

CSCI-570: Analysis of Algorithms
Spring 2025

Instructor: Máté Szabó
E-mail: mateszab@usc.edu
OH: Tue, Thur: 10:00 - 11:30 am
OH location: TBA

TA: TBA
E-mail: TBA

Graders: TBA
E-mail: TBA

Section 30177D Lecture: 5:00 - 7:20 pm SGM 101
 Tuesdays Discussion: 7:30 - 8:20 pm SGM 101

Section 30395D Lecture: 5:00 - 7:20 pm SLH 200
 Wednesdays Discussion: 7:30 - 8:20 pm SLH 200

**This syllabus is subject to change and will be updated regularly.
Please check it frequently!**

Course description:

This course is about designing algorithms for computational problems, and how to think clearly about analyzing correctness and running time. The main goal of this course is to provide the intellectual tools needed for designing and analyzing your own algorithms for new problems you need to solve in the future. The course explores fundamental algorithm design techniques such as greedy, divide and conquer, dynamic programming, network flow, reduction, approximation, for efficient algorithm construction. The course describes Turing-machines and explains what NP-completeness means with respect to possibilities for solving these problems efficiently. There are no programming assignments in this course.

Learning objectives:

- Understanding a variety of techniques for designing algorithms.
- Develop skills to reason about and prove properties of algorithms such as their correctness and running time.
- Design experiments to evaluate and compare different algorithm techniques on real-world problems
- Use approximation and linear programming to find near-optimal solutions for challenging problems.
- Use the concept of randomization to find efficient algorithms for challenging problems.
- Use the theory of NP-completeness to argue for the difficulty of some problems.

Textbook:

Algorithm Design, by J. Kleinberg and E. Tardos.

Optional textbooks:

Introduction to Algorithms, by T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein,

Algorithms, by S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani,

Algorithms in Action, by V. Savvich.

Prerequisites:

Students in the class are expected to have a reasonable degree of mathematical sophistication, and to be familiar with the basic notions of algorithms and data structures, discrete mathematics, and probability. Undergraduate classes in these subjects should be sufficient. If you have no previous background in these, I suggest a more thorough introduction such as “*Mathematics for Computer Science*”, by Eric Lehman, Thomson Leighton and Albert Meyer, 2017 or “*An Active Introduction to Discrete Mathematics and Algorithms*” by Charles Cusack and David Santos, 2015. The course does not emphasize or require programming, just pseudocode to help students’ conceptual understanding.

Homeworks:

- There will be six written theory assignments.
- Homeworks will be due at 11:59 pm on Wednesdays (for both Sections).
- The assignments should be submitted electronically through GradeScope.
- Theory assignments must be submitted as a single pdf file.
- You are allowed to work together on the homework. Collaboration should be limited to high level talking about the problems, make sure each of your answers are written in your own words. Clearly indicate your collaborators at the top of your submission, and list any resources you consulted outside of the official course resources.
- Homeworks won’t be regraded.

Homework late policy:

Everyone can be 1 day late once per semester without any consequences. This “get out of jail free card” will be automatically applied by graders, who will also keep track of everyone’s late days. For every further late day a 15% of penalty will be applied to your grade on that HW.

(If you happen to be late due to health issues, family emergency, etc., please don’t hesitate to reach out to me and we will find appropriate solutions to those special circumstances.)

Purpose of the homework:

Algorithms is a pivotal course in computer science studies. The course will require a significant amount of work on your part to follow what is taught in class and complete homework successfully. We stress that the homework is an essential part of your course work. We devote a fairly large amount of time for designing, writing, grading and explaining the homework, so that you can test yourselves and see how well you understand and implement the course’s material.

Exams:

- There will be two in-person exams during the term.
- Each exam is 2 hrs long.
- No makeup exams will be provided.
- The exam solutions and grading rubric will be posted.
- There will be a regrading session for each exam where you can discuss grading errors. A regrade is allowed only when there are clear and obvious grading errors. Grading errors are simple mistakes made on the part of the graders, and not differences in interpretation of a question or answer.
- If you missed the last exam, you may be eligible for an IN grade for the course. The incomplete grade has to be completed within one year. However, in order to get an IN you have to have a valid cause. Please read the University policy on IN grade for more details.
- Accommodations for students with letters from OSAS will be provided.

Grading:

Weighting:

HWs	24%	(4% each)
Exam 1	36%	
Exam 2	40%	

Letter grade distribution:

A	≥ 90	B+	80-85	C+	67-70	D+	57-60	F	< 50
A-	85-90	B	75-80	C	63-67	D	53-57		
		B-	70-75	C-	60-63	D-	50-53		

Tentative schedule:

This schedule is meant as an outline. Depending on progress, material may be added or removed. Each lecture is 2hrs and 20 mins long (with a break around the middle), immediately followed by a 50 mins long discussion session.

