

Welcome To CS 376 — Algorithm Design and Analysis Colby College, Spring '25

Course: CS 376 — Algorithm Design and Analysis
Lecture: M / W 1:00–2:15 PM, meetings in Davis 117
Website: <https://cs.colby.edu/courses/S25/cs376>

Course Description:

Algorithm Design and Analysis focuses on rigorous algorithm design and analysis techniques, including asymptotic complexity bounds, correctness proofs for iterative and recursive algorithms, and NP-Completeness. Motivating examples include classic sorting, searching, and optimization algorithms, for problem solving with data structures including arrays, lists, trees, and graphs. Emphasis is placed on concepts underlying general techniques, with applications to the design and analysis of correct and efficient algorithms in the iterative, divide-and-conquer, dynamic programming, and greedy paradigms.

Prerequisites and Restrictions: CS 231, and Math 274 (or equivalent) or permission of instructor. Students cannot receive credit for both CS375 and CS376.

Your Professor: Eric Aaron

Website: <https://cs.colby.edu/eaaron>

Office: Davis 113

Office Hours: M 4:00–5:00pm, Tu 3:30–4:30pm, W 2:30–3:30pm, F **TBD**,
and by email appointment.

Please feel free to come by and chat—I look forward to talking with you!

Phone/Voicemail: 207-859-5857

E-mail: eaaron@colby.edu (email is the best way to contact me)

Teaching Assistant: Melody Li

Your textbook

- *Introduction to Algorithms, Fourth Edition* by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein.

Grading: Your grades for the course will be computed (roughly) based on

- Exams (2–4 Midterms, one regularly scheduled Final expected): 60–70%
- Problem sets: 15–25%
- Smaller assignments and class participation: 10–20%

The above percentages may be changed if administrative concerns demand it.

Desired Course Outcomes

- Students understand and can employ rigorous methodology and notations for asymptotic complexity to calculate and prove results about algorithm efficiency.
- Students understand and can employ rigorous approaches to prove algorithm correctness.
- Students understand and can analyze classic sorting, searching, and graph algorithms, and their advantages and disadvantages in various contexts.
- Students understand and can design and analyze algorithms in various categories, including iterative, divide and conquer, dynamic programming, and greedy.
- Students understand the concept of NP-Completeness and its significance in studying the time efficiency of algorithms. Students can prove problems are NP-Complete.

Lectures, Classroom Discussions, and Classroom Accountability

All students are responsible for **ALL** information given in class, whether or not it is presented in any other form (handout, course website, textbook, etc.). **Attendance is essentially mandatory**, as unexcused absences will negatively affect the class participation grade; in the case of excused absences, it is essential that students who miss lecture consult classmates and find out about any information—academic, administrative, or other—that they missed. There may be unintended (potentially severe) consequences for students who do not keep up with all information from class; it is your responsibility to see that this does not happen to you.

Before each class, students are expected to review material from the previous class meeting—the new material will build upon previously covered material, so review is important for understanding new material as it is presented. It is also expected that, before each class, you will read (though not necessarily completely understand) the section of material to be covered in the next class. Please use class lecture notes and the course textbook as complementary sources of information; in cases of discrepancy, please notify your professor immediately.

There will be many opportunities for discussion and participation during class meetings; reviewing old material and reading new material can give these discussions more value for everyone in the class. An important part of the value of these discussions is *explanation*: It is *absolutely not expected* that every response in a class discussion will be correct; it is important, however, that students try to give reasons for their answers. Note that participation is part of the course grade, which requires actively contributing to in-class discussions, not simply attending class meetings; the lecture notes of the first day's class meeting contain additional details about ways to contribute to in-class discussion. Unexcused absences or use of devices during class time (see below) will negatively impact your class participation grade.

Use of Computers / Devices during Class Meetings: Scientific studies (e.g., Sana et al., 2013) demonstrate that the use of phones, computers, tablets, wearables, or other electronic devices during class meetings negatively affects the learning environment in the classroom—not just for the user of the device, but for classmates around them as well. To improve our learning environment, and as a courtesy to your classmates, the use of such devices is prohibited unless explicitly permitted. If for any reason it is important that you use such a device during a class meeting, please talk with me about how best to accommodate you.

