

# CS151 - Written Problem 1

To be done by: Monday, Sept. 13

1. Sudoku  
(from <http://www-nlp.stanford.edu/grenager/cs121//handouts/hw1.pdf>)

Consider the popular game Sudoku, in which one tries to fill a 9 x 9 grid of squares with numbers subject to some constraints:

- every row must contain all of the digits 1,2, ..., 9
- every column must contain all of the digits 1,2, ..., 9
- each of the 9 different 3 x 3 boxes (look online if you don't know what I'm talking about :) must also contain all of the digits 1, . . . , 9

A game is specified by filling in some of the boxes with numbers (in our case  $M$ ). Each game is guaranteed to have a single solution, that is, there is only one assignment to the empty squares which satisfies all the constraints. For the purposes of this homework, use  $n_{i,j}$  to refer to the number in row  $i$ , column  $j$  of the grid.

- (a) Formalize this problem as an incremental search problem. What are the start state, actions, goal test, and edge costs?
  - (b) What is the branching factor, solution depth, and maximum depth of the search space? What is the size of the state space?
  - (c) Assuming we don't use a heuristic, which of the following would you recommend for solving the incremental search formulation of this problem: DFS, BFS, or Iterative Deepening (ID)? Why?
  - (d) Assuming we use the incremental search formulation, is heuristic search possible? If so, provide a heuristic. If not, why not?
2. Exercise 3.15 (parts a + b)

3. Exercise 3.18
4. Exercise 3.21
5. Exercise 3.23 (if you want more practice with  $A^*$ )