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An improved mathematical model for a two-agent scheduling problem in a two-machine flow shop

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Keywords: Two-agent scheduling; Two-machine flow shop; MIP model;

1 Introduction

The management problems in which multiple agents compete on the usage of a common processing resource are receiving increasing attention in different appliction environments and different methodological fields, such as artificial intelligence, decision theory, operations research, etc (Agnetis et al., 2004). One major stream of research in this context is multi-agent scheduling problems that have been an active area of research for the past three decade. In this problem, each agent has a certain objective function that independent of the other agents' objective.

In this paper a two-agent constrained optimization scheduling problem in a two machine flow shop is considered.

2 Objectives

Both total tardiness and total number of tardy job performance measures have a significant impact on a schedule's cost and agent's responsiveness. Also, in many applications in both industrial and planning areas, each job must undergo two or more basic processes in the same order implying that the jobs have to follow the same route. This environment is referred to as a flowshop. Motivated by these, the objective is to minimize the total tardiness of the first agent with the restriction that the number of tardy jobs of the second agent is zero**.**

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3 Methods

This problem has been shown to be NP-hard in the strong sense an so in literature a branch and bound algorithm has been proposed to find exact solutions(Lee et al., 2010). However, the proposed algorithm couldn't efficiently solve problem instances with more than 12 jobs in size. Since this problem is NP-hard in the strong scene, solving it to optimality in a reasonable amount of time is difficult. To this end, in this study, a mixed integer mathematical programming (MIP) model developed to tackle the problem. Afterward, by using literature optimal solution properties, a set of valid inequalities created for the problem to strengthen the formulation and value of some decision variables fixed to accelerate the search process of the MIP model.

4 Results

We use the data-set available in the literature. Results show that the proposed model produces optimal solution in effective manner and reasonable time.

5 Conclusion

In this paper, the two-agent scheduling problem on the two machine flow shop was considered. The objective is to minimize the total tardiness of the first agent with the restriction that the number of tardy jobs of the second agent is zero. For this problem, the MIP model incorporating with several optimal solution properties to search for the optimal solution was developed. Results show that proposed model produces optimal solution in effective manner and reasonable time. Computational results indicated that the proposed MIP model outperforms the literature branch and bound algorithm and can solve the instances of 40 jobs in a reasonable amount of time.

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