INFORMED SEARCH

A search*

A* SEARCH

- Evaluates nodes by combining g(n), the cost to reach the node, and h(n), the cost to get from the node to the goal.

$$f(n) = g(n) + h(n)$$

g(n) = Path cost from the initial state to node n

h(n) = Estimated cost of shortest path from n to a goal state

f(n) = Estimated cost of the best path that continues from n to a goal state.

- Complete and Optimal
- Identical to Uniform-cost search except A* uses g+h instead of g.

CONDITIONS FOR OPTIMALITY

- Admissibility: An admissible heuristic is one that never overestimates the cost to reach a goal. Optimistic!

- Consistency: A heuristic function h(n) is consistent if, for every node n and every successor n' of n generated by an action a, we have:
  - $h(n) \leq c(n, a, n') + h(n')$

GRAPH (MAP OF ROMANIA)

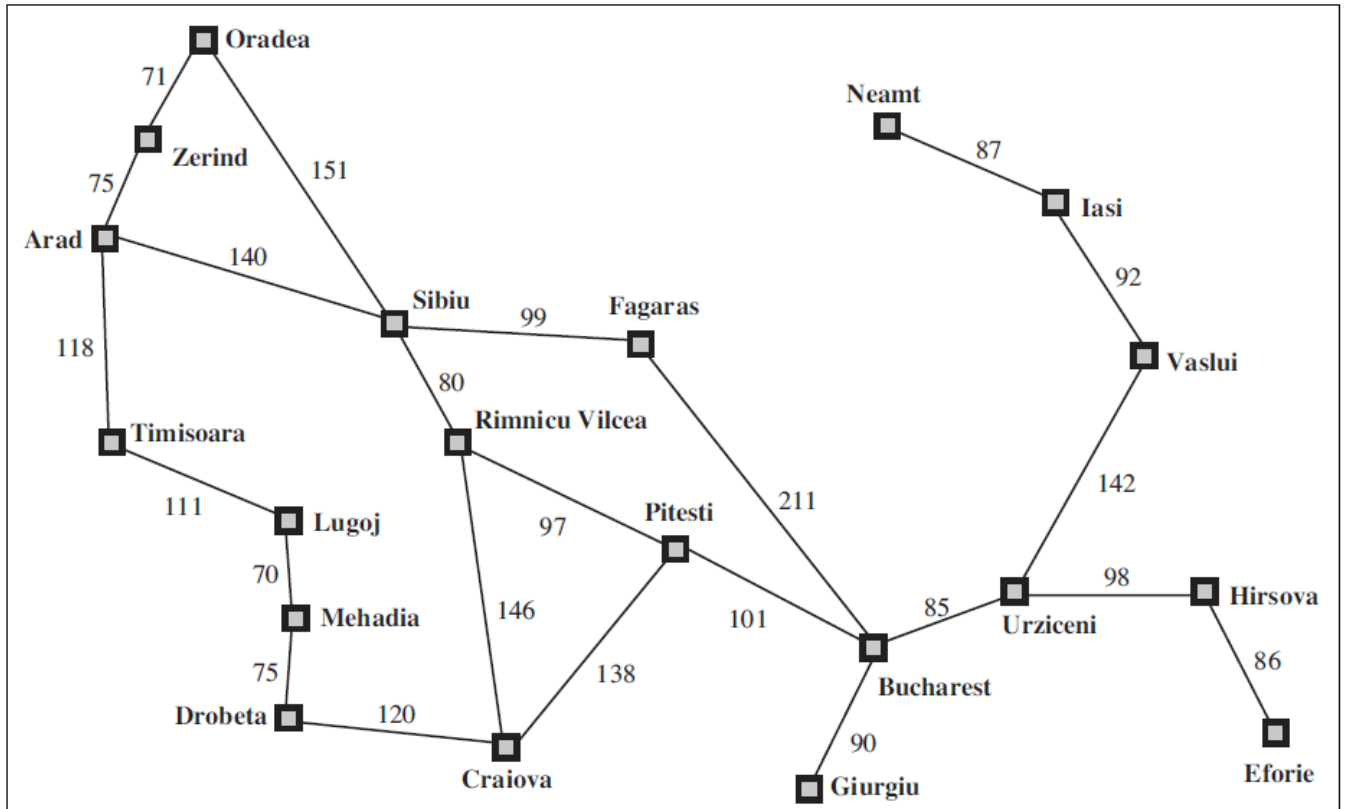

Figure 3.2 A simplified road map of part of Romania.

