Abstract

We consider the classical problem of Scheduling on Unrelated Machines. In this problem a set of jobs is to be distributed among a set of machines and the maximum load (makespan) is to be minimized. The processing time p_{ij} of a job j depends on the machine i it is assigned to. Lenstra, Shmoys and Tardos gave a polynomial time 2-approximation for this problem (J. K. Lenstra, D. B. Shmoys and É. Tardos, *Approximation Algorithms for Scheduling Unrelated Parallel Machines*, Mathematical Programming, 46(3):259-271, 1990). In this paper we focus on a prominent special case, the Restricted Assignment problem, in which $p_{ij} \in \{p_j, \infty\}$. The configuration-LP is a linear programming relaxation for the Restricted Assignment problem. It was shown by Svensson that the multiplicative gap between integral and fractional solution, the integrality gap, is at most $2-1/17 \approx 1.9412$ (O. Svensson, *Santa Claus Schedules Jobs on Unrelated Machines*, 41(5):1318-1341, 2012). In this paper we significantly simplify his proof and achieve a bound of $2 - 1/6 \approx 1.8333$. As a direct consequence this provides a polynomial $(2 - 1/6 + \epsilon)$-estimation algorithm for the Restricted Assignment problem by approximating the configuration-LP. The best lower bound known for the integrality gap is 1.5 and no estimation algorithm with a guarantee better than 1.5 exists unless P = NP.