TAs will be monitoring the newsgroup and will step in with guidance when appropriate
- Finally, there is an email alias (cs-343-ta@cs) for the TAs that you should use for questions that would be inappropriate to post on the newsgroup (source code being a good example).

Materials

Required

- *Operating Systems Concepts, 6th Ed.*, A. Silberschatz, P. Galvin and G. Gagne, John Wiley & Sons, NY, 2003. ("OSC" from now on.)
- Papers: A set of papers that will be made available.

Recommended

- *Advanced Programming in the Unix Environment*, R. Stevens, Addison-Wesley, 1992. A basic book for anyone writing programs that run under Unix.
- *The C Programming Language, 2nd Ed.*, B. W. Kernighan and D. M. Ritchie, Prentice Hall, 1988. A must.
- *Expert C programming: Deep C Secrets*, P. van der Linden, 1994. Fun to read and full of useful advice.

Grading

I will try very hard to give you the grade you deserve. I will use a criterion-referenced method and the total scores will be determined, roughly, as follows:

- Homeworks 10%
- Projects 50%
- Exams 40%

Exams

There will be four (4) exams scheduled during the quarter; approximate dates and times are listed below. Exams will be in-class, 30'-length, closed-book, and will cover materials from lecture, required readings and projects.

Homework

There will be two kind of homework assignments given throughout the class: reading assignments and textbook-style questions. You should have finished the assigned reading before coming to lecture. In addition, there will be a set of written homeworks that must be done alone and turned in at the end of class on the due date (see course policies below).

Projects

As you can deduce from the allocation of weights for grading, programming projects are a major portion of this class. There will be four (4) projects. The first three (3) projects are designed for you to work alone while the last one requires you to form a two-person team. Only if you cannot find a partner and we are unable to find a partner for you, will you be permitted to work by yourself (we generally don't view this as a reason for relaxed deadlines or grading). Both partners should work cooperatively on the design, implementation, and testing of their solution.

Course Outline and Approximate Dates

- **Introduction – Sep. 26 - Oct. 1**
  - Overview
  - Historical Perspective
  - Computer System Structure
  - Operating System Structure

  Readings:
  - OSC chap. 1-3
  - E. W. Dijkstra, E. W., The Structure of THE multiprogramming system, *CACM* 11(5), May 1968, pp. 341-346.
  - P. H. Salus, Unix at 25, *Byte* 19, pp 75–82, Oct. 1994.
  - F. J. Corbato, F.J., On Building Systems That Will Fail, *Communications of the ACM* 34(9), pp. 72–81, Jun. 1991.
  - Lampson, B., Hints for Computer System Design, *Proceedings of the 9th ACM Symposium on Operating Systems Principles*, pp. 33–48, 1983.

- **Processes and Threads – Oct. 1-15**
  - Processes
  - Threads
  - CPU Scheduling
  - Process Synchronization
  - Deadlocks

  Readings:
  - OSC chap. 4-7 (skip 4.6)
  - A.D. Birrel. An Introduction to Programming with Threads. Tech. Report, Digital - Systems Research Center, Palo Alto, CA, Jan. 1989.

- **Memory Management – Oct. 17-29**
  - Memory Management
  - Virtual Memory

  Readings:
  - OSC 9-10
  - R.C. Daley and J.B. Dennis, Virtual Memory, Process, and Sharing in MULTICS, *Communications of the ACM*, 11(5), May 1964, pp. 306–312.

- **I/O Systems – Oct. 31-Nov. 5**
  - I/O Systems
  - Mass-Storage Structure

  Reading:
  - OSC 8 and 13-14

  - P.M. Chen, E.K. Lee, G.A. Gibson, R.H. Katz, D.A. Patterson, RAID: High Performance Reliable Secondary Storage, *ACM Computing Surveys*, 26(2), pp. 145–185, June 1994.
  - G.A. Gibson and R. Van Meter, Network Attached Storage, *Communication of the ACM*, 43(11), pp. 37–45, Nov. 2000.

- **File Systems – Nov. 7-14**
  - File-System Interface
  - File-System Implementation

  Readings:
  - OSC 11-12
  - M.K. McKusic, W.N. Joy, S.J. Leffler, and R.S. Fabry, A Fast File System for UNIX, *ACM Trans. on Computer Systems*, 2(3), pp. 181–197, Aug. 1984.

- **Introduction to Distributed Systems – Nov. 19-26**
  - Distributed System Structures
  - Distributed File Systems
  - Distributed Coordination

  Readings:
  - OSC 15-17
  - C. Hedrick, Introduction to the Internet Protocols, Computer Science Facilities Group, Rutgers University, Jul 1987.

- **Thanksgiving Break – Nov. 28**
- **Protection and Security – Dec. 3-5**
  - Protection
  - Security

  Readings:
  - OSC 18-19
  - Denning, D., The United States vs. Craig Neidorf, *Communications of the ACM*, 34(3), Mar. 1991, pp. 22–43.

Policies

Late policy: Unless otherwise indicated, homeworks and projects are due by the end of lecture on their due date. If you hand in an assignment late, we will take off 20% for each day (or portion thereof) it is late.

Cheating vs. Collaboration: Collaboration is a really good thing and we encourage it. On the other hand, cheating is considered a very serious offense. When in doubt remember that it's OK to meet with colleagues, study exams together, and discuss assignments with them. However, what you turn in must be your own (or for group projects, your group's own) work. Copying code, solution sets, etc. from other people or any other sources is strictly prohibited.