

Outline

Informed search (using domain-specific hints about the goal)

I. Greedy best-first search

II. A* search

I. Informed (Heuristic) Search

Use of domain-specific hints about the location of a goal can find a solution more efficiently.

Heuristic function:

$h(n)$ = *estimated* cost of the cheapest path from the state at node n to a goal state

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e.g., straight-line distance h_{SLD} on the map between two sites

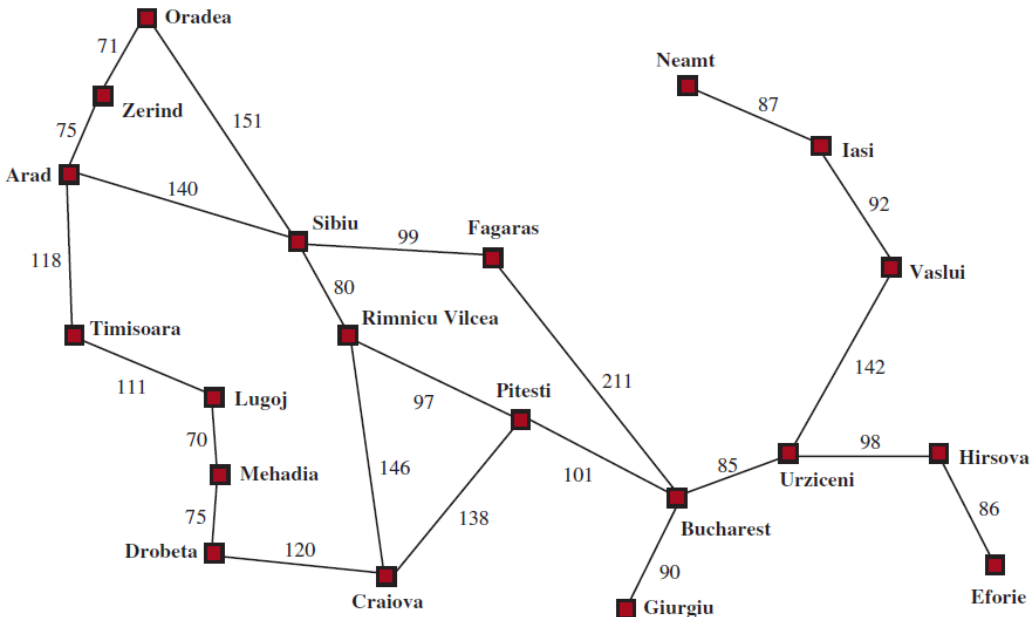
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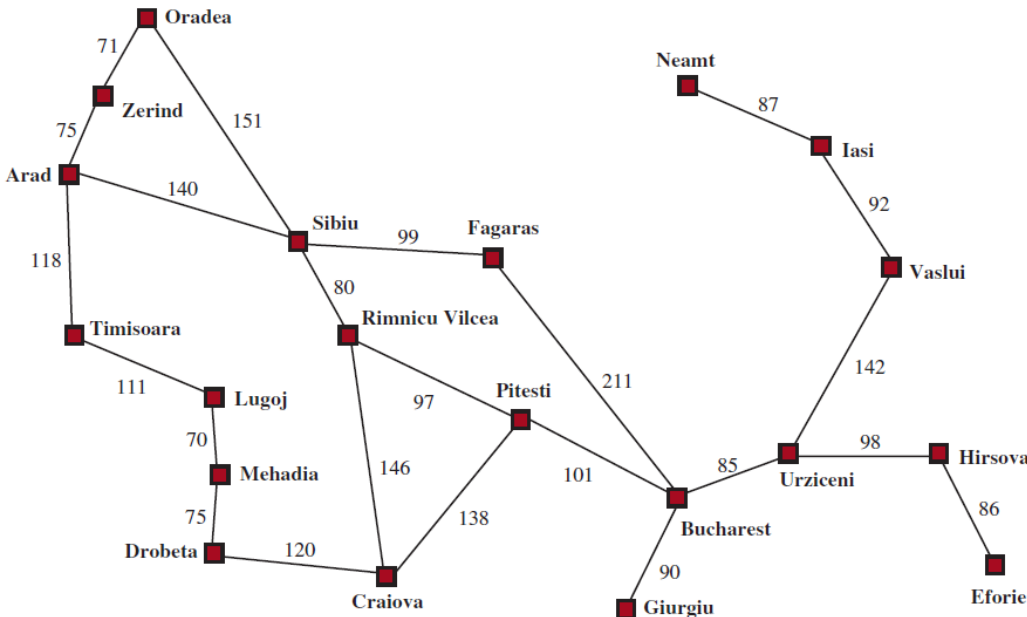
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Straight-line distance to Bucharest

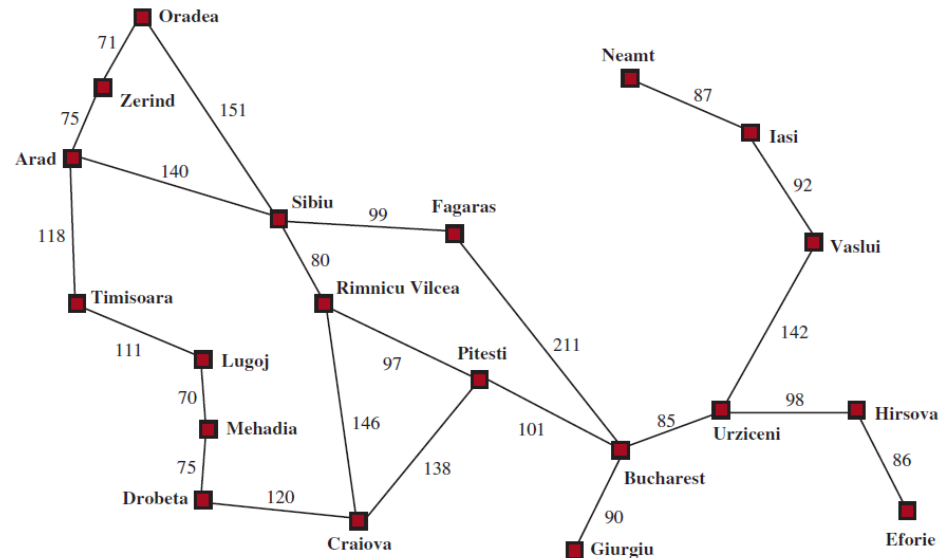
Greedy Best-First Search

Evaluation function $f(n) = h(n)$

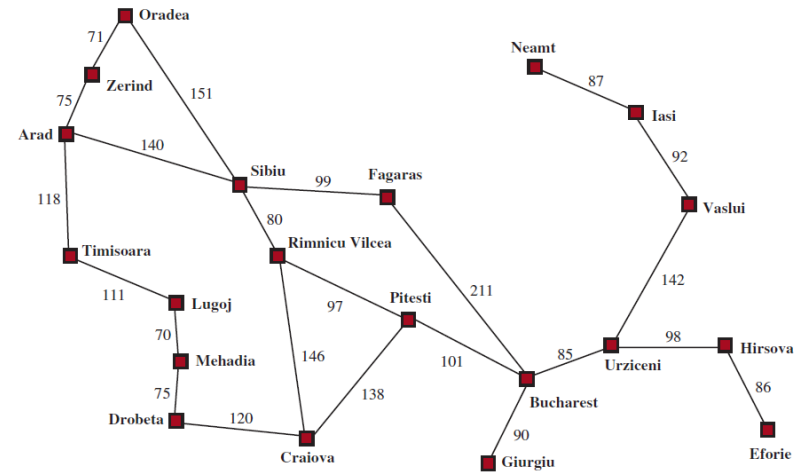
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$$f(n) = h_{SLD}(n)$$

