Abstract

Sensitivity Analysis (SA) is an old theme in Operations Research. General procedures for performing sensitivity analysis in Linear Programs (LPs) are by now well established, and are incorporated into most commercially available LP codes. In sharp contrast, most combinatorial optimization problems (COPs) appear to elude easy sensitivity analysis. Curiously enough, this has been the state of affairs even for several classical COPs that are, in fact, LPs; these include the shortest s - t path, assignment, and minimum cost s - t flow problems. The computational complexity of SA for COPs in general is also not well understood. Further, SA for min-max (bottleneck) COPs has received little attention in the literature.

In this dissertation, we provide characterizations for the SA problem for min-sum and min-max COPs in a general setting, and use these to resolve issues of computational complexity. We then devise efficient SA procedures for several COPs including

- min-sum and min-max versions of matroid optimization problems (including the min-max version of the minimum spanning tree problem);
- min-sum and min-max versions of shortest s - t path problems in undirected graphs and acyclic directed graphs;
- the minimum cost s - t flow problem.