

CS 219 Advanced Data Structures

Syllabus – Fall 2024

Description: This course will provide a rapid and intensified introduction to C++ and advanced data structures. The course will emphasize the relative advantages and disadvantages of various design and implementation choices and the way these choices affect software quality. The instruction will use C++, including template programming and the Standard Template Library (STL).

Course Outcomes: Upon completion of this course, the student should be able to:

1. Effectively program in C++ on Windows/Unix/Linux platforms;
2. Classify generally stated problems and implement programming solutions with proper data structures;
3. Describe the space and time complexity of STL containers and algorithms; and
4. Define and use containers, iterators, and other standard library components.

Learning Outcomes for CS Program Students: This course supports the following student outcomes in Computer Science:

1. Developing the ability to analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Developing the ability to design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in computer science.
3. Building the ability to apply computer science theory and software development fundamentals to produce computing-based solutions.

Prerequisites: CS 202 and Math 207

Classes: 3:35 – 5:00 p.m. on Tuesday and Thursday

Hodson Technology, Room 319

Instructor:

Prof. Cheng Qian

Email: qian@hood.edu

Office: HT 251

Office Hour: 5:00 - 5:30 p.m. on Tuesday

Zoom: <https://zoom.us/j/97965721450?pwd=HGx8TWmjGBlt6wuhDaOmE1h1ZscTAu.1>

Class Website: *Blackboard*

Blackboard is our primary communication channel. Students are responsible for monitoring the class website for any new materials (*i.e.*, homework, announcement, references) as they are posted.

Textbook:

1. *C++ Programming: Program Design Including Data Structures, 7th Ed.*, D.S. MALIK (required)
2. *C++ PROGRAMMING LANGUAGE*, STROUSTRUP, BJARNE, Addison-Wesley, 2013 (recommended)
3. *PROBLEM SOLVING WITH C++*, SAVITCH, WALTER, Pearson, 2017
4. *Absolute C++*, 6th. ed., W. Savitch, Addison Wesley, 2016 (recommended)
5. *STL Tutorial and Reference Guide, 2nd Ed.*, D. Musser, G. Derge and A. Saini, Addison Wesley, 2001 (a good reference book after you've learned STL)

About this course: This course serves two purposes: to learn beginning to intermediate C++ programming (approximately 60%) and to gain insightful knowledge on data structures and applications (about 40%). Students who have no prior C/C++ programming experience may find the course challenging at the beginning. Those with such experience often find the sudden rising curve around midterm time uncomfortably bumpy. Programming is often seen as **a technique**, while it is also **an art**. Please keep this in mind.

The learning curve of this class looks like the graph: it will grow slowly throughout the first half-semester when we are reviewing essential C++ knowledge (often similar to that of JAVA), then a sharp rising around the midterm time with a series of homework towards understanding C++ pointers and C++ operations. Then, you cruise to the end while learning data structures and algorithms. Students with some C/C++ programming background should be cautious about the sudden rising curve after an (over-)relaxing half of the semester.

Tentative Schedule: This is a tentative schedule, and is likely to be adjusted throughout the semester.

Weeks	Title	Comments
1	Course Preview, C++ Programming Environment	Chapter 1
2	Basic Elements of C++ / C++ Input and Output	Chapter 2 & 3; HW 1
3	C++ Control Structures	Chapter 4 & 5; HW 2
4	User Defined Functions, Namespace	Chapter 6 & 7;
5	Arrays and Strings	Chapters 8; HW 3
6	Struct and Classes	Chapter 9 & 10; HW 4
7	Midterm Exam	
8	Inheritance and Polymorphism	Chapter 11; HW 5
9	Pointers and Exception Handling	Chapters 12 & 14; HW 6
10	Overloading	Chapter 13; HW 7
11	Recursion and Linked List	Chapter 15 & 16; HW 8
12	Stacks and Queues	Chapter 17; HW 9
13	Searching and Sorting Algorithms	Chapter 18; HW 10
14	Binary Trees & Graphs	Chapter 19 & 20; HW 11
15	Final Exam	

Homework: There will be a variety of homework assignments. Programming assignment is, by default, due before the next class by Blackboard; or by a date designated when the assignment is given. Non-programming homework is, by default, due in class one week after it is given or by the date indicated on the assignment sheet. Be sure to start your homework assignment early. Writing a program is often easy or at least more straightforward than troubleshooting. Late assignments will not be accepted.

Attendance: Attendance is critical to the success of this class, especially in the latter part of the semester when we will have extensive discussions on topics not covered in the required textbook. Having that said, all students are expected to be in all classes. Excessive lateness (more than 20 minutes) and early departures will count as absences. If you cannot attend a class, please send the

instructor an email in advance so that we both have a written record. Discussions within/without the classroom are encouraged and promoted. Absent from a class, approved or not, is not an automatic excuse to miss or delay a homework assignment. Students missing from a lecture are still responsible for catching up with the materials covered, completing the homework, and turning it in on time.

