MET CS566 Analysis of Algorithms

Instructor Name: Ming Zhang Course Dates: 09/06/2022 ~ 12/19/2022

Office Location: 1010 Commonwealth Ave, RM324 Course Time & Location: Thu 6 ~8:45 pm, [FLR 152](https://www.bu.edu/link/bin/uiscgi_studentlink.pl/1657280560?ModuleName=bldg.pl&CourseKey=MET%20CS%20566&KeySem=20233&BldgCd=FLR&ClassCd=METCS566%20A3&TopicCd=)

Contact Information: mzhang2@bu.edu Course Credits: 4

Office Hours: Email to schedule an appointment

Grader: Zhaowei Gu (zwgu@bu.edu)

**Course Description**

This course teaches theoretical backgrounds for design and analyzing algorithms, as well as practical implementation methods. 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 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 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 concrete 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](http://bu.bncollege.com/). An [e-book is available from the MIT Press](https://mitpress.ublish.com/book/introduction-algorithms#purchase).

**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 the module 1 to the end of module 3. Students will have two weeks to complete the midterm assignment.
* **Term 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.

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| Letter Grade |
| 94 $\leq $ G | A |  | 77 $\leq $ G$ <80$ | C+ |
| 90$ \leq $ G < $94$ | A- |  | 73$ \leq $ G < $77$ | C |
| 87$ \leq $ G < $90$ | B+ |  | 70$ \leq $ G < $73$ | C- |
| 83$ \leq $ G < $87$ | B |  | 60$ \leq $ G < $70$ | D |
| 80$ \leq $ G < $83$ | B- |  | G$ < $60 | F |

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| Overall Grading Percentages |
| Five Assignments | 40 |
| Midterm Assignment | 20 |
| Term Presentation | 10 |
| Final Exam | 30 |

**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 in advance of 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 grade deduction. **Late homework can be accepted up to 48 hours after the due date. 10% penalty will be applied after 24 hours and 20% after 48 hours, and after that we will not accept any late submissions.** 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 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](https://services.smarthinking.com/login)

**Disability and Access Services**

In accordance with university policy, every effort will be made to accommodate students with respect to speech, hearing, vision, or other disabilities. Any student who may need an accommodation for a documented disability should contact [Disability and Access Services](http://www.bu.edu/disability) at 617-353-3658 or at access@bu.edu for review and approval of accommodation requests.

Once a student receives 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.

Students are encouraged to review book chapters assigned for each lecture before coming to class.

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