

Syllabus for Math/CCS 103

*Weeks 1-10**UCSB 2014*

Basic Course Information

- Professor: Padraic Bartlett.
- Email: padraic@math.ucsb.edu.
- Class time/location: MWF 11-12:20, Building 494, Room 160B.
- Office hours/location: MTThF, 1-2pm, South Hall 6516. These OH are shared with other classes, but there should be a lot less people in them than in the previous quarter (yay not teaching 4 classes and 140 students.)
- Course webpage: http://math.ucsb.edu/~padraic/mathcs103_s2014/mathcs103_s2014.html.

Course Description

Last quarter, we basically did everything in discrete mathematics you can do with Latin squares. This quarter, we're going to try to do everything you can do in discrete mathematics that's left over! There's a lot of topics that I want to get to. Here's a sampling of what we'll try to discuss:

- Enumerative combinatorics.
- The probabilistic method in combinatorics.
- Graph theory. (More!)
- Generating functions.
- Set theory.
- Random walks.
- Fair division algorithms.
- Algorithms.
- P versus NP.
- Cellular automata.
- Algebraic topology.
- Euler characteristic.
- Ramsey theory.
- The art gallery theorem.
- Quadratic residues.
- Inclusion-exclusion.
- Stirling's approximation.
- Electrical networks.
- Combinatorial games.
- Surreal numbers.
- Voting theory.
- Paradoxes in probability.

You may have noticed that this is way too much for a quarter. Which is where the second different thing that we're doing this quarter comes in: you're going to choose some of these topics! In particular, you're going to find a small piece of mathematics, either from the above list or from some other area of mathematics that you like — literally anything that's new to your classmates — and you're going to **lecture on it**.

In particular: **twice** during this quarter, you're going to sign up for a 20-minute time slot on either Wednesday or Friday, and you're going to give a talk to the class on something mathematically interesting. Here's the timeline for how this works:

- **On the first day of class:** you sign up for two slots throughout the quarter to give a talk in. At least one slot must come before the start of week 8.
- **Three weeks before you're scheduled to talk:** you meet with me. We come up with a topic for you to talk about.
- **A week before you talk:** you send me the lecture notes for your talk. These should look like the minilecture notes I posted last quarter, and should be presentable enough to be placed on the internet, because that's where they're going (so your classmates can read your notes!) I will send you feedback on the lecture notes, tell you if there's way too much material there for the time you have, etc.
- **A week before you talk:** you also send me a homework problem for that day's HW set! If it's too easy/hard I'll send it back to you.
- **The day of your talk:** you talk! Your talk will be evaluated for both the skill of the presentation (i.e. is the presentation easy to follow, do you present things clearly, etc.) and the mathematics in the presentation (was your math correct, was it nontrivial, etc.) Your grade here is determined by both my evaluation and the evaluation of your peers! Peer evaluations will be done via some sort of paper-slip method.

Course Evaluation

There are three components of your grade in Math/CS 103:

1. **Homework** (50%.) As noted before, there will be daily problem sets, collected and turned in on the Friday of each week. Problem sets need to be written in L^AT_EX to be graded.

I wasn't happy with how the regrade policy worked out last quarter: a lot of people used it as a "hand in HW a week (or much more than a week) late." This was a nightmare for me to grade at the end of the quarter, and I think actively hurt students who abused this policy, because they fell behind in the class and never caught up. So: this quarter, this policy is gone. HW is due at the start of class on Fridays; late HW gets -5% for each day it's late by. Also, no more emailing of HW, because that was a pain for me to deal with (tons of emails, unopenable attachments, lots of printing, HW's with no name on them, etc.)

2. **Presentations** (25%). As described above: you are responsible for creating two presentations to give to your classmates on a subject in mathematics! Each presentation will be graded on its mathematical content and style; you will need to explain something interesting, and do it well. Grades will be determined by both my evaluation and an evaluation by your peers.
3. **Quizzes** (25%.) There will be weekly brief quizzes on Mondays at the start of class.

This course is pass-fail and for five units. Students will receive the full five units for work at or above the B- line; four of five units for work in the C range; and less units for lower marks. Don't get lower marks.

Collaboration/resources policy

Collaboration is allowed (and indeed encouraged) on the homework sets; mathematics at the research level is a collaborative activity, and there is no reason that it should not also be this way in a classroom. Work with your classmates!

Similarly, mathematics **is** a research activity; I would claim that banning resources like textbooks, Wikipedia, Mathematica, etc. is something of a fool's errand, and contradictory to the spirit in which we pursue research as researchers ourselves.

The only things that we ask of you are the following:

- Write up your work separately, and only write up solutions you understand fully.
- When writing up your own work, you can directly cite and use without proof anything proven in class or in the class notes posted online. Anything else — i.e. results from textbooks, results that you find on mathexchange / Wikipedia, etc. — you need to both (1) cite in your writeup, and (2) reprove the results you're using from those sources carefully in your own words. Simply copying solutions over directly is plagiarism / cheating / otherwise poor academic form; it is passing off as your own work the ideas of others. You are certainly welcome to read and learn what other people have attempted! All I am asking you to do here is to (1) not pass it off as your own work, and (2) rephrase and present it in a new way so that it is clear that you have actually learned something.
- If you work with other students on a problem, it is considered good form to refer to them (i.e. "I worked with Andrew Wiles on this proof of Fermat's Last Theorem") when writing up your solutions. I mostly ask this because crediting collaborators is something you're going to do as mathematicians, and should get in the habit of.
- Don't post questions to online messageboard-style services.

If you have any questions on the collaboration policy, please email me and I'll be glad to clarify matters.

Course Textbook

There is no primary textbook for this course. I will post notes on the course website.