Introduction to Mathematical Reasoning (Math 235)

Fall 2018

Technicalities

Instructor: Dr. Clayton Shonkwiler (clay@shonkwiler.org)
Office: Weber 216
Course web page: https://www.math.colostate.edu/∼clayton/teaching/m235f18
Text: *Mathematical Reasoning: Writing and Proof*, by Ted Sundstrom, available free online at https://www.tedsundstrom.com/mathreasoning
Time/Location: 1:00–1:50 TR, Engineering E105.
Office Hours: Monday 11:00–12:00, Wednesday 2:00–3:00.

What's this all about?

What, exactly, do mathematicians do? Of course there are many different answers to this question, but very common thing that mathematicians do is try to discover new things. These things might be statements about numbers, but they could just as well be statements about topological spaces or commutative rings or dynamical systems or any number of other things.

In general, discovering new statements (or lemmas, propositions, theorems, etc.) is not very much like solving calculus problems: there's usually no textbook telling you which statements to prove and, most frighteningly, *nobody even knows which statements are true* (yet). Consider a statement like the following:

The real part of every non-trivial zero of the Riemann zeta function is $\frac{1}{2}$.[1]

Nobody knows whether this is true or not, but since the 19th century various people (some serious, some complete cranks) have claimed that it is true, and some day somebody will probably definitively resolve the question of whether it is true or false. So the question is: what would such a resolution look like? In other words, if you want to convince the world that (say) the statement is true, how would you go about it?

In short: give a proof. In mathematics, a proof is a rigorous justification of a statement. "Rigorous" and "justification" are, in the end, just words that convey a certain meaning and aren't really formally justified, but there are conventions in the mathematical community about what constitutes a valid proof that (eventually, usually) lead to a consensus about which statements are true and which are false.

The goal of this class is to start learning those conventions and to develop your skills in giving convincing mathematical arguments (a.k.a., proofs). In other words, the goal is to learn how to write (and, more generally, communicate) mathematics.

[1] This statement is known as the *Riemann hypothesis*, and is almost certainly the most famous unsolved problem in mathematics. To make sense of the statement, one needs to know what the Riemann zeta function is and what makes a zero trivial: look it up if you're interested!

Assignments

It is impossible to *learn* mathematics without actually *doing* mathematics, and this goes doubly so for learning how to *write* mathematics. The importance of effective communication is vital: knowledge without the ability to communicate that knowledge is of limited value.

Reading Assignments

You will be assigned to read a section from the text before almost every class; links to related videos will also be provided. Although it is impossible (at least absent some pretty intrusive surveillance) to check whether you are doing this reading, you will also be expected to do a short online reading comprehension quiz on Canvas for each reading assignment. This quiz will not be graded for correctness, only for whether you made an honest attempt at each problem.

Homework

There will be weekly homework assignments which will be handed in on Thursdays in class or submitted through Canvas.

Extensions will rarely if ever be granted.

Exams

There are two midterm exams and a final. The midterms are in-class exams on **September 27** and **November 1**, and the final is **December 12**, from 6:20–8:20PM.

You may not use any electronic aids (calculators, phones, etc.) or books on the exams. One handwritten sheet of notes is fine.

Attendance

You are expected to attend class every day, to participate in class, to read the textbook, and to do the homework.

Grading

Your final grade in the course will be determined by:

Reading quizzes and class participation: 10%
Homework: 30%
Midterms: 15% each
Final Exam: 30%

Here's how the grading process works. First, I compute an overall course grade for you on a scale of 0–100 by combining your various scores using the weights above. Then, I rank everybody in the class in order by their score and assign cutoffs for 'A', 'B', 'C', and 'D'. Generally these are somewhat lower than the traditional 90, 80, 70, and 60. When setting the cutoff I consider the students immediately above and below the line and try to take into account improvement and other circumstances. That being said, the list is never, ever reordered. Regardless of other circumstances,

a better score in the class should always earn at least as good a letter grade. Ultimately, I can only grade the course based on what you have actually done.

Policies

The Department of Mathematics has a set of policies which cover topics ranging from cell phones to alternate exams. These are available at

`http://www.math.colostate.edu/programs/undergraduate/policies.shtml`

and it is your responsibility to read them.

Some particular issues of interest:

Academic honesty

Colorado State University has an Academic Integrity Policy and Student Conduct Code; you can read about this policy at `http://policylibrary.colostate.edu/policy.aspx?id=442`, and find related materials at `https://tilt.colostate.edu/integrity/`. This will be enforced in Math 161. Briefly, while you are encouraged to seek out help, including from your peers, for labs and homework assignments, all work on any quiz or exam must be your own.

Students judged to have engaged in cheating on a particular quiz or exam will receive a score of 0 for that particular quiz or exam. Also, for the student who received a 0 on a quiz or exam due to cheating, Repeat/Delete will not be an option for the grade earned the semester cheating occurred. A second offense will result in an F for the course. Cases of flagrant academic dishonesty will be brought to the attention of the TILT Academic Integrity Program.

RDS

Colorado State University is committed to providing reasonable accommodations for all individuals with disabilities; Resources for Disabled Students (`http://rds.colostate.edu`) coordinates the necessary support systems.

If you need accommodation, especially for exams, it is up to you to work with RDS to make suitable arrangements; the sooner you do this, the better. In particular, you can schedule an exam with them at `http://rds.colostate.edu/schedule-an-exam`

Make-up exams

Make-ups for exams will be given only in the cases of university-approved absence and documentable emergencies. All excuses must include adequate documentation. Please inform me about any such absences as soon as possible.

Additional help

If I were a perfect teacher, you could learn everything you need to know just by going to class and doing the assignments. Unfortunately, I am not a perfect teacher, so there's a good chance that, at some point, you'll find yourself confused, stuck or otherwise frustrated by the material or the course. If you do, ask for help! Come to office hours, send me email, ask me questions after class.

Also, your fellow classmates are a great resource! Odds are that, for any question you have, there's someone in the class who can answer it, so don't be afraid to ask. Even the simple process of explaining why you're stuck to someone who is just as confused as you is often enough to make things clearer. Just be sure to return the favor when you get the chance to help someone else.

If you need additional help or outside resources, please ask and I will be happy to try to give suggestions.

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Disclaimer

The course syllabus is a general plan for the course; deviations announced in class may be necessary.