COMP 7500/7506 Advanced Operating Systems

Syllabus

Term: Spring 2021. Schedule: MWF, 9:00 – 9:50 a.m.
Classroom: Shelby 1120
Zoom Virtual Classroom ID: 137 568 624

Instructor: Dr. Xiao Qin (xqin@auburn.edu)
Office: 3101E Shelby Center
Office Phone: 334-844-6327
Office Hours: MWF, 1:30 – 2:30 p.m.
Zoom Virtual Office ID: 334 444 8888

TA: Christian Kauten (jck0022@auburn.edu)
Office Hours: TR, 3:30 - 5:00 p.m.
Zoom Virtual Office ID: 836 7073 5665.

Instructional Mode: Face to Face Flexible

The instructional mode for this course is *Face-to-Face Flexible*. In brief, this means that at least half of the contact hours for this course will involve in-person activities; you will be expected to attend all such activities but required to attend none. The details of this are as follows.

- *Lecture meetings*: Each Monday, Wednesday, and Friday I will hold an in-person class meeting during the scheduled lecture time (11:00 AM CT - 11:50 AM CT). This in-person class meeting is optional but encouraged. A maximum attendance of 50% room capacity will be strictly enforced. The online version will be both synchronous and asynchronous.
- *Exams and Tests*: Each of the three exams will be given online in a window of four days.
- *Office Hours*: Instructor office hours will be held via Zoom from 1:30 to 2:30 p.m. on Monday, Wednesday, and Friday. Zoom Office ID is 334-444-8888.

In case you are unable to attend lectures on campus, I encourage you to join Zoom virtual classroom (ID 137568624) from 9:00 to 9:50 a.m. on Monday, Wednesday, and Friday to participate in learning activities like *Menti* interactive experiences and real-time discussions. University safety guidelines, including those for personal protective equipment and physical distancing, will be strictly observed during all face-to-face class meetings. Failing to adhere to these guidelines will be considered a violation of the University Policy on Classroom Behavior.

Contingency Plan (Syllabus B)
In case (1) Dr. Qin has any COVID-19 symptom or (2) Auburn University closes on-campus operations, the instructional modality will be immediately switched to "Online Synchronous". The Zoom virtual classroom ID is 137568624. In this mode, you are expected to participate remotely during the scheduled class time over Zoom. The following are the synchronous activities: (1) Menti interactive quizzes, (2) Canvas Quizzes, and (3) Real-Time Chat.

Required Text:
- Operating System Concepts 9th Edition, Authors: Abraham Silberschatz, Peter B. Galvin, and Greg Gagne. ISBN-13: 978-1118063330, ISBN-10: 1118063333.

Optional Text:
- Operating Systems, Publisher: Pearson, 8th Edition, Author: Stallings, Publication Date: Jan. 1, 2014. ISBN 9780133805918
- Operating Systems (3rd Edition) 3rd Edition Author: Gary Nutt. ISBN-13: 978-0201773446, ISBN-10: 0201773449

Course Description

Course Objectives

This course aims to
- educate students on the advanced concepts and topics of operating systems;
- introduce the data storage management and file system implementation; and
- present the design of virtual machines and distributed systems.

On completion of the course, students should be able to:
- know the inter-process communication technologies
- understand the essential concepts of threads;
- build and evaluate CPU scheduling algorithms;
- design frame allocation strategies;
- learn the design of mass-storage structure;
- implement a simple file system;
- evaluate operating system performance;
- demonstrate ability to program at low levels.

This course typically requires at least 9 hours of time per week, on average for the average student. If you don't have it, drop.

Prerequisite:
- COMP 2710 Software Construction
- COMP 3350 Computer Organization and Assembly Language Programming
- COMP 3500 Introduction to Operating Systems

Topic List (not necessarily strictly in chronological order; these topics may change)
- Administrative Stuff
- Interprocess Communication
- Threads
- Advanced CPU Scheduling Algorithms
- Allocation of Frames
- Memory-Mapped Files
- Allocating Kernel Memory
- Mass-Storage Structure

- File System Mounting
- File Sharing
- File Protection
- Free-Space Management
- Cryptographic File Systems
- Secure Storage Systems
- File System Performance
- I/O Systems
- Virtual Machines
- Distributed Systems

Assessment

Exams: Midterm Exam and Final Exam
Exams will be closed book, closed notes. Questions will be derived from lectures, material taught only in class, and from assignments. Question format will be mixed.

Short Homework Assignments and Activities: Two homework assignments
These activities will be take-home in nature and designed to reinforce concepts taught in class. An electronic copy must be submitted through the Canvas system. Generally, these assignments are designed to be low-risk in the sense that they are designed to assess thinking and effort, rather than to strictly punish errors.

