Adapting h^{++} for Proving Plan Non-Existence
(IPC 2014 Planner Abstract)

P@trik Haslum
Australian National University & NICTA Optimisation Research Group
firstname.lastname@anu.edu.au

h^{++} is an incremental lowerbounding procedure, based on repeatedly computing minimum-cost plans for a relaxation of the planning problem and strengthening the relaxation (Haslum 2012). If the relaxed plan is valid also for the real (unrelaxed) problem, it is an optimal plan.

If the relaxed problem is unsolvable, so is the original problem. If the original planning problem is unsolvable, the successive strengthening is guaranteed to eventually produce a relaxation that is also unsolvable.

The only change made to the h^{++} procedure for the unsolvability competition is that it computes a non-optimal relaxed plan in each iteration. The relaxed problem considered in each iteration is a delete relaxation (in later iterations, of a modification of the original problem). Thus, the existence of a plan for the relaxation, and extracting such a plan if one exists, can be done in polynomial time. Finding a cost-optimal relaxed plan, in contrast, is NP-hard.

The relaxation strengthening problem transformation is potentially exponential in size. It is possible to define a different strengthening scheme, which does not preserve optimal cost, but which does preserve unsolvability and restricts growth to polynomial (Haslum 2009). However, this was not implemented for the competition.

References

Haslum, P. 2009. $h^m(P) = h^1(P^m)$: Alternative characterisations of the generalisation from $h^{\max}$ to h^m. In *Proc. of the 19th International Conference on Automated Planning and Scheduling (ICAPS'09)*.

Haslum, P. 2012. Incremental lower bounds for additive cost planning problems. In *Proc. 22nd International Conference on Automated Planning and Scheduling (ICAPS'12)*, 74–82.