CSc 445: Algorithms

Chavez Room 111

Monday & Wednesday 3:30 - 4:45 PM

Course Description

Introduction to the design and analysis of algorithms: basic analysis techniques (asymptotics, sums, recurrences); basic design techniques (divide and conquer, dynamic programming, greedy, amortization); acquiring an algorithm repertoire (sorting, median finding, strong components, spanning trees, shortest paths, maximum flow, string matching); and handling intractability (approximation algorithms, branch and bound).

Instructor and Contact Information

Melanie Lotz
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Office: GS 847

Teaching Assistants

Mahshad Habibpourparizi – mahshadh@arizona.edu
Rubin Yang – yuchan0401@arizona.edu

Office Hours:

- Lotz office hours will be held in GS 847
- TA office hours will be held in TBD
- Our scheduled office hours have an open door policy, which means you do not have to make an appointment. If you need to meet with any of us at an unscheduled time, you can email to set up an appointment.
- The office hours schedule will be posted on Piazza, and office hours will start in the second week.

Course Format and Teaching Methods

- This class is in-person and regular attendance is expected.
- Class will include lecture, as well as in-class assignments that may or may not be for a grade.
- Attendance and participation are important to learning the material and succeeding in the course.

Course Objectives

• Learn about algorithm analysis and relevant tools, techniques.
• Gain experience in algorithm design making use of techniques including divide and conquer, greedy algorithms, dynamic programming, amortization, and approximation algorithms.

Expected Learning Outcomes

Students will:

• learn algorithm design (the ability to synthesize correct and efficient procedures for new combinatorial problems),

• acquire an algorithm repertoire (a toolbox of classic algorithms for well-solved problems)

• be able to apply algorithm reduction (the ability to reduce new problems to known problems from your repertoire)

Transferable Career Skills

National Association of Colleges and Employers (NACE) Career Readiness:

Career readiness is a foundation from which to demonstrate requisite core competencies that broadly prepare the college-educated for success in the workplace and lifelong career management. For new college graduates, career readiness is key to ensuring successful entrance into the workforce.

There are eight career readiness competencies, each of which can be demonstrated in a variety of ways." (NACE, 2025)

- Career & Self Development
- Communication
- Critical Thinking
- Equity & Inclusion
- Leadership
- Professionalism
- Teamwork
- Technology

In this course, we will focus on the following competencies:

- **Communication** – This class requires students to not only understand concepts and reason about them but also to effectively communicate their ideas.
- **Critical Thinking** – Students are expected to think critically about how problems are solved and be able to apply strategies and techniques to new problems.
- **Professionalism** – Being a computer scientist is more than programming, and this class seeks to develop students more fully as computer scientists who can be successful as professionals in the field, with skills that go beyond what artificial intelligence can provide.

Makeup Policy for Students Who Register Late

Students who register late are encouraged to work through the missed material, but credit will not be given for any missed assignments.

Course Communications

There will be various ways that communication will take place in this course, and it is important that you keep track of all of them.

- **Email**: Check your UA email regularly.
- **D2L**: This is the main website for the course and includes
    - the syllabus
    - the course materials
    - the assignments

    - the official calendar
    - the official gradebook
    - announcements
- **Piazza**: Announcements may be made on Piazza, which is also used for questions and discussions *about course content*.
    - **Please do not use Piazza to ask about grades or request a regrade.**
    - Please note that although you are able to post anonymously to other students, none of your posts are anonymous to the instructor or the TAs.
    - You may be added automatically, but if you register late, you can add yourself using the following link: https://piazza.com/arizona/fall2025/csc445
- **Gradescope:** Gradescope is used for grading most of the assignments and can also be used for submitting regrade requests on said assignments. Please note that the official gradebook is in D2L, but grades from Gradescope will not be transferred to D2L until after the regrade request window has closed.

Required Texts or Readings

There is no *required* textbook for this class, but the following textbook is *recommended*:

Introduction to Algorithms: 3rd Edition
Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
ISBN #978-0-262-03384-8

Assignments and Examinations: Schedule/Due Dates

In-Class Assignments (200 points). In-class assignments can include quizzes (announced or unannounced) and other assignments that must be completed in class. Some will be graded for accuracy and some will be graded for completion, but for all of them, you must be present in class to get credit, and they cannot be made up for any reason. There will be 225 points possible in this category, but your score will be capped at 200, providing some flexibility.

If you are absent from class and provide appropriate documentation (see the note below about what that means), these kinds of assignments can be excused but please note that excusing an assignment means that the other ones will be worth more AND that excusing an assignment will likely not make much of a difference in your grade unless the missed assignment(s) go(es) beyond the extra 25 points, so it is in your best interest to come to class unless you have a very good reason not to.

