Enhancing Finite Set Constraint Programming with Probe Backtrack Search

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Abstract. Finite Set constraint programming (FS) offers a very expressive language to formalize combinatorial problems. The primitives of FS are set variables and relations (e.g. subset, intersection, union, ...). Usually, finite set constraint systems have also syntactic abstractions for $n - ary$ set relations, such as $partition([S_1 \dots S_n], M)$, which forces the n set variables to be pairwise disjoint and their union to be equal to M. Combinatorial optimisation problems are often solved by using classical optimisation methods (e.g., integer and linear programming) which are quite efficient but not very expressive. *Expressiveness* is sacrificed for the sake of *efficiency*. Recent works that aim at improving the efficiency of FS have investigated alternative set representations [3] or new efficient global constraints [4]. We are investigating a different approach for improving the efficiency of FS based on the use of Probe Backtrack Search [1]. A probe is a solution of a relaxation of the original problem that can be obtained efficiently. At each step of the search process, a probe is generated and used to prune infeasible alternatives and to guide the search. We have solved a simple network routing optimization problem using a FS constraint system enhanced by a linear prober. The FS-based model uses less decision variables and is much more expressive than classical optimization approaches. Preliminary results on a set of problem instances from [2] show that adding a linear prober to a standard FS search approach does improve the search of the optimal solution.

References

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