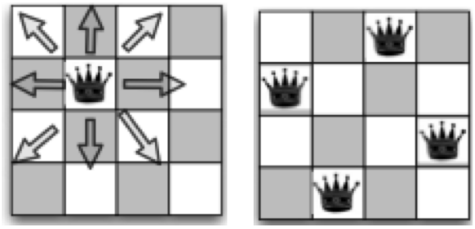
CS188 Spring 2012 Section 1: Search

1 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:

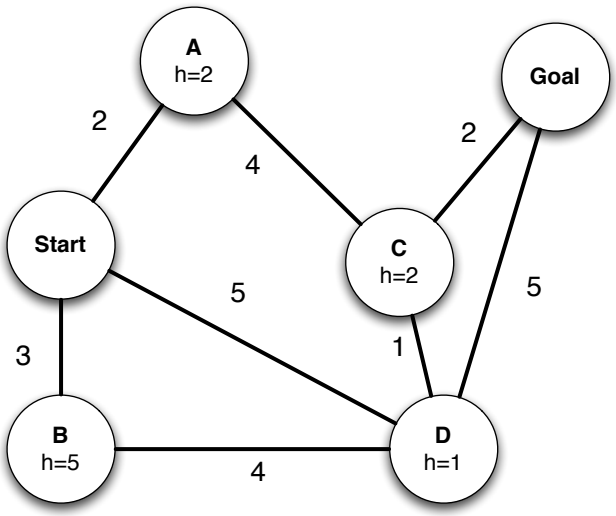
Goal Test:

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) Give a more efficient state space representation.

2 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) $A^\star$ search with the same heuristic.