

6.034 Recitation - CSP

1. Sudoku-BOT

You are involved as a consultant for a startup that plans to build robots that can automatically solve the Sudoku puzzles in the daily paper. An example of such a puzzle is visible in Figure 1.

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

Figure 1: A Sudoku puzzle.

The rules of the game are that each unfilled box must be filled in with a digit within a particular range (in this case 0..8), such that no two digits appear in the same *row*, *column*, or *region*. Thus, in a solved sudoku puzzle, each row, column and region will have a complete set of digits {0..8}. You plan to apply your newly acquired knowledge about Constraint Propagation algorithms to make your robot able to solve Sudoku puzzles with exceeding speed and grace.

- What do variables represent in your CSP algorithm?
- What are the domains of the variables represented by your CSP algorithm?
- What are the constraints among the variables of your algorithm? What order are they?

2			
	3		
		0	
0		1	

Figure 2: Mini-sudoku. Values of squares constrained to range $\{0,1,2,3\}$

d. Draw a constraint hypergraph for the mini-sudoku puzzle in Figure 2, then solve the puzzle using pure arc-consistency (if possible)

e. For a general Sudoku puzzle of N by N squares using forward checking and most constrained variable reordering, what determines the depth of the search tree? What determines the branching factor at each level?