Abstract: Approximating bicriteria network design problems

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Bicriteria network design problems seek to optimize simultaneously several network criteria. In real life, many measures are important, and at times a solution is useful only if it satisfies approximately all or most major criteria. For example, in a communication network, the following criteria can all be simultaneously important: average delay, throughput, reliability of communication, bandwidth and flow constraints, and load balancing. Building networks with several optimization objectives is motivated by applications in many areas such as multimedia, wireless networks, data transmission, VLSI design, recovery from outage, buying bandwidth, and more. Some of the resulting problems are modeled by the task of finding subgraphs with some desired properties, e.g., shallow-light trees, buy at bulk network design problems, connectivity problems with degree bounds, bicriteria spanner problems, and spanner problems with degree bounds. These problems are NP-hard. Hence we attempt to find approximation algorithms or prove inapproximability results for the problems. For most of the problems of interest there are wide gaps between the best known upper bound and the best known lower bound. We intend to focus mainly on theoretical aspects: to close (or at least narrow) the gap between best known approximation ratios and hardness results. Most of the problem selected are in the forefront of current research. Moreover, they have large practical significance as well. We expect to test the heuristics developed for some of the problems in a practical setting with the help of some of the Open University students.