Integrating Cardinality Constraints into Constraint Logic Programming with Sets

Maximiliano Cristiá[1] and Gianfranco Rossi[2]

[1] UNR and CIFASIS, Rosario, Argentina
`cristia@cifasis-conicet.gov.ar`
[2] Università degli studi di Parma, Parma, Italy
`gianfranco.rossi@unipr.it`

Formal reasoning about finite sets and cardinality is important for many applications, including software verification, where very often one needs to reason about the size of a given data structure. The Constraint Logic Programming tool $\{log\}$ ('setlog') provides a decision procedure for deciding the satisfiability of formulas involving very general forms of finite sets, although it does not provide cardinality constraints. In this paper we adapt and integrate a decision procedure for a theory of finite sets with cardinality into $\{log\}$. The proposed solver is proved to be a decision procedure for its formulas. Besides, the new CLP instance is implemented as part of the $\{log\}$ tool. In turn, the implementation uses Howe and King's Prolog SAT solver and Prolog's CLP(Q) library, as an integer linear programming solver. The empirical evaluation of this implementation based on +250 real verification conditions shows that it can be useful in practice.

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References

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