MET CS566 Analysis of Algorithms

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Course Dates: check online
Course Time & Location: check online
Course Credits: 4

Course Description
This course teaches theoretical backgrounds for designing and analyzing algorithms and practical implementation methods. The course starts with a review of principles of algorithm analysis and includes divide and conquer, dynamic programming, greedy programming, and matrix operations and extends them to advanced topics of linear programming. Students should be familiar with basic data structures and basic Python programming. Weekly course assignments include both theoretical analysis and practical algorithmic implementation in Python.

Prerequisite
MET CS 521 (Information Structures with Python) and MET CS 526 (Data Structures and Algorithms), or the instructor's consent

Course Objectives

By completing this course, you will be able to:

- Implement algorithms with theoretical backgrounds in computer science analysis and design, as well as practical implementation methods.
- Understand the concepts of asymptotic notation in analyzing algorithms and its usage in comparing algorithm performance.
- Understand the concepts of divide and conquer algorithms and their usage in algorithm design.
- Understand the concepts of hashing, binary search trees, graph algorithms, and dynamic programming.
- Describe advanced analysis of algorithm topics like NP-Completeness and NP-Hard problems.

Instructional Format, Course Pedagogy, and Approach to Learning
This course will combine traditional lecturing with hands-on assignments that reinforce the lecture material. In particular, lectures focus on concepts and ideas, while the assignments provide substantial experience and skills.

Required Book: Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). Introduction to Algorithms. 3rd ed. The MIT Press. ISBN: 978-0262033848. This book can be purchased from Barnes and Noble at Boston University. An e-book is available from the MIT Press.

Recommended Books:
Miller, B., & Ranum, D. (2011). Problem-Solving with Algorithms and Data Structures Using Python. 2nd ed. Franklin, Beedle & Associates. ISBN: 978-1590282571.

Courseware
The class has a Blackboard site that contains the syllabus, lectures, assignments, and other course-related materials. You can log in to the Blackboard page at: https://onlinecampus.bu.edu/

Assignments and Grading Criteria
The grade for the course is determined by the following, including both theoretical algorithmic analysis as well as practical implementation in Python:

Graded Items:

- **Assignments**: From Module 1 to Module 5, there is one assignment at the end of each module. There are a total of five assignments.
- **Midterm Assignment**: A midterm assignment is similar to other module assignments but includes more advanced tasks. It includes questions related to module 1 to the end of module 3. Students will have two weeks to complete the midterm assignment.
- **Final Project Presentation**: Students learn one topic out of a list of topics, and prepare a presentation video and/or implementation of the algorithm. Term project guidelines will be published at the end of Module 3. In the final project presentation, students will present a topic between 8 to 12 minutes
- **Final Exam:** There will be a Final Exam in this course.

Overall Grading Percentages

Five Assignments	40
Midterm Assignment	20
Final Presentation	15
Final Exam	25

Letter Grade

100-95.00	A		74.99-70.00	C+
94.99-90.00	A-		69.99-65.00	C
89.99-85.00	B+		< 65	F
84.99-80.00	B			
79.99-75.00	B-			

Class Policies

Assignment Completion & Late Work: We recognize that emergencies occur in professional and personal lives. If one occurs that prevents your completion of homework by a deadline, please share the plan with the instructor. This must be done before the deadline (unless the emergency makes this impossible, of course) and should be accompanied by particulars that back it up. Additional documentation may be requested. Late submissions without reasons will result in a grade deduction. **Late submissions without reasons will not accept.** There will be no make-up exam for the final exam. Students who cannot take the final exam on the designated day will receive an incomplete grade. If you have any questions about your grading, you need to contact the grader and cc me **before the next assignment/quiz** (before the final exam for the last assignment/quiz). After that, we will not discuss the grade for that assignment/grade.

Academic Conduct Code: 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. See link below
http://www.bu.edu/met/metropolitan_college_people/student/resources/conduct/code.html

Please do not share our class Assignments, Quizzes, and Exams on online websites like Coursehero, Chegg, etc. We are monitoring these sites and sending the providers' takedown requests. Our Class Material has Boston University Copyright.

Resources/Support/How to Succeed in This Course:

1) Office hours, Blackboard discussion board, etc.
2) Online tutor (24/7): Schedule an appointment with BU Smarthinking

Disability and Access Services

By university policy, every effort will be made to accommodate students with speech, hearing, vision, or other disabilities. Any student needing accommodation for a documented disability should contact Disability and Access Services at 617-353-3658 or access@bu.edu for review and approval of accommodation requests.
Once students receive their accommodation letter, they must send it to the instructor and/or facilitator each semester. They must also send a copy to the Faculty & Student Support Administrator, who may need to update the course settings to ensure accommodations are in place. Accommodations cannot be implemented if the student does not send their letter.

Tentative Schedule
The following schedule is tentative and subject to change.

Week	Topics	Lecture	Reading	Works due
1	Course introduction, what is an Algorithm? Processing Machine, Insertion Sort, Growth of Functions	Lecture 1	Ch.1, 2	
2	Big O, Big Ω, θ, asymptotic cost	Lecture 2	Ch.1, 2	Assign 1
3	Divide and Conquer, Merge Sort, Recurrences, Strassen's Algorithm	Lecture 3	Ch.3, 4	
4	Solving Recurrences, Substitution method, Master Method	Lecture 4	Ch.4	Assign 2
5	Priority Queue, Heap, Max Heap, Heap-Increase-Key, Heap Sort	Lecture 5	Ch.6	
6	Hash Tables, Hash Function, Open Addressing, Hash Collisions	Lecture 6	Ch.11	Assign 3
7	Graphs and Graph Representations, Graph Search, Breadth-First Search (BFS), Depth-First Search (DFS)	Lecture 7	Ch.22	
8	Shortest Paths, Dijkstra's Algorithm, Bellman-Ford Algorithm	Lecture 8	Ch.22, 24	Midterm assign
9	Dynamic Programming, Fibonacci Sequence, Rod Cutting Problem	Lecture 9	Ch.15	
10	0-1 Knapsack Problem, Matrix-chain Multiplication	Lecture 10	Ch.15	Proposal
11	Binary Search Trees, BST Operation	Lecture 11	Ch.12	Assign 4
12	No Class			
13	Greedy Algorithms, Computational Complexity	Lecture 12	Ch.16	
14	**Final Presentation**			Assign 5
15	Study Week			
16	**Final Exam**			