

Artificial Intelligence

Exercises week 1 - Search

COMP3411/9814

Question 1: Romanian map

This exercise uses the route-finding example with the Romanian map from Russell & Norvig (Artificial Intelligence: A Modern Approach). See Fig. 1.

For the route from Arad to Bucharest, in what order are nodes in the state space expanded for each of the following algorithms when searching for the shortest path between Arad and Bucharest? Where there is a choice of nodes, take the first one alphabetically. Make sure you understand the key properties of the different algorithms, as listed below.

1. Depth-first search.
2. Breadth-first search.
3. Uniform-cost search.
4. Greedy best-first search.
5. A* search.

Question 2: Relationships between search strategies

Prove each of the following statements, or give a counterexample:

1. Breadth First Search is a special case of Uniform Cost Search.

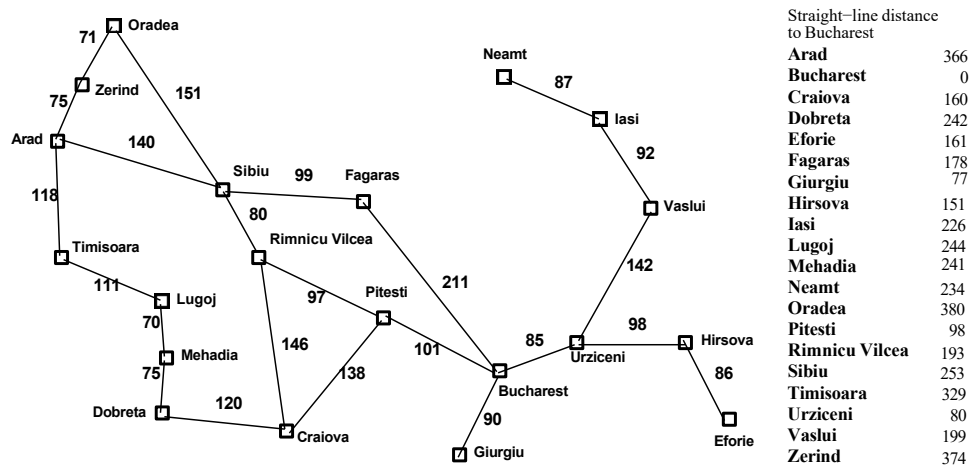


Figure 1: Romanian map from Russell & Norvig (Artificial Intelligence: A Modern Approach).

2. Breadth First Search, Depth First Search and Uniform Cost Search are special cases of best-first search.
3. Uniform Cost Search is a special case of A*Search.

Question 3: Modified Romanian map

Suppose in Question 1, the heuristic value for Fagaras is 176 rather than 178, and the value for Pitesti is 100 rather than 98. What difference does this make?

Question 4: Path search

Consider the task of finding a path from start state S to goal state G , given the distances and heuristic values in Fig. 2.

For each of the following strategies, list the order in which the states are expanded. Whenever there is a choice of states, you should select the one that comes first in alphabetical order. In each case, you should skip any states that have previously been expanded, and you should continue the search until the goal node is expanded.

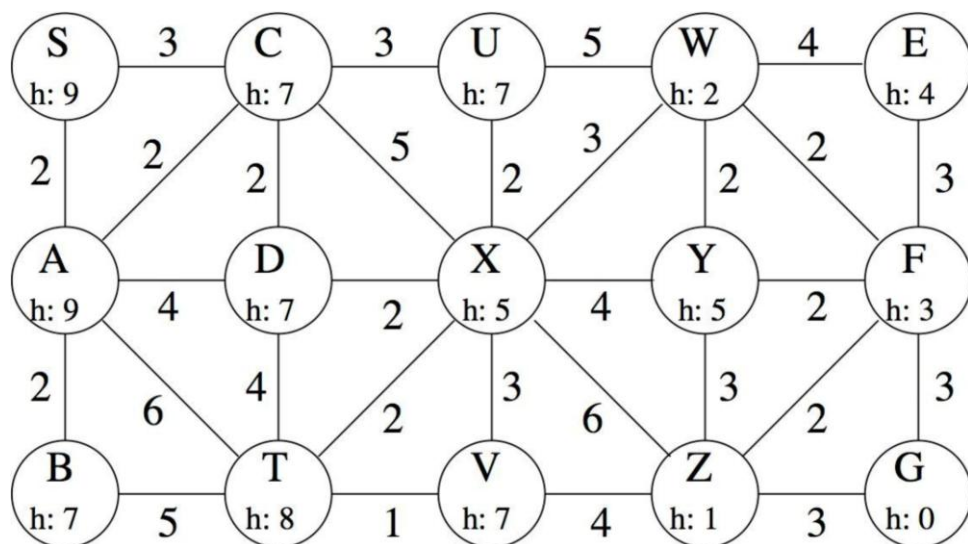


Figure 2: Path search.

1. Depth-first search.
2. Breadth-first search.
3. Uniform-cost search.
4. Greedy best-first search.
5. A* search.