G22.3250: Honors Operating Systems  
Handout #1: Course Information

Instructor: Vijay Karamcheti  
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Lectures: Tuesdays and Thursdays, 1:20pm-2:35pm  
102 CIWW

Office Hours: Thursdays, 2:45pm-4:00pm and by appointment  
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the body of the message containing the line: subscribe g22_3250_001_sp99


PREREQUISITES

One undergraduate-level course in algorithms and one in C or C++ programming.

DESCRIPTION

This course will cover both basic and some advanced operating systems concepts, focusing primarily on uniprocessors. The emphasis will be on understanding general concepts that are applicable to a wide range of operating systems, rather than a discussion of the features of any one specific system. Topics that will be covered include: Process Management, Storage Management, I/O Systems, Protection and Security, Encryption, Extensible OSes, and Fault Tolerance, and two case studies: Linux and Windows-NT.

The course is intended for full-time Ph.D. students and will cover a lot of ground relatively quickly. To make sure that you don’t fall behind in the course, I urge you to complete the assigned readings for each lecture and take full advantage of the office hours.

COURSE STRUCTURE

The course will consist of lectures based on material from the textbook (required), supplemented with seminal research papers from the reading list given below.

Textbook

- Abraham Silberschatz and Peter Baer Galvin  
  *Operating System Concepts*, Fifth Edition  
  Addison-Wesley, 1998.
Reading List

Process Management

Storage Management

File Systems

Protection and Security

Encryption

Extensible Operating Systems

Fault Tolerance
WORKLOAD

- **Class**: Students are expected to attend all lectures.

- **Readings**: Students are responsible for completing suggested readings: this would help both in understanding the lecture material, and in conducting meaningful discussions.

- **Research Paper Critiques**: To ensure that you actually read the research papers in the reading list, I shall require that you turn in a 1-page critique of each paper. The critique will be due the day the paper will be discussed in class. Note that you are required to “critique” the paper (i.e., discuss its good and bad points), as opposed to just summarizing its contents.

- **Programming Projects**: There will be **three programming projects**, each involving a combination of programming and analysis. Tentatively, the projects will cover the following topics:
  1. Project 1: Process synchronization, language support for concurrency, and deadlocks.
  2. Project 2: Memory management and virtual memory.
  3. Project 3: A larger-scale programming project that will bring together several operating system concepts. This assignment can be done in groups of 2-3 students.

  I shall provide additional details about this project in a separate handout.

Projects 1 and 2 will be due **two weeks** after they have been assigned. I shall make every effort to grade these assignments and return them to you by the following week. Project 3 will have a deadline of four to six weeks.

- **Exams**: There will be a mid-term and a final exam. The mid-term exam is scheduled for **1:20pm-2:35pm, March 9, 1999**. The final exam will be held during the time slot scheduled by the university and will be comprehensive.

COMPUTING RESOURCES

Projects 1 and 2 can be done on any machine that supports a C or C++ compiler. Project 3 will require a PC running Windows NT which I shall provide access to.

POLICIES AND GRADING CRITERIA

Final grades will be computed based upon the following weights: **Paper Critiques 10%**, **Programming Projects 35%** (Project 1: 8%, Project 2: 7%, Project 3: 20%), **Mid-term Exam 20%**, and **Final Exam 35%**. I will expect all paper critiques and project writeups to be turned in on time. Having said that, *if you're worrying about grades, you're missing all the fun!*

SYLLABUS

The following is a tentative syllabus. I may modify the order and/or emphasis given to specific topics based on class interest and reaction. The topics can be broadly divided into seven categories: overview (Lectures 1-2), process management (Lectures 3-11), storage management (Lectures 12-16), I/O systems (Lecture 17), protection and security (Lectures 18-19), case studies (Lectures 20-21), and advanced topics including encryption, extensible OSes, and fault tolerance (Lectures 22-28).

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<th>Date</th>
<th>Lecture</th>
<th>Topic</th>
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<td>1/19</td>
<td>Lecture 1</td>
<td>Overview: Administrivia and Introduction</td>
<td>OSC Chap. 1</td>
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<td>1/21</td>
<td>Lecture 2</td>
<td>Overview: Operating-System Structures</td>
<td>OSC Chap. 2-3</td>
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1/26 Lecture 3 Process Management: Processes and Threads
Reading: OSC Sec. 4.1-4.5

1/28 Lecture 4 Process Management: Interprocess Communication
Reading: OSC Sec. 4.5-4.7, [Laue78], [Bers90]

2/02 Lecture 5 Process Management: CPU Scheduling
Reading: OSC Sec. 5.1-5.4

2/04 Lecture 6 Process Management: Scheduling Algorithms
Reading: OSC Sec. 5.5-5.7, [Wald94]

2/09 Lecture 7 Process Management: Synchronization
Reading: OSC Sec. 6.1-6.4

2/11 Lecture 8 Process Management: Synchronization (contd.)
Reading: OSC Sec. 6.5-6.6

2/16 Lecture 9 Process Management: Language Support for Concurrency
Reading: OSC Sec. 6.7 + other stuff

2/18 Lecture 10 Process Management: Deadlocks
Reading: OSC Sec. 7.1-7.4

2/23 Lecture 11 Process Management: Deadlock Avoidance and Recovery
Reading: OSC Sec. 7.5-7.9

2/25 Lecture 12 Storage Management: Memory Management
Reading: OSC Chap. 8

3/02 Lecture 13 Storage Management: Virtual Memory
Reading: OSC Chap. 9, [Denn80]

3/04 Lecture 14 Storage Management: Virtual Memory (contd.)
Reading: [Tall95]

3/09 — MID-TERM EXAM —

3/11 Lecture 15 Storage Management: File Systems
Reading: OSC Chap. 10

3/16 — Spring Break —

3/18 — Spring Break —

3/23 Lecture 16 Storage Management: File Systems (contd.)
Reading: OSC Chap. 11, [Rose92]

Reading: OSC Chap. 13

3/30 Lecture 18 Protection
Reading: OSC Chap. 19

4/01 Lecture 19 Security
Reading: OSC Chap. 20, [Wall97]

4/06 Lecture 20 Case Study: UNIX/Linux
Reading: OSC Chap. 21-22

4/08 Lecture 21 Case Study: Windows NT
Reading: OSC Chap. 23

4/13 Lecture 22 OPEN SLOT

4/15 Lecture 23 Advanced Topics: Encryption
Reading: [Voyd85]

4/20 Lecture 24 Advanced Topics: Encryption (contd.)

4/22 Lecture 25 Advanced Topics: Extensible OSes
Reading: [Lied95]

4/27 Lecture 26 Advanced Topics: Extensible OSes (contd.)
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<td>4/29</td>
<td>Lecture 27</td>
<td>Advanced Topics: Fault-Tolerance</td>
<td>[Bers95], [Engl95]</td>
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<td>5/04</td>
<td>Lecture 28</td>
<td>Advanced Topics: Fault-Tolerance (contd.)</td>
<td>[Borg89]</td>
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