Using different local search algorithms to solve n queen problem and evaluating their performance:

Assumptions:- In order to simplify the problem, the initial state is assumed to contain one queen in each column. So, the possibility of moving any given queen across the board then reduces to moving the queen within its respective column.

**Changes would be made soon to remove this assumption and provide a more generalized solution*

Experimentation:- 100 different random initial states were generated and then each initial state was passed to the following algorithms for solving the problem:

1. *Hill Climbing First Choice*
2. *Hill Climbing Steepest Ascent*
3. *Hill Climbing Random Restart*
4. *Simulated Annealing (initial_temperature= Integer.MAX_VALUE(in Java) , cooling rate= 0.00001)*

The percentage of problems solved (out of 100) by each algorithm has been depicted in the graph below. It can be noticed that while hill climbing random restart and simulated annealing were able to solve all the problems, hill climbing first choice and hill climbing steepest ascent were not able to solve any problems at all.
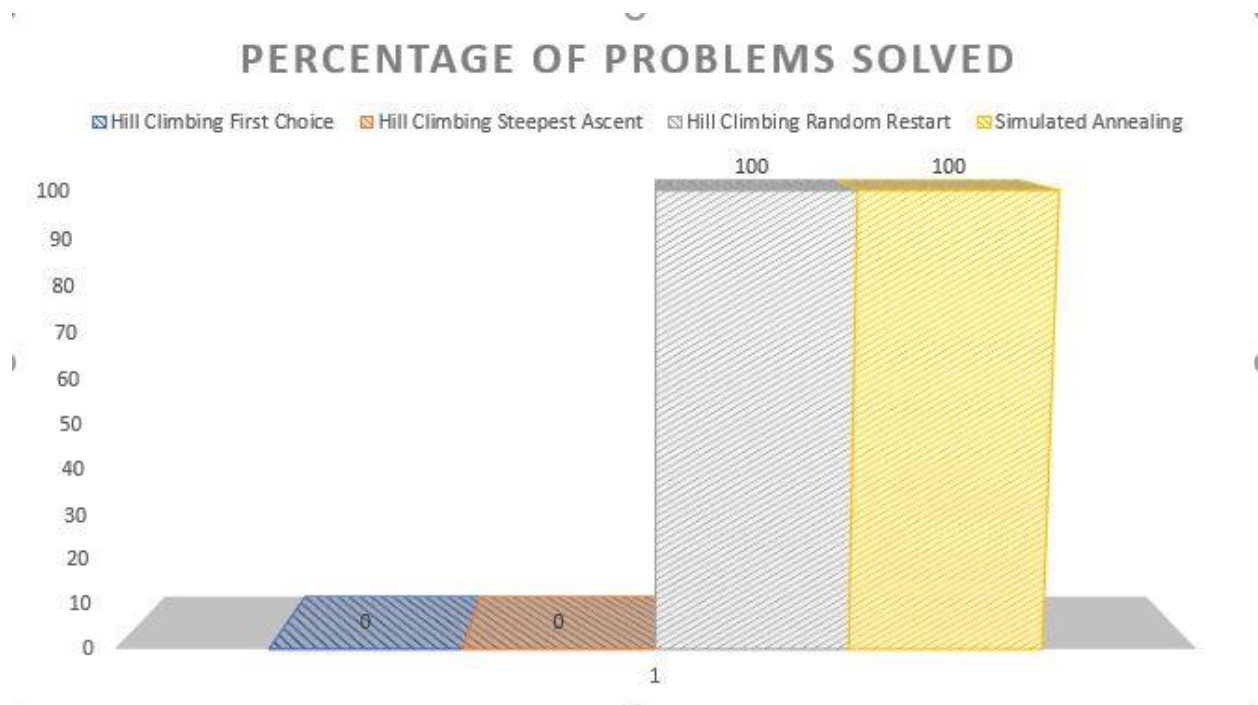
Comparing simulated annealing's performance in this problem to the 8 puzzle problem, a drastic change has been noticed. Here it is able to solve 100% of the problems while in 8 puzzle, it restricted only to 48%. Thus it can be hypothesized that with increasing the number of states in the state space, simulated annealing performs better.

AVERAGE SEARCH COST

Hill Climbing Random Restart Simulated Annealing Optimized algorithm
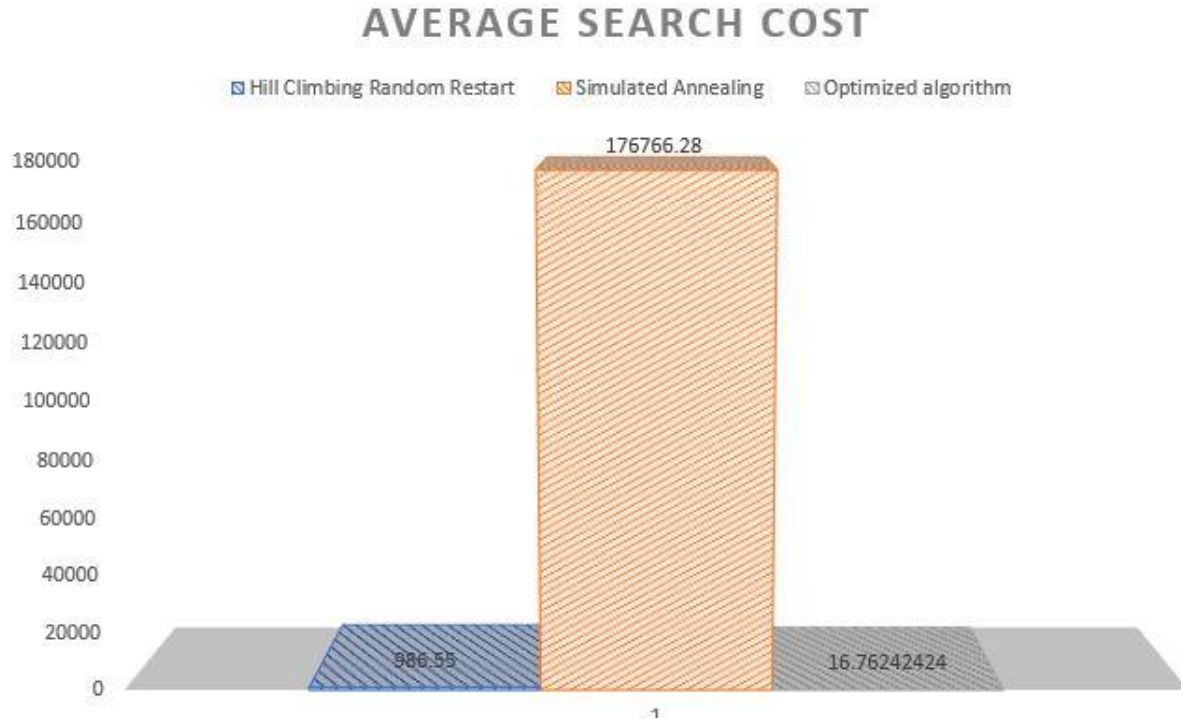
Average number of steps to solve the problem were also compared among the algorithms. Since hill climbing FC and hill climbing SA did not solve any problem, they were not considered for comparison.

It can be seen that hill climbing random restart takes far less steps than simulated annealing and is therefore more efficient for this specific problem. Also, since the number of steps for simulated annealing depend on the initial temperature and the cooling rate, I believe that with appropriate values simulated annealing can perform better.

Conclusion:-

So far, it has been seen that hill climbing random restart was able to solve all the problems and with the least average search cost. Thus, it seems to be the most appropriate algorithm for solving n queen problem.