

San José State University
Department of Computer Science
Spring Semester 2016
CS 149 – Operating Systems, Section 3

Course and Contact Information

Instructor:	Ahmed Ezzat
Class Hours:	Tu,Th: 9:00AM – 10:15AM
Office Hours:	TU 7:00PM – 8:30PM (by reservation only), MacQuarrie Hall, Room 210
Email:	Ahmed.Ezzat@sjsu.edu
Classroom:	MH-233
Grader:	Sahil Kaw Email: sahil.kaw@sjsu.edu
Prerequisites:	CS 146 (Data Structures and Algorithms) <i>or</i> SE-146 with a grade of C- or better, or instructor's consent. The Department of Computer Science strictly enforces prerequisites. The instructor may drop any student who does not show up for the first two class meetings without providing a valid excuse ahead of time.

Course Description

Operating Systems: Overview of Operating Systems and its components; views as an extended machine. Microkernel architecture, client server model, and virtual machines. (2) Processes, threads models and hybrid model. Race conditions and critical regions. Producer-Consumer problem. Mutexes, Semaphores and monitors as synchronization. Types of scheduling algorithms. (3) Memory management. Virtual memory and paging. Virtual to physical memory mapping, and page replacement algorithms. Shared libraries and page fault handling. Persistent memory (backing store). (4) File System File naming, type and structure. File operations. Shared files and virtual file system. Disk space management. File system consistency and performance. (5) Input/Output devices. Memory-Mapped I/O. Direct Memory Access (DMA). I/O types: Programmed I/O vs. Interrupt-driven I/O. Device drivers. Graphical User Interface (GUI). (6) Deadlock: preemptable vs. non-preemptable resources. Conditions for deadlock. Deadlock detection and recovery. (7) Virtualization and the Cloud. Virtualization requirements. Type-1 vs type-2 hypervisors. Cloud and virtualization. Host operating system. (8) Multiple processor Systems:UMA vs NUMA. OS architecture for multiprocessor systems. Interconnect technology. Blocking vs. Nonblocking calls. Remote Procedure Call (RPC). (9) Security: Protection Domains, ACL and Capabilities. Multi-level security. Cryptography. Authentication using Biometrics. Firewalls. Virus scanners. Sandbox. (10) Unix, Linux and Android. (11) Windows8. (12) Operating System Design.

Learning Outcomes Upon Successful Completion of the Course

- 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.

Required Texts

- **Modern Operating Systems** by Andrew Tanenbaum and Herbert BOS, 4th Edition, Pearson Prentice Hall (2015). **ISBN-13:** 978-0-13-359162-0 or **ISBN-10:** 978-0-13-359162-x [Mandatory].

Course Requirements and Assignments

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](http://www.sjsu.edu/senate/docs/S12-3.pdf) at <http://www.sjsu.edu/senate/docs/S12-3.pdf>. Note that University policy [F69-24](http://www.sjsu.edu/senate/docs/F69-24.pdf) at <http://www.sjsu.edu/senate/docs/F69-24.pdf> states that “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.”

All the assignments and related documents must be handed in the classroom on due date. Students will lose 10% of the homework or project grade for each day delay, and after 5 days, homework or projects will not be accepted.

Homework and Project descriptions are available on Canvas

- Homework-1: [Assignment is on Feb. 4, 2016, and is due back on Feb. 11, 2016.](#)
- Homework-2: [Assignment is on Feb. 16, 2016, and is due back on Feb. 23, 2016.](#)
- Homework-3: [Assignment is on Feb. 23, 2016, and is due back on March 1, 2016.](#)

- Homework-4: [Assignment is on March 1, 2016, and is due back on March 8, 2016.](#)
- Homework-5: [Assignment is on March 8, 2016, and is due back on March 17, 2016.](#)
- Homework-6: [Assignment is on April 7, 2016, and is due back on April 14, 2016.](#)

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 closed book and no notes. There will be no laptops, or any personal digital devices allowed. There will be no make-up exams. If a student misses an exam without a legitimate excuse, a grade of zero will be recorded. If a student missed an exam with a legitimate excuse then the grade for that exam will be prorated.

