UIT2504 Artificial Intelligence

Heuristics-Based Search Strategies

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Searching for a solution

- Start with initial state in the working set
- Iterate:
  - Return failure if the working set is empty
  - Choose and remove a state x from the working set
  - If it is a goal state, return solution
  - Else, expand x and add the successor states $S(x)$ to the working set

Search Strategies

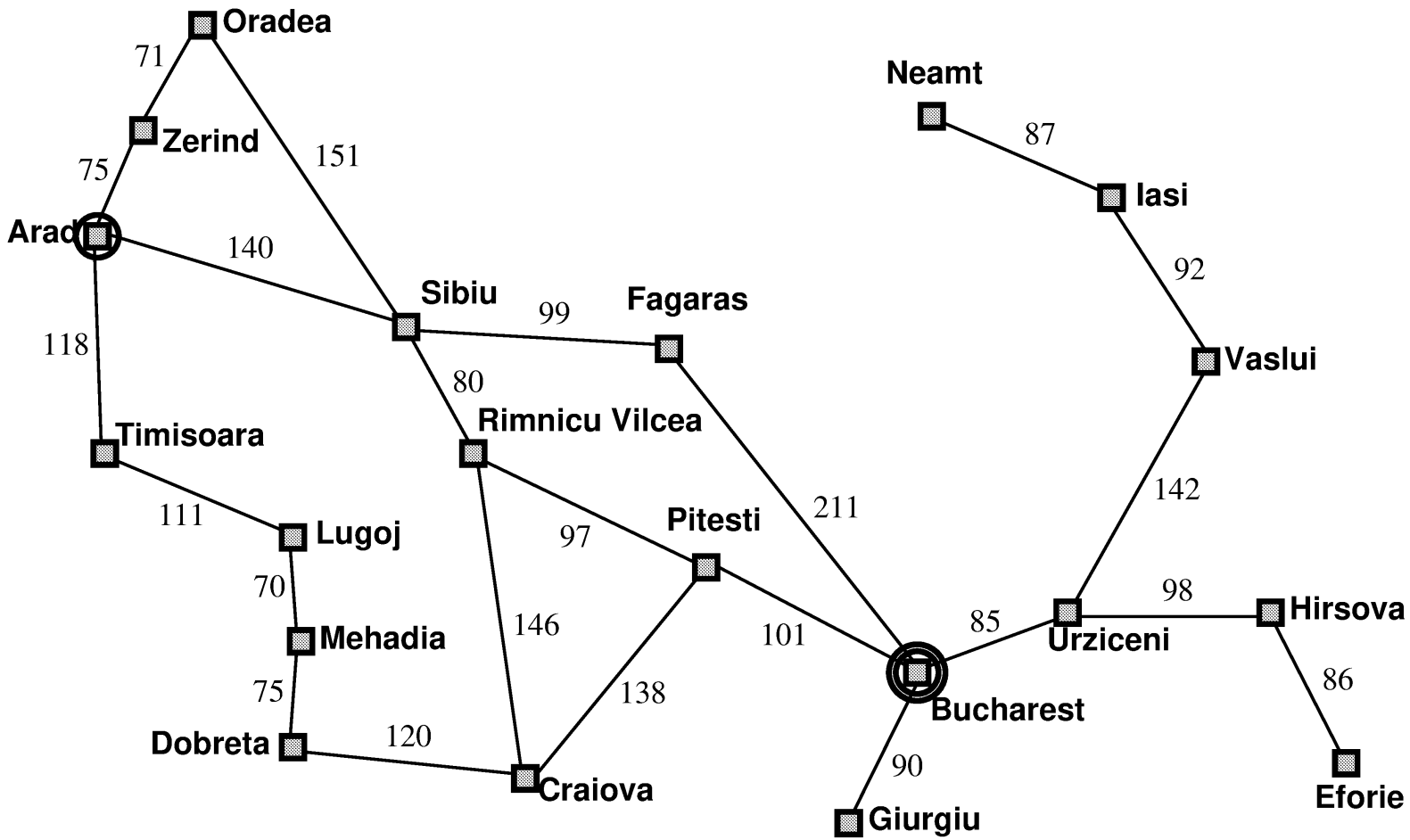
- Uninformed:
  - Breadth-First
  - Depth-First
  - Iterative Deepening
  - Bi-Directional Search
- Informed (Heuristics):
  - Best-first Greedy
  - A^*
  - Local Search Strategies
- Constraint Satisfaction

Performance Measures

- Completeness
- Time Complexity
- Space Complexity
- Optimality

Exercise

- Practice all the basic search strategies to find a route from Arad to Bucharest in the following state graph



Questions?

Evaluating a state

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- Obviously, the quality of search depends on the evaluation function f

