Applied Algorithms

Fall 2024

Instructor:	Sam McCauley	**Time:**	TF 1:10-2:25
Email:	srm2@williams.edu	**Place:**	Schow 30A

Webpage: https://williams-cs.github.io/cs358-f24/index.html

Office Hours: Wed 3-5PM, Thursday 3-5PM; TCL 306

Textbooks: There is no textbook for this course. There are some optimal textbooks that may be useful for reference. These are listed on the course website. Copies of these textbooks will be available in TCL 312.

Objectives: This course aims to study the interaction between practical and theoretical computer science. At the end of the course, students should be able to:
- analyze potential bottlenecks in code,
- analyze potential bottlenecks in a given algorithmic strategy,
- translate a high-level description of an algorithm into efficient code, and
- apply the algorithmic techniques discussed in class to solve computational problems.

Prerequisites: CS 256 and 237 or equivalent. Concurrently taking both this class and 256 is acceptable, but a student in that position may need to do extra work to catch up on some topics if we cover them before 256 does. (Probability and Dynamic Programming are likely in this category.) Similarly, taking both this class and 237 is acceptable, but students who do not much experience coding in C are encouraged to seek outside help (e.g. office hours or recommended texts), especially during the first few homeworks.

Tentative Course Outline:
- Section 1: Time, Space, and Cache Efficiency
- Section 2: Hashing and Randomization
- Section 3: Linear Programming
- Section 4: Strings and Trees

Grading Policy: Homeworks (25%), Assignments (50%), Final Project (25%)

Attendance: Attendance is not required in this class; however, it is highly recommended.

Academic Honesty: For a full description of the Computer Science Honor Code, please see:

> https://csci.williams.edu/the-cs-honor-code-and-computer-usage-policy/.

If you have any doubt about what is appropriate, please contact me; one way is via email at srm2@cs.williams.edu. Specific rules are outlined below, and are further explained in the "Handing in Homeworks" handout, found at https://williams-cs.github.io/cs358-f24/handouts/handingInAssignments.pdf.

Homeworks are divided into two parts: code and questions. Homeworks allow for a great deal of collaboration between students on code, but not on questions.
- The student must submit their own answers to any questions that are a part of the homework. On these questions, students may only discuss high-level strategies and small syntax issues. The best way to ensure that this rule is followed is to never write anything down during discussions with other students—instead, discuss at a high level, and write down the details alone after the discussion completes. Students should not use the internet, neither tools like Google nor ChatGPT, to get help answering these questions.

- On the coding part of a homework, students may collaborate with proper citations up to and including sharing pieces of code—thus, these are closest to "Practice Programs" under the CS honor code. However, every student must be able to explain every part of their submission. Furthermore, this sharing must always be mutually agreed upon—stealing content from another student violates the honor code as it normally would.

Any online resources are considered to be **acceptable** for homeworks. For example, a student may use StackOverflow to help with their code or with the answer to a question, so long as this help is properly cited and the student is able to explain their response. The same is true for AI help (like ChatGPT): you may use it, and even may ask it to write your code, so long as you cite this and are able to explain the result.

Assignments are more about assessment, and have significantly stricter standards than homeworks. Assignments are to be the sole work of each student. No collaboration or discussion is allowed whatsoever. Internet resources, including generative AI, may not be used to obtain any assignment solutions; however they may be used for diagnostic purposes—i.e. looking up an unusual compiler error, or how to (say) debug memory leaks. When using the internet for help in this context, be sure that what is being searched is the tool being used, like the compiler, rather than your code itself. You should not google your code, ask ChatGPT about it, email or otherwise send it to anyone or post it anywhere for assignments. They are considered "Test Programs" under the CS honor code.

For the Final Project, students will work in groups of at most 2. Within a pair any collaboration is allowed, but you may not work with students not in the pair. It is considered a "Team Program" under the CS honor code. Final Projects have both a research component, and a coding/writing component. Students may use outside resources when doing background research and learning about a problem. But, the code submitted as their Final Project work must have been written only by the students themselves. Any information or code obtained from outside sources as background information should be clearly delineated. I will have regular meetings with each group about the final project during the last portion of the class; students should ask me any questions they may have about how the honor code relates to the final project.

