

CS 106 - Introduction to Data Structures

Fall 2024

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TTH 1 - 2:25, KINSC H204

Labs: Th 2:30 - 3:25 or F 11:30 - 12:25 or F 1:30 - 2:25, KINSC H110
<http://www.cs.haverford.edu/courses/cmsc106>

An introduction to the fundamental data structures of computer science: strings, lists, stacks, queues, trees, BSTs, graphs, sets and their accompanying algorithms. Principles of algorithmic analysis and object reasoning and design will be introduced using mathematical techniques for the notions of both complexity and correctness. More practical issues, such as memory management and hashing, will also be covered. The programming language used to illustrate and implement these concepts will be able to support functional, imperative and object-oriented approaches.

Lab: Includes a weekly required programming lab section. Class sessions will also be taught in a computer lab.

Prerequisites: CS 105 or BMC 109 or 113 with a grade of 2.0 or better.

Students who have taken CS 107 or BMC CS 151 *may not* receive credit for this course.

Enrollment Limit: 36. The course will be divided into three lab sessions of at most 12 each.

Lab Instructor: Suzanne Lindell

Lab monitors and TAs: Lab monitors are in KINSC H110 every Sunday - Thursday from 7-11pm to help you with your lab assignments. TAs will also hold office hours (TBD - see the class Google Calendar).

Office hours: see the class Google Calendar for times. Office hours are additionally available by appointment.

Textbook (required): *Data Structures and Algorithms in Java* by Goodrich and Tamassia. The textbook is available online via the Haverford library; see link on course website.

Schedule of Topics

This schedule is *tentative*. Labs are due **by 11:59pm on Tuesday** in the week listed. Students should expect ***at least 10 hours of work each week***. For the most up-to-date dates and deadlines see the CS 106 Google Calendar.

Week 1. Introduction. Java basics. The importance of documentation and programming style.

- Reading: Chapter 1

- Programming topics: Java syntax, types and type conversion, variable scope, Javadoc comments, very basics of classes.
- In lab: how to check out assignments in GitHub Classroom, work in VS code, and getting started with Lab 0.

Week 2. Basics of object oriented programming (objects and classes and inheritance), variable scope.

- Lab 0 Due: Java basics
- Reading: Chapter 2
- Programming topics: Objects, Classes, inheritance, variable scope, Strings.

Week 3. Object oriented programming basics.

- Reading: Chapters 2, 3.1
- Programming topics: type generics, exceptions.
- Data structures: basics of arrays, ArrayLists, and main args input.
- Ethics: reproducibility, reading and writing documentation.

Week 4. Linked lists.

- Reading: Chapter 3
- Lab 1 Due: Designing data structures - ProPublica 1

Week 5. Introduction to big-Oh notation

- Reading: Chapter 4
- Lab 2 Due: ArrayLists - ProPublica 2

Week 6. Review week and midterm.

- Reading: review chapters 1-4 and 6
- Lab 3 Due: Linked lists.
- Thursday: **Midterm 1 exam** during class time.
- Thursday/Friday: all lab sessions cancelled.

Week 7. **Fall Break!**

Week 8. Stacks and queues.

- Reading: Chapter 6

Week 9. Lists, iterators, interfaces, and graph basics

- Reading: Chapter 7, 8.1, and 14.2
- Topics: graph basics (nodes, edges, weights, neighbors, degree, directed vs. undirected) and implementations (adjacency lists and adjacency matrices)

Week 10. Binary trees

- Reading: Chapter 8
- Lab 4 Due: Stacks and queues

Week 11. Priority queues

- Reading: Chapter 9
- Lab 5 Due: Binary trees

Week 12. Maps and hash tables

- Reading: Chapter 10
- Lab 6 Due: Priority queues

Week 13. Sorting and selection

- Reading: Chapter 12

Week 14. Search trees, union-find, and Huffman coding

- Reading: Chapter 11 and 14.7.3
- Lab 7 Due: Maps, hash tables, sorting and selection (data deduplication)

Week 15. Review week and midterm

- Reading: review chapters 7-12, 14.2, and 14.7.3
- Thursday: **Midterm 2 exam** during class time.

