Efficiency of linear programming using the simplex method via diameter growth in abstract polytopes

Mac Gallagher

The graphs of polytopes are studied in mathematical optimization because of their relation to the simplex method for linear programming. A polytope is the convex hull of a finite set of points, and is a high-dimensional generalization of a convex polygon or polyhedron. They are the set of feasible solutions for linear programs. The study of the diameter of graphs obtained from polytopes is related to the efficiency of the simplex method.

Recently, Kim introduced subset partition graphs, a generalization of previous abstract polytopes. This past summer, we created a computer program to analyze the change in diameter for operations on subset partition graphs, which led to additional software and new results on both upper and lower diameter bounds. In this talk, we show that an analogue of Todd’s improved subexponential diameter bound for polytopes applies to subset partition graphs. We also discuss further avenues of research.

The transportation problem and the diameters of transportation polytopes

Edward D. Kim

In this talk, we introduce the transportation problem, one of the traditional examples of linear programs. The transportation problem models the situation of trying to minimize the cost of shipping goods from a set of supply locations to a set of demand locations. The set of feasible solutions to a transportation problem is special kind of convex polyhedron called a [classical] transportation polytope. From the viewpoint of statistics, classical transportation polytopes are the set of all real-valued contingency tables with fixed marginals. The integer-valued contingency tables are generalizations of semi-magic squares.

We present some recent upper bounds for the diameters of transportation polytopes and the relationship between these results and the Hirsch Conjecture. At the end of the talk, we generalize the transportation polytopes (which are represented by tables) to multi-way tables. We present the best known diameter upper bound and discuss ongoing work in improving this bound.

Friday, March 6th
Time: 3:30-4:30pm
All Welcome to Attend
2205 Centennial Hall