Syllabus

Course Information

Course Information

Course Number: CSCE 410/611
Course Title: Operating Systems
Time/Location: asynchronous online (activities are on TR)
Credit Hours: 3

Instructor Details

Instructor: Riccardo Bettati Office: PETR 417 / online Phone: 845-5469 E-Mail: bettati@tamu.edu Office Hours: by email Weekly Live Session with Instructor: TBA, on zoom (link will be provided on Canvas)	Co-Instructor: Junjie Wang Office: TBA Phone: TBA E-mail: **jjwang@tamu.edu (mailto:jjwang@tamu.edu)** Office Hours: TBA Weekly Life Session with Instructor: TBA, on zoom (link will be provided on Canvas)

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, (c) some understanding of the theory and practice of multithreaded programming and synchronization, and (d) some basic familiarity with programming in C/C++.

Check out **this video** **(https://www.dropbox.com/s/pni30twrxuemsdi/CSCE_410-611-Course%20Intro-REV.mov?dl=0)** for an introduction to the course!

Special Course Designation

(none)

Course Learning Outcomes

By the end of the course, students should be able to do the following:

- 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.
- Describe the major difficulties encountered in the design of networked and distributed systems.

Textbook and/or Resource Materials

This course will be using the following two textbooks:

- 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

The course will have a **midterm** and a **final exam** (totaling 400 points). In addition, there will be a series of **design and programming assignments** (machine problems) that will walk the students through the steps of designing and developing a simple operating system (400 points). Finally there will be a set of **daily quizzes** (100 points) and a set of **homework assignments** (100 points).

The course will be using a standard letter grading scale.

Standard Letter Grading Scale:

A = 90% and above
B = 80% and above
C = 70% and above
D = 60% and above
F = less than 60%

Submissions of Assignments

Homework assignments and machine problems 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

Deadlines for on-line quizzes and homework assignments will be hard. Late submissions will not be accepted. Unless noted otherwise, lateness for machine problems is penalized with 1/5 of the earned

points per calendar day (1/3 during 10-week summer courses). Lateness penalty starts at the deadline and is pro-rated. This means that the student will incur a penalty of approximately 0.0139 percent for each minute that their submission is late (0.0231 percent during 10-week summer courses). **No make-up work submissions will be accepted.**

Course Schedule

Table of Weekly Activities and Due Dates of Major Assignments

Week	Day	Topic	MPs
1 Aug 21 - Aug 28	Tues Thurs	-- Project Setup, **OS:** Intro, What is an OS?	MP1 out
2 Aug 29 - Sep 4	Tues Thurs	Arch Support, OS Structure System Calls, Interrupts and Exceptions on x86	MP1 due
3 Sep 5 - Sep 11	Tues Thurs	**Memory:** Intro, Memory Allocation Paging, Advanced Paging	MP2 out
4 Sep 12 - Sep 18	Tues Thurs	TLBs, Paging on the x86 Segmentation, Beyond Physical Memory	MP2 due
5 Sep 19 - Sep 25	Tues Thurs	Virtual Memory Mechanisms, Rec. PT Lookup on x86 Virtual Memory Policies I	MP3 out
6 Sep 26 - Oct 2	Tues Thurs	Virtual Memory Policies II **Threads:** Intro, User-level View, Thread Dispatch on x86	MP3 due
7 Oct 3 - Oct 9	Tues Thurs	Scheduling Kernel vs. User Threads, Threads vs. Events	MP4 out
8 Oct 10 - Oct 16	Tues Thurs	**FALL BREAK** **MIDTERM EXAM (Thursday, October 12; Time TBD)**	
9 Oct 17 - Oct 23	Tues Thurs	**Synchronization:** Intro, SW Solutions to Critical Sections HW Solutions to Critical Sections	MP4 due
10 Oct 24 -	Tues Thurs	Concurrent Data Structures Atomic Transactions	MP5 out

Oct 30			
11 Oct 31 - Nov 6	Tues Thurs	**I/O:** Intro, IO Management and Device Drivers, Disks RAID	MP5 due
12 Nov 7 - Nov 13	Tues Thurs	Flash Memory **File Systems:** Intro, File System Allocation	MP6 out
13 Nov 14 - Nov 20	Tues Thurs	UNIX File System UNIX Fast File System	MP6 due
14 Nov 21 - Nov 27	Tues Thurs	Journaling in File Systems **THANKSGIVING**	MP7 out
15 Nov 28 - Dec 4	Tues Thurs	Log-based File Systems **Virtualization:** Intro, Virtualization Mechanisms	
16 Dec 5 - Dec 11	Tues Thurs	Memory Virtualization **FINAL EXAM (MONDAY, Dec 12; TIME TBA)**	MP7 due on Thursday, Dec 8

Note: Machine Problems are posted on Monday morning of the week where they are listed. They are due on Sunday night of the week where they are listed. **MP7 is due on Thursday, Dec 8**. In order to allow for a timely grading, the due date for MP7 is **hard**.

Note: Exams will be held on-line. The midterm exam will be on October 12 and the final exam will be on December 12. Because asynchronous online courses don't have a designated exam time, we will send out a survey to determine a generally acceptable slot to hold the exam(s). Stay tuned...

Homework assignments are posted on the Friday of the week where they are listed. Their due date is the next Thursday.

Quizzes are posted with the modules and are typically due on Saturday of the same week.

University Policies

Attendance Policy

Classroom: The class work for this course will be delivered completely on-line, and students are not required to be present on campus. Students will study on-line learning modules on Canvas and regularly submit assignments to demonstrate mastery of the material.

Exams: (midterm and final) will be held on-line, using a proctoring service. Details will be made available on Canvas.

Exams are scheduled at the beginning of the semester, and make-up exams are given only in extraordinary circumstances. Two such cases are:

- **Medical:** If a student cannot take an exam because of medical reasons, a doctor's note is required in order to schedule a make-up exam (See Student Rule 7 for details). (This may change as the semester progresses.)
- **Mandatory Interviews:** If a student has to schedule a makeup exam because of a "mandatory" interview for employment or professional or graduate school, she or he has to submit a written note from the organizer of the interview stating that the interview is in fact mandatory and cannot be held at a different time. This note must be submitted to the instructor at least 2 weeks before the interview, and it must contain the contact information, including email and telephone number, of the person responsible for the interview. The instructor will then contact the organizer and confirm that the interview cannot be rescheduled.

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 (https://student-rules.tamu.edu/rule07/)** in its entirety for information about excused absences, including definitions, and related documentation and timelines.

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 (https://student-rules.tamu.edu/rule07/)** 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 (https://student-rules.tamu.edu/rule07/)).**

"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 (https://student-**

rules.tamu.edu/rule07/)).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. **(See Student Rule 24 (https://student-rules.tamu.edu/rule24/)).**

Academic Integrity Statement and Policy

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

You are encouraged to discuss solution approaches to programming assignments. The solution that you hand in has to be your own, however. This means that you are not to use any part (code, text, figures, etc.) that has been developed by others. Spelled out, this means:

- For programming assignments: Do not show or make available in any form to other students either design documents or code. Do not look at or use other students’ design documents or code. Do not make use of previous years’ solutions. Do not look at or download solutions from the Internet.
- For homework: Do not make your homework available to other students. Do not copy from other students’ work. Do not look at or download solutions from the Internet.
- For exams: Do not use any information from sources other than the exam form and allowed cheat sheets; disallowed source of information include the Internet, books, notes, or other students. Do not pass any information to other students. By information we mean any information, not even the time-of-day.

How do we determine that plagiarism has happened? We will delegate our decisions to code-similarity detection tools and automated plagiarism detection tools. Whenever a tool flags your submission, we will treat it as a potential violation, and we will issue a report to the Aggie Honor System Office. So, to be safe, stay away from other students’ code and other solutions that are not your own!

Once an alleged violation has been reported, it is Aggie Honor Systems Office policy to not allow the student to Q-drop the course until the student is cleared of the violation.

“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 (https://aggiehonor.tamu.edu/Rules-and-Procedures/Rules/Honor-System-Rules)**).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at **aggiehonor.tamu.edu (https://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 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.

Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit ***disability.tamu.edu*** **(https://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 (https://rules-saps.tamu.edu/PDFs/08.01.01.M1.pdf)**):

- 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.

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with ***Counseling and Psychological Services*** **(https://caps.tamu.edu/)** *(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*** **(https://titleix.tamu.edu/) .**

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.

*Students who need someone to talk to can contact **Counseling & Psychological Services (https://caps.tamu.edu/)** (CAPS) or call the **TAMU Helpline (https://caps.tamu.edu/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 (https://suicidepreventionlifeline.org/)**.*