Grading Policy

Your individual class grade will be weighted as follows:

- Assignments 50% 5 points individual scores
- Midterm 25% 30 points individual scores
- Final exam 25% 30 points individual scores

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

Final individual class letter grades will be assigned based on the class curve (i.e. relative grading). Your final class grade can be adjusted up or down depending on your level and quality of participation on your project team.

Note that “All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades.” See [University Policy F13-1](#) at <http://www.sjsu.edu/senate/docs/F13-1.pdf> for more details.

University Policies

General Expectations, Rights and Responsibilities of the Student

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU’s policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arise. See [University Policy S90-5](#) at <http://www.sjsu.edu/senate/docs/S90-5.pdf>. More detailed information on a variety of related topics is available in the [SJSU catalog](#), at

<http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html>. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

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](http://info.sjsu.edu/static/catalog/policies.html) 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](http://www.sjsu.edu/provost/services/academic_calendars) at http://www.sjsu.edu/provost/services/academic_calendars. The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/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](http://www.sjsu.edu/advising) at <http://www.sjsu.edu/advising>. Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

Consent for Recording of Class and Public Sharing of Instructor Material

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor's permission to record the course. "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

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor's permission to record the course. "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."

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 \(AEC\)](http://www.sjsu.edu/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.

CS 149, Operating Systems, Section 3, Course Schedule

Tentative course calendar

Week	date	Item
1	January 28 th	Lecture: Operating Systems Overview (Ch. 1)
2	February 2 nd	Lecture: Operating Systems Overview (Ch. 1)
2	February 4 th	Lecture: Processes and Threads (Ch. 2)
3	February 9 th	Lecture: Processes and Threads (Ch. 2)
3	February 11 th	Lecture: Processes and Threads (Ch. 2)
4	February 16 th	Lecture: Processes and Threads (Ch. 2)
4	February 18 th	Lecture: Memory Management (Ch. 3)
5	February 23 th	Lecture: Memory Management (Ch. 3)
5	February 25 th	Lecture: File Systems (Ch. 4)
6	March 1 st	Lecture: File Systems (Ch. 4)
6	March 3 rd	Lecture: Input/Output (Ch. 5)
7	March 8 th	Lecture: Input/Output (Ch. 5)
7	March 10 th	Lecture: Deadlock (Ch. 6)
8	March 15 th	Lecture: Deadlock (Ch. 6)
8	March 17 th	Lecture: Virtualization and the Cloud (Ch. 7)
9	March 22 nd	Lecture: Virtualization and the Cloud (Ch. 7)
9	March 24 th	Midterm (Closed book)
10	March 29 th	Lecture: Multiple Processor Systems (Ch. 8)
10	March 31 th	Campus closed
11	April 5 th	Lecture: Multiple Processor Systems (Ch. 8)
11	April 7 th	Lecture: Multiple Processor Systems (Ch. 8)
12	April 12 th	Lecture: Security (Ch. 9)
12	April 14 th	Lecture: Security (Ch. 9)

13	April 19 th	Lecture: Case Study 1: Unix, Linux and Android (Ch. 10)
13	April 21 th	Lecture: Case Study 1: Unix, Linux and Android (Ch. 10)
14	April 26 th	Lecture: Case Study 1: Unix, Linux and Android (Ch. 10)
14	April 28 th	Lecture: Case Study 1: Unix, Linux and Android (Ch. 10)
15	May 3 th	Lecture: Case Study 2: Windows 8 (Ch. 11)
15	May 5 th	Lecture: Case Study 2: Windows 8 (Ch. 11)
16	May 10 th	Lecture: Case Study 2: Windows 8 (Ch. 11)
16	May 12 th	Lecture: Operating Systems Design (Ch. 12)
17	May 17 th	Class review
17	May 19 th	Final Discussion
18	May 23	Final (Closed book) – 7:15 – 9am