Homework Policies

Homeworks should be typewritten using L^AT_EX (see L^AT_EX resources linked from our course homepage!) and submitted as PDFs; detailed submission instructions will be provided. Excessive submission of handwritten work included as images in L^AT_EX documents may not earn full credit. Problem sets and smaller assignments are typically due at the beginning of class (1:00pm) on the due date; assignments received after the beginning of class may be considered late. For purposes of having a consistent lateness policy that applies equally to everybody, please do not consider deadlines as “soft”—unless there are extenuating circumstances, deadlines apply exactly as posted.

As always, indicate **all resources consulted** / sources of assistance and collaborators—including anyone with whom you discussed the assignment, any resources used for help with L^AT_EX, etc.—on every submitted assignment; if none, indicate that in writing. Not doing so may result in significant delays in grading your work; repeatedly not doing so will result in penalties for not following instructions. For each cited resource, attributions should make clear in what ways (if any) that resource contributed to the submitted work. Moreover, incomplete or misleading attributions may be treated as a violation of academic integrity (see below). Please be conscientious, complete, and generous in citing all resources used in your work!

Both the larger problem sets and smaller assignments serve important purposes for the course, but because of their differences, different policies apply to each.

Smaller assignments Although smaller assignments do not have as much weight in the final course grade as problem sets, it is important for learning and reinforcing of concepts in the course that each assignment be completed on time—for example, we may go over the exercises in class the day they’re due, which substantially diminishes the value of late submitted work. These smaller assignments will be graded on a $\checkmark +$ / $\checkmark$ / $\checkmark -$ / 0 scale; they may frequently be graded on effort even more than correctness. The lateness policy is that if an assignment is handed in up to 1 week late, the maximum grade it can receive is a $\checkmark -$; after that, an automatic grade of 0 is given.

When computing your final grade, your lowest score **on smaller assignments submitted (on time or late) and showing substantial effort** will be dropped. (However, see additional information below.)

Problem sets Problem sets are opportunities for deeper engagement with course material, and because course material builds on what preceded it in the class, it is important that problem sets be completed on time. Problem sets submitted up to one week late will typically receive a 10% deduction; every student will get one free “lateness day” for problem sets in the course, however, enabling a problem set to be submitted up to 24 hours late without penalty—you do not need to ask for this extension, it will be granted on the first problem set submitted late by up to 24 hours.

Problem sets will receive a 25% deduction if they are submitted more than one week late or they are submitted after feedback on submitted assignments has been given to the class in any form (email, discussion during a class meeting, returning graded work, etc.). I will try to give advance notice if we’ll be going over a problem set within one week after it is submitted, so students can avoid the extra lateness penalty.

When computing your final grade, your lowest score **on problem sets submitted (on time or late) and showing substantial effort** will be dropped.

No homework (Problem Set or Smaller Assignment) will be accepted for credit—even as a lowest grade to be dropped—after the last day of classes. Moreover, no work reported for an academic integrity violation may count as a grade to be dropped.

As with all policies, homework and grading policies are intended to be fair to everyone involved. They will be enforced fairly. (Extenuating circumstances will of course be considered.) Please feel free to ask me any questions about specific cases that may emerge over the semester!

Policy on Collaboration and Academic Integrity

There may be assignments on which collaboration is forbidden or restricted to a particular group working together; such exercises will be explicitly noted by your professor. In general, however, collaboration will be permitted—indeed, you are encouraged to work with classmates on problem sets and smaller assignments!

On homework exercises where collaboration is permitted, you are encouraged to discuss *approaches* to solving problems *on a general level* with your classmates (as well as your professor, of course!). Unless permission has been explicitly given by your professor, however, you may not discuss specifics with your classmates, and the expression of your answer and your written work—including the specific wording / syntax used to express and explain your answers—must be entirely your own. As part of this, in cases of collaboration, if you know the answer and a classmate does not, telling them the answer is a violation of class policy; if a classmate needs further assistance, they should see your professor or TA (if applicable).

