

Exercise 1 (Tseitin Encoding) [4 points]

Encode the following formula into CNF using the Tseitin Encoding.

$$(\bar{x}_1 \wedge \overline{(x_3 \iff x_2)}) \vee ((x_3 \implies \bar{x}_4) \wedge (x_1 \implies (x_2 \wedge \bar{x}_3))) \wedge (x_4)$$

Exercise 2 (DPLL) [5 points]

Simulate modern DPLL (from Slide 22 of Lecture 5 slides) by hand on the formula below. Select branching literals in the order x_1, x_2, x_3, \dots

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

Exercise 3 (Stålmarcks Method) [5 points]

Simulate Stålmarcks Method (from Slide 28 of Lecture 5 slides) by hand on the formula from Exercise 2. Select variables in the order x_1, x_2, x_3, \dots

Exercise 4 (Unit Propagation Challenge) [10(+10) points]

Implement a formula preprocessor that does unit propagation until fixed point (until no more unit propagation is possible). Given a CNF formula F in the DIMACS format containing some unit clauses output F after unit propagation also in the DIMACS format. For a working preprocessor you get 10 points. The author of the fastest implementation receives a bonus of 10 points.