

CS-152: Data Structures

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Willamette University, Spring 2024

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Office Hours: By Appt. & TBA

Office: Zoom, Ford 206

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Lecture MWF 9:10-10:10 PM

Lecture Hall: "Salem TBD"

Course Description

Theoretical and practical study of programming and abstract data types including lists, stacks, queues, trees and algorithms used on these data structures. The course includes object implementation of structures and sharpens programming skills learned in previous courses.

A note: while this course may be of interest to majors in Data Science, this course's name reflects a more traditional usage of the term "data", simply referring to information stored in computer memory. It also called "Discrete Structures" or "Programming Abstractions" at other colleges and universities.

Required Materials

Required materials will be available on the [course webpage](#).

Prerequisites

This class is meant for computer science students who have completed introductory coursework in programming. Be comfortable with the content of CS 151 or equivalent.

Accessibility

I will make every effort to ensure all coursework and materials are accessible to all students, including working with on-campus specialists. However, there is always room for improvement. I always appreciate hearing from students about how I can make the course more accessible, so please reach out if there is something I can be doing better!

Course Objectives

This course will teach you how to organize the data used in computer programs so that manipulation of that data can be done efficiently on large problems and large data instances. This course will address both how to use the data structures found in the libraries of programming languages, and how those libraries are constructed and why the items that are included in them are there (and why some are excluded).

- Study important categories of problems that are commonly encountered in software development
- Learn data organizations to practically and efficiently solve problems.
- Analyze the performance and efficiency of your algorithms preceding the upper level course in algorithms.
- Encoding data organizations in Python programs.
- Practice program and software organization.
- See examples of the induction proof methods to reason about your programs supporting mid level courses in mathematics.

Competency of the data structures taught in this course will prepare you to study higher level areas where those data structures are heavily used: operating systems, networking, graphics, vision, compilers, databases, and security.

Course Structure

The course will be composed of lectures, homeworks, midterms, and a final project.

Lecture Structure

Lectures are scheduled for Mondays, Wednesdays, and Fridays at 9:10 A.M. in "Salem TBD". The schedule of lectures will be available on the [course webpage](#).

I will combine lectures with slides, live coding demonstrations, and in-class exercise. Slides will be posted, and code from the demonstrations will be posted, but intermediate coding stages may not be captured.

Homework Structure

Feedback will be provided on homework assignments. Homework assignments will be considered when determining grades for this course.

Homeworks will consist of programming assignments to be completed outside of class and submitted for feedback. There will be a “Homework 0” at the beginning of the semester to get used to programming and assignment submission. Homework assignments be out of either 50 or 100 points, for a total of 500 points. Your grade will be determined based on your performance on the best 400 points worth of assignments - this is roughly equivalent to dropping the lowest homework grade out of five assignments.

Homework assignment will be due at 9:10 A.M. on Fridays so we can discuss solutions in class on the day they are due.

As a rule, I encourage students to submit their assignment as-is at the due date and not to submit late work. By way of explanation, it is my experience as both a student and a grader that time spent working on assignments after their deadline is often better spent working on the next assignment.

As-is submission is supported in the grading policy by dropping the lowest homework grade. In special circumstances such as extended medical problems or other unforeseeable emergencies, please reach out and so we can collaboratively develop a more personal solution to achieve the learning objectives of the course. Homework assignments will be assessed by an autograder that

will be provided with the assignment, so you can assess your progress on the assignment prior to receiving my feedback.

Midterm Structure

Feedback will be provided on midterm exams. Midterm exams will be considered when determining grades for this course.

There will be two written midterm exams, intended to be completed individual without access to notes or documentation. The midterms are intended to achieve a learning focus of reasoning about data structures in isolation from coding environments, as well provide me as an instructor with greater insight into how effective course instruction has been. I will provide practice

midterms one week prior to the exam date, and we will go over the practice midterm in the class prior to the exam date.

Final Project

Feedback will be provided on the final project. The final project will be considered when determining grades for this course.

There will be a final project that will be similar in format but distinct in content from homeworks. Whereas homeworks will include programming assignments for which there is some correct answer that may be measured against an answer key and notions of coding style, the project will be a student-centered exploration of data structures meant to give you an opportunity to apply what you've learned in the course while still receiving support from an instructor.

The final project will be released as soon as the final homework is due and will be due at the time of the final examination as set by the registrar.

Feedback and Grading

Feedback will be provided on assignments, midterms, and the final project using a 100 point scale. This 100 point scale is intended to be familiar to established grading standards, such as letter grades. To provide aggregate feedback for the whole course, these feedback scores will be combined as follows:

- 40% of your grade will be determined by homework assignments
- 40% of your grade will be determined by midterm exams.
20% each for the two midterms.
- 20% of your grade will be determined by the final project.

If you receive a higher score on the second midterm than the first term, the second midterm's score will replace the first midterm's score.

Feedback scores will constitute the minimum grade on an assignment, but the instructor may exercise discretion at any time to award a higher grade. For example, a submitted homework may not use some important algorithmic technique as submitted, but if the student showed familiarity with this technique on an earlier assignment or exam, the absence of that technique in a specific case need not be counted against a student in grading, but only noted in feedback. This corresponds to the high level notion of feedback corresponding to how well an assignment reached the intended learning goals, while the overall course grade is meant to indicate that a student is prepared to succeed in latter coursework. Under this model, the final project will offer an opportunity to show familiarity with all content in the course, so a strong final project

can ensure a high course grade for any student, regardless of prior scores on midterms and homeworks.

