Foundations of Computer System Software (Operating Systems)

Course Description

Introduction to operating systems concepts, principles, and design. Topics include: processes and threads, CPU scheduling, mutual exclusion and synchronization, deadlock, memory management, file systems, security and protection, networking, and distributed systems. Selected existing operating systems are discussed, compared, and contrasted.

Learning Objectives

Upon completion of this course, students will be able to...

1. Understand the functionality operating systems provide, basic operations and services
2. Understand the design of various operating systems, system calls, kernel and user modes, operating system structures, virtual machines, and the system boot process
3. Understand the concept of a process, process scheduling and inter-process communication
4. Understand the concept of a thread, multi-threading models and libraries
5. Understand the concepts of CPU scheduling, scheduling criteria, and scheduling algorithms
6. Understand various aspects of process synchronization including the critical section problem, Peterson's solution, synchronization hardware, and semaphores. Classic synchronization problems will also be explored.
7. Understand the system model and characteristics of deadlocks and methods of handling deadlocks (prevention, avoidance, detection, recovery)
8. Understand the structures for main memory including swapping, paging, and segmentation
9. Understand the structures for virtual memory including demand paging, page replacement algorithms, frame allocation, and thrashing
10. Understand the concepts related to the file system interface and file system implementation including free space management, efficiency and performance
11. Understand the concepts related to mass storage structures such as disk structure, attachment, and scheduling and including the various RAID architectures

Prerequisites

Successful completion of Computer Architecture (COSC 2334) and Data Structures (COSC 2347). Strong knowledge of C/C++.

Major Course Requirements

Homework and Quizzes (40%): There will be weekly assigned homework throughout the semester. Weekly or bi-weekly quizzes will be used to verify students are reading the textbook and completing the assigned homework. There will be
approximately 4-5 programming projects. Unless otherwise directed, the programming projects must be written in C/C++. The projects will be submitted electronically and the details on project submission will be given to you together with the project assignment.

Exams (60%): There will be three exams (on approximately the 6th, 11th, and finals week).

**Required or Recommended Readings**


**Websites:**
http://www.sci.tamucc.edu/~mscherger/OS

**Course Policies**

**Attendance / Tardiness**
Attendance and active participation during lecture will help you succeed in the course.

**Grading Scale**
A=90-100  B=80-89  C=70-79  D=60-69  F=0-59

**Late work and Make-up Exams**
All homework and programming projects are due one the assigned date and time. Furthermore, all programming projects must be submitted (and grade received) “in order” (i.e. you cannot submit project 3 without having a grade for project 2). Late projects will be accepted with a 10% penalty per calendar day.

You will have adequate time to complete each assignment (homework or programming project) or exam. However, you should begin working on each assignment early so that you will have plenty of time for debugging which may take significantly longer than the initial code writing. Waiting to start coding until the night before the project is due is a bad idea.

No late homework will be accepted. No make-up quizzes. Late programming projects will be accepted with a penalty of 10% per calendar day. No late exams. No make-up exams.

**Extra Credit**
Some programming projects may have extra credit opportunities. These will be described in the programming project description and made available for everyone in the class. Extra credit opportunities will not be made available at an individual student basis.
Cell Phone/Electronic Device Usage
Please turn off cell phones and other related electronic devices. You may use a laptop during lecture so long as the applications are course related. Please refrain from using email, chatting, or updating social networking sites.

Academic Integrity / Plagiarism.
University students are expected to conduct themselves in accordance with the highest standards of academic honesty. You are expected to avoid all forms of academic dishonesty as defined in the current Catalog. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) This includes NOT sharing code for the individual lab assignments! If you feel uncertain about a particular activity, please speak to me BEFORE problems arise. You are not allowed to work with someone else to actually solve the assignment, or to write code (even pseudo-code) for a program, and you are certainly not allowed to copy anyone else's solution!

Unless otherwise stated on the assignment sheet, all graded material must be completed individually. Students may give each other general advice, but they may not share algorithms, final answers, or program source code. I strongly believe that discussion with your peers is an excellent way to learn.

Finally, you should be careful not to give others access to your code. This means that you should not keep your program in a publicly accessible directory, you should not leave your terminal unattended, and you should not forget to pick up your printouts.

In this course, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in failure of the course (grade ‘F’).

Student Computer and Networking Security Statement
Please be sure to read the student computer and networking security statement. A copy (link) of this can be found on our course web page.

Dropping a Class
You must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the current academic calendar for the last day to drop a class with an automatic grade of “W” this term.

Grade Appeals
As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.
Disabilities Accommodations
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

Academic Advising
The College of Science and Technology requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. The College's Academic Advising Center is located in Faculty Center 178, and can be reached at 825-6094.

Syllabus
(subject to change)

Week 1 Course Overview, Computer System Overview
Week 2 Computer System Overview, Operating System Overview
Week 3 Operating System Overview
Week 4 Process Description and Control
Week 5 Process Description and Control, Threads, SMP, and Microkernels
Week 6 Threads, SMP, and Microkernels, Exam 1
Week 7 Concurrency: Mutual Exclusion and Synchronization
Week 8 Concurrency: Mutual Exclusion and Synchronization, Concurrency: Deadlock and Starvation
Week 9 Concurrency: Deadlock and Starvation
Week 10 Exam 2, Memory Management
Week 11 Virtual Memory
Week 12 Uniprocessor Scheduling
Week 13 I/O Devices and Disk Scheduling
Week 14 File Management
Week 15 TBD
Week 16 Final Exam