Lightning talk @ Computational Aspects of Buildings

Shivam Arora

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Background

- 
- BSc: University of Delhi, India
- MS: Indian Institute of Science Education and Research, Mohali, India
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- Currently: Second year Ph.D. student at Memorial University of Newfoundland, St. John's, Canada

Mathematics

MS

- Thesis: z-Classes in p-groups.
- (with K. Gongopadhyay) z-Classes in finite groups of conjugate type (n,1). Proc Math Sci (2018) 128: 31
- z-Classes: Equivalence relation on Group, eqv if the centralizers are conjugate. Interesting relation with 'dynamical types' in groups of isometries. R. Kulkarni J. Ramanujan Math. Soc. 22 (2007), no.1.

Current

- Problem: Are subgroups of Hyperbolic groups Hyperbolic?
- Gersten: Let G be a hyperbolic group such that $cd_{\mathbb{Z}}(G) = 2$. If H is a finitely presented subgroup, then H is hyperbolic. J. London Math. Soc. (2) 54
- (with E.M. Pedroza) Let G be a hyperbolic group such that $cd_{\mathbb{Q}}(G) = 2$. If H is a finitely presented subgroup, then H is hyperbolic. arXiv:1811.09220
- Application: Hyperbolic groups with torsion, Bestvina-Mess example
- Similar results for tdlc hyperbolic group, isoperimetric characterization etc. (In preparation, with I. Castellano , E.M. Pedroza)

Daniel Belin

- Undergraduate mathematics major (4th-year) at the University of Wisconsin - Madison
- Primary interests:
  - Formal and computational approaches to mathematics (theorem provers, automated reasoning, etc.)
  - Mathematical logic (reverse mathematics, proof and recursion theory, categorical logic)
  - Philosophy of mathematics (proof, Hilbert's 24th problem, mathematical practice, heuristic)
- A software developer and data analyst in previous life, with experience in computational linguistics

Place your trust in proof checkers!

We have long realized a formal method of proof due to Hilbert, Gentzen, and others (sequent calculus, natural deduction). This method allows us to formalize proofs of propositions from premises in a variety of logical systems.

Theorem (Curry-Howard Correspondence)

Derivations in a natural deduction system are equivalent to constructions in a typed lambda calculus (e.g., System F, CoC)

Key Point: Constructing objects (types) in a proof verification language relies on properties of the programming language (e.g., valid programs only interpret if types match correctly). Viewing propositions as types allows us to now prove statements in propositional logic (by essentially type-checking definitions)
Key Point 2: We can build up and formalize mathematics using a recursive hierarchy of types.

References

Theorem Proving in Lean:
`https://leanprover.github.io/theorem_proving_in_lean/`
The Mechanization of Mathematics (Avigad):
`http://www.andrew.cmu.edu/user/avigad/Talks/mechanization_talk.pdf`

- Thierry Coquand and Gérard Huet, *The calculus of constructions*, Information and Computation **76** (1988), no. 2, 95 – 120.
- William A. Howard, *The formulae-as-types notion of construction*, 1969.
- P. Martin-Löf, *Constructive mathematics and computer programming*, Proc. Of a Discussion Meeting of the Royal Society of London on Mathematical Logic and Programming Languages, 1985, pp. 167–184.

Lightning Talk

Brian Grove

University of Toledo

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Introduction and Research

- I will be a senior math major in the fall.
- I studied recurrence sequences and learned how to generate Fibonacci and Lucas Identites such as $F_{n+3}F_{n+5} = 2F_{n+2}F_{n+4} + 2F_{n+1}F_{n+3} - F_nF_{n+2}$.
- I am interested in Combinatorial Group Theory and Analytic Number Theory.
- The Automorphisms of Free Groups (Senior Thesis).
- Generating Twin Primes with recurrence sequences.

Twin Primes

Euler's Theorem

Every prime $p > 3$ is of the form $6n - 1$ or $6n + 1$, where $n \in \mathbb{N}$.

Prime Tuples

The tuple $(6n - 1, 6n + 1)$ generates sets of twin primes for certain values of n. We can form a sequence a_n of the values of n which gives $(6a_n - 1, 6a_n + 1)$. Hence, $a_n = 1, 2, 3, 5, 7, 10, \ldots$.

Questions

- Can we find a recurrence formula for a_n?
- Can we write tuples to generate primes distance 4 apart, 6 apart, ..., 2n apart?
- Are the formulas for these tuples related?