EL-GY 9343: Data Structure and Algorithm
(Fall 2023, Updated 9/5/2023)

Instructor: Pei Liu

Course Prerequisites
1) Basic knowledge of fundamental data structures.
2) Basic programming language skills, such as C/C++, Java, Python
If you are not sure you have the proper preparation, you must talk to me before taking this course. Additionally, you should not take this course if you have taken a similar course, such as CS6033 with a 'B' or better grade.

Course Description
- Review of basic data structures and mathematical tools.
- Data structures: priority queues, binary search trees, balanced search trees.
- Algorithm design and analysis techniques illustrated in searching and sorting: heapsort, quicksort, sorting in linear time, medians and order statistics.
- Design and analysis techniques: divide and conquer, dynamic programming, greedy algorithms.
- Graph algorithms: elementary graph algorithms (breadth-first search, depth-first search, topological sort, connected components, strongly connected components), minimum spanning trees, shortest paths.
- Brief introduction of complexity and NP-completeness.

Textbook

Cormen, Leiserson, Rivest, and Stein, *Introduction to Algorithms*, 4th Edition, MIT Press, 2022;

ISBN-13: 9780262046305. It is known as CLRS. We have free access to CLRS (on the library web site https://library.nyu.edu, search the name of the book under "Books & More").

Note: You can also use the third edition of this book. However, please double check the homework assignment with your friends who has the fourth edition of the book to make sure it is the same problem.
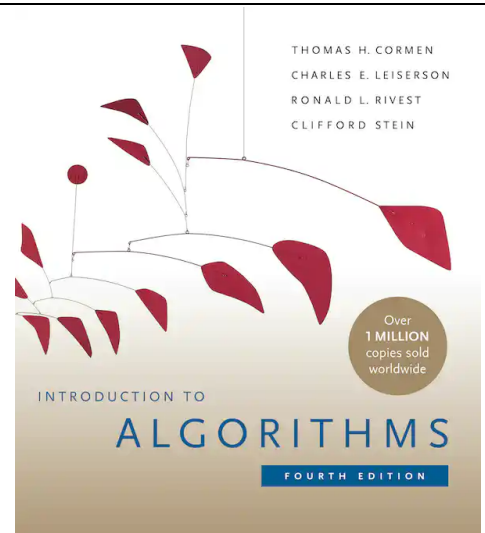
Course Work and Grading
Your final grade will be determined as follows: Homework 10%; Midterm 40%; Final 50%.

Teaching Assistant: Xiaotian Li (xl3399 nyu.edu)

Lectures: Thursday 11:00 AM - 1:30 PM, 6 MetroTech Center, Room 301

Office Hour:
All office hours are online over Zoom.
Instructor: Friday 11:00AM-12:00PM https://nyu.zoom.us/j/97367354213
Lead TA: TBD

Homework:

Homework is due in one week after it is released. All homework submissions are in Gradescope. You will get an invitation to join Gradescope once semester starts.

We only accept a single PDF for homework. If it is handwritten, please make sure you use some APP to scan all the pages clearly with brightness/contrast adjusted. You can use Adobe Scan, iOS Notes App (https://www.macworld.com/article/232686/how-to-scan-documents-and-make-pdfs-using-notes-on-your-iphone-or-ipad.html) or some other third-party software. Please don't just take pictures of your solution, as it is very difficult to read by the grader. If you use a pencil, please use a pencil of 2B or darker!

Once you upload the pdf, it prompts you to tag the pages for each question. Please tag your pages accurately. Otherwise, the grader may not be able to find where your solutions are.

Tentative Schedule

- Week 1 (9/7): Introduction to algorithm: correctness and performance. Best-, worst-, and average-case performance. Asymptotic notation: big-O, big-Ω, and big-Θ; little-o, and little-ω.

- Week 2 (9/14): Recurrence and solving methods: iteration, substitution and master theorem

- Week 3 (9/21): Divide and conquer algorithms, introduction to sorting: insertion sort, bubble sort

- Week 4 (9/28): Sorting: MergeSort, Heap and HeapSort,

- Week 5 (10/5): Sorting: quick sort, randomized algorithms, lower bound for comparison sorting, counting sort and radix sort

- Week 6 (10/12): HASH Tables and Binary Search Tree, Midterm review

- Week 7 (10/19): Midterm Exam, date TBD

- Week 8 (10/26): AVL Tree

- Week 9 (11/2): Graph Basics: Breath-First Search, Depth First Search

- Week 10 (11/9): Directed acyclic graph and topological ordering, strongly connected components

- Week 11 (11/16): Dynamic Programming

- Week 12 (11/23): Thanksgiving break

- Week 13 (11/30): Greedy Algorithm, Minimum Spanning Tree

- Week 14 (12/7): Single-source Shortest Paths

- Week 15 (12/14): NP-Completeness

- Week 16 (12/21): Final Exam, date TBD

If you are experiencing an illness or any other situation that might affect your academic performance in a class, please email Deanna Rayment, Coordinator of Student Advocacy, Compliance and Student Affairs.
Deanna can reach out to your instructors on your behalf when warranted.
- deanna.rayment@nyu.edu
- https://engineering.nyu.edu/staff/deanna-rayment

Inclusion Statement:
The NYU Tandon School values an inclusive and equitable environment for all our students. I hope to foster a sense of community in this class and consider it a place where individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities will be treated with respect. It is my intent that all students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. If this standard is not being upheld, please feel free to speak with me.