Uninformed Search

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Uninformed Search

An uninformed search method has no knowledge of how close each state is to the goal state.

Path Finding with Uninformed Search

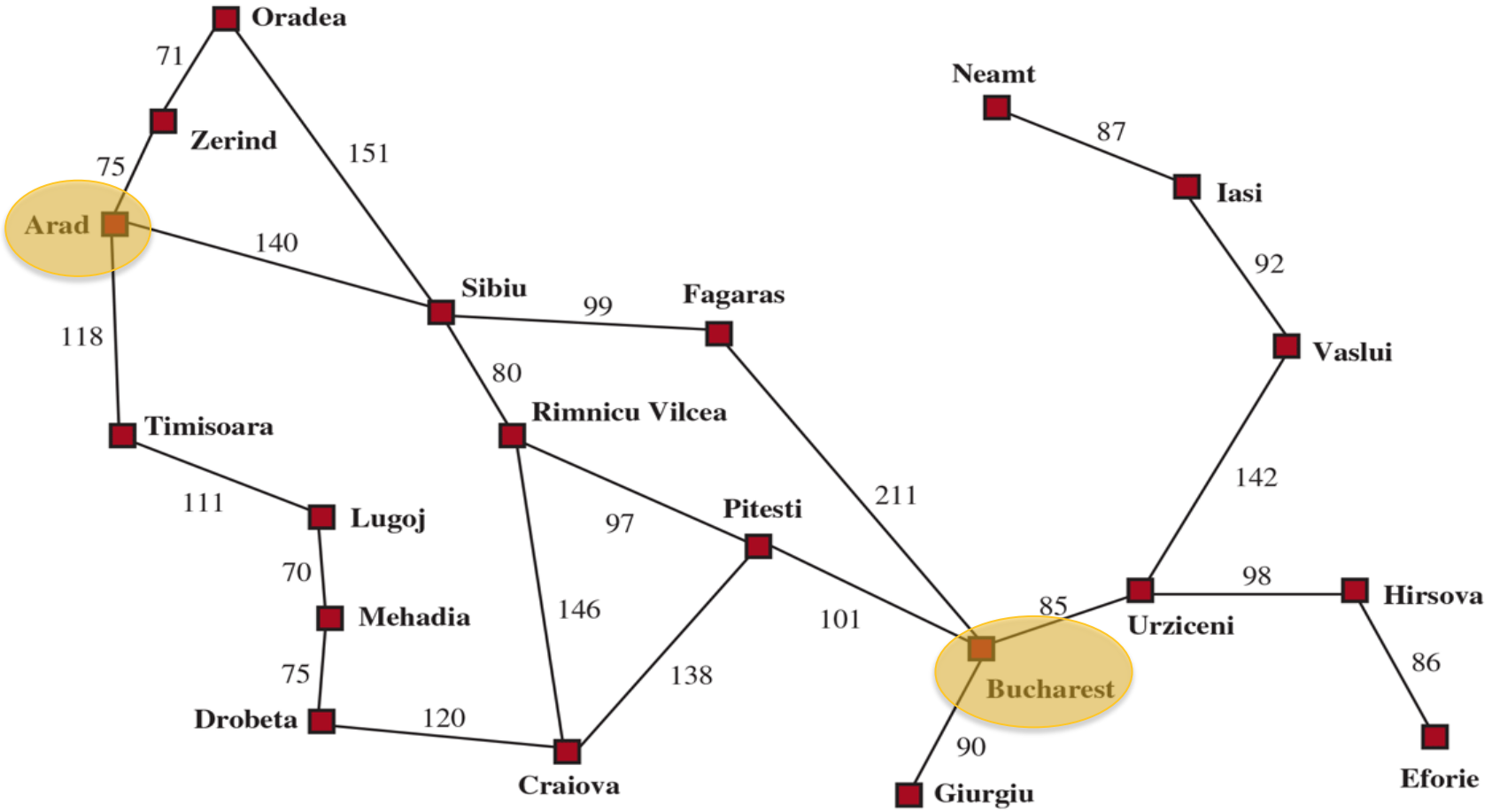


Fig 3.1, Russell & Norvig's Textbook

Algorithm has no clue whether going through Sibiu or Zerind is closer to Bucharest.