Good correlations with road distances

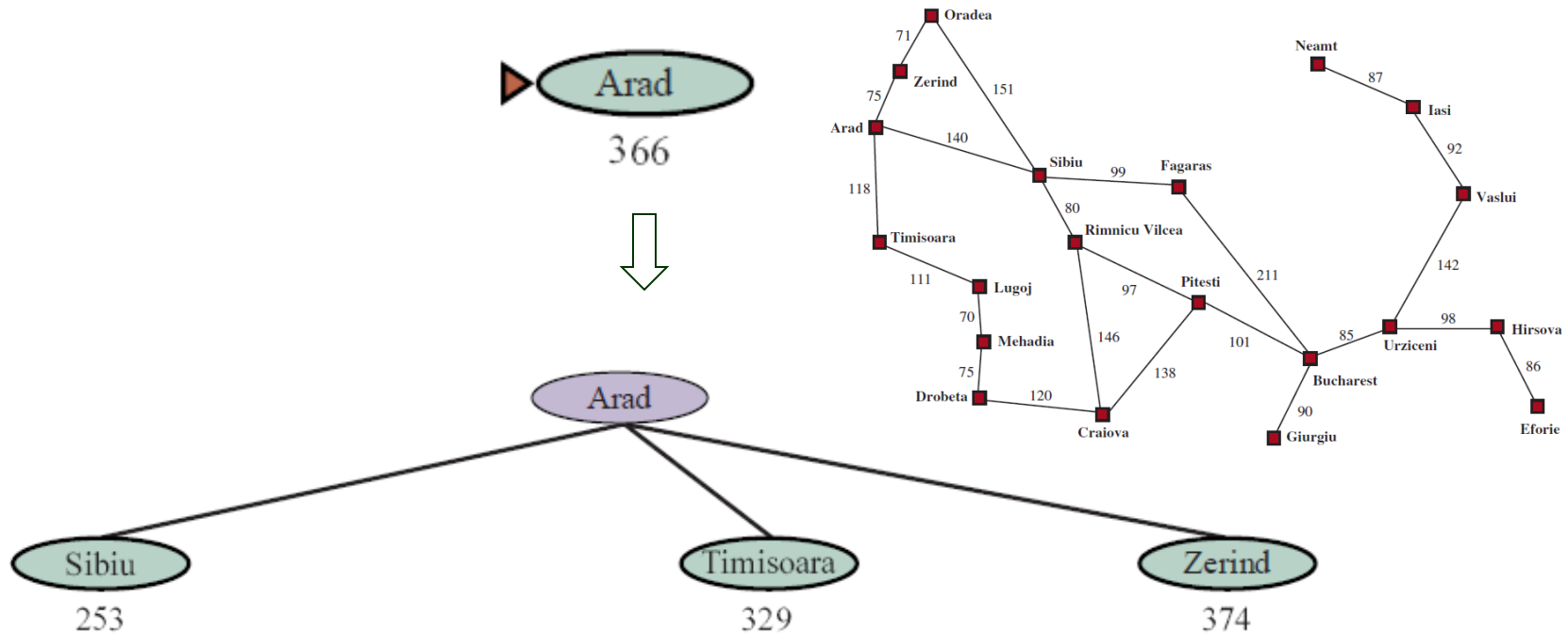


Greedy Search for Bucharest



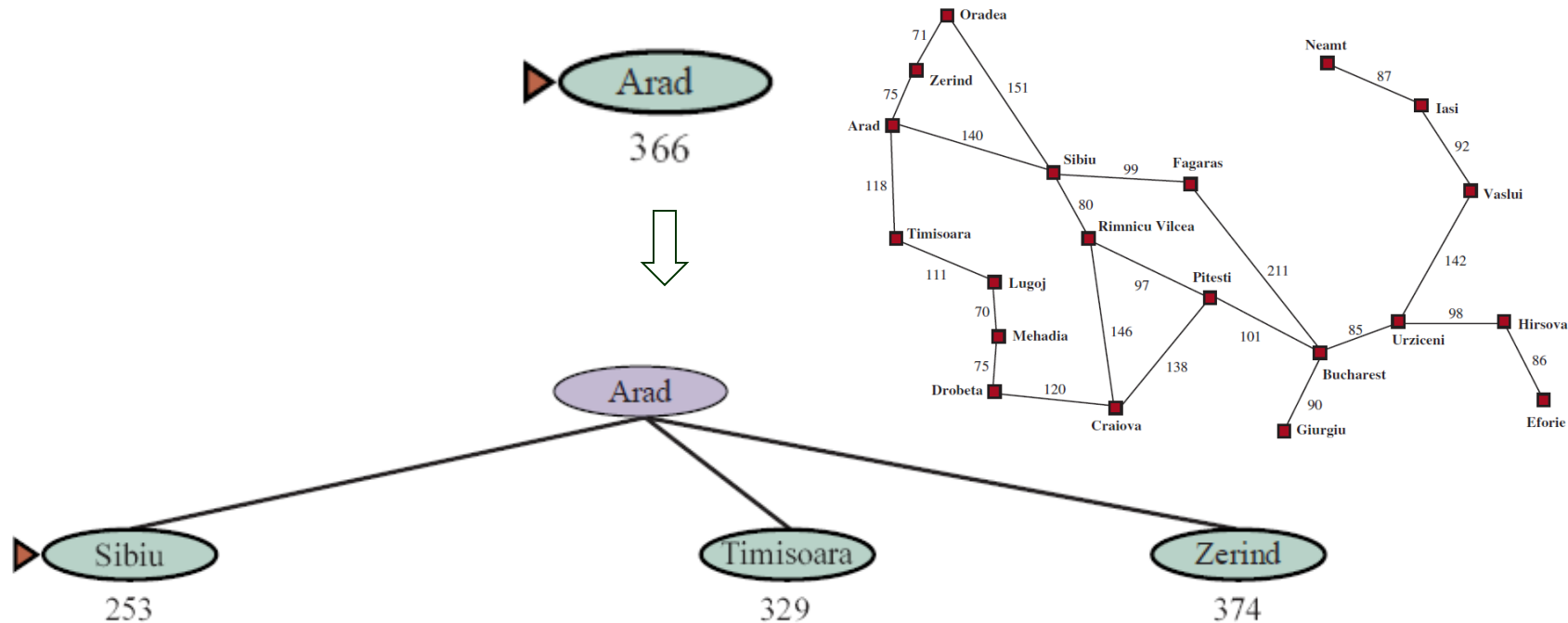
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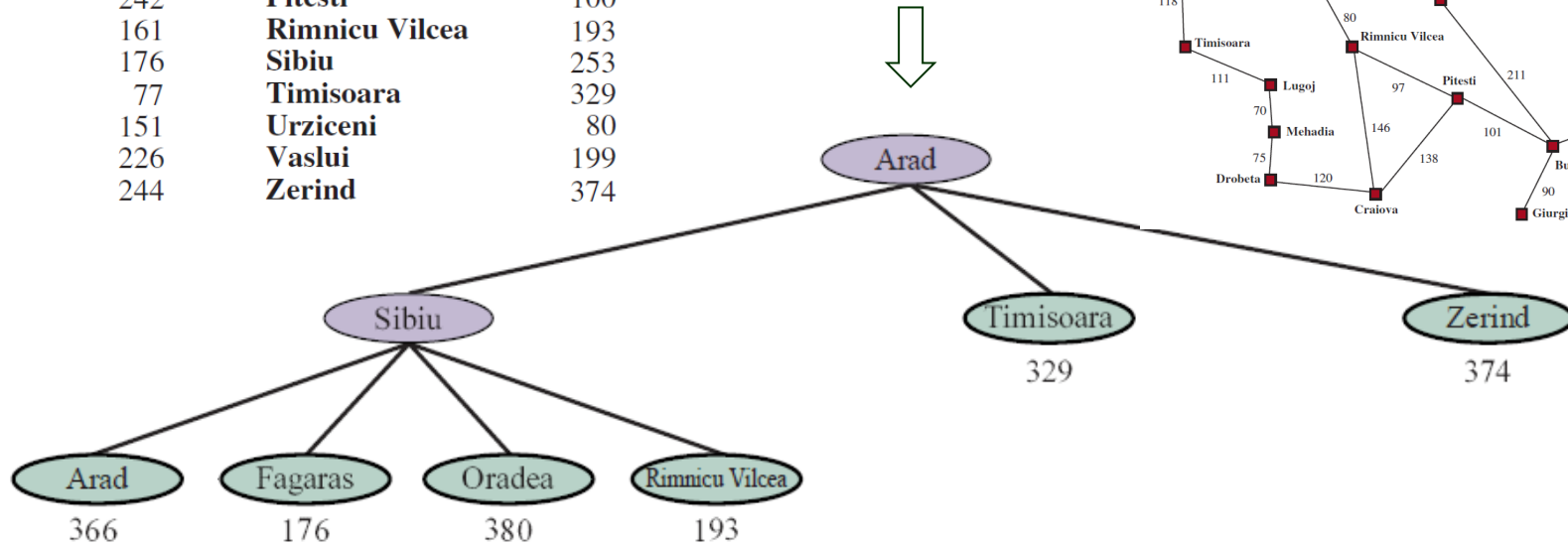
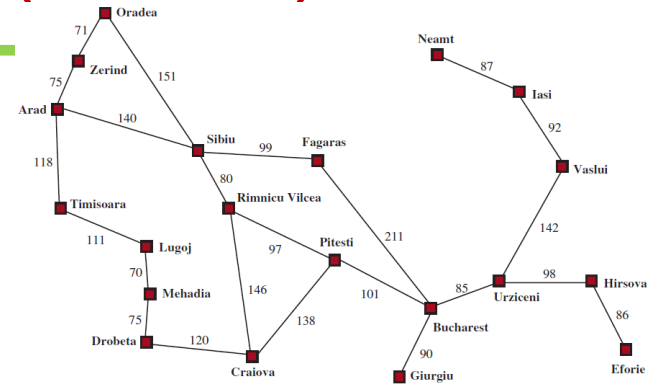