Final project due at the end of final exam period.

Labs and Exams

A general outline of the labs is given below. Lab starter code will be distributed to the class.

0. Java basics
1. Data structure design
2. Array lists
3. Linked lists (with timing)
4. Stacks and queues
5. Binary trees
6. Priority queues
7. Maps / hash tables, sorting / selection (data deduplication)
8. Final project

There will be two midterms.

Total grade breakdown

Labs	50%
Final Project	10%
Midterm 1	20%
Midterm 2	20%

Grades will be awarded based on the number of points earned and according to the percentage breakdowns shown. Students will not be graded on a curve.

Attendance and Participation

Attendance at, and active participation in, all class and lab sessions is expected of all students. Participation will be taken into account in awarding of final grades for students who are “on the edge” between two grades. For example, a student with a B+/A- average and a strong attendance and participation record would receive an A-, while a student with a weak record would receive a B+. Missing more than two classes will ensure that the final grade is rounded down.

Late work policy

All extensions must be requested **at least 24 hours in advance** of the deadline. Extensions of 24 or 48 hours will be granted based on individual circumstances. Work handed in late without a previously granted extension will not be accepted (i.e., will receive zero credit).

Rules and Pet Peeves

- **Be on time.** This includes class, lab, office hours, and appointments.
- **Expect 24 hours before an email response** and read all emails within 24 hours.
- **Attend all classes and labs.**

Collaboration, Plagiarism, and AI use

Please see the full version of the departmental collaboration policy [here](#). A summary is below, but students are encouraged to read the full linked document.

Work done in collaboration should never be copied from another student (e.g., from their computer or from joint work on the board). Work from previous semesters should never

be shared with current students, or looked at by students in the current semester, though it is fine to share notes you make about lectures or the textbook. Code and other material should never be copied from another student or outside sources unless permission is explicitly given in advance by your professor and the code is cited. In this class it is never appropriate to use AI to generate any part of your assignments, whether code, text, or other content.

If you are ever in doubt about if your collaboration or use of outside sources is appropriate, please talk to the professor or TAs for clarification.

Learning Accommodations

I am committed to partnering with you on your academic and intellectual journey and recognize that you bring many strengths, perspectives and strategies as you navigate this journey. I encourage you to think proactively and strategically about leveraging these strengths, in partnership with the many resources on campus. These resources include CAPS (free and unlimited counseling is available), Office of Academic Resources, Writing Center, Student Diversity Equity and Access Team, Health Services, Professional Health Advocate, Religious and Spiritual Life, the GRASE Center, and the Advising Deans. At times you may experience challenges or stressors that impact your ability to fully engage intellectually. If the stressors are academic, I welcome the opportunity to discuss and address those stressors with you in order to find solutions together. If you are experiencing challenges or questions related to emotional health, finances, physical health, relationships, learning strategies or differences, or other related topics, I hope you will consider reaching out to the many resources here on campus. Additional information can be found at: <https://www.haverford.edu/student-life/advising>.

Additionally, Haverford College is committed to creating a learning environment that meets the needs of its diverse student body and provides equitable access to students with disabilities. If you have (or think you may have) a disability related to mental health, chronic health, neurological state, and/or physical condition – please contact the Office of Access and Disability Services (ADS) at hc-ads@haverford.edu. It is never too late to request ADA accommodations – our bodies and circumstances are continuously changing. Please know that all inquiries and health-related information is handled in a sensitive and confidential manner.

Students who have already been approved to receive academic ADA accommodations and want to use these in this course should share their accommodation letter and make arrangements to meet with me as soon as possible to discuss how their accommodations will be implemented in this course. Please note that accommodations are not retroactive and require advance notice in order to successfully implement.

If, at any point in the semester, a disability or personal circumstances affect your learning in this course, please do not hesitate to reach out to me. I want to be sure you are aware of the full range of resources and options available to you.

It is a state law in Pennsylvania that individuals must be given advance notice that they may be recorded. Therefore, any student who has a disability-related need to audio record

this class must first be approved for this ADA accommodation by Access and Disability Services and then must communicate approval to me. I will then work with you to provide the accommodation while respecting all students' right to privacy.