Mathcamp Schedule for Friday, July 14th

Schedule changes for Friday

Time	Room	Friday
8:00–9:00	IDX Dining Hall	Breakfast
9:10–10:00	CCM 442	Infinite Ramsey theory 🍐🍐🍐 (Susan)
	Ireland 114	Representation theory of the symmetric groups 🍐🍐🍐🍐 (Raj)
	JLC 301	[**HR**] Epsilons and deltas 🍐🍐 (Ben & Charlotte)
	JLC 302	Beyond inclusion/exclusion 🍐🍐🍐 (*John Mackey*)
	JLC 305	What are your numbers worth? 🍐 (Eric)
10:10–11:00	CCM 233	Introduction to model theory 🍐🍐🍐 (Krishan)
	CCM 442	Introduction to cryptography 🍐🍐 (Ian)
	Ireland 114	Mechanics of fluid flow 🍐🍐🍐 (Neeraja)
	JLC 301	Polygons, friezes, and snakes — oh my! 🍐 (Kayla)
	JLC 305	[**HR**] Problem solving: triangle geometry 🍐🍐🍐 (*Zach Abel*)
11:10–12:00	CCM 442	Gödel's incompleteness theorems 🍐🍐🍐 (Steve)
	CCM 233	Introduction to ring theory 🍐🍐 (Kevin)
	Ireland 114	What actually are the real numbers, anyway? 🍐🍐 (*Dan Zaharopol*)
	JLC 301	Elliptic curves 🍐🍐🍐 (*Ruthi Hortsch*)
	JLC 302	The Wythoff array 🍐🍐 (Della)
	JLC 305	When will this end??? 🍐🍐 (Arya)
12:00–1:00	IDX Dining Hall	Lunch
1:10–2:00	CCM 442	Polytopes (Week 1 of 2) 🍐🍐🍐 (Susan)
	CCM 444	First, choose randomly 🍐🍐🍐 (Travis)
	JLC 301	Randomized vs. deterministic computation 🍐🍐🍐 (Tanya)
	JLC 302	Packing permutation patterns 🍐🍐🍐 (Misha)
	JLC 305	Introduction to graph theory 🍐🍐 (Tim!)
2:00–4:00	EATS	TAU
4:10–5:00	JLC 30*x*	Project selection fair (Staff)
5:30–7:00	IDX Dining Hall	Dinner

Surprise extra class at 11:10

What actually are the real numbers, anyway?
(🍐🍐, *Dan Zaharopol*, Friday only)

Have you ever thought about just how weird the real numbers are? Naturals, integers, rationals… all countable. Hit the reals, and WHAM, uncountable. The rationals feel like they should be a nice little line, but you could waggle your infinitely-thin finger right through the "hole" at $\sqrt{2}$. Somehow the reals spackle that hole right up, but to do it they have to break the barrier from countable to uncountable?!? And don't even get me started on how you don't just have the rationals (countable), and algebraic numbers (zeros of integer polynomials—also countable), but also the transcendental numbers (uncountable, and so weird that we don't even know if $e + \pi$ is transcendental although we know that both e and π are)!

But ask someone to tell you what the real numbers *are*, and they're like, "eh, whatever, just take all infinite decimals or something."

Nonono, we should build them. There are actually lots of (equivalent) ways to build them, but Dedekind cuts are one of the simplest ways to plug all those holes in $\mathbb{Q}$. We'll see how to do it, and then go back to elementary school as we define addition, subtraction, multiplication and division of real numbers!

Homework: Recommended

Class format: Interactive lecture

Prerequisites: None, except a good basis in arguments about countability is helpful

Note: the S. D. Ireland Global Business Center (or "Ireland") is a building adjacent to Rosendaal Courtyard (the area outside EATS). You can also get there by a walkway from the 4th floor of CCM.

Project selection fair locations

In JLC 301

Allison	Flow Free
Allison and Gloria	Make something!
Ben	Classical cryptanalysis
Ben	Throwing stuff and catching it
Ben and Steve	Abstract functional analysis reading project
Ian	Mathcamp Sudoku Project (MCSP)
Steve	Logic reading: nonclassical propositional logics
Steve	Multiplayer combinatorial games
Tanya	Mathematical literature or literary mathematics
Tanya	Mathematics and its impact on society

In JLC 302

Ania and Mia	Plan a math circle session
Della	Build a Turing machine in Minecraft
Della	Read a paper about gadgets
Della	Solve open problems about gadgets
Mia	Create your own adventure… pictorially!
Misha	Drawing toroidal maps
Misha	Master countless short papers
Misha	Soma Cube origami
Travis	Reimagining school
Travis	Write a fairy tale

In JLC 304

Arya	Brethren of traveling pants
Arya	Hyperbolic hyperbolic geometry
Kayla	Join the Cluster Clan
Kayla	Join the Cluster Clan *extreme addition*
Kevin	Learn German (to read a paper!)
Kevin and Raj	Quantum groups and crystal bases
Kevin and Raj	What is Schubert calculus?
Neeraja	An algorithm for the Borsuk–Ulam theorem
Neejara	Philosophy of math
Neeraja	The Szemerédi–Trotter theorem

In JLC 305

Charlotte and Narmada	Crossover episode
Eric	Combinatorial music
Eric	Advent of code
Eric and Narmada	Math Camp Student Parsely
Eric and Tim!	Learn change ringing
Krishan	Theorem proving in Lean
Narmada	Become ambidextrous
Tim!	Evasiveness & Qualifying Quiz 2022 problem 6
Tim!	Make a math video
Tim!	Mathematical engineering with Arduino

Talk to any staff about project ideas of your own! If we can't help you, we'll guide you toward someone who can.