CAS CS 330 - Fall 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
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):
http://piazza.com/bu/fall2021/cascs330

Gradescope (Homework submission):
https://www.gradescope.com/courses/293144 (Entry code: 4PYWE2)

TopHat: A platform for in-class interaction and questions. You will be signed up automatically for the course. There is a one-time fee for getting a TopHat account. If you do not have an account and the fee represents a financial hardship, please let us (the instructors) know via a private Piazza post.

Instructors and Teaching Fellows

<table>
<thead>
<tr>
<th>Name</th>
<th>Office Hours</th>
<th><a href="mailto:Email@bu.edu">Email@bu.edu</a> *</th>
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</thead>
<tbody>
<tr>
<td>Prof. Dora Erdos</td>
<td>Mon. 11 am-12:30pm, Wed. 8:30-10 am</td>
<td>edori</td>
</tr>
<tr>
<td>Prof. Adam Smith</td>
<td>Tue 8:30am-10am, Fri. 8:30am-10am</td>
<td>ads22</td>
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<tr>
<td>TF Marika Swanberg</td>
<td>Wed 1-4 pm</td>
<td>marikas</td>
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<tr>
<td>TF Nathan Cordner</td>
<td>Tue 5-6 pm, Fri 3-5 pm</td>
<td>ncordner</td>
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* Messaging via Piazza is preferable to email (and will get a faster response).

**Textbook**


Useful additional resources:
  - 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:**

**Structure:**
The class will be co-taught by Professors Smith 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 objective is to reinforce the concepts covered in the lectures through problem-solving, and to provide clarification and guidance on the homework assignments. The purpose of the office hours of the Instructors and Teaching Fellows is to answer specific questions or clarify specific issues.

**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.
A1 section: Tue, Thur 2:00 - 3:15 pm, CAS 313
B1 section: Tue, Thur 3:30 - 4:45 pm, CAS 313

Discussion Labs
A2: Mon 8:00 - 8:50 am, CAS B27
A3: Mon 9:05 - 9:55 am, CAS B29
A4: Mon 10:10 – 11:00 am, CAS 218
A5: Mon 11:15 am – 12:05 pm, CAS 213
B2: Mon 12:20 – 1:10 pm, CAS 326
B3: Mon 1:25 – 2:15 pm, CAS 320
B4: Mon 2:30 – 3:20 pm, CAS 223
B5: Mon 3:35 – 4:25 pm, CAS 222

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 and recordings will be posted after all labs conclude.

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
- 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.

Coursework and Grading
Grading:

The course grade will break down as follows:

5% class participation (based on TopHat)
35% weekly homework assignments (due Wednesdays, first due Wednesday, Sept. 8th, 2021).
25% in-class midterm exam (in-class, planned for Tuesday, Oct. 26th, 2021).
35% comprehensive final (during finals week).

Last day to drop without a “W”: Thur, Oct. 7th 2021. With a “W”: Fri. Nov. 5th, 2021. 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. 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.

TopHat is a web-based platform for interactive questions during class. Our goal in using it is to make lectures more interactive, get you thinking actively about the material, and get some feedback on what you are learning. TopHat questions are generally multiple choice. Most of the points (80%) are for participation. The remaining 20% is for correctness. You will get the full 5% of the course grade if you get at least 80% of the possible TopHat points for the semester.

Homework:

Homework problems: Homework problem sets will be a mix of written problems (mostly) and programming 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.

Programming problems are in Python and will be submitted via Gradescope.

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. Your citation may be a url, the title and chapter of a book, or a paper reference.

Searching explicitly for answers to problems on the Web or from other outside sources (these include anyone not enrolled in the 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. 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 for the class for specific problems. 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.