**Practical SAT Solving** (ST 2024) Assignment 1

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Algorithm Engineering (KIT) 2024-04-23 – 2024-05-07

## 1 Coloring Competition (Points 7)

Implement SAT based graph vertex coloring solver. Your application should take as a single command line argument a DIMACS file with a graph and find the smallest number of colors needed to color the graph. The application should output the number of colors required. The fastest solver gets seven bonus points. Download and test with the following benchmark instances: `https://github.com/satlecture/kit2024/tree/main/exercises/coloring`

## 2 Sudoku Competition (Points 7)

Write an encoder for the generalized Sudoku puzzle. The generalized Sudoku puzzle of order $n$ is an $n^2 \times n^2$ grid, consisting of $n^2$ sub-blocks of size $n \times n$, to be filled with numbers $1, \ldots, n^2$, such that

- in each row each number occurs exactly once,
- in each column each number occurs exactly once, and
- in each sub-block each number occurs exactly once.

The well-known Sudoku problem[1] is the generalized Sudoku puzzle of order three. The best encoding (solving the most instances and fastest) will get a bonus of seven points. Download and test with the following benchmark instances: `https://github.com/satlecture/kit2024/tree/main/exercises/sudoku`.

## 3 Pythagorean Triples (Points 6)

Find a coloring for the numbers $1 \leq i \leq 1000$ such that no Pythagorean triple is monochromatic. Estimate the number of variables and clauses in the Pythagorean triples encoding from the lecture (as a function of $n$).

## 4 Tseitin Encoding (Points 6)

Encode the following formula into CNF using the Tseitin Encoding. How would the formula look like the Plaisted-Greenbaum Encoding?

$$(\overline{x_1} \wedge \overline{(x_3 \iff x_2)}) \vee ((x_3 \rightarrow \overline{x_4}) \wedge (x_1 \rightarrow (x_2 \wedge \overline{x_3})) \wedge (x_4))$$

[1] `https://en.wikipedia.org/wiki/Sudoku`