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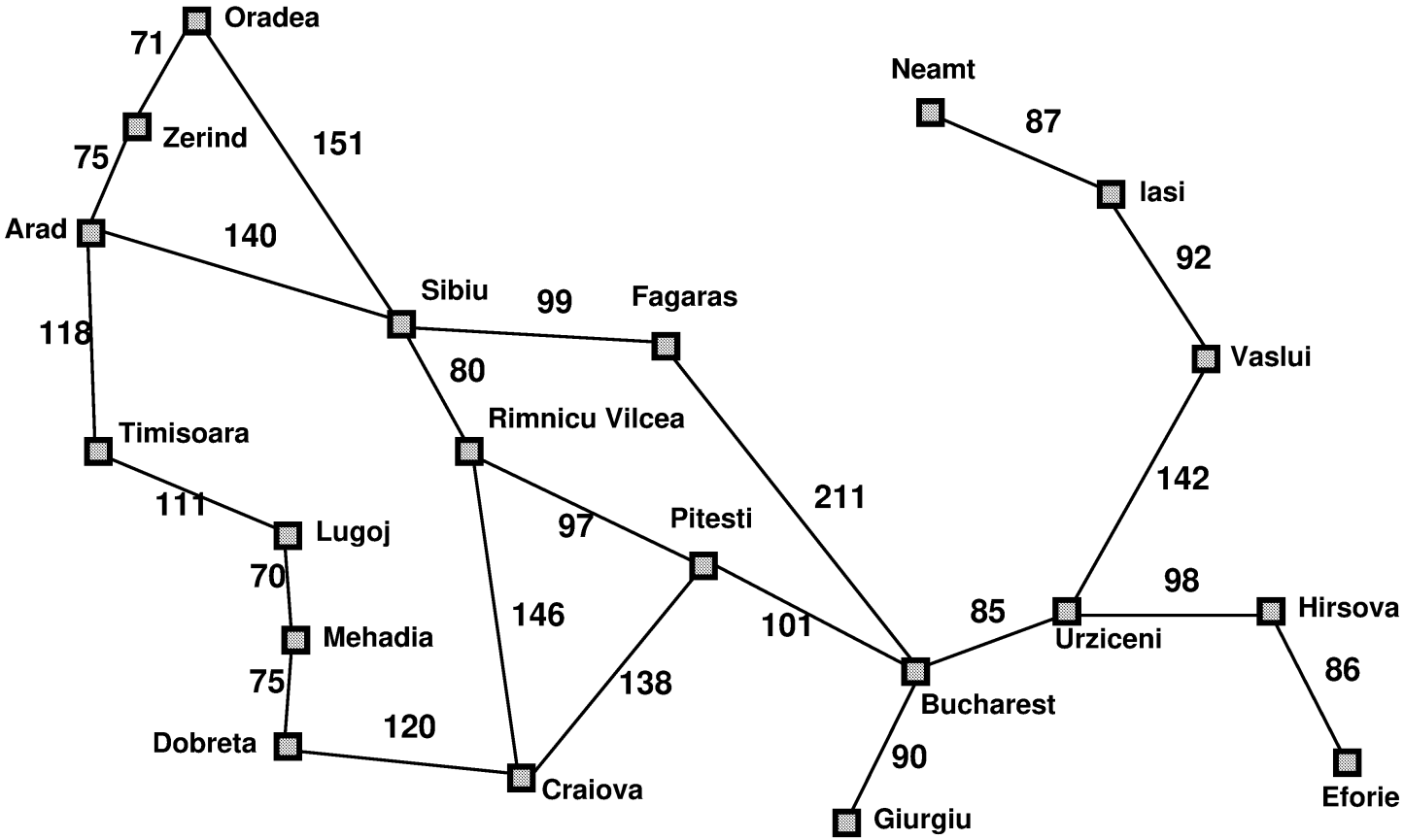
- Heuristics should be an easy function to compute!
- $h(s^*)$ should be 0 for any goal state s^*

Example: Route finding problem



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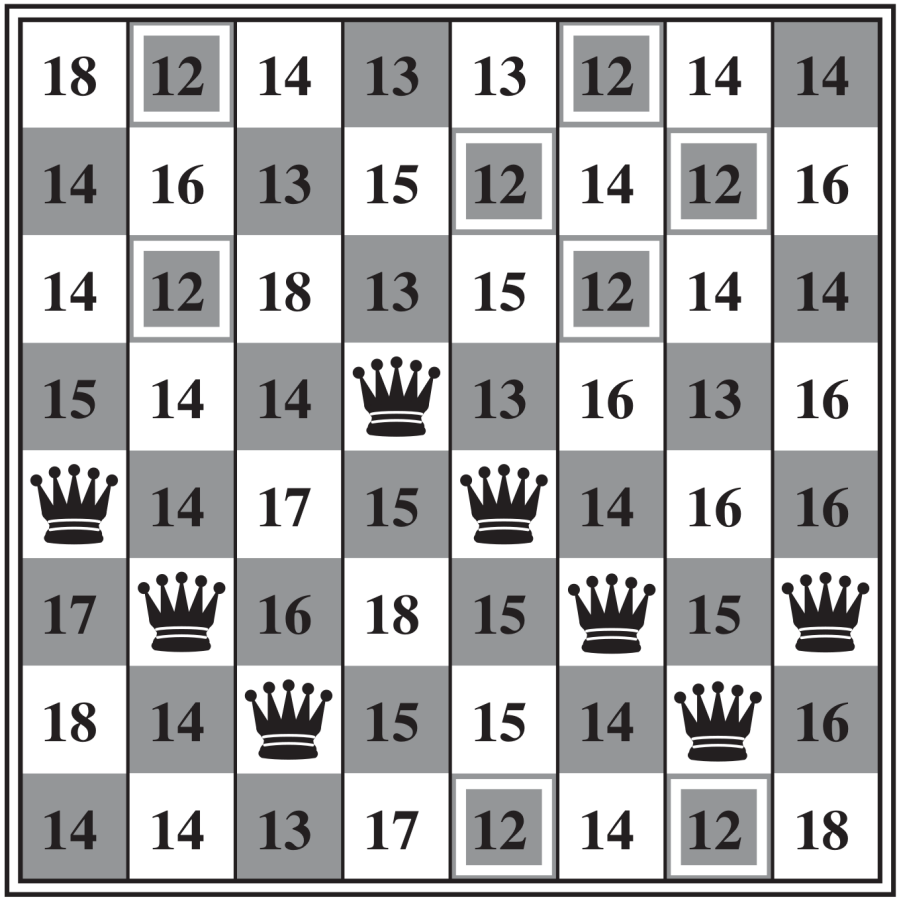

