WOMBAT 2023 - Parallel Machine Scheduling Problem with Flexible Resources and Shift Consideration

WOMBAT/WICO conference 2023 - University of Sydney

This talk presents a challenging problem related to team formations, team assignments, and job schedules. The presented problem incorporates shift consideration into the static Unspecified Parallel Machine Flexible Resource Scheduling (UPMFRS) problem. In the literature, teams are simplified as machines that perform jobs throughout the day without any breaks. However, these teams cannot work continuously within a day, as they require breaks between shifts. Therefore, we involve shift considerations where teams are not allowed to perform jobs in consecutive shifts. We consider flexible workers, capable of performing any job, who are distributed among different teams in different shifts to undertake various tasks. The number of teams in each shift is treated as a decision variable. The duration of each job is defined by the number of workers in a team assigned to it. The objective function is to minimise the makespan, which represents the overall schedule completion time while adhering to precedence constraints. An integer linear programming model is formulated for the proposed problem, which is difficult to solve on a large scale. Therefore, we address the dimensionality challenge by developing data-preprocessing techniques and a bilinear branch-and-check algorithm that utilises bilinear valid inequalities to accelerate convergence. The numerical results indicate that our algorithm is more efficient than the IBM CPLEX standard branch-and-cuts.

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2023-12-13