Boston University Metropolitan College

Operating Systems

MET CS 575
Course Format On-Campus
Tuesday 6:00 PM – 8:45 PM
Spring 2023

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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.
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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 system, an operating system, and 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

- Assignments: LO1-LO12
- Research Project: LO1-LO13
- Quizzes and Exams: LO1-LO8
- Final Exam: LO1-LO12

Class Policies

1) **Attendance Policy** – Students are expected to attend all scheduled classes and be punctual. Active student participation and attendance are an essential part of the learning experience and are part of the course grade. There are NO EXCUSED ABSENCES under this policy. All absences are counted, regardless of the reason for the absence. You are responsible for all announcements and materials discussed in class.
2) **Assignments Format** – Assignments are typically in Operating Systems programming language C, although there may be some other languages. All programming assignments are to be completed using VirtualBox virtualization software. We will use the latest Ubuntu LTS version that is released at the time.
3) **Assignments Late Policy** – *NO LATE ASSIGNMENTS GRADED* – Assignments typically require systems programming which demands time and effort on design, implementation, and debugging, so make sure to plan accordingly. All assignments will be due at the start of class on the due date. If a compelling reason is given, a late assignment may be accepted up to three days late with a 10% reduction per day accumulative. Any assignments submitted after the due date will be zero credit.
4) **Assignments Submission Policy** – *NO EMAIL SUBMISSIONS GRADED* – Assignments shall be submitted to Blackboard. Check Blackboard transactions to ensure your submission was correct and has been successful. Failure to check for successful submission or submission of wrong files will result in zero credit. All submissions are a single attempt.
5) **Research Project** – *NO LATE RESEARCH PROJECT GRADED* – The research project may consist of several deliverables. The final deliverables are due at the start of the research discussion and presentation class. Any parts of the research project submitted after the due date will be recorded as zero.
6) **Quizzes and Exams** – ALL assessments are scheduled ahead of time and shall be taken on the date they are offered. Any quizzes or exams not taken on their designated date will be recorded as zero credit. No make-up will be given unless a compelling and verifiable reason is given in advance. The instructor reserves all the rights for its consideration. The date for the Final Exam will be determined by the Registrar's office.
7) **Grading** – Grades are calculated per performance of completed coursework requirements. To improve your grade, I encourage you to read the “Strategies for Learning“ following the course policies. If a student wishes to dispute a grade, may do so within 48 hours of the instructor providing the grade on Blackboard. After the Final Exam, there will be No extra credit, No resubmission, and No regrading to improve the final

grade. The final letter grade is calculated using industry-standard software with high precision and accuracy. There is no rounding up of the final grade.

8) **Redo, Resubmission, Bonus/Make-up work, Extensions** – NONE GIVEN. There will be No additional work 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 and 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
- Research project and presentation
- Quizzes and Exams
- 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 Criteria

The grade that a student receives in this class will be based on class attendance and participation, assignments, a research project, quizzes, and a final exam. The final grade will be calculated using weighted averaging of the following percentages:

- 5% on Attendance and Participation
- 20% on Assignments
- 12% on Research Project
- 15% on Quiz 1
- 15% on Quiz 2
- 33% on the Final Exam

Letter grade/numerical grade conversion is shown below:

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.

Amendment

The instructor reserves the right to amend the course syllabus during the term. The course Blackboard will contain the updated version.

Boston University Metropolitan College

Class Meetings, Lectures & Assignments:
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
January 24	Introduction	Chapter 1	
January 31	Operating-System Structures	Chapter 2	
February 7	Processes	Chapter 3	Setup Virtualization and Ubuntu Desktop LTS
February 14	Threads	Chapter 4	Assignment 1 Due
February 21	Substitute the Monday schedule of classes		
February 28	Quiz 1		**Quiz 1** **Lectures & Chapters 1, 2, 3, 4**
March 4-12	Spring recess		
March 14	CPU Scheduling	Chapter 5	Assignment 2 Due
March 21	Synchronization Deadlocks	Chapters 6-8	Research Project Proposal Due
March 28	Main Memory	Chapter 9	Assignment 3 Due
April 4	Quiz 2		**Quiz 2** **Lectures & Chapters 5, 6, 7, 8, 9**
April 11	Virtual Memory Mass-Storage Structure	Chapters 10, 11	
April 18	I/O Systems Filesystems	Chapters 12-15	Assignment 4 Due
April 25	Security & Protection	Chapters 16, 17	
May 2	Research Project Discussion and Presentations		Research Project Paper & Presentation Due by 6 PM
May 9 'Tentative'	Final Exam		**Final Exam** **All Covered Materials**