Invited Session

Does Semidefinite Programming Help to Approximate Combinatorial Optimization Problems?

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Abstract

To investigate the potential (and also the limits) of Semidefinite Programming (SDP), we first look at various combinatorial optimization problems and techniques to obtain SDP relaxations. In some cases this relaxation is straightforward to obtain, but this is not always the case.

We briefly look at Max-Cut, Graph Coloring, Traveling Salesman and the Quadratic Assignment Problem.

To answer the question from the title, we look at two issues:

* What can be said about the quality of some SDP relaxation in comparison to the original problem?
* What is the best way to actually solve the resulting SDP?

Theoretical estimates about the quality of SDP relaxations are available only for few problems, most prominently for Max-Cut.

On the practical side, the method of choice for SDP is the interior-point approach. Unfortunately, dense linear algebra sets severe limits in the size of problems manageable this way. We take a closer look on practical experience with SDP relaxations, and report results on the problems mentioned above. The main message here is that a combination of interior-point methods and the Bundle method from non-smooth optimization yields the best trade-off between quality of the relaxation and efficiency to actually compute the relaxation.