ITC-2007 Track1: An Approach using General CSP Solver

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Description of the method

Our approach is to formulate the given timetabling instances as instances of constraint satisfaction problem (CSP), and then apply a general purpose CSP solver to find their solutions. To validate this approach, however, (1) a powerful CSP slover must be available, and (2) compact CSP formulations that can utilize all the power of such solver must be devised.

As the general purpose CSP solver, we use the one proposed by [1]. This solver adopts hyblid algorithm of tabu search and iterated local search, and handles weighted constraints. By specifying initial weights, it can distinguish soft and hard constraints, but their weights are dynamically controlled during computation to improve performance. The solver used in this experiment is an improved version of [1] in the sense of added capability of handling quadratic 0-1 constraints.

The CSP foumulation of Track 1 instances was basically done by using linear 0-1 inequalities, quadratic 0-1 inequalities, and all-different constraints. As the sizes of Track 1 instances are huge, careful selections have been made for their description (particularly for the two in a row/day and the period spread constraints), so that the numbers of variables and constraints can be kept within manageable sizes, and the load to computer memory is minimized. This is where we spent most of our efforts to obtain reasonable computational results.

Large advantages of our approach are that we can skip the most time consuming part of developing sophisticated algorithms, and that different types of timetabling problems can be accessed in the same manner. To show this, we also tried to solve Track 2 and Track 3 instances. We hope that our results will prove the practical usefulness of this general purpose CSP approach.

References

1. K. Nonobe, and T. Ibaraki, An Improved tabu search method for the weighted constraint satisfaction problem, INFOR, Vol. 39, No.2, pp. 131-151, 2001.