Homework (150 points). There will be 6 homework assignments, which are already listed on the syllabus. In most cases, these are released on a Wednesday and due on Friday of the following week by 11:59 PM. The exception to this is HW #6 which spans a longer period of time due to the overlap with Thanksgiving Break. Each homework assignment is worth 30 points, so the total number of points possible is 180, but your points will be capped at 150. This is to provide flexibility since **homework will not be accepted late and cannot be made up for any reason.**

If you miss a homework deadline and provide appropriate documentation (see the note below about what that means), a homework assignment can be excused but please not that excusing an assignment means that the other ones will be worth more AND that excusing an assignment will likely not make much of a difference in your grade unless the missed assignment(s) go(es) beyond the extra 30 points, so it is in your best interest to submit all the homework assignments on time in order to fully benefit from the extra points.

Midterms (400 points). There are two midterms, each worth 200 points. They are already

on the schedule and will be given during the regular class period. Make-ups for exams are only allowed if you provide appropriate documentation (see the note below about what that means), but if your final exam grade (%) is better than your lowest midterm grade (%), then the lowest midterm grade (%) will be replaced by the final exam grade (%).

Final Exam (250 points). The final exam is worth 250 points and will be cumulative. The final exam for this course is on Tuesday, December 16, 2025 from 3:30 to 5:30 PM in our regular classroom. Students are expected to attend the exam in person. I rarely allow students to take the exam at a different time, so plan accordingly.

"Appropriate Documentation": Dean's Excuses and Letters from the Dean of Students Office.

I only allow make-ups and excuse assignments in cases where I receive official documentation in the form of a Dean's Excuse or an official letter from the Dean of Students Office. Below is information about how that works.

- Dean's Excuses are special excuses provided for students *for school-sanctioned events*, such as sporting competitions.
- A Letter from the Dean of Students Office is an official notification from the Dean of Students Office that they may send out to your instructors if you contact them about an emergency situation, typically when it causes you to miss class for a week or more. Please note that just talking to someone in that office is not sufficient. I require an official letter from them indicating the dates of your absence and verifying that they have deemed it an emergency situation. (Note that they don't usually share details of the situation, just a general idea.) This is required for my class because I am not allowed to ask for medical documentation. The Dean of Students information can be found here: https://deanofstudents.arizona.edu/

Please note that each type of assignment has its own makeup/excuse/late work policy, which are described above. This is just general information about how to get appropriate documentation, when it is possible and applicable.

Final Examination

The final exam for this course is on Tuesday, December 16, 2025 from 3:30 to 5:30 PM in our regular classroom. Students are expected to attend the exam in person. I rarely allow students to take the exam at a different time, so plan accordingly.

Grading Scale and Policies

Your grade will be calculated based on the following point distribution.

Category/Assignment	**Points**
In-class Assignments	200
Homework	150
Midterms	400
Final Exam	250

The following are the expected grade cut-offs. Although these can vary a bit at the end of the semester (sometimes I lower them a bit, but I never raise them), you should expect

them to be around the same as what is listed.

Points	Grade
900+	A
800-899	B
700-799	C
600-699	D
0-599	E

University policy regarding grades and grading systems is available at https://catalog.arizona.edu/policy/courses-credit/grading/grading-system

Incomplete (I) or Withdrawal (W):

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at https://catalog.arizona.edu/policy/courses-credit/grading/grading-system.

Dispute of Grade Policy:

- Regrade requests and grade disputes must be handled within 72 hours of the grade being released. No regrade requests will be considered outside of that window and no regrade requests will be considered after Wednesday, December 10, 2025.
- For assignments graded on Gradescope, you can submit regrade requests directly through Gradescope. All other questions or concerns about grades should be directed to your instructor (Lotz).
- Always check your answer against the posted solutions before submitting a regrade request.
- Follow any specific instructions given through announcements or emails.
- It is your right as a student to know how you are being graded and to ask for clarification or a regrade when appropriate. However, requesting a regrade through Gradescope is a privilege, and you are expected to do so by following the guidelines and with courtesy to the graders. I reserve the right to turn off the regrade request feature on Gradescope and require all regrade requests and grade disputes to be handled by me during office hours.

Scheduled Topics and Activities

Note: This is a tentative schedule and may change as necessary.