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- As a simple strategy, we may let the evaluation function f to be the same as the heuristics function h

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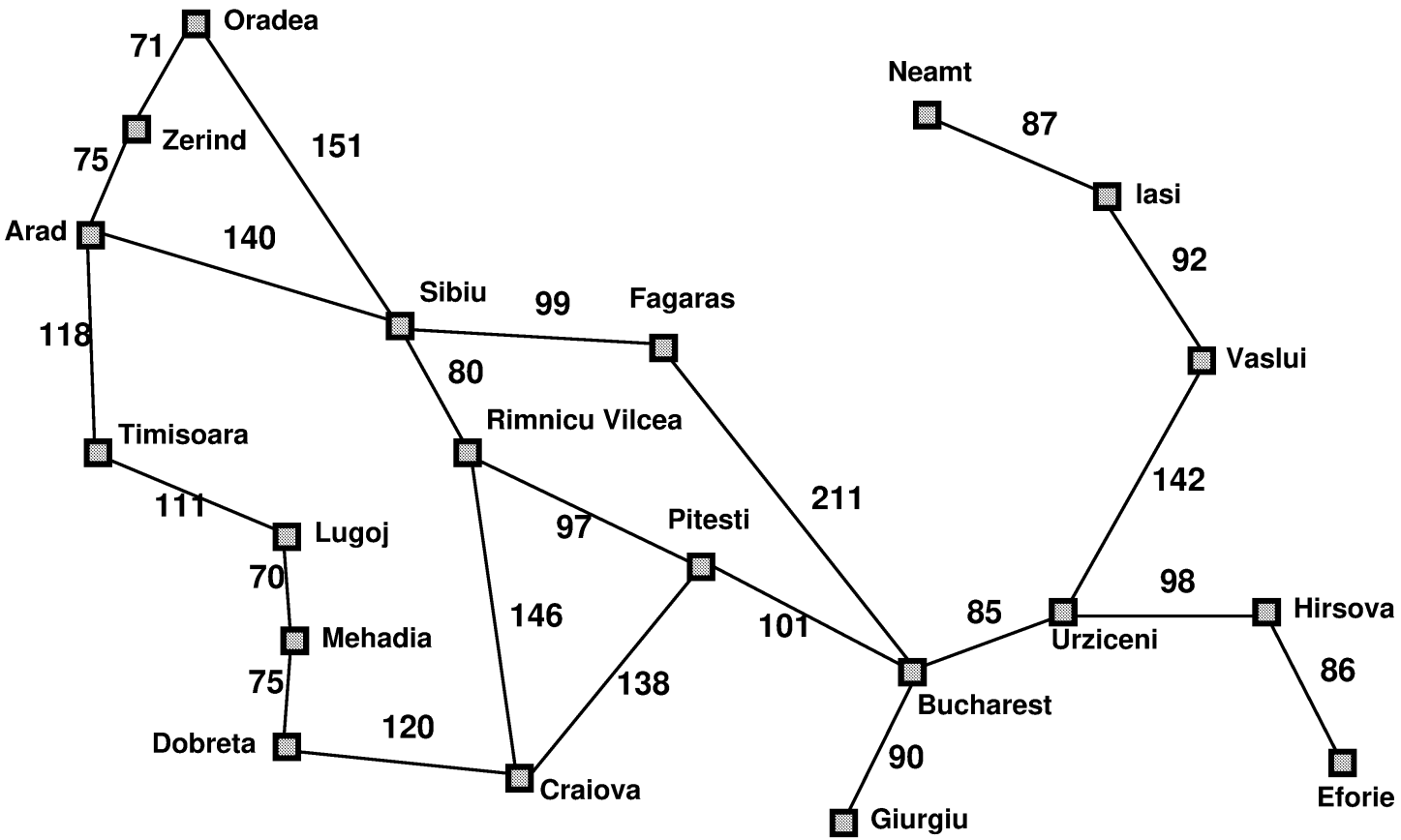
- Nodes in the working set (priority queue) are organized based on estimated cost and the one with the least cost is given preference
- This is a generalization of greedy design strategy, that you have learnt in the previous semester

Best-first greedy search



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Find the best route from Arad to Bucharest

Best-first greedy search

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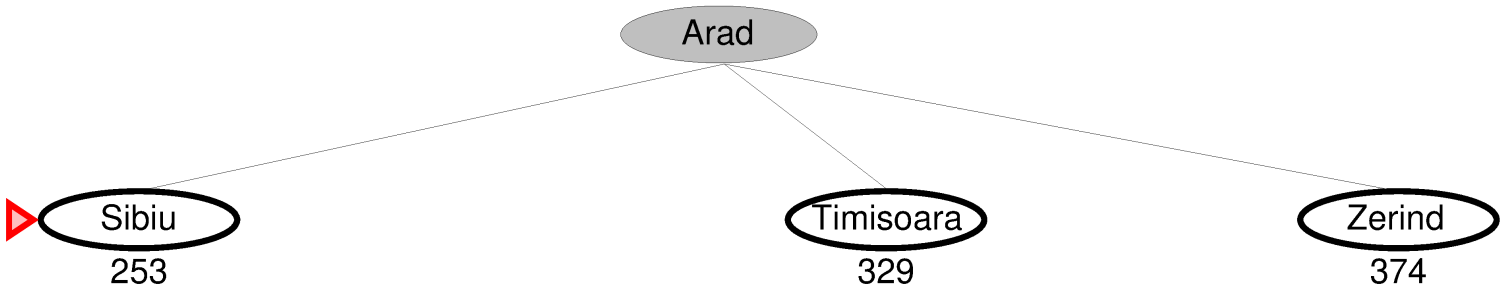

