San José State University
College of Science/Computer Science Department
CS 149 – Operating Systems, Section 1, Spring 2020

Course and Contact Information

Instructor:	Dr. Kong Li
Office Location:	ENG 250
Email:	kong.li@sjsu.edu (Email subject starts with CS149)
Office Hours:	Tue 3PM – 4PM or by appointment
Class Days/Time:	Tue and Thu 1:30PM – 2:45PM (01/23/2020 - 05/11/2020)
Classroom:	Sweeney Hall 100
Prerequisites:	CS 146 or SE 146 (with a grade of "C-" or better). Computer Science, Applied and Computational Math 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 or SE 146 (with a grade of "C-" or better). Computer Science, Applied and Computational Math or Software Engineering Majors only; or Instructor Consent.

Catalog Course Description is available at http://info.sjsu.edu/web-dbgen/catalog/courses/CS149.html

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 http://one.sjsu.edu to learn of any updates. Students are encouraged to use the Canvas discussion boards for collaboration.

- Canvas information at http://www.sjsu.edu/ecampus/teaching-tools/canvas/index.html
- Canvas student resources at http://www.sjsu.edu/ecampus/teaching-tools/canvas/student_resources/index.html
- 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/l/54359-how-do-i-view-instructor-comments, and view annotated comment 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
    - http://www.os-book.com/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.

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 *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

- 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.

- Web-browsing in class is not allowed. Cell Phones are to be turned off during lectures and tests. During exams if you receive a cell phone call or a message of any form, it will be assumed that you have completed your exam and no further work will be allowed.
- Audio/video recording, or taking pictures are not allowed.
- Student causing disruption in the class will be asked to leave the class.

Academic Integrity and Collaboration Policy

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 any one. But any 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. You must not share or publish your solutions to any one or at any web sites (github, stackoverflow, etc.), in this semester or any future semester. You are obligated to protect your files and printouts from access. Github repositories are public by default, do not put your code there unless you make the repository 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.

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 (http://www.sjsu.edu/gup/syllabusinfo), which is hosted by the Office of Undergraduate Education. Make sure to visit this page to review and be aware of these university policies and resources.

CS 149 Operating Systems, Section 1, Spring 2020, 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	1/23	Course Logistics & Linux VM Environment		
2	1/28	Introduction	1	1/27 Prerequisite due
2	1/30	OS Structure	2	1/29 Honesty pledge due
3	2/4	OS Structure (cont'd)	2	2/4 Last day to drop classes
3	2/6	Processes	3	
4	2/11	Processes (cont'd)	3	2/11 Last day to add classes
4	2/13	Processes (cont'd)	3	
5	2/18	Threads	4	
5	2/20	Threads (cont'd)	4	
6	2/25	Synchronization	6, 7	2/24 HW1 due
6	2/27	Synchronization (cont'd)	6, 7	
7	3/3	Synchronization (cont'd)	6, 7	3/2 HW2 due
7	3/5	CPU Scheduling	5	
8	3/10	CPU Scheduling (cont'd)	5	3/9 HW3 due
8	3/12	HW1, HW2, HW3 Discussion, Review		
9	3/17	**MIDTERM EXAM (close book, close notes, no calculator). Bring student ID**	1 ~ 4, 6, 7	
9	3/19	Deadlocks	8	
10	3/24	Deadlocks (cont'd)	8	
10	3/26	Deadlocks (cont'd)	8	
11	3/30 ~ 4/3	(no class - Spring Recess)		
12	4/7	Midterm Exam Discussion		4/6 HW4 due

Week	Date	Topics	Textbook	HW
12	4/9	Memory	9	
13	4/14	Memory (cont'd)	9	
13	4/16	Virtual Memory	10	
14	4/21	Virtual Memory (cont'd)	10	
14	4/23	Mass storage	11	4/25 HW5 due
15	4/28	Mass storage (cont'd)	11	
15	4/30	Virtual Machine	18	
16	5/5	Virtual Machine (cont'd)	18	5/5 Last office hours
16	5/7	HW4, HW5 Discussion		
17	5/12	(no class - last day of instruction 5/11)		
Final Exam	5/19	**FINAL EXAM Tue, May 19, 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

http://info.sjsu.edu/static/catalog/final-exam-schedule-spring.html