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On the Average Case Performance of Some Greedy Approximation Algorithms for the Uncapacitated Facility Location Problem

In combinatorial optimization, a popular approach to NP-hard problems is the design of approximation algorithms. These algorithms typically run in polynomial time and are guaranteed to produce a solution which is within a known multiplicative factor of optimal. Unfortunately, the known factor is often known to be large in pathological instances. Conventional wisdom holds that, *in practice*, approximation algorithms will produce solutions closer to optimal than their proven guarantees.

We analyze the performance of three related approximation algorithms for the uncapacitated facility location problem (from [Jain, Mahdian, Markakis, Saberi, Vazirani, 2003] and [Mahdian, Ye, Zhang, 2002]) when each is applied to an instances created by placing n points uniformly at random in the unit square. We find that, with high probability, these three algorithms do not find asymptotically optimal solutions, and, also with high probability, a simple plane partitioning heuristic does find an asymptotically optimal solution.