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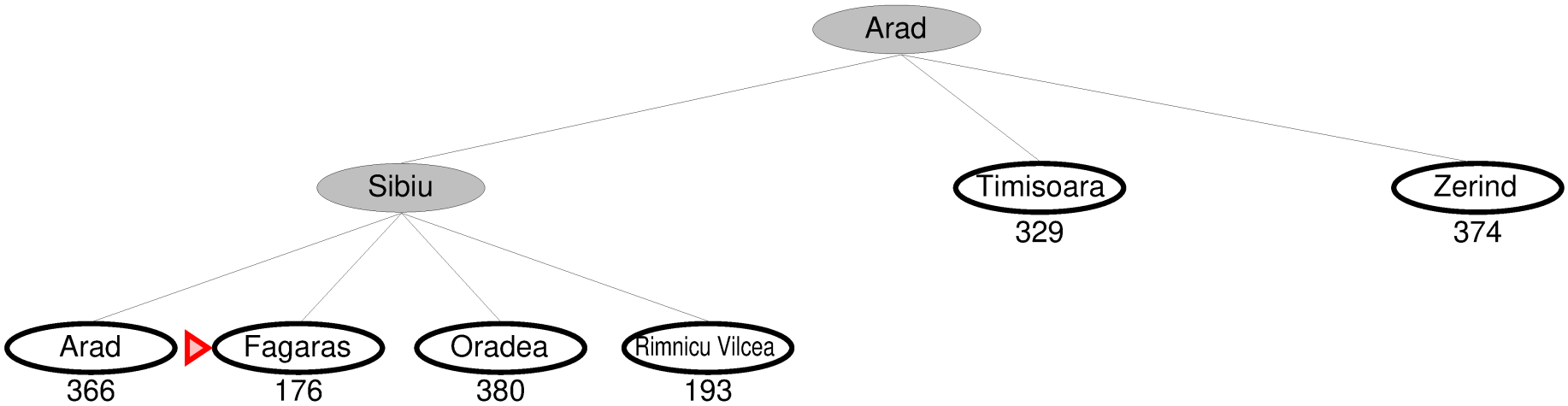

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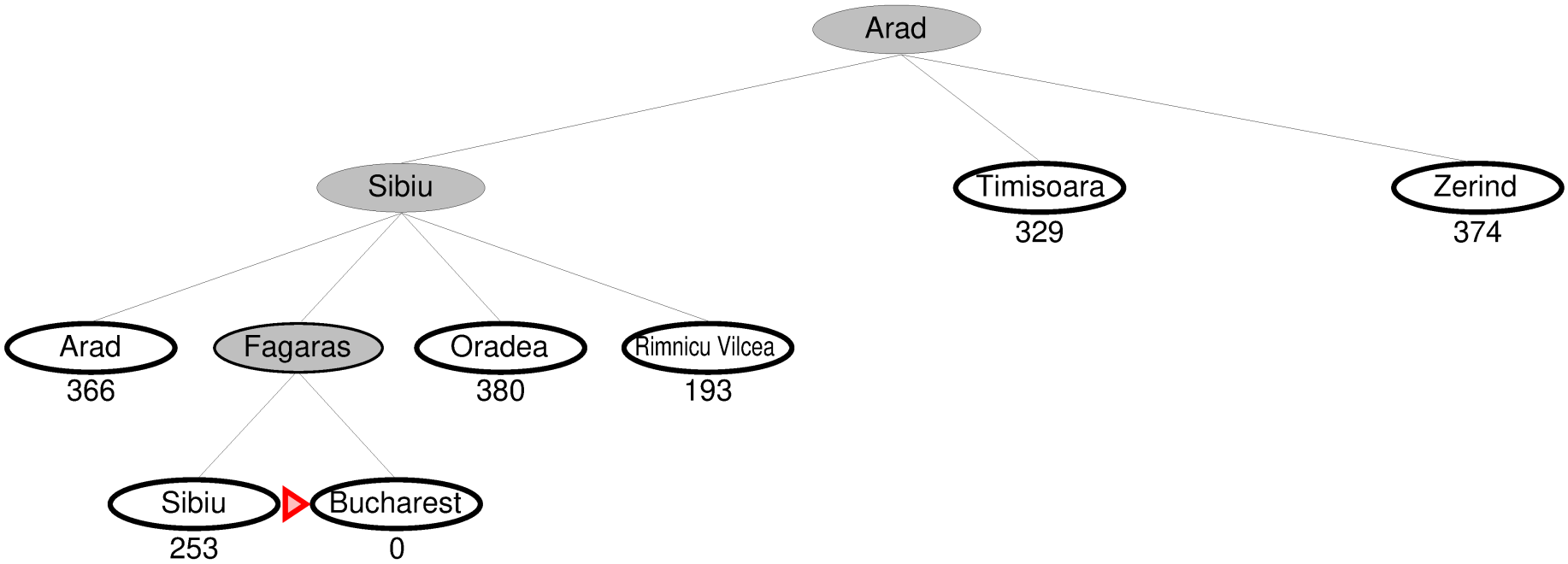