Date	Lecture Topics	Released	Due
Week 1			
M 8/25	• Course Overview • Introduction (Ch. 2)		
W 8/27	Basic Analysis (Ch. 3)	HW #1	
Week 2			

M 9/1	**Labor Day – no class**		
W 9/3	Basic Analysis		
F 9/5			HW #1
Week 3			
M 9/8	Divide-and-Conquer (Ch. 4)		
W 9/10	Divide-and-Conquer	HW #2	
Week 4			
M 9/15	Probabilistic Analysis and Randomized Algorithms (Ch. 5)		
W 9/17	Sorting (Ch. 6-8)		
F 9/19			HW #2
Week 5			
M 9/22	Sorting		
W 9/24	Medians & Order Statistics (Ch. 9)		
Week 6			
M 9/29	**Midterm #1**		
W 10/1	Dynamic Programming (Ch. 15)	HW #3	
Week 7			
M 10/6	Dynamic Programming		
W 10/8	Greedy Algorithms (Ch. 16)		
F 10/10			HW #3
Week 8			
M	Greedy Algorithms		

10/13			
W 10/15	Amortized Analysis (Ch. 17)	HW #4	
Week 9			
M 10/20	Amortized Analysis		
W 10/22	Elementary Graph Algorithms (Ch. 22)		
F 10/24			HW #4
Week 10			
M 10/27	Minimum Spanning Tree (Ch. 23)		
W 10/29	Minimum Spanning Tree		
Week 11			
M 11/3	**Midterm #2**		
W 11/5	Shortest Path (Ch. 24-25)	HW #5	
Week 12			
M 11/10	Shortest Path		
W 11/12	Maximum Flow (Ch. 26)		
F 11/14			HW #5
Week 13			
M 11/17	Maximum Flow		
W 11/19	String Matching (Ch. 32)	HW #6	
Week 14			

M 11/24	String Matching		
W 11/26	NP-Completeness (Ch. 34)		
Week 15			
M 12/1	NP-Completeness		
W 12/3	Approximation Algorithms (Ch. 35)		
F 12/5			HW #6
Week 16			
M 12/8	Review/Buffer Day		
W 12/10	Review/Buffer Day		
Week 17			
T 12/16	**Final Exam, 3:30-5:30 PM**		

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Safety on Campus and in the Classroom

For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): https://cirt.arizona.edu/case-emergency/overview
Also watch the video available at
https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/app/me/ledetail;spf-url=common%2Flearningeventdetail%2Fcrtfy000000000003841

Course-specific Academic Integrity Policy

This course is set up in order to hopefully foster an environment where learning is the goal. To that end, your grade is based mostly on assignments done in class (to provide practice, help you self-assess your understanding, and to encourage regular attendance) and assessments done in controlled environments. Homework is given so that you have time to practice, but if you do not actually do the homework yourself, you will likely not be able to do well on the exams, which are worth 65% of your grade. Unless you are given explicit permission to do differently on an assignment, **everything you submit for this course needs to be your own work from beginning to end.** It is not permissible to share answers with other students or look at other student answers. If you are using resources outside of the course materials (including, but not limited to, online resources and artificial intelligence), you need to be careful to use it in a way that enhances your learning and does not bypass it. For example, if you are going to use ChatGPT to help you, I recommend you use it in study mode.

This is not an exhaustive list but the following table is provided in order to help you determine which kinds of behavior are acceptable and which are not.

Acceptable Behavior	**Unacceptable Behavior**
Discussing ideas about homework with other students *without writing anything down*	Sharing full solutions to homework with other students or looking at another student's solution
Asking an AI system or using other resources to clarify or give examples of an idea from the course or using AI in study mode to help you understand examples from class.	Looking at full solutions to assignments online, posting homework questions to any website, getting solutions to assignments from a tutor, getting solutions to assignments from ChatGPT or other AI systems
Referencing course materials or the textbook	Using someone else's work or ideas except in limited ways and when giving proper credit

This is not an exhaustive list and individual assignments may have additional academic integrity details, so read and follow the instructions. If there is any suspicion of academic integrity, I will set up a meeting with you to discuss the issues and try to determine if you have behaved in a way that bypasses learning rather than enhances it.

This information is not meant to scare you but to give you appropriate guidance so that you can learn without the stress of worrying about violating the policy. **If you have any doubts about whether certain behavior is acceptable or not, just ask.**

If I believe, after investigation, that you have violated the academic integrity policy, I will file a report with the Dean of Students Office, and the recommended sanction will be that you fail the course.

University-wide Policies link

Links to the following UA policies are provided here:
https://catalog.arizona.edu/syllabus-policies

- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy

Department-wide Syllabus Policies and Resources link

Links to the following departmental syllabus policies and resources are provided here, https://www.cs.arizona.edu/cs-course-syllabus-policies :

- Department Code of Conduct
- Class Recordings
- Illnesses and Emergencies
- Obtaining Help
- Preferred Names and Pronouns
- Confidentiality of Student Records
- Additional Resources
- Land Acknowledgement Statement

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.