Local Search:

- Local search techniques works on complete state formulation

- They keep only small number of nodes / state in memory.

* Hill climbing Search
* Simulated Annealing

Hill climbing Search:

- It solves the problems that have many solutions.

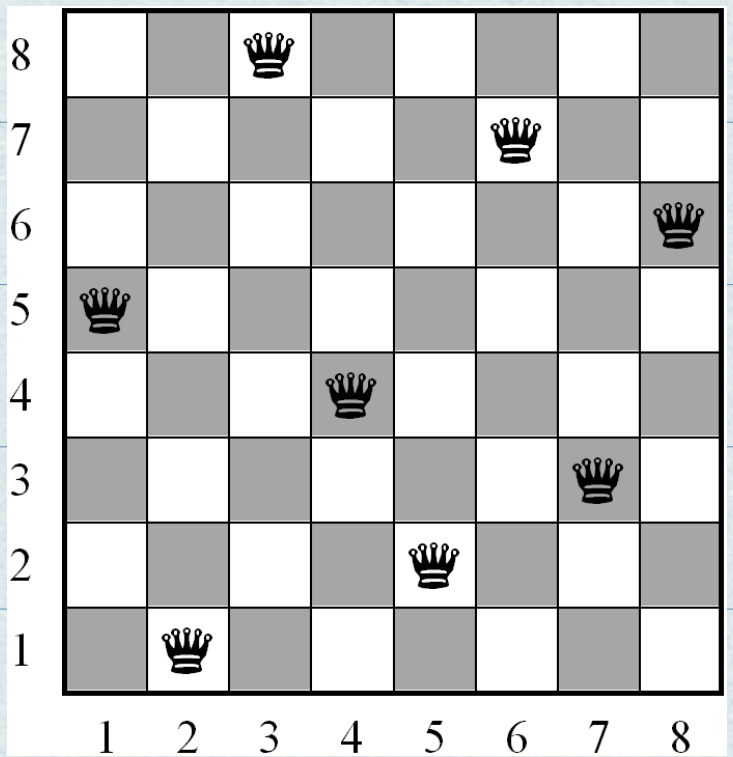
- For example: - 8 queens
  - Graph/ map colouring

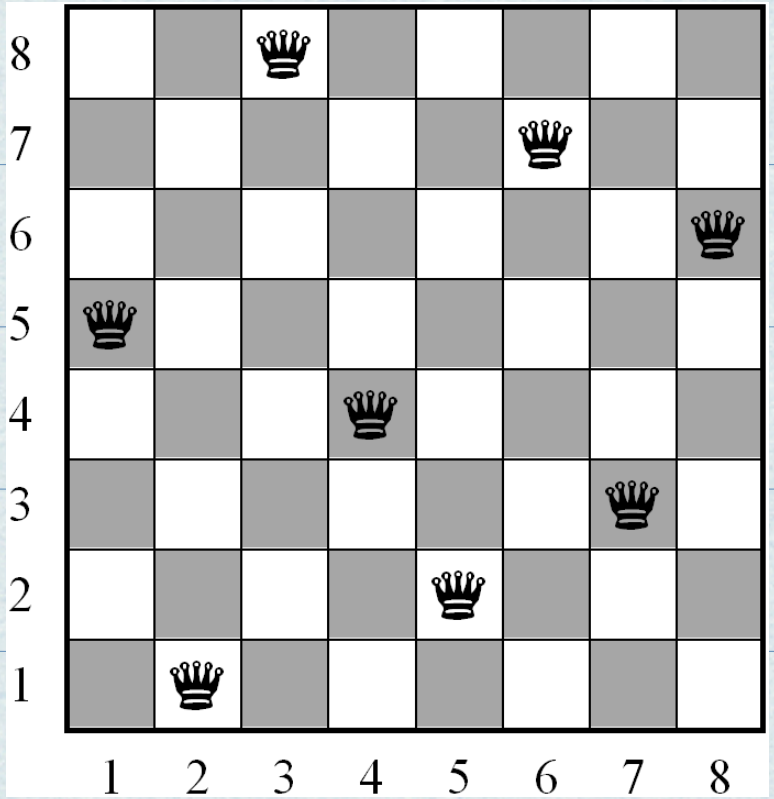
- N queens problem:

Goal: Put n chess queens on n x n board, with no two queens on the same row, column, or diagonal.

chess board configurations:

- goal is initially unknown
- However, as specified by the problem constraints that must satisfy Hill climbing (or gradient ascent/descent)

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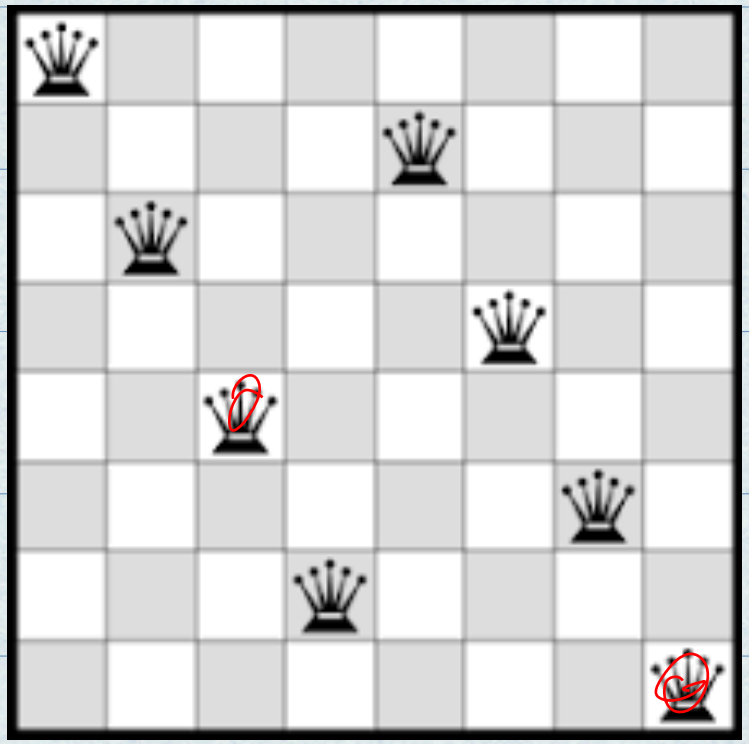


To conclude:

- It start with random (potentially poor solution)
- iteratively makes small changes to solution, each time improving a little
- When algorithm cannot see any improvement anymore, it terminates.

- Hill climbing uses DFS with heuristic measurement.

- It always select most promising successor of the current node.

Algorithm:

1. determine successor of current node
2. choose successor of Maximum goodness
3. if goodness of best successor is less