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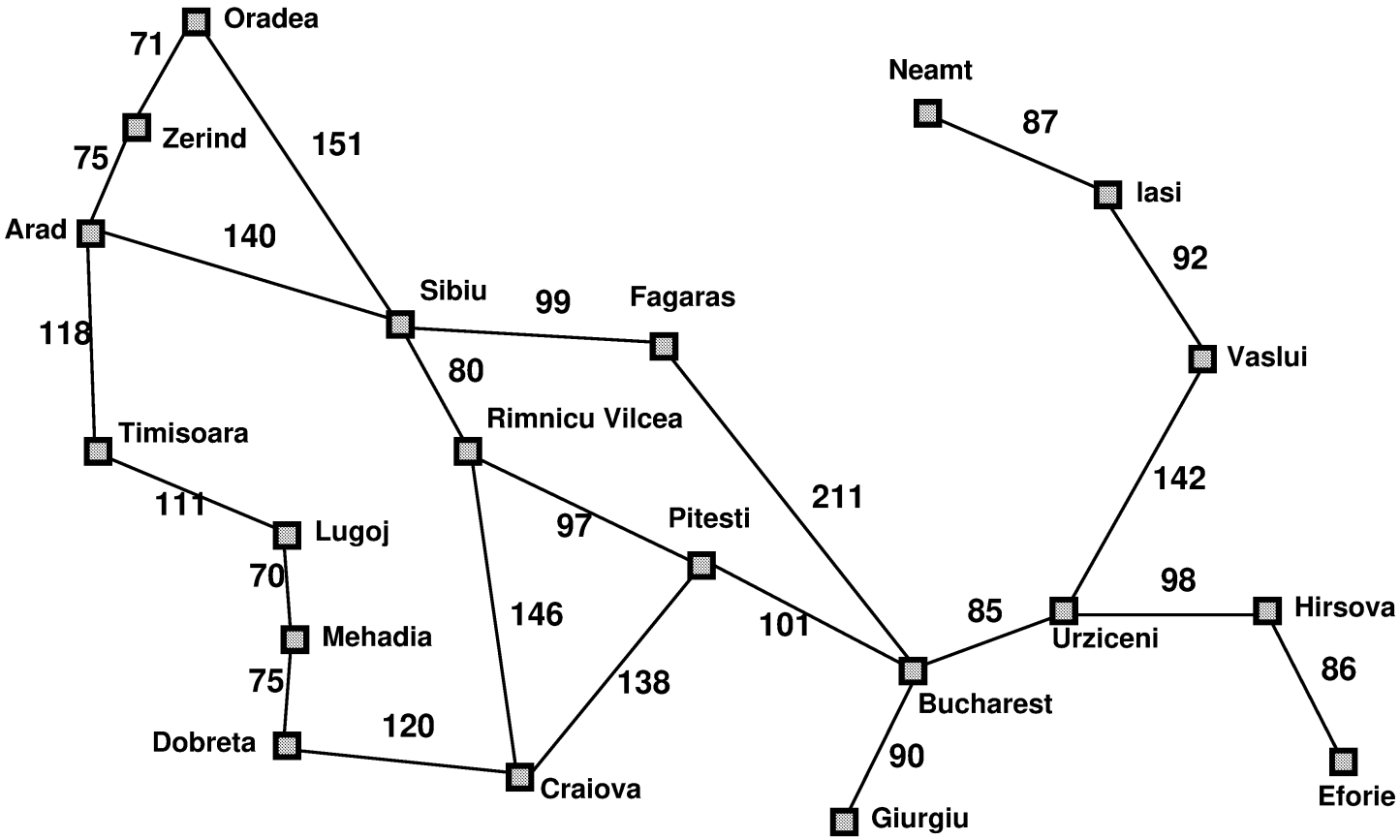

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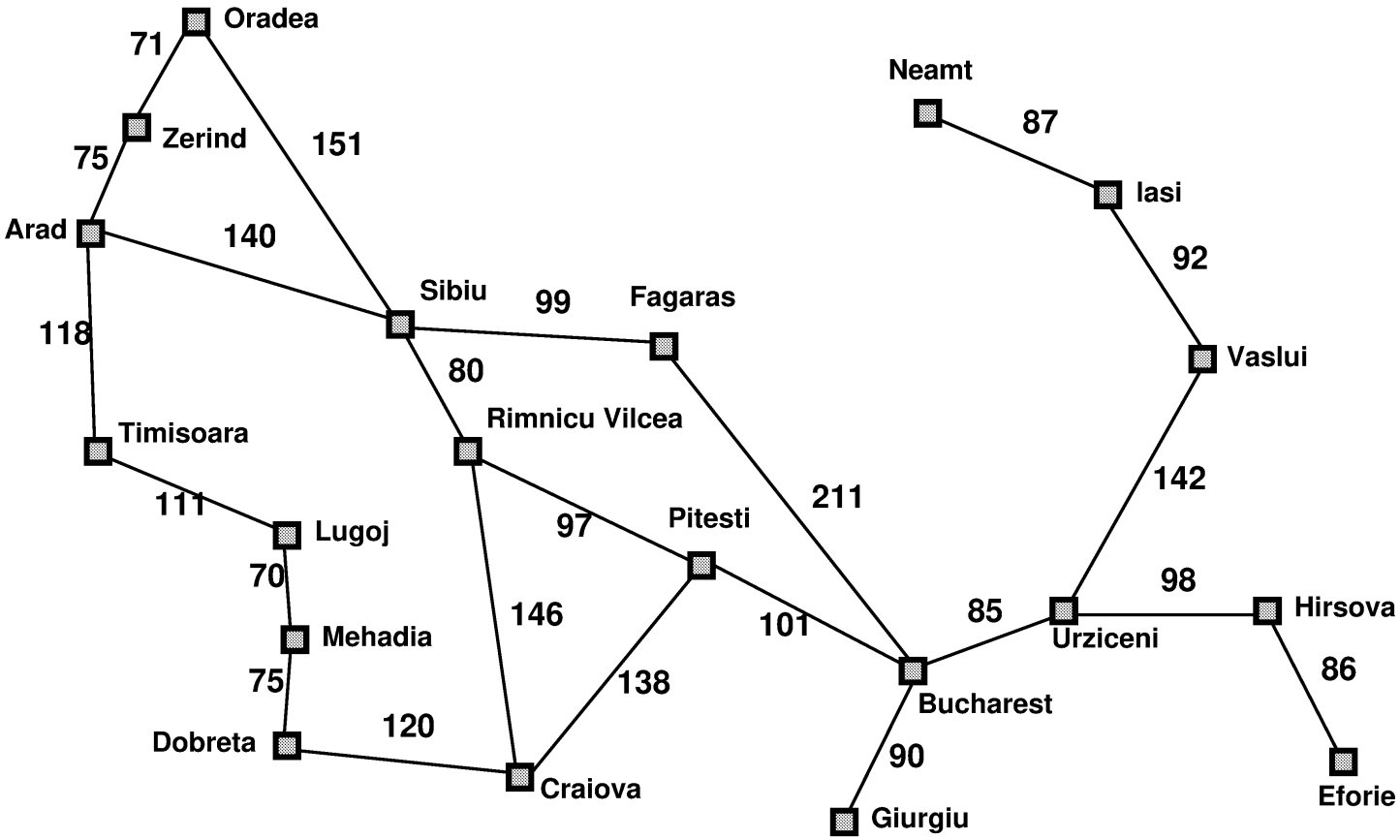

