MATH 918: TORIC GEOMETRY

SPRING 2025

Description. Toric varieties are a type of algebraic variety, meaning that they are spaces defined by polynomial equations. A variety is "toric" if it has a certain group action, which allows its structure to be described using combinatorics. The geometry of toric varieties can be a particularly nice introduction to the subject of algebraic geometry because we can describe geometric properties concretely and compute many examples.

Class meetings. Tuesdays and Thursdays 11:00–12:15 in Avery 112

Prerequisites. MATH 905: Commutative Algebra I

In particular, you should be familiar with Spec of a commutative ring, localization, normalization, codimension of a prime ideal, polynomial rings, and modules over them. We will also use concepts from algebraic geometry, where prior knowledge could be helpful, but we will develop them slowly alongside MATH 953: Algebraic Geometry.

Textbook. *Toric Varieties* by Cox, Little, and Schenck

Content. I plan to start with roughly Chapters 1–5 of the textbook, likely with adjustments for your experience and interests. We will certainly cover the definition of a toric variety, how to construct one from a fan, the orbit-cone correspondence, and morphisms of toric varieties.

Assignments. There will be biweekly homework assignments worth the majority, if not the totality, of your grade. You are encouraged to collaborate with your classmates.

Structure. I expect to lead a variety of activities during class, including a combination of lectures, worksheets, small group work, and class discussion.

Auditors. You are welcome to participate in some or all of the class without registering. I may prioritize homework grading for people who are receiving credit and/or attending regularly but will look at all assignments I receive as time permits.

Instructor. I prefer that you address me by my first name (Lauren). My office is Avery 333. Please contact me at lheller2@unl.edu with questions, comments, and concerns. I have never taught a grad class before and will happily adjust the plan above as we go!