Approximation Algorithms
June 12–14, 2006

Approximation algorithms for nonuniform buy-at-bulk network design problems

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Abstract

We consider approximation algorithms for nonuniform buy-at-bulk network design problems. The first non-trivial approximation algorithm for this problem is due to Charikar and Karagiozova (STOC' 05); for an instance on h pairs their algorithm has an approximation guarantee of $\exp\left(O\left(\sqrt{(}\log h * \log\log h)\right)\right)$ for the uniform-demand case, and $\log D * \exp\left(O\left(\sqrt{(}\log h \log\log h)\right)\right)$ for the general demand case, where D is the total demand. We improve upon this result, by presenting the first poly-logarithmic approximation for this problem. The ratio we obtain is $O(\log^3 h * \min\{\log D, \gamma(h^2)\})$ where h is the number of pairs and $\gamma(n)$ is the worst case distortion in embedding the metric induced by a n vertex graph into a distribution over its spanning trees. Using the best known upper bound on $\gamma(n)$ we obtain an $O(\min\{\log^3 h * \log D, \log^5 h\})$ ratio approximation.

Thus, for polynomial in n demands our ratio is $O(\log^4 h)$. This is achieved by a combinatorial (namely greedy) algorithm. For super-polynomial in n demands the ratio can be as bad as $\log^5 h$ and uses LP methods.

Joint work with C. Chekuri, M. Hajiaghayi and M. Salavatipour.