Uninformed Search Strategies

- Breadth-First
- Dijkstra’s Uniform Cost
- Depth First
- Depth-Limited
- Iterated Deepening

Breadth-First Search

Expand root, then all its child nodes, and proceed one level at a time.

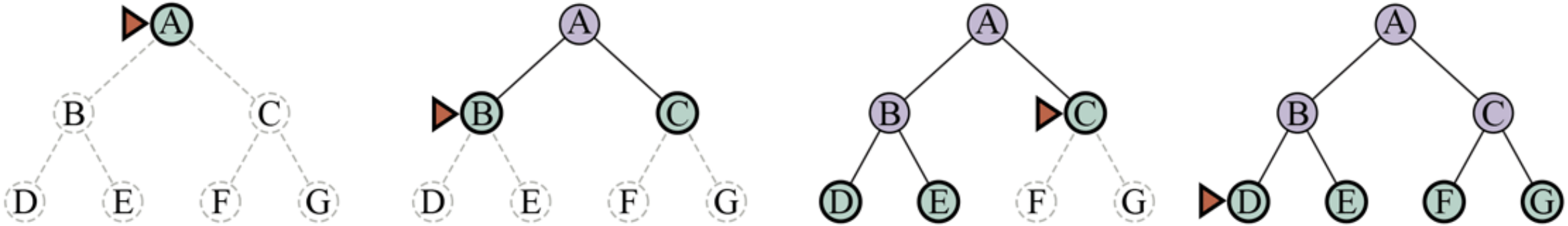


Fig 3.8, Russell & Norvig's Textbook

Always finds the solution with the minimum number of steps from root.

Breadth-First Search

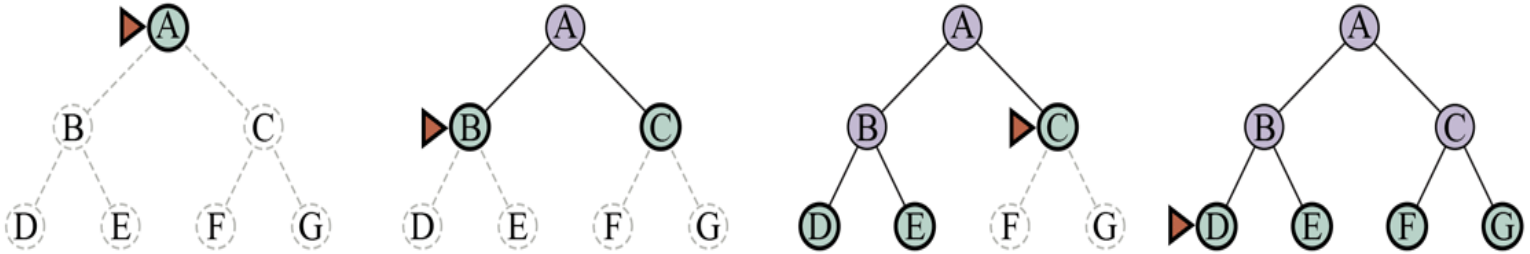


Fig 3.8, Russell & Norvig's Textbook

Problem with memory and time complexity.

If each node has 2 children:
Level 1 has 1 node
Level 2 has 2 nodes
Level 3 has 4 nodes
Level 4 has 8 nodes
Level 5 has 16 nodes

➔

If each node has b children:
Level 1 has b^1 node
Level 2 has b^2 nodes
Level 3 has b^3 nodes
Level 4 has b^4 nodes
Level 5 has b^5 nodes

Breadth-First Search

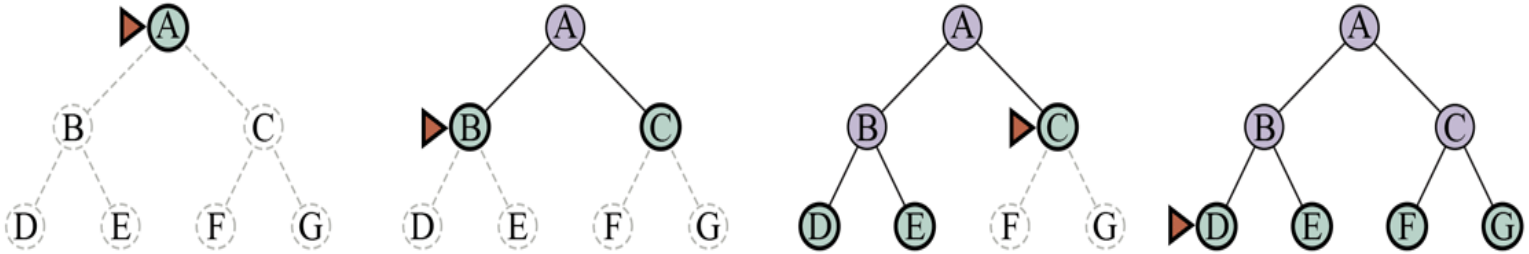


Fig 3.8, Russell & Norvig's Textbook

Problem with memory and time complexity.