Closer to Bucharest
than is Zerind or Timisoara

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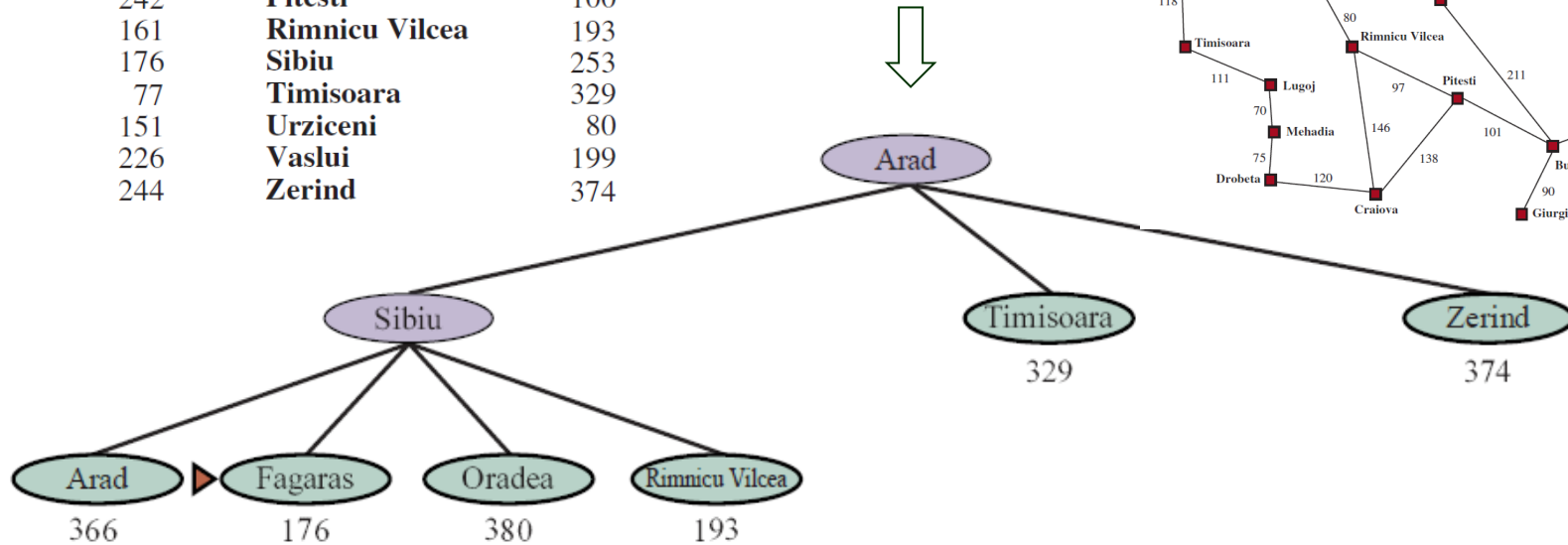
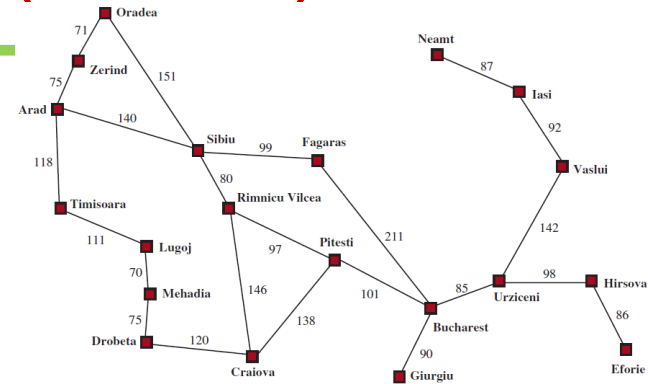
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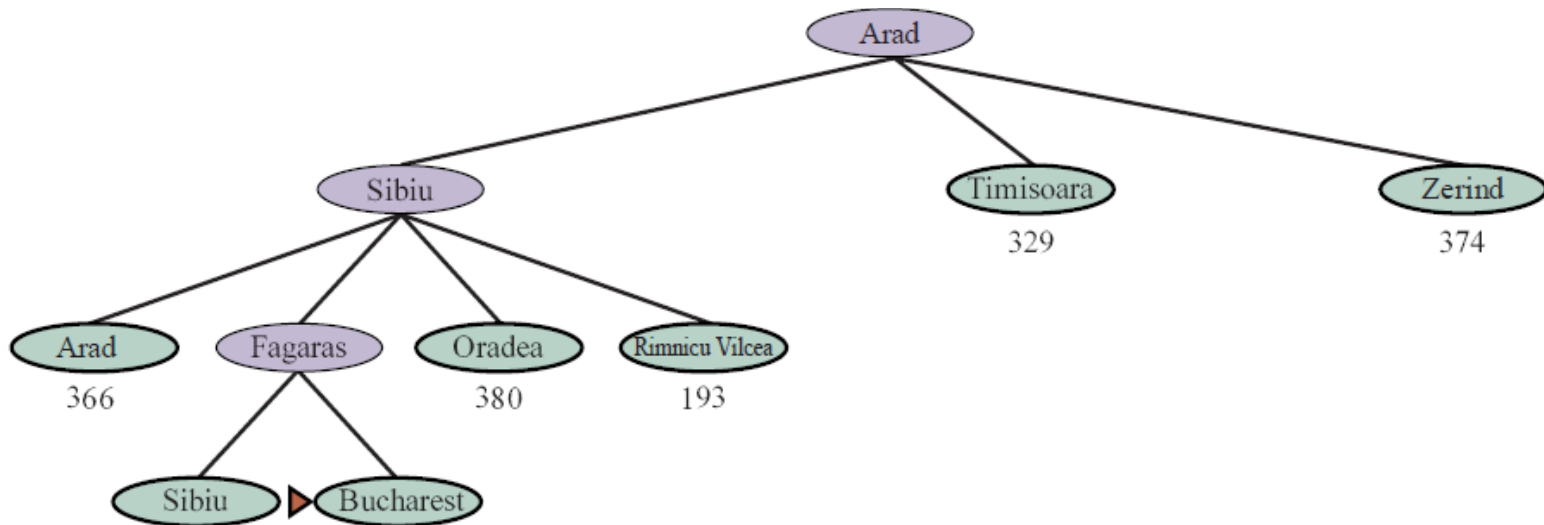
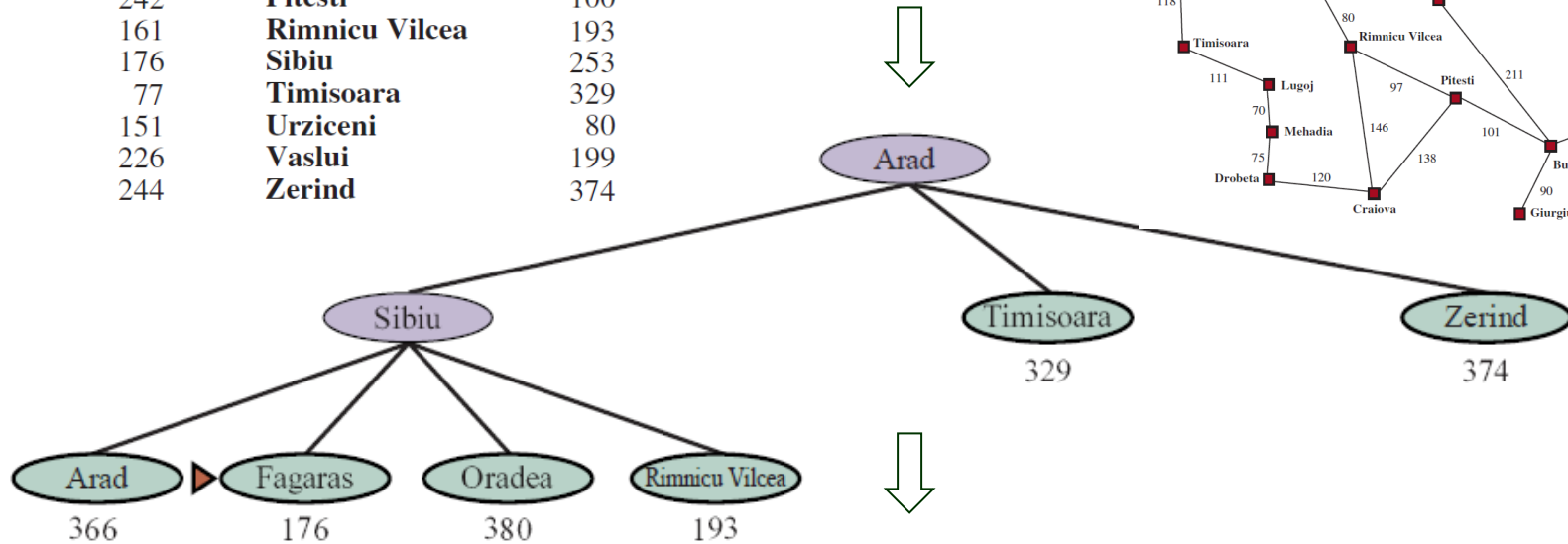
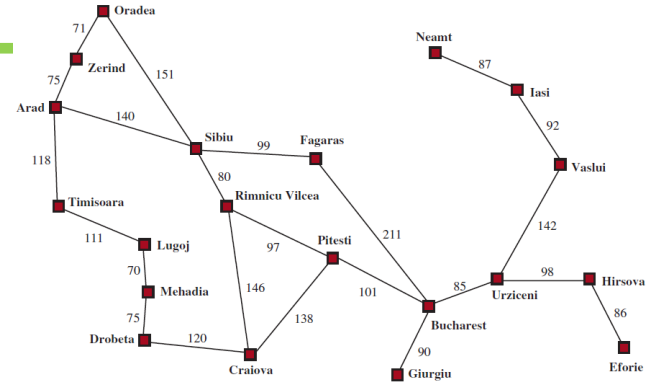
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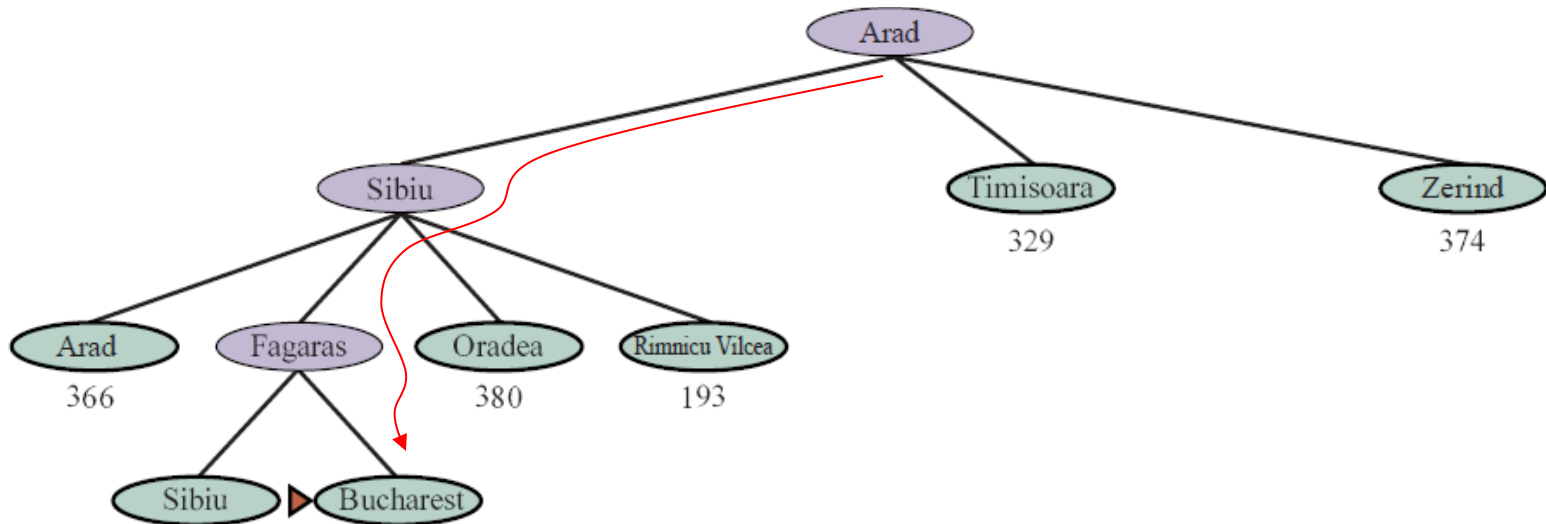
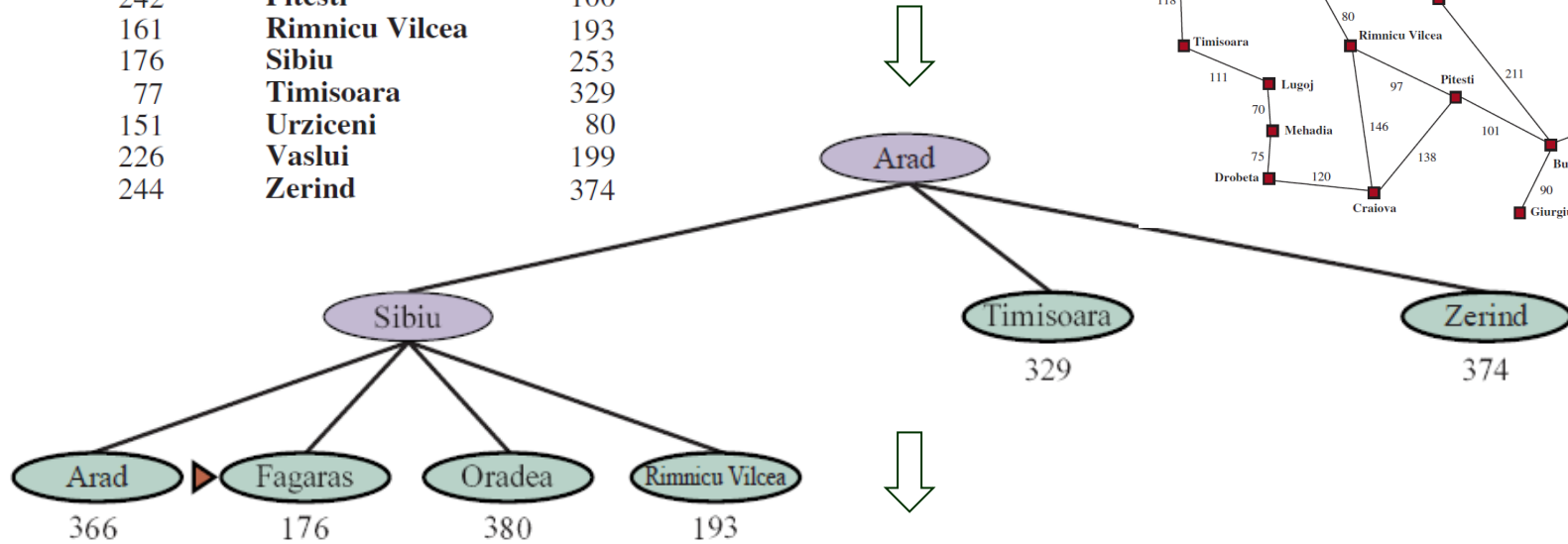
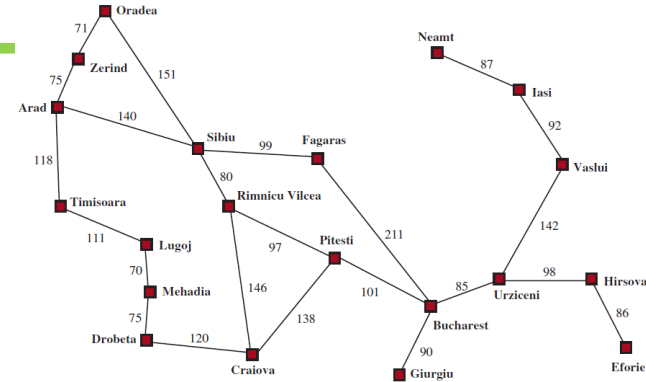
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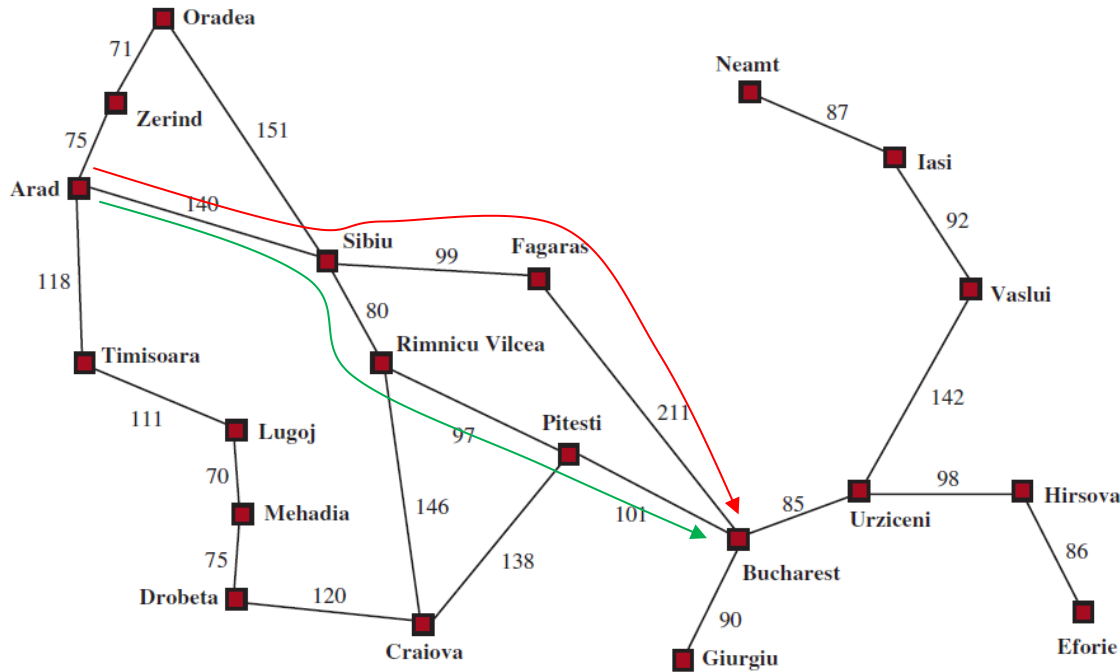


