

CSED 3320

Data Structures and Algorithms

Fall 2026

Course Information

Class Information

Course Dates: August 24-December 11, 2026

Instructor Information

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Student Office Hours

Class Websites

- <https://cs.uni.edu/~schafer/3320> (Most course/lesson materials)
- [Blackboard](#) (Grades and Competency Demos)

Textbook

There is not a formal textbook for this course. We will use several online resources.

Computer Use

Most of the learning materials for this course are available online. You will need regular access to a computer with Internet access. If you do not have access to a device for daily use, please contact me and we will discuss how you might check one out from the university.

Course Learning Outcomes

Course Catalog Description

Introduction to the structure and application of common data structures used in computer science and the algorithms used with/for these structures. Includes an ongoing discussion on algorithm analysis.

The Mission of the UNI Educator Preparation Program

The UNI Educator Preparation Program provides an authentic and challenging education that empowers candidates to serve as reflective, professional educators who advocate for students, schools, communities, and the profession in a dynamic and changing world.

Belief Statements UNI Educator Preparation Program:

1. Candidates must deeply understand and reflect on their content and pedagogy.
2. Candidates must engage in rich, purposeful, and authentic field-based experiences to develop appropriate dispositions and practices.
3. Candidates have a responsibility to understand historical, social, cultural, and political contexts and how they impact education.
4. Candidates must understand the importance of diversity and equity and engage in opportunities to promote social justice.
5. Candidates must develop competence in the skills and dispositions that allow them to engage in effective leadership and advocacy.
6. Candidates must develop strong skills in order to effectively collaborate with all stakeholders for student learning.

Course Competencies

The material in this course has been designed to align with

The CSTA K-12 Standards (<https://csteachers.org/k12standards/>)

The CSTA Standards for CS Teachers (<https://csteachers.org/teacherstandards/>).

The material in this course has been divided into seven major competencies that well-educated CS teachers should be able to demonstrate. Each of these competencies is subdivided into one or more measurable outcomes. Students should be able to:

- **Competency 1** – Object Oriented Code
 - Identify and explain the key concepts of object-oriented programming, including classes, objects, methods, inheritance, polymorphism, encapsulation, and abstraction. [3A-AP-15]
 - Recognize and describe the purpose and structure of Python classes and objects in a provided code snippet. [3B-AP-16]
- **Competency 2** – Algorithm Analysis

- Employ appropriate vocabulary to discuss algorithmic efficiency, including terms like Big-O notation, time complexity, and space complexity.
- Analyze code to determine its execution-time (big-oh notation) and storage utilization. [3A-AP-15, 3B-AP-11, Teacher 1e]
- **Competency 3** – Linear Data Structures
 - Trace, identify and explain common "linear" data structures constructed using "arrays" (i.e., contiguous block of memory) and "linked nodes" as appropriate: stack, queue, dequeue and list. [3B-AP-12, Teacher 1e]
- **Competency 4** – Searching and Sorting Algorithms
 - Trace, explain, and analyze common search/sort techniques such as linear search and binary search. [3B-AP-10, Teacher 1e]
 - Explain and analyze simple and advanced sorts such as bubble, selection, insertion, merge, and quick sorts. [3B-AP-10, Teacher 1e]
- **Competency 5** – Recursive Algorithms
 - Define recursion and identify the components of a recursive function.
 - Trace the execution of a recursive function, demonstrating understanding by outlining the calls and return values step-by-step. [3B-AP-13]
- **Competency 6** – Searching Algorithms and Tree Data Structures
 - Trace, identify, and explain the appropriate use of common "tree" data structures. [3B-AP-09]
- **Competency 7** – Additional "Traditional" Algorithms/Structures
 - Research a new data structure or algorithm not previously covered in the course, using credible sources, to understand its purpose and application. Summarize the algorithm's key components for peers/students [2-IC-22].
 - Trace, identify, and explain common graph algorithms: depth-first search, breadth-first search, Prim's algorithm, Dijkstra's algorithm, and topological sort.
- **Across all competencies**
 - Apply appropriate terminology when describing the characteristics, advantages, and limitations of different data structures such as array, stack, queue, tree, graph, dictionary, and hash table.

Course Grading

Grading Structure

I use a grading system that is a combination of standards-based grading and several elements of "alternative grading practices." My main beliefs are:

- As the teacher, my job is to design a variety of chances for you to learn material, practice required skills, and demonstrate overall competency.
- As the student, your job is to show that you can meet the course outcomes by demonstrating the defined competencies.
- Your final grade in the class should indicate how well you were able to meet course objectives/competencies by the end of the semester.

I WANT you to succeed in the course. That means giving you multiple opportunities to show that you can demonstrate course competencies. In most cases, if you can't do this the first time, you will be able to re-study and try again.

While you will complete a variety of activities to help you learn the material in this course, your overall assessment will be based on formal exams:

- Written Competency Demos (CD) - These are closed notes/book/internet/AI activities (unless otherwise noted) completed on Blackboard.

For each, your assessment will be converted to a competency evaluation score from 1-4 which is a summarization of the overall competency you have demonstrated based on the following rubric.

Score	Meaning
1	UNASSESSABLE - You submitted deliverables for the activity but what you submitted shows little understanding of the competency being assessed.
2	NEEDS WORK - You have made significant progress towards demonstrating competency but there are limited items that remain unsatisfied.
3	SATISFACTORY - You have met the standards of the competency. [Your results show reasonable competency with few mistakes or remaining issues.]
4	EXCELLENT - You have exceeded the standards of the competency. [You have met the standards of competency and shown considerable understanding/knowledge of the material.]

