Informed Search

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MULTIMEDIA ENGINEERING

ARTIFICIAL INTELLIGENCE

What is an informed search?

Use **specific knowledge** about a problem to find efficient solutions.

Heuristics:

Specific knowledge about the problem **domain** further tan its definition.

To reduce the search effort.

Search first the best

- Search in a tree that expands the “best” node.
- How is it measured “the best”: With an evaluation function $\boldsymbol{f(n)}$
- Generally, to choose the least $\boldsymbol{f(n)}$because it usually measures the distance between nodes.
- Priority Queue.

Heuristic function

Evaluates the viability of expanding a node.

Estimate a cost between a node and the goal.

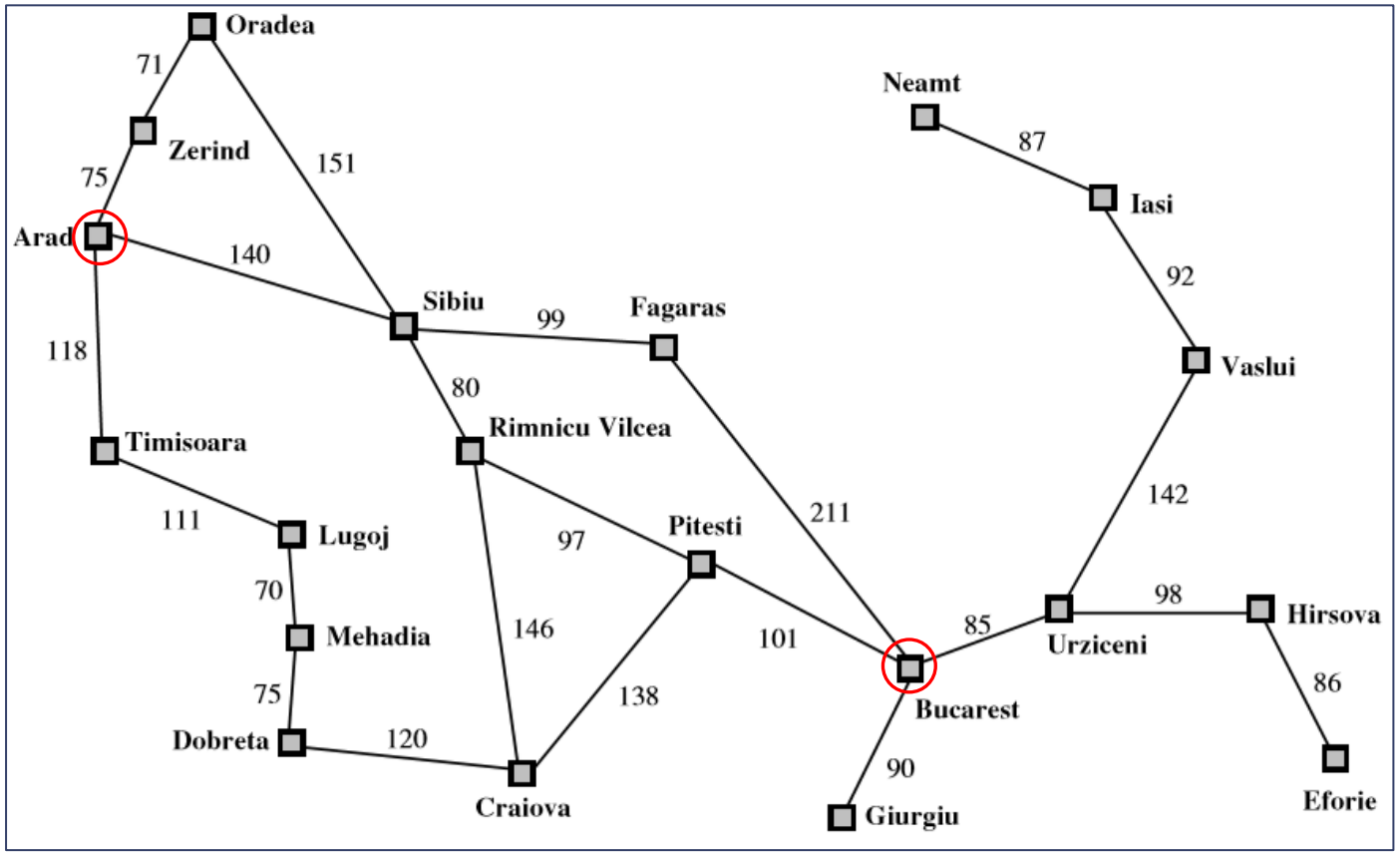
The time evaluating the heuristic should be compensated with a more efficient search.

$$h(n) = \ estimated\ path\ cost; the\ cheapest\ between\ the\ n\ node\ to\ the\ goal\ node$$

$$si\ (h(n) == 0) \rightarrow the\ current\ node\ \boldsymbol{is\ the\ goal\ node}$$

Estrategy to transfer aditional knowledge from the problem to the search.

