

# CSCE 310 Sec. 250 – Data Structures and Algorithms

**Fall 2024**

## **Lectures**

MWF 12:30PM – 1:20PM  
Room 19, Avery Hall

## **Recitations (Sec. 251)**

M 2:30PM – 3:20PM  
Room 107, Burnett Hall

### **Instructor**

Dr. Massimiliano Pierobon  
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### **Graduate Teaching Assistant**

Clinton Jules

**Meeting Location for Office Hours:** TBA

**Office Hours:** TBA.

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### **Undergraduate Teaching Assistants**

Bharath Kumar Manchikanti, Eli Martinez, Preston Ward

**Meeting Location for Office Hours:** Avery 15, basement floor of Avery Hall

**Office Hours:** Manchikanti (X XX:XX XM-XX:XX XM), Martinez (X XX:XX XM-XX:XX XM), Ward (X XX:XX XM-XX:XX XM)

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**Description**

A review of algorithm analysis, asymptotic notation, and solving recurrence relations. Advanced data structures and their associated algorithms, heaps, priority queues, hash tables, trees, binary search trees, and graphs. Algorithmic techniques, divide and conquer, transform and conquer, space-time trade-offs, greedy algorithms, dynamic programming, randomization, and distributed algorithms. Introduction to computability and NP-completeness.

**Prerequisites**

- CSCE 156/156H or SOFT 161.
- CSCE 235/235H.

Or consult with the course instructor by email or appointment.

**Textbook**

*Levitin A., Introduction to the Design and Analysis of Algorithms, Third edition*  
ISBN-13: 978-0132316811

**Learning Objectives**

In this course, you will gain exposure and understanding to

- (1) the key concepts and basic algorithmic techniques or approaches for solving algorithmic problems;
- (2) the interplay between advanced data structures and algorithms;
- (3) the important classical algorithmic problems and their complexities, solutions, and applications;
- (4) the limitation of computational power through Computability and Complexity.

**Course Topics**

- 1. Introduction (and Some Review...)**
  - a. Thinking in “Algorithms”
  - b. Let’s Organize our Stuff: Data Structures
  - c. Let’s be Efficient: Algorithm Analysis
- 2. “Brute and Exhausted” Algorithms**
  - a. Brute Force Algorithms
  - b. P, NP, and NP-hard
  - c. Exhaustive Search
- 3. Divide & Conquer Algorithms**

- a. Binary Tree Traversal
- b. Multiplication
- c. Closest Pair
- d. Branch & Bound
- e. Introduction to Dynamic Programming

#### **4. Decrease & Conquer Algorithms**

- a. Decrease by a Constant
- b. Decrease by a Constant Factor
- c. Decrease by a Variable Factor

#### **5. Transform & Conquer Algorithms**

- a. Instance Simplification
- b. Gaussian Elimination
- c. Representation Change
- d. Binary Exponentiation
- e. Balanced Search Trees
- f. B-Trees
- g. Heaps & Heapsort
- h. Problem Reduction

#### **6. Graphs Algorithms**

- a. Reduction to Graph Problems
- b. Graph Algorithms
- c. Shortest Paths
- d. All-Pairs Shortest Paths
- e. Flows in Graphs
- f. Applications of Graph Algorithms

#### **7. Dynamic Programming**

- a. 1-D Problems
- b. 2-D Problems
- c. Recovering the Solution
- d. Knapsack Problem
- e. Optimal Binary Search Trees

#### **8. String Matching**

- a. Horspool's Algorithm
- b. Boyer-Moore Algorithm
- c. Time Complexity of String Matching
- d. String Matching in the Real World  
(find and grep)

#### **9. Computability & Complexity**

- a. Lower-Bound Arguments
- b. Decision Trees

- c. P, NP, and NP-Complete
- d. Backtracking
- e. Branch & Bound
- f. State-Space Tree
- g. Sample Problems
- h. Approximation Algorithms for NP-Hard Problems

## 10. Hashing

- a. Open Hashing (Separate Chaining)
- b. Closed Hashing (Open Addressing)

### **Course Organization and Assessment Plan**

Reading and homework assignments would be available from the course Canvas site. There will be unannounced pop-up quizzes. There will be two major exams in this course (midterm + final). The midterm will cover the first part of the course, while the final will cover the second part of the course (and possibly some concepts from the first part of the course).

**Any assignments submitted after the due dates (including a few seconds late) will not be graded.**

- **Lectures**

Lectures will be in person according to the course schedule. Participation to the lectures is considered mandatory and will be assured through the participation of students in random quizzes (see below).

- **Quizzes**

To motivate class participation, there will be pop quizzes spread throughout the semester. These quizzes will be taken through Canvas. At the end of the semester, two quizzes with the lowest grades would be dropped from the final grade. This means that every student has a chance to make up for up to two (missed) quizzes. Note that students should try to perform well in every quiz so that they can use up to two quizzes for rainy days. There will be no separate makeup for quizzes.

- **Homework Assignments**

The purpose of assignments is to enrich and reinforce students learning. Throughout the course, students will be handed over assignments which may include written questions or programming assignments. There will be no separate makeup for homework.

- **Recitations**

Recitations will be lectures and questions that will be answered by students with help from graduate teaching assistant. Attendance is MANDATORY (student's active presence will be graded with 1pts for each recitation). There will be no separate makeup for recitations.