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Solution found: Arad → Sibiu → Fagaras → Bucharest with total cost

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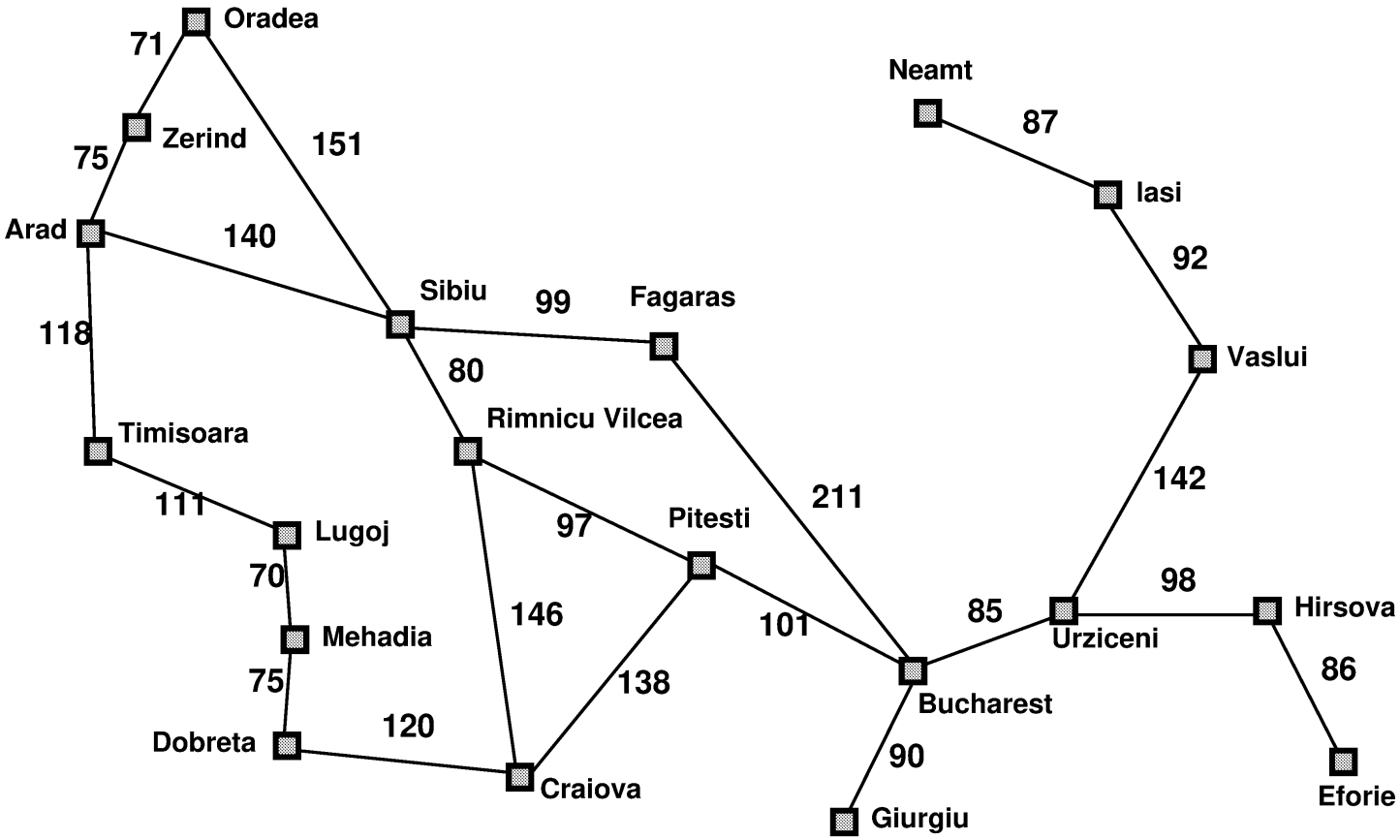

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Solution found: Arad → Sibiu → Fagaras → Bucharest with total cost 450

Is it optimal?

