MATH 648b Tropical Scheme Theory

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Course description: This course will be an introduction to tropical scheme theory. We will explore a way to endow tropical varieties, which are combinatorial objects (polyhedral complexes), with additional structure, analogous to the additional structure that schemes carry in algebraic geometry, when compared with classical algebraic varieties. We will start with basic foundational material such as commutative algebra over idempotent semirings, matroids and valuated matroids, and some classical tropical geometry.

Further topics will include, but are not limited to the construction of tropical schemes from toric embeddings, universal (scheme theoretic) tropicalization, tropical ideals, and various notions of cohomology in the context of tropical varieties and schemes.

Prerequisites: Familiarity with toric varieties, scheme theory and basic tropical geometry will be very helpful.

Meeting time: TTh 1-2:15 PM

Location: LOM 205

Start date: Tuesday, September 5

References

[1] M. Baker and N. Bowler, *Matroids over Hyperfields*, arXiv:1601.01204

[2] A. Bertram and R. Easton, *The Tropical Nullstellensatz for Congruences*, Advances in Mathematics 308 (2017) 36-82

[3] A. Connes and C. Consani, *Homological algebra in characteristic one*, arXiv:1703.02325

[4] J. Giansiracusa and N. Giansiracusa, *Equations of tropical varieties*, Duke Math. J. 165, no. 18 (2016)

[5] J. Giansiracusa and N. Giansiracusa, *The universal tropicalization and the Berkovich analytification*, arXiv:1410.4348

[6] J. Golan, *Semirings and Their Applications*, Kluwer, Dordrecht, 1999

[7] Z. Izhakian and L. Rowen, *Congruences and coordinate semirings of tropical varieties*, Bulletin des Sciences Mathématiques Volume 140, Issue 3 (2016)

[8] D. Joó, K. Mincheva *Prime congruences of idempotent semirings and a Nullstellensatz for tropical polynomials*, to appear in Selecta Mathematica

[9] D. Joó, K. Mincheva *On the dimension of the polynomial and the Laurent polynomial semiring*, arXiv:1510.02493

[10] J. Jun *Čech Cohomology of Semiring Schemes*, arXiv:1503.01389

[11] D. Maclagan and F. Rincón, *Tropical schemes, tropical cycles, and valuated matroids*, arXiv:1401.4654

[12] D. Maclagan and F. Rincón, *Tropical ideals*, arXiv:1609.03838

[13] L. Rowen, *Algebras with negation map*, arXiv:1602.00353