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Greedy \neq Optimal



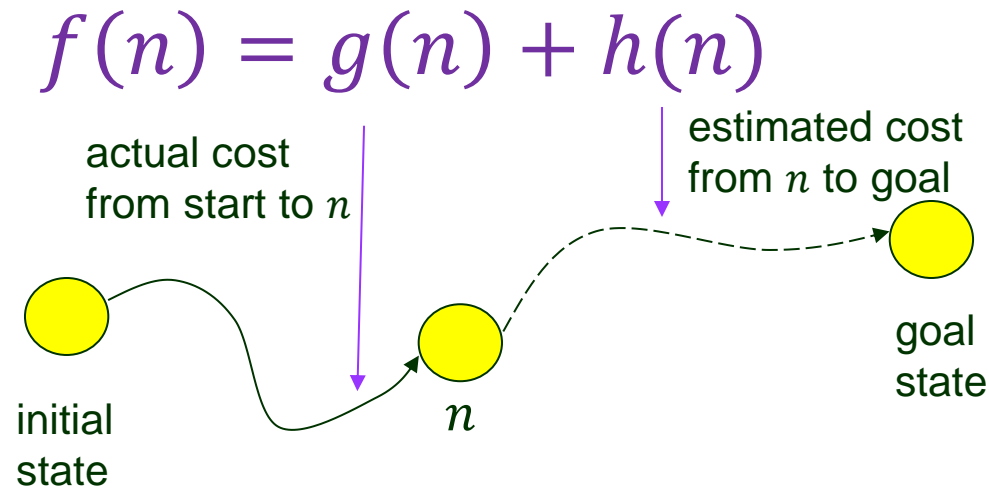
Greedy solution: **Arad – Sibiu – Fagaras – Bucharest** (450)

Optimal solution: **Arad – Sibiu – Rimnicu Vilcea – Pitesti – Bucharest** (418)

This greedy strategy does *not* account for the cost to get to the current state.

II. A* Search

P. E. Hart, N. J. Nilsson, and B. Raphael (1968)



$f(n)$: **estimated cost** of the best path that continues from n to a goal.