than current node/state's goodness

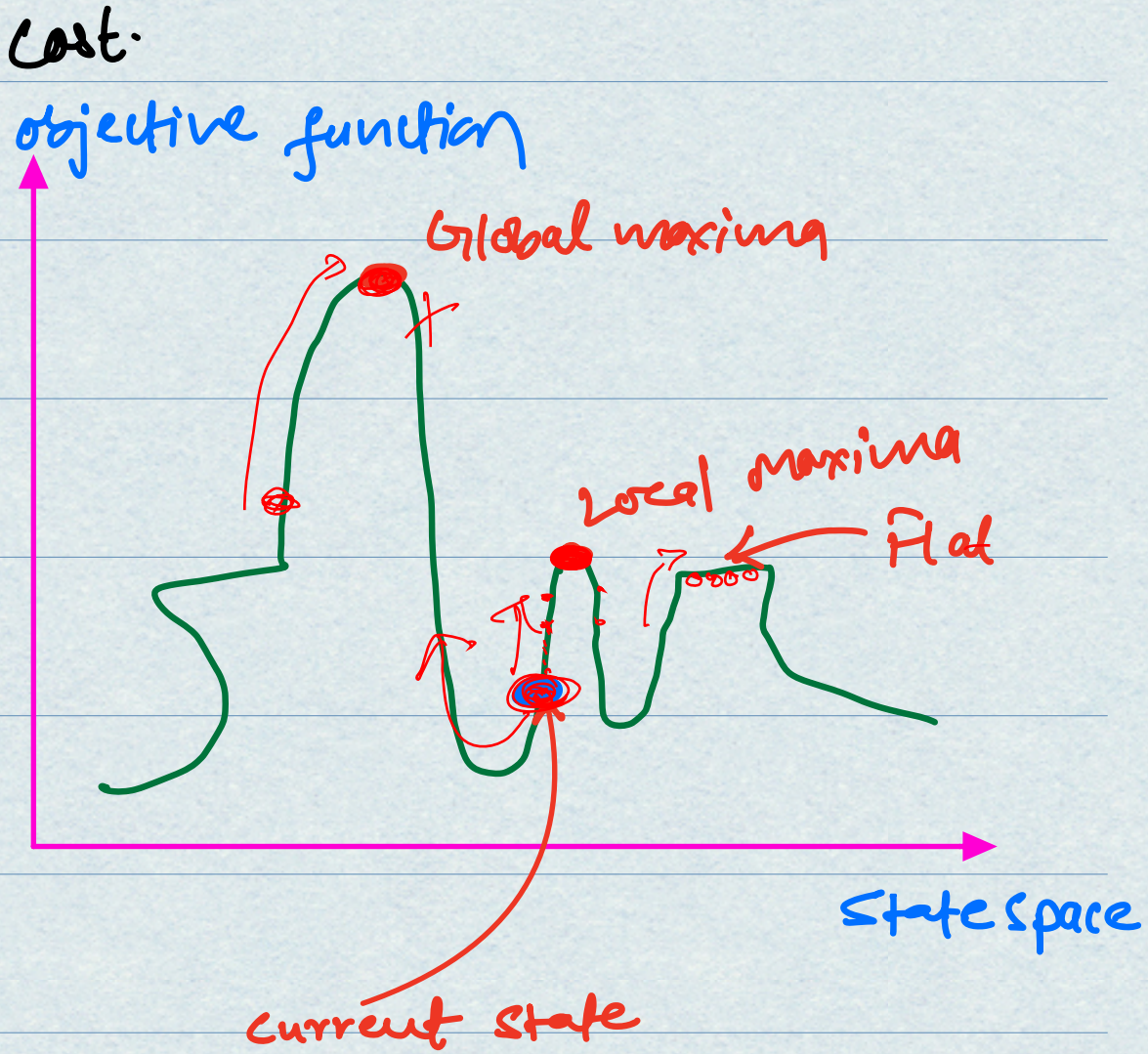
Stop

4. else make best successor the current state & go to step 1.

- No search tree is maintained, only current state/node

- No back tracking

- like greedy approach, moves in the direction which optimizes the



Regions in the state space landscape:

Local Maxima:

- Better than its neighbor states
- But there is other state which is higher that it.

Global Maxima:

- Best possible state/ node of the state space
- Has highest value of objective function

- Current State:

- state where an agent is

currently present

Flat local Maxima:

— where all neighbor state has same value

* Unlike best first search will climb search expand the most promising successor of the node last expanded.

Where as, best first search expands most promising leaf node of the current search tree.

Problems of hill climb search:

- Get stuck at local minima
  + position where there are no better neighbor
  * no guarantee that we found the best solution

- Finding a plateau, this is a situation where search space returns the same evaluation for all the neighbors.

Simulated Annealing:

- Hill-climbing search never move back to lower value.

- This guranteed to be incomplete

- It can get stuck on local maxima

- simulated Annealing is motivated by physical annealing

process in which metal is heated & slowly cooled into a uniform structure.

- Likewise, Simulated Annealing allows downward steps.

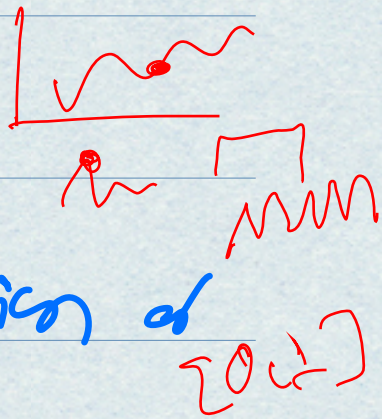
- Simulated Annealing select a move at random & decides whether to accept it.

- If move is better than current position, accept it.

- If move is worse, then accept based on same probability

- probability of accepting worse state is given by,

$P = \text{exponential}(-c/t) > r$



where,

c = change in evaluation of objective fn

t = the current value

r = random number between 0 & 1