

## CS 499 (Fall 2006)- Assignment 10

Due: Thursday, 11/30/2006

- (1) Write a Sudoku solver using resolution proofs. If you don't know how Sudoku is played yet, check out <http://www.sudoku.com>, for instance. Many examples can be found at <http://www.websudoku.com>. Your solver should be able to solve problems marked as “easy” there within reasonable time, say, a few hours. (Mine, implemented in Java, takes about 20 seconds on easy puzzles, and about 10 minutes to a few hours on medium difficulty ones.)

Here are a few pieces of advice:

1. Try to make the Resolution engine generic. That way, you can apply it to other logic puzzles easily later. I would recommend defining a `class Literal` or so, which encapsulates all the information about the meaning of variables. Based on that, you can then talk about clauses and sets of clauses. It should be pretty easy to separate out the Sudoku specific parts, which is exactly what clauses you start with.
  2. To make it run reasonably fast, you need to be careful about which data structures you use. You want to be able to quickly look up whether a new clause you generated is already among the clauses you have. You also presumably want to be able to keep track of which clauses have already been combined, so you don't do the same work again. And you probably want a way to combine short clauses first, because they are more likely to generate (useful) short clauses. All the while, keep in mind that the number of potential clauses is extremely large. You are explicitly allowed to use STL/Java data structures such as Trees, Hashtables, etc., if they are useful.
- (2) Describe at least two other natural problems that can be conveniently described in propositional logic (and presumably solved using resolution, or other techniques we discuss). List the variables and the formulas necessary. If appropriate, distinguish between the “interesting” formulas, and those that one might take for granted (such as, in our example from class “Each person is at least one of evil, good, or human, but not two”). Notice that the requirement of *natural* and *convenient* are to be taken seriously: in principle, every problem can be written in propositional logic.