BOSTON UNIVERSITY METROPOLITAN COLLEGE COMPUTER SCIENCE DEPARTMENT

MET CS 566 A2 ANALYSIS OF ALGORITHMS

Course Overview

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

Course Format **Learn from Anywhere**
Offered Simultaneously On Campus and Remote

Time and location Thursday 6:00 PM – 8:45 PM,
Room KCB 104

Prerequisites

MET CS 248 Discrete Mathematics and MET CS 341
or MET CS 342 Data Structures or instructor's consent

Learning Objectives

This course provides an overview of the theory of algorithm analysis, and encourage students to develop and implement algorithms for various practical applications.

1. Reinforce basic design concepts (e.g., pseudocode, specifications, top-down design)
2. Knowledge of algorithm design strategies
3. Familiarity with an assortment of important algorithms
4. Ability to analyze time and space complexity

Key Topics

Topics to be covered include Asymptotic notation; Sums and Recurrences; Divide and Conquer; Dynamic Programming; Greedy Algorithms; Graph Algorithms; Advanced Data Structures; Machine Learning algorithms and NP Completeness for decision problems.

Learning Outcomes:

Students who have completed this course should be able to
1. Use discrete mathematics in analysis of algorithms
2. Understand different algorithmic design strategies
3. Analyze the efficiency of algorithms using time and space complexity theory

4. Apply design principles and concepts to algorithm design

Assessment methods of all of the above: assignments, exams, term project

Required Textbook
Sara Baase, Allen Van Gelde, "Computer Algorithms", 3rd Ed.,
Addison-Wesley,2000, ISBN-0-201-61244-5

Recommended book T.H. Cormen, C.E. Leiserson,
R.L. Rivest, and C. Stein, "Introduction to Algorithms,"
3rd Ed., MIT Press, 2009, ISBN-13: 9780262033848.

Courseware

The lecture notes will be available in traditional digital-file formats (*.doc, *.ppt, and *.pdf) on the blackboard site related to our course **CS566 A2Analysis of Algorithms (Fall 2020).**
Blackboard Learn, URL: https://learn.bu.edu

Fall 2020 COVID-19 Policies

Classroom Rotations: KCB 104 *cannot accommodate all students wanting to meet in-person.* 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. Our classroom hold 12 students, and therefore we will have two rotations of students that come to class on campus alternate weeks. You will be asked to attend remotely on the week that you have rotated out 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 own 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 prior to 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 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 fall semester.

Evaluation and Grading Policy

There will be two exams. If any grading criteria event will be missed it will be the responsibility of the student to arrange a mutually agreeable schedule for completion of work.

An assignment will be considered late, if you fail to hand in the assignment by the specified time and date, and you will be charged 10 pts.
Charge will be waived in case of circumstances are beyond your control.

You may resubmit your corrected assignment however you will be charged 5 pts per each submission. Charge will be waived in case of circumstances are beyond your control.

The grade is made up of your performance on your home works, project paper, midterm, final exams and participation.

Participation will be based on the percentage of in-class polling questions answered. Correctness of in-class polling responses will not be taken into account for participation grades.

Approximate weightings are as following:

Assignments	Percentage
Six Written Homework Assignments	48%
In Class Participation	4%
Midterm Exam	24%
Final Exam (or Project Paper)	24%

Letter Grade:

94 ≤ G:	A,	77 ≤ G < 80:	C+
90 ≤ G < 94:	A-	73 ≤ G < 77:	C
87 ≤ G < 90:	B+	70 ≤ G < 73:	C-
83 ≤ G < 87:	B	60<G<70:	D
80 ≤ G < 83:	B-	G<70 :	F

There will be no make-up exam for the final exam. If a student cannot take the final exam on the designated day, she/he will receive an incomplete grade.

Academic Honesty

The course is governed by the Academic Conduct Committee policies regarding plagiarism (any attempt to represent the work of another person as one's own). This includes copying (even with modifications) of a program or segment of code. You can discuss general ideas with other people, but the work you submit must be your own. Collaboration is not permitted. See link below

http://www.bu.edu/met/metropolitan_college_people/student/resources/conduct/c ode.html.

Instructor Information

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Office Hours: After each class meeting

Tentative Schedule

- The schedule is subject to change according to the actual progress of the class. Some topics may be skipped and some topics may be added.
- Students are encouraged to review book chapters assigned for each lecture before coming to class.

SESSION	TOPIC	Text book READING	Assignment with Learning Outcome Assessment *
1 (09/03)	Preliminaries (Chapters 1-2): What is an algorithm? Principles of algorithm analysis and design. Classification of functions by their asymptotic growth rate. Big-*O* and similar notations. Abstract Data Type (ADT) specification and design techniques.	Ch. 1, 2	
2 (09/10)	Elementary ATDs: lists, trees, stacks, queues, and dynamic sets. Recurrence equations and their solution. Applications of recurrences. Induction proofs and examples. Principles of proving correctness of procedures. Review of series and sets, some probability.	Ch. 2, 3	**Homework #1 due CBK LO1, LO3**
3 (09/17)	Sorting Algorithms (Heapsort, quicksort, merge sort, and radix sort). Proof that sorting (by comparisons) takes *O*(n log(n)) time. Medians and order statistics.	Ch. 4	
4 (09/24)	Divide and conquer techniques for mergesort and quicksort.	Ch. 4, 5	**Homework #2 due CBK LO1, LO2, LO3**
5 (10/01)	Dynamic Sets: Amortized time analysis;	Ch. 6	
6 (10/08)	Graph algorithms: Spanning trees or forests; Shortest paths and Maximum flow. Mid-term Exam Preparation	Ch. 7,9	**Homework #3 due CBK LO1, LO2, LO3**
7 (10/15)	**MID-TERM EXAM**	Ch. 1-7	
8 (10/22)	Graph optimization problems, greedy and Minimum Spanning Tree algorithms; Huffman codes	Ch. 8	**Homework #4 due CBK LO1, L02, LO3**
9 (10/29)	Dynamic programming; Examples and principles;	Ch. 10	
10 (11/05)	String matching: Rabin-Karp and Knuth-Morris-Pratt algorithms.	Ch. 11	**Homework #5 due CBK LO1, LO3, LO4**
11 (11/12)	NP-complete problems; Virtual Reality	Ch. 13	**Homework #5 due**
12 (11/19)	Machine Learning; Miscellaneous topic3		**Homework #6 due CBK LO2, LO3, LO4**
13 (12/03)	Deep Machine Learning; Miscellaneous topics	Slide Presentation	**Term Project Draft Due**

			LO1,LO2,LO3,LO4

14 (12/10)	Projects Presentations; Final Exam Preparation		
15 (12/17)	**FINAL EXAM or Project Paper**	Ch. 8 - 13	

***Learning Outcome Assessments criteria abbreviations**

LO# Learning outcome number (see list of Learning Outcomes above)

CBK Common Body of Knowledge

Communication

- All official announcements will be made in the class.
- All assignments will be posted on the class web page.
- **Important:** The primary method of communication is through in-class announcements. So, if you miss a class you need to talk to a friend in the class or contact me to find out whether there was any important announcement.