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Project proposal: Nonogram solver

What is a nonogram?

A nonogram is a logic puzzle similar to sudoku. You have a grid of squares, which must be either filled in black or left blank. Beside each row of the grid are hints that list the lengths of the runs of black squares on that row. Above each column are listed the lengths of the runs of black squares in that column. The aim is to find all black squares, which usually reveals some sort of hidden picture at the end. The puzzle can be of various different sizes, and either a square or a rectangle. Here is an example:

		empty Nonogram									
					2	2					
		0	9	9	2	2	4	4	0		
0											
4											
6											
2	2										
2	2										
6											
4											
2											
2											
2											
2											
0											

		solved Nonogram									
					2	2					
		0	9	9	2	2	4	4	0		
0											
4		■	■	■	■	■					
6		■	■	■		■	■	■			
2	2		■	■				■	■		
2	2		■	■				■	■		
6		■	■	■	■	■					
4		■	■	■	■						
2		■	■								
2		■	■								
2		■	■								
2		■	■								
0											

We would like to create a solver for a nonogram, which should be a search algorithm, and then parallelize as much of the algorithm as we can.

One approach could be an exhaustive search and backtracking. This would mean constructing each possibility for a row and then trying each version for the remainder of a puzzle. For example, a row of length 6 with the hint [4] could look like XXXX - -, - XXXX -, or - - XXXX. We could then try a DFS on each possibility, and then fail as soon as some solution doesn't fulfill the constraints. Since this results in a very large game tree, we could consider parallelizing searching this tree. We could also consider solving a lot of nonograms (similar to the sudoku solver we saw in class) in parallel.

We would also want to constrain the size of the nonogram to something manageable like 15x15, and would consider generalizing our solution if time allows.