TWO FORMULATIONS FOR THE CAPACITATED STEINER TREE PROBLEM

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We face a variant of the Steiner tree problem in which some commodities must be sent from the root node to terminal nodes through transshipment nodes with limited capacity. We present two formulations for this problem. The second one uses the notion of cardinality of terminals assigned to a transshipment node as in [1]. An immediate benefit of the second formulation is that it is stronger than the first one. Moreover, we present two classes of inequalities which exploit the cardinality effect of the second formulation and use separation heuristics to identify and sequentially add valid inequalities to further improve the lower bound. This approach is embedded in a branch-and-bound to obtain the optimal solution and results in a branch-and-cut algorithm. We test our solution approach on a large set of random generated instances. The experimentation clearly shows that this approach is able to identify the optimal solution at the root node in most of the problem instances with limited capacity. For problem instances with larger capacity, the proposed cuts are shown to be useful, even if the first formulation is sometimes easier to solve.

References

[1] M. Di Francesco, M. Gaudioso, E. Gorgone, I. Murthy *A new extended formulation with valid inequalities for the Capacitated Concentrator Location Problem*, European Journal of Operational Research, 289 (2021), pp. 975–986.