CSCE311 — Operating Systems

UNIVERSITY OF SOUTH CAROLINA

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office hours[1] — TTh 10–11 am, TTh 1–2 pm, and by appointment

Course Details

Location — Swearingen Engr Ctr 2A14

Section —	Meeting Time —
001	TTh 8:30–9:45 am
002	TTh 6:00–7:15 pm

Credit Hours — 3

Bulletin Description — Operating system structure and function; process implementation, scheduling, and synchronization; memory management; security; naming protection; resource allocation; network file systems.

Prerequisite(s) — CSCE 240 and CSCE 210 or CSCE 212

Learning Outcomes

Students will be able to:

1. Describe the major components of an operating system and state their functions and purpose.
2. Implement and use algorithms for the management and programming of concurrent processes.
3. Implement and use algorithms for resource allocation and management in computer systems.

Course Materials

Required Text — *Operating System Concepts*, 10th edition, Silberschatz, Galvin, and Gagne. Wiley, 2018.

Recommended Text — *Computer Systems - A Programmer's Perspective*, 3rd edition, Bryant & O'Hallaron. Pearson, 2016. (The 2nd edition is fine; you can find the free e-book online)

Recommended Text — *Operating Systems: Three Easy Pieces*, 1st edition, Arpaci-Dusseau & Reiher. Online (and in print), 2023. `https://pages.cs.wisc.edu/~remzi/OSTEP/`

All reading/materials comply with copyright/fair use policies.

Course Overview

All sections of CSCE 311 are synchronous and in-person. Attendance is mandatory as described in the Course Delivery section below. Students unable to attend a synchronous session will face no prescribed course penalties.

Student-to-Instructor Interaction — There will be two synchronous, in-person course meetings each week. Those meeting times and locations can be found in Course Details section, above.

Student-to-Content Interaction — Students will complete readings, submit graded assignments taken from and inspired by the course text (see Course Materials section), and take in-class exams.

Communication Response Time — While classes are in session and excluding holidays, students may expect communication to be within the following constraints:

- Project Submission feedback: five business days after submission deadline. Students should address any concerns about feedback within five business days of feedback posting.
- Exam Submission feedback: five business days after submission. Students should address any concerns about feedback within five business days of feedback posting.

Technologies and Software

Blackboard — This course relies extensively on Blackboard for posting homework, projects, and exams. Each student is responsible for monitoring posted course content.

Linux — This course uses the Linux (Ubuntu 22.04 LTS) operating system for the programming projects.

Course Activities

Projects — There will be four graded projects consisting of operating system and concurrent programming tasks. The target operating system is Linux (Ubuntu 22.04), the programming language will be C/C++, compiled using the Gnu Compiler Collection (gcc/g++). The projects are worth

Project 1 5%,

Project 2 10%,

Project 3 10%, and

Project 4 10%

of your total grade.

Projects must run on the target operating system (Ubuntu 22.04 LTS) and any submission which does not run due to portability issues WILL NOT BE CONSIDERED.

Exams: There is one midterm exam and a final exam. Both exams must be taken in-person, during the time, and in the location for the section in which a student is enrolled. Other arrangements may be made through Disability Services but must be established prior to the exam—see Students With Disabilities Resource Center section below—as usual.

The midterm exam covers any material discussed in lecture, readings, and projects up to the point of the midterm. Tentatively, it is expected to include chapters 1–7, and 18 from our required textbook[2], selected readings from our optional textbook, along with articles.

The Final Exam includes all previous material, adding textbook chapters 8–13 and additional articles. The exam is administered as indicated below.

Section	Date & Time	Location
001	Tuesday, May 2nd, 9:00 am	Swearingen Engr Ctr 2A14
001	Thursday, April 27th, 7:30 pm	Swearingen Engr Ctr 2A14

Exams consist of short-answer answer problems, are timed, and must be completed in a single sitting.

Exam attendance is mandatory. Any student missing an exam without a medical excuse and documentation from the correct medical professional will receive a grade 0. If an excuse is accepted, then the student will have the opportunity to replace the missing Exam with her/his Final Exam grade. Documentation dated after the exam cannot be accepted. Any student missing the Final Exam will receive an F for the course.

Grading[3]

Projects:	35%
Midterm:	30%
Final Exam:	35%

A	grade $\geq 90\%$	C	grade $\geq 70\%$
B+	grade $\geq 85\%$	D+	grade $\geq 65\%$
B	grade $\geq 80\%$	D	grade $\geq 60\%$
C+	grade $\geq 75\%$	F	grade < 60.0

Students With Disabilities Resource Center

Students with disabilities should contact the Student Disability Resource Center. The contact information is below:

1705 College Street, Close-Hipp Suite 102,
Columbia, SC 29208
Phone: 803.777.6142
Fax: 803.777.6741
Email: sasds@mailbox.sc.edu
Web: https://sc.edu/about/offices_and_divisions/student_disability_resource_center/index.php

These services provide assistance with accessibility and other issues to help those with disabilities be more successful. Additionally, students with should review the information on the Disabilities Services website and communicate with the professor during the first week of class. Other academic support resources may help students be more successful in the course as well.

