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Artificial Intelligence
Period 9

The Heuristification of a Sudoku Solver

Pre-Processing + Heuristic Function - What is it?

Pre-Processing refers to the initial search through a board for all empty cells that can only be one unique value. That value is then placed inside its respective cell space.

The use of a *heuristic function* refers to assigning an *h-value* to each empty cell in the board given the function $h(r,c) = \text{len}(\text{allowed})$ where **allowed** is a list of values that can possibly be placed in a given cell without disturbing sudoku criteria (same number can't be in same column, row, or square).

The heursitification is applied after the pre-processing so time is saved by not looking at cells that can only possibly be 1 value from the start.

When solving the sudoku, cells are solved in order of the magnitude of the *h-value* from decreasing to increasing. For example, if a cell has $h(r,c) = 2$ and another cell has $h(r,c) = 3$, then the cell with the *h-value* of 2 would be looked at first to place a value inside. *H-values* are recalculated every time a value is placed inside an empty cell.

	Naive	Heuristified
A1-1	A. 0.009048700332641602s B. 260 backtracks C. 1.0	A. 0.0887916088104248s B. 0 backtracks C. 260 / 0 = DNE
A2-1	A. 0.6296072006225586s B. 27917 backtracks C. 1.0	A. 0.8841691017150879s B. 310 backtracks C. 132.94
A3-1	A. 0.24431395530700684s B. 10616 C. 1.0	A. 1.2216367721557617s B. 449 C. 23.64
A4-1	A. 1.0372326374053955s B. 39975 C. 1.0	A. 0.3671257495880127s B. 89 C. 449.16
A5-1	A. 0.15661287307739258s B. 6964 C. 1.0	A. 0.12862586975097656s B. 0 C. DNE
A6-1	A. 1.1162564754486084s B. 49498 C. 1.0	A. 38.52350687980652s B. 10041 C. 4.93
A7-1	A. 93.03974843025208s B. 2482069 C. 1.0	A. 73.11332368850708s B. 16891 C. 146.95
A8-1	A. 876.8942692279816s B. 19029872 C. 1.0	A. 105.1877703666687s B. 24685 C. 770.91