MATH 113: DISCRETE STRUCTURES

SPRING 2019

Place:	Chem 301
Time:	MWF, 1:10-2:00P.M.
Instructor:	Kyle Ormsby (ormsbyk@reed.edu)
Office Hours:	Library 306, MWF 2:00-3:30P.M.
Problem Sessions:	Eliot 314, MTh 7:30-8:30P.M.
Textbook:	*Discrete Mathematics: Elementary and Beyond*
Website:	people.reed.edu/~ormsbyk/113/

Summary. This course is a rigorous, problem-centered exploration of the mathematics of discrete structures focusing on the following subjects:

» *Combinatorics* tells us why there are 40,320 ways to place eight non-attacking rooks on an 8×8 chessboard. We will learn how to count permutations, combinations, derangements, and other collections, develop the language of sets and functions, and utilize basic proof techniques like the pigeon hole principle and mathematical induction. We will touch on graph theory as well.
» *Probability* tells us why it's likely that two of us share the same birthday. We will study conditional probability, Bayes' Theorem, and expected values.
» *Number theory* tells us why we shouldn't try to solve the equation $a^3+b^3=c^3$ with nonzero integers. Topics include divisibility, prime numbers, the Fundamental Theorem of Arithmetic, modular arithmetic, and Fermat's Little Theorem.

You should leave the course with a firm understanding of these topics that you can apply in mathematics, science, technology, and other contexts. You should also gain experience in collaborative problem-solving and the communication of mathematics (verbal and written).

Course design. Nearly all of our meetings will break down into three components:

» *Reading*. Every class will have an assigned reading which you must complete and engage with before we meet. By noon before the class period covering a given reading assignment, you will complete a Moodle quiz covering the reading material. You are also encouraged to submit questions on the text or requests for review of a topic (accompanied by an explanation of what you find confusing).
» *Active class sessions*. Our 50-minute meetings will include mini-lectures delivered by the instructor and group work with your peers. The mini-lectures will delve deeper into reading topics and attempt to answer your questions. The group work will allow you to interact with and truly understand the material through problem-solving. There will be many opportunities for presenting solutions and proofs to your peers.
» *Homework*. I will assign two or three harder homework problems for you to complete after class. These are due two class periods later (along with your reading responses for the upcoming meeting).

Date: 28.I.19.

The purpose of this structure is to scaffold your learning so that you will first engage with easy problems based on your reading, then bolster skills through mini-lectures and collaborative problem-solving, and finally gain mastery over content by engaging with homework problems.

Here's an example of how the course design will play out in practice: Suppose that it's Friday of the second week of classes. By noon before class, you'll complete the Moodle quiz reading questions related to that day's content. At the start of class, you will turn in the homework problems related to the content delivered on Monday of the second week of classes. We will then spend the class period engaged in mini-lectures and group work related to the reading assignment. You will leave that class prepared to work on the homework problems which are due Wednesday of the third week. If you have difficulty with the homework problems or any of the course material, you could attend office hours on Monday of the third week between 2:00 and 3:30P.M.[1]

Texts. The course will use *Discrete Structures: Elementary and Beyond* as its primary text. Copies are available in the campus bookstore, and will additionally be on reserve in the library. I will also assign and supply a number of supplementary readings.

Reading assignments. The required reading is essential to the course and provides a leaping off point for each of our class meetings. The reading questions are intended to ensure that you are following the text at an appropriate level; they should not be particularly hard, though some will be nontrivial. They will be delivered in the form of Moodle quizzes (linked to from the course website), and are due by noon on the day of the reading assignment. (This will allow me to review the class's comprehension of the material before we meet at 1:10P.M.) Reading questions will be assessed primarily on the basis of completion.

Homework. Homework is due at the start of (nearly) every class meeting, based on the content covered two meetings prior. Excellent solutions take many forms, but they all have the following characteristics:

- » they are written as explanations for other students in the course; in particular, they fully explain all of their reasoning and do not assume that the reader will fill in details;
- » when graphical reasoning is called for, they include large, carefully drawn and labeled diagrams;
- » they are neatly written or typeset;[2] and
- » they use complete sentences, even when formulas or symbols are involved.