In general, **assignments should be completed without consulting resources other than your textbook and CS376 lecture notes (and other explicitly permitted resources), classmates, TA (if applicable), and Prof**; note that consulting a resource to learn material relevant to an assignment is considered to be using that resource for that assignment. Using any resources (electronic or print, online or otherwise) other than those explicitly permitted as course resources is prohibited; if you'd like to use a resource that has not been explicitly permitted, consult your Prof. before using it to avoid any unintended violations of course policies. Receiving and copying complete or partial solutions from any source (a classmate, a friend, a family member, a tutor, a published text, an online source, generative AI, etc.) is disallowed, and using such material as “inspiration” and submitting highly derivative solutions is viewed as copying.

Furthermore, on each submitted assignment, you should always cite and acknowledge (i.e., write down on the submitted assignment) everyone with whom you discussed the assignment and all sources you consulted / from which you received assistance, including your textbook, lecture notes, classmates, TAs, or other people. There are many reasons to be generous and complete in acknowledging sources; among them, using a resource on an assignment and citing it (along with attributing specifically what it contributed to the work) and later realizing it was not a permitted resource is better than not citing such resources—indeed, intentionally not citing resources may be treated as academic dishonesty.

Your professor reserves the right to ask students to verbally explain the reasoning behind any work that they submit and to modify assignment / exam grades based on the answers; such explanations should be from primary foundations or first principles to receive full credit. (Merely observing that some other presentation did something so you did too, without demonstrating an understanding the foundations and reasons why, will not receive full credit.) It is vitally important that you turn in work that is your own! Please also see the **Statement on usage of generative AI** below; in CS376, content created or significantly inspired by generative AI is not considered work that is your own.

Reports of academic dishonesty are handled by an academic review board. A finding of academic dishonesty may result in significant sanctions. From Colby's Academic Integrity Coordinator:

If a student is found responsible for academic dishonesty, the sanctions range from failing the assignment and receiving up to a one letter grade reduction in the course (typical for minor assignments) to failing the course (typical for a major assignment) for a first infraction. Subsequent infractions can lead to suspension and expulsion. Furthermore, regardless of the severity of the infraction, all students found responsible for dishonesty will have a disciplinary letter placed in their file for 6 years after they leave Colby. Disciplinary infractions are reported upon request to graduate programs,

medical/dental/law schools, and employers. Thus, the consequences of even minor infractions can be significant.

For more details on Colby's Academic Integrity policies and procedures, see <https://www.colby.edu/academics/academic-integrity/>

In general, the highest level of academic integrity is expected of every student in this class. If there are any questions about collaboration or related policies, please come talk with me!

Statement on usage of generative AI for CS376 The use of generative AI tools (ChatGPT, GitHub Copilot, etc.) for language, algorithms, pseudocode, or code generation is considered inappropriate collaboration and **prohibited for this class** unless explicit permission is given from your Prof. The primary goals of CS376 focus on learning and demonstrating command of concepts and techniques useful for creating algorithms and communicating about Computer Science from first principles / foundations; in general, the use of generative AI is inconsistent with this focus. If you have questions about this policy, or specific cases where you think using generative AI would improve the learning of course content from first principles / foundations, please ask me!

Statement regarding Academic Accommodations *The following is standard suggested language regarding Academic Accommodations at Colby. It applies to this course.*

I am committed to creating a course that is inclusive in its design. If you encounter barriers, please let me know immediately so we can determine if there is a design adjustment that can be made. I am happy to consider creative solutions as long as they do not compromise the intent of the assessment or learning activity.

If you are a student with a disability, or think you may have a disability, you are also welcome to initiate this conversation with the Dean of Students Office. The Dean of Students Office works with students with disabilities and faculty members to identify reasonable accommodations. Please visit their website for contact and other information:

<https://life.colby.edu/get-support/access-disability-services/>

If you have already been approved for academic accommodations, please connect within the two weeks of the start of the semester so the office can develop an implementation plan.

The Colby Affirmation

(<https://www.colby.edu/academics/academic-integrity/the-colby-affirmation/>)

Colby College is a community dedicated to learning and committed to the growth and well-being of all its members.

As a community devoted to intellectual growth, we value academic integrity. We agree to take ownership of our academic work, to submit only work that is our own, to fully acknowledge the research and ideas of others in our work, and to abide by the instructions and regulations governing academic work established by the faculty.