A* on Route Planning

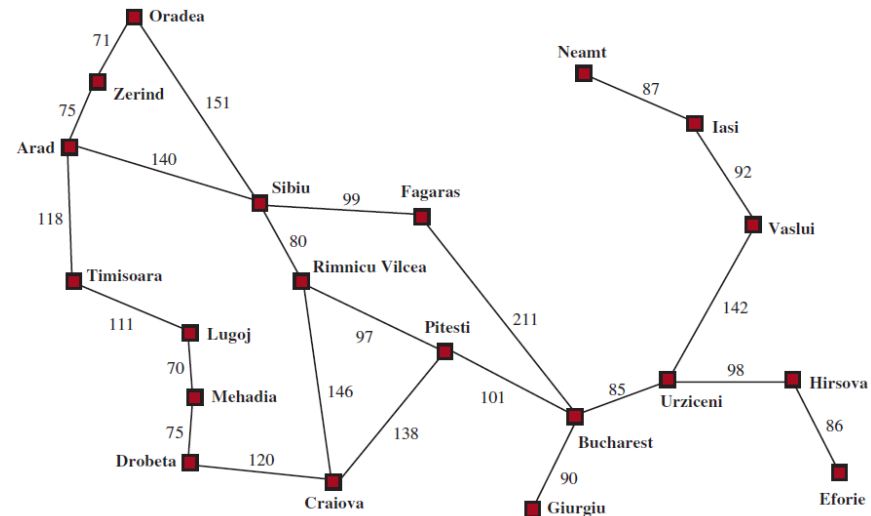
$$f(n) = g(n) + h_{SLD}(n)$$



$$366 = 0 + 366$$

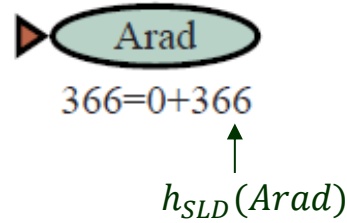
h_{SLD} : straight-line distance

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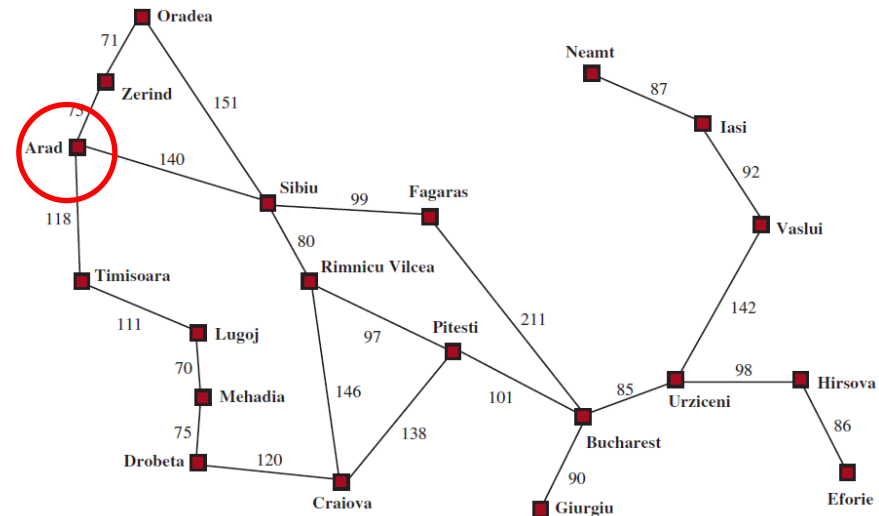
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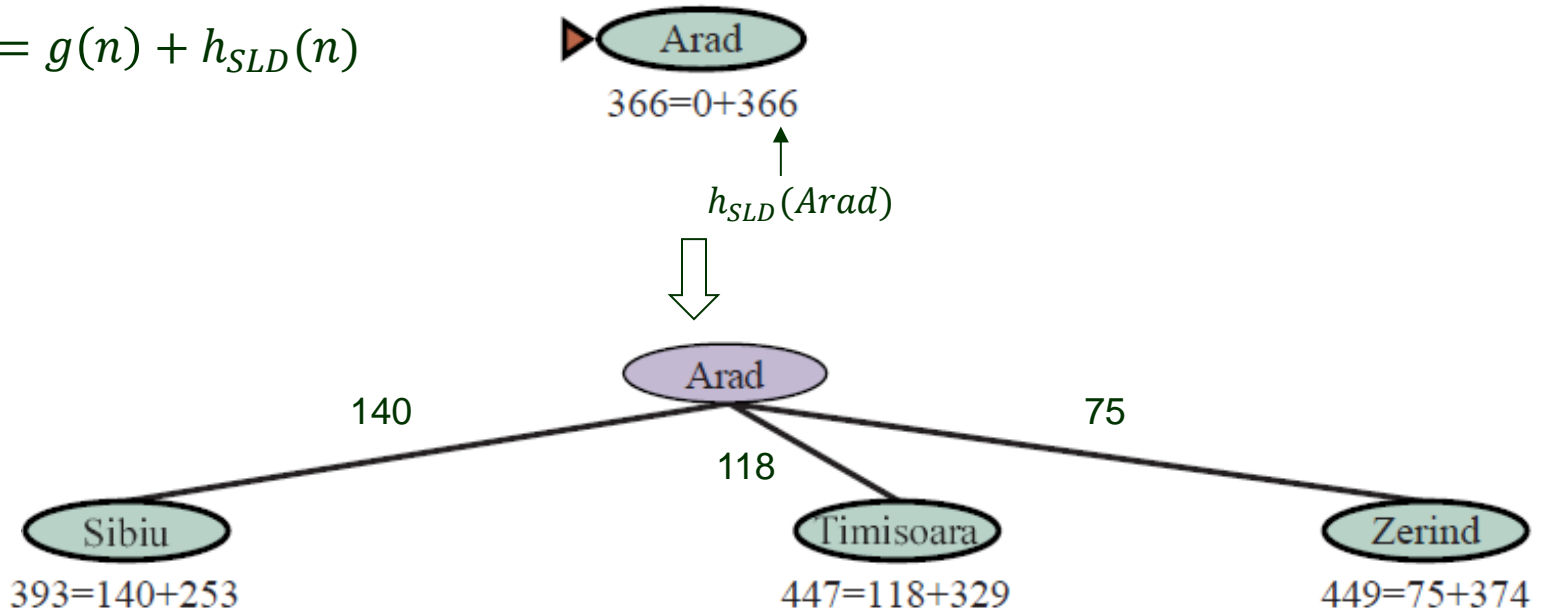
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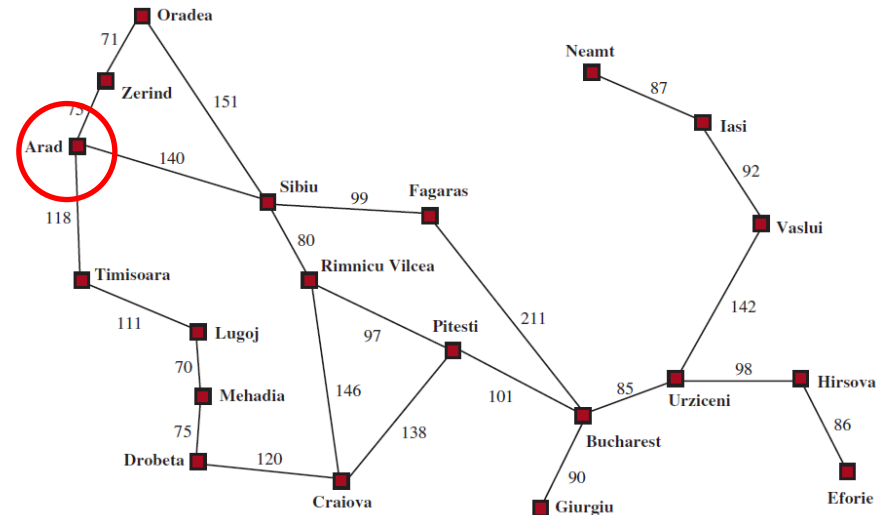
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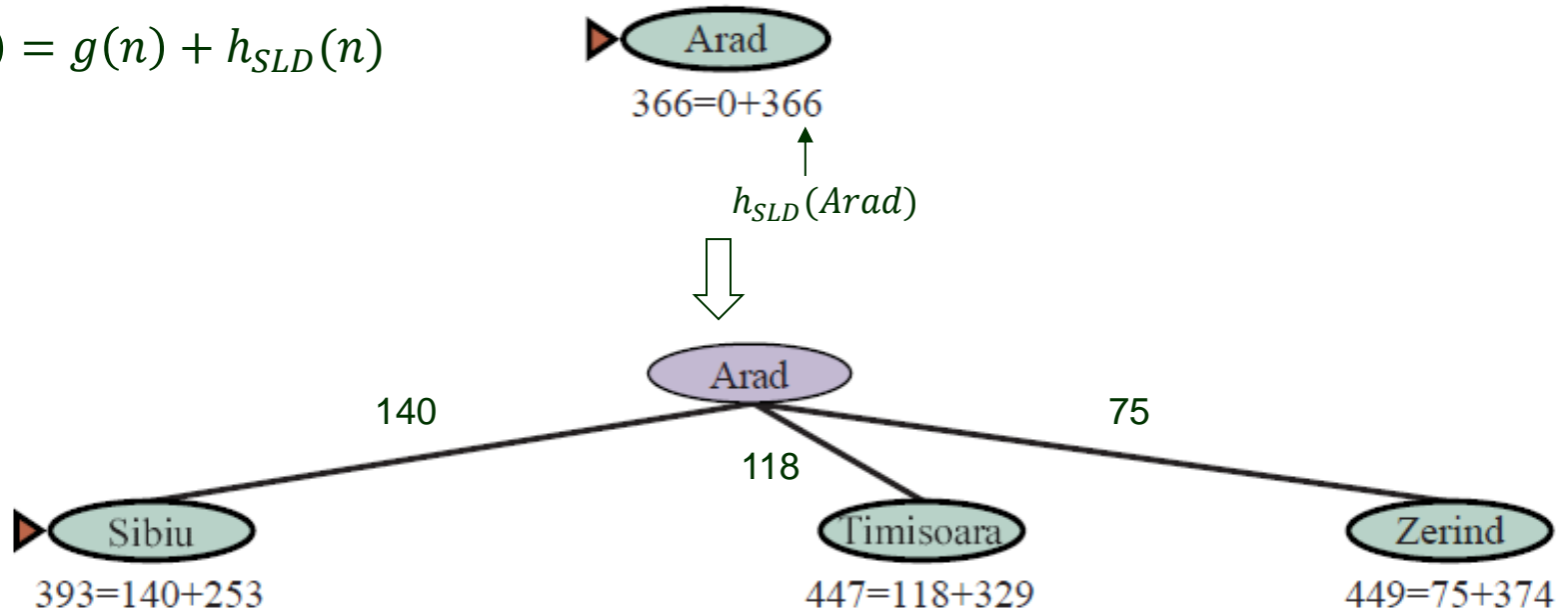
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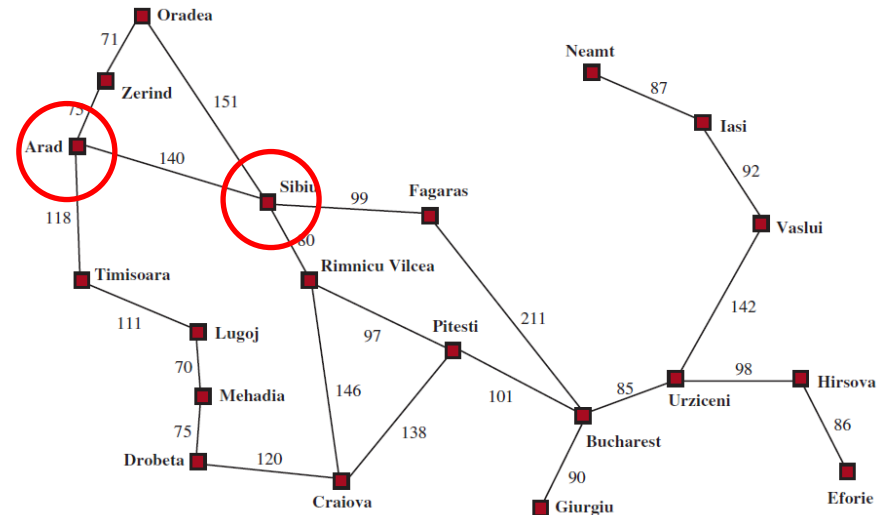
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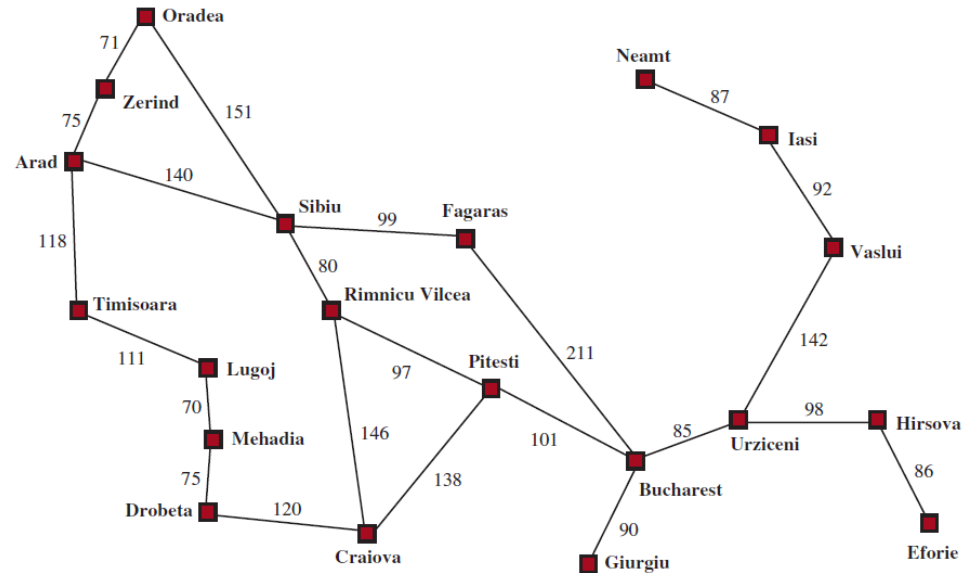
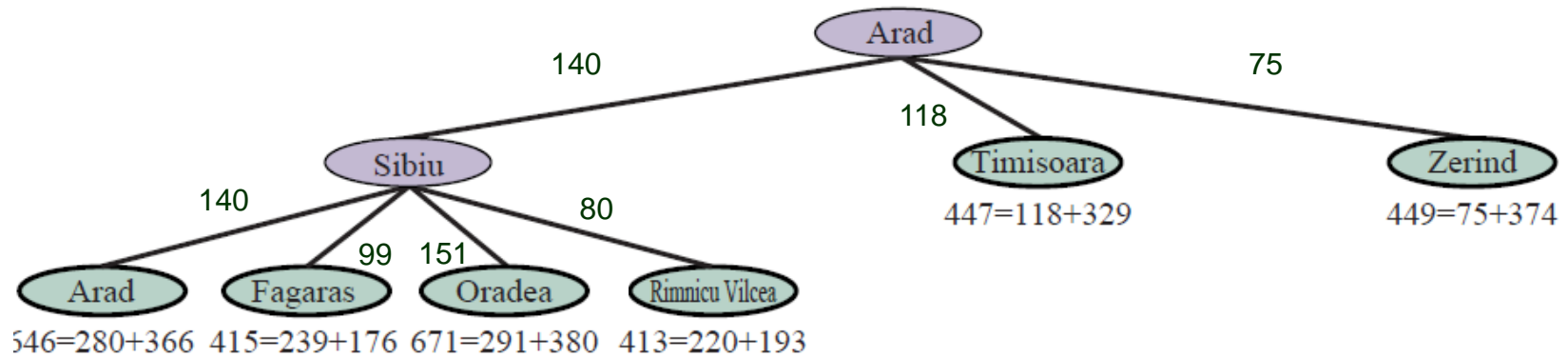


