Cesar Pedroza
Professor Tang
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N-Queen Project Report

My approach the the n queens problem was both the Straight-forward steepest-ascent hill climbing and the genetic algorithm. I made difference classes for Node, puzzleResult, and a helper class for my genetic algorithm. The hill climbing heuristic calculates the intersections of the possible ways that the queens can attack from which are top, bottom, both sides, and the diagonals. This heuristic tries to find the local maximum of the problem but falls short to where it only solves about 14% of all n-queen problems that it attempts. The main point of this heuristic is to see if any queens are attacking each other. If a board has 5 queens attacking each other, the heuristic = 5. Goal is to get a heuristic of 0 which is considered the best move.

The second approach I did was the genetic algorithm which finds a solution by creating a scenario where the best nodes survive. A probability of mutation is entered by the user that's between 0.1 and 1.0 that can modify a node and change its contents. Asks the user for the size of the initial population where all of the possible “chromosomes” (my nodes) come from. We crossover two nodes to “breed” them where they can either lead us closer to a goal by a lot or not at all. That's why we determine how “fit” (seeing the number of attacking queens, lower the better) a node is compared to the whole population. Fittest node of them all is the solution since we would have hit h=0 meaning no queens are attacking each other.

Comparing both algorithms, it seems that the genetic algorithm outshines the steepest hill climbing algorithm in terms of completion rate. It seems that most of the time genetic finds a solution while steepest hill climbing gets confused and thinks it's found a solution even though it failed already getting to the final point. The steepest hill algorithm has genetic algorithm beat in both the amount of moves needed and the runtime for each board.

Using 200 cases on both of the algorithms I found averages of various items:

	Run time (ms)	Moves to Complete	Search Cost (nodes)
Hill climbing	2.107874825	10.36	4316.8
Genetic	95.5547	1346.85	