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Matheuristics- Hybrids Between Metaheuristics and Exact Solvers

Optimization problems are usually formulated as Mixed Integer Programs (MIPs) and solved by various exact solution methods (CPLEX, Gurobi, etc.). However, most of the real-life optimization problems are intractable for exact solvers and are usually addressed by metaheuristic methods. They represent general computational algorithms to optimize a given objective function by iteratively generating new or improving the existing solutions. The generality means that they do not use *a priori* knowledge about the problem being optimized and that enables its application to the various range of problems. Among general heuristics, a special place is reserved for 0-1 MIP solution methods, the so-called *matheuristics*. These methods are hybrids between metaheuristic methods and exact solvers for MIP problems. The main idea behind this hybridization is to use metaheuristic rules for fixing values of some binary variables and creating subproblems for exact solvers. Three methods from the literature using a combination of Variable Neighborhood Search (VNS) (or its variations) and CPLEX commercial solver are described in detail. These are Variable Neighborhood Branching (VNB), Variable Neighborhood Decomposition Search for 0-1 MIP (VNDS-MIP) and Variable Intensity Neighborhood Search for 0-1 MIPs (VINS).