A hyper-heuristic approach to the patient admission scheduling problem

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Abstract:

Operations research has been progressively used in health organizations. In this paper, we study the Patient Admission Scheduling Problem (PASP) which aims at providing an efficient schedule for assigning patients to beds of a hospital based on availability and the required treatment with the needs and preferences of the patients.

Solving distinct combinatorial optimisation problems and finding state of the art results is often possible by utilizing problem specific approaches. These fine-tuned approaches increase the solution quality but at the same time decrease the level of general applicability. So, there is a trade-off between quality and generality. Hyper-heuristics are generic search strategies that look for the most appropriate steps to solve a problem or instance of a problem. The traditional (improvement) hyper-heuristics are defined as "*heuristics to choose heuristics*", since they search for the best way of solving a problem by employing different heuristics at each step. This characteristic distinguishes them from problem-dependent or solution-based search techniques.

In this study, we apply different hyper-heuristic strategies which are generated by combining distinct 1) heuristic selection mechanisms that perform the selection process and distinct 2) move acceptance mechanisms that decide on whether to accept a new solution produced by the selected heuristic(s). We present a comprehensive study and show how it is possible to increase the quality and generality at the same time. For solving the PASP, we determine different hard constraints and optimise against some soft constraints. To differentiate between the constraints, different weights are utilized during the fitness evaluation. In the presentation, experimental results on the PASP will be presented and the effect of using different sub-mechanisms, heuristic selection with or without learning and some threshold accepting move acceptance mechanisms, will be discussed.