San José State University
Computer Science Department
CS149, Operating Systems, Section 3, Spring 2022

Course and Contact Information

Instructor(s):   William "Bill" Andreopoulos
Office Location: Online (former MacQuarrie Hall 416)
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Email: william.andreopoulos@sjsu.edu
Office Hours: Friday 2:30-4:30
Class Days/Time: Monday and Wednesday, 12:00pm-13:15pm
Classroom: WSQ109
Prerequisites: CS 146 (Data Structures and Algorithms) or SE-146 with a grade of C- or better, or instructor's consent

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 http://sjsu.instructure.com. You are responsible for regularly checking with the Canvas messaging system to learn of any updates. You should modify the Canvas settings for notifications of announcements and discussion forum postings to be sent to you.

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.

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.

Required Texts/Readings

Textbooks

Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau. Operating Systems: Three Easy Pieces. (*OSTEP*)

This book is available online: http://pages.cs.wisc.edu/~remzi/OSTEP/

Other Readings

•   W. Richard Stevens, Stephen A. Rago. Advanced Programming in the UNIX Environment - 3rd Edition, 2013, Addison-Wesley. (APUE)

•   Robert Love. Linux Kernel Development - 3rd Edition, 2010, Addison-Wesley. (LKD)

•   A. Silberschatz, P. Galvin, and G. Gagne. Operating System Concepts - 9th Edition, 2012, Wiley. http://www.os-book.com/

•   Handouts through Canvas.

Other technology requirements / equipment / material

In this class we will use Virtual Box with Ubuntu as our programming environment for homework assignments – see Canvas for details to install it. We will use a C compiler for programming assignments. Unless otherwise stated, all homework assignments should compile and run using the class VM, which is explained on a Canvas page.

Integrated Development Environment for C - different students use different IDEs. You can choose from vi, nano, visual studio, eclipse, or cLion.

zyBooks – We will also use zyBooks for practicing C programming in-class. You can follow 3 steps to subscribe, as described on Canvas.

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.

Reading assignments: Readings will regularly be assigned for the next class (see schedule). Slides will be posted under the Canvas modules before the next class.

Worksheets: There will be worksheets with problem solving. These will generally involve coding problems (in C or bash) from the reading assignment or similar to the homework. The worksheets are a tool for you to learn the material, prepare for exams and practice coding for your future job interviews. These can be done in an IDE of your choice and submitted on Canvas.

The worksheets are graded based on effort and get graded "complete" if a reasonable solution is proposed for each problem. It is understood that a worksheet solution might be imperfect or have a few errors.

Worksheet submissions are due one week after the class. The worksheet submission page on Canvas closes after one week. Please submit what you have by the due date.

We will take time at the beginning of each class to discuss any difficulties students have in completing the worksheets from previous classes. We will also do code reviews.

Homework assignments: Programming assignments will be assigned.

More information will be given at the time of the first programming assignment. Penalty for late submission 5% for every 3 days up to 15 days; after 15 days no submission will be accepted and the submission page will be closed.

Students have the option to work in groups of two and discuss the worksheet or assignment solutions with a partner. If two students form a group, the pair of both group members will get the same grade for any worksheet/assignment they submit together. *Only one group member should submit a worksheet/assignment (to avoid double grading). If you form a group, you should indicate both your group members' names in a spreadsheet that will be given.* Students are free to leave a group, or work on their own if they prefer. Note it is optional to work with a partner.

While it is fine to discuss the worksheet/assignment solutions with your partner within your group, code solutions submitted on Canvas should reflect the students' own efforts in writing the code. *Do not write the code for anyone else. Never copy any code you find on another source, such as a website. Canvas automatically checks submissions for plagiarism from multiple online sources.* Oral examination might be requested.

All homework should be uploaded to Canvas under the proper submission page. If you send your homework via an email or message it will not be graded.

iClicker participation during class: The iClicker questions are in the form of multiple-choice and true-false questions. All students are expected to participate with iClicker. Points will be awarded based on participation and it is not necessary to get the correct answer to get credit. Please do not purchase any clicker technologies, as

they are free to SJSU students from iClicker. Students are responsible for creating a free student account at www.iClicker.com, and adding this course to their account. Detailed instructions are available on the SJSU eCampus website at https://www.sjsu.edu/ecampus/software-tools/teaching-tools/collaboration/iclicker.php . Please contact eCampus at ecampus@sjsu.edu with any questions or issues with the iClicker technology.

Midterm exams: There will be two Midterm exams during the semester.

Final exam: One final cumulative exam.

The exams will contain multiple choice questions, true/false and short answer questions. Exams are closed book, closed notes, and comprehensive. Exams are in-person unless there are extraordinary circumstances, in which case they will require access to the internet, Canvas, Lockdown Browser (on Windows or macOS machine), and Respondus Monitor (web camera). The exams should be done individually. No make-up exams except in case of verifiable emergency circumstances.

