

COMP9414: Artificial Intelligence - Solutions Week 3

Search

1. State space: set of cities on Romania map

Initial state: Arad

Successor function: $s(x)$ is the set of cities adjacent to x on the map

Goal state: Bucharest

Path cost: Sum of the costs of distances between the cities on the path

- (i) (Depth-first) Arad, Sibiu, Fagaras, Bucharest (note that the solution is found on the first branch only because of the rule for ordering the successors alphabetically; this is not usually the case!)
- (ii) (Breadth-first) Arad, Sibiu, Timisoara, Zerind, Fagaras, Bucharest (assuming that the search stops once the goal state is generated and that when expanding a node, previously expanded nodes are checked to ensure that nodes with repeated states are not generated, e.g. Arad which is generated via the paths Arad \rightarrow Sibiu \rightarrow Arad and Arad \rightarrow Sibiu \rightarrow Oradea \rightarrow Zerind \rightarrow Arad)
- (iii) (Uniform-cost) Arad (0), Zerind (75), Timisoara (118), Sibiu (140), Oradea (146), Rimnicu Vilcea (220), Lugoj (229), Fagaras (239), Mehadia (299), Pitesti (317), Craiova (366), Dobreta (374), Bucharest (418) (this time assuming that nodes with the same state but different costs are expanded only once, for the lowest cost, so ignore Oradea (291) reached via Sibiu, and Sibiu (297) reached via Zerind and Oradea)
- (iv) (Iterative deepening) Arad, Arad, Sibiu, Timisoara, Zerind, Arad, Sibiu, Fagaras, Oradea, Rimnicu Vilcea, Timisoara, Lugoj, Zerind, Oradea, Arad, Sibiu, Fagaras, Bucharest (assuming a cycle check on each path, so omit Arad reached via Arad \rightarrow Sibiu \rightarrow Arad)
- (v) (Greedy) Arad (366), Sibiu (253), Fagaras (178), Bucharest (0)
- (vi) (A*) Arad (366), Sibiu (393), Rimnicu Vilcea (413), Pitesti (415), Fagaras (417), Bucharest (418) (unexpanded states on the frontier are Timisoara (447), Zerind (449), Craiova (526), Oradea (671)) – for example, $f(\text{Rimnicu Vilcea}) = g(\text{Rimnicu Vilcea}) + h(\text{Rimnicu Vilcea}) = 140 + 80 + 193 = 413$