

Welcome To CS 346 — Computational Modeling & Simulation I (Interdisciplinary Science) Colby College, Spring '21

Course: CS 346 — Computational Modeling & Simulation I (Interdisciplinary Science)

Lecture: T / R 11:00AM–12:15PM, meetings in Davis 117 ... It's complicated ...

Website URL: <https://cs.colby.edu/courses/S21/cs346>

Course Description

A programming-oriented introduction to techniques in computational modeling and simulation, motivated by applications to the natural and social sciences. Topics may include: dynamical system simulation; finite difference equations; numerical error in simulation; numerical methods for integration; Monte Carlo simulation; cellular automata; and agent-based modeling. Students complete projects in multiple application domains to develop interdisciplinary breadth; to understand explanatory models and methods underlying computational science; and to develop programming style and skills that support easily extended and maintained code.

Prerequisites: Computer Science 231, and Mathematics 122 or equivalent.

Your Professor: Eric Aaron

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

Office: Davis 113

Office Hours: M 2:30–4:00pm, Tu 4:00–5:00pm, W 2:30–4pm and 6:30–7:30pm,
and by email appointment (but may change)

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

NB: The above email address is the best way to contact me.

Course textbook

- *Introduction to Computational Science* by Angela B. Shiflet and George W. Shiflet.

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

- Projects (including Problem Sets) (2–3 expected, and 1–2 optional expected): 50–55%
- Final Project / Assignment: 30% (There will not be a Final Exam for the course.)
- Class participation, labs, other small assignments, etc.: 15–20%

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

Desired Course Outcomes

- Students understand how differential equations, difference equations, cellular automata, and agent-based models can represent time-varying systems. Students can use these paradigms to create computational models of scientific phenomena.
- Students can implement computational models of scientific phenomena—based on differential equations, cellular automata, or agent-based modeling—in computer programs.
- Students understand the causes and importance of error introduced by computational modeling and simulation, and can employ techniques to manage or minimize such error.
- Students can create tests for code correctness and employ code testing, programming techniques, and programming style to create well-documented code that is validated and easily extended and maintained.
- Students gain experience in modeling systems across a range of sciences, understanding fundamental concepts and programming techniques that can apply broadly to computational modeling and simulation for interdisciplinary science applications.

Lectures, Labs, 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.). Thus, although lecture attendance is not mandatory, it is strongly encouraged, and 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 severe, unintended 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. The easiest way to ensure it: Attend every lecture.

There will be occasional “lab” meetings in class to work together with Matlab on course concepts. Attendance at labs is especially strongly advised. ~~and may be made mandatory.~~

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 discussion; the lecture notes of the first day’s class meeting contain additional details about ways to contribute to in-class discussion.)

~~As a courtesy to your classmates and your instructors, the use of computers, tablets, mobile phones, wearables, or other electronic devices during lectures and labs is discouraged. If for any reason it is important that you use such a device during lecture or lab, please talk with me about how best to accommodate you.~~ Please use devices only in respectful ways, directly related to course content, during class meetings.

Homework Policies

Specific submission instructions for homework assignments will be presented on the CS346 website. Assignments such as programs and PDF write-ups are typically due by the end (11:59 PM) of the specified due date. There may also be some written assignments (code documentations,

responses to papers, etc.) that may instead be due by the beginning of class (e.g., 11 AM) on the specified due date. **For purposes of having a consistent CS346 lateness policy that applies equally to everybody, please do not consider CS346 deadlines as “soft”—unless there are extenuating circumstances, deadlines will be applied exactly as posted.**

There will be two kinds of graded assignments for CS346: *Projects* (which may include Problem Sets); and *Smaller Assignments*. Both kinds of assignments serve important purposes for the course, but because of their differences, different policies apply to each. The default policies are:

Smaller assignments Although these smaller assignments do not have as much weight in the final course grade as problem sets, it is often extremely important for progress in the course that each assignment be completed on time—for example, such an assignment might be to write a response to a paper, which a guest speaker will need to receive from you in time to incorporate your thoughts into their presentation. These smaller assignments will be graded on a $\checkmark + / \checkmark / \checkmark - / 0$ scale; the lateness policy is that if an assignment is handed in up to 1 week late, there is a penalty of one “level” down; after that, an automatic grade of 0 is given.

Projects The **default** policy (but, there will be many exceptions, see below): Any project submitted by its deadline will receive timely feedback. A project submitted after its deadline but before feedback is given on the assignment will not necessarily be subject to a grade penalty for lateness, but it may not be graded immediately, so the submitter may not receive written feedback before the end of the semester. Any project submitted after feedback on the assignment has been given to the class, either by email or by discussion during a class meeting, will receive a 25% deduction. **PLEASE NOTE: It is possible that, for pedagogical reasons, we will go over all or part of a project in class on the day it is submitted—please submit homework on time to avoid lateness penalties!**

Although these are the default penalties for projects, it is **extremely likely** that there will be exceptions. For instance, I expect that there will be several assignments or parts of assignments that are time-critical—e.g., making sure I receive your code 24 hours before you do a code demo with me; finishing stage 1 of a 2-stage assignment, so the class can progress with stage 2—and in those instances, lateness could be severely problematic, so there may be substantial penalties for lateness. Any instances of these exceptional lateness penalties will be clearly announced as parts of the particular assignments to which they apply.

