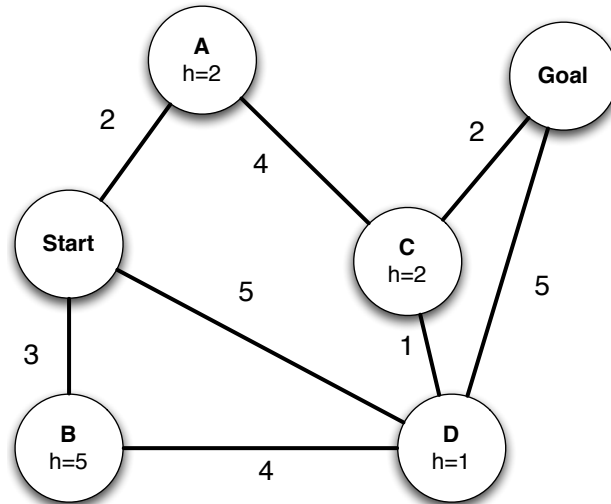


CS188 Fall 2010 Section 1: Search

1 Search algorithms in action

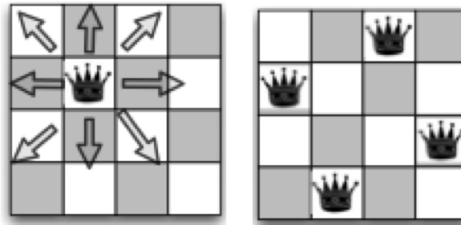


For each of the following graph search strategies, work out the order in which states are expanded, as well as the path returned by graph search. In all cases, assume ties resolve in such a way that states with earlier alphabetical order are expanded first. The start and goal state are S and G, respectively. Remember that in graph search, a state is expanded only once.

- (a) Depth-first search.
- (b) Breadth-first search.
- (c) Uniform cost search.
- (d) Greedy search with the heuristic h shown on the graph.
- (e) A^* search with the same heuristic.

2 n-Queens

Max Friedrich William Bezzel invented the eight queens puzzle in 1848: place 8 queens on a chess board such that none of them can capture any other. The problem, and the generalized version with n queens, has been studied extensively (a Google Scholar search turns up over 3500 papers on the subject).



Queens can move any number of squares along rows, columns, and diagonals (left); An example solution to the 4-queens problem (right).

a) Formulate n -queens as a search problem, using the following state-space representation of: a set of boards, in which each space on the board may or may not contain a queen.

Start State:

Successor Function:

Goal Test:

b) How large is the state space in your formulation?

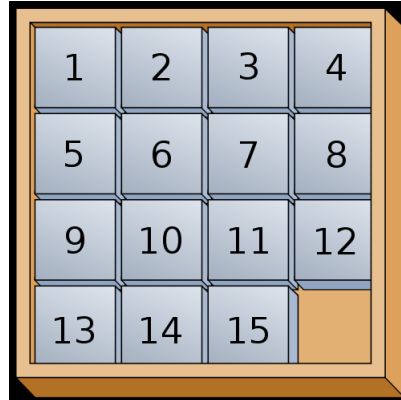
c) One way to limit the size of your state space is to limit what your successor function returns. Reformulate your successor function to reduce the effective state-space size.

d) How large is the state space in your formulation with an efficient successor function?

e) Give a more efficient state space representation. How large is the state space, with and without an efficient successor function?

3 15-puzzle

The puzzle involves sliding tiles until they are ordered correctly. To solve these puzzles efficiently with A* search, good heuristics are important.



- (1) Create a heuristic for the 15-puzzle based on the number of misplaced tiles.
- (2) Create a heuristic using Manhattan distance.
- (3) Explain why your heuristics are admissible.