Voracius Algorithm

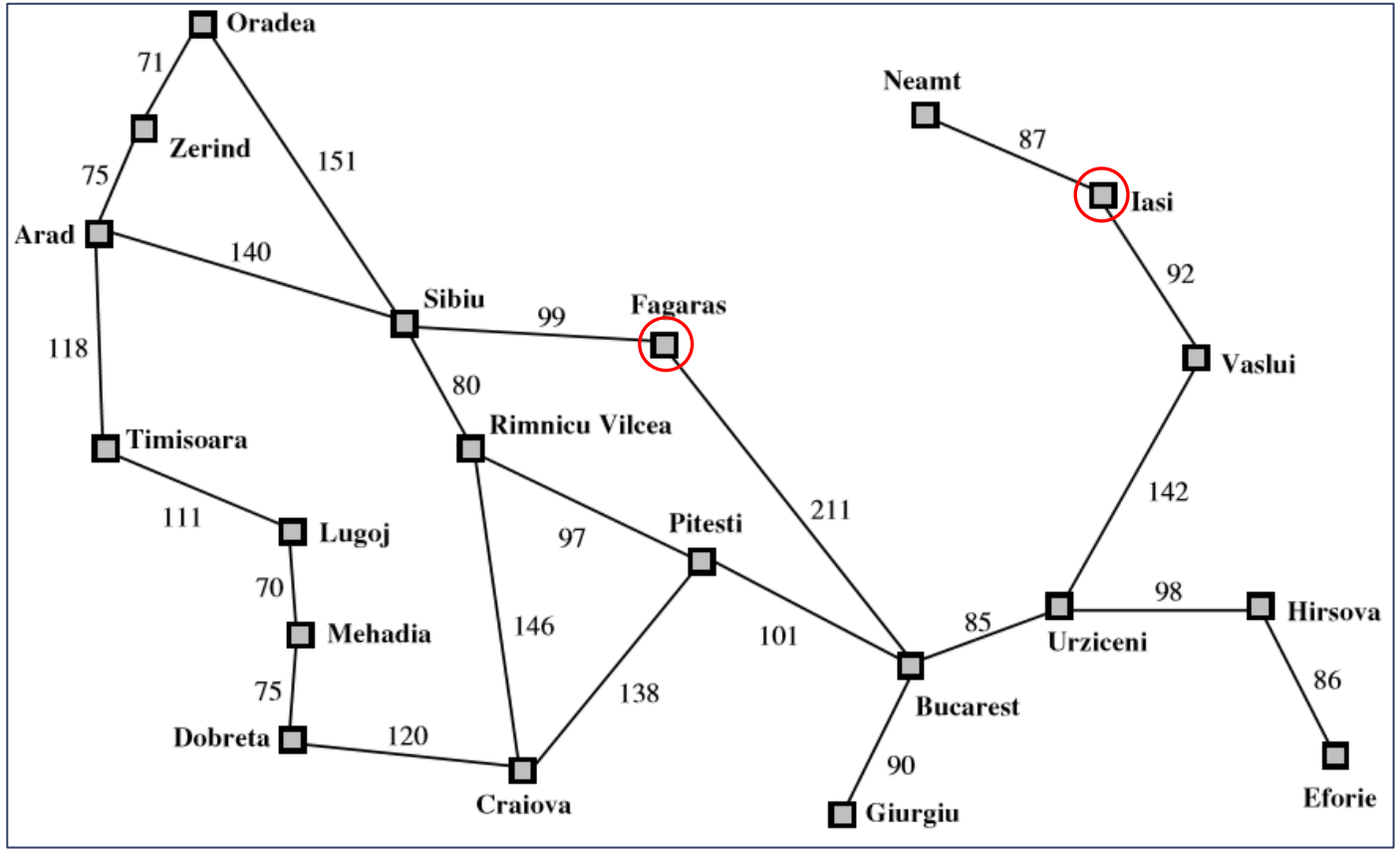


Arad	366	Mehadia	241
Bucarest	0	Neamt	234
Craiova	160	Oradea	380
Dobreta	242	Pitesti	100
Eforie	161	Rimnicu Vilcea	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Hirsova	151	Urziceni	80
Iasi	226	Vaslui	199
Lugoj	244	Zerind	374