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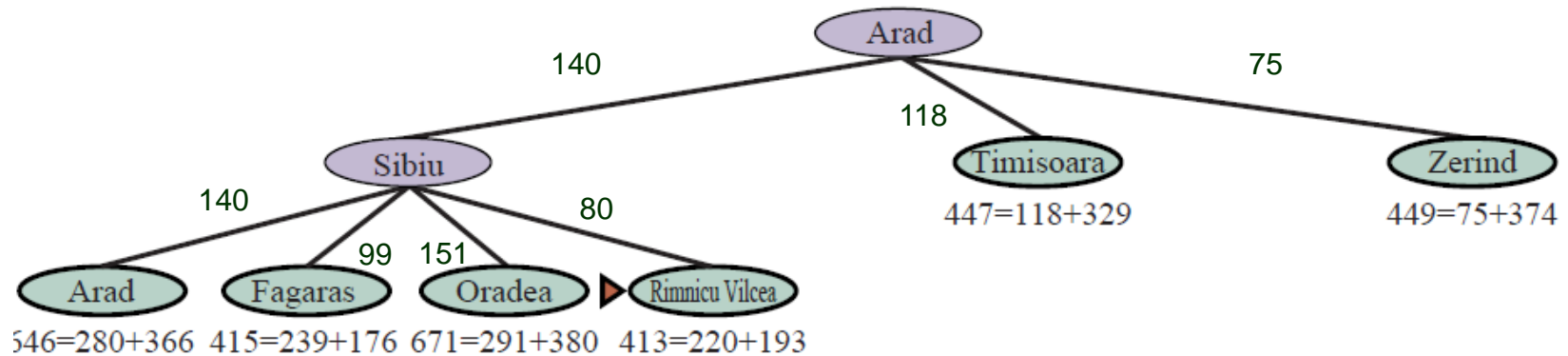
Working of A* Search



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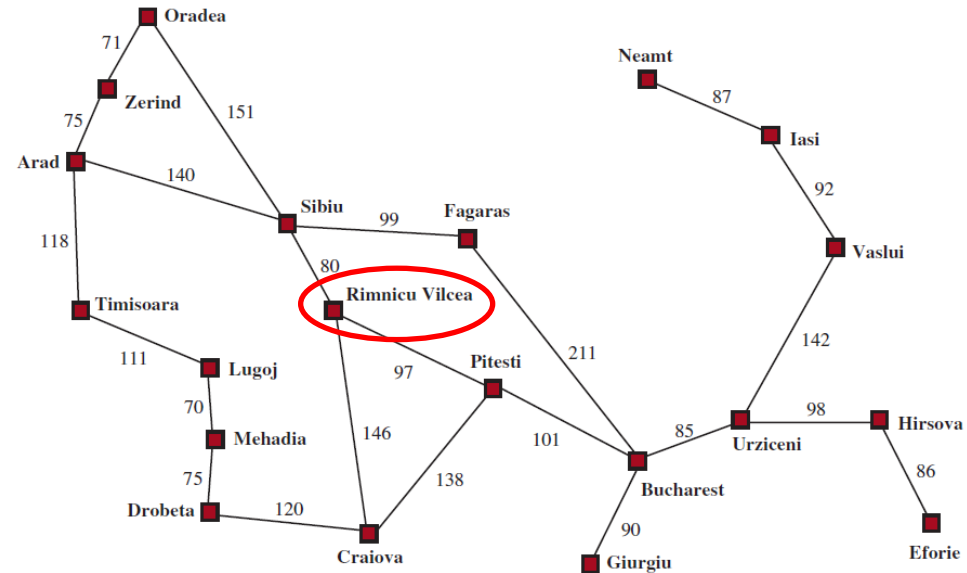
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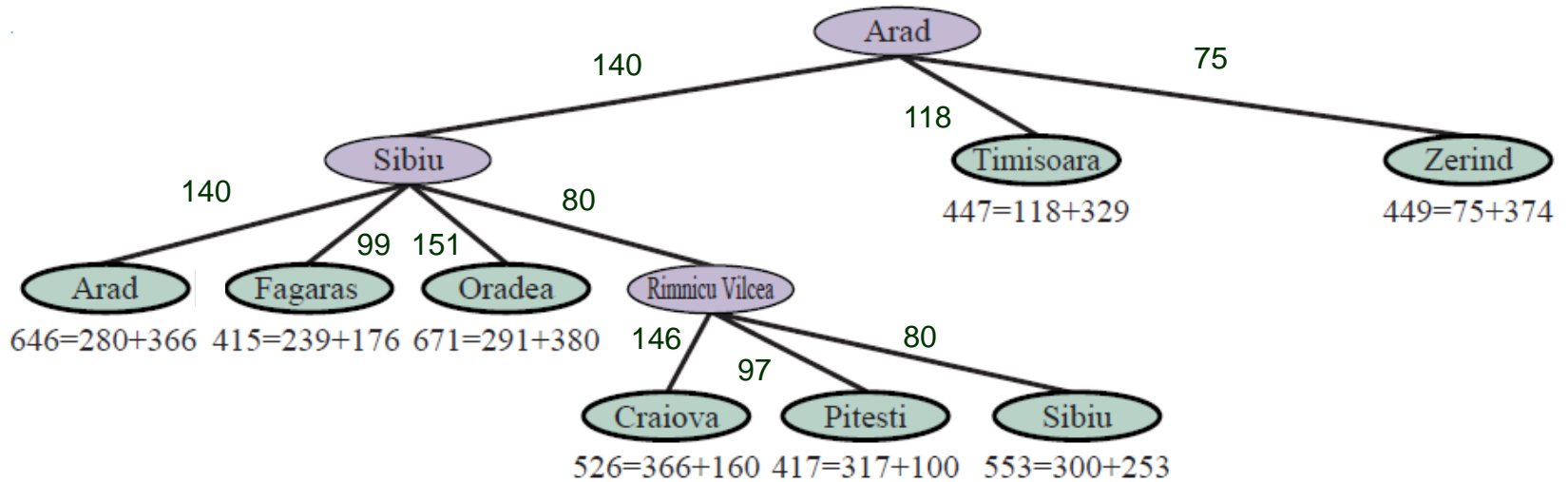


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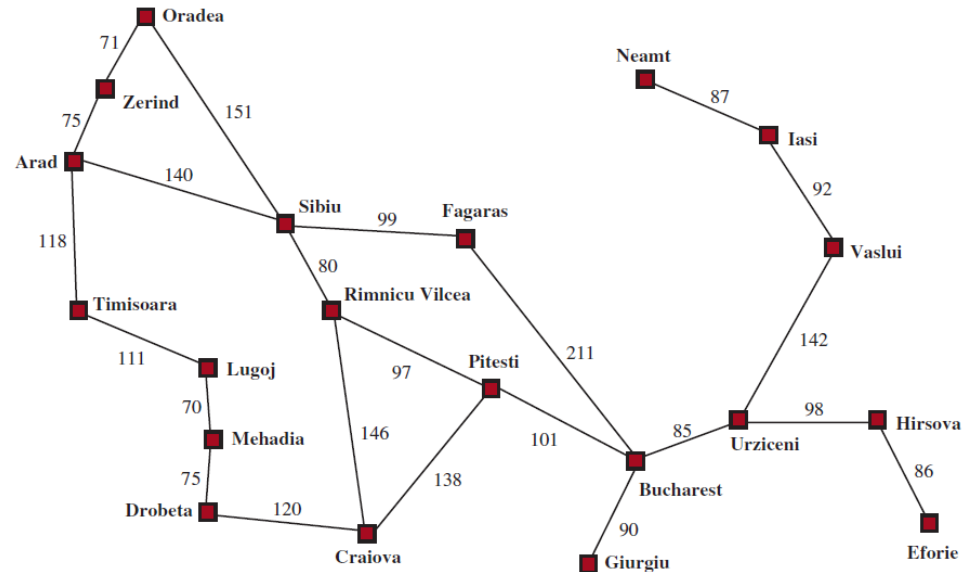


