

Decomposition Algorithms for a Parallel Machine Scheduling Problem with Workforce and Precedence Constraints

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Abstract. In this work, we consider a scheduling problem with parallel machines and human resources. Compatibility, precedence and contiguity constraints must be respected, as well as release dates for the jobs. The aim is to minimize the total weighted tardiness. The problem is inspired by a real-world industrial application, and, because of its generality, can be used to model a large variety of further applications. To solve the problem, we implemented a Mixed Integer Linear Program (MILP) and a Constraint Program (CP). We then tested different decomposition algorithms, using both MILPs and CPs in the master and slave problems. A promising solution method is given by a Combinatorial Benders' decomposition where we first schedule the jobs and then assign the human resources to the jobs. The efficiency of the methods is proven by computational tests on realistic instances.

Keywords: Compatibility; Precedence; Contiguity; Mixed Integer Linear Program; Constraint Program; Combinatorial Benders' Decomposition.