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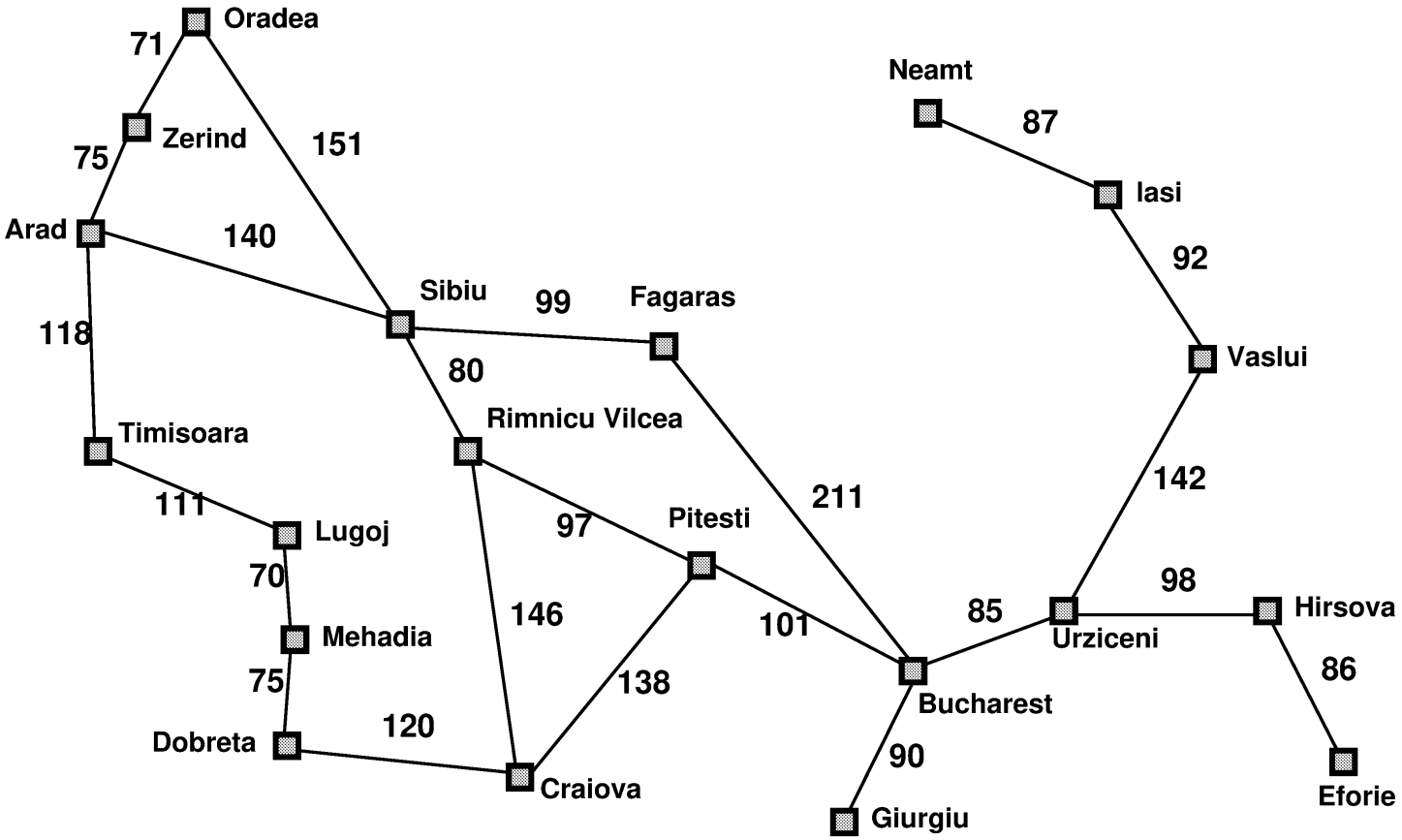

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Is it optimal? — No!

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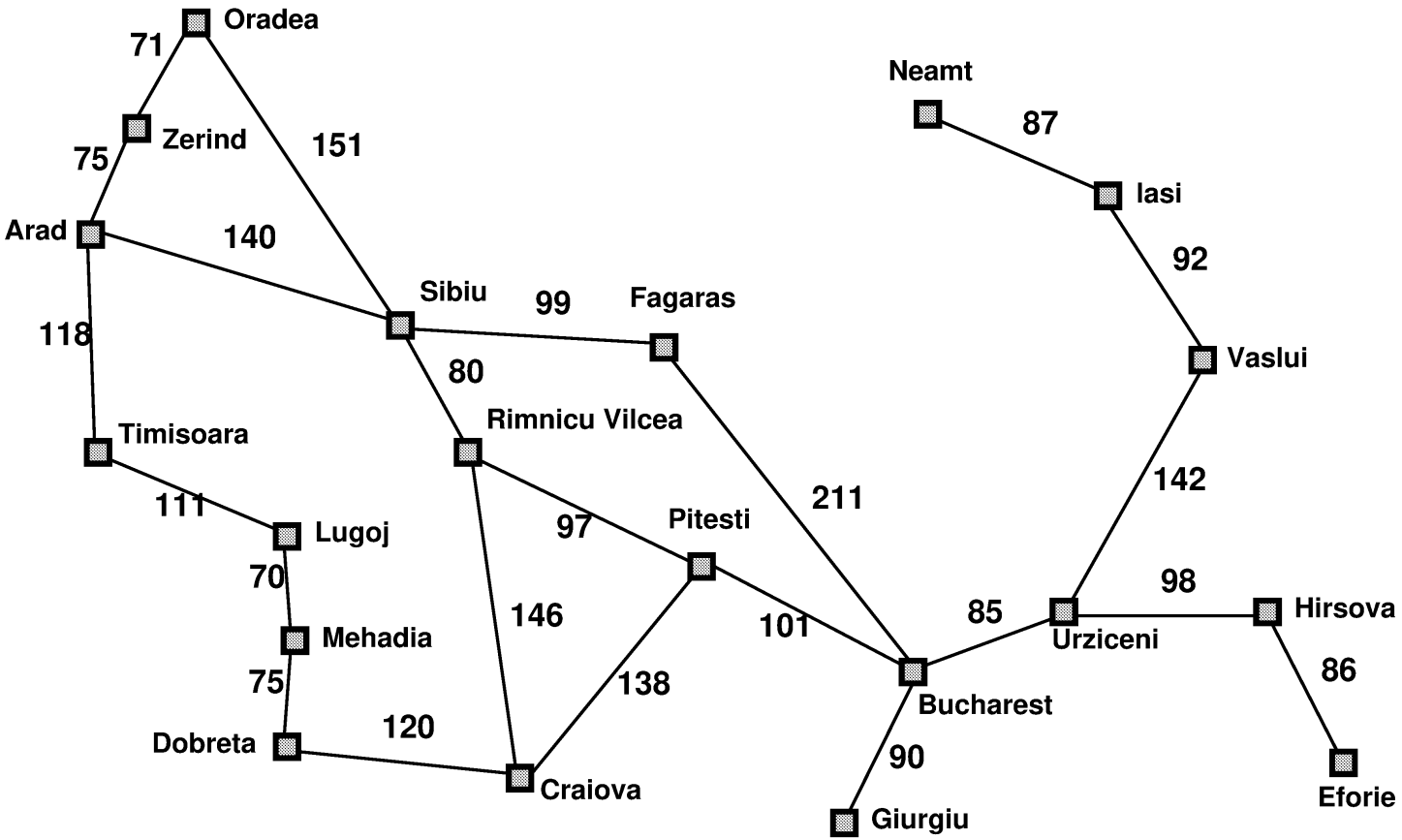

