Exercises for the Lecture
Practical SAT Solving

Summer Semester 2016

Assignment 2

Institute for Theoretical Informatics, Karlsruhe Institute of Technology (KIT)

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Exercise 1 (Resolution Proof) [3 points]

Construct a resolution proof of unsatisfiability for the following formula

$(x_3 \vee x_4 \vee \overline{x}_1 \vee x_5) \wedge (\overline{x}_3 \vee x_4 \vee x_5) \wedge (x_3 \vee \overline{x}_4 \vee \overline{x}_1) \wedge (x_1 \vee x_2) \wedge (x_1 \vee \overline{x}_2) \wedge (\overline{x}_1 \vee \overline{x}_5) \wedge (\overline{x}_3 \vee \overline{x}_4 \vee x_5)$

Exercise 2 (DPLL) [5 points]

Simulate modern DPLL (from Slide 19 of Lecture 4 slides) by hand on the formula from Exercise 1. Select branching literals in the order $x_1, x_2, x_3, \ldots$

Exercise 3 (Planning) [7 points]

Design and describe a SAT encoding for SAS+ planning that uses only one kind of Boolean variables – variables representing actions ($a_i^t = \mathit{True}$ if and only if a_i is present in the t-th step of the plan). Compute how many clauses are required for such an encoding.

Exercise 4 (Sokoban Challenge) [10(+10) points]

Design and implement a SAT encoding for Sokoban (`http://en.wikipedia.org/wiki/Sokoban`). You get 10 points for any working encoding. The author of the best encoding receives additional 10 points.

- input/output format: `http://www.sokobano.de/wiki/index.php?title=Level_format`
- benchmark levels and scripts: `http://baldur.iti.kit.edu/sat/files/sokoban.zip`

Exercise 5 (Local Search Challenge) [5(+10) points]

Implement a (stochastic) local search SAT solver. Follow the SAT Competition input/output format `http://www.satcompetition.org/2004/format-solvers2004.html` For a working solver you get 5 points. The author of the best solver receives a bonus of 10 points. The solvers will be evaluated on satisfiable phase transition random 3-SAT problems (like the ones here: `http://www.cs.ubc.ca/~hoos/SATLIB/benchm.html`).