

CS 149 / SE 149 Operating Systems

GREEN SHEET

Spring Semester 2015

Department of Computer Science
San Jose State University
Instructor: Ron Mak

Section 3: TuTh 9:00 – 10:15 AM, DH 450
Section 2: TuTh 3:00 – 4:15 PM, MH 233
Section 8: TuTh 6:00 – 7:15 PM, MH 223

Office hours: TuTh 7:30 – 8:30 PM
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Catalog description

“Fundamentals: Contiguous and non-contiguous memory management; processor scheduling and interrupts; concurrent, mutually exclusive, synchronized and deadlocked processes; files. Substantial programming project required.” *3 units*

Course Goal

To examine alternative algorithms associated with the implementation for each of the fundamental responsibilities of an operating system kernel including hierarchical memory management, CPU and task scheduling, resource management, input/output processing, and file management.

Course Objectives

- To introduce students to the role of an operating system as a hardware resource manager, and where the OS fits into the software application layer.
- To acquaint students with the need to perform memory management, and to explain to them the various memory management techniques and their tradeoffs.
- To help students appreciate how the CPU itself is managed by the operating system.
- To educate students about the computer deadlock problem, how deadlocks are not unique to the computer system, and attempted solutions to fix the deadlock problem.
- To instruct students about processes, their creation, and the software race condition that can happen when multiple processes are run concurrently and perform IPC.
- To ensure that students are familiar with the classic IPC problems and how to use semaphores in their software development process to avoid race conditions

Student Learning Outcomes

Upon successful completion of this course, you should be able to:

- Understand the role that the operating system software plays in the management of the various hardware subsystems of the computer system
- Understand locality of memory reference and how it is used to perform effective memory hierarchy management
- Understand the various mapping, replacement, and dynamic allocation algorithms for cache and virtual memory management
- Understand the alternative CPU scheduling schemes, their tradeoffs, and their applications to other queue processing situations
- Appreciate the difficult tradeoffs faced when attempting to deal with the resource deadlock problem and distinguish between the different deadlock prevention and avoidance schemes and understand why and how deadlocks can still happen today
- Understand software race conditions, their origin and the problems they can cause, along with knowing how to apply semaphores in software design to solve the race condition problem
- Understand the various issues associated with the operating system's role in performing I/O and file management.

BS in Computer Science program outcomes supported

- An ability to apply knowledge of computing and mathematics to solve problems.
- An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
- An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
- An ability to use current techniques, skills, and tools necessary for computing practice.
- An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- An ability to apply design and development principles in the construction of software systems of varying complexity.

Prerequisites

CS 146 or SE 146 Data Structures and Algorithms

A grade C- or better, or instructor's consent. **The Department of Computer Science strictly enforces prerequisites.** If you are not already pre-enrolled, you must come to the first class meeting and pick up an Add Form from the instructor. If applicable, show the instructor your card that indicates you're a graduating senior. It will be the instructor's and the department's decision whether or not to send you an add code by email.

The instructor may drop any student who does not show up during the first two class meetings and who didn't provide a valid excuse ahead of time.

Material assumed from prerequisite courses

Knowledge of computer organization and architecture including internal memory and external memory, input/output, central processing unit CPU, instruction sets, CPU structure and function, RISC, control unit, and system buses.

There will be systems programming assignments in both C and Java. (C programming will be at an elementary level that shouldn't be a problem for Java programmers.)

Required texts

Title: **Modern Operating Systems, 4th edition**

Author: Andrew S. Tanenbaum and Herbert Box

Publisher: Pearson, 2014

ISBN-13: 978-0133591620

Schedule

Subject to change with fair notice.

Weeks	Dates	Topics and activities	Chapters
1	Jan 22	Introduction History of operating systems <i>Create project teams</i>	1
2	Jan 27, 29	VirtualBox and Debian Linux Processes and threads	2
3	Feb 3, 5	Processes and threads	2
4	Feb 10, 12	Processes and threads	2
5	Feb 17, 19	Processes and threads	2
6	Feb 24, 26	Deadlocks	6
7	Mar 3, 5	Memory management	3
8	Mar 10, 12	Memory management <i>Midcourse review</i>	3
9	Mar 17, 19	Midterm: Tuesday, March 17 Operating systems design	12
	Mar 23-27	Spring recess	
10	March 31 Apr 2	Storage management and file systems	4
11	Apr 7, 9	Storage management and file systems	4
12	Apr 14, 16	I/O systems	5
13	Apr 21, 23	Virtual systems Multiprocessor systems	7 8
14	Apr 28, 30	Distributed systems Security	8 9
15	May 5, 7	Case study: Android Case study: Windows 8	10 11
16	May 12	<i>Course review</i>	
		Final exams: Section 3 (9:00 AM): Thursday, May 21, 7:15–9:30 AM , DH 450 Section 2 (3:00 PM): Monday, May 18, 2:45–5:00 PM, MH 233 Section 8 (6:00 PM): Tuesday, May 19, 5:15–7:30 PM, MH 223	

Laptops and lab time

Bring your laptops to class — we'll try to set aside some "lab" time for all the students to get together and share tips and accomplishments. This class will move rapidly and cover a lot of material. Class attendance and participation are very important.

Project teams

You will form project teams of 2 to 3 students each. The teams will last throughout the semester. Once the teams are formed, you will not be allowed to move from one team to another, so form your teams wisely! Each student must be on a team.

Course requirements and assignments

Assignments will be team-based. For each assignment, each project team will turn in one set of work, and all members of each team will receive the same score for the assignment. Each team is responsible for choosing a team lead and dividing up the work among the team members. You are personally responsible for participating and contributing to your team's work, and for understanding each part of the work for every assignment whether or not you worked on that part.

Each assignment is worth a maximum of 100 points. Late assignments will lose 20 points and an additional 20 points for each 24 hours after the due date.

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

University policy F69-24: "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading."

Assessments

At the end of the semester, each of you will turn in an assessment of your own performance on your team, and an assessment of each of the other members of your team.

Exams

The midterm and final examinations will be open book, notes, and laptops. Instant messaging, e-mails, texting, tweeting, or other communication with anyone else during the exams will be strictly forbidden.

Class grade

Your individual class grade will be weighted as follows:

65%	Assignments*
15%	Midterm exam**
20%	Final exam**

* *project team scores*

** *individual scores*

Each assignment, project, and exam will be scored (given points) but not assigned a letter grade. The mean score and standard deviation will be announced after each assignment and exam.

Final individual class letter grades will be assigned based on the class curve. Your final class grade can be adjusted up or down depending on your level and quality of participation on your project team as determined by the project tracking tools and your team members' assessments of your performance.

Classroom protocol

It is important for each student to attend classes and to participate. Arrive to class on time. Cell phones in silent mode, please.

Dropping and adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the Academic Calendars webpage at http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop Policy is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at <http://www.sjsu.edu/advising/>.

Recording lectures and Public Sharing of Instructor Material

Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.

Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor-generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy S07-2 at <http://www.sjsu.edu/senate/docs/S07-2.pdf> requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at <http://www.sjsu.edu/studentconduct/>.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Integrity Policy S07-2 requires approval of instructors.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the Accessible Education Center (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.

In 2013, the Disability Resource Center changed its name to be known as the Accessible Education Center, to incorporate a philosophy of accessible education for students with disabilities. The new name change reflects the broad scope of attention and support to SJSU students with disabilities and the University's continued advocacy and commitment to increasing accessibility and inclusivity on campus.