$h(n) \rightarrow Rect\ line\ distance$

Russell (2008)

Voracius Algorithm



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$h(n) \rightarrow Rect\ line\ distance$

Russell (2008)

A* Algorithm

The evaluation of the nodes considering both the cost and the heuristics:

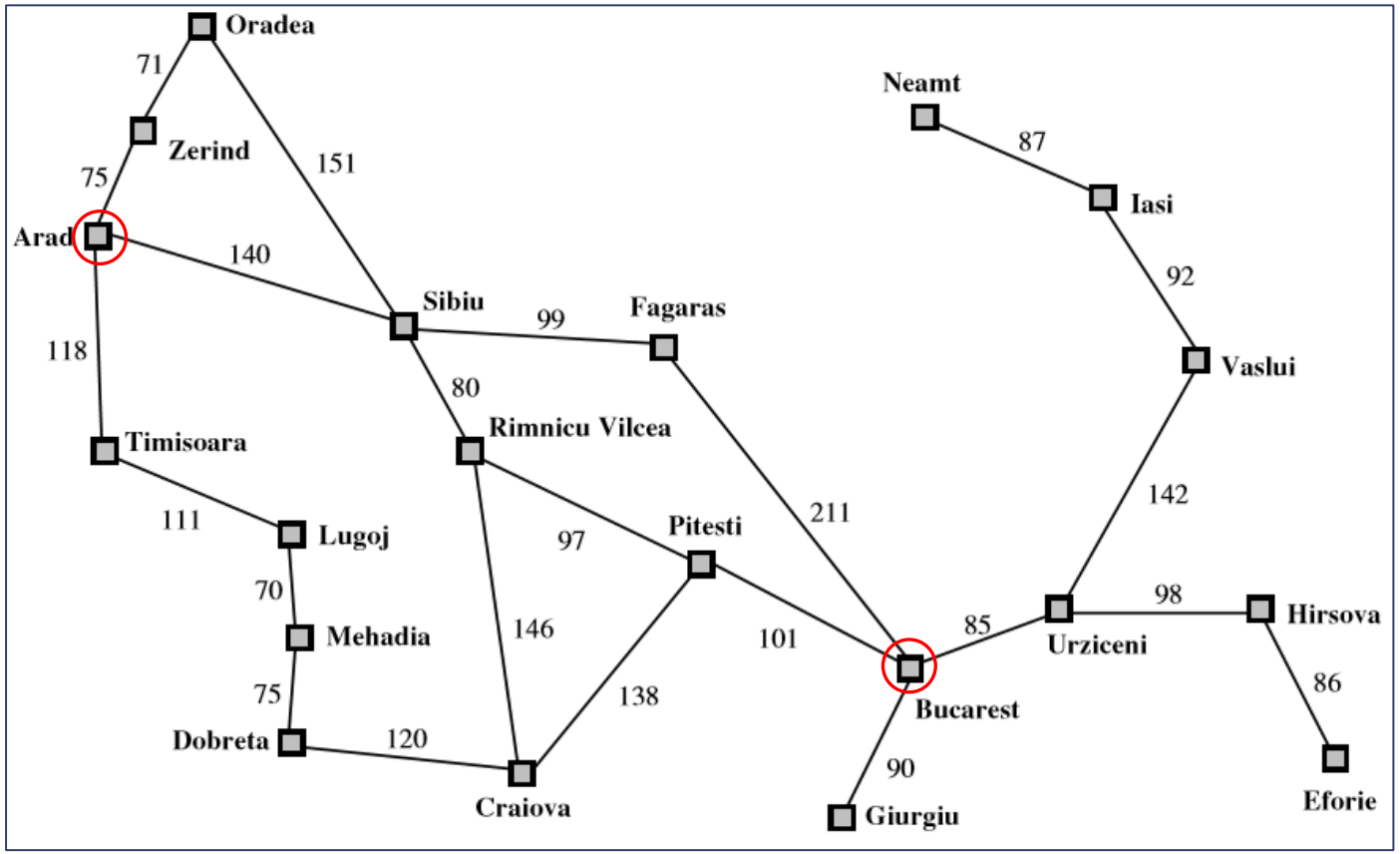
$$f(n) = g(n) + h(n)$$

$g(n)$*: Path cost from start to node*

$h(n)$*: Estimated cost from node to goal*

If the heuristic is **admissible**, then the search is **optimal.** Don't overestimate the cost of reaching the goal.

