CSc 345 (Analysis of Discrete Structures) Syllabus

M Pacheco ILC, Rm 140, TuTh 3:30pm-4:45pm

Course Description

Introduction to and analysis of algorithms and characteristics of discrete structures. Course topics include algorithm analysis techniques, recurrence relations, structural induction, hierarchical structures, graphs, hashing, and sorting.

Course Prerequisites

Computer Science Advanced Standing. CSc 210 and CSc 244. In particular, you are expected to know the Java programming language; to be able to design, code, and debug programs consisting of hundreds of lines of object-oriented code; to understand and use basic common algorithms (e.g., sorting) and data structures (e.g., stacks); and to understand and apply basics of discrete mathematics, including the interpretation and creation of formal proofs.

Instructor and Contact Information

Professor Hudson Lynam, GS Room 823, 775-750-5038, hlynam@arizona.edu

Office Hours: Tuesday & Thursday, 2:00pm-3:00pm

For additional information (including TA office hour information), please refer to the course website.

Course Format and Teaching Methods

This course is scheduled to be an in-person course, meeting in-person two times a week. Your meeting time should be:

M Pacheco ILC, Rm 140, Tuesday, Thursday 2:00pm-2:50pm
This is a three-unit course, meeting in the lecture room two times a week. Attendance is expected and required. If you need an exception due to a medical or visa issue, please reach out to the DRC or instructor.

Course Objectives

Students will learn about data structures, algorithms, and algorithm design and analysis techniques beyond those covered in CSc 120, 210, and 244.

- Learn more complex data structures and algorithms than those covered in CSc 120, 210, and 244.
- Be able to select appropriate data structures and/or algorithms to solve specific problems, and explain the advantages and disadvantages of the choices as compared to alternative solutions, and
- Construct implementations of those data structures and algorithms in the programming language used in the course.

Expected Learning Outcomes

A successful CSc 345 student will be able to:

- Asymptotically analyze iterative and recursive algorithms
- Follow a provided style guide to write clean, well-structured, and readable code.
- Construct and compare hierarchical structures and graphs
- Identify, analyze, and compare common searching and sorting algorithms

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:

- **Technology**: You will implement and analyze a variety of algorithms and data structures to develop software applications.
- **Communication**: In addition to interacting with the instructor and TAs in-person, by email, and via the class discussion board, you will describe your software implementations via in-line documentation and you will construct clearly-written solutions to homework problems.
- **Critical Thinking**: You will construct solutions to algorithmic problems to meet specific outcomes such as expected worst-case execution and storage efficiencies.

Makeup Policy for Students Who Register Late

If you enroll in the class after the first graded activity has been assigned, please see the instructor to discuss possible adjustments to due dates.

Administrative Drops

Every semester, students enroll in CS classes but do not submit any work, resulting in a grade of 'E' at the end of the term. To prevent this, after the end of the second week, I will be administratively dropping all students who have not submitted any activities collected prior to the no-W drop date.

Course Communications

All online communication will be conducted through my official UA e-mail address (hlynam@arizona.edu), D2L, and Piazza. Ask questions on Piazza when you have questions about assignments, quizzes, and exams (has private options). Email the instructor only when you have logistics-related questions.

Required Texts or Readings

All readings, videos, and assignment instructions will be available on the course website.

Course D2L: https://d2l.arizona.edu/d2l/home/1725364
Course Gradescope: https://www.gradescope.com/courses/1221227
Course website: https://professorlynam.github.io/csc345/
Piazza: https://piazza.com/arizona/spring2026/csc345/home

Assignments and Examinations: Schedule/Due Dates

The breakdown of grades in this course is as follows:

30% Midterm Exams (2)

24% Programs (4)
20% Homeworks (4)
16% Final Exam
10% Quizzes (best 5)

There will be two midterm exams (each 15%) and a final exam (16%) throughout the course, for a total of 46%. At the end of the semester, if at least two-thirds of the students have submitted class evaluations, we replaced your lowest midterm exam score with a percentage-equivalent copy of your final exam score, if the final exam score is higher than your lowest midterm score. We do this not only to encourage class evaluations, but also to reward you for demonstrating an improved mastery of the material over the course of the semester. If you would like an exam regraded, we reserve the right to regrade the entire exam, not only the parts you might question.

