Description of CirQit2.1

Alexandra Goultiaeva and Fahiem Bacchus

Department of Computer Science
University of Toronto
`{alexia,fbacchus}@cs.toronto.edu`

CirQit2.1 is a QBF solver that uses a circuit-based internal representation of the formula. The propagation it performs on the circuit representation is equivalent to unit propagation on the Tseitin encoding of the formula; in addition, it utilizes Don't Care propagation to further reduce search space. The solver performs cube and clause learning, and uses a VSIDS heuristic. More details about the solver can be found in [1].

Beyond what is reported in [1] the submitted solver has some additional features:

– The solver now takes input in qpro format. Such input is processed so that identical and negated-identical subformulas are recognized and all duplicates removed. Two subformulas are recognized as being negated-identical if one of them is identical to the Negation Normal Form of the negation of the other. In that case, only one instance of the subformula is represented as a sub-circuit and the other instance is represented by utilizing the negation of the sub-circuit's output.
– Additional preprocessing is done to obtain an equivalent formula by applying rules of the following form: $a \wedge f(a) \equiv a \wedge f(T)$ and $a \vee f(a) \equiv a \vee f(F)$.
– The solver remembers phases during search. When backtracking the settings of the variables are remembered. The next time one of these variables is branched on it is first set to its previous value (if necessary the other value is explored after backtracking)
– The solver also employs dual propagation. This is a new technique for utilizing the duality of conflicts and solutions, and will be described in a paper that is currently in preparation.

References

1. Goultiaeva, A., Iverson, V., Bacchus, F.: Beyond CNF: A Circuit-Based QBF Solver. In Kullmann, O., ed.: SAT. Volume 5584 of Lecture Notes in Computer Science., Springer (2009) 412–426