Homeworks: Homeworks are designed to give students practice with the course materials. Grading on homeworks is intended to give students an idea of how solutions will be graded on the Assignments and Final Project. Some homeworks will be accompanied by a coding competition. The students with the first, second, and third best competition scores will be assigned 20, 15, 10 extra points respectively (out of 100, after grades are converted to numeric equivalents) on the homework. Generally, students with similar scores will be considered "tied"; if a student is tied with a higher-ranked student they will receive the same number of bonus points as the higher-ranked student.

Late homeworks will incur a penalty of one letter grade per day. If you cannot submit a homework on time, please let me know ahead of time. The primary goal of the late penalty is to discourage students from falling behind in the course—I am very much willing to give extensions that are consistent with this goal.

Assignments: Assignments are designed to test student's knowledge of the material. There will be three assignments. All work must be done individually. Assignments will have two components: questions and a coding assignment. The coding assignment will not have an associated competition; however, the quality of the solution will be evaluated in part on performance. Each assignment will include example benchmarks, along with the scores that will result from performance on that benchmark. Depending on student performance, the grade given for a given performance may be increased; however, it will never be decreased.

Final Project: The end of this course has a Final Project, in which students will explore one of the course topics in more detail in groups of 1 or 2. Students will split into groups and choose a topic in mid-November. For the rest of the semester, students will meet regularly with each other and with me about progress on the project. The goal of the Final Project is to have roughly similar content to a homework or assignment: a component where students produce efficient code, and a component where students analyze the code experimentally and/or theoretically.

Grading: Grading in this course will generally be done using letter grades rather than specific point values.

The hope is that this will help ensure that the focus of the course is on understanding the key points, rather than on small details.

Final grades will be calculated by averaging letter grades, and then using the standard cutoffs (above 93 for A, above 90 for A-, etc.). These final cutoffs may be lowered (i.e. a 89.5 for an A-), but will not be raised.

Accommodations: Students with disabilities of any kind who may need accommodations for this course are encouraged to contact Katy Evans (Interim Director of Accessible Education) at 597-4672. I am happy to discuss accommodations personally as well. Also, students experiencing mental or physical health challenges that are significantly affecting their academic work or well-being are encouraged to contact me and/or speak with a dean so we can help you find the right resources. The deans can be reached at 597-4171.

The college generally reaches out to professors about accommodations. If any of your accommodations affect how you interact with the course (e.g. by changing a due date), I will reach out to you with these changes. If you have not heard from me about accommodations you should have, please let me know as soon as possible so that we can make sure any resources are prepared in time.

Health and Accessibility Resources: Students with disabilities or disabling conditions who experience barriers in this course are encouraged to contact me to discuss options for access and full course participation. The Office of Accessible Education is also available to facilitate the removal of barriers and to ensure access and reasonable accommodations. Students with documented disabilities or disabling conditions of any kind who may need accommodations for this course or who have questions about appropriate resources are encouraged to contact the Office of Accessible Education at `oaestaff@williams.edu`

Inclusion and Classroom Culture: The Williams community embraces diversity of age, background, beliefs, ethnicity, gender, gender identity, gender expression, national origin, religious affiliation, sexual orientation, and other visible and non visible categories. I welcome all students in this course and expect that all students contribute to a respectful, welcoming and inclusive environment. If you have any concerns about classroom climate, please come to me to share your concern.

Addressing Each Other: In this class, we use the name and gender pronouns that individuals ask us to use as a sign of mutual respect. I will use the pronouns you have indicated on GLOW unless you alert me to a different pronoun (I'll also ask in Homework 0). That said, everyone makes mistakes—in general, should you use an incorrect pronoun or name, the best course of action is to make a quick correction and move on, rather than dwelling on it.