Design of Steiner Networks

Zeev Nutov

Abstract

In the Steiner Network problem, we are given a graph G=(V,E) with edge/node costs, and connectivity requirements r(u,v) for pairs of nodes u,v in V. The goal is to find a min-cost sub-graph with r(u,v) edge/node-disjoint uv-paths for all u,v in V. This includes many known problems such as Minimum Spanning Tree, Steiner Tree, Steiner Forest, Min-Cost k-Flow, and others. The edge-connectivity variant admits a 2-approximation algorithm [Jain 98]. On the other hand, the node-cost and node-connectivity versions of the problem are unlikely to admit even a poly-logarithmic approximation ratio, and nontrivial approximation algorithms for these versions were discovered only recently.

In this talk I will present some recent techniques and approximation algorithms for the node-costs and node-connectivity versions that decompose the problem into several problems of finding a min-cost edge-cover of an un-crossable set-family. If time allows, I will also survey a simple and elegant proof recently found by [Ravi, Nagarjan, and Singh 09] of the 2-approximation algorithm of [Jain 98] for the edge-connectivity variant.