While it might be tempting to view these categories as similar to GPA categories (which also use a 4-point scale) that is not the way they are used or interpreted.

If you are unsatisfied with your score on any competency or activity (in particular, if you did not earn at least a 3), you may meet with me to discuss the situation, restudy the material, and make

a second attempt to demonstrate your ability to meet the standards of the competency/activity. While not expected, I reserve the right to modify the number and types of these assessments to adapt for the needs of a particular class.

Final Grades

Final course grades will be determined using the following evaluation criteria.

Grade Earned	Average Score	Additional Conditions
A	> 3.5	All scores 3-4
A-	> 3.5	All scores 2-4
B	> 3	All scores 3-4
B-	> 3	
C	> 2.5	All scores 2-4
C-	> 2.5	
D	> 2	All scores 2-4
D-	> 2	
F	≤ 2	

Because I allow – and encourage – retakes, most students do well in this course. It is rare for a student who has been an active participant in the class to not earn at least a C for a final grade.

Additional Comments:

- Communication is key: I cannot help you if I do not know what is going on. If you are having trouble with a topic in the class, please reach out to me early. Do not wait until the situation is out of control. I am very willing to help. However, I must know that you need and want that help.
- If I feel there are specific and individual circumstances where "mathematically" you earned a grade slightly lower than I feel your overall competence has demonstrated, then I reserve the right to raise your grade one level from that published above.
- To be responsive to your needs I reserve the right to modify the structure of this course as we are in progress. If there is significant deviation from the policies described in this syllabus, the new policy will be clearly discussed with you and in a timeframe that gives you time to plan accordingly.

Additional Policies and Statements

Scholastic Conduct

You are responsible for being familiar with the University's Academic Ethics Policies:

<https://www.uni.edu/policies/301>

Your final submission for assignments and competency demos should be your own original and individual work unless the directions specify otherwise. Copying from another source - a peer or an online or published source - is expressly forbidden. Any contribution from another source should by should be properly acknowledged in writing. Failure to do so is plagiarism and will necessitate disciplinary action. If an assignment makes you realize that you do not understand the material, ask a fellow student a question designed to improve your understanding, not one designed to get the assignment done.

In addition to the activities we can all agree are cheating (plagiarism, bringing notes to a closed book exam, etc.), assisting or collaborating on cheating is cheating. Cheating can result in failing the course and/or more severe disciplinary actions. Remember: Discussing assignments is fine and even encouraged. Copying code or answers is not.

Accessibility

The University of Northern Iowa (UNI) complies with the Americans with Disabilities Act Amendments Act of 2008 (ADAAA), Section 504 of the Rehabilitation Act of 1973, the Fair Housing Act, and other applicable federal and state laws and regulations that prohibit discrimination on the basis of disability. Students with disabilities experiencing a barrier to access should connect with Student Accessibility Services (SAS) to request accommodations. For more information about the accommodation process, please contact SAS at (319) 273-2677 Relay 711, accessibilityservices@uni.edu, or GIL 118. Additional information is also available at sas.uni.edu.

The Learning Center

The Learning Center at Rod Library provides free tutoring for a variety of different areas (i.e., writing, math, science, business, Spanish, college reading and learning strategies). The Learning Center at Rod Library is open for walk-in assistance Monday-Thursday 10am-10pm and is free of charge for all UNI students. If you are unavailable during normal tutoring hours, online tutoring is also available through TutorMe. To request access, go to <https://tlc.uni.edu/online>. For more information, go to <https://tlc.uni.edu>, email TheLearningCenter@uni.edu, call 319-273-6023, or visit the TLC desk located on the main floor of Rod Library.

In addition, The Office of International Engagement offers free coaching sessions with experienced staff, in-person and online, for international and multilingual students. Students can schedule time with an advisor for in-person assistance or simply walk-in for services during established coaching times at The Learning Center in Rod Library. More information can be found on the OIE Academic Coaching Website.

Free Speech

The University of Northern Iowa supports and upholds the First Amendment protection of freedom of speech and the principles of academic and artistic freedom. We encourage the free and responsible exchange of diverse ideas on our campus. The University is committed to open inquiry and the spirited and thoughtful debate of such ideas.

All UNI employees, students, applicants and campus visitors are welcome to disclose their personal pronoun preferences, though no one shall be compelled to do so.

Non-discrimination in Employment or Education

Content in this class has the potential to be disturbing to some individuals based on life experiences. If you ever feel the need to step out of the classroom or decline participation in an activity, please request an alternative learning experience.

UNI Policy 13.02 Discrimination, Harassment, and Sexual Misconduct states: "The University is committed to providing a workplace and educational environment, as well as other benefits, programs, and activities, that are free from discrimination and harassment based on a protected class, as well as retaliation."

Policy 13.02 outlines prohibited conduct and reporting processes. All University employees who are aware of or witness discrimination, harassment, sexual misconduct, or retaliation are required to promptly report to the Title IX Officer or Title IX Deputy Coordinator.

Title IX Officer Leah Gutknecht, Assistant to the President for Civil Rights Compliance, 117 Gilchrist, 319-273-2846, leah.gutknecht@uni.edu

If you or someone you know has been harassed or assaulted, you can find the appropriate resources at civilrights.uni.edu. Resources that provide free, confidential counseling are also detailed at civilrights.uni.edu.

For additional information, contact the Office of Civil Rights Compliance, 117 Gilchrist Hall, 319-273-2846, civilrights@uni.edu.