College Policies

The following material is adapted from “Information for Syllabus” recommended language on syllabus preparation provided to instructors in the College of Arts & Sciences. The following sections represent the views of the instructors employer, rather than the instructor themselves, and have been lightly edited in some cases for clarity and sensitivity.

Time Commitment

Willamette’s Credit Hour Policy holds that for every hour of class time there is an expectation of 2-3 hours’ work outside of class. Thus, for this class you should anticipate spending 6-9 hours outside of class engaged in course-related activities. Examples include reading course materials, preparing for discussion, preparing and writing papers and exams.

Academic Integrity

Students of Willamette University are members of a community that values excellence and integrity in every aspect of life. As such, we expect all community members to live up to the highest standards of personal, ethical, and moral conduct. Students are expected not to engage in any type of academic or intellectually dishonest practice and encouraged to display honesty, trust, fairness, respect, and responsibility in all they do. Plagiarism and cheating are especially offensive to the integrity of courses in which they occur and against the College community as a whole. These acts involve intellectual dishonesty, deception, and fraud, which inhibit the honest exchange of ideas. Plagiarism and cheating may be grounds for failure in the course and/or dismissal from the College. <http://willamette.edu/cla/catalog/policies/plagiarism-cheating.php>

Commitment to Positive Sexual Ethics

Willamette is a community committed to fostering safe, productive learning environments, and we value ethical sexual behaviors and standards. Title IX and our school policy prohibit discrimination on the basis of sex, which regards sexual misconduct — including discrimination, harassment, domestic and dating violence, sexual assault, and stalking. We understand that sexual violence can undermine students’ academic success, and we encourage affected students to talk to someone about their experiences and get the support they need.

Please be aware that as a mandatory reporter I am required to report any instances

you disclose to Willamette's Title IX Coordinator.

If you would rather share information with a confidential employee who does not have this responsibility, please contact our confidential advocate at confidential-advocate@willamette.edu. Confidential support also can be found with SARAs and at the GRAC (503-851-4245); and at WUTalk - a 24-hour telephone crisis counseling support line (503-375-5353). If you are in immediate danger, you may reach campus safety at 503-370-6911.

DACA/Undocumented Student Advocate

Willamette is committed to supporting our DACA/Undocumented students in a variety of ways. This year, Tori Ruiz is the contact person for all DACA/undocumented students can provide those students with a number of external and internal resources that are available. Her contact information is email: truiz@willamette.edu, Office: 3rd Floor UC, Phone: 503-370-6447.

Diversity and Disability Statement

Willamette University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. My goal is to create a learning environment that is usable, equitable, inclusive and welcoming. If there are aspects of the instruction or design of this course that result in barriers to your inclusion or accurate assessment or achievement, please notify me as soon as possible. Students with disabilities are also encouraged to contact the Accessible Education Services office in Smullin 155 at 503-370-6737 or Accessible-info@willamette.edu to discuss a range of options to removing barriers in the course, including accommodations.

If you are disabled person or person with a disability and have preference for indentity first or person first language, I would be grateful to be informed of your preference to best affirm you.

Religious Practice

Willamette University recognizes the value of religious practice and strives to accommodate students' commitment to their religious traditions whenever possible. Please let me know within the first two weeks of the semester if a conflict between holy days or other religious practice and full participation in the course is anticipated. I will do my best to work with you to determine a reasonable accommodation.

As an instructor, I will exercise my discretion to offer accomodations for conflicts after the first two weeks of the semester. You may always reach out to me, including retroactively, though the quality of the accommodation I am able to offer may improve given advanced warning!

SOAR Center Offerings: Food, Clothing, and School Materials

The Students Organizing for Access to Resources (SOAR) Center strives to create equitable access to food, professional clothing, commencement regalia, and scholarly resources for WU and Willamette Academy students. The SOAR Center is located on the Putnam University Center's third floor (in the former Women's Resource Center and across from the Harrison Conference Room). The space houses the Bearcat Pantry, Clothing Share, and First-Generation Book Drive and is maintained by committed students and staff and faculty advisers.

Trans Inclusion and Gender Justice

I am always appreciative of the opportunity to address you by your affirmed name, pronouns, and any other gender markers. Please advise me of this at any point in the semester so that I may best respect you at all times.

If I ever misgender you in any way, I would greatly appreciate that you let me know, in whatever manner makes you comfortable, so that I can correct that error and endeavour to repair any harm.

Mental Health

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. Willamette services are available and treatment does work. If you think you need help, please contact Bishop Health as soon as possible at <http://willamette.edu/offices/counseling/>. Crisis counseling is available 24/7 at WUTalk: 503-375-5353 and Campus Safety is available at 503-370-6911. Emergency resources are also available from the Psychiatric Crisis Center at 503-585-4949 and the National Suicide Prevention Lifeline at 1-800-273-8255.

Intellectual Property & Privacy

Willamette's Credit Hour Policy holds that for every hour of class time there is an expectation of 2-3 hours' work outside of class. Thus, for this class you should anticipate spending 6-9 hours outside of class engaged in course-related activities. Examples include reading course materials, preparing for discussion, preparing and writing papers and exams.

Class materials and discussions including recorded lectures are for the sole purpose of educating the students enrolled in the course. The release of such information (including but not limited to directly sharing, screen capturing, or recording content) is strictly prohibited, unless the instructor states otherwise. Doing so without the permission of the instructor will be considered

an Honor Code violation and may also be a violation of other state and federal laws, such as the Copyright Act.

All of my course materials are open source. I will rely on some materials from our instructors, but believe they are all open source as well.