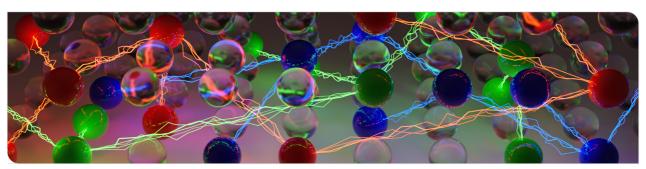




Practical SAT Solving

Exercise 1

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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/





// non-det. choice

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 \text{UnitResolution}(F)
if \bot \in F then return UNSAT
else return SLURSAT(F)
```

Function: SLURSAT

- 1 if all variables appear in a unit clause then return SAT
- 2 $V \leftarrow SelectVariable(F)$
- 3 F_1 ← UnitResolution($F \land (v)$)
- 4 $F_2 \leftarrow \text{UnitResolution}(F \wedge (\overline{V}))$
- 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