Referee report on
Lagrangian Heuristic for Simultaneous Subsidization and Penalization: Implementation on Rooted Travelling Salesman Games
by
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This paper examines the problem of stabilizing the grand coalition of an unbalanced cooperative game under simultaneous subsidization and penalization (S&P) of the characteristic function values. It presents an approach for developing heuristic algorithms to evaluate the trade-off between subsidy and penalty in the S&P instrument. This approach is applied with some Lagrangian relaxation techniques for computing feasible subsidyûpenalty pairs and stabilize the grand coalition.

Major concerns:

1. Testing core non-emptyness in most cooperative games is NP-hard. This can be motivated by two main facts: 1) It requires to solve a linear program with an exponential number of constraints; and 2) the evaluation of the characteristic function of each coalition can be non-polynomial (as it is the case in most Integer Minimization (IM) games).

   The methodology presented in this paper does not overcome any of these two issues.

2. The whole story starts by assuming that the considered game is unbalanced. This is an issue by itself. To start with, one should determine whether or not the core is empty. However, this is not resolved, not even mentioned in the paper.

3. The paper concentrates on providing a heuristic approach to evaluate the characteristic function, c, of IM games. Nevertheless, even assuming that this is doable once one has the evaluation table of c, the problem still remains hard because it requires solving an LP with exponentially many constraints for which no polynomial separation oracle is known.

The contribution of this paper to cost sharing in IM games is rather marginal. It describes a set of standard techniques in linear programming

to be applied to give bound on integer problems but that does not actually help in answering the important questions in cost sharing.

Based on the above comments, this referee cannot recommend this paper for publication in EJOR.