Welcome To CS 346 — Computational Modeling & Simulation I (Interdisciplinary Science) Colby College, Fall '25

Course: CS 346 — Computational Modeling & Simulation I (Interdisciplinary Science)
Lecture: T / R 1:00PM–2:15PM, meetings in Davis 117
Website URL: *https://cs.colby.edu/courses/F25/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, mechanistic 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 125 or equivalent.

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 3:00–4:00pm, 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*
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 (possibly including Problem Sets) (2–4 expected): 30–45%
- Final Project / Assignment: 15–25%
- Exams (1–3 expected, including a regularly scheduled Final Exam): 15–35%
- 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.). **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.

There will be occasional "lab" meetings in class to work together with Matlab on course concepts. Attendance at labs is mandatory unless specified otherwise by your Prof.

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.)

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 strongly discouraged. (Of course, computers required for in-class / lab exercises are exceptions to this policy.) 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

Specific submission instructions for homework assignments will be presented on the CS346 website. Assignments such as programs, write-ups, and recorded video presentations 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., 1 PM) 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 (not Exams) 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 ✓+ / ✓ / ✓− / 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): If an assignment is handed in 1-2 days late, a deduction of 10%; 3-4 days late, a deduction of 15%; 5-10 days late, 25% deduction; after 10 days, 50% deduction, and students may not received graded feedback during the semester. In addition, any project submitted after feedback on submitted assignments has been given to the class, either by email or by discussion during a class meeting, will receive at least 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 deductions for projects, it is **extremely likely** that there will be variations from project to project. For instance, I expect that there will be several assignments or parts of assignments that are time-critical—e.g., 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.

Every student will receive a three-hour "freebie": A student may submit *one* project up to 3 hours late without penalty. In cases where students are doing a live presentation or code demo with me, however, the "freebie" cannot excuse a deduction for not submitting work at least 24 hours before the presentation / 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.

Talking with someone about an assignment during the process of carrying out that assignment is considered collaboration, and 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, generative AI, etc.) is disallowed. Using any resources (electronic or print, online or otherwise) other than those explicitly permitted as course resources is prohibited; note that consulting a resource to learn material relevant to an assignment is considered to be using that resource for that assignment. 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, 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. Failing to cite resources may result in deductions to your grade—and intentionally not citing resources may be treated as academic dishonesty.

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 Mat-**

lab tools on assignments; using Copilot or any toolboxes other than the most basic Matlab is similarly prohibited for this learning experience. Our goal in CS346 is to learn material from first principles / foundations, to create broadly applicable and easily extended / modified solutions by building up from simple foundations; using complex built-in Matlab functions or tools is typically 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; 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 CS346, content created 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. These policies are intended to be consistent with the particular subject matter and context of CS346, and they 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!

Statement on usage of generative AI for CS346 The use of generative AI tools (including but not limited to: ChatGPT, Gemini, Llama, DeepSeek, CoPilot, etc.) for purposes such as answering questions on assignments, collaboration on problem solving, language generation, and code generation is considered inappropriate collaboration and **prohibited for this class** unless explicit permission is given from your Prof. The primary goals of CS346 focus on learning and communicating about Computational Science from first principles / foundations, and 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!

[1] If there are to be changes to these policies over the semester, ample advance notice will be given.

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: www.colby.edu/studentlife/handbook-section/f-sexualmisconduct/.

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. The Counseling Center: 207-859-4490
2. The Title IX Confidential Advocate: 207-509-9122
3. The Office of Religious and Spiritual Life: 207-859-4272
4. Maine's 24/7 Sexual Assault Helpline: 1-800-871-7741

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.