Course Information

Course Number:	CSCE410/611
Course Title:	Operating Systems
Sections:	410-501, 410-599, 611-600
Time:	Tuesday / Thursday 11:10 am – 12:25 pm
Location:	Zachary 244
Credit Hours:	3

Instructor Details

Instructor:	Hamilton
Office:	Peterson 223
Phone:	979-845-2758
E-Mail:	hamilton@tamu.edu
Office Hours:	by appointment contact Jennifer Cutler at jenniferjoe@tamu.edu

Course Description

This course gives an overview of the general architecture and the most important components of modern operating systems. The student will leverage knowledge acquired in previous courses on Computer Architecture and Computer Systems to understand (and to some level implement) aspects of operating systems, such as memory management, persistent storage and file systems, threading, scheduling, and resource management in general. The student will understand fundamental approaches to virtualization and what it takes to build a distributed system. The course will cover general aspects, realization approaches, and case studies. In addition, the student will implement a simple operating system that will be able to boot and run on a bare PC.

Course Prerequisites

Prerequisites for this course are a course in Computer Organization or Computer Architecture (CSCE 312 or ECEN 350) and a course on Computer Systems (CSCE 313), or equivalent. In particular, the course assumes (a) some understanding with interrupts from a hardware perspective, (b) some familiarity with low-level programming with some instruction set and (c) some understanding of the theory and practice of multithreaded programming and synchronization.

Special Course Designation

This is a stacked course. Graduate student should expect to be assigned some amount of additional work.

Course Learning Outcomes

- Describe the role, the architecture, and the major components of an operating system.

- Describe the role and operation of exception and interrupt handling.

- Implement a virtual memory manager for a paged system.

- Describe and compare various forms of concurrency mechanisms.

- Describe and compare various synchronization mechanisms, both for single-processor and multiprocessor systems.

- Implement a kernel-level threading system for a single-processor system.

- Implement a simple device driver.

- Implement a simple file system.

- Describe the motivation for virtualization.

- Describe and compare the various virtualization approaches and their effect on system performance.

- Practical exercise on operating system hardening using the Texas Cyber Range

- Practical exercise on operating system administration using the Texas Cyber Range

Textbook and/or Resource Materials

- Operating System Concepts 9th or 10th edition, by Silberschatz, Galvin, Gagne, John Wiley & Sons, Inc., New York, 2012, ISBN-13: 978-1118063330. (Any recent edition will be fine. Reading assignments in the course will use the chapter numberings from the 9th and 10th edition. If you use an earlier textbook, you will have to map the chapters to your edition.)

- Operating Systems: Three Easy Pieces by Remzi and Andrea Arpaci-Dusseau. This book is available for free in PDF form. It can also be purchased as hardcopy.

Grading Policy

Event	Undergraduate Points	Graduate Points
Examination 1	150	150
Examination 2	200	200
Examination 3	250	250
Homework (5)	150	100
Project 1	125	100
Project 2	125	100
Project 3	Not required	100
Total	1000	1000

A = 900 points or more
B = 800 – 899 points
C = 700 – 799 points
D = 600 – 699 points
F = 599 points or less

Assignment Submissions

Homework assignments, projects and take-home exams will be posted and submitted on Canvas. It is the student's responsibility to make sure that the correct assignment is submitted to the correct place. Also, Canvas submissions may look completed when they actually are not. It is the student's responsibility to make sure that the submission process is completed. It is best to download the submission and to confirm that the submission stored on Canvas is the intended one.

Under no circumstances will the instructor team consider material that has not been part of the original submission. If a student wants to add to or correct submitted files because they noticed that the original submission was wrong or incomplete, they can do this, but this will be considered as a new submission, and any late penalty will apply. The instructor and the TA's will not consider non-submitted material, and they will not consider the file timestamps (as opposed to submission timestamps) as indication of completion of the assignment. (Time stamps of files can be easily tampered with and will therefore not be considered.)

Late Work Policy

A full letter grade cut will be imposed for every 24 hours (excluding weekends but including holidays) that an assignment is late. After 96 hours, the assignment will receive no credit.

Up to 24 hours late	1 letter grade reduction
24 - 48 hours late	2 letter grade reduction
48 - 72 hours late	3 letter grade reduction
72 - 96 hours late	4 letter grade reduction
96 – 120 hours late	F grade with some points
more than 120 hours late	F grade with 0 points

Work submitted by a student as makeup work for an excused absence is not considered late work and is exempted from the late work policy. (reference Student Rule 7)

Honor and Documentation of Submitted Work

Documentation of Project Assistance:
Assistance for all help, with the exception of syntax error resolution, must be acknowledged and placed at each specific location in the source code or documentation where assistance was received. Note that "assistance" is restricted to "advice," NOT "keying in the corrections for someone else." No student may make changes of any kind (keyboard, mouse action, etc) to another student's program. If you need further clarification, ask your instructor **before** submitting the project.