Regarding these exceptional cases, every student will receive a three-hour “freebie”: A student may submit *one* Project up to 3 hours late without penalty. An exception to this: The “freebie” cannot excuse a penalty for not submitting work at least 24 hours before its code demo.

As always, indicate all collaborators, sources of assistance, and people with whom you discussed the assignment, on every submitted assignment.

As with all CS346 policies, homework policies are intended to be fair to everyone involved in the course. They will be enforced fairly. Please feel free to ask me any questions about specific cases that may emerge over the semester!

Policy on Collaboration and Academic Integrity

Your CS346 homework will include both non-programming and programming exercises. Collaboration on assignments is generally permitted, although there may be some parts of assignments

for which work is expected to be individual, and collaboration will be explicitly prohibited. In addition, some exercises may be done in teams, and in such cases, teammates may share all ideas and written work with each other without restriction; other collaborations (between teams, between individuals that are not teammates) may be restricted. In all cases, every individual is responsible for understanding all the material in each assignment and doing their own work. Always strive to do your best, give generous credit to others where credit is due, start early, and seek help early.

On most exercises, collaboration in the form of discussing **ideas and approaches on a general level** will be permitted, even encouraged! Your written work and coding work, however, must be entirely your own: you must write and submit your own code, and you may not share or copy code, solutions, or files; the originality or novelty of your work may be part of the basis for the grade of an exercise. **One implication of this—on a homework exercise, you may not look at a screen to see the code of a classmate.** (I understand there may be accidental slips about this—please be sure to self-report to your prof. any time that seeing someone’s screen has influenced your work, to find a way to address it without any academic dishonesty!) Another way to think about it: You should be speaking in English with one another, not in Matlab or some other programming language.

In general, receiving and copying solutions (code, pseudocode, equations in a model, etc.) from any source (a classmate, a friend, a published text, an online source, etc.) is disallowed; note that using code or other material from sources (other than those explicitly given as course resources) as “inspiration” and submitting highly derivative solutions is viewed as copying. Furthermore, on each submitted assignment, you should always **cite and acknowledge all sources of assistance**, including everyone with whom you discussed the assignment and any other material consulted.

In particular, there are restrictions on Matlab-based resources you are permitted to use on your assignments. (These may seem unusual, but they are integral to the particular approach and context of CS346, and they have worked very well in the past—please talk with me to find out more, if you’d like!) **You may not use any Matlab resources other than those online with a mathworks.com URL** without explicit permission. In addition, **you may not use Matlab’s build-in differential equation solvers (*diff*, *ode45*, etc.) or other complex built-in Matlab tools** on assignments—our goal in CS346 is to learn how to create solutions by building up from simple foundations, and using complex built-in Matlab functions or tools is often inconsistent with that goal. If you have questions about whether a Matlab tool or function is appropriate for work in CS346, please ask your Prof.!

Your professor reserves the right to ask students to verbally explain the reasoning behind any answer or code that they submit and to modify assignment grades based on the answers. It is vitally important that you turn in work that is your own! Reports of academic dishonesty are handled by an academic review board and a finding of academic dishonesty may result in significant sanctions. For more details on Colby’s Academic Integrity policies and procedures, see <https://www.colby.edu/academicintegrity/>.

In general, the highest level of academic integrity is expected of every student in this class. This policy is intended to be consistent with the particular subject matter and context of CS346, and it may be different from policies you’ve experienced in other courses.¹ If there are any questions about collaboration or related policies that come up over the semester, please come talk with me!

¹If there are to be changes to this policy over the semester, you will be given ample advance notice.

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.

<https://www.colby.edu/catalogue/front-of-catalogue/colby-affirmation/>

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

I am available to discuss academic accommodations that any student with a documented disability may require. Please note that you'll need to provide a letter from the Dean of Studies Office documenting your approved accommodations. *Please meet with me within two weeks of the start of the semester to make a request for accommodations* so that we can work together with the College to make the appropriate arrangements for you. Kate McLaughlin, Associate Director of Access and Disability Services (kmclaugh@colby.edu), is the primary contact for accommodations and any questions related to educational testing and documentation.

Mental health: I care about our students' well-being and understand they may face mental health challenges. Students are encouraged to seek support from the College's available resources, including your advising dean and Counseling Services. (For immediate care, please call 207-859-4490 and press "0" to reach the on-call counselor.) I am willing to discuss reasonable accommodations during a crisis, but to fulfill our educational mission, students are expected to adhere to the attendance policy. Failure to do so because of mental health challenges may require consultation with the Dean of Studies Office.

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

Colby College supports the religious practices of students, faculty, and staff. Students are expected to notify their instructors of their intent to fulfill the obligations of their religious tradition well in advance of these days. For this class I ask that you notify me by e-mail at least 14 days in advance of the date in question.