Boston University Metropolitan College

Operating Systems

MET CS 575
Course Format On-Campus
Tuesday 6:00 PM – 8:45 PM
Fall 2024

Dr. Mehrdad Nourai
mnourai@bu.edu
Office hours: after class

Course Description
Overview of operating system characteristics, design objectives, and structures. Topics include concurrent processes, coordination of asynchronous events, file systems, resource sharing, memory management, security, scheduling, and deadlock problems. Prerequisites: MET CS472, and MET CS231 or MET CS232, or instructor's consent. 4 credits.
.

Books
Operating System Concepts 10th Edition, Silberschatz, Galvin, and Gagne – Wiley.
The book is available from Barnes & Noble.

Courseware
Blackboard website: https://learn.bu.edu/

Learning Outcomes

1. Explain the fundamental concepts of operating systems, including OS structures, virtualization, address space, kernel mode, interrupt, access control, etc.
2. Explain the basic components of a computer and an operating system, including how they interact with each other in a system.
3. Describe the kernel implementation of various OS components and functions, such as kernel mode, process/thread operations, context switch, page table, address translation, message passing, file systems, etc.
4. Compare the multi-process and multi-thread implementation of an application.
5. Evaluate and Compare different CPU scheduling algorithms.
6. Analyze the synchronization problems, identify the race condition, and properly implement synchronization in multiple processes or multi-thread applications.
7. Analyze the effect of virtual memory management on program performance.
8. Design or construct OS components such as CPU scheduler, memory management, file systems, etc.
9. Apply the OS concepts to real-world OSes such as Windows and Linux.
10. Develop hands-on experience in Linux programming.
11. Be introduced to the Linux kernel source code and simple kernel-level programming.
12. Explain the security principles and security issues in the OS design.
13. Develop system-thinking skills.

Learning Outcomes Assessment

- Homework: LO1-LO12
- Research Project: LO1-LO13
- Quizzes: LO1-LO8
- Final Exam: LO1-LO12

Class Policies

1) **Attendance & Absences** – Active student attendance and participation are an essential part of the learning experience. Attendance and punctuality are expected at all class meetings, and it is part of the overall grade. There are NO EXCUSED ABSENCES under this policy. All absences will be deducted from the final grade, regardless of the reason for the absence. You are responsible for all announcements and materials discussed in class.
2) **Assignments** – Assignments consist of homework and a research project. All assignments are collected on Blackboard by their designated due date.
3) **Assignment Format** – *Homework* for this class requires systems programming in Linux kernel using a Virtual Machine. Assignments demand time and effort in design, implementation, debugging, and working with a new Operating System and virtualization. The work is mostly in the Operating System programming language C, and a few in other languages. All programming assignments are to be completed using VirtualBox virtualization software with Ubuntu Linux. The *Research Project* has several components and deliverables as follows: research proposal, research paper, research slides, and research presentation. The research project's final deliverables are due at the start of the research discussion and presentation class.
4) **Assignments Late Policy** – *NO LATE ASSIGNMENTS GRADED* – All assignments are due at the start of class on their due date. Plenty of time is given ahead of time to complete each assignment on time, so no extra time will be given after the due date. Any assignment submitted after the due date is graded as zero. If a compelling reason is given in advance, a late assignment may be accepted up to three days late with a 10% reduction per day accumulative. The instructor reserves all the rights for its consideration.
5) **Assignment Submission Policy** – *NO EMAIL SUBMISSIONS GRADED* – All coursework submissions shall be made online via Blackboard. No hard copies and No Email submissions are accepted. It is the student's responsibility to check Blackboard submission transactions were successful by downloading and verifying the submissions. Any submissions of incorrect files, corrupted files, or missing files will result in zero credit. All submissions are on a single attempt, No Re-Submission and No Re-Grading.
6) **Quizzes and Final Exam** – ALL assessments are scheduled ahead of time and shall be taken on the date they are offered. Any assessments not taken on their designated date

are graded as zero. No makeup assessments will be given unless a compelling and verifiable reason is provided in advance. The instructor reserves all the rights for its consideration.

7) **Grading** – Grades are assessed per performance of completed coursework requirements. If a student wants to dispute a grade, may do so within 48 hours of the grade provided on Blackboard. The final letter grade is calculated using industry-standard software with high precision and accuracy. There is no rounding up of the final grade. To improve your grade, I encourage you to read the section on "Strategies for Learning". After the Final Exam, there are No Extra Credits, No Re-Submission, and No Re-Grading to improve your Final grade.

8) **Re-Do, Re-Submission, Re-Grading, Bonus/Make-up work, Extensions** – *NONE GIVEN*. Furthermore, No additional coursework will be given after the Final Exam to improve your grade, as this arrangement by fairness has to be extended to the rest of the class (an impossible situation).