Any coursework and derivatives (homework, projects, programming assignments, etc.) submitted during the semester may be later used for evaluation, teaching, or research purposes; they may also be published or made public without additional notice.

Having missed 3 class meetings will cost you all attendance credits.

Exams: There will be a midterm exam and a final exam.

Final grade = 45% Homework + 20% Midterm + 30% Final + 5% Attendance

A: ≥ 91	A-: ≥ 88	
B+: ≥ 85	B: ≥ 81	B-: ≥ 78
C+: ≥ 75	C: ≥ 71	C-: ≥ 68
D+: ≥ 65	D: ≥ 61	D-: ≥ 58
F: < 58		

Ethics: Exams and homework should reflect individual work. Code *'copy & paste'* is strictly prohibited under any circumstances. If you use ideas from a book, talk, or the Internet in your work, please give proper credit to the original sources. If a exam is open-book, you can not discuss it with *anyone, in person or electronically*; you cannot use a computer in any exam unless the instructor approves it. As programmers, you are to uphold the ACM Code of Ethics.

Be prepared to spend 7-8 hours per week on this course outside of the classroom. Read geek news ([slashdot](#), [ars technica](#), [reddit](#), [medium](#), etc.), follow tech trends, and have some fun. This course demands significant time in programming, especially in the weeks immediately after the midterm exam. As to programming skills, *practice makes perfect*.

Tips to succeed in this class:

- start working on the homework as early as possible, better on the same evening of the course;
- ask questions whenever the moment you feel lost in the course;
- participate in the class discussions
- make good use of the tutoring service provided by the department

Note: This course syllabus/outline is tentative and subject to perpetual revisions as needed.

Tutoring: Free tutoring in many subjects is available for Hood students through Thinking Storm professional tutoring and Hood peer tutoring. For more information about tutoring and to see the specific subject tutoring offered, please visit the student success website or contact the student success center at studentsuccess@hood.edu.

The Academic Honor System (Student Handbook)

As a place of honor and respect, all members of Hood College assume the obligation to maintain the principles of honesty, responsibility, and intellectual integrity in all activities related to their Hood College experience. Students are expected to adhere to the highest standards of academic honesty and integrity in all coursework and related matters. It is the responsibility of each student to support these values through maturity of thought, expression, and action. Members of the faculty and staff are available to assist students in this process.

Here are general guidelines for what constitutes proper academic conduct.

- Get familiar with Graduate Academic policies
- For individual homework, your individual work must be your own. You may not copy another student's solution (or allow yours to be copied) or otherwise use portions of another student's solution in your own individual work. Violations of this rule will result in a score of 0 for that work for all parties involved. Submissions that are alike in a substantive way (not due to coincidence) will be considered to be cheating by ALL parties involved.
- For all coursework, you are not allowed to elicit solutions from web forums. You may use and adapt any part of the class examples from lectures, notes, and the assigned textbooks.
- For the exams, you are not allowed to use any help or reference other than what is specified.
- Instructors also reserve the right to assign a final course grade of "F" to a student for cases of academic dishonesty.

For more information relating to Graduate Academic Policy, please visit this [link](#).

Health and Wellness

A wide range of support services for graduate students can be found from this [link](#).

Communication Standards (Faculty Handbook, Section Four. N)

The student's ability to write and speak standard English is an integral part of the grade evaluation for the course. Therefore, the quality of written and spoken work will be considered as a student's final grade is calculated.

Accommodations for Students with Disabilities (Faculty Handbook, Section Four. E)

By Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act of 1990, Hood makes every reasonable effort to accommodate the needs of handicapped students. The Coordinator for Disability Services arranges for academic accommodations, such as note-takers or interpreters; the Office of the Dean of Students coordinates residential room accommodations for these students.

As the instructor of this course, I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me and the Office for Accessibility Services, at 301-696-3421, gmuer@hood.edu.

Title IX Compliance and Reporting (Student Handbook)

Sexual misconduct is one of the most serious violations of Hood College's values of honor and respect and no form of sexual misconduct is acceptable within our community. Consistent with state and federal laws, including Title IX of the Education

Amendments of 1972 as amended ("Title IX") and Title VII of the Civil Rights Act of 1964, the College has implemented measures to ensure that all allegations of sexual misconduct are investigated and resolved in a timely, confidential, fair, and impartial manner. The College has designated certain officials as "responsible officials". A report to these individuals is an official report to the College that necessitates a response by the College. Faculty members are considered responsible officials and, as such, are not considered confidential resources. Therefore, incidents shared with the Faculty must be reported to the Title IX Coordinator. Please be advised that if you wish to speak confidentially about an incident and/or to obtain an academic accommodation, you may contact the Wellness Center to speak with a counselor, Health Services Staff, and/or the Dean of the Chapel.