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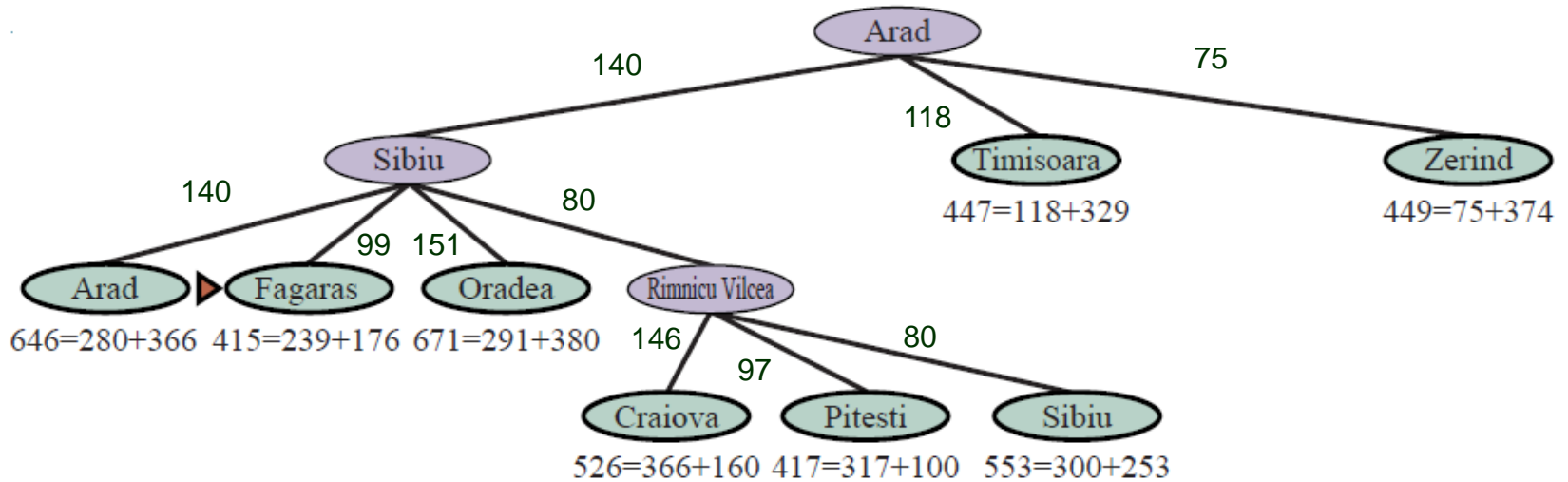


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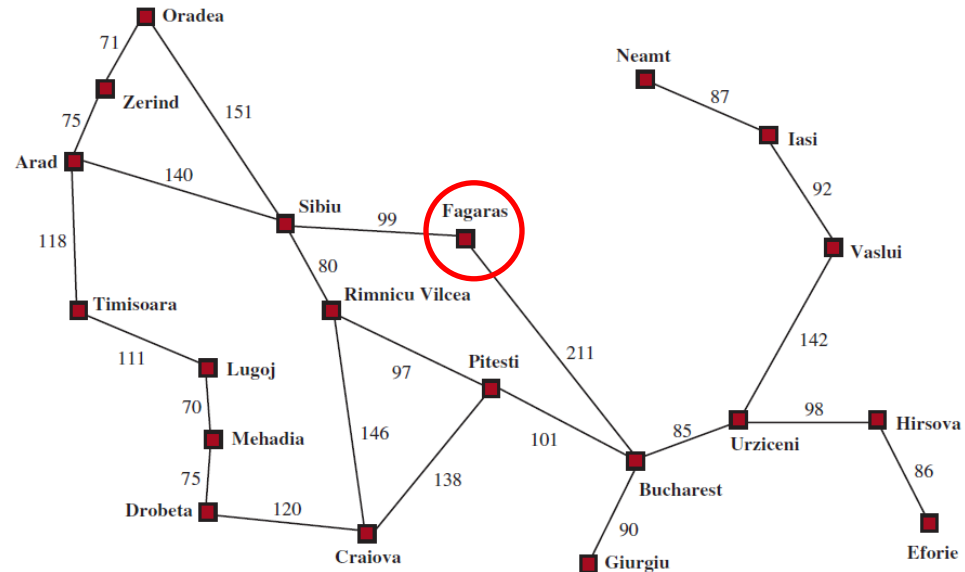


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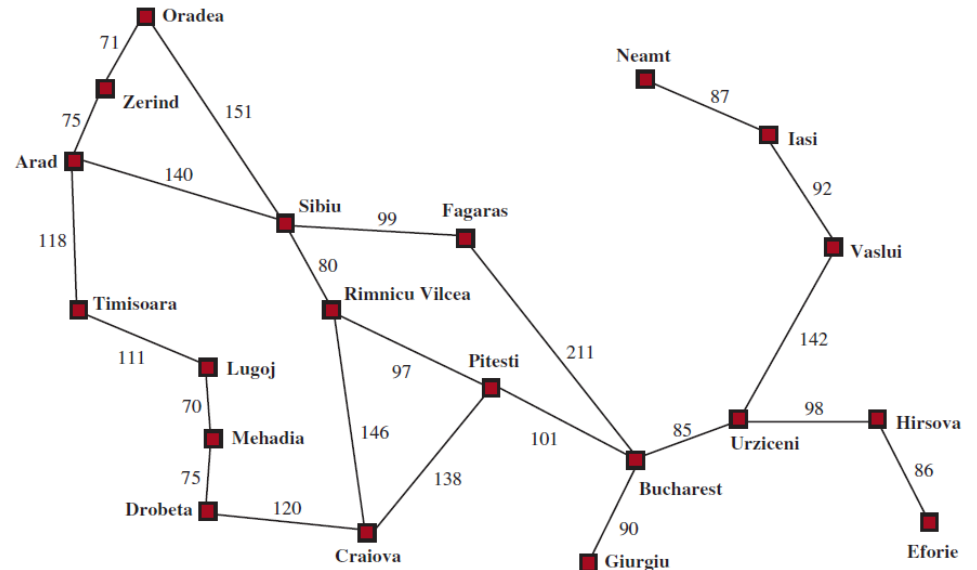
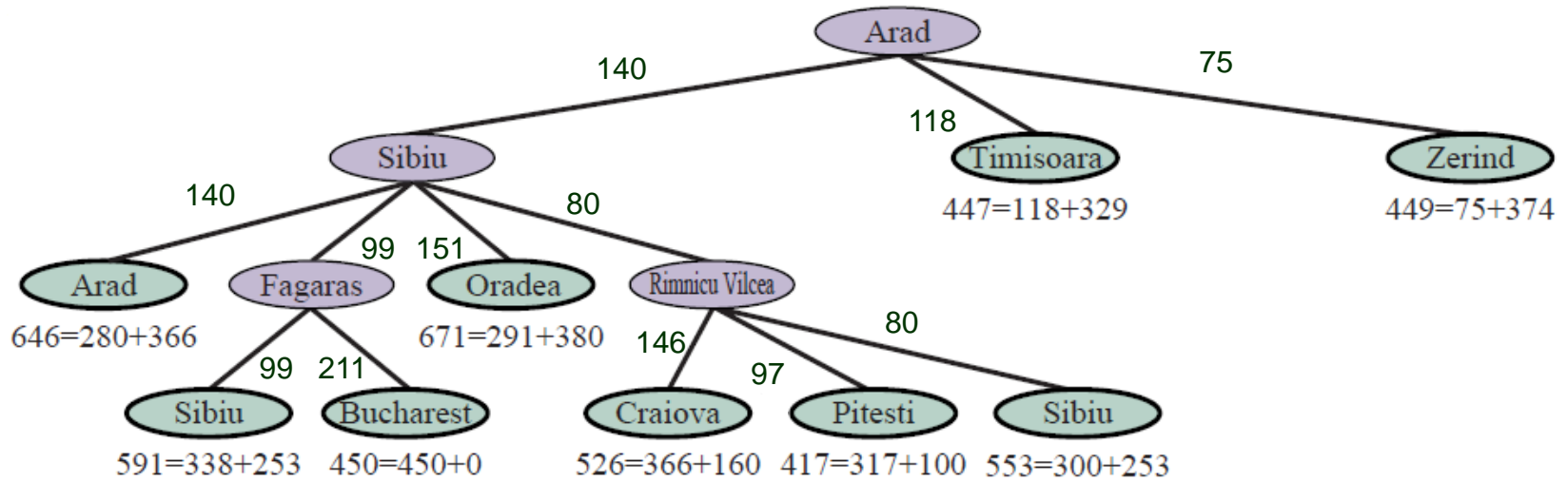


