Operating Systems Design - 44088 - CSCI 470 - 001 - Spring 2017

Class 2:00 pm - 2:50 pm MWF Wubben Hall and Science Center 120

Jan 17, 2017 - May 11, 2017 Lecture Warren MacEvoy

Instructor and Communication Information

Instructor	Dr. Warren D. MacEvoy
Office	WS 119F
Phone	970-248-1070 email is preferred.
Email	**wmacevoy@coloradomesa.edu - have a clear subject line!**
Office Hours	9:30-10:20 AM Tuesday and Thursday WS 119F 1:00-1:50 PM Monday, Wednesday and Friday WS 119F
Communications Policy	I check email daily. You must have a clear subject line or I will probably skip the email.
Assignment Grading and Feedback	The instructor will attempt to return grades and feedback on your assignments within two weeks after the due date. Since these assignments are large virtualized systems, your assignment will often come from a demonstration of the configured system(s).

Course Information

Course Title	Operating Systems Design - 44088 - CSCI 470 - 001 - Spring 2017
Class Time	2:00 pm - 2:50 pm MWF
Classroom	Wubben Hall and Science Center 120
Prerequisites	CSCI 250 Data Structures and CSCI 330 Programming Languages
General Education Requirements	*None.*
Drop Date	February 1

Credit Hours	3 (45 contact hours)
Lecture Hours	3
Lab Hours	0
Other Hours	0

Course Catalog Description

Advanced programming techniques using the object-oriented paradigm, with emphasis on abstractness of design, encapsulation, inheritance, and polymorphism. Additional topics include design tools and methodologies for determining classes, responsibilities, collaborations, and hierarchies. Prerequisite: CSCI 250.

Required Text and Supplies

Modern Operating Systems, by Tanenbaum, 3rd edition.

Lesson/Instructional Materials

It would be helpful to install VMWare or VirtualBox on your system and Ubuntu 16.04 Desktop.

Learning Objectives

Learning the theory and practice of accomplishing what is in the course description.

Methods of Evaluation/Grading Policy

Grade Items	**Percent (or points if not using weighted categories) of Final Grade**
Projects	40%
Exams	40%
Final Project	20%

GRADING	**SCALE**
A	90 -100%

B	80 - 89%
C	70 -79%
D	60 - 69%
F	Under 60%

Assignments

You will be asked to build demonstration versions of OS ideas on various operating systems. You will also be asked to create and present some self-defined topic of operating systems which has not otherwise been covered in class.

Testing Statement

This is more of a traditional class with tests that go over both reading and lecture material.

Supplemental Help

If you wish to discuss academic accommodations, please contact me as soon as possible. Specific information about Educational Access Services and the Tutorial Learning Center is included under General Student Services in this Syllabus.

Attendance Policy

Let me know ahead of time if you can't be here for a due date or exam.

Course Correspondence

All communication in this course will be made via your CMU email account. Please include the title of the course and section number in the subject line (i.e, CSCI 470 - useful subject line) Check your email regularly throughout the semester. I will respond within 48 hours.

Plagiarism and Academic Integrity

Academic dishonesty is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another or uses unauthorized material or fabricated information in any academic exercise. Academic dishonesty also includes, but is not limited to: (1) Forgery/fabrication/falsification/plagiarism of academic documents; (2) Intentionally impeding or damaging the academic work of others; (3) Assisting others in acts of academic dishonesty; (4) Cheating in the classroom; (5) Unauthorized attendance; (6) Multiple submissions; and (7) Unauthorized collaboration. Any academic misconduct may be reported to the Department Head and Office of Academic Affairs and may result in a failing grade, suspension, or dismissal.

These policies are outlined at:

http://www.coloradomesa.edu/academics/policies/academic_integrity.html

Netiquette

"Netiquette" refers to the etiquette by which you should abide when using online services for your classes and campus communications. This includes email, social media, online chat, blogs, online discussions or message boards, instant messages, etc. Although you are participating in course activities and using course materials online, the CMU Student Code of Conduct still applies. Online participants are expected to behave in a respectful manner that is supportive to other learners, participants, and faculty.

