universität innsbruck

Constraint Solving | SS 2024 | LVA 703305

Week 1 | March 8, 2024

Homework

1. Give an example binary operation $\cdot$ that is associative ($(x \cdot y) \cdot z = x \cdot (y \cdot z)$) but not commutative ($x \cdot y = y \cdot x$), and one that is commutative but not associative. (2 P)

2. Use DPLL to check if the following formula is satisfiable on paper: (2 P)
   - $(\neg b \vee c) \wedge (\neg c \vee a) \wedge (\neg a \vee b) \wedge (\neg a \vee \neg b \vee \neg c) \wedge (b \vee a)$

   and encode it in DIMACS and run a SAT solver on it (for example CaDiCaL[1] or MiniSAT[2])

3. Consider the formula $\varphi = \neg((\neg r \to s) \wedge \neg(p \vee q))$ (3 P)
   (a) Extend the lemmas on slide 18 to formulas containing implications ($\to$) and equivalences ($\leftrightarrow$).
   (b) Use the extended Tseitin's transformation to convert φ to an equisafisfiable CNF formula.
   (c) How does the inclusion of $\to$ and $\leftrightarrow$ affect the transformation of Plaisted and Greenbaum? What CNF does it produce for φ?

4. Consider the following conflicting state of a DPLL run: (3 P)

   $$1^d\, 2\, 3^d\, 4\, 5^d\, 6 \parallel (\neg 1 \vee 2) \wedge (\neg 3 \vee 4) \wedge (\neg 5 \vee 6) \wedge (5 \vee \neg 6) \wedge (\neg 6 \vee \neg 5 \vee \neg 2)$$

   Find three ways of applying the backjump rule, where each uses a different backjump clause and results in a different state.

[1] `https://fmv.jku.at/cadical/`
[2] `http://www.minisat.se/`