Extra credit opportunities

A student can volunteer to present his/her solution for an assignment or a worksheet in-class (either via Zoom or in person). These will take the form of code reviews, where the student walks us through his/her code solution for an assignment or a worksheet, we discuss the proposed solution and if there are better ways to solve the problem. A code review lasts for 10 minutes max. Extra credit of 1% for a student who reviews their code solution for an entire assignment or a worksheet. Students have to add their name to a code review worksheet to reserve a code review timeslot. An assignment or worksheet can only be reviewed once. A student may reserve one timeslot at a time. If, after presenting, there are other timeslots available, a student may reserve another timeslot.

If you attend one 30' of tutoring session with the embedded tutor you will receive 1%.

Determination of Grades

Final Grade is based on:

50% Assignments
20% Midterms (10% each)
20% Final
9%   Worksheets
1%   iClicker participation

Grade	Points	Percentage
A plus	960 to 1000	96 to 100%
A	930 to 959	93 to 95%
A minus	900 to 929	90 to 92%
B plus	860 to 899	86 to 89 %
B	830 to 859	83 to 85%
B minus	800 to 829	80 to 82%
C plus	760 to 799	76 to 79%

C	730 to 759	73 to 75%
C minus	700 to 729	70 to 72%
D plus	660 to 699	66 to 69%
D	630 to 659	63 to 65%
D minus	600 to 629	60 to 62%

Communication with the instructor

Students should follow the correct channels for communication. Questions should preferably be done during the regular class meeting time via Zoom or office hours. For course-related electronic communication students should use the Slack channel:

1) We will be using the course Slack channel for class discussion. The system is catered to getting you help efficiently from classmates, the TA, embedded tutor, and the instructor. Rather than emailing redundant questions to the teaching staff, students should post questions on the Slack channel where the entire class can read and benefit from the responses. If a direct message is needed students should use Slack, rather than email, since this allows the instructor to track all course-related electronic communication. The professor may re-post questions that are of general interest to the general channel or discuss them in class.

2) Students are invited to join the office hours on Friday from 2:30-4:30pm via Zoom.

Private messages sent to the instructor's other email addresses may be lost due to the large volume of emails received.

The instructor does not write messages after normal business hours, on weekends or holidays.

Reviewing code for the homework and technical trouble-shooting should be done during the office hour via Zoom.

Never email your entire code for an assignment to the instructor. The instructor will not fix all the bugs in your code. Limit the code you post to 20 lines or less.

Announcements that concern everyone, such as reminders about due dates or class policy, will be posted under Announcements on Canvas.

Embedded Tutor

Rohan Surana (rohan.surana@sjsu.edu)

Graders/TAs

Prashanth Adapa (venkatapavanprashanth.adapa@sjsu.edu)
Ravindar Reddy Siddenki (ravindarreddy.siddenki@sjsu.edu)

Classroom Protocol

Attendance (via Zoom) is highly recommended. Students do not have permission to publicly share or upload material for this course such as exam questions, lecture notes, or solutions. Course material developed by the instructor is the intellectual property of the instructor. Students can not publicly share or upload instructor

generated material for this course such as exam questions, lecture notes, hands-on exercises or homework solutions without instructor permission.

Regrading Procedure

Grades assigned are final, unless there was an error in the grading. If a student wants to request a regrade of a homework or test, please fill out the "Regrade request" form on Canvas. A request for a regrade is not a technique to drum up a few more points. If the course instructor thinks a component was scored too highly the first time, it may be lowered in a regrade. The overall grade may increase, decrease, or stay the same after a regrade request.

COVID-19 Safety

All students registered for a College of Science (CoS) class with an in-person component must view the [CoS COVID-19 Training](#) slides and the [SJSU Phased Adapt Plan](#) website and acknowledge reading them according to their instructor's directions. By working together to follow these county and SJSU safety practices, we can keep our college safer. Students who do not follow COVID-19 Safety practice(s) outlined in the training, the SJSU Phased Adapt Plan, or instructions from their instructors, TAs or CoS Safety Staff may be dismissed from CoS buildings, facilities or field sites. Please review this training as needed throughout the semester, as updates will be implemented as changes occur (and posted to the same links).

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information [web page](#) at http://www.sjsu.edu/gup/syllabusinfo/

CS149 Operating Systems, Section 3, Spring 2022

The schedule is subject to change with fair notice.

Course Schedule

Week	Topic
01/26	Introduction
01/31	Review C and the command line
02/02	Review C and the command line
02/07	Processes (**Last Day to Drop Classes without a "W" Grade**)
02/09	Process API
02/14	Direct Execution
02/16	System calls with File I/O
02/21	Interprocess Communication, Sockets, Pipes
02/23	Signals

Week	Topic
02/28	CPU Scheduling
03/02	Multilevel CPU Scheduling
03/07	**Midterm 1**
03/09	Address Space
03/14	Memory API
03/16	Free-Space Management
03/21	Paging
03/23	Swapping Policies
03/28-30	*Spring Recess – no classes*
04/04	Thread API
04/06	Locks
04/11	Lock-based concurrent Data Structures
04/13	**Midterm 2**
04/18	Condition Variables and Semaphores
04/20	Concurrency Bugs

04/25	Advanced Locks
04/27	Hard Disks
05/02	Files and Directories
05/04	File System Implementations
05/09	Review
05/11	Review
05/16	Review, wrap-up
	Final exam – Section 3: Monday, May 23, 9:45am-12:00pm