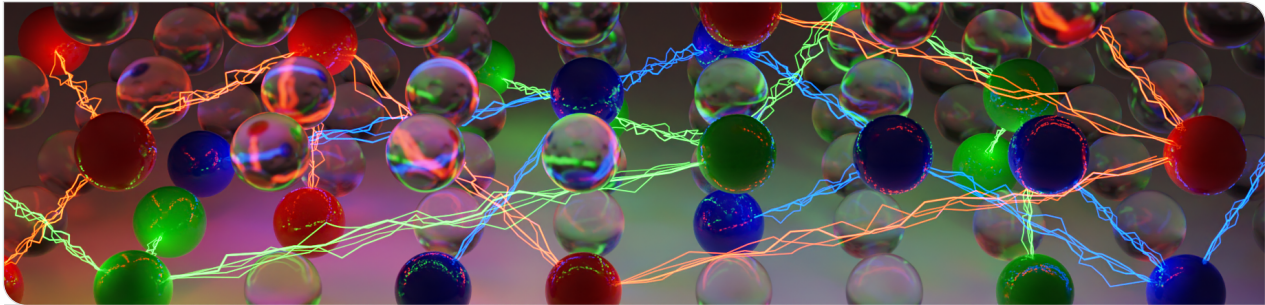# Practical SAT Solving

Exercise 1

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Pigeon Hole Principle

The pigeonhole principle asserts that there is no injective mapping from m pigeons to n holes as long as $m > n$.

Image by https://jineralknowledge.com/

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Assignment 2

The next assignment is for four weeks, so you can get twice as many points as usual.

Competitions: Tetris Puzzle Encoding and Local Search Solver

You can team up with a partner in the competitions. This has some advantages.

- You can discuss the problem with someone else.

- You can split the work.

- You can learn from each other.

- You double your chances of winning the competition.

- You double your chances of getting a bonus.

SLUR Formulas (Čepek et al., 2012)

A CNF formula is SLUR if the SLUR algorithm never gives up on it regardless of the non-deterministic choices in Lines 2 and 8.

Algorithm: Single-lookahead Unit Resolution (SLUR)

$F \leftarrow$ UnitResolution(F)
if $\bot \in F$ **then return** UNSAT
else return SLURSAT(F)

Function: SLURSAT

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1 **if** *all variables appear in a unit clause* **then return** SAT
2 $v \leftarrow$ SelectVariable(F)   // non-det. choice
3 $F_1 \leftarrow$ UnitResolution($F \wedge (v)$)
4 $F_2 \leftarrow$ UnitResolution($F \wedge (\overline{v})$)
5 **if** $\bot \in F_1$ **and** $\bot \in F_2$ **then return** GIVE-UP
6 **if** $\bot \in F_1$ **and** $\bot \notin F_2$ **then return** SLUR(F_2)
7 **if** $\bot \notin F_1$ **and** $\bot \in F_2$ **then return** SLUR(F_1)
8 **return** SLUR(F_1) **non-det. or** SLUR(F_2) // non-det. choice

Properties of SLUR Formulas

- Solvable in polynomial time (using the SLUR algorithm)

- SLUR is an umbrella class for polynomially solvable classes
    - All Horn and Hidden Horn formulas are SLUR formulas
    - Also true for Extended Horn, Balanced, and Propagation Complete formulas

- It is co-NP-complete to recognize whether a given CNF is a SLUR formula or not