There are a number of quizzes that will be scheduled throughout the semester depending on how quickly course material is covered. However many end up being given, only the best 5 will count toward the quiz category. Make-up quizzes are not given.

Final Examination

The final exam is worth 16%.

The final exam date, time and room is: 05/13/26, 3:30pm-5:30pm, M Pacheco ILC, Rm 140.

You must keep this time available. Do not schedule any flights, travel plans, or other conflicts with this exam.

See also: Final Exam Regulations and Final Exam Schedule: https://registrar.arizona.edu/faculty-staff-resources/room-class-scheduling/schedule-classes/final-exams

Grading Scale and Policies

The instructor and teaching staff will do their best to have grades back to students within 1 week. This includes, but is not limited to, grades for exams, projects, programming assignments, attendance, and quizzes. Once a grade has been entered for a particular item on the digital grade-book, students have **at most 5 days** to dispute the grade. This includes disputes related to excuses such as sickness, personal matters, dean's excuses, etc. If 5 days pass and there has not been such a request, the grade is final. Appeals submitted after this period will not be considered by the instructor or teaching staff under any circumstances. Please review your grades promptly and plan accordingly.

The correspondence between percentage grade and numeric grade is as follows:

Greater or equal to 90% at least an A

Greater or equal to 80% at least a B

Greater or equal to 70% at least a C

Greater or equal to 60% at least a D

Anything less, at least an E / F

Department of Computer Science Grading Policy:

Instructors will explicitly promise when every assignment and exam will be graded and returned to students. These promised dates will appear in the syllabus, associated with the corresponding due dates and exam dates.

Graded homework will be returned before the next homework is due. Exams will be returned "promptly",

as defined by the instructor (and as promised in the syllabus). Grading delays beyond promised return-by dates will be announced as soon as possible with an explanation for the delay.

Late work is accepted for homeworks and programming assignments up to two days after the assigned due date. If it is submitted within one day of the assigned due date, there will be a 20% deduction from the final grade for the assignment. If it is submitted on the second day after the assigned due date, there will be a 40% deduction from the final grade for the assignment. After two days have passed beyond the assigned due date, no submissions will be accepted.

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.

Topic Outline

Topics may be added, removed, or reordered as time and circumstances dictate, however, advance warning will be provided in such cases.

Topics and Subtopics		
Topic 1 (Review) A: Basic Data Structures	5, (S) 4.1-4.3, Lecture	Review Lists, Stacks, and Queues. Describe n-D Array Storage Considerations.
Topic 1 B: Mathematics and Proofs	3, (S) 2	Know summation, sequence, and logarithmic identities. Identify and follow the logic of fundamental varieties of proofs.
Topic 2 (Algorithm Analysis) A: Step-Counting and Code Profiling	Lecture	Identify which algorithm components are most responsible for efficiency. Use a code profiler to identify inefficient code.
Topic 2 B: Asymptotic Analysis	4, (S) 3	Know and apply Big-O and related concepts. Perform asymptotic analysis of algorithms.
Topic 2 C: Recurrence Relations	3.6, (S) 14.2, Lecture	Demonstrate ability to solve recurrence relations. Know and apply the Master Theorem.
Topic 3 (Graphs) A: Representations	14.1, (S) 11.1-11.2	Compare and contrast adjacency lists and matrices
Topic 3 B: Graph Algorithms	14.3, (S) 11.3-11.4, 14.5, 14.8, 14.6, 14.4, Lecture	Perform and implement BFS and DFS traversals. Describe and apply SSSP and APSP algorithms. Construct MCSTs. Construct a topological sort.
Topic 4 (Internal Sorting) A: In-memory-only Sorting	8, (S) 7	Demonstrate mastery of common algorithms. Identify algorithm strengths and weaknesses.
Topic 5 (External Sorting)	9.6, (S) 8.5, Lecture	Use external sorting to solve large data arrangement problems.
Topic 6 (Linear Searching & Hashing) A: Linear Searching	(S) 9.1, Lecture	Compare searching ordered and unordered sequences.
Topic 6 B: Skiplists	15.1	Produce probabilistically logarthmic seach time from LLs.
Topic 6 C: Internal Hashing	10, (S) 9.4	Describe the characteristics of a good hash function, and describe efficient implementations of hash tables and operations.
Topic 7 A: Review of Binary Search Trees	7.11, (S) 5.1-5.4	Summarize basic properties and operations of BST, and compare and contrast implementation options.
Topic 7 B: AVL and Splay Trees	(S) 13.2, Lecture	Distiguish these structures from BSTs, show an understanding of basic operations, and demonstrate the ability to create efficient implementations.
Topic 7 C: Optimal Binary Search Trees	Lecture	Describe Optimal BSTs.
Topic 8 A: Beyond Binary Search Trees	12.5, 12.6, Lecture	Contrast these trees with BSTs and their kin, understand an extension to B-trees, and decide when

