COMS 3203 - Discrete Math, Fall 2026.

Lecture 001: MW 4:10 - 5:25pm, Pupin 301
Lecture 002: MW 11:40 - 12:55pm, Math 417
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What is (discrete) math for? There are two aspects:

1. **Precise communication**. Mathematics gives us the language to speak precisely about how we define intuitive ideas. We use words like "infinite," "probably," "prove," and "contradictory" all the time, but what do they actually mean? This extends beyond purely mathematical words, too: math gives us the tools to think about what we mean when we talk about things like "efficiency," "fairness," "privacy," and other useful notions for doing CS.
2. **Problem-solving**. Math gives us the tools to find out facts about those precise definitions.

These two themes are closely intertwined with each other. When trying to precisely describe what we mean, we often find new insights; similarly, when trying to solve a problem, we often realize our definitions aren't sufficiently precise.

These closely correspond to the two objectives of this course:

1. (Math for precise communication). We will learn the language that math uses to describe the world (logic, sets, functions, relations) and particular subfields (graph theory, number theory, probability, combinatorics). This aspect is like a language class: we'll learn "conversational mathematics."
2. (Math for discovering truths via problem-solving). We will learn to do proofs: formal arguments that certain statements are true or false. Figuring out how to prove a given statement can be like a maze (or an escape room): fitting together different definitions, using different tools, and trying different strategies to arrive at our destination. We will learn many such definitions and strategies, but you will also be equipped to come up with new definitions, tools, and strategies on your own.

Learning Objectives
By the end of the course,

1. You will be able to use mathematical language to precisely communicate concepts, statements, and arguments via definitions, theorems, and proofs.
2. You will develop a toolkit of foundational definitions and techniques in graph theory, combinatorics, countability, probability, and number theory.
3. You will be able to prove mathematical statements in a variety of domains.

Grading

- Two midterms, 20% each
- Final exam: 35%

- Homeworks: 25%
- Recitations: 4% extra credit

Recitations
Recitations are optional, but strongly (strongly!) recommended. Attendance at recitation will be worth up to 4% extra credit on your final grade (attending all recitations = 4%, attending half = 2%, etc.). (The idea is that attending all recitations should bump you from C to a C+, a B+ to an A-, etc.) Recitation sections are all on Fridays; see the course website for specific times.

Please register for a recitation section using the “groups” functionality on Courseworks.

Exams
We will have 2 midterms and a final, all in-person. Midterm 1 will be on October 12, and Midterm 2 will be on November 11. The midterms are worth 20% each, and the final is worth 35%.

Problem sets, collaboration
Homework (problem sets) will be weekly, and worth a total of 25% of your grade. Your two lowest homeworks will be dropped. Homeworks will be due on Fridays at 11:59pm on Gradescope. Homeworks must be handwritten.

We will generally release assignment solutions 12 hours after a deadline, at which point no further submissions will be accepted. You may submit an assignment during this grace period only if an unforeseen event arises preventing you from submitting it by the original deadline.

You are welcome to work on homework problems in study groups of two to four people; however, you must always write up the solutions on your own. Please indicate your collaborators on the first page of your homework.

I believe that you can tell between helping or hindering your peers' learning. Remember that most of the grade comes from exams, and the homeworks are designed such that learning through the homework is the best way to prepare for the exams. Giving your peers homework solutions may be setting them up for failure.

AI
LLMs are fully able to do every homework problem we will have in this class. If you use AI to do the problem sets, we will *not* be able to detect it when grading, but <u>you will do very poorly on the exams</u>, which are a majority of the grade. With LLMs, it is *very easy* to mislead yourself into thinking you understand the content when you do not, and it is hard to recover from this down the line.

Feedback

We will periodically include feedback forms as (free) points on the homework. Please give honest feedback! If something is going poorly for you, it is probably also going poorly for many

others, and we want to be able to address it as well as we can. These forms will be anonymous, but if you have feedback you want to give directly please email Gabriel or a TA, or come to OH.

Materials
Most course materials will be posted to the course website. Homeworks will be submitted on Gradescope. Lecture recordings will be posted to Courseworks.

We will not have an official textbook, but if you want one I recommend these:

- An Infinite Descent into Pure Mathematics, Clive Newstead (free: https://infinitedescent.org/)
- *Mathematics: A Discrete Introduction*, Edward R. Scheinerman
- *Discrete Mathematics and its Applications*, Kenneth H. Rosen

I will post the corresponding chapters of each of these books alongside the lectures, so you have reference(s) if you want to read ahead or review.

Communication
Please use the EdStem for all course-related questions (homework, exams, logistics, etc.). Nearly all questions should be public so that everyone can learn from them. Students are encouraged to respond to other students' questions! We will verify all student comments and answers, so there is no need to be afraid of giving wrong or misleading answers.

Tentative calendar
See the course website for updates.

We	1	9/9/2026	Introduction; proof techniques	Intro; quantifiers, logical connectives.
Mo	2	9/14/2026		Logic, proofs
We	3	9/16/2026		Proof types. sequences. induction.
Mo	4	9/21/2026		Induction, strong induction
We	5	9/23/2026	Sets and functions	Sets, double containment
Mo	6	9/28/2026		Functions
We	7	9/30/2026		Functions, inverses, injectivity/surjectivity/bijectivity
Mo	8	10/5/2026		Relations. equivalence, partial orders.
We	9	10/7/2026	Midterm 1	MIDTERM 1 REVIEW
Mo	10	10/12/2026		MIDTERM 1
We	11	10/14/2026	Graph theory	Graph theory 1
Mo	12	10/19/2026		Graph theory 2
We	13	10/21/2026	Countability, combinatorics	Combinatorics 1
Mo	14	10/26/2026		Combinatorics 2
We	15	10/28/2026		Counting in two ways; combinatorics 3
Mo		11/2/2026		ELECTION DAY

We	16	11/4/2026		Countability, finiteness
Mo	17	11/9/2026	Midterm 2	MIDTERM 2 REVIEW
We	18	11/11/2026		MIDTERM 2
Mo	19	11/16/2026	Probability	Probability
We	20	11/18/2026		Events, Bayes theorem, binomials
Mo	21	11/23/2026		Random variables, expectation
We		11/25/2026		THANKSGIVING BREAK
Mo	22	11/30/2026	Number theory	Division, GCD
We	23	12/2/2026		Primes, modular arithmetic
Mo	24	12/7/2026		Euler's and FLT
We	25	12/9/2026		Means and inequalities
Mo	26	12/14/2026		FINAL EXAM REVIEW