

**San José State University**  
**College of Science/Computer Science Department**  
**CS 149 – Operating Systems, Section 6, Spring 2023**

**Course and Contact Information**

Instructor:	Dr. Kong Li
Office Location:	Online (Zoom URL in Canvas → Syllabus)
Email:	kong.li@sjsu.edu (Email subject starts with CS149)
Office Hours:	Mon 1:30PM – 2:30PM or by appointment
Class Days/Time:	Mon and Wed 3:00PM – 4:15PM (1/25/2023 - 5/15/2023)
Classroom:	MacQuarrie Hall 222
Prerequisites:	CS 47 or CMPE 102 (with a grade of "C-" or better), and CS 146 (with a grade of "C-" or better). Computer Science, Applied and Computational Math, Forensic Science: Digital Evidence, or Software Engineering Majors only; or Instructor Consent. Students who do not provide documentation of having satisfied the class prerequisite requirements by the <b>second</b> class meeting will be dropped from the class. <b>Proficiency in C and Linux.</b>

**Course Description**

Fundamentals: Contiguous and non-contiguous memory management; processor scheduling and interrupts; concurrent, mutually exclusive, synchronized and deadlocked processes; parallel computing; files. Substantial programming project required.

Catalog Course Description is available at  
[https://catalog.sjsu.edu/preview\\_course\\_nopop.php?catoid=13&coid=116275](https://catalog.sjsu.edu/preview_course_nopop.php?catoid=13&coid=116275)

**Format**

Course lectures are in-person; no Zoom. Office Hours are always online. Exams are online but is held in-person (in classroom). We will follow the University's directive for any change to in-person modality.

Students must follow CSU COVID-19 vaccination policy to enroll in hybrid or in-person courses. You may need to [update your attestation and provide supporting documentation](#) at <https://www.sjsu.edu/medical/covid19/covid-vaccine.php>.

Students registered for a College of Science (CoS) class with an in-person component should view the [CoS COVID-19 and Monkeypox Training](#) slides for updated CoS, SJSU, county, state and federal information and guidelines, and more information can be found on the [SJSU Health Advisories](#) website. By working together to follow these safety practices, we can keep our college safer. Failure to follow safety practice(s) outlined in the training, the SJSU Health Advisories website, or instructions from instructors, TAs or CoS Safety Staff may result in dismissal from CoS buildings, facilities or field sites. Updates will be implemented as changes occur (and posted to the same links).

## Technology Requirements

- For any online exams (Midterm Exam, Final Exam, etc.), you **must** have a computer. Your computer **must** have a webcam and **must** run either Windows or macOS; Linux and Virtual Machine are not supported. If the online exam is remote (i.e., not in-person, not in a classroom), you also must have a **separate** Zoom-device running Zoom. The Zoom-device **must** have a camera and can be a smart phone, tablet, etc. SJSU has a free [equipment loan](#) program available for students.
- Students are responsible for ensuring that they have access to reliable Wi-Fi during tests. See [Learn Anywhere](#) website for current Wi-Fi options on campus.
- We will use iClicker Cloud to take attendance and conduct polls in class. To participate in these activities, you must bring a device (laptop, tablet, or smart phone) to class, and run the iClicker Student App for free or use the web browser on this device. Follow the instructions to [setup an iClicker account](#) (or use your existing one if you already have one), and [add this course to your account](#). Visit [iClicker](#) at <https://www.iclicker.com> for more information.

## Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on [Canvas Learning Management System course login website](#) at <https://sjsu.instructure.com>. Each submission of any assignment (homework, report, etc.) is “**self-contained**” and should be made on Canvas. You are responsible for regularly (i.e. every couple of days) checking with the messaging system (email, announcements, discussions) through Canvas and through MySJSU on [Spartan App Portal](#) at <https://one.sjsu.edu> to learn of any updates. Students are encouraged to use the Canvas discussion boards for collaboration.

- [Canvas information](#) at <https://www.sjsu.edu/ecampus/software-tools/teaching-tools/canvas/>
- [Canvas student resources](#) at <https://www.sjsu.edu/ecampus/software-tools/teaching-tools/canvas/student-resources/>
- If you are having problems logging on, please [submit a ticket](#) at <https://isupport.sjsu.edu>
- [View instructor’s comment](#) at <https://guides.instructure.com/m/4212/1/54359-how-do-i-view-instructor-comments>, and [view annotated comment](#) at <https://guides.instructure.com/m/4212/1/352349-how-do-i-view-annotation-feedback-comments-from-my-instructor-directly-in-my-assignment-submission>

## Course Goals

- 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

## Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

- CLO 1 Understand the role that the operating system software plays in the management of the various hardware subsystems of the computer system.

- CLO 2 Understand locality of memory reference and how it is used to perform effective memory hierarchy management.
- CLO 3 Understand the various mapping, replacement, and dynamic allocation algorithms for cache and virtual memory management.
- CLO 4 Understand the alternative CPU scheduling schemes, their tradeoffs, and their applications to other queue processing situations.
- CLO 5 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.
- CLO 6 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.
- CLO 7 Understand the various issues associated with the operating system's role in performing I/O and file management.

