SAT/SMT Practical Session (SAT)

Solve and Generate Sudokus

Agenda

- Clone your own pySAT (http://bitbucket.org/lorensi/pysat)

- Solve a sudoku with it (warming up)

- Remove as many clues as possible
  (Ensuring only one solution… That's the trick)

- Bonus
  - Try to measure what makes a Sudoku hard
    (for humans)
  - Is there a limit on the minimal number of clues?
    (you observed)

Very simple CNF encoding of a Sudoku instance

- Variable XYZ means there is Z in cell (X,Y)
- We will have 999 variables
- Input Sudoku is (also) simple:

```
1 2 5
1 3 1
1 6 2
2 2 8
...
```

	5	1			2			
	8			7	4		2	1
		2			8		3	7
	1			5		7		2
2			4		6			8
3		9		2			1	
5	9		7			2		
4	3		2	8			5	
			3			8	7	

Dimacs CNF File Format

- SAT solvers are reading CNF files in DIMACS format:
- Variables indexed from 1 to n
- Negation is - (minus)
- 0 is the end of clause character
- A clause is a set of integers

```
c comment
p cnf 5678 5
1 -3 4 0
42 43 -176 2 0
-1 -2 -3 -4 -5 0
1234 5678 0
-67 0
```

- A special line “p cnf n m” where n is the number of variables and m the number of clauses
(often this line can be omitted (at least in pySAT))