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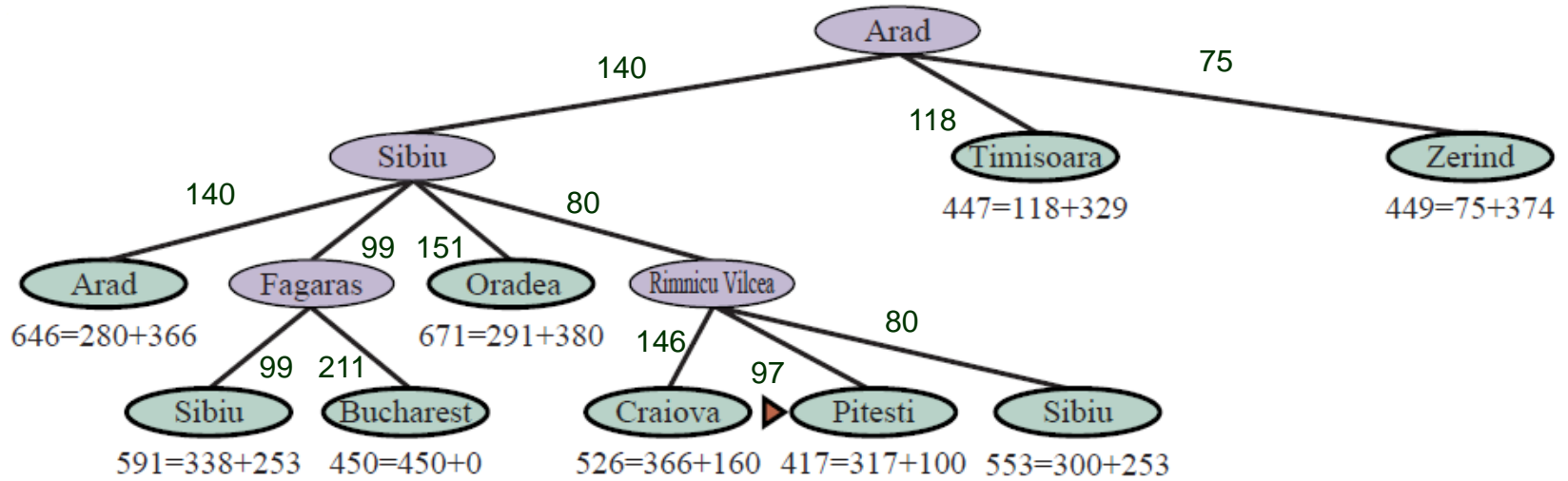
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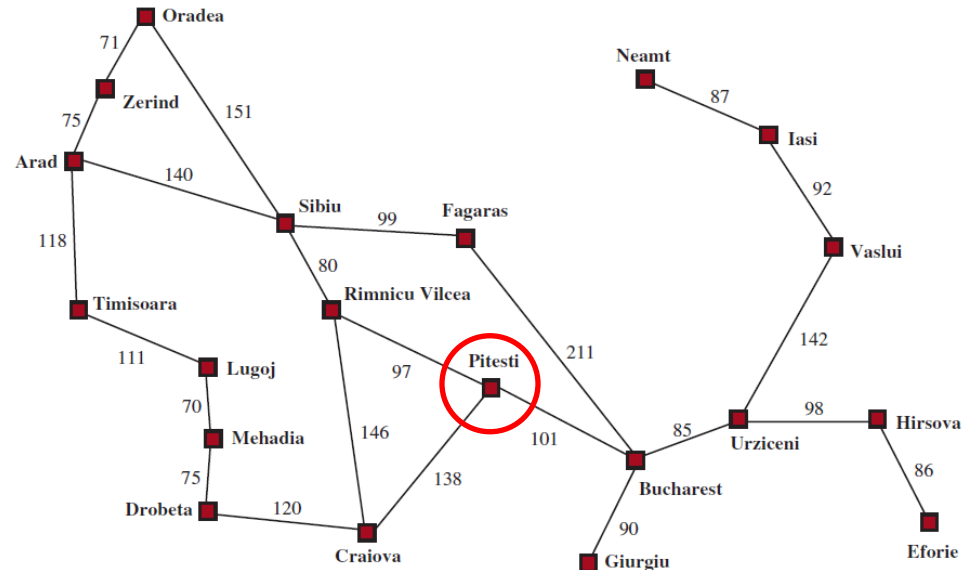
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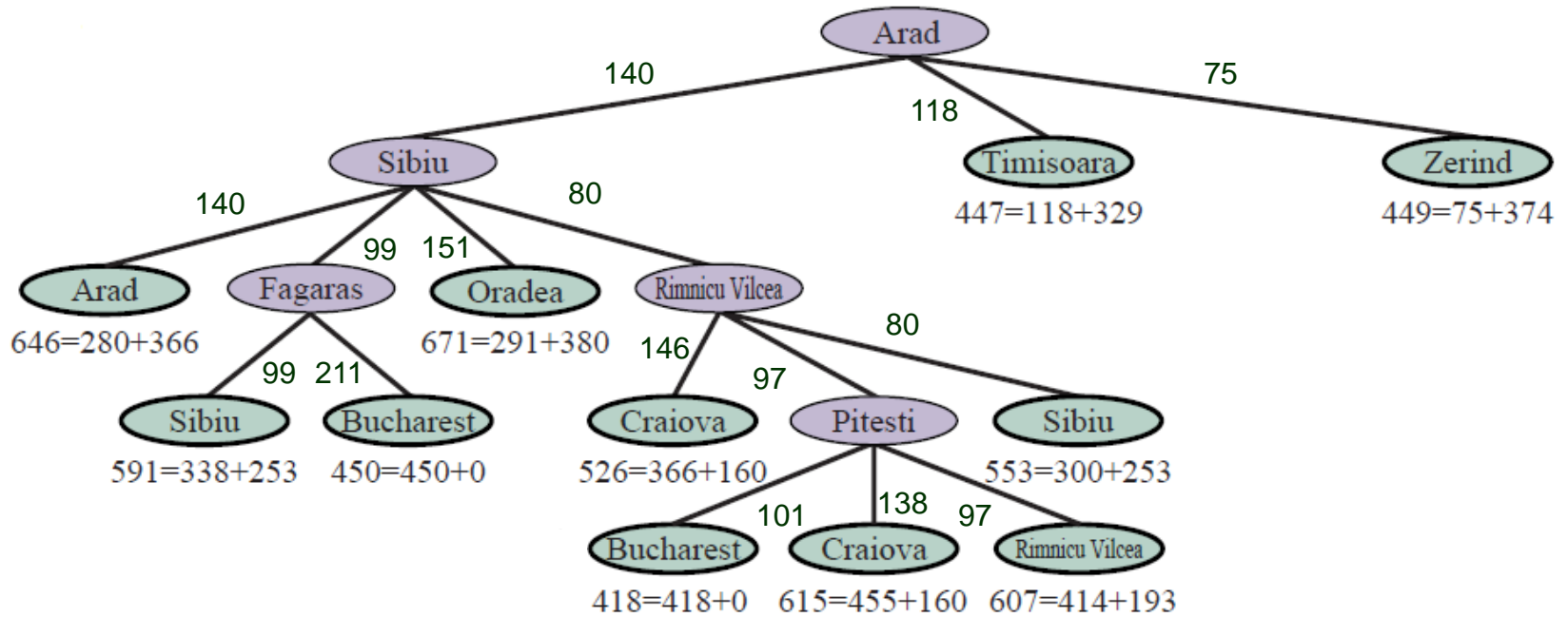


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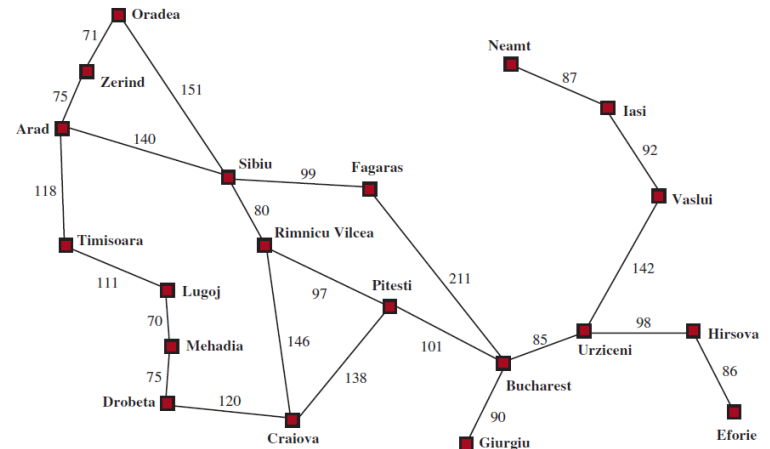


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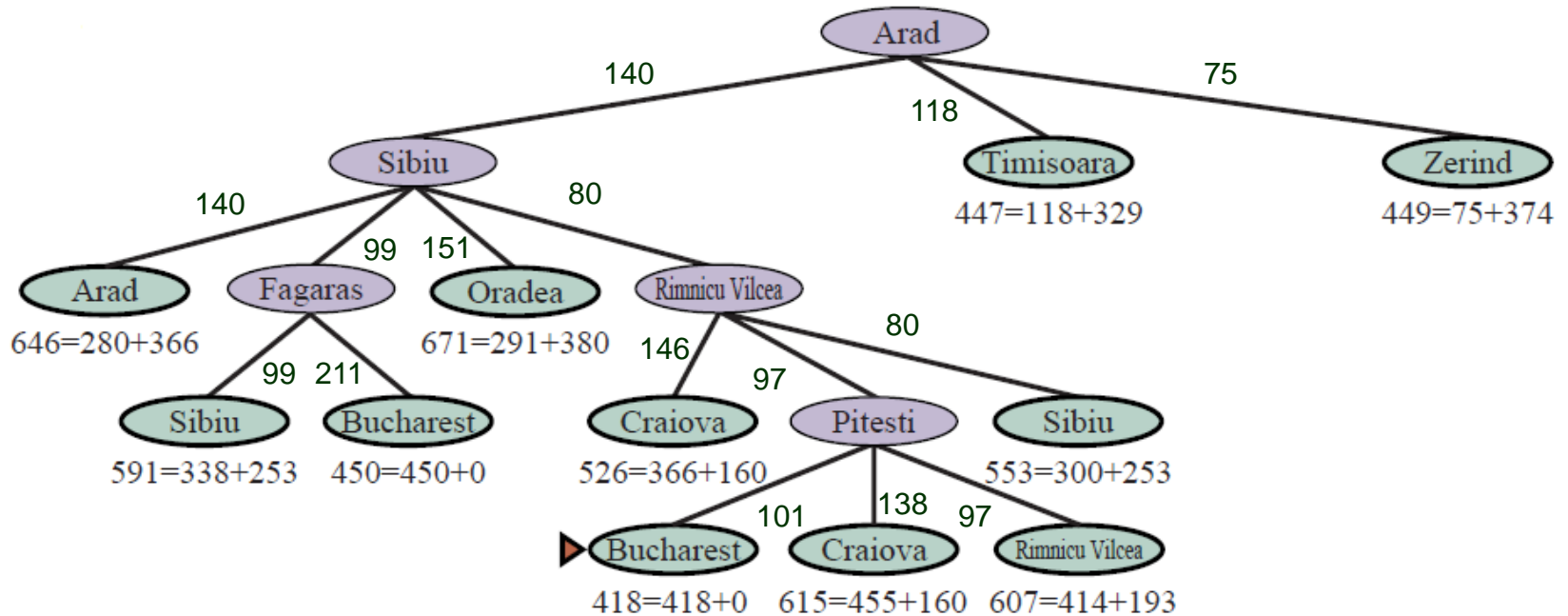


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