Tropicalization of Graph Profiles

The number of homomorphisms from a graph H to a graph G, denoted by $\hom(H;G)$, is the number of maps from $V(H)$ to $V(G)$ that yield a graph homomorphism, i.e., that map every edge of H to an edge of G. Given a fixed collection of finite simple graphs $\{H_1,\dots,H_s\}$, the graph profile is the set of all vectors $(\hom(H_1;G),\dots,\hom(H_s;G))$ as G varies over all graphs. Graph profiles essentially allow us to understand all polynomial inequalities in homomorphism numbers that are valid on all graphs. Profiles can be extremely complicated; for instance the full profile of any triple of connected graphs is not known. To simplify these objects, we introduce their tropicalization which we show is a closed convex cone that still captures interesting combinatorial information. We explicitly compute these tropicalizations for some sets of graphs, and use those results to answer some questions in extremal graph theory. This is joint work with Greg Blekherman, Mohit Singh and Rekha Thomas.

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Discrete Math Seminar

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2-2:50PM CT
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