		to use trees or hashing for searching.
Topic 8 B: Binary Heaps	7.17, (S) 5.5, 8.12, Lecture	Know operations and preferred implementation, and apply heaps to sorting.
Topic 9: Algorithm Families	(S) 14.2, (S) 16.1, Lecture	Categorize algorithms by family of common solution algorithm.
Topic 10 A: P, NP, and Undecidability	(S) 17.2, Lecture	Define, P, NP, NP-Hard, and NP-Complete, and name algorithms from each category.
Topic 10 B: Undecidable Problems	(S) 17.3, Lecture	Distinguish solvable and unsolvable problems.
Topic 11 A: Regular Expressions	Lecture	Define languages using regular expressions.
Topic 11 B: Finite Automata	Lecture	Define FSMs.

Scheduled Topic and Activities

Week	***Date***	***Scheduled Topics***	***Assignments and Due Dates***
1	*Jan 15*	*Syllabus*	
2	*Jan 20*	*1*	*Homework #1 Assigned*
2	*Jan 22*	*1, 2*	
3	*Jan 27*	*2*	*Homework #1 Due, Program #1 Assigned*
3	*Jan 29*	*2*	
4	*Feb 3*	*2*	
4	*Feb 5*	*2*	
5	*Feb 9*	*2*	*Program #1 Due, Homework #2 Assigned*
5	*Feb 11*	*3*	
6	*Feb 17*	*3*	*Homework #2 Due, Program #2 Assigned*
6	*Feb 19*	*3*	
7	*Feb 24*	*3*	
7	*Feb 26*	*4*	
8	*Mar 3*	*Exam #1*	
8	*Mar 5*	*4*	*Program #2 Due, Program #3 Assigned*
9	*Mar 10* *Mar 12*	*No Classes*	
10	*Mar 17*	*4*	
10	*Mar 19*	*4*	
11	*Mar 24*	*5*	
11	*Mar 26*	*6*	*Program #3 Due, Homework #3 Assigned*
12	*Mar 31*	*6*	
12	*Apr 2*	*6*	*Homework #3 Due, Program #4 Assigned*
13	*Apr 7*	*6,7*	
13	*Apr 9*	*7*	
14	*Apr 14*	*7*	
14	*Apr 16*	*Exam #2*	
15	*Apr 21*	*7, 8*	*Program #4 Due, Homework #4 Assigned*
15	*Apr 23*	*8*	
16	*Apr 28*	*9*	*Homework #4 Due*
16	*Apr 30*	*9, 10*	
17	*May 5*	*10*	

Week	Date	Scheduled Topics	Assignments and Due Dates
17	May 7	No Class	Reading Day
18	May 13	Final Exam	

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

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
- Class Recordings
- Additional Resources
- Preferred Names and Pronouns

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
- Illnesses and Emergencies
- Obtaining Help
- Confidentiality of Student Records
- 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.