CAS CS 330 - Spring 2022 - Introduction to Analysis of Algorithms Syllabus

Official Course Description

Examines the basic principles of algorithm design and analysis; graph algorithms; greedy algorithms; dynamic programming; network flows; polynomial- time reductions; NP-hard and NP-complete problems; approximation algorithms; randomized algorithms This course fulfills a single unit in each of the following BU Hub areas: Quantitative Reasoning II, Critical Thinking.

Prerequisites

The class assumes **working knowledge of CS 112 and CS 131** (or MA 293). CS majors need to complete at least one of their Group B coursework (any two of CS 132/MA242, CS235/MA294 and CS237/MA581) before taking CS 330. If you don't have the prerequisites, please talk to an instructor before deciding to continue with this class.

TODO asap:
Sign up to the course Piazza and Gradescope pages. We'll use these for communication and homework. Details can be found later in this syllabus.

Piazza (Q&A, discussion, as well as distribution of lecture notes, homework, all links): piazza.com/bu/spring2022/cascs330

Gradescope (Homework submission) : https://www.gradescope.com/courses/352061 (Entry code: 5VGXDG)

Instructors and Teaching Fellows

Name	Office Hours (updated on Piazza)	Email@bu.edu *
Prof. Dora Erdos	TBA, Wed 8:30-10 am	edori
TA Anton Njavro	TBA	njavro
TF Nathan Cordner	TBA	ncordner
TA Anming Gu	TBA	agu2002
TA Shengyao (Jax) Luo	TBA	jaxluo

* Messaging via Piazza is preferable to email (and will get a faster response).

Textbook

Algorithm Design, by Kleinberg and Tardos. ISBN 0-321-29535-8.

Useful additional resources:

- Cormen, Leiserson, Rivest, and Stein. *Introduction to Algorithms*, 3rd ed. MIT Press.
- J. Erickson. *Algorithms,* 2019. Available from http://algorithms.wtf/
  See also the extensive exercises on the website.
- Mathematics for Computer Science by Eric Lehman, Tom Leighton, and Albert Meyer. (Useful background on discrete mathematics.)

Course Structure, Communication:

Lectures:
This course has two sections, A1 and B1. The sections are treated as one, the lecture and lab material, assignments, teaching resources are shared across the sections. You can attend either lecture (as long as there are free seats). However, for the exam you have to attend the lecture you are registered for.

This semester CS330 has one instructor, prof. Dora Erdos, two PhD student TFs, an two BA/MS TAs. The TFs will lead the discussion sessions, TAs will hold tutorials, all of the teaching staff will be available for office hours.

Discussions:
Labs will be an invaluable part of the course involving interactive problem-solving sessions, tips on homework questions, and supplemental material not covered in lecture. We will post lab notes on Piazza in advance -- please read before coming to lab. Lab solutions will be posted after all labs conclude. These sessions are only useful if you take active part in the problem solving process, simply reading the solutions won't be nearly as helpful.

Attendance in the discussions is mandatory. You can only skip for legitimate reasons, such as illness.

Communication:

We will be using **Piazza for all discussion** pertaining class. You should post your questions about the material, lectures, homework or course logistics there. Piazza is highly preferred over sending the course staff emails. Don't hesitate to ask any question, even if it seems too simple. Most likely some of your fellow students have the same question and will be glad that you asked. We encourage you to participate in the discussion and respond to questions. The course

staff will be monitoring Piazza and chime in as needed, but we highly encourage student answers. You are encouraged to ask questions about the homework assignments, e.g. clarifications, related material, but **do not post solutions** to the problems. If you think your question reveals too much, then please ask in a private post. If you would like to discuss a personal matter, you can send us a private post.

Lectures
A1 section : Tue, Thur 11:00 am - 12:15 pm, WED 130
B1 section : Tue, Thur 12:30 - 1:45 pm, WED 130

Discussion Labs
A2 : Mon 8 :00 - 8 :50 am, XX
A3 : Mon 9 :05 - 9 :55 am, XX
A4 : Mon 10 :10 – 11 :00 am, XX
A5 : Mon 11 :15 am – 12 :05 pm , XX
B2 : Mon 12 :20 – 1 :10 pm, XX
B3 : Mon 1 :25 – 2 :15 pm, XX
B4 : Mon 2 :30 – 3 :20 pm, XX
B5 : Mon 3 :35 – 4 :25 pm, XX

Topics We will mostly follow the order and content in the textbook. Topics are subject to change.

- Asymptotics, data structures, how to describe an algorithm (pseudocode)
- Graphs – data structures, graph traversals, connectivity, DAGs
- Greedy algorithms – scheduling, shortest paths, minimum spanning trees
- Divide-and-conquer – variations on MergeSort, integer multiplication, recurrences
- Dynamic programming – interval scheduling, sequence alignment, knapsack
- Network flow – Ford-Fulkerson, MFMC theorem, applications
- Polynomial time reductions, NP

Course atmosphere, diversity and inclusion: We intend to provide a positive and inclusive atmosphere in classes and on the associated virtual platforms. Students from a wide range of backgrounds and with a diverse set of perspectives are welcome. We ask that students treat each other with thoughtfulness and respect, and do their part to make all their peers feel welcome. Your suggestions are encouraged and appreciated. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups.