Each homework problem can earn up to five points for mathematical content; each problem will also have the quality of writing assessed with a ✓+, ✓, or ✓−. Late assignments *will not be accepted* except in extreme circumstances.

Collaboration. You are permitted and encouraged to work with your peers on homework problems. You must cite those with whom you worked, and you must write up solutions independently. **Duplicated solutions will not be accepted and constitute a violation of the Honor Principle.**

[1] You could also work on the problems with peers (see the Collaboration section), attend the problem session or drop-in tutoring (see the Help section), or ask a question via email or our Slack channel (see the Slack section).

[2] Interested students are encouraged to prepare solutions in the LaTeX document preparation system. A guide to LaTeX resources is available on the course website. Nearly all of the `.pdf` files on the course website are produced by LaTeX; you can find their associated source files by changing the `.pdf` suffix to `.tex` in the file's URL.

Revisions. You may revise any homework problem after receiving comments, and you will sometimes be encouraged to revise problems. This will allow you the opportunity to perfect the skills required to solve the problems. You may revise multiple times, and will receive the average of all of your scores. Revisions must be turned in at most one week after you receive comments on the previous version of a solution. There are no revisions of answers to reading questions.

Revisions should be turned in at the start of class, stapled to the original assignment.

Tests. We will have one in-class exam, one timed take-home exam, and a final exam. You may reference one two-sided US Letter or A4-size page of notes during each exam. Calculators, computers, phones, collaboration, books, and the Internet are prohibited during exams.

» Exam 1: in-class, Monday, 18 February
» Exam 2: take-home, two hours, distributed Monday, 1 April, due Friday, 5 April
» Final Exam: three hours, as scheduled by the registrar

Joint expectations. As members of a communal learning environment, we should all expect consideration, fairness, patience, and curiosity from each other. Our aim is to all learn more through cooperation and genuine listening and sharing, not to compete or show off. I expect diligence and academic and intellectual honesty from each of you. You should expect that I will do my best to focus the course on interesting, pertinent topics, and that I will provide feedback and guidance which will help you excel as a student.

Help. There are a number of resources you can access for help with this course's content. Everyone is welcome and encouraged to attend my office hours, Monday, Wednesday, and Friday 1:30–2:30P.M. in Library 306. If you are unable to make these times, I am happy to schedule alternate times at which to meet with you.

Additionally, all three sections of Math 113 have a joint problem session Monday and Thursday evenings, 7:30–8:30P.M. in Eliot 314, run by our course assistant Aryeh Stahl. The problem sessions will provide a structured, facilitated environment in which you can collaborate on homework. Location will be announced shortly and posted on the course website.

The math department also hosts drop-in tutoring in Library 204 Sunday, Tuesday, Wednesday, and Thursday 7–9P.M. Upperclass tutors will be available to clarify concepts and help you with homework problems.

Finally, every Reed student is entitled to one hour of free individual tutoring per week. Use the tutoring app in IRIS to arrange to work with a student tutor.

Slack. Our section of Math 113 has a Slack channel on which you can ask and answer questions. Sign up at this link. You may discuss homework problems on Slack, but should not give away an answer. The Slack channel is an extension of our classroom and Reed, and the Honor Principle and our joint expectations govern our conversations there.

Technology. The use of electronic devices (cell phones, computers, tablets, calculators, *&c*) is strictly prohibited in the classroom without prior authorization from the instructor. That said, legitimate uses of technology (*e.g.*, note-taking) will be accommodated — just talk to me first.

The Internet. You are welcome to use Internet resources to supplement content we cover in this course, with the exception of solutions to homework problems. **Copying solutions from the Internet is an Honor Principle violation and will result in an academic misconduct report.**

Academic accommodations. If you have a documented disability requiring academic accommodation, please have Disability Support Services (DSS) provide a letter during the first week of classes. I will then contact you to schedule a meeting during which we can discuss your accommodations. If you believe you have an undocumented disability and that accommodations would ensure equal access to your Reed education, I would be happy to help you contact DSS.

Grades. Your grade will reflect a composite assessment of the work you produce for the class, weighted in the following fashion: 40% homework and reading questions, 25% final exam, 20% exam 2, 10% exam 1, 5% class participation.

Remember: *Math is hard, but we're going to get through this together!*