CS 3080 : OPERATING SYSTEMS

Semester Hours: 3.0  
Contact Hours: 3
Coordinator: TBD
Text: Operating System Concepts
Author(s): SILBERSHATZ GALVIN, GAGNE
Year: 2008

SPECIFIC COURSE INFORMATION

Catalog Description:

Features of modern multiprocessing operating systems. Threads and processes; resource management; scheduling, concurrency, and communication; virtual memory management; secondary storage management. Students cannot get credit for both CS 3080 and CS 3270. Prerequisite: Grade of C or better in CS 2020 and CS 2170 or CS 2190.

Course type: REQUIRED

SPECIFIC COURSE GOALS

- I can describe process scheduling algorithms, and compare their performance.
- I can use language primitives to manage threads and processes.
- I can describe concurrency issues and compare approaches to solving them.
- I can implement pseudo-code & actual code to solve certain synchronization problems.
- I can describe real and virtual memory management algorithms.
- I can derive the mapping between virtual and real addresses.
- I can describe certain scheduling algorithms for device management.

COMPUTER SCIENCE STUDENT OUTCOMES ADDRESSED BY THIS COURSE

- CS 1 Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions
- CS 2 Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline
- CS 6 Apply computer science theory and software development fundamentals to produce computing-based solutions

LIST OF TOPICS COVERED

- Overview (~ 13%, 2.0 weeks)
  - OS history and features
  - Process, user and kernel threads
  - Security
  - Introduction to Unix/Linux (reintroduced and utilized throughout the course)
- Scheduling (~ 20%, 3 weeks)
  - Process and thread management
  - Scheduling algorithms
  - Performance tradeoffs
  - Examples
- Concurrency (~ 20%, 3 weeks)
  - Race condition
  - Mutual exclusion algorithms for processes and threads
  - Deadlock
  - Examples
- Communication (~ 15%, 2.25 weeks)
  - Shared memory
  - Pipes and other paradigms
  - Examples
- Memory Management (~ 15%, 2.25 weeks)
  - Real and virtual memory
  - Address Translation
  - Paging algorithms
  - Performance and examples
- Device Management (~ 10%, 1.5 weeks)
- Device interaction
- Buffer management
- Disk schedulers

- Platform Specifics (~ 7%, 1 week)
  - Windows
  - Unix

**COMPUTER SECURITY TOPICS**

Faculty who recently offered CS 3080 have discussed and identified a list of topics related to computer security in this course. Below is a list for instructors to incorporate. (*) indicates topics that are mandatory.

<table>
<thead>
<tr>
<th>Security Topic</th>
<th>Description</th>
<th>Textbook Reference(^1)</th>
<th>Estimated Class Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
<td>Virtual Machines. Benefits of a virtual machine. Include discussion of how virtual machines provide a level of isolation from the guest to the host OS.</td>
<td>Chapter 16</td>
<td>1</td>
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<tr>
<td>*Isolation</td>
<td>Virtual Memory. Discussing how virtual memory works, including how kernel processes are allocated separately and isolated, from user processes.</td>
<td>Chapter 9</td>
<td>1</td>
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<tr>
<td>*Protection</td>
<td>User vs. kernel mode; SVC-protect CPU, I/O and computer memory; ring structure. Notions of protection domains and access matrices are applied in OS to control access to resources. Specifically cover notion of <em>principle of least privilege</em>.</td>
<td>Chapter 2  Chapter 14</td>
<td>5</td>
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<tr>
<td>*Security</td>
<td>Discussion of security threats and attacks. Basics of encryption, authentication, and hashing techniques. Topics including port scanning, denial of service, and worms. Authentication of users (passwords, biometrics, etc.).</td>
<td>Chapter 15</td>
<td>2</td>
</tr>
<tr>
<td>*Concurrency</td>
<td>Threading, threading issues such as thread safety. Synchronization techniques.</td>
<td>Chapter 4  Chapter 5</td>
<td>3-6</td>
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</tbody>
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\(^1\)Silberschatz, 8\(^{th}\) Edition.