Exercises for the Lecture Practical SAT Solving | Summer Semester 2017 | Assignment 2

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Exercise 1 (At most one with log(n) extra variables) [4 points]

Show how to encode the at-most-one constraint over n Boolean variables by only using $O(\log n)$ extra variables and $O(n \log n)$ clauses.

Exercise 2 (Pidgeon Hole Principle) [4 points]

Show how to encode the following question into a SAT formula: is it possible to put $n+1$ pidgeons into n holes such that each pidgeon has its own hole?

Exercise 3 (Planning Encoding) [7 points]

Design and describe a SAT encoding for SAS+ planning that uses only one kind of Boolean variables – variables representing actions ($a_i^t = True$ if and only if a_i is present in the t-th step of the plan). Compute how many clauses are required for such an encoding.

Exercise 4 (Sliding Puzzle Challenge) [10(+10) points]

Implement a DIMSPEC encoder for the sliding puzzle problem. Your application should take a single command line argument – a string with the initial state of the puzzle (example: "123-480-765", goal state is always "123-456-780", "0" represents the empty slot) and print the sequence of steps required to solve it (movements of the empty slot, in the example above: "DLURD"). The puzzle will have at most 15 pieces (0123456789ABCDEF) and is not necessarily a square.

Some example inputs for testing: "023-145", "1034-9267-D5B8-E6FC", "162-530-478", "012-345-678", "876-543-210", you can create your own inputs, be careful not to create unsatisfiable ones :)

Use Stephan's DIMSPEC solver (called incplan in the IPASIR app package: `https://github.com/biotomas/ipasir`) to solve DIMSPEC files. The best solver (solving the most instances and fastest) will get a bonus of 10 points.

Exercise 5 (Sokoban Challenge) [15(+15) points]

Design and implement a DIMSPEC encoder for Sokoban (`http://en.wikipedia.org/wiki/Sokoban`). You get 15 points for any working encoding. The author of the best encoding receives additional 15 points.

- input/output format: `http://www.sokobano.de/wiki/index.php?title=Level_format`
- benchmark levels: `http://baldur.iti.kit.edu/sat/files/sokoban.zip`
- DIMSPEC solver: incplan app in `https://github.com/biotomas/ipasir`.