Online behavior should foster an environment that is productive and thoughtful. Netiquette provides guidelines for facilitating this positive atmosphere. Some basic principles of netiquette include:

- **Be respectful.** Remember that you are communicating with actual people. Be courteous and show respect, even if you have differences of opinion. Remember to treat others as you'd like to be treated. Good manners apply online as well as in the traditional classroom.

- **Think before you post.** Follow posting directions and examples. Be aware of who may be able to view your posting, and how your post may be interpreted. Try to maintain a fair and objective tone.

- **Stay on topic.** Make sure your communication is related to the subject and does not wander off-topic. Ask questions that are appropriate and relevant to the topic. Keep academic discussions free of "chit-chat".

- **Write clearly.** Even though the online environment may seem more informal than your face-to-face class, you are still in an academic course and mature communication is expected. Correct spelling and grammar are required. Proper sentence structure and punctuation should be used. Avoid abbreviations and "text speak."

- **Use appropriate language and style.** Profanity or offensive wording is not acceptable. ALL CAPS and repeated punctuation (???? or !!!!) is considered rude and should be avoided. While it is okay to have robust discussions and differences of opinion, avoid inflammatory wording 'flaming' that might start arguments. To disagree, use language that encourages intelligent discourse and discussion. Ignore statements by others that

appear inflammatory.

- **Be considerate of others.** Do not make derogatory, condescending, or harassing remarks. Communication should be well-intentioned and well-articulated. It should foster a positive learning environment. Be aware of how sarcasm may be misinterpreted by your readers. Bullying, threatening, or abusive language will not be tolerated.

- **Allow for misunderstandings.** Keep in mind that writing can often convey the incorrect tone or intention. Make allowances for unintended rudeness or misunderstanding.

- **Cite your sources.** If you post work that is not your own or contains work that is not your own, be sure to reference your sources.

- **When in doubt, do not send or post.**

Technology & Technology Skill Requirements

You will need basic computer skills and should be comfortable using a word processing program, browsing for files, and copying and pasting between programs. You will need a computer that connects to the Internet. Your username and password are required for access. If you do not own a computer or if your computer malfunctions during the term, you will be expected to identify a computer to use. Technology issues are not an excuse for missed or late work.

Colorado Mesa University strongly prefers students use the following technology minimums: DSL/Cable modem and high-speed Internet connection, Microsoft Windows XP or later, Microsoft Office 2003 or later, and Java Runtime Environment 7.

Technical Help

If you experience a technical problem, call the Help Desk at (970) 249-2111 to receive technical support in the following areas:

- Usernames and passwords
- Desire2Learn
- MavZone
- Microsoft Office products
- Connecting to the wireless network
- Desktop computer hardware installation and troubleshooting
- Desktop software installation and troubleshooting
- Network file storage

For more information, visit the CMU Help Desk website at:
http://coloradomesa.edu/it/helpdesk.html

Withdrawal Statement

Regular class attendance is expected. CMU is required by law to verify the enrollment of students who participate in Federal Title IV student aid programs and/or who receive educational benefits through other funding sources. CMU is responsible for identifying students who have not attended or logged into a class for which they are registered. At the conclusion of the first week of a semester, instructors will report any registered students who have "Never Attended" a class so that those reported students will be administratively withdrawn from that class. However, it is the student's responsibility to withdraw, using the appropriate CMU form, from any class which she/he is no longer attending or risk receiving a failing grade in that class. Student's wishing to withdraw must complete and submit the appropriate CMU form by the established withdrawal deadline.

General Student Services

Educational Access Services: If you are a student with a documented physical or learning disability and need an accommodation for this class, you must contact the Educational Access Services Office, 248-1801, at the start of the semester.