Level 15 has b^{15} nodes, for b=10 ➔ total number of nodes = 10^{15}

If each node requires 1Kb of memory ➔ total required memory = 10^{15}Kb ~ 1 million terabytes!

If we can process 1 million nodes/sec, we need 10^{12} seconds to process all nodes, that's (10^{12}/60 /60 /24 /365) ~ 31.7 years!!

An Exponential-complexity search problems cannot be solved using uninformed search methods except for the smallest instances.

Dijkstra's Algorithm (Uniform Cost Search)

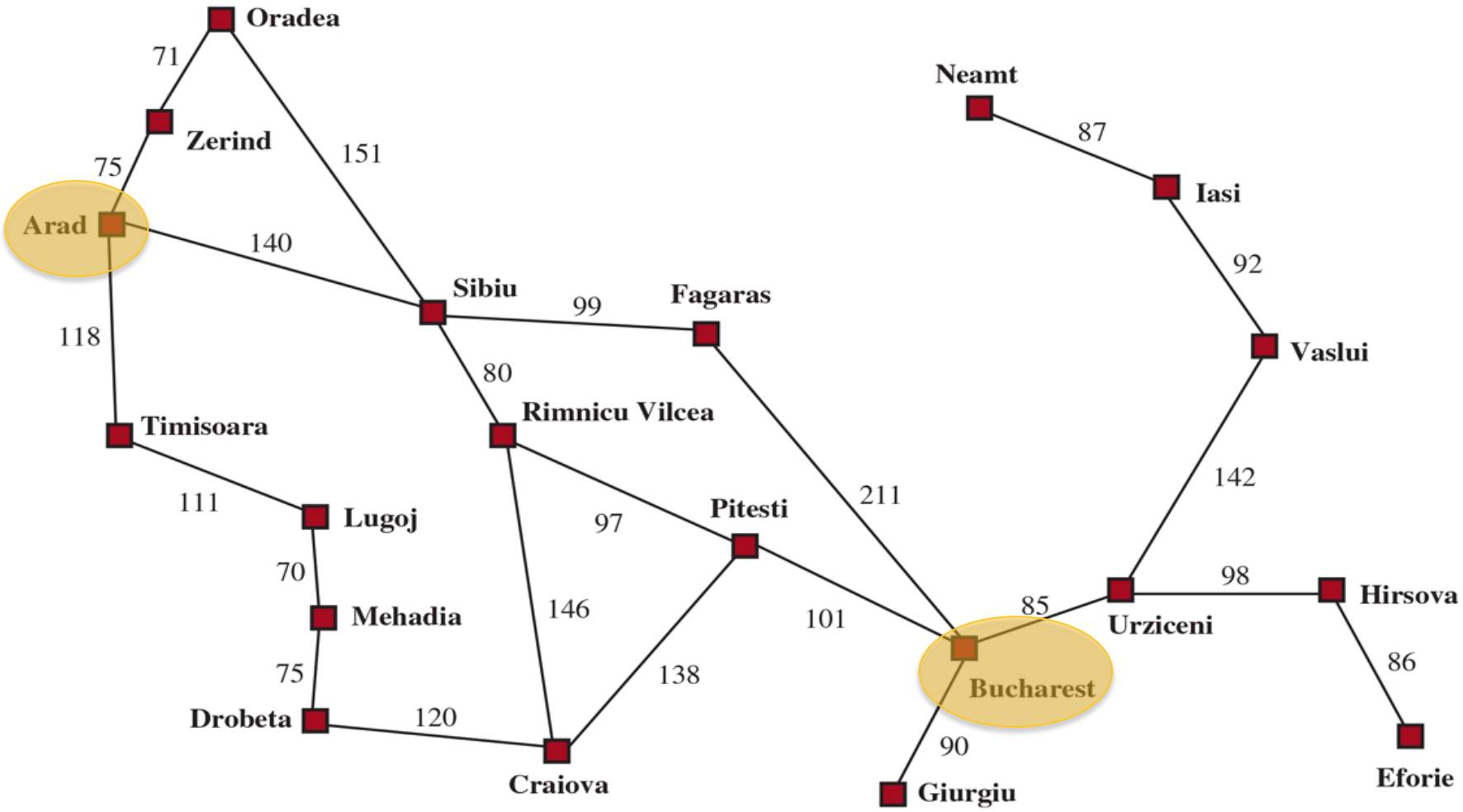


Fig 3.1, Russell & Norvig's Textbook

Each path has a different cost. Dijkstra's expands the minimum cost nodes. This way it reaches the optimal solution without having to expand all nodes at each level.

Complete and Cost-Optimal

Depth-First Search

Solves the memory problem of Breadth-First Search.

Expand one path to the end, then moves to the next path and so on.

