

# Syllabus

## CSED 3320/5320, Data Structures and Algorithms

### Fall 2024

#### Course 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

#### Course Information

**Time and Place:** This course is an online course. There are no required meeting times. However, I encourage you to meet with me as much as necessary.

#### Student Hours:

I want to be available to you. To get started, I am available during the school day with appointments:

- MWF, 10-11 AM
- MWF, 12-1 PM

I am also available after school and in the evenings. The days and times may change as I find out what works best for you and juggle this with my family obligations. To schedule an appointment use

- <https://bit.ly/SchaferCalendar>

Then at the appropriate time, you can log on to the following Zoom room:

- <https://uni.zoom.us/j/3192732187>

If those times don't work for you, please send me an email, and propose a specific alternative. I want to meet with you at a time/place that works for both of us, and I am very willing to work things out.

**Credit Hours:** Three (3). This course meets the Credit Hour Expectations outlined in the Course Catalog. Students should expect to work approximately 2 hours per week outside of class for every course credit hour. [In other words, you should expect this course to require 9-10 hours of work in a typical week]

#### Class Websites:

- <https://www.cs.uni.edu/~schafer/cohort23/DSA/> (most lesson materials)
- Blackboard (Grades and Competency Demos)

#### Textbooks

- "Computer Science: An Overview. (13<sup>th</sup> edition)" Brookshear and Brylow. [The textbook we previously used for FCCS].
- "Problem Solving with Algorithms and Data Structures using Python" Miller and Ranum. [An online textbook]

#### Computer Use

This is an online course. All of the learning materials and programming environments for this course are available from any computer with a web browser and internet access.

## Course Learning Outcomes

This course is built around seven major topics. Each of these topics is subdivided into one or more measurable outcomes. By the end of the course students should be able to:

### Topic 1 - Object Oriented Code

- Identify and explain the key concepts of object-oriented programming, including classes, objects, methods, inheritance, polymorphism, encapsulation, and abstraction.
- Recognize and describe the purpose and structure of Python classes and objects in a provided code snippet.

### Topic 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.

### Topic 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, and list.

### Topic 4 - Searching and Sorting Algorithms

- Trace, explain, and analyze common search/sort techniques such as linear search, binary search, closed-address hashing.
- Explain and analyze simple and advanced sorts such as bubble, selection, insertion, merge, and quick sorts.

### Topic 5 - Recursive Algorithms

- Define recursion and identify the components of a recursive function, including the base case and the recursive case.
- Trace the execution of a recursive function, demonstrating understanding by outlining the calls and return values step-by-step.

### Topic 6 - Searching Algorithms and Tree Data Structures

- Trace, identify, and explain the appropriate use of common "tree" data structures.

### Topic 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.
- Trace, identify, and explain common graph algorithms: depth-first search, breadth-first search, Prim's algorithm, Dijkstra's algorithm, and topological sort.

### Across all topics

- 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.

## How Student Performance Will Be Evaluated

### Course Grading

I use a grading system drawn from the philosophies of "standards-based grading" and "equitable grading" (<https://gradingforequity.org/>).

You will earn a grade for each of the seven topics listed in the course outcomes section. Each of these is a category of understanding that, for simplicity, is recorded as a score from 1-4 with the following meaning:

Score	Meaning
1	UNASSESSABLE - You submitted the deliverables for the activity but what you submitted shows little understanding of the standards of the activity.
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 activity.
4	EXCELLENT - You have "exceeded" the standards of the activity. [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 is also a 4-point scale) that is not the way they are used or interpreted. See the discussion about final grade assignment for more on this idea.

You will complete three different types of activities this semester.

- "You Do It" Activities (ungraded, formative assessment)
  - We will do a lot of activities that I ask you to complete on your own or with a classmate.
  - In almost all cases these are there to enhance your learning.
    - In most cases, it is the **process** that I am after rather than the results.
  - As such, I may ask you to submit your results, but I prefer not to assign a grade to this. Please keep an eye on the course website and be prepared to submit these activities.
- Competency Demos (graded, summative assessment)
  - These are similar to a quiz or test in other classes that you take.
  - You will complete each competency demo on Blackboard and during assigned times.
  - Most CDs will cover more than one topic.
  - Most CDs consist of several questions, individually graded. From these, I will assign a final, single evaluation of the questions pertaining to a particular topic based on your overall set of responses. This score is not necessarily a simple mathematical average but an assessment of your overall CD.
  - If you are unsatisfied with your grade on any topic, you may talk to me, restudy the material, and attempt a second version of the CD for a (potentially) higher grade.
    - You need not retake the whole CD if you are only attempting to show greater competency on a single topic. Talk to me about this situation as it arises.

- Research/Writing Project (graded)
  - Once you have had a chance to fully engage with the content of this course, I will ask you to complete one (students in CSED 3320) or two (students in CSED 5320) research and writing based projects.
  - I anticipate that you will be able to submit each for an initial grade. If you do not like the grade you earned, you will be provided an opportunity to ask questions, and revise the project(s).

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

Grade	Criteria
A	ALL topic scores are 3 or 4 AND an overall average of 3.5 or higher
B	An overall average of 3.0 or higher
C	An overall average of 2.50 or higher
D	An overall average of 2.0 or higher
F	Any situation not handled above.

In most situations, grades earned are straight letter grades – no plusses or minuses. Because you have multiple opportunities to retake and earn better grades this isn't as rough as it might sound. However, there are two situations where I may add a plus or a minus:

- If your final project is a grade lower than your overall course grade I reserve the right to add a minus to your grade.
- If your final project is a grade higher than your overall course grade I reserve the right to add a plus to your grade.
- 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 than I reserve the right to add a plus to your grade.

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 original policies, the new policy will be clearly discussed with you and in a timeframe that gives you a time to plan accordingly.

### **Final Thoughts**

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 you need/want that help.

## **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>

Copying from other students is expressly forbidden. Doing so on CDs will be penalized every time it is discovered. The penalty can vary from zero credit for the copied items (first offense) up to a failing

grade for the course. If an assignment makes you realize 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. Your final submission for assignments should be **individual, original** work unless otherwise specified. Any substantive contribution to your solution by another person or taken from a publication should be properly acknowledged in writing. Failure to do so is plagiarism and will necessitate disciplinary action. 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](mailto:accessibilityservices@uni.edu), or GIL 118. Additional information is also available at [sas.uni.edu](http://sas.uni.edu).

### **The Learning Center**

The Learning Center @ 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 @ 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 Smarthinking. You will need your CATID and passphrase to gain access. To access the Smarthinking platform go to <https://tlc.uni.edu/online>. For more information, go to <https://tlc.uni.edu>, email [TheLearningCenter@uni.edu](mailto:TheLearningCenter@uni.edu), call 319-273-6023, or visit the TLC desk located on the main floor of Rod Library.

### **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.

### **Office of Compliance and Equity Management 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 Compliance and Equity Management, 117 Gilchrist, 319.273.2846, leah.gutknecht@uni.edu
- Title IX deputy coordinator: Christina Roybal, Sr. Associate Athletic Director Athletics Administration, North DOME 319.273.2556, christina.roybal@uni.edu

If you or someone you know has been harassed or assaulted, you can find the appropriate resources at [safety.uni.edu](http://safety.uni.edu) and [equity.uni.edu](http://equity.uni.edu). Resources that provide free, confidential counseling are also detailed at [safety.uni.edu](http://safety.uni.edu).

For additional information, contact the Office of Compliance and Equity Management, 117 Gilchrist Hall, 273-2846, [equity@uni.edu](mailto:equity@uni.edu).