CAS CS 330 - Spring 2021 - 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

Both CS 112 and CS 131 (or MA 293) are prerequisites for CS 330, and the class assumes a good working knowledge both classes. 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. 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 and homework):
piazza.com/bu/spring2021/cascs330

Gradescope (Homework submission) :
https://www.gradescope.com/courses/223436 (code: D5PJRV)

Instructors and Teaching Fellows

Name	**Office hours via Zoom (all times are in ET)**	**Email@bu.edu ***
Prof. Steve Homer	Mon 7:30-8:30 pm, Tue Thur 1-2 pm during weeks when prof. Homer is teaching, Fri 10-11 am when not teaching.	homer
Prof. Dora Erdos	Wed 9:30-11, Tue, Thur 1-:1:45 during weeks when prof. Erdos is teaching.	edori
Siqi Wang (TF)	TBD	siqiwang
Timothy Jackman (TF)	TBD	tjackman

* 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 and LfA:

Structure:
The class will be co-taught by Professors Homer and Erdos. On any given lecture date, one of the two instructors will deliver the lecture for both the A1 and B1 sections. The TFs will lead the discussion sessions. The two sections of CS330 will be treated as one course; the material covered, lab exercises and assignments will be identical for the two. If you can't make it to your assigned lecture, please feel free to join the other.

The discussion sessions will be problem-solving style. With the goal to reinforce the concepts covered in the lectures and to provide guidance on the homework assignments.

Communication:
We will be using Piazza for all discussion pertaining class. You should post your questions about the material, lectures, homework or course logistics here. Piazza is highly preferred over sending the course staff emails. Most often your question and the answer will be just as useful to your fellow students as yourself. We encourage you to respond to questions. The course staff will be monitoring Piazza and chime in as needed. 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 is too specific or would reveal too much, then please ask in a private post.

Lfa – Learn from Anywhere (a.k.a. remote and in-person learning):

This course is provided in the LfA format. You'll be able to come to the lecture hall in person or tune in via Zoom. Lectures (and discussions) will be recorded and posted so

that you can view them later. Links to Zoom and the recordings can be found on the course Piazza. All office hours will be held via Zoom. We encourage participation from all students online or in person!

Lectures
Lecture A1: Tue, Thu 2-3 :15 ET, AGG G105
Lecture B1: Tue, Thu, 3 :30-4 :45 ET, AGG G105

Discussion Labs

Lab A2 (Mon 9:05 - 9:55) KCB106
Lab A3 (Mon 10:10 - 11:00) KCB106
Lab A4 (Mon 11:15 - 12:05) CAS B06A
Lab A5 (Mon 12:20-1:10) CAS B06A
Lab B2 (Mon 12:20 - 1:10) PSY B53
Lab B3 (Mon 1:25 - 2:15) CAS B06A
Lab B4 (Mon 2:30 - 3:20) CAS B06A
Lab B5 (Mon 3:35 - 4:25) CAS B06A

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 problem sets on Piazza in advance -- please read before coming to lab. Lab solutions will be posted Monday evening, after all labs conclude.

Coursework and Grading

The course grade will break down as follows:

25% weekly homework assignments, due Wednesdays, starting February 3).
30% in-class midterm exam (in-class, planned for **XXX data**).
4**5%** comprehensive final, in the normal exam slot for classes in our respective time blocks.

Last day to **drop without a "W": March 1, 2021**. **With a "W" April 2, 2021**. Incompletes for this class will be granted based on CAS Policy (mostly only for last minute emergencies).

Exams: There will be one seventy-five minute in-class midterm held during the middle of the semester on XXX**, 2021**. The cumulative final will be held during the normal two-hour final exam slot. Please make your travel plans accordingly.

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. While the class is large, class participation and questions are very much encouraged.

Homework problems: Homework problem sets, assigned weekly, 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). The assignments will mostly be written problems.

The homework is probably the most useful learning tool in the course—take it seriously, allow yourself time to do it, (try to) enjoy the challenge! Alumni often describe this course's homework as critical to their success in job interviews. Limited collaboration is permitted; see below.

Two lowest grades on your homework assignments during the semester will be **dropped**.

Homework Submission: Assignments will typically be due Wednesdays by 11:59PM, electronically via Gradescope. Solutions should be typeset (preferred) or neatly hand-written and scanned.

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 late assignments. Also, be mindful that sometimes it's ok to submit partial results if you weren't able to fully finish your assignment.

Regrade Policy: If, after reviewing your solution, 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: Be forewarned -- the workload in this course will be **heavy**. There is a problem set (almost) every week. As you likely already know, assignments requiring substantial creativity can take more time than you expect, so plan to finish a day early.

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 5 other students currently enrolled in the class. Before working with others on a problem, you should think about it 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. 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 an instructor or TF. You may get help on Piazza, from the TFs and instructors for the class for specific problems. (Don't expect them to do it for you, however!)

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

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. You can use Piazza posts to find team mates if you don't have any and you can meet over Zoom.

Academic Conduct:

Academic standards and the code of academic conduct are taken very seriously by our University, by the College of Arts and Sciences, and by 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.

Tentative schedule:

This schedule is subject to change. We will keep an up-to-date schedule on Piazza.

Num	Topics
1	Syllabus, logistics. Stable Matching
2	Asymptotics
3	Data structures

4	Graphs - BFS
5	Graphs - BFS + top. sort + SCC
6	Greedy - interval scheduling
7	Greedy - interval partitioning
8	Greedy - minimize lateness
9	Dijkstra
10	MST
11	MST - Prim's and Kruskal's
12	D&C - mergesort+closest pair of points
13	D&C
spring break	
spring break	
14	**Midterm**
15	DP - concept of DP, weighted int sch.
16	DP - longest common substring
17	DP - knapsack, subsetsum
18	DP - Bellman-Ford
19	Network flow - push-pull algo
20	Network flow - MFMC
21	Network flow - max bip. matching and perfect match
22	reductions
23	NP and NP-C
24	random algos
25	random algos
26	tbd
27	tbd