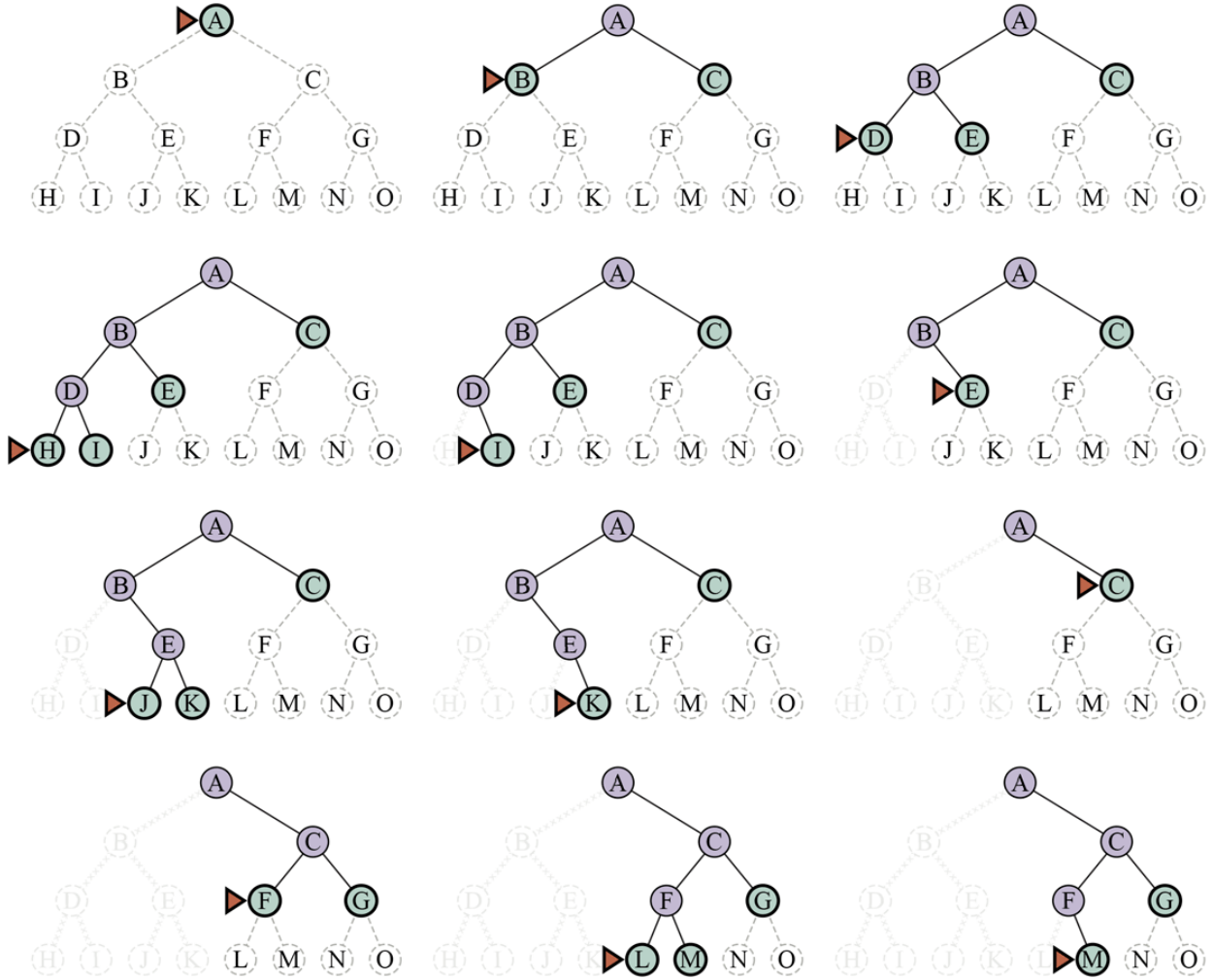


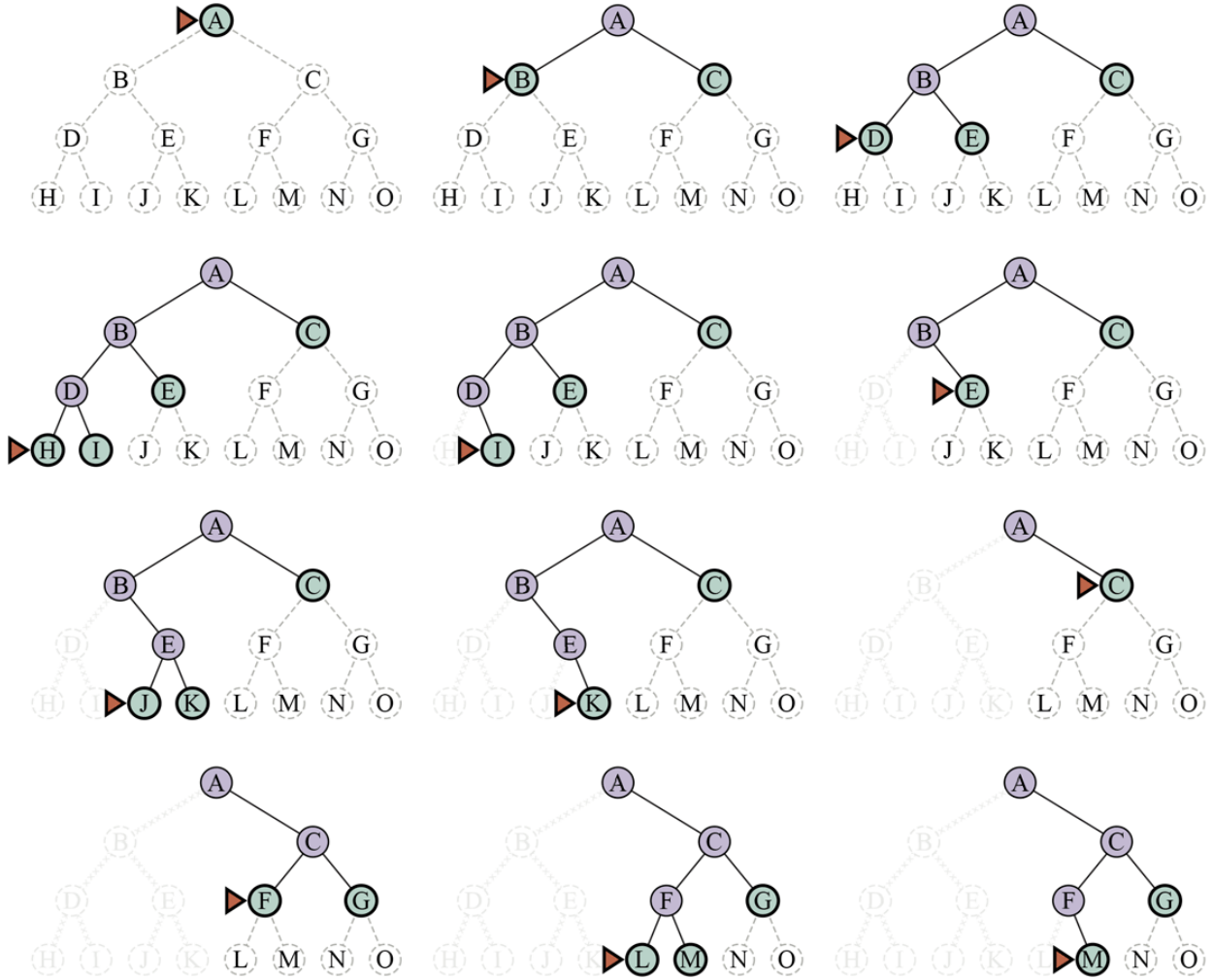
Fig 3.11, Russell & Norvig's Textbook

Not cost-optimal. Returns the first solution, which may not be the cheapest.

