

An overview of Knowledge Compilation

Exercise Sheet 2, December 05, 2017.

Exercise 1.

Show that a clause learned during the CDCL conflict analysis process is not subsumed¹ by any clause of the current formula.

Exercise 2. Tseitin Transformation

1. Let C be a Boolean circuit on variable X and z a variable of C such that $C \models z \Leftrightarrow f(X')$ for some $f : \{0, 1\}^{|X'|} \rightarrow \{0, 1\}$ and $X' \subseteq X \setminus \{z\}$. Show that C has the same number of models as C' , the circuit obtained by replacing z with $f(X')$ in C .
2. Given a Boolean circuit C , construct a CNF $F(C)$ that has the number of models as C .

Hint. For every gate v of C , introduce a new variable z_v and add clauses to define the value of z_v .

Exercise 3.

Show that if given two FBDD F_1 and F_2 you can construct an FBDD F computing $F_1 \wedge F_2$ and of size at most $c + |F_1| + |F_2|$ for some constant c then $P = NP$ (and worse!).

Exercise 4. Encodage

Let $G = (V, E)$ be a graph. Find a CNF formula F_G that is satisfiable if and only if G is 3-coloriable.

¹A clause α is subsumed by a clause β if $\beta \subseteq \alpha$. Observe that in this case, $\beta \wedge \alpha \Leftrightarrow \beta$.