Examination Resources:
All examinations in this course will be open book and open note. You may bring and use any written references to the exams. The use of the textbook's solution manual in any form, bound, copied or electronic is forbidden.   The use of any electronic devices such as laptops, PDAs, calculators, etc. is also forbidden.

Student Honor and Academic Integrity Issues
The policies of the Student Honor Code concerning electronic copying of individual work apply to the programming assignments in this class. In general, a student must personally enter (via the keyboard) all work submitted under his/her own name. Submission of *individual* work that was created by another student and subsequently transferred (using any automated transfer facilities) to the submitting student's account **is prohibited**.   Software reuse, as described below, is permitted and will not be considered a violation of the "electronic copying" prohibition. Electronic transfer of portions of formal (i.e., instructor-designated) group projects among members of that group is also permitted.

Any output files submitted as part of a programming project must have been generated by that program. *Editing* of output files or submission of "output files" *created by an editor*, rather than being generated by the program, is clearly contrary to expectations and may very likely constitute an attempt to deceive, i.e. cheating.

Software Reuse:

Accordingly, unless otherwise instructed, reusable software components may be acquired from a variety of free software repositories available on the Internet. This type of "electronic copying" is acceptable; you simply need to document the source for the reusable software component and the method in which it was obtained. You will not be penalized for reusing this type of "library" source code.

Note, however, that other student accounts are **not** "free software repositories," and reusing code from another student is strictly prohibited.

Also note that, while you may find useful small pieces of a program in a free software repository, you should expect to develop the majority of the code used in these projects yourself. The projects are not intended to be software repository "cut and paste" exercises!

Course Schedule

Week #	Topic	Assignments	Readings (Silberschatz)
1	Introduction, OS Fundamentals		Chapter 1
2	Operating System Services	HW 1 due	Chapter 2
3	Processes	HW 2 due	Chapter 3
4	Threads and Concurrency	HW 3 due	Chapter 4
5	CPU Scheduling	Project 1 due	Chapter 5
6	Synchronization Tools	Exam 1	Chapter 6
7	Synchronization and Deadlocks	HW 4 due	Chapters 7 & 8
8	Main Memory		Chapter 9
9	Virtual Memory	Project 2 due	Chapter 10
10	Mass Storage and I/O Systems	Exam 2	Chapters 11 & 12
11	File System Interface / File System Implementation	HW 5 due	Chapters 13 & 14
12	File System Internals / Security		Chapters 15 & 16
13	Protection / Virtualization	Project 3 due	Chapters 17 & 18
14	End of course review	Exam 3	

University Policies

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to Student Rule 7 in its entirety for information about excused absences, including definitions, and related documentation and timelines.

There is no penalty for failing to attend class. The student will be responsible for all the material presented during missed lectures. Missing class does not excuse a student from turning in assignments on their due date. Early turn-ins are acceptable. A student who expects to be absent from class during an exam should notify the instructor well

prior to the absence and ensure that the absence is meets university criteria for an excused absence. Unexcused absences during a scheduled exam will result in a grade of zero for the exam.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to Student Rule 7 in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" (Student Rule 7, Section 7.4.1).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" (Student Rule 7, Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See Student Rule 24.)

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" (Section 20.1.2.3, Student Rule 20).

Texas A&M at College Station
You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact the Disability Resources office on your campus (resources listed below) Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Texas A&M at College Station
Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu.

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](#)):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Texas A&M at College Station
Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with [Counseling and Psychological Services](#) (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's [Title IX webpage](#).

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care by utilizing available resources and services on your campus

Texas A&M College Station
Students who need someone to talk to can contact Counseling & Psychological Services (CAPS) or call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the National Suicide Prevention Hotline (800-273-8255) or at [suicidepreventionlifeline.org](#).

Campus-Specific Policies

Statement on the Family Educational Rights and Privacy Act (FERPA)

FERPA is a federal law designed to protect the privacy of educational records by limiting access to these records, to establish the right of students to inspect and review their educational records and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings. Currently enrolled students wishing to withhold any or all directory information items may do so by going to [howdy.tamu.edu](#) and clicking on the "Directory Hold Information" link in the Student Records channel on the MyRecord tab. The complete [FERPA Notice to Students](#) and the student records policy is available on the Office of the Registrar webpage.

Items that can never be identified as public information are a student's social security number, citizenship, gender, grades, GPR or class schedule. All efforts will be made in this class to protect your privacy and to ensure confidential treatment of information associated with or generated by your participation in the class.

Directory items include name, UIN, local address, permanent address, email address, local telephone number, permanent telephone number, dates of attendance, program of study (college, major, campus), classification, previous institutions attended, degrees honors and awards received, participation in officially recognized activities and sports, medical residence location and medical residence specialization.

Personal Illness and Quarantine

Students required to quarantine must participate in courses and course-related activities remotely and **must not attend face-to-face course activities**. Students should notify their instructors of the quarantine requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities.

Students experiencing personal injury or Illness that is too severe for the student to attend class qualify for an excused absence (See Student Rule 7, Section 7.2.2.) To receive an excused absence, students must comply with the documentation and notification guidelines outlined in Student Rule 7.