CS 3080: OPERATING SYSTEMS

Semester Hours: 3.0
Contact Hours: 3
Coordinator: Ruinian Li
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)
  o OS history and features
  o Process, user and kernel threads
  o Security
  o Introduction to Unix/Linux (reintroduced and utilized throughout the course)

• Scheduling (~ 20%, 3 weeks)
  o Process and thread management
  o Scheduling algorithms
  o Performance tradeoffs
  o Examples

• Concurrency (~ 20%, 3 weeks)
  o Race condition
  o Mutual exclusion algorithms for processes and threads
  o Deadlock
  o Examples

• Communication (~ 15%, 2.25 weeks)
  o Shared memory
  o Pipes and other paradigms
  o Examples

• Memory Management (~ 15%, 2.25 weeks)
  o Real and virtual memory
  o Address Translation
  o Paging algorithms
  o Performance and examples

• Device Management (~ 10%, 1.5 weeks)
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</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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</tbody>
</table>
| *Protection    | 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 principle of least privilege. | Chapter 2  
Chapter 14 | 5 |
| *Security      | 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.). | Chapter 15 | 2 |
| *Concurrency   | Threading, threading issues such as thread safety. Synchronization techniques. | Chapter 4  
Chapter 5 | 3-6 |

1Silberschatz, 8th Edition.