

Mixed integer programming: applications and recent progress

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Abstract

This talk has two parts. In the first part, we give examples of mixed integer programming models that can be used to solve practical problems. The first example is the set partitioning and set covering models. These models are used in the airline industry for scheduling the crew of commercial planes. The goal is to minimize the total cost involved while ensuring that all scheduled flights can be serviced. The second example is known as the facility location model. In this model, the goal is to minimize the total cost involved in choosing a number of potential facilities to service the demand of a given set of customers. The cost is two-fold. There is a cost for setting up a given facility, and there is a cost for a given facility in servicing one unit of demand of a given customer.

In the second part, we present recent work on modeling mixed integer programs. The basic idea is to replace a given constraint of a problem with a new and improved constraint. We first define what we mean by an "improved" constraint. A special of an improved constraint is obtained by strengthening one of the coefficients in a constraint. We show that, if there is an improved constraint, then there is a coefficient that can be strengthened. We then show that a method, which is based on strengthening one coefficient at a time, converges in a finite number of steps to a formulation which can not be improved. We finish with some computational results that demonstrate that formulations of mixed integer programs sometimes can be substantially improved. We compare with the "state-of-the-art" software of Cplex 8.0.

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