Boston University Metropolitan College

Operating Systems
MET CS 575
Learn from Anywhere Course Format, Offered Simultaneously On-Campus and
Remote
Tuesday 6:00 PM – 9:30 PM
Summer 2021

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Office hours: after class and remote

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. 4 credits. Prerequisites:
MET CS 472 and (MET CS 231 or MET CS 232). Or instructor's consent.

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

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 in 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.

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

Academic Year 2020-2021 COVID-19 Policies

Classroom Rotations: Classrooms on campus have new capacities that follow guidelines issued by state and local health and government authorities related to COVID-19 and physical distancing. Before the beginning of the class, and throughout the semester, I will be reaching out to students who have indicated that they want to attend the classroom in-person. Classroom capacity has been reduced, hence, we may have two or more rotations of students that come to class on campus on an alternate week's basis. You will be asked to attend remotely on the week that you have rotated out of the classroom.

Compliance: All students returning to campus will be required, through a digital agreement, to commit to a set of Health Commitments and Expectations including face coverings, symptom attestation, testing, contact tracing, quarantine, and isolation. The agreement makes clear that compliance is a condition of being a member of our on-campus community.

You have a critical role to play in minimizing transmission of COVID-19 within the University community, so the University is requiring that you make your health and safety commitments. Additionally, if you will be attending this class in person, you will be asked to show your Healthway badge on your mobile device to the instructor in the classroom before starting class, and wear your face mask over your mouth and nose at all times. If you do not comply with these rules, you will be asked to leave the classroom. If you refuse to leave the class, the instructor will inform the class that they will not proceed with the instruction until you leave the room. If you still refuse to leave the room, the instructor will dismiss the class and will contact the academic Dean's office for follow up.

Boston University is committed to offering the best learning environment for you, but to succeed, we need your help. We all must be responsible and respectful. If you do not want to follow these guidelines, you must participate in class remotely, so that you do not put your classmates or others at undue risk. We are counting on all members of our community to be courteous and collegial, whether they are with classmates and colleagues on campus, in the classroom, or engaging with us remotely, as we work together this academic year.

Class Policies

1) **Attendance Policy** – Attendance and participation in every class meeting is a responsibility that shall be taken seriously and is part of the grade. Students will be often called for participation to help the retention of their learning, promote engagement, and improve attention in class. You are responsible for all announcements and materials discussed in class.

2) **Assignments Format** – Assignments are typically in Operating Systems programming language C, although some may be in C++ or Java. All programming assignments are to be completed using Ubuntu Linux. It is preferable to use Oracle's VirtualBox as a guest OS to run the Linux on your main system.

3) **Assignments Late Policy** – *NO LATE ASSIGNMENTS ACCEPTED* - Assignments typically require systems programming which demands time and effort on design 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 provided, a late assignment may be accepted up to three days late with a 10% per day reduction, accumulative. Any assignments submitted after the due date will be zero credit.

4) **Assignments Submission Policy** – *NO EMAIL SUBMISSIONS ACCEPTED* - Assignments shall be submitted to the Blackboard. Check the 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 ACCEPTED* – The research project may consist of several deliverables. The final deliverable is due at the start of the presentation class. Any parts of the research project submitted after the due date will be zero credit.

6) **Quizzes, Exams** – ALL assessments are scheduled ahead of time and **may not be taken on another day.** Any quizzes or exams not taken on their designated date will be zero credit. No make-up quizzes and exams will be given unless a compelling and verifiable reason is given in advance. The instructor reserves the right for its consideration. The date for the Final Exam will be determined by the Registrar's office.

7) **Grading** – Grades are earned and not given. To improve your performance in this class, please read the "Strategies for Learning" section following the course policies. If a student wishes to dispute a grade, he/she may do so within 48 hours of the instructor providing the grade on the Blackboard. No coursework will be accepted after the Final Exam. When the semester ends, students cannot make up for lost opportunities. The Final letter grades are calculated with high precisions and high accuracy using industry-standard software.

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, 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 been 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, policies, and file an official withdrawal from the class 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** – Please use the following wording, or an equivalent, in your syllabus: "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.

NOTE: 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 solutions 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 grade breakdown is shown below. All points/percentages are approximate and the instructor reserves the rights to make necessary changes.

- 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 ($0.\overline{0} - 59.\overline{9}$)

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Class Meetings, Lectures & Assignments:

Lectures, Readings, Assignments, Research Project, and Assessments are subject to change and will be announced in class as applicable within a reasonable period.

Date	Topic	Readings Due	Assignments Due
May 25	Introduction	Chapter 1	
June 1	Operating-System Structures	Chapter 2	
June 8	Processes	Chapter 3	Assignment 1
June 8	Threads	Chapter 4	
June 15	Quiz 1		**Quiz 1 (Chapters 1, 2, 3, 4)**
June 22	CPU Scheduling	Chapter 5	Assignment 2
June 29	Synchronization Deadlocks	Chapters 6-8	
July 6	Main Memory	Chapter 9	Assignment 3
July 13	Quiz 2		**Quiz 2 (Chapters 5, 6, 7, 8, 9)**
July 20	Virtual Memory Mass-Storage Structure	Chapters 10, 11	
July 27	I/O Systems Filesystems	Chapters 12-15	Assignment 4
August 3	Security & Protection	Chapters 16, 17	
August 3	Research Project Discussion and Presentations		**Research Project**
August 10	Final Exam		**All covered materials**