# Problem Solving & Searching Algorithms

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# Artificial Intelligence: A Modern Approach

3 SOLVING PROBLEMS BY SEARCHING

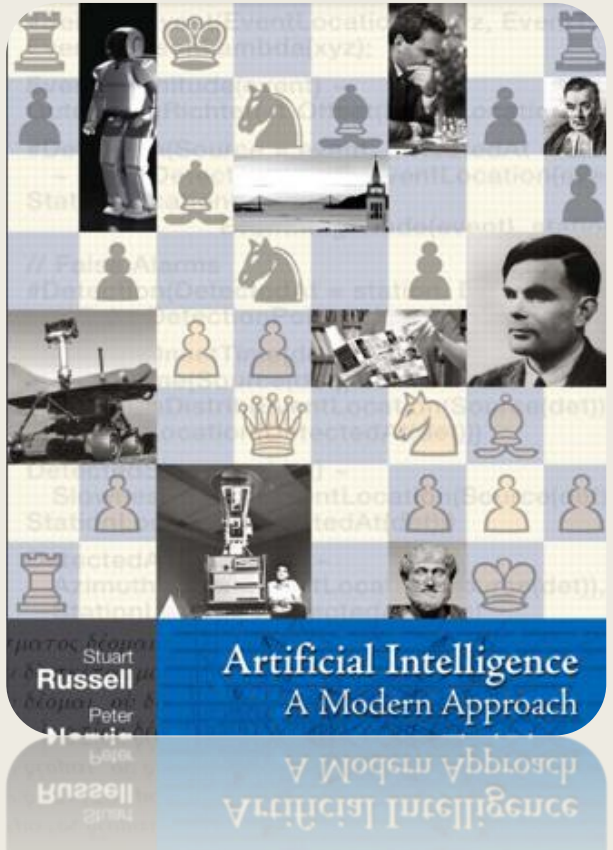
Section 3:

Problem Solving

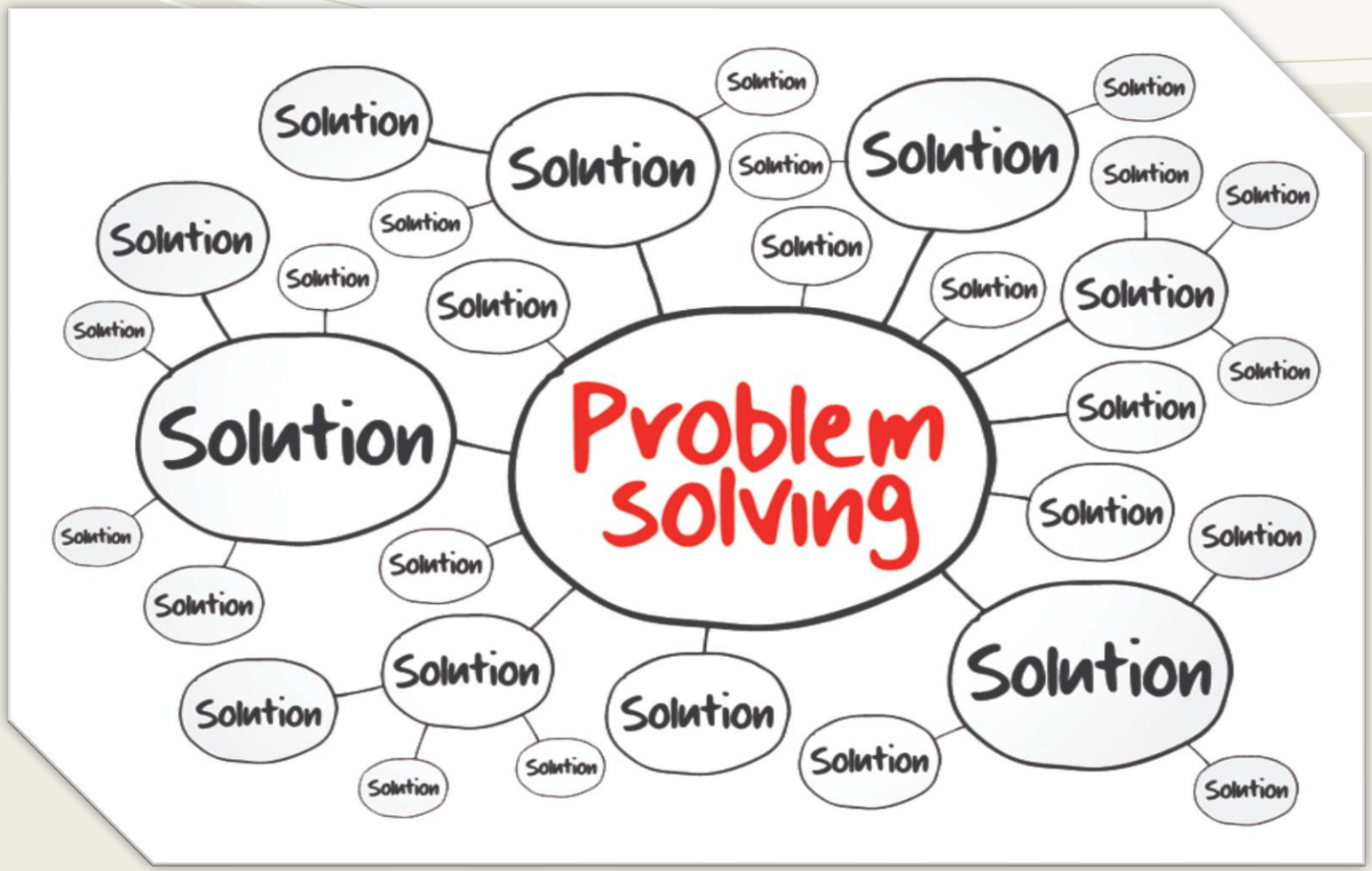
Problem Searching

Uninformed Search Algorithms

Informed Search Algorithms



# Problem Solving in AI