- **Midterm and Final Exam**

Students will take midterm and final exams which will test their knowledge and understand of the presented concepts. There will be no separate makeup for exams.

**Grade Distribution**

**Final scores will be computed through this weighted distribution:**

- **Homework Assignments:** 50%
- **Midterm Exam:** 15%
- **Final Exam:** 20%
- **Popup Quizzes:** 10%
- **Recitation:** 5%

The following scale will be used to determine letter grades. An absolute grading system will be utilized. Scores will be rounded to the nearest integer. For example, scores in the range of 89.00 to 89.49 will be rounded to 89.00, while scores in the range of 89.50 to 89.99 will be rounded to 90.00. Therefore, a score of 89.49 will earn you a B+, whereas a score of 89.50 will earn you an A- (minus):

A+: $\geq 97$	A: 93% to 96%	A-: 90% to 92%
B+: 87% to 89%	B: 83% to 86%	B-: 80% to 82%
C+: 77% to 79%	C: 73% to 76%	C-: 70% to 72%
D+: 67% to 69%	D: 63% to 66%	D-: 60% to 62%

F: < 60%

**Additional Materials**

All the following additional materials will be available in Canvas:

- Lecture slides
- Additional reading resources
- Homework assignments
- Submissions guidelines

**The University's  
Inclement Weather  
Policy**

All instructors should include a statement on syllabi to explain the mode of communication they will use (e.g., @huskers.unl.edu email or Canvas) if in-person classes are canceled and the campus follows instructional continuity plans:

*If in-person classes are canceled, you will be notified of the instructional continuity plan for this class by email or Canvas.*

Students will be expected to be responsible for checking these notifications for instructional continuity assignments or virtual class meetings.

**Attendance Policy**

Attendance at all officially scheduled class meetings (class and lab sections) is mandatory. Students are responsible for knowing all material discussed in class meetings. Changes to class lectures and assignments will be announced in class and Canvas.

**Academic Integrity**

All homework assignments, quizzes, exams, etc. must be the student's own work. No direct collaboration with fellow students, past or current, is allowed unless otherwise stated. The School of Computing has an **Academic Integrity Policy**:

<https://computing.unl.edu/academic-integrity-policy/>

All students enrolled in any computer science course are bound by this policy. You are expected to read, understand, and follow this policy. Violations will be dealt with on a case-by-case basis and may result in a failing assignment or a failing grade for the course itself.

**Dealing with Stress  
and Adversity**

UNL offers a variety of options to students to aid them in dealing with stress and adversity. [Counseling and Psychological & Services \(CAPS\)](#); is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling 402-472-7450. [Big Red Resilience & Well-Being \(BRRWB\)](#) provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students

create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling 402-472-8770.

**Writing Center**

The Writing Center, located at 102 Andrews Hall and satellite locations from 5-7 pm in Adele Hall , is a free service for all UNL students, faculty, and staff. You can work with an individual writing consultant on any type of writing at any stage in your writing process. For an appointment, call 402-472-8803 or [schedule online](#).

**Academic Support Services**

You can schedule free appointments for individual academic coaching with First-Year Experience and Transition Program staff through MyPLAN. You can also take advantage of study stops--which provide individual and group study with learning consultants in a variety of disciplines--and free group workshops on topics such as time management, goal setting, test preparation, and reading strategies. See [success.unl.edu](http://success.unl.edu) for schedules and more information.

**Students with Disabilities**

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. This includes students with mental health disabilities like depression and anxiety. It is the policy of the University of Nebraska-Lincoln to provide individualized accommodations to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 232 Canfield Administration, 472-3787.

**Suggestion Box**

The School of Computing (SoC) has an **anonymous suggestion box** (<https://computing.unl.edu/anonymous-department-feedback-form/>) that you may use to voice your concerns about any problems in the course or the school if you do not wish to be identified.

**Stay Up-to-date**

It is SoC Department policy that all students in SoC courses are expected to regularly check their email, so they do not miss important announcements.

**Resource Student Center**

The SoC Student Resource Center (Avery Hall 13A) is intended to provide UNL Computer Science and Computer Engineering majors who are new to the program with a set of resources that will help them assimilate to college life and

encourage them to continue their study of Computer Science and Computer Engineering (<https://computing.unl.edu/current-undergraduate/#SRC>).

**Academic Honesty**

Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. The University's [Student Code of Conduct](#) addresses academic dishonesty. Students who commit acts of academic dishonesty are subject to disciplinary action and are granted due process and the right to appeal any decision.

**Diversity & Inclusion**

The University of Nebraska-Lincoln does not discriminate on the basis of race, ethnicity, color, national origin, sex (including pregnancy), religion, age, disability, sexual orientation, gender identity, genetic information, veteran status, marital status, and/or political affiliation.

**Trespass Policy  
(Regents' Policy  
6.4.7)**

The areas of University academic, research, public service, and administrative buildings of the University used for classrooms, laboratories, faculty and staff offices, and the areas of University student residence buildings used for student living quarters are not open to the general public. Any person not authorized to be or remain in any such building area will be deemed to be trespassing on University property and may be cited and subject to prosecution for criminal trespass in violation of Neb. Rev. Stat., § 28-520 or § 28-521.

This syllabus will be updated and expanded as the semester progresses.