Must check for cycles to avoid infinite looping!

Depth-Limited Search

Avoids infinite loops by putting a cutoff on the maximum depth the algorithm should reach.



Not cost-optimal. Returns the first solution, which may not be the cheapest.

Fig 3.11, Russell & Norvig's Textbook

What if the solution exists at a depth greater than the maximum depth limit?

Iterative Deepening Search

Overcomes the limits of the depth-limited search.

Keeps increasing the depth limit one step at a time until a solution is found.

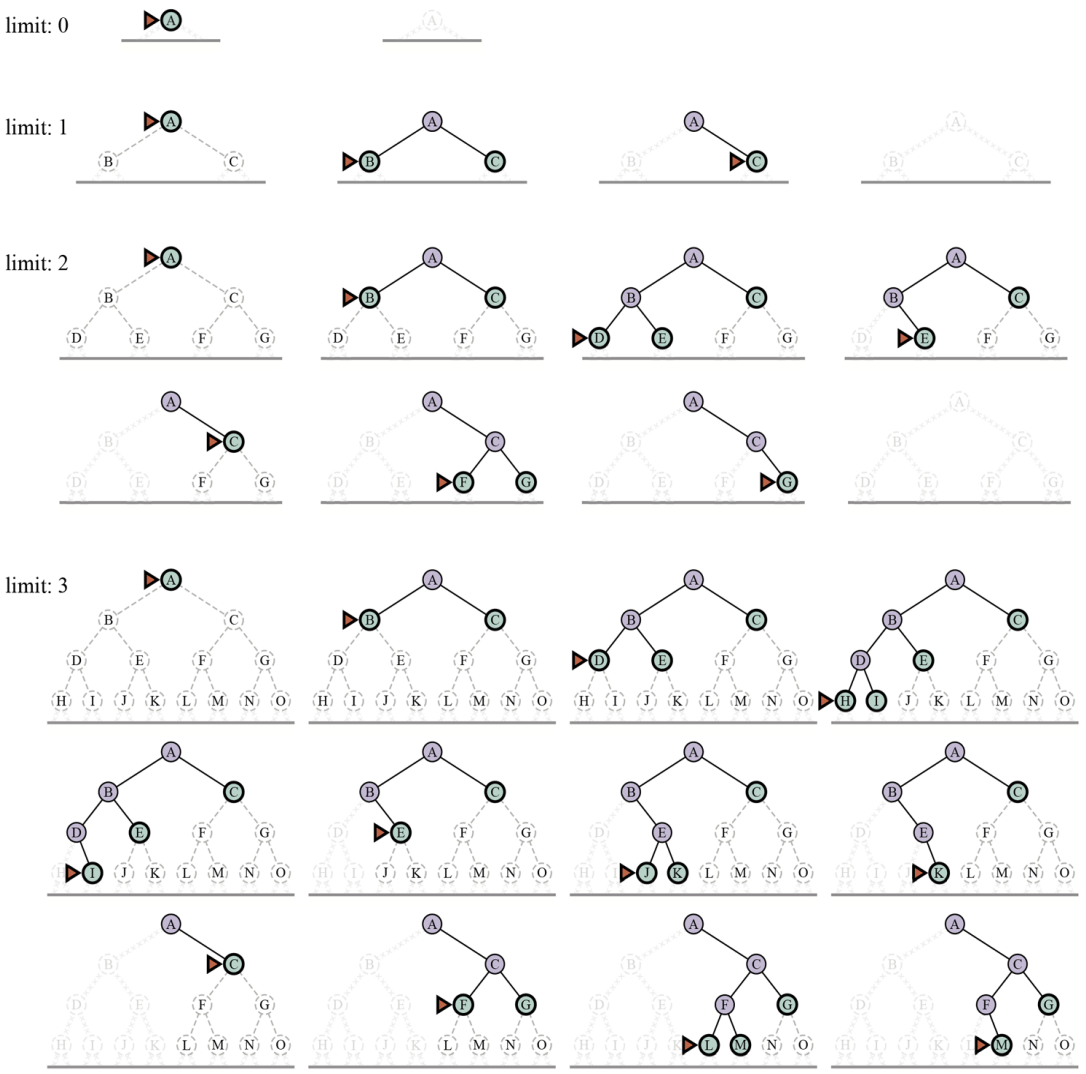
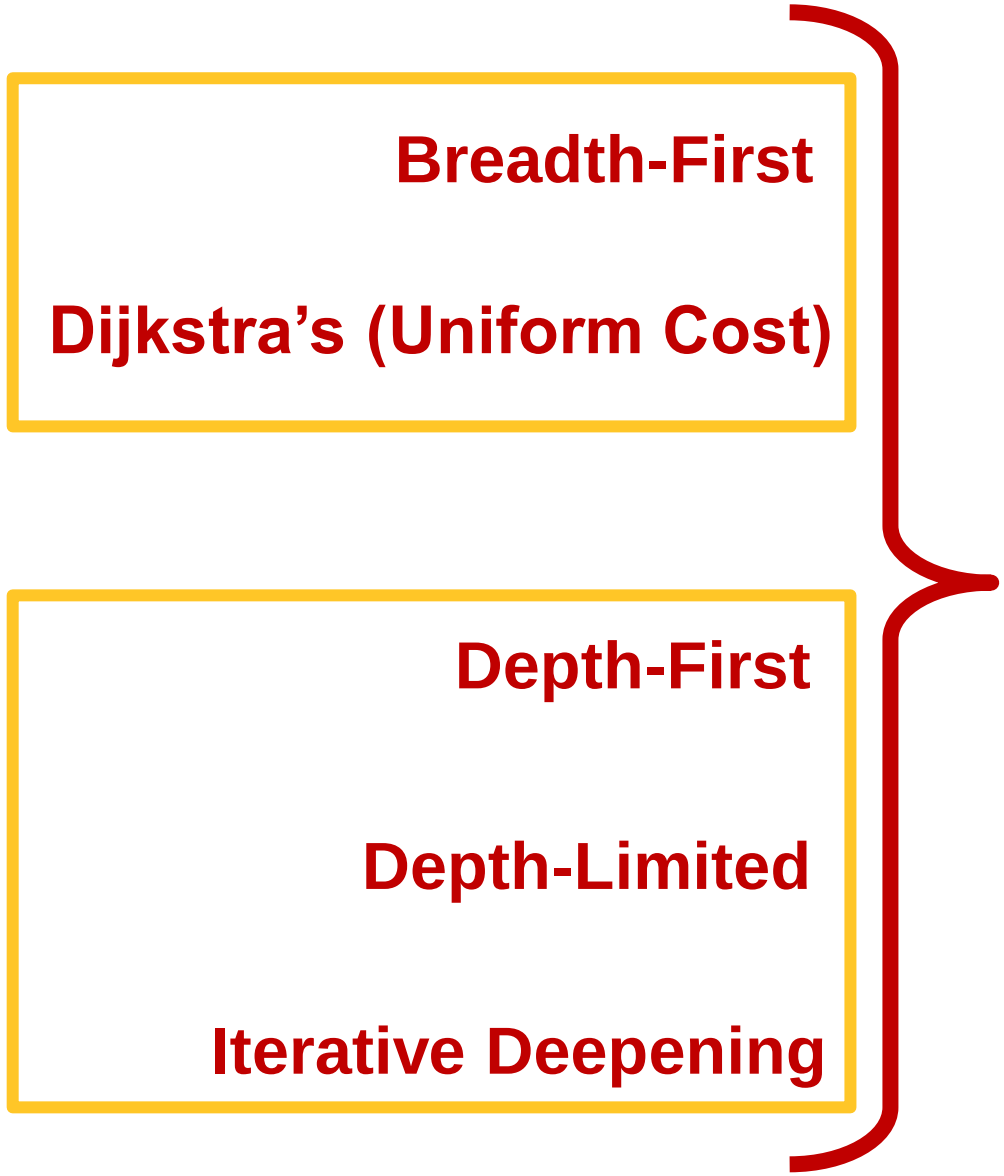


Fig 3.13, Russell & Norvig's Textbook

Not cost-optimal. Returns the first solution, which may not be the cheapest.



Uninformed Search Methods