### BS in CS Program Outcomes (PO)

- (a) An ability to apply knowledge of computing and mathematics to solve problems
- (b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
- (c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
- (i) An ability to use current techniques, skills, and tools necessary for computing practice
- (j) 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
- (k) An ability to apply design and development principles in the construction of software systems of varying complexity

### Required Texts/Readings

#### Textbook

- A. Silberschatz, P. Galvin, and G. Gagne, *Operating System Concepts, Enhanced eText, 10/E*. Wiley, April 2018. ISBN: 9781119127482. eBook ISBN: 9781119320913.
  - <https://www.wiley.com/en-us/Operating+System+Concepts%2C+10th+Edition-p-9781119320913>
  - <https://www.vitalsource.com/products/operating-system-concepts-enhanced-etext-abraham-silberschatz-greg-v9781119320913>
  - The chapter-end exercises are not included in the print text 9781119456339 but are in the e-book
  - <https://codex.cs.yale.edu/avi/os-book/OS10/index.html>

#### Other Readings

- T. Anderson and M. Dahlin, *OPERATING SYSTEMS: Principles and Practice, 2/E*. Recursive Books, 2014. ISBN: 9780985673529.
  - <http://www.recursivebooks.com>
- W. Stallings, *Operating Systems: Internals and Design Principles, 9/E*. Pearson, 2018. ISBN: 9780134670959. eBook ISBN: 9780134700113.
  - <https://www.pearson.com/us/higher-education/program/Stallings-Operating-Systems-Internals-and-Design-Principles-9th-Edition/PGM1262980.html>
  - <https://www.vitalsource.com/products/operating-systems-william-stallings-v9780134700113>

- A. Tanenbaum and H. Bos, *Modern Operating Systems, 5/E*. Pearson, 2023. ISBN: 9780137618873. eBook: 9780137618941.
  - <https://www.pearson.com/us/higher-education/program/Tanenbaum-Modern-Operating-Systems-RENTAL-EDITION-5th-Edition/PGM100003101728.html>
  - <https://www.vitalsource.com/products/modern-operating-systems-subscription-andrew-s-tanenbaum-herbert-v9780137618941>
- Remzi H. Arpaci-Dusseau, and Andrea C. Arpaci-Dusseau, *Operating Systems: Three Easy Pieces. (OSTEP)*.
  - <http://pages.cs.wisc.edu/~remzi/OSTEP/>

Additional reading material will be distributed to the class as appropriate.

## Course Requirements and Assignments

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

**Homework:** Each homework is **individual**. Homeworks include non-trivial C programming and non-programming questions. See separate document for homework assignment.

**Exam and quiz:** Midterm Exam, Final Exam, and quiz is **individual** and will be in the form of, but not limited to, short answer questions, design questions, programming questions, etc., and will be based on the individual assignments and course material. Close book; close notes; no calculator; no cheat sheet.

## Final Examination or Evaluation

Refer to the Course Schedule for the datetime of the Final Exam.

## Grading Information

Except the final course grade which is posted on MySJSU, all other grades (assignments, projects, quizzes, exams) are posted on Canvas.

## Student Assessment

Homework Assignments and Quiz	25%
Midterm Exam	35%
Final Exam	40%

- The instructor reserves the right to change the percentages.
- **The final grade of this class is final, and is solely based on your performance in this class.**
- **Failure to obtain 50% of homework grade, or failure to take Midterm Exam or Final Exam, will result in a failing grade in this class.**
- **Receiving total 0 point for all programming questions in the Final Exam will result in a failing grade in this class.**
- **The exam dates are final.**

## Determination of Grade

Grade	Overall Score
A+	95-100

A	90-94.99
A-	85-89.99
B+	80-84.99
B	75-79.99
B-	70-74.99
C+	65-69.99
C	60-64.99
C-	55-59.99
D+	50-54.99
D	45-49.99
D-	40-44.99
F	0-39.99

### Late Penalty

Based on the clock of Canvas, assignments submitted after the deadline earn no credit. However, many exam questions are derived from assignments. It is never too late to do the assignments.

### Makeup Exam

**NO makeup exams will be given** unless (1) you are pre-approved by the instructor **before** the exam, (2) you have **urgent** medical excuse for yourself (with medical **doctor's written notes covering the exam date**), and (3) you bring the proof to the instructor **within** a week.

Your request **WILL NOT** be granted if you come back after the scheduled exam date and request a makeup exam.

### Classroom Protocol

- Dress code (in-person and Zoom): business casual.
- Students are encouraged to ask questions in the class.
- Each student is required to engage in classroom activities, submit assignments and reports on time, *and* take exams and tests on time.
- You may use your computer for class-related activity only. Web-browsing in class is not allowed.
- During any exams you must **power off** all devices (except your computer and Zoom-device); **any** form of communication is treated as cheating.
- Audio/video recording, or taking pictures are **not** allowed.
- Student causing disruption in the class will be asked to leave the class.
- Online Exam: Exams will be proctored through Respondus Monitor, and LockDown Browser. Please note it is the instructor's discretion to determine the method of proctoring. If cheating is suspected the proctored videos may be used for further inspection and may become part of the student's disciplinary record. Note that the proctoring software does not determine whether academic misconduct occurred, but does determine whether something irregular occurred that may require further investigation. Students are encouraged to contact the instructor if unexpected interruptions (from a parent or roommate, for example) occur during an exam.