Week	Topics covered and remarks	Assessment
Jan 13-17	Mathematical Background, Mathematical Proofs	
Jan 20-24	Runtime Analysis, Big-O notation, Amortized Analysis	HW1 out
Jan 27-31	Advanced Heaps	HW1 Jan 29
Feb 3-7	Divide-and-Conquer Algorithms	HW2 out
Feb 10-14	Divide-and-Conquer Algorithms	HW2 Feb 12
Feb 17-21	Dynamic Programming	HW3 out
Feb 24-28	Dynamic Programming	HW3 Feb 26 HW4 out
March 3-7	Review for exam EXAM 1 on March 7th, from 6pm until 8pm	HW4 March 5 Exam 1
March 10-14	Greedy Algorithms	
March 17-21	Spring Break, NO CLASSES \o/	
March 24-28	Network Flow Video lecture!!! No in-person class!!!	
March 31 - April 4	Flow Circulation	HW5 out
April 7-11	NP-Completeness	HW5 April 2
April 14-18	NP-Completeness	HW6 out
April 21-25	Approximation Algorithms	HW6 April 23
April 28 - May 2	Review for exam EXAM 2 on May 2nd, from 6pm until 8pm	Exam 2

Homework by topic:

Assignment	Topic
HW1	proofs, runtime, big-O, amortized costs
HW2	heaps, divide-and-conquer
HW3	divide-and-conquer, dynamic programming
HW4	dynamic programming
HW5	greedy algorithms, , network flow, flow circulation
HW6	NP-completeness

Piazza and E-mails:

If you have a question about the material or logistics of the class, please do not use e-mail but instead post it on the Piazza at piazza.com/usc/fall2024/csci570. You may post it on Piazza publicly to the whole class or privately to the instructors. Often times, if one student has a question/comment, other also have a similar question/comment. Please DO NOT send emails to the course staff unless your issue is private and/or a private post on Piazza is unsuitable.

Attendance:

There is no lecture attendance requirement that counts towards your grade in the class. However, students who do not attend lecture are responsible for everything covered in lecture. If attendance falls below 60% the video recordings of the lecture will be discontinued without previous announcement.

Academic integrity:

The USC Student Conduct Code prohibits plagiarism. All USC students are responsible for reading and following the Student Conduct Code, which appears on <https://policy.usc.edu/files/2018/07/SCampus-2018-19.pdf>.

In this course we encourage students to study together. This includes discussing general strategies to be used on individual assignments. However, all work submitted for the class is to be done individually. Some examples of what is not allowed by the conduct code: copying all or part of someone else's work (by hand or by looking at others' files, either secretly or if shown), and submitting it as your own; giving another student in the class a copy of your assignment solution; consulting with another student during an exam. If you have questions about what is allowed, please discuss it with the instructor.

Honor code pledge:

I pledge to uphold the highest academic standards and integrity. In accordance with USC Viterbi's Honor Code (<https://viterbischool.usc.edu/academic-integrity/>), I affirm that I have not used any unauthorized materials in completing the exams, and have neither given assistance to others nor received assistance from others. Further, I affirm that I have not observed any other students in this class acting to gain an unfair advantage, or I have reported to my instructor any activity I have observed that is not in accordance with USC Viterbi's Honor Code. I do so to sustain a Viterbi culture of integrity, responsibility, community and "excellence in all our endeavors." I understand that there are significant consequences for violating academic integrity (<https://policy.usc.edu/scampus-part-b/>) and that suspected violations will be reported to the School and the University.

For students with disabilities:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs each semester. A letter of verification for approved accommodations

can be obtained from OSAS. Please be sure the letter is delivered to me as early in the semester as possible. OSAS is located in STU 301 and is open 8:30 a.m.-5:00 p.m., Monday through Friday.

Support Systems

Counseling and mental health:

(213) 740-9355 – 24/7 on call <http://studenthealth.usc.edu/counseling>. Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline:

(800) 273-8255 – 24/7 on call <http://suicidepreventionlifeline.org>. Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services:

(213) 740-9355(WELL), press “0” after hours – 24/7 on call <http://studenthealth.usc.edu/sexual-assault>. Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity:

(213) 740-5086 | Title IX – (213) 821-8298 <http://equity.usc.edu>, <http://titleix.usc.edu>. Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting incidents of bias or harassment:

(213) 740-5086 or (213) 821-8298 http://usc-advocate.symplicity.com/care_report. Avenue to report incidents of bias, hate crimes, and micro-aggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

USC Emergency:

(213) 740-4321 – 24/7 on call, <http://emergency.usc.edu>. Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety:

(213) 740-6000 – 24/7 on call, <http://dps.usc.edu>. Non-emergency assistance or information.