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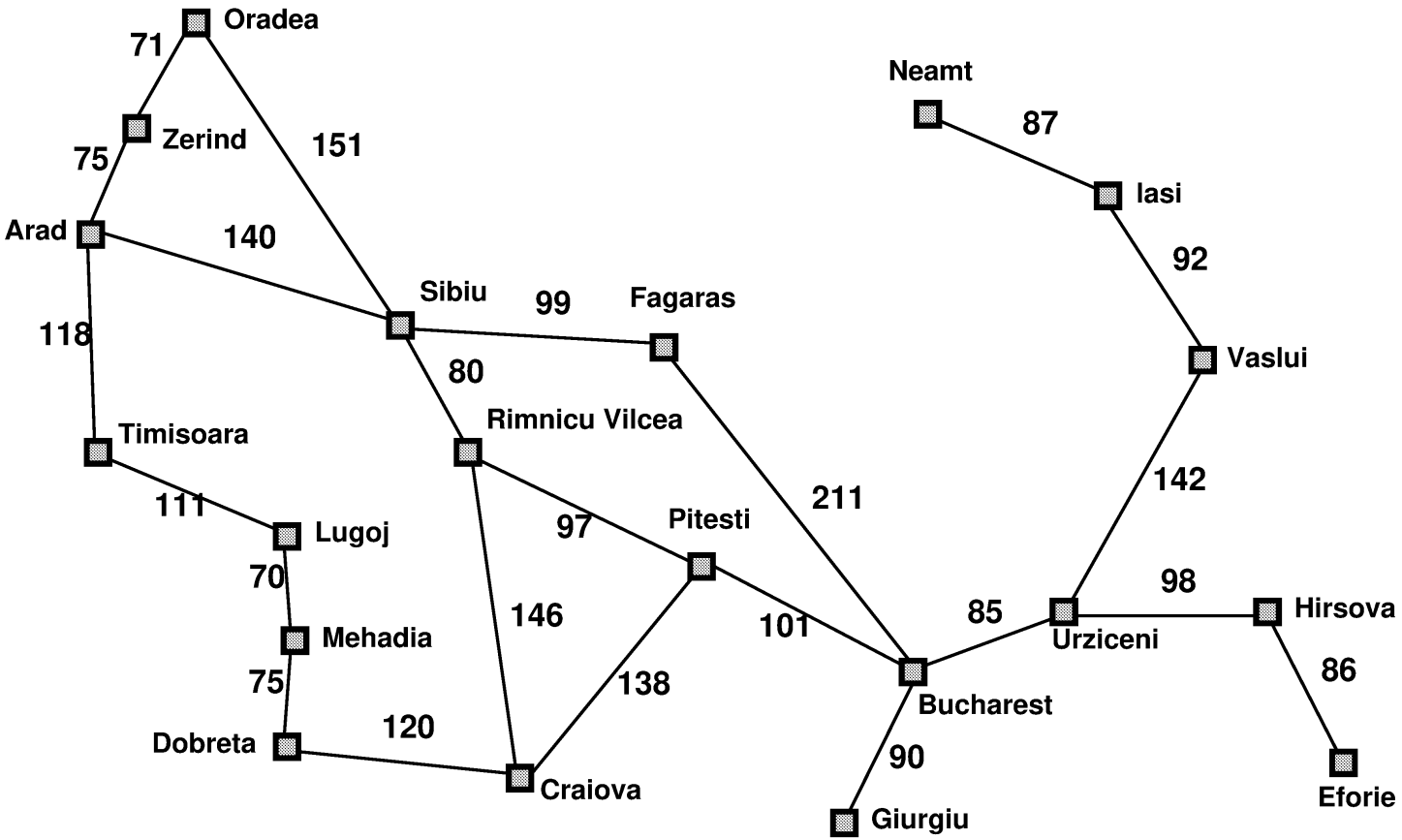

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Find a path from Iasi to Fagaras

Best-First Greedy: Complexities

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