

Exercise 1 (Stålmarcks Method) [5 points] Simulate by hand Stålmarcks Method (from Slide 8 of Lecture 6 slides) by hand on the following formula. Select variables 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 2 (CDCL) [7 points]

Simulate CDCL by hand on the formula below. Select branching literals in the order x_1, x_2, x_3, \dots . Draw the implication graph for each conflict and learn the 1-UIP clause.

$$(x_1 \vee x_{13}) \wedge (\bar{x}_1 \vee \bar{x}_2 \vee x_{14}) \wedge (x_3 \vee x_{15}) \wedge (x_4 \vee x_{16}) \wedge (\bar{x}_5 \vee \bar{x}_3 \vee x_6) \wedge (\bar{x}_5 \vee \bar{x}_7) \wedge (\bar{x}_6 \vee x_7 \vee x_8) \wedge (\bar{x}_4 \vee \bar{x}_8 \vee \bar{x}_9) \wedge (\bar{x}_1 \vee x_9 \vee \bar{x}_{10}) \wedge (x_9 \vee x_{11} \vee \bar{x}_{14}) \wedge (x_{10} \vee \bar{x}_{11} \vee x_{12}) \wedge (\bar{x}_2 \vee \bar{x}_{11} \vee \bar{x}_{12})$$

Exercise 3 (Unit Propagation Challenge) [10(+10/+5) 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. In case of at least 3 participants the second fastest implementation will receive a bonus of 5 points.

Exercise 4 (Hidoku Challenge) [12(+12/+6) points]

Hidoku a.k.a Hidato a.k.a Number Snake is a logic puzzle where the goal is to fill a grid with consecutive numbers that connect horizontally, vertically, or diagonally. The grid is rectangular and some of the cells are pre-filled. Example:

1			5
	7		
			14
		16	

Unsolved Hidoku

1	3	4	5
2	7	6	13
8	11	12	14
9	10	16	15

It's solution

1			5
2			14
		16	

Unsatisfiable Hidoku

The input is a single string looking like this (for the example above):

4, 4 : 1, 0, 0, 5 ; 0, 7, 0, 0 ; 0, 0, 0, 14 ; 0, 0, 16, 0 ;

The first two numbers are the width and height of the grid followed by the values separated by commas, rows are separated by semicolons, 0 represents an empty cell. The output format:

sol : 1, 3, 4, 5 ; 2, 7, 6, 13 ; 8, 11, 12, 14 ; 9, 10, 16, 15 ;

A Hidoku puzzle may be unsatisfiable, in that case output sol : UNSAT

Implement a SAT solving based Hidoku solver. For a working solver you get 12 points. The fastest solver will receive a bonus of 12 points. In case of at least 3 participants the second fastest solver will receive a bonus of 6 points.