H_{LSD} (STRAIGHT LINE FUNCTION)

Arad	366	**Mehadia**	241
Bucharest	0	**Neamt**	234
Craiova	160	**Oradea**	380
Drobeta	242	**Pitesti**	100
Eforie	161	**Rimnicu Vilcea**	193
Fagaras	176	**Sibiu**	253
Giurgiu	77	**Timisoara**	329
Hirsova	151	**Urziceni**	80
Iasi	226	**Vaslui**	199
Lugoj	244	**Zerind**	374

Figure 3.22 Values of h_{SLD}—straight-line distances to Bucharest.

Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
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Eforie	161	Rimnicu Vilcea	193
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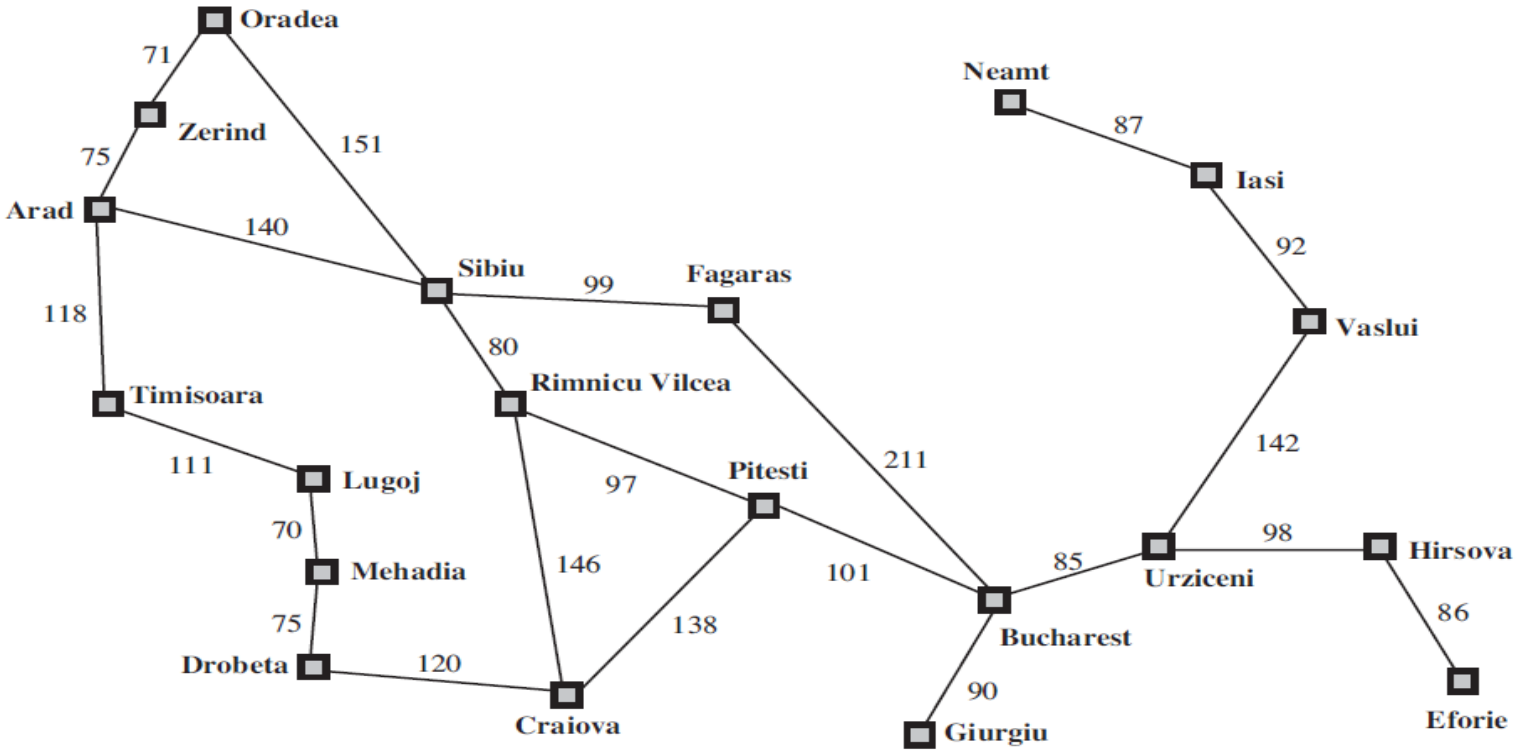


Figure 3.2 A simplified road map of part of Romania.

