Solving the Solid Assignment Problem

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Abstract

The Solid Assignment Problem (SAP) also known as the 3-dimensional assignment problem, consists in allocating *n* jobs to *n* machines in *n* factories such that exactly one job is allocated to one machine in one factory. The objective function is to minimise the total cost of the allocation. SAP is an extended version of the standard 2-dimensional assignment problem, which aims to assign *n* tasks to *n* operators at minimum total cost. This combinatorial optimisation problem appears in many applications and has aroused research interests for decades. In this paper, we suggest a new heuristic algorithm called the Diagonal Method (DM) to solve SAP. The largest SAP solved with an exact solution to this day is of size *n*=26. As it is intractable, only approximate solutions are found in reasonable time for larger instances. DM that we suggest here is an approximate solution approach, which relies on the Kuhn-Tucker Munkres algorithm, also known as the Hungarian method. The new approach is discussed, hybridised, presented and compared with the Branch-and-Bound method (B&B). Tie cases are discussed with examples. Our numerical experiments for larger instances show that DM finds optimal or near-optimal solutions in competitive computational times.

Key words: Solid assignment problem, Diagonal method, Branch-and-Bound method and Hungarian method.