

# On the integrality gap for the minimum cost 2-edge connected multi-subgraph problem

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## Abstract

In this paper we study the 2-edge connected multi-subgraph problem (2EC): Given a complete graph  $G$  on  $n$  nodes with nonnegative edge costs, find a minimum weight 2-edge connected multi-subgraph of  $G$ . The 2EC problem is well-known to be NP-hard. One direction which seems promising for finding improved solutions and approximation algorithms for this problem is the study of its linear programming (LP) relaxation, which provides a lower bound for 2EC. In this paper we examine the worst-case ratio (i.e. integrality gap)  $k$  between the optimal solutions of 2EC and its LP relaxation. Currently the exact value of  $k$  is not known, only that it lies somewhere between  $\frac{6}{5}$  and  $\frac{3}{2}$ . Finding the exact value for  $k$  is difficult even for small values of  $n$  due to the exponential size of the data involved. We describe how we were able to overcome such problems to obtain the exact value of  $k$  for all  $n$  up to 10, and partial results for  $n$  up to 13.

*Joint work with Anthony Alexander, Paul Elliott-Magwood.*