Exercise 1 (Tseitin Encoding) [4 points]

Encode the following formula into CNF using the Tseitin Encoding.

\((\overline{x_1} \land (x_3 \iff \overline{x_2})) \lor ((x_3 \implies \overline{x_3}) \land (x_1 \implies (x_2 \land \overline{x_1})) \land (x_4))\)

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 \(x_1, x_2, x_3, \ldots\).

\((x_3 \lor x_4 \lor \overline{x_1} \lor x_5) \land (\overline{x_3} \lor x_4 \lor x_5) \land (x_3 \lor \overline{x_4} \lor \overline{x_1}) \land (x_1 \lor x_2) \land (x_1 \lor \overline{x_2}) \land (x_1 \lor x_4) \land (x_3 \lor \overline{x_4} \lor x_5)\)

Exercise 3 (Stålmars Method) [5 points]

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

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.