A* Search



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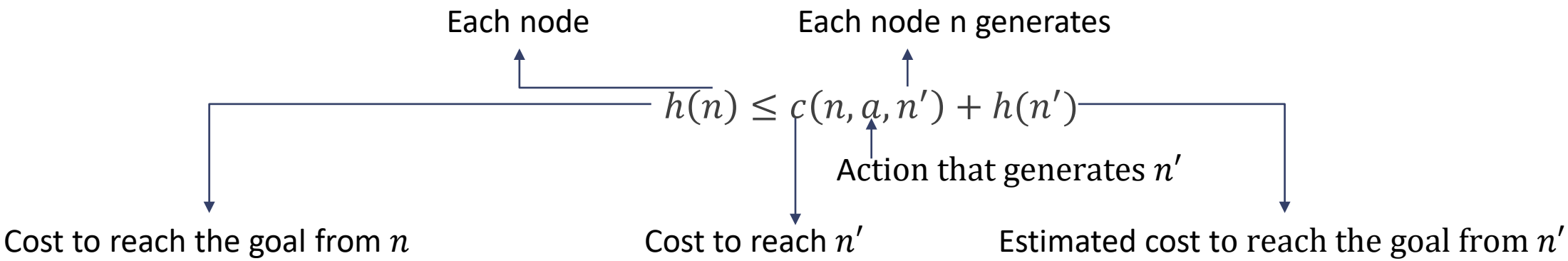
$h(n) \rightarrow Straight\ line\ distance$

Russell (2008)

Consistent heuristics

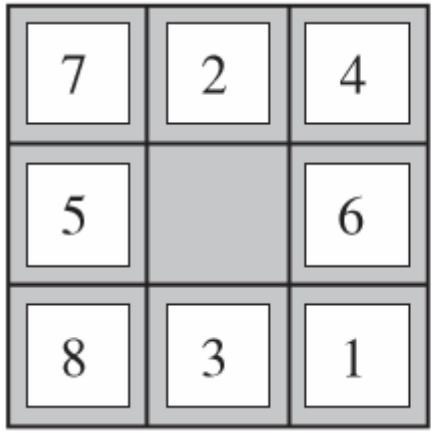


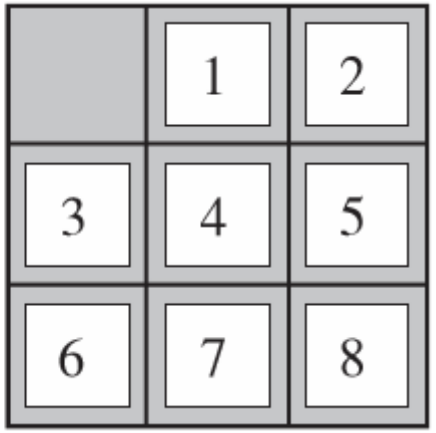
Consistent heuristics

$$f(n') = g(n') + h(n') = g(n) + c(n, a, n') + h(n') \geq g(n) + h(n) = f(n)$$

if h(n) is consistent, then the values of f(n), along any path, do not decrease.

Heuristic Functions





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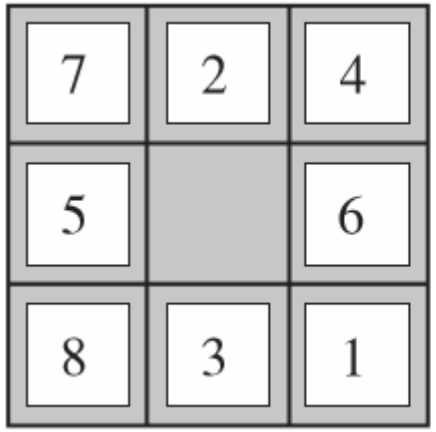

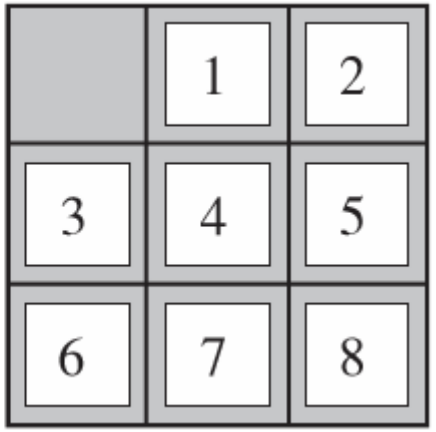

References

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