9) **Backup** – It is the student's responsibility to keep secure backups of all coursework. No credits and No extensions will be given for lost files due to computer failure or theft.

10) **Incomplete and withdrawal** – There will be No incomplete in this class except for reasons of dire illness near the end of the semester. The student must have actively attended and participated in class and completed the majority of coursework throughout the semester with good standing. It is the student's responsibility to observe the university's guidelines, and policies, and file an official withdrawal to avoid earning a failing grade.

11) **Classroom Expectations** – Please respect your classmates by turning off your phone or other electronic devices before class begins, and do not use them during class. I encourage you to participate in class discussions and ask questions.

12) **Academic Conduct Code** – The following is a message from the Dean's office:

"Cheating and plagiarism will not be tolerated in any Metropolitan College course. They will result in no credit for the assignment or examination and may lead to disciplinary actions. Please take the time to review the Student Academic Conduct Code:

http://www.bu.edu/met/metropolitan_college_people/student/resources/conduct/code.html. This should not be understood as a discouragement for discussing the material or your particular approach to a problem with other students in the class. On the contrary – you should share your thoughts, questions, and solutions. Naturally, if you choose to work in a group, you will be expected to come up with more than one and highly original solution rather than the same mistakes."

Course Objectives

To enable the students to gain knowledge of:

- Understand the fundamental concepts of operating systems, including OS structures, processes/threads management, synchronization, deadlocks, memory management, filesystems, disk, I/O, protection & security.
- Develop hands-on experience in Linux programming.
- Be introduced to the Linux kernel source code and simple kernel-level programming.

Course Requirements

- Class participation
- Reading and studying
- Assignments (Homework and Research project & presentation)
- Quizzes and Final Exam
- Additional reading materials

Strategies for Learning

We will cover many materials that require critical thinking and practice to master. The following are strategies for in-depth learning of the materials:

- Attend class, participate in class discussions, and take notes.
- Read the textbook and any additional materials covered in class.
- Explore online resources, e.g., articles, tutorials, source code, documentation, etc.
- Form a study group.
- The more time and effort you expend, the more benefits you will receive.

Grading Policy

The grade that a student receives in this includes class attendance & participation, assignments (homework and research project & presentation), quizzes, and a final exam. All percentages are approximate and the instructor reserves the right to make necessary changes.

The final grade will be calculated using category percentages with a weighted grading chart as follows:

Category	**Percentages**
Attendance and Participation	10%
Assignments (Homework and Research Project)	30%
Quizzes	30%
Final Exam	30%
TOTAL	100%

Letter grade/numerical grade conversion is shown below:

Grade	**%**
A	$95.\overline{0} - 100$
A-	$90.\overline{0} - 94.\overline{9}$
B+	$85.\overline{0} - 89.\overline{9}$
B	$80.\overline{0} - 84.\overline{9}$
B-	$77.\overline{0} - 79.\overline{9}$
C+	$74.\overline{0} - 76.\overline{9}$
C	$70.\overline{0} - 73.\overline{9}$
C-	$65.\overline{0} - 69.\overline{9}$
D	$60.\overline{0} - 64.\overline{9}$
F	$0.\overline{0} - 59.\overline{9}$

NOTE: A bar over a decimal number means the number repeats indefinitely, and grades will NOT be rounded up.

Disclaimer – The course syllabus, schedule, and contents on Blackboard are intended as preliminary information on what may be covered during the semester. The professor reserves all the rights to modify, supplement, and make changes to the course when the need arises.

Boston University Metropolitan College

Class Meetings, Lectures & Assignments:
This is a live schedule. Lectures, Readings, and Assignments are subject to change and will be announced in class and/or on Blackboard as applicable within a reasonable period.

Date	Topic	Readings Due	Assignments Due
September 3	Introduction	Chapter 1	
September 10	Operating-System Structures	Chapter 2	Homework 1 Due
September 17	Processes	Chapter 3	
September 24	Threads	Chapter 4	Homework 2 Due
October 1	Quiz 1		**Quiz 1** **Lectures & Chapters 1, 2, 3, 4**
October 8	CPU Scheduling	Chapter 5	Homework 3 Due
October 15	Substitute schedule of classes (Monday schedule)		
October 22	Synchronization Deadlocks	Chapters 6-8	Research Project Proposal Due
October 29	Main Memory	Chapter 9	Homework 4 Due
November 5	Quiz 2		**Quiz 2** **Lectures & Chapters 5, 6, 7, 8, 9**
November 12	Virtual Memory Mass-Storage Structure	Chapters 10, 11	
November 19	I/O Systems Filesystems	Chapters 12-15	Homework 5 Due
November 26	Security & Protection	Chapters 16, 17	
December 3	Research Project Discussion and Presentations		Research Project Paper & Presentation Due by 6 PM
December 10	Research Project Discussion and Presentations		
December 17 'Tentative'	Final Exam		**Final Exam** **All Covered Materials**