Refer to a separate document "Online Course Guidelines" for more details.

### Course, Academic Integrity and Collaboration Policies

**Any course materials such as slides, homework, projects, tests, recordings, etc. are the instructor's intellectual property and you are **not** allowed to share them in any form with any one or any web site (coursehero.com, chegg.com, etc.) in this semester or any future semester.**

Participation in the course means that you fully understand the University's [Academic Integrity Policy](#) (i.e., plagiarism, cheating, and dishonesty), and agree to its provisions.

The work that you turn in must be **original** - Every single byte must come from you. You are **not** allowed to look at anyone else's solution in any form (from other students, web sites, AI tools, etc.). You may discuss assignments with instructor, grader, and your classmates, provided such discussion is at the high level **only**, and you still must write your solution yourself.

You must take reasonable steps to protect your work (source code, solution, etc.). **You must not share your work in any form with anyone or any web sites (github.com, sourceforge.net, coursehero.com, etc.) in this semester or any future semester.** Github repositories are public by default, do **not** put your code there unless you make the repository **private**. Any projects on sourceforge.net must be set to **private**.

**Each assignment submission including programming code will be checked for similarity.**

Any academic integrity incident will result in the reporting of such incident to the university office of Student Conduct & Ethical Development, will result in academic sanctions (including failing the course), as well as possible administrative sanctions, in accordance to the [University Academic Integrity Policy](#) at <http://www.sjsu.edu/senate/docs/F15-7.pdf>.

### **Spartan Support Network Referral**

Our campus has developed Spartan Support Network to bring students together with specific campus resources promoting academic success. The instructor may refer students who need academic or personal support to [Spartan Support Network](#) at <https://www.sjsu.edu/peerconnections/programs/support-network.php>.

### **University Policies**

Per [University Policy S16-9](#) (<http://www.sjsu.edu/senate/docs/S16-9.pdf>), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on [Syllabus Information web page](#) (<https://www.sjsu.edu/curriculum/courses/syllabus-info.php>). Make sure to visit this page to review and be aware of these university policies and resources.

# CS 149 Operating Systems Section 6 Spring 2023 Course Schedule

The schedule is tentative and subject to change with fair notice. *The final exam date is firm and cannot be changed.* Any changes will be announced in due time in class and on the course's web site. The students are obliged to consult the most updated and detailed version of the reading material and syllabus, which will be posted on the course's web site.

## Course Schedule

Week	Date	Topics	Textbook	HW
1	1/25	Course Logistics & Linux VM Environment		
2	1/30	Introduction	1	1/29 Prerequisite due
2	2/1	OS Structure	2	1/31 Honesty pledge due
3	2/6	OS Structure (cont'd)	2	
3	2/8	Processes	3	
4	2/13	Processes (cont'd)	3	
4	2/15	Processes (cont'd)	3	
5	2/20	Threads	4	2/20 Last day to add or drop classes
5	2/22	Threads (cont'd)	4	2/23 HW1 due
6	2/27	Synchronization	6, 7	
6	3/1	Synchronization (cont'd)	6, 7	
7	3/6	Synchronization (cont'd)	6, 7	3/5 HW2 due
7	3/8	CPU Scheduling	5	
8	3/13	CPU Scheduling (cont'd)	5	3/12 HW3 due
8	3/15	HW1, HW2, HW3 Discussion		
9	3/20	<b>MIDTERM EXAM (close book, close notes, no calculator). Bring student ID, Computer, and power adaptor.</b>	1 ~ 4, 6, 7	
9	3/22	Deadlocks	8	
10	3/27, 3/29	(no class - Spring Recess)		
11	4/3	Deadlocks (cont'd)	8	
11	4/5	Deadlocks (cont'd)	8	

Week	Date	Topics	Textbook	HW
12	4/10	Midterm Exam Discussion		4/9 HW4 due
12	4/12	Memory	9	
13	4/17	Memory (cont'd)	9	
13	4/19	Virtual Memory	10	
14	4/24	Virtual Memory (cont'd)	10	
14	4/26	Mass storage	11	4/27 HW5 due
15	5/1	Mass storage (cont'd)	11	
15	5/3	Virtual Machine	18	
16	5/8	Virtual Machine (cont'd)	18	5/8 Last office hours
16	5/10	HW4, HW5 Discussion		
17	5/15	<b>FINAL EXAM: Mon, May 15, 2023, 3:00-4:15 PM (close book, close notes, no calculator). Bring student ID, Computer, and power adaptor.</b>	5, 6, 7, 8 ~ 11, 18	

<http://www.sjsu.edu/up/docs/holiday-calendar.pdf>

Available rooms on campus for study, taking online courses, or taking exams:

<https://library.sjsu.edu/spaces-technology>

<https://www.sjsu.edu/learnanywhere/campus-resources/study-resources.php>