Mathematics Seminar

Rocky Mountain Algebraic Combinatorics Seminar

Random Knot Diagrams

Jason Cantarella
University of Georgia

A knot diagram is an immersion of a single closed loop into the plane, together with over-under information at the crossings. These are interesting combinatorial objects in their own right, and also have the potential to shed some light on old and tricky questions about random knotting. Enumerating knot diagrams is very close to enumerating a subset of planar 4-valent graphs, and closely related problems have been studied by Schaeffer and Zinn-Justin in the context of 2d quantum loop gravity.

In this talk, I'll talk about results from a purely computational enumeration experiment in which we classified all knot diagrams of 10 and fewer crossings using computing resources from the Amazon EC2 service. Then we'll discuss some conjectures which arose from the experiment, and their proofs by my student Harrison Chapman. The computational part is joint work with Harrison Chapman and Matt Mastin, while the proofs are due to Chapman alone.

Simplicial face numbers via extremal graph theory

Michal Adamaszek
University of Copenhagen

One aspect of topological combinatorics is face enumeration, and one of its main problems is to understand how the topology of a spaces affects the face numbers of its simplicial triangulations. For example, Euler proved that any triangulation of S^2 satisfies $(f_0, f_1, f_2) = (n, 3n-6, 2n-4)$, where f_0, f_1, f_2 are the number of vertices, edges and triangles, respectively. Since then various algebraic and topological tools have been developed to study face numbers of spheres and manifolds.

We are interested in this type of question for the natural class of flag complexes, which are just clique complexes of graphs. The good news is that such a complex is completely determined by its 1-skeleton but the bad news is that clique numbers of graphs are not understood nearly as well as face numbers of arbitrary complexes. The structure of sparsest flag triangulations of spheres (a lower bound type of statement) is mostly conjectural and related to the Charney-Davis conjecture and its γ-vector generalizations by Gal. In this talk I will concentrate on the densest flag triangulations (an upper bound statement) of manifolds. I will introduce a method that allows to determine the flag triangulations with maximal (or close to maximal) face numbers and can be tailored to spheres, (homology) manifolds and some classes of pseudomanifolds. It has two ingredients: first, we use tools from extremal graph theory to get a rough structure of the maximizer, and then we rigidify it using whatever topological properties we have at hand.

Joint work with Jan Hladky (Prague).

Weber 223
4–6 pm
Thursday, June 23, 2016
(Refreshments in Weber 117, 3:30–4 pm)
Colorado State University

This is a joint Denver U / UC Boulder / UC Denver / 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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