San José State University
College of Science/Computer Science Department
CS 149 – Operating Systems, Section 4, Spring 2021

Course and Contact Information

Instructor:	Dr. Kong Li
Office Location:	Online
Email:	kong.li@sjsu.edu (Email subject starts with CS149)
Office Hours:	Tue 3:00PM – 4:00PM or by appointment
Class Days/Time:	Tue and Thu 1:30PM – 2:45PM (1/27/2021 - 5/17/2021)
Classroom:	Online
Prerequisites:	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 second class meeting will be dropped from the class. Proficiency in C and Linux.

Course Description

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

Catalog Course Description is available at
https://catalog.sjsu.edu/preview_course_nopop.php?catoid=2&coid=6983

Format

This course (lectures, exams, office hours, etc.) is completely online via Zoom, and is taught synchronously at the specified meeting pattern. You may participate asynchronously based on class recordings, except you must attend a few specific sessions synchronously at the specified datetime. See the schedule for details.

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on Canvas Leaning 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/teaching-tools/canvas/index.html
- Canvas student resources at https://www.sjsu.edu/ecampus/teaching-tools/canvas/student_resources/

- If you are having problems logging on, please [submit a ticket](https://isupport.sjsu.edu) at https://isupport.sjsu.edu
- [View instructor's comment](https://guides.instructure.com/m/4212/l/54359-how-do-i-view-instructor-comments) at https://guides.instructure.com/m/4212/l/54359-how-do-i-view-instructor-comments, and [view annotated comment](https://guides.instructure.com/m/4212/l/352349) at https://guides.instructure.com/m/4212/l/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-13: 9781119127482.
  - The end of the chapter exercises are not included in the print text 9781119456339 but are in the e-book
  - https://www.vitalsource.com/products/operating-system-concepts-enhanced-etext-abraham-silberschatz-greg-v9781119320913
  - https://www.wiley.com/en-us/Operating+System+Concepts%2C+10th+Edition-p-9781119320913
  - 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-13: 9780985673529, ISBN-10: 0985673524.
  - http://www.recursivebooks.com

- A. Tanenbaum and H. Bos, *Modern Operating Systems, 4/E*. Pearson, 2015. ISBN-13: 9780133591620.
  - https://www.pearson.com/us/higher-education/program/Tanenbaum-Modern-Operating-Systems-4th-Edition/PGM80736.html

- W. Stallings, *Operating Systems: Internals and Design Principles, 9/E*. Pearson, 2018. ISBN-13: 9780134670959.
  - https://www.pearson.com/us/higher-education/program/Stallings-Operating-Systems-Internals-and-Design-Principles-9th-Edition/PGM1262980.html

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 both 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.

Technology Requirements

- For any online exams (Midterm Exam, Final Exam, etc.), you must have a computer and a separate Zoom-device running Zoom. The Zoom-device must have a camera and can be a smart phone, tablet, etc. Your computer must have a webcam and must run either Windows or macOS; Linux and Virtual Machine are not supported. 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. In order to participate in these activities, you must bring a device (laptop, tablet, or smart phone) to class. 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. You can use either the web browser or the iClicker Reef app for free. Visit iClicker at https://www.iclicker.com for more information.

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.

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 causal.
- 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.
- Zoom classroom etiquette: Mute your microphone; Be mindful of background noise and distractions; Position your camera properly; Limit your distractions/Avoid multitasking.
- 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.

Use of Zoom

- Camera: You must enable your camera during any online exam and project presentations. You should disable the camera during regular lecture in class.
- Recording: You are not allowed to record any class sessions (audio and video). The instructor records lecture/presentation sessions and share them with you through Canvas. You are permitted to only view recordings but not download them. These recordings will be deleted at the end of the semester.
- Online Exam: Exams will be proctored through Respondus Monitor, LockDown Browser, and recorded Zoom sessions. 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.

Academic Integrity and Collaboration Policy

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.

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, 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 any one 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 cheating 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 4, Spring 2021, 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	1/28#	Course Logistics & Linux VM Environment		
2	2/2	Introduction	1	2/1 Prerequisite due
2	2/4	OS Structure	2	2/3 Honesty pledge due
3	2/9	OS Structure (cont'd)	2	2/8 Last day to drop classes
3	2/11	Processes	3	
4	2/16	Processes (cont'd)	3	2/15 Last day to add classes
4	2/18	Processes (cont'd)	3	
5	2/23	Threads	4	
5	2/25	Threads (cont'd)	4	
6	3/2	Synchronization	6, 7	3/1 HW1 due
6	3/4	Synchronization (cont'd)	6, 7	
7	3/9	Synchronization (cont'd)	6, 7	3/8 HW2 due
7	3/11	CPU Scheduling	5	
8	3/16	CPU Scheduling (cont'd)	5	3/15 HW3 due
8	3/18	HW1, HW2, HW3 Discussion		
9	3/23#	**MIDTERM EXAM (close book, close notes, no calculator). Bring student ID**	1 ~ 4, 6, 7	
9	3/25	Deadlocks	8	
10	3/30, 4/1	(no class – Spring recess)		
11	4/6	Deadlocks (cont'd)	8	
11	4/8	Deadlocks (cont'd)	8	
12	4/13	Midterm Exam Discussion		4/12 HW4 due

Week	Date	Topics	Textbook	HW
12	4/15	Memory	9	
13	4/20	Memory (cont'd)	9	
13	4/22	Virtual Memory	10	
14	4/27	Virtual Memory (cont'd)	10	
14	4/29	Mass storage	11	4/30 HW5 due
15	5/4	Mass storage (cont'd)	11	
15	5/6	Virtual Machine	18	
16	5/11	Virtual Machine (cont'd)	18	5/11 Last office hours
16	5/13	HW4, HW5 Discussion		
17	5/18	(no class - last day of instruction 5/17)		
Final Exam	5/20[#]	**FINAL EXAM Thu, May 20, 12:15 – 14:30 (close book, close notes, no calculator). Bring student ID**	5, 6, 7, 8 ~ 11, 18	

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

https://www.sjsu.edu/classes/final-exam-schedule/spring-2021.php

[#] synchronous sessions