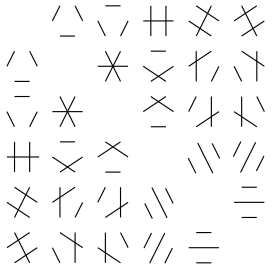
Mathematics Seminar



Rocky Mountain Algebraic Combinatorics Seminar

A high-level language for higher structures

Michael Shulman
San Diego State

Recent decades have seen a growing use of categorical and homotopical ideas in many areas of mathematics. Increasingly, mathematicians are finding a need to collect objects, not only into sets, but into "groupoids" and "homotopy types" that incorporate isomorphisms and automorphisms. However, the prevailing set-based language of mathematics, while adequate for this, is not particularly well-adapted to it, just as assembly language is not particularly well-adapted to techniques such as object-oriented programming and concurrency. Homotopy type theory is a "high-level language" that treats such higher structures natively, making them easier to learn, use, and formalize in a computer. This introductory talk will be an overview of higher groupoidal structures and their representation in homotopy type theory.

Coinductive definitions of infinite higher structures

Michael Shulman
San Diego State

Existing versions of homotopy type theory excel at working with finite structure on homotopy types, but struggle to represent those involving infinitely many types or operations. This is because such structures generally involve infinitely many "coherence" homotopies, but specifying exactly what that means requires another infinite structure, leading to an infinite regress. Coinduction is a technique arising originally from computer science; it is formally dual to mathematical induction, and works naturally on infinite structures just as induction works on finite ones. It is thus natural to attempt a coinductive definition of infinite higher structures in homotopy type theory, but current theories do not support a sufficiently powerful form of coinduction. In this talk I will introduce Displayed Type Theory, which supports a form of coinduction that can be used to define many infinite structures such as semi-simplicial types (a long-standing open problem originally posed by Voevodsky). This is joint work with Astra Kolomatskaia.

Weber 223
4–6 pm, Friday, April 26, 2024
(Refreshments 3:30–4 pm)
Colorado State University
4 pm, Friday, April 26, 2024

This is a joint Denver U / UC Boulder / U of Wyoming / CSU seminar that meets biweekly.
Anyone interested is welcome to join us at a local restaurant for dinner after the talks.

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