Exercises for the Lecture Practical SAT Solving | Summer Semester 2018 | Assignment 5

Institute for Theoretical Informatics, Karlsruhe Institute of Technology (KIT) | June 28, 2018

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Exercise 1 (Core-Guided MaxSAT solving) [4 points]

Solve the following formula as a MaxSAT problem using the Core-Guided MaxSAT algorithm.

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

Exercise 2 (Weighted Partial MaxSAT to MaxSAT) [4 points]

Show that any Weighted Partial MaxSAT problem instance (with positive integer weights) can be translated into a MaxSAT problem instance.

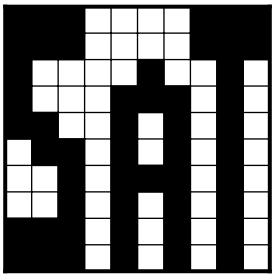
Exercise 3 (Longest Path as Weighted Partial MaxSAT) [6 points]

Describe how to encode the Longest Path Problem `https://en.wikipedia.org/wiki/Longest_path_problem` for a graph with positive edge weights as a Weighted Partial MaxSAT problem.

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

A Nonogram is a logic puzzle in which cells in a grid must be colored or left blank according to numbers at the side of the grid to reveal a hidden picture. Example (and the solution on the right):

			5 2	2 2 2	2 5	0	7	2 1	7	2	10	2
		3 3										
		3 3										
	1 1 1											
	1 3 1											
2 1 1 1												
2 1 1 1												
	1 3 1											
1 1 1 1												
3 1 1 1												
3 1 1 1												



The input is a single string looking like this (for the example above):
`10,10:3,3;3,3;1,1,1;1,3,1;2,1,1,1;2,1,1,1;1,3,1;1,1,1,1;3,1,1,1;3,1,1,1;5,2;2,2,2;2,5;0;7;2,1;7;2;10;2;` The first two numbers are the width and heigth of the grid followed by the values separated by comma and semicolons. If the puzzle is unsatisfiable ouput `sol:UNSAT` otherwise print the solution in this format: `sol:1110000111;1110000111;...;1110101010`
Implement a SAT solving based Nonogram 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. Some example inputs here: `https://baldur.iti.kit.edu/sat/files/nonograms.txt`