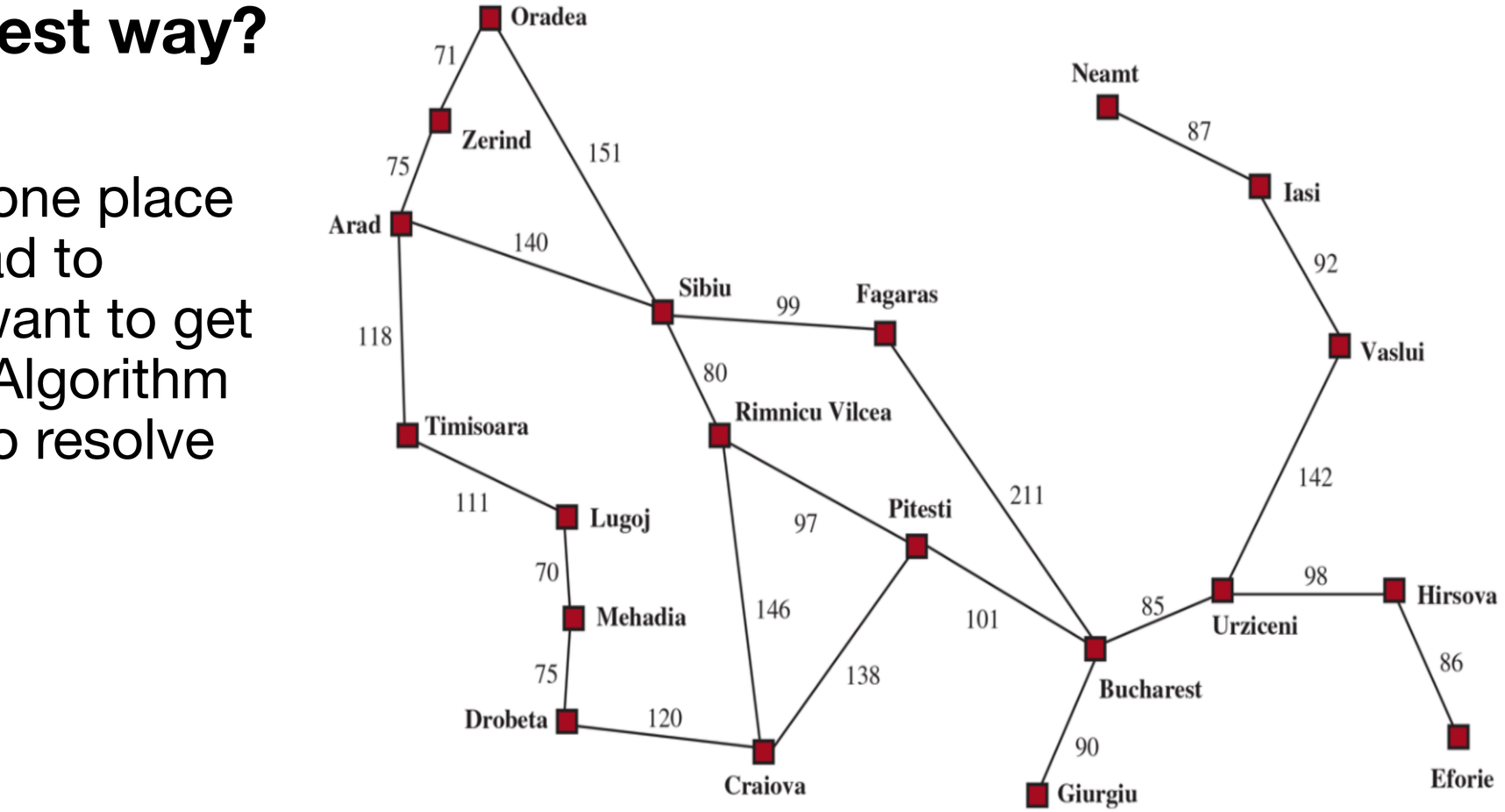
A Star (A*) Search Algorithm

The algorithm of searching the best way from one place to another

Problem

How to find the fastest way?

When we travel from one place to another (e.g. from Arad to Bucharest), we always want to get the lowest cost. The A* Algorithm can help us find a way to resolve this problem.



Algorithm Principle

How is the algorithm works?

- *Key Point:* Combine actual cost g(n) with heuristic estimate h(n)
- Evaluation function:

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

- Data Structures:

Frontier (priority queue sorted by f(n))

Visited set (set of visited nodes)

Algorithm Process

Result

- Start city: Arad
- Goal city: Bucharest
- Path: ['Arad', 'Sibiu', 'Rimnicu', 'Pitesti', 'Bucharest']
- Cost: 418

Conclusion

Essence of the algorithm

- The core of A* is to combine the real cost (the sum of costs from one city to the next city) and heuristic estimate (the Euclidean distance of two cities).
- It is more efficient than BFS / DFS, because it avoids some unnecessary exploration by combining the heuristic estimate.