Math 8850 — VRG in Tropical Geometry, Fall 2015–Spring 2016

BASIC
INFORMATION

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Class time and location: Thursdays 2:00–3:15pm (*tentative*), Boyd TBD

Office hours: Tuesdays 4–5:30pm (and by appointment—just email me to schedule!)

COURSE OVERVIEW Tropical geometry is a very recent branch of mathematics, rooted primarily in algebraic geometry but with applications and interactions to a surprisingly broad spectrum of topics. Various threads of its origin started appearing around the 1970s, but a more coherent narrative with standardized terminology only arose in the last decade, and in this time it has grown at a remarkable speed. Fully developed foundations for the subject remain elusive, although various strides in this direction have been proposed, yet nonetheless several striking applications have appeared. Throughout the year during our weekly seminar meetings we will read and present various topics in tropical geometry, based mostly on the references listed below. We will also look for open research problems along the way that we can work on in groups, depending on the interest of the participants.

REFERENCES

- *Introduction to Tropical Geometry*, by Maclagan and Sturmfels, published by AMS in 2015.
  Graduate textbook, emphasizing combinatorial perspective and connection to Gröbner bases.

- "Brief introduction to tropical geometry," by Brugallé, Itenberg, Mikhalkin, and Shaw:
  `http://arxiv.org/abs/1502.05950`
  Introductory survey article leading up to tropical computation of Gromov-Witten invariants.

- "Degeneration of linear series from the tropical point of view and applications," by Baker and Jensen: `http://arxiv.org/abs/1504.05544`
  Survey article on recent tropical proofs of classical results about line bundles on curves.

- "Analytification is the limit of all tropicalizations," by Payne: `arxiv.org/abs/0805.1916`
  Short article relating tropicalization to Berkovich analytification.

- "Equations of tropical varieties," by Giansiracusa[2]: `http://arxiv.org/abs/1308.0042`
  Article introducing scheme-theoretic tropicalization using semiring schemes.

- "The universal tropicalization and the Berkovich analytification," by Giansiracusa[2]:
  `http://arxiv.org/abs/1410.4348`
  Scheme-theoretic perspective on the tropicalization-analytifiction relation.

- "Cech cohomology of semiring schemes," by Jun: `http://arxiv.org/abs/1503.01389`
  Article extending cohomology to semiring schemes, with some simple examples.

- "Matroid theory for algebraic geometers," by Katz: `http://arxiv.org/abs/1409.3503`
  Long survey on tropical linear spaces and a recently solved famous combinatorial conjecture.

- "A tropical approach to the strongly positive Hodge conjecture," by Babaee and Huh:
  `http://arxiv.org/abs/1502.00299`
  Recent breakthrough on the Hodge conjecture via tropical geometry.

- "Berkovich skeleta and birational geometry," by Nicaise: `http://arxiv.org/abs/1409.5229`
  Survey on recent applications of tropicalization/analytification to birational geometry.

- "Product-Mix Auctions and Tropical Geometry," by Tran and Yu:
  `http://arxiv.org/abs/1505.05737`
  Article discussing recent application of tropical geometry to economics.

PREREQUISITES We will aim to keep the assumed background knowledge for this course to a minimum. Since tropical geometry touches upon so many subjects, students with different backgrounds and interests can focus on the topics that best suit them. For instance, those who have taken algebraic geometry already will have plenty of topics explore throughout the year, but those who have not seen algebraic geometry yet can still fully participate by focusing on the combinatorics and polyhedral geometry that underlies much of tropical geometry. Ideally we will form collaborations that bridge different areas, depending on the interest and background of the participants.

SPECIAL ACCOMODATIONS If you have a documented disability or learning disability and need accommodations please contact the Disability Resource Center: `http://www.drc.uga.edu/about/welcomeletter.php`

DISCLAIMER The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary. As a University of Georgia student, you have agreed to abide by the University's academic honesty policy, "A Culture of Honesty," and the Student Honor Code. All academic work must meet the standards described in "A Culture of Honesty" found at:
https://ovpi.uga.edu/academic-honesty/academic-honesty-policy
Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to me.