Course Intro

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CS 0220 2023

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Overview

Who we are

- Instructor: Robert Lewis (call me Rob!)
- HTAs: Josh Benzon, Ben Goff, Tyler Gurth, Jania Vandevoorde
- STAs: Christian Armstrong, Carmen Yu
- UTAs: 26 friendly faces :)

Our Website: Plants!

- Class goals.
- Course outline.
- Meet the UTAs!
- Collaboration policy.
- Assignments, dates and deadlines.
  - Homework released Thursdays, due following Wednesday at 11:59pm
  - Midterm: March 17
  - Final: May 12
- Attendance policy.
  - Lectures encouraged, not required. Recitations required.
- Recitations.
- TA hours.

Recitations

- Lectures for the "what" and the "why"; recitations for the "how".
- Required, in person or virtual: you'll sign up for a particular section.
  - One "makeup" section, in case of illness/quarantine/...
- The first one (during shopping period): go to any section.
- Afterward, we'll ask you to sign up for a particular section, to help us load balance.

Other sites

Details, links on main site!

- EdStem: Best way to get quick answers. Key announcements there, too.
- Gradescope: Handins, homework grading.
- Overleaf (optional): LaTeX without installation.

Class goals

CS can feel like a very applied field. Why learn math?

- Problem solving
- Communication
- Collaboration

A key result of this class: you'll have a *vocabulary* for discussing certain kinds of problems that appear in many different contexts, and a toolbox of general approaches for solving them.

A vital point of computer science (academic, industry, hobbyist): *communication*.

Proof assistants

A big experiment this semester: we're going to use a proof assistant called Lean at various points, for class demos and some homework assignments.

This has never been done (AFAIK) in a discrete math course.

Upsides:

- Get instant and interactive feedback on proofs.
- Learn a bit about a kind of tool that's growing in popularity.
- Pilot a new way of learning discrete math!

Downsides:

- ?

Our expectations from you

- No mathematical background is assumed. We're not doing calculus, statistics, ...
- Approach things with an open mind.
- Try to communicate clearly and concisely.
- Respect your classmates and TAs: we're in this together.

- Let us know how you're doing!

Ethics in Discrete Math

- Two STAs this semester. Why?
- Math often seen as a “neutral” or “pure.” It’s more complicated than that.
- Math becomes relevant when it is applied to the real world. Doing so **always** requires simplifications.
- Issues arise via: (1) flawed assumptions when bridging between theory and reality, (2) ethical flaws in understanding the “end-goal” application, and more.
- Keep uses in mind. The largest employer of mathematicians in the US is the NSA, which has clear ethical implications.
- We’ll be asking you to consider potential ethical implications of the topics we cover and the importance of considering issues in advance.

Odd times odd

- Poll. How approach a problem like this one?
- Check a few cases to see if you believe it.
  $3 \times 5 = 15$, $7 \times 3 = 21$. One times anything is the same, so, if it was odd, it stays odd. So far so good.
- Go to definitions. What does odd actually mean, mathematically? A number is *odd* if it can be written $2k + 1$ for an integer k.
- Use definitions to express the problem.
  We have two odd numbers: $2k_1 + 1$, $2k_2 + 1$.
  What can we say about their product?

$$\begin{aligned}(2k_1 + 1)(2k_2 + 1) &= 4k_1k_2 + 2k_1 + 2k_2 + 1 \\ &= 2(2k_1k_2 + k_1 + k_2) + 1 \\ &= 2k_3 + 1,\end{aligned}$$

Since $k_3 = 2k_1k_2 + k_1 + k_2$ is an integer, the product is odd.

Bad “proof”

Each step must be done carefully to avoid going off the rails.

Pick any y and let $x = 2y$	x	$=$	$2y$
Multiply by $-x$	$-x^2$	$=$	$-2xy$
Add $2x^2$	x^2	$=$	$2x^2 - 2xy$
Subtract $2xy$	$x^2 - 2xy$	$=$	$2x^2 - 4xy$
Factor	$x(x - 2y)$	$=$	$2x(x - 2y)$
Cancel common terms	1	$=$	2

Conclusion: Math is over. If we can conclude $1 = 2$, we can conclude *anything*.