Individual Programming Projects: Four programming projects
- There will be four programming assignments
- Assignment solutions will be submitted in C code. All projects should be made to compile under the gcc compiler on Linux.
- **You may use any development platform or compiler, but your projects will be graded ONLY on a gcc compilers running on Linux. If your project does not work in that environment, you will NOT get credit. Always test your programs on a Linux machine!**
- I reserve the right to assess other penalties for any errors not strictly covered in the above rubric. I also reserve the right to give bonus points for exceptional work.

Grades:
- Mid-term Exam   20%
- Final Exam   20%
- Quizzes   10%
- Homework   10%
- Programming Projects   40%

A [88, 100], **B** [78,88), **C** [68,78), **D** [58,68), **F** [0,58)

Note: In order to pass the class, you must receive at least 60% credit on the Individual Construction Projects, regardless of performance on exams.

Course Policies

Quiz Policy: There will be 10 popup quizzes in this semester. If you miss a quiz regardless of reasons, **no makeup quiz** will be offered. The two lowest quiz scores will be dropped from the calculation by the end of this semester.

Makeup Policy for Exams: There will be no make-up exams except through arrangement with Dr. Qin **24 hours prior to** the exams. There is no guarantee that your request will be granted.

Scaling, Curves, etc: Grades may be (not guaranteed) scaled, curved, or adjusted arbitrarily. Some opportunities for bonus points may be provided to the entire class at Dr. Qin's discretion.

Project Due Dates: Projects will be submitted through Canvas. Projects will always be due at 11:59 pm on the due date. Deadlines will be made as generous as possible to *a priori* take into account illness, other courses, Acts of God, and nearly all conceivable excuses. If you have a documented illness preventing you from completing your assignment, you may submit all of your partial work and request an extension. **This extension is not automatic**.

Late Submission Penalty
- Ten percent (10%) penalty per day for late submission. For example, an assignment submitted after the deadline but up to 1 day (24 hours) late can achieve a maximum of 90% of points allocated for the assignment. An assignment submitted after the deadline but up to 2 days (48 hours) late can achieve a maximum of 80% of points allocated for the assignment.
- Assignment submitted more than 3 days (72 hours) after the deadline will not be graded.

Rebuttal Period: You will be given a period of a week (i.e., 7 days) to read and respond to the comments and grades of your homework or project assignment. The TA may use this opportunity to address any concern and question you have. The TA also may ask for additional information from you regarding your homework or project.

Email Policy: Your questions posted through emails are less likely to be answered (see the **Piazza** Section below), because the questions by emails cannot benefit other students. Dr. Qin will answer homework and project questions on Piazza and Canvas. If a student asks a particularly relevant question, I will post the response on **Piazza** in Canvas for the benefit of the entire class. You are responsible for all announcements made in class or electronically. You should read your Canvas information at least once every two days.

Piazza: We will adopt Piazza for class discussion. Piazza is highly catered to getting you help fast and efficiently from peer COMP3500 students, the TA, and Dr. Qin. Rather than sending questions to me through emails, you should post your questions on Piazza.
Find our class page at: https://piazza.com/auburn/spring2021/202120comp7500001/home

Special Accommodations: A student in need of special accommodations must bring that need to my attention within the first two weeks of class. The need must be properly documented.

Academic Integrity: Students will be expected to understand and follow Academic Honesty policies in place by the university. Programming projects and written assignment are completed in teams of two.

Students may discuss with their friends about general approaches to solving problems and writing programs. Students in one group should NOT share any project code or even detailed algorithm information with students in other groups. Your programming code is exclusive to you and your group. Please do not attempt to recycle code from the Internet (plagiarism). Any instance of suspected cheating or plagiarism will be referred to student judicial affairs.

Approved references:
The following constitute acceptable references to help you to complete assignments.
- The course textbook is always approved and content may be used without citation.
- My course notes, lectures, and advice I give in my office may be used without citation
- Online general web references are fine, provided you give a citation for the website at the top of your code AND clearly label any lines of code that you use (it should never be ambiguous which lines of code you used from a website)
- Other books/textbooks on the language are fine, but require citations
- You are allowed to discuss broad conceptual ideas (for example, the idea of polymorphism) with other students, but never to share code. If you discuss something with another student (even casually), you should always cite that reference in clear terms.

