MET CS566 Analysis of Algorithms

Instructor Name: Alexander Belyaev
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Office Hours: Email to schedule a Zoom appointment

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

Course Format. Offered on Campus and Remotely only if needed

Time and Location. Wednesday 6:00 PM – 8:45 PM, Room SOC B57

Course Description
Algorithm analysis provides the theoretical background for building correct, efficient algorithms to solve real life problems. Students will learn the art of problem solving through studying fundamental algorithm design techniques. Emphasis is on recursion, search, sorting, and graph and tree algorithms, implementation and on application of various algorithmic strategies. The course starts with a review of principles of algorithm analysis and includes divide and conquer, dynamic programming, greedy programming, matrix operations, and extends them to advance topics of neural network based machine learning algorithms. Weekly course assignments include both theoretical analysis and practical algorithmic implementation.

Prerequisite
MET CS 521 (Information Structures with Python) and MET CS 248 (Discrete Mathematics), or the instructor's consent

Course Objectives

By successfully 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 the analysis of 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 will focus on concepts and ideas, while the assignments will 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:
Steven S. Skiena, "The Algorithm Design Manual", 2nd ed.,
Springer Verlag, 2008, ISBN: 978-1-84800-069-8

Miller, B., & Ranum, D. (2013). Problem Solving with Algorithms and Data Structures Using Python. 3rd 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 programming language of your choice:

Graded Items:

- **Assignments**: There is one assignment at the end of each module. Module consists of two lectures. 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 lecture 1 to the end of lecture 6. 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 lecture 6. 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	10
Final Exam	30

Letter Grade

100-95.00	A		79.99-77.00	C+
94.99-90.00	A-		76.99-73.00	C
89.99-87.00	B+		72.99-70.00	C-
86.99-84.00	B		69.99-60.00	D
83.99-80.00	B-		below 60.00	F

Evaluation Rubric for Assignments

Criteria	1 Great	2 Good	3 Poor	4 Needs work
Understanding of Material	Clear understanding of material and concept.	Correct usage of methodology and result, but some typos or miscalculations. Up to 5% points off per question	Student has a grasp of concept but made major mistakes in solution. Up to 25% points off per question	Does not understand concept. Up to 40% points off per question.
Presentation	Messy presentation: vague handwriting, misleading drawings and formulas, spaghetti style coding. It is disrespect to the graders. Penalty up to 10 pts, even in the case of correct answers.			
Promptness	Submitted on time.	No late submission without instructor permission		
Resubmission	Corrected mistakes in 1st try (-6 pts)	No Corrected mistakes submission without instructor permission		

Resources/Support/How to Succeed in This Course:
For any question email TA (Raj Mehta) rajtm@bu.edu or Dr. Alexander Belyaev abelyaev@bu.edu.

TA information:

- Expect emails to be returned by Tuesday 5pm every week.
- TA Office hours: To be announce after first day of class.
- TA Office hours will be conducted thru the Blackboard zoom link, email for in-person meet up.

Class Policies
Assignment Completion & Late Work:
Evaluation Rubrics outlines the charges for resubmission and submisions after dealine.
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.
The above charges may be waived in case of circumstances are beyond your control.

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.

Disability and Access Services
By university policy, every effort will be made to accommodate students with respect to speech, hearing, vision, or other disabilities. Any student who may need 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	Date	Topics	Reading	Works due
1	09/04	Course introduction, what is an Algorithm? Processing Machine, Insertion Sort, Growth of Functions	Ch.1, 2	
2	09/11	Big O, Big Ω, θ, asymptotic cost	Ch.1, 2	Assign 1
3	09/18	Divide and Conquer, Merge Sort, Recurrences, Strassen's Algorithm	Ch.3, 4	
4	09/25	Solving Recurrences, Substitution method, Master Method	Ch.4	Assign 2
5	10/02	Priority Queue, Heap, Max Heap, Heap-Increase-Key, Heap Sort	Ch. 6	
6	10/09	Priority Queue, Heap, Max Heap, Heap-Increase-Key, Heap Sort	Ch.6	Assign 3
7	10/16	Hash Tables, Hash Function, Open Addressing, Hash Collisions	Ch.11	
8	10/23	Graphs and Graph Representations, Graph Search, Breadth-First Search (BFS), Depth-First Search (DFS)	Ch.22	Midterm assign
9	10/30	Shortest Paths, Dijkstra's Algorithm, Bellman-Ford Algorithm	Ch.22, 24	
10	11/06	Dynamic Programming, Examples and principles	Ch.15	Proposal, Assign 4
11	11/13	String matching: Rabin-Karp and Knuth-Morris- Pratt algorithms.	Ch.32	
12	11/20	NP-complete problems Deep Machine Learning	Ch 16	Assign 5
13	11//27	Thanksgiving		
14	12/04	Final Presentation		
15	**Final Exam December 18**			