

More Complex Search Methods

Local search

- Don't care about paths just want the successful final state
e.g. 8 Queens: only the solution matters
- Don't record paths to states
- Don't even record the set of states that have been reached
- Saves a lot of memory
- Not systematic: may never find some states
- May re-explore some states
- But often finds a good enough solution in an infinite state space

Maybe rather than a global best, we can accept a local best

- Hill climbing
 - Objective function
 - Steepest ascent
 - Eight Queens again
 - Initial state random, one per row
 - Heuristic = number of queens under attack
 - Greedy local search
 - Unlikely to find global maximum
 - Random restarts
 - Simulates annealing, two styles
 - Test random moves, take first that gives an improvement
 - After finding solution, knock the system about a bit.
- Random walks
- Local beam search
 - Start with N random start states
 - Generate all successor states
 - Only keep the best N of them
- Evolutionary or Genetic algorithms
 - e.g. 8 Queens again
 - 8 digit strings, digit = column for each row
 - Many other examples of uses

Non-deterministic actions

Actuator may fail, or real world may intervene
Can't be sure of successor state for each action
e.g. powerful but erratic vacuum cleaner, 8 states

And-or trees

Or node for each action having different possible outcomes
And node because all possible outcomes must be solved
Not really a tree, may have loops

Partially observable environment

- Totally Sensorless
 - Assembly line, sequence of moves will result in correct position
 - Broad spectrum antibiotic instead of blood test first

Sensorless but reliable vacuum cleaner

Start state could be anything, 8 possible

Each action reduces set of possible states (if it works)

Don't always know which actions are legal

Maybe illegal actions have no effect

State spaces can be huge, 2^N instead of N

Sometimes impossible, e.g. 8 puzzle

- Partially broken robot trying to find where it is in a known maze
Percepts are four bits - is there a block in each direction?
- Partially sensorless 15-puzzle with sensor only in top left corner

On-line search

- Off-line means you can work out a solution before doing anything
- On-line, you need to decide after actually making a move
e.g. robot mapping an unknown maze
Can not determine possible actions without actually being there
- Dead ends (not as in a maze), states from which nothing can be done
Some actions may be irreversible
Some state spaces are not safely explorable