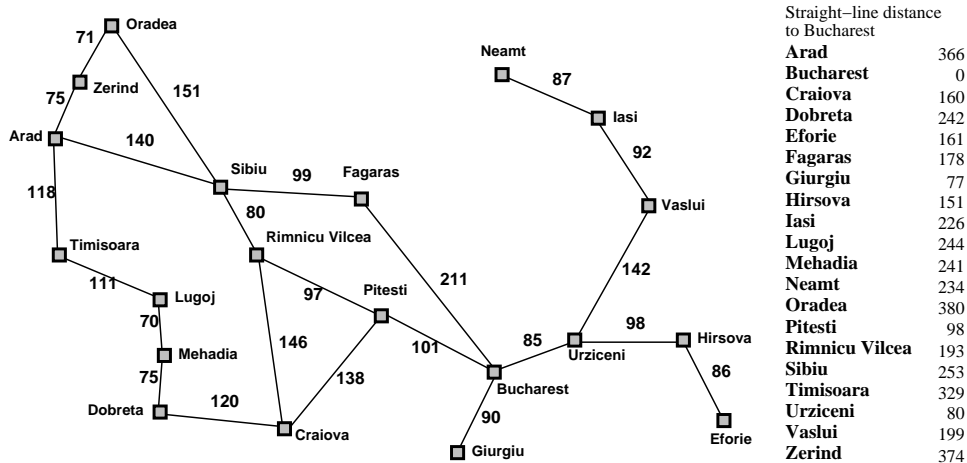


COMP9414: Artificial Intelligence - Exercise Set Week 3

Search

- This exercise concerns the route-finding problem using the Romania map from Russell & Norvig (*Artificial Intelligence: A Modern Approach*) as an example.



Define the route-finding problem (from Arad to Bucharest) as a state space search problem (give short descriptions of the state space, etc. in English). What order are nodes in the state space expanded for each of the following algorithms when searching for a (shortest) path between Arad and Bucharest (when there is a choice of nodes, take the one earliest in the alphabetical ordering)? Make sure you understand the key properties of the different algorithms, as listed below.

To clarify, for breadth-first search, stop the search when the goal state is generated and use a check to ensure that nodes with the same state as a previously expanded node are not added to the frontier. For the other search algorithms, stop the search when the goal state is expanded; for uniform-cost search include a check that nodes with the same state as a previously expanded nodes are not added to the frontier (as in breadth-first search) and a test so that only one node for a given state is stored on the frontier (that with the shortest path to that state), and for depth-first search and its variants use cycle checking along a path to avoid repeated states that may lead to infinite branches.

- (i) Depth-first search (efficient use of space but may not terminate)
- (ii) Breadth-first search (space inefficient, guaranteed to find a solution)
- (iii) Uniform-cost search (similar to breadth-first, but order nodes by cost)
- (iv) Iterative deepening depth-first search (space efficient, but repeated work)
- (v) Greedy best-first search (efficient, not guaranteed optimal solution)
- (vi) A* search with straight-line distance heuristic (inefficient, guaranteed optimal solution)

Which algorithm is suitable in practice for solving route-finding problems such as this?