Integer Programming: Domain Transformation in Nurse Scheduling Problem.

Authors : Geetha Baskaran, Andrzej Barjiela, Rong Qu

Abstract : Motivation: Nurse scheduling is a complex combinatorial optimization problem. It is also known as NP-hard. It needs an efficient re-scheduling to minimize some trade-off of the measures of violation by reducing selected constraints to soft constraints with measurements of their violations. Problem Statement: In this paper, we extend our novel approach to solve the nurse scheduling problem by transforming it through Information Granulation. Approach: This approach satisfies the rules of a typical hospital environment based on a standard benchmark problem. Generating good work schedules has a great influence on nurses' working conditions which are strongly related to the level of a quality health care. Domain transformation that combines the strengths of operation research and artificial intelligence was proposed for the solution of the problem. Compared to conventional methods, our approach involves judicious grouping (information granulation) of shifts types' that transforms the original problem into a smaller solution domain. Later these schedules from the smaller problem domain are converted back into the original problem domain by taking into account the constraints that could not be represented in the smaller domain. An Integer Programming (IP) package is used to solve the transformed scheduling problem by expending the branch and bound algorithm. We have used the GNU Octave for Windows to solve this problem. Results: The scheduling problem has been solved in the proposed formalism resulting in a high quality schedule. Conclusion: Domain transformation represents departure from a conventional one-shift-at-a-time scheduling approach. It offers an advantage of efficient and easily understandable solutions as well as offering deterministic reproducibility of the results. We note, however, that it does not guarantee the global optimum.

Keywords : domain transformation, nurse scheduling, information granulation, artificial intelligence, simulation

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