COVID-19: We will follow BU policies regarding social distancing and other measures related to COVID-19. Students are **required to wear a mask** that *fully covers* their mouth and nose while at lecture, discussion, and office hours. If you need to quarantine or isolate, or if you are unable to attend lectures for other reasons, we will make lecture notes available as quickly as possible

after lectures. *If you need to stay away from campus for COVID-related (or other) reasons, let us know via a Piazza private post*.

Coursework and Grading

Grading:

The course grade will break down as follows:

35% weekly homework assignments (always due on Wednesdays, first due date is **Wed. 1/26**).
30% in-class midterm exam (in-class, planned for **Tuesday 3/22**).
35% comprehensive final (during finals week).

Last day to **drop without a "W": Thursday, February 24, 2022**. **With a "W": Friday, April 1, 2022**. Incompletes for this class will be granted based on CAS Policy (mostly only for last minute emergencies).

Exams: Both exams will consist of problem solving and short questions about the material. The midterm will be during class time and takes 75 minutes. The final is during the University-assigned final exam slot and is 120 minutes long. The content of the final is cumulative.

No collaboration whatsoever is permitted on exams.

Accommodations: All are welcome in the course. If you require particular accommodations for exams or coursework, please contact us (and forward any relevant documentation from Disability and Access Services). If you are facing unusual circumstances during the semester, please **reach out to us** early on so that we can find a good arrangement.

Attendance: We will not take formal attendance in this course. However, while our textbook will be very helpful, it is an imperfect substitute for in-class learning, which is the fastest (and easiest) way to learn the material. Some material covered in lecture and lab may not be in our textbooks. You are in all cases responsible to be up to date on the material. Class participation and questions are very much encouraged. Please ask as many questions in class as you need. Chances are that your question and answer will be as helpful to your classmates as to you.

Homework:

Homework problems: Homework problem sets will contain of written problems assigned weekly. Assignments will always be posted Thursday morning and due the following Wednesday

evening. They will allow you to practice (a) solving problems using the ideas from class, often in a new way, (b) communicating your ideas using technical language (precise descriptions, pseudocode, formal claims, proofs). Be aware that this latter is just as important as the former.

The two lowest grades on your homework assignments will be **dropped**.

Content: The homework is probably the most useful learning tool in the course—take it seriously, allow yourself time to do it, and have fun! Alumni often describe this course's homework as critical to their success in job interviews.

Limited collaboration is permitted; see below.

Homework Submission: Assignments will be due **Wednesdays by 11:59PM ET**, electronically via **Gradescope**. Solutions to written problems should be typeset (preferred) or neatly hand-written and scanned. Make sure that your scan is legible. When submitting on Gradescope, don't forget to assign the pages to each problem, otherwise graders won't find it.

Late Policy: Late assignments will NOT be accepted as we intend to post solutions the next morning. You can use your dropped grades to cover for up to two late assignments. Also, be mindful that sometimes it's ok to submit partial results if you weren't able to fully finish your assignment, don't miss the deadline because of last minute work.

Regrade Policy: If, after reviewing the solutions and your answer, you still believe a portion of your homework was graded in error, you may request a regrade, **via Gradescope**, *NOT* through email. One of the staff will consider your request and adjust your grade if appropriate. Note that when we regrade a problem, your score may go up or down.

Workload: CS 330 is a **substantial amount of work**. There is a problem set every week as well as two exams to study for. As you likely already know, assignments requiring substantial creativity can take more time than you expect, so plan to finish a day early.

Collaboration, citation, and Academic Honesty

Citation policy: You are allowed and encouraged to further your knowledge by finding related material online or in books. However, if you use any resource other than material distributed in class in your homework solutions, **you have to cite it** otherwise it is considered plagiarism. Your citation may be a url, the title and chapter of a book, or a paper reference. You may use anything that was covered in lectures, labs or the textbook without explicitly referencing.

Searching explicitly for answers to problems on the Web or from other outside sources (these include anyone not enrolled in this class) is strictly forbidden.

Collaboration Policy: Collaboration on homework is permitted and even encouraged. If you choose to collaborate on some problems, you are allowed to discuss each problem with **at most 3** other students currently enrolled in the class. You cannot work in groups larger than 3, especially large course-wide collaboration (e.g. through Discord channel) is forbidden. Before working with others on a problem, you should think about it by yourself for at least 45 minutes.

You must write up each problem solution by yourself (using your own words) without assistance, even if you collaborate with others to solve the problem. You must also identify your collaborators clearly on the first page of your assignment. If you did not work with anyone, you should write ``Collaborators: none.'' It is a violation of this policy to submit a problem solution that you cannot orally explain to the instructors. You may get help on Piazza or in office hours from the instructors. You don't need to list them as collaborators .

No collaboration whatsoever is permitted on exams!

Collaboration strategies: If you do collaborate, use it as an opportunity to practice group work skills: give everyone a chance to speak, listen carefully, acknowledge good suggestions. If you have a tendency to be shy, speak up! If you have the tendency to dominate conversations, make sure to give others the floor. We strongly encourage you to find a small group of classmates that you regularly discuss and review material with. Feel free to post on Piazza to find a study mate and you can meet over Zoom or in person.

Academic Conduct:
Academic standards and the code of academic conduct are taken very seriously by the University, the College of Arts and Sciences, and the Department of Computer Science. Course participants must adhere to the CAS Academic Conduct Code. Please take the time to review this document if you are unfamiliar with its contents.

If in doubt, our department has an extensive compilation of **examples** with regard to Academic Conduct and permissible collaboration.

Violations of this policy will be dealt with according to University regulations.