Library Services (http://www.sc.edu/study/libraries_and_collections)
Writing Center (http://www.cas.sc.edu/write)
CarolinaTechZone(http://www.sc.edu/technology/techstudents.html)

Academic Integrity

All students must review the Office of Academic Integrity sanctions.This information may be found at USC Honor Code Sanctions One or more of the following sanctions may be imposed for Academic Integrity violations:

1. Expulsion from the University,
2. Suspension from the University for a period of no less than one semester, and/or
3. Probation.

A combination of the above sanctions may be implemented. It should be noted that submitting someone else's work is cheating and against the Carolina Code. Cheating, or any other Academic Integrity violations, will result in failure of the course for all involved parties.All parties will also be referred to the Office of Academic Integrity for additional retribution. Contact Information: Byrnes 201, 803.777.4333 https://www.sa.sc.edu/academicintegrity

In addendum, any student found to upload solutions to this class' problem set to a public repository or any plagiaristic website like Chegg or Course Hero, at any point, will receive an automatic F for this course in addition to any sanctions imposed by Academic Integrity. Such willful violation cannot be excused.

Course Delivery

This in-person synchronous course. Attendance is mandatory. Though amenities will be provided when possible, there can be no guarantee of availability to in-class materials outside of class or a guarantee of in-class submissions accepted outside of class. You will need to attend class. I cannot maintain additional online sections of courses along with the in-person sections. I do not have the resources.

Students suffering from any contagious or unknown illness should not attend class. Students should instead go to campus health and see a health professional. In addition to helping contain the spread of sickness, it will provide you with documentation for your absence or absences. Without correct documentation from a reasonable source, assignments, quizzes, and exams cannot be submitted late, made up, or dropped. With correct documentation, an Instructor of Record (in

many cases) must attempt to provide reasonable accommodations by law and University Policy.

Students experiencing emotional distress should contact Mental Health in University Heath Services. If short-term distress becomes a long-term problem, documentation may provide an avenue for consideration. Documentation of work with counselors and therapists is not listed in the prescribed reasons for excused absence, but provides documentation that may be useful in extreme cases e.g., a hardship withdrawal. Additionally, working with a counselor or therapist may allow a student to reduce or manage distress.

Schedule[4]

Date	Topic	Activities
Jan 10	Introduction	Syllabus. Textbook Chapter 1. Bryant & O'Hallaron, Chapter 1.
Jan 12	CPU mode	Textbook Chapter 2. CPU Rings, Privilege, and Protection, Duarte, 2008.
Jan 17	Processes and threads	Textbook Chapters 3 and 4. How fast should timer HZ be?. Project 1 Assigned.
Jan 19	Interrupts, exceptions, and signals.	Bryant and O'Hallaron, Chapter 8.
Jan 24	IPC for data passing.	Textbook Chapter 18. An Introduction to Linux IPC, Kerrisk 2013.
Jan 26	Synchronization based on busy waiting	Textbook Chapter 5. Synchronization by Krzyzanowski(from start to "Help from the processor").
Jan 31	Synchronization without busy waiting	Synchronization by Krzyzanowski (Section "OS mechanisms for synchronization").
Feb 02	Applications of Semaphores	The Little Book of Semaphores, Downey 2016. Chapters 1.1–3.5. Project 1 due.
Feb 07	Synchronization: producer-consumer problem	The Little Book of Semaphores, Downey 2016. Chapters 3.6, 4.1–4.2. Project 2 Assigned.
Feb 09	Synchronization review	
Feb 14	Deadlock	Textbook Chapter 7
Feb 16	CPU scheduling	Textbook Chapter 6
Feb 21	Project 2 and Midterm Exam review	
Feb 23		Midterm Exam
Feb 28	Midterm Exam discussion	
Mar 02	Contiguous memory allocation	Textbook Chapter 8 Project 2 Due.
Mar 05	Spring Break	
Mar 09	Spring Break	
Mar 14	Non-contiguous memory allocation	Textbook Chapter 8. Anatomy of a Program in Memory, Duarte 2009. Project 3 assigned.
Mar 16	Address translation	Textbook Chapter 9.
Mar 21	Address translation for paging	Textbook Chapter 9. How the Kernel Manages Your Memory, Duarte 2009.
Mar 23	Project 3 discussion	
Mar 28	Multi-level Page Table and TLB	

Date	Topic	Activities
Mar 30	Cache and Demand paging	Textbook Chapter 9. Page Cache, the Affair Between Memory and Files, Duarte 2009. Cache: A Place for Concealment and Safekeeping, Duarte 2009. Project 3 due. Project 4 assigned.
Apr 04	Page replacement	Textbook Chapter 9.
Apr 06	I/O	Textbook Chapters 10 and 13.
Apr 11	File systems	Textbook Chapter 11.
Apr 13	File systems	Textbook Chapter 12. Anatomy of the Linux virtual file system switch, M. Tim Jones 2009, Project 4 due.
Apr 18	File systems security	Linux File Permissions, chmod, & umask. Tutonics. 2012.
Apr 20	Course review	

Notes

[1]Office hours may be virtual, as necessary.
[2]See Course Materials section
[3]Grades are rounded to three decimal places e.g., 89.445% is a B.
[4]This schedule may be reordered, extended, or abridged as necessary.