

Math 387: Computability and Complexity

Fall 2015

Basic information

Professor: Adam Groce, agroce@reed.edu

Class schedule: Class meets Monday, Wednesday, and Friday in Physics 123.

Office hours: I hold office hours (in Library 390) Monday 2-3 and 4-5, Wednesday 10-11, Thursday 11-12, and Friday 2-3. I can also meet with you by appointment if those times are bad or if you would like to discuss something privately. You are also welcome to stop by other times, but I might be busy.

Website: The course website is <http://people.reed.edu/~agroce/math387/>. Homework and other information will be posted on that website.

Textbook: The textbook is *Introduction to the Theory of Computation* by Michael Sipser. The second edition is preferred, though you can probably get by with the first or third.

Course overview

This course seeks to answer deep conceptual questions about computation: What can computers do? What resources (time, memory, etc.) are required to do those things? We mean these questions in the deepest sense possible. We are not worried about the limits of our practical ability to program, for example, but in the inherent power that computation encompasses.

This is a math class. We will be writing proofs, not writing programs. Knowledge of programming will mean you're a little more used to thinking in some of the ways you'll need to think in this course, but it's not strictly necessary. (We'll also cover a variety of topics that are very useful to programmers, though we won't get into the syntax of using them with a particular language.) Similarly, I will be assuming you have some experience writing proofs, but no particular knowledge from prior classes is necessary.

The material in this class has everything you need to make a course interesting. We're talking about really deep and interesting questions. The proofs we'll be seeing use a variety of really clever ideas, and the results are cool and surprising. This subject is also unusual in math in that in a single course we can get from the very beginning to a point where you will understand many of the most important open questions in computer science. I am excited to teach the course, and I hope you are excited to take it.

Coursework and grading

Homework: There will be a homework assignment roughly each week, due in class on (probably) Fridays. Late homework will be accepted, but will be greatly penalized in grading. You are allowed to work with others on the homework, but the final result must be your own. That said, I encourage you to at least try your best on your own before working with others. The homework is a very small part of your grade, but a very big part of preparing for tests. Struggling through difficult problems can be a much better learning experience than getting pointed directly towards the answer by a classmate.

Tests: There will be three tests in total during the course, two during the regular semester plus a final, with the final worth a little more than the other two tests. These tests will be the primary determinant of your grade in the course.

Other policies

Attendance: I trust you to make decisions regarding attendance for yourself. I think you should attend every class because I think that is important to learning the course material, but it is that learning of the material on which you will be judged, not the attendance directly. I will, however, assume everyone is in class, and if you miss class you should make sure to talk to someone else in the class to find out if you missed any announcements, schedule changes, etc. If you miss a test you will receive no credit unless your absence is excused. Some excuses (such as illness) may require documentation (such as a doctor's note). I expect that if you will be missing class for an excusable but predictable reason (say, a religious holiday) that you inform me before the absence. I will not excuse absences after the fact for reasons that were known about ahead of time.

Academic integrity: You are allowed to work with classmates on the homework, but you should write on the homework the names of anyone you collaborated with. You must also

write up the actual solutions on your own, and you must actually do the homework together – copying and collaborating are very different things, and I expect you to know the difference. I take academic integrity very seriously, and I will not hesitate to report inappropriate behavior.

Advice

Don't procrastinate! The homework problems I will be assigning are a lot like puzzles – it will take some time thinking them over to figure out how to do them. I recommend taking a little time to read over the homework and spend a couple minutes trying each problem as soon as it is assigned. That will often get your mind churning over the questions and help you think of answers.

Don't get frustrated! I assign hard homework problems, and I put hard problems on tests. I don't expect you to get every problem correct every time. A certain amount of difficulty is par for the course. If you feel particularly stuck, don't hesitate to come to office hours and ask me about it.

Use the textbook! The textbook for this class is excellent, and it very closely covers what we're doing in class. If something is missing from your notes, it's probably in the textbook. If you want to see some simple problems worked out, they're in the textbook. If you just were confused in class and want to see a different explanation, it's in the textbook.

Have fun! I found this class to be arguably the most fun of anything I took as an undergrad, and I want your experience to be just as good. Please tell me if there's anything about the course that's bothering you.