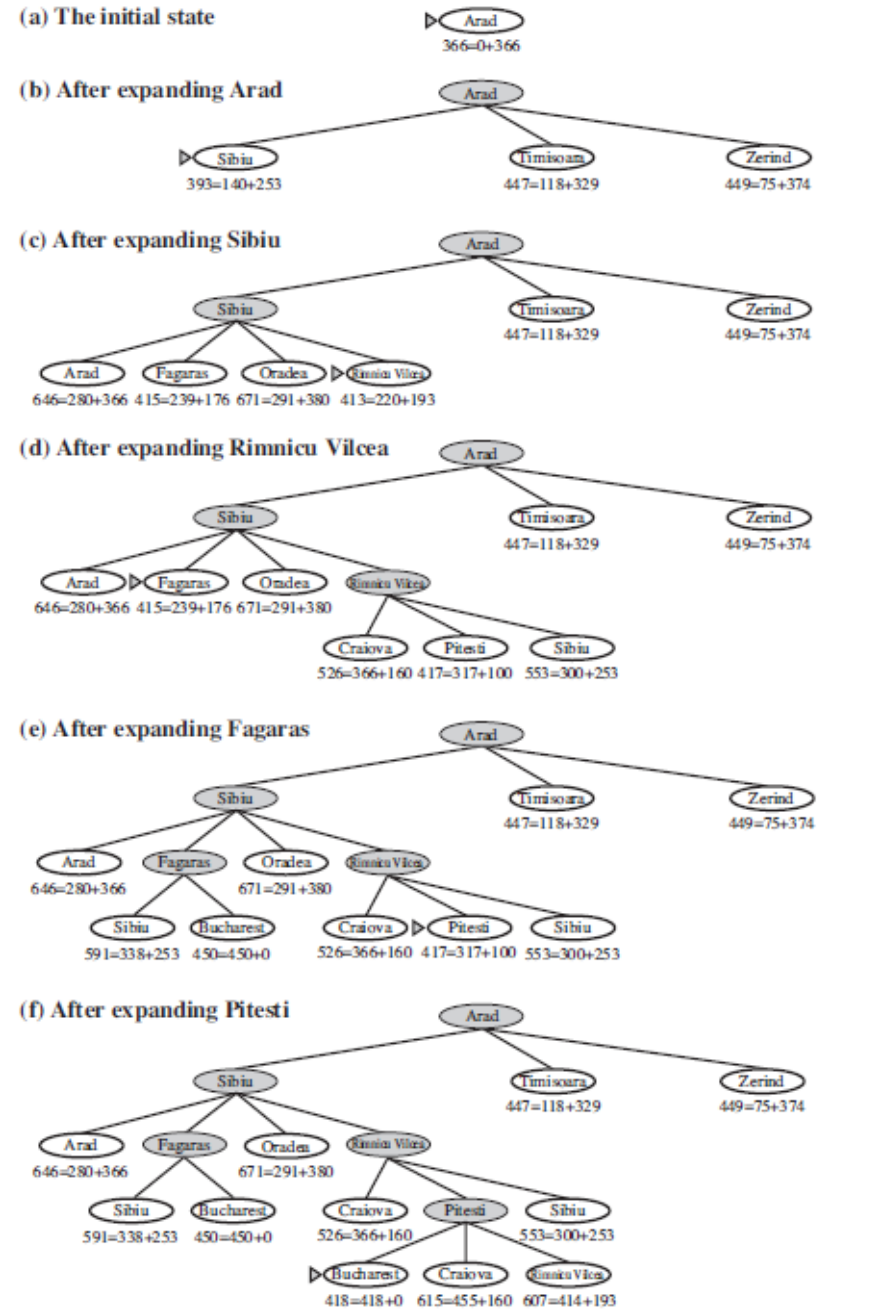
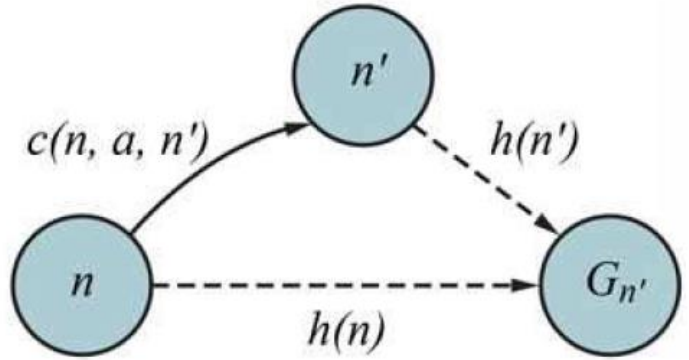


Figure 3.24 Stages in an A* search for Bucharest. Nodes are labeled with $f = g + h$. The h values are the straight-line distances to Bucharest taken from Figure 3.22.

CONDITIONS FOR OPTIMALITY: CONSISTENCY (MONOTONICITY)

$$h(n) \leq c(n, a, n') + h(n')$$



- Triangle inequality
- Each side of the triangle cannot be longer than the sum of the other two sides.

- Generally, all admissible functions are Consistent!

A* TREE SEARCH CHALLENGE

- Large memory space requirement