ITC-2007 Track2: An Approach using General CSP Solver

Mitsunori Atsuta[1], Koji Nonobe[2], and Toshihide Ibaraki[1]

[1]Kwansei-Gakuin University, School of Science and Technology,
2-1 Gakuen, Sanda, Japan 669-1337
{ady67525, ibaraki}@kwansei.ac.jp
[2]Hosei University, Faculty of Engineering & Design
2-17-1 Fujimi, Chiyoda-ku, Tokyo, Japan 102-8160
nonobe@hosei.ac.jp

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 solver 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 formulation of Track 2 instances was basically done by using linear 0-1 inequalities, quadratic 0-1 inequalities, and all-different constraints. In this track, competitor is required to obtain valid solutions (all hard constraints are satisfied, but there may be unplaced events). Compared to ITC-2002, it is said that finding feasible solutions (valid solutions without unplaced events) is difficult. Corresponding to this, we introduced a dummy variable to represent unplaced events, and we carefully adjusted the weights of the relevant constraints so that we tend to obtain feasible solutions.

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 1 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.