As a community built on respect for ourselves, each other, and our physical environment, we recognize the diversity of people who have gathered here and that genuine inclusivity requires active, honest, and compassionate engagement with one another. We agree to respect each other, to honor community expectations, and to comply with College policies.

As a member of this community, I pledge to hold myself and others accountable to these values.

Title IX Statement *The following is standard suggested language regarding Sexual Misconduct/Title IX at Colby. It applies to this course.*

Colby College prohibits and will not tolerate sexual misconduct or gender-based discrimination of any kind. Colby is legally obligated to investigate sexual misconduct (including, but not limited to, sexual assault and sexual harassment) and other specific forms of behavior that violate federal and state laws (Title IX and Title VII, and the Maine Human Rights Act). Such behavior also requires the College to fulfill certain obligations under two other federal laws, the Violence Against Women Act (VAWA) and the Jeanne Clery Disclosure of Campus Security Policy and Campus Statistics Act (Clery Act). To learn more about what constitutes sexual misconduct or to report an incident, see: <https://life.colby.edu/your-safety/sexual-violence-title-ix/>

I am committed to all Colby students feeling safe, accepted, and included in all aspects of their college experiences, including this course. Colby prohibits and will not tolerate sexual misconduct or gender based discrimination of any kind and is obligated, by federal and state laws, to respond to reports and provide resources to students. As your professor I am considered a “responsible employee” which requires me to report incidence of sexual assault, sexual harassment, dating violence, or stalking to the Title IX Coordinator.

If you wish to access confidential support services, you may contact:

1. Counseling Services: 207-859-4490
2. Dean of Religious and Spiritual Life, Kate Smanik: 207-859-4272, kesmanik@colby.edu
3. Director of Student Access and Disability Services, Kevin Murray: 207-859-5166, kjmurray@colby.edu
4. Assistant Dean of Student Success, Kay Shirley: 207-859-4560, kshirley@colby.edu
5. Colby Health Services: 207-861-6860, healthservices@colby.edu
6. Maine’s 24/7 Sexual Assault Helpline: 1-800-871-7741

To learn more, visit <https://life.colby.edu/your-safety/sexual-violence-title-ix/>

Mental and Emotional Health *The following is standard suggested language regarding Mental and Emotional Health at Colby. It applies to this course.*

I am invested in the mental and emotional health of my students. Even as I establish and maintain the academic standards of my course, I value each of you as individuals with complex lives, identities, and challenges.

Throughout the semester, the responsibilities of your Colby education may interact with situational as well as ongoing mental and emotional challenges in foreseeable and unforeseeable ways. If you are in need of reasonable flexibility due to an emotional situation or an ongoing mental health issue, please communicate as openly as possible with your Class Dean, and/or members of the office of Access and Disability Services, preferably in advance of the need, so that we can discuss how your circumstances interface with course requirements. Together, we will consider what is needed and what is possible. If we can discuss the situation, we can manage the situation together.

Please do not allow academic responsibilities to prevent you from getting help you need. Our Colby Counseling Services staff (207-859-4490) and the staff in the Dean of Studies office (207-859-4560) are available to connect with you. The safety of my students and every member of this community is paramount. If you or someone you know is struggling with thoughts of suicide or may be a danger to themselves or others, please call the on-call counselor immediately (207-859-4490, press “0”).

Respect for Diversity *The following is standard suggested language regarding Respect for Diversity and Religious Holidays at Colby. It applies to this course.*

It is my intent that students from diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. I expect you to feel challenged and sometimes outside of your comfort zone in this course, but it is my intent to present materials and activities that are inclusive and respectful of all persons, no matter their gender, sexual orientation, disability, age, socioeconomic status, ethnicity, race, culture, perspective, and other background characteristics.

I have attempted to avoid scheduling exams during major religious holidays. If, however, I have inadvertently scheduled an exam or major deadline that creates a conflict with your religious observances, please let me know within two weeks of the start of classes so that we can make other arrangements. Colby College is supportive of the religious practices of its students, faculty, and staff. The College is committed to ensuring that all students are able to observe their religious beliefs without academic penalty.

Class rosters are provided to each instructor with the student's legal name. I will gladly honor your request to address you by an alternate name and/or gender pronoun. Please advise me of this early in the semester so that I may make appropriate changes to my records.