Unapproved references (these constitute Academic Dishonesty):
This is not a complete listing and cases of ambiguity should always be referred to the instructor for approval prior to use.
- Solution manuals for the text (or the like)
- Websites that sell custom code to individuals
- Code written by others (students or otherwise) for this class or similar classes
- Anything not listed under "Approved References" or approved by the instructor

You MUST document references clearly. If you discuss a project with another student or professor, you should indicate what you discussed and who you discussed it with clearly in the header of your project documentation (and/or code).
For example:
//Xiao Qin
//Project2.cpp
//Dr. Homer Carlisle helped me debug a syntax error in my 'for' loop.
//I used Wikipedia.org in order to learn how a genetic algorithm works.
//I spoke with Bob Smith in the class about identifying objects in C++.
If you don't need any sources for an assignment, clearly state "I did not use any external sources for this assignment" in your source code. Failing to document sources is plagiarism and will be penalized. If you are unsure whether or not to document a source, it is better to document. Breaches of Academic Honesty will be referred to the Academic Honesty Committee and the strictest sanctions possible (including expulsion and failure) will be my recommendation. **If you are ever unclear about whether or not a course of action is unacceptable, you are always encouraged to consult the instructor.**

Attendance: You are responsible for all material and announcements presented in class (even if absent).
1) For exams:
a. if you have a planned university-approved absence you must make me aware before the test in writing (with appropriate documentation).
b. if you an unplanned absence, you must provide written, documented, and verifiable justification.

c. Make-up exams will be different from the original exam.
2) If you are late for a test, you do not receive any extension.
3) Consistent attendance is typically essential to obtaining a good grade (C or better) in COMP3500.

Excused Absence: Engineering Student Services provides excused absence memos to students who present verifiable documentation related to university excused absences. The steps for obtaining an excused absence memo are as follows:

1) The student submits the request form using this link: https://aub.ie/EngAbsence
- Students submit documentation of the reason for the absence
- Students must read and acknowledge the excused absence policy

2) The ESS office staff processes the requests and verifies authenticity of documentation provided by student, as well as the dates of the absence (s).

3) Assistant Dean determines if the documentation meets the standard for a university excused absence or if the documentation warrants consideration by the professor

4) An official memo is sent directly to professors via email regarding the student's absence

NOTE: The ESS office does not process excused absences for red screens from the GuideSafe app. Students receive a notification email related to the "greater risk" red screen instructing them not to come to campus. Students can provide this email as documentation for Covid-related absences.

Reading: Students are expected to read the appropriate sections of the book before each lecture.

Getting Help: Project assignments are challenging and time-consuming. You are always welcome to bring questions concerning labs to the class, as well as to office hours. A good strategy is to always start early on projects, so that if you run into difficulties, you can get help as soon as possible. I will do my best to answer e-mails concerning labs within 48 hours of receiving them; however, I do not guarantee that I will always have time to debug code via e-mail (I prefer not to do so). For time-consuming problems dealing with code, office hours are always preferable. I will not help debug code via e-mail on the day an assignment is due. The Blackboard Discussion Board is a great way to ask questions so that everyone benefits from the answer to your question!

Office Hours: You are always welcome to drop by during office hours to discuss projects or general concepts. To get urgent help or advice out of office hours, it is recommended to send an email in advance to make an appointment.

Course Difficulty: The course starts off relatively easy and gets harder as time goes on. Often, students are deceived by the (slower) initial pace and develop lazy habits at the beginning of the course. By mid-semester, they have thrown away many grade opportunities and find themselves in a bad situation with respect to grades. No amount of effort at the end of the class will compensate for consistent, dedicated effort throughout the class. Whether or not you have past experience with programming (or even with C++), my strongest recommendation is that you respect the class and come to class ready to engage every single class period. If you do this, you will dramatically increase your chances of success.

Study Hints
- Ask questions in class.
- At the first sign of difficulty, talk to your instructor and the teaching assistant.
- Form a study group and meet regularly.

- Construct chapter summaries noting concepts, definitions, & procedures.
- Embark on homework and project assignments as earlier as possible.

What's new?

Dr. Qin has been striving to enhance COMP7500 students' learning experience by regularly upgrading course teaching materials. In what follows, you may find a summary of new or updated items in the COMP7500 learning package.

What's new in the Spring 2019 semester?

1. The "What's new" document (i.e., see this file)
2. New peer learning strategy
3. Updated course schedule
4. Updated Plicker exercises
5. Updated lecture handouts
6. Updated lecture slides
7. Updated project FAQs
8. Updated announcements
9. Updated kickoff lecture
10. New popup quizzes on Canvas
11. New reflective writing exercises
12. New magic shows

What's new in the Spring 2018 semester?

1. The "What's new" document
2. Updated the kickoff lecture
3. Updated syllabus and course schedule
4. Updated Plicker exercises
5. New project specifications
6. New homework assignments
7. New lecture handouts
8. New lecture slides
9. New modules in Canvas
10. New subfolder in the file section of Canvas
11. New regular announcement
12. New communication channel through Piazza
13. Keep track of attendance rates
14. One magic show
15. Mock midterm exams