



COPROCESSOR 2.0

A Flexible CNF Simplifier

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CNF formulas

- Are generated automatically
- Can contain redundancies
- Come from many different fields
- Contain different structures

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Understand SAT formulas:

- During preprocessing, many redundancies can be uncovered
- How can these intermediate states be produced?
- There are many techniques to remove redundancies.

Outline

Motivation
SAT Preprocessing
Conclusion

Preprocessing

Properties of CDCL SAT solvers

- Solvers perform a depth first search
- They do not look for early conflicts (after each branch)
- They utilize back-jumping and aggressive restarts
- The performance of unit propagation heavily depends on the number of clauses

Preprocessing

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Preprocessors can:

- Remove redundant clauses, e.g. duplicates
- Can shrink the size of clauses
- Can eliminate variables
- Might also perform extended resolution and add variables

Modern Preprocessors

Implement a wide range of techniques (references in paper)

- Unit Propagation and Pure Literal Elimination
- (Bounded) Variable Elimination
- Subsumption, Self-Subsuming Resolution
- Asymmetric Branching

Modern Preprocessors

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- Unit Propagation and Pure Literal Elimination
- (Bounded) Variable Elimination
- Subsumption, Self-Subsuming Resolution
- Asymmetric Branching
- Failed Literal Probing, with double look-ahead
- Equivalent Literal Elimination
- Hidden Tautology Elimination
- (Hidden) Blocked Clause Elimination
- Unhiding Literal Elimination
- ...

Most preprocessors schedule their techniques in a fixed sequence.

Coprocessor 2

Tries to implement most of the known preprocessing techniques

- in a modular way
- with an exchangeable order
- with a computation limit based on counters
- efficiently
- treating learned clauses correctly

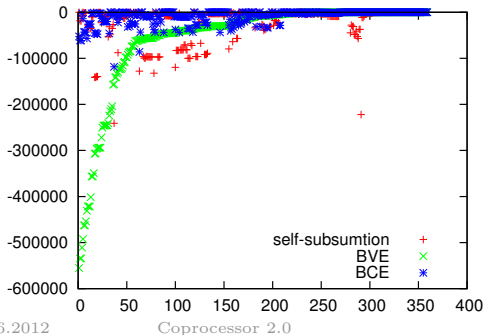
More features include:

- Recovering the model for the original formula
- Maintenance of a white-list of variables
- Eliminate specified variables always
- A time limit for the computation

Recommended Techniques

From what we experienced

- Currently, the SatELite techniques are most crucial
- Subsumption, Variable Elimination, Blocked Clause Elimination
clause reduction



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Why should you use Coprocessor

- Coprocessor 2.0 implements more techniques than SatELite
- It allows to schedule preprocessing techniques in a user-defined order
- It allows to exclude variables from preprocessing easily
- There is no performance decrease compared to SatElite
- The tool will be extended and improved by further research

Thanks for your attention

The solver is available at <http://tools.computational-logic.org>