- The **Tutorial Learning Center** (TLC) is a **FREE** academic service for all Colorado Mesa University students. Tutors are available on a walk-in basis for many courses. Do you have a quick question? Do you need homework clarification or feedback on a paper? Are you reviewing for a test? Help is available at the TLC!
  At the main campus, come to Houston Hall 113 to meet with one of our friendly peer tutors. We are open on Monday through Thursday from 8am-6pm and Fridays from 8am-5pm. We are also open Sundays from 1pm-6pm! Tutoring at branch campuses and distance tutoring is also available. Check out the website for schedules and locations at www.coloradomesa.edu/tutoring or call (970) 248-1392 with any questions.

- **Research Assistance at the Tomlinson Library:**

  CMU's professional librarians are an excellent resource for helping you to find the best research to support your academic work, evaluate articles and electronic information, and cite the articles and images that you use in your papers. We are here for you!

  Find us**:** in the Library at the Research Help Desk Mon-Thurs 8am-9pm, Fri 8am-5pm, Sat 10am-5pm, and Sun 1-9pm; via online chat 24/7 at coloradomesa.edu/library; by email at library@coloradomesa.edu; or by calling 970.248.1860.

- **Student Services**: The Office of Student Services works to support CMU students in all aspects of college life, by offering a vast array of services, resources and programs that make each student's time at Colorado Mesa University as exciting and successful as possible. Student Services works collaboratively with faculty, students, and staff to create a campus community that fosters the growth of students as strong individuals

and productive citizens. To learn more, go to http://www.coloradomesa.edu/studentservices.

- **Financial Aid**: Financial aid staff is dedicated to assisting you in sorting through the various forms of student financial aid. We believe that by helping you take advantage of a variety of available resources, you will find an education at Colorado Mesa University is attainable. Our office is located in the lower level of Lowell Heiny Hall, Room 116. Our phone number is (970)248-1396, or you may contact us via email at financialaid@coloradomesa.edu

- **Advising Center:** Advisors can assist students with course selection and registration, major exploration, and identifying strategies for academic success. The Advising Center is committed to promoting academic success and in facilitating students to attain their educational goals. We are located in Lowell Heiny Hall, on the lower level, room 127. Our phone number is (970)248-1177, or toll free at 1-800-982-6372 (option #7 or extension 1177). Our FAX number is (970)248-1267. You can also reach us via email at advising@coloradomesa.edu Appointments are scheduled from 9:00 to 4:00, Monday through Friday. Please call a week or two in advance of your desired appointment date to schedule. Bring your picture ID, as failure to do so may result in a rescheduled appointment.

- **Business and Financial Services Office:** The Business and Financial Services Office is located in the lower level of Lowell Heiny Hall. Our staff is available to assist you Monday through Friday from 8:00 am to 5:00 pm, MST. Our phone number is (970)248-1567, our FAX number is (970)248-1136, or you may contact us via email at businessoffice@coloradomesa.edu

Week	Mon	Wed	Fri
15-Jan		2017 18-Jan 1	2017 20-Jan 2
22-Jan	2017 23-Jan 3	2017 25-Jan 4	2017 27-Jan 5
29-Jan	2017 30-Jan 6	2017 01-Feb 7	2017 03-Feb 8
5-Feb	2017 06-Feb 9	2017 08-Feb 10	2017 10-Feb 11
12-Feb	2017 13-Feb 12	2017 15-Feb 13	2017 17-Feb 14
19-Feb	2017 20-Feb 15	2017 22-Feb 16	2017 24-Feb 17
26-Feb	2017 27-Feb 18	2017 01-Mar 19	2017 03-Mar 20
5-Mar	2017 06-Mar 21	2017 08-Mar 22	2017 10-Mar 23
12-Mar	2017 13-Mar 24	2017 15-Mar 25	2017 17-Mar 26
19-Mar	2017 20-Mar *Spring Break*	2017 22-Mar *Spring Break*	2017 24-Mar *Spring Break*
26-Mar	2017 27-Mar 27	2017 29-Mar 28	2017 31-Mar 29
2-Apr	2017 03-Apr 30	2017 05-Apr 31	2017 07-Apr 32
9-Apr	2017 10-Apr 33	2017 12-Apr 34	2017 14-Apr 35
16-Apr	2017 17-Apr 36	2017 19-Apr 37	2017 21-Apr 38
23-Apr	2017 24-Apr 39	2017 26-Apr 40	2017 28-Apr 41
30-Apr	2017 01-May 42	2017 03-May 43	2017 05-May 44
7-May	2017 08-May *Finals*	2017 10-May *Finals*	

Topics:

1. OS - Overview
2. Process Management
3. Processes
4. Threads
5. Synchronization

6. Memory
7. File System
8. Security

Chapter 1: Hw (p. 79) 1, 3, 5-10, 12, 17-20, 22, 24, 27, 29. Due Feb 10

Project: Write an application that determines the current date & time (to the millisecond) -- using some kind of system call. Use this twice to determine the runtime of some section of code. Due Feb 10.

Chapter 2: p 170 3, 4, 5, 6, 8, 10, 13 - Due Feb 10

Project: Write an application that illustrates process creation using win api (CreateProcess) or the unix (fork/exec). Due Feb 10.

Project: Write an application that uses threads and either mutexes / locks. Due Feb 24

Project: Write a C/C++ program that allocates a 2D array of doubles with random numbers in them (10000 x 10000). Calculate the sum of the entries row-wise and column-wise, & time the difference. Due: March 3.

Chapter 3: Due March 10 (maybe).

1. Why is cache so important server grade CPU's?
2. Suppose a cache/TLB miss is 1000 times slower than a hit (1ns vs 1us, on average). How much faster will the memory access be if going from 90% to 99.99% cache/tlb hit rates. How about 99.99% to 99.9999%?
3. Explain LRU
4. The the difference between a forward and reverse paging table?
5. Why not just map every address through a paging system (page size = 1b).
6. Describe some security enhancements with respect to process memory management.
7. Why are dynamic libraries built with position independent code?

Chapter 4:

Write a program that, using a system api (not just calling another process), that finds all folders named "src" within a given folder (and all its subdirectories). For example, with a directory with the following files (and subdirectory) . Due Mar 13 (monday).

here/src/code
here/code/src
here/src/code/src

here/dir/null

Giving your program the “here” directory should report

here/src
here/code/src
here/src/code/src

Perhaps in a different order.

Homework Questions

1. Explain Journaling.
2. What are snapshots for?
3. Why are disks considered “blocks” instead of “bytes”?
4. Explain RAID.
5. Where might viruses store data on a disk?

Chapter 5 Questions

1. What is memory mapped I/O
2. What might be good memory-mapped I/O devices vs. direct-memory-access I/O devices?
3. What is bandwidth?
4. What is latency?
5. What is jitter?
6. What is RAID 5?
7. What are some innovations in I/O devices?
8. What are some power management concerns for CPU and I/O devices.

Ex credit: Make an example RAID filesystem.

Chapter 6 Questions

1. What are deadlocks?
2. What is a scheme to prevent deadlocks if you have a global list of resources.
3. What is priority inversion?
4. What can an operating system do to help with priority inversion?
5. What can an application developer do to help with priority inversion?

Ex credit: Make an application that demonstrates a deadlock or priority inversion and a version without it (fixed with ordered resource allocation or PCP).

Chapter 7 Questions

1. Why is UDP vs TCP more important in multimedia?
2. Why shouldn't you use analog components in a modern multimedia system?
3. What are the value of specific codes like H.254 and JPEG2000
4. What mathematical steps are usually required for video transformations?
5. What are some differences between streaming media (a song/movie) vs real-time (voice/video)?

Ex credit: build a streaming protocol (audio or video).

Chapter 8 Questions

1. What are some OS and developer advantages for a single core system?
2. What are some advantages of a multi-core system?
3. What is a typical heterogeneous multi-core system?
4. What is processor/core affinity?
5. What are theoretical limits on parallelization?
6. What are bottlenecks to parallelization?
7. Other than speed, what are reasons to use multiple threads/processing for a problem?
8. Why not make a faster single core system instead of many slower cores?

Ex credit: Take a single-threaded compute-bound problem and parallelize it.