Truthfulness and approximation for a classical scheduling problem

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Abstract

We consider the problem of scheduling n tasks on m parallel (identical, or related) machines in order to minimize the makespan in a game theoretic context where each task is owned by a distinct agent. Every agent is the only one that knows the length of its task and aims at minimizing its completion time. We focus on the following process: at first every agent declares a (possibly false) length of its task, and then given these bids the scheduler allocates the tasks to the machines. The objective of the scheduler is to minimize the makespan, i.e. the date at which the last task finishes its execution, while the aim of each agent is to minimize its completion time and thus an agent may lie if by doing so, her task can finish earlier. Our goal is to design an algorithm such that the scheduler's goal matches with the agents' preferences, i.e. such that the agents report the true lengths of their tasks. After discussing different variants of the problem and some recent results of the literature, we will focus on a new characterization for an algorithm to be truthful. We will introduce the notion of increasing algorithm and a simple reduction that transforms any increasing algorithm to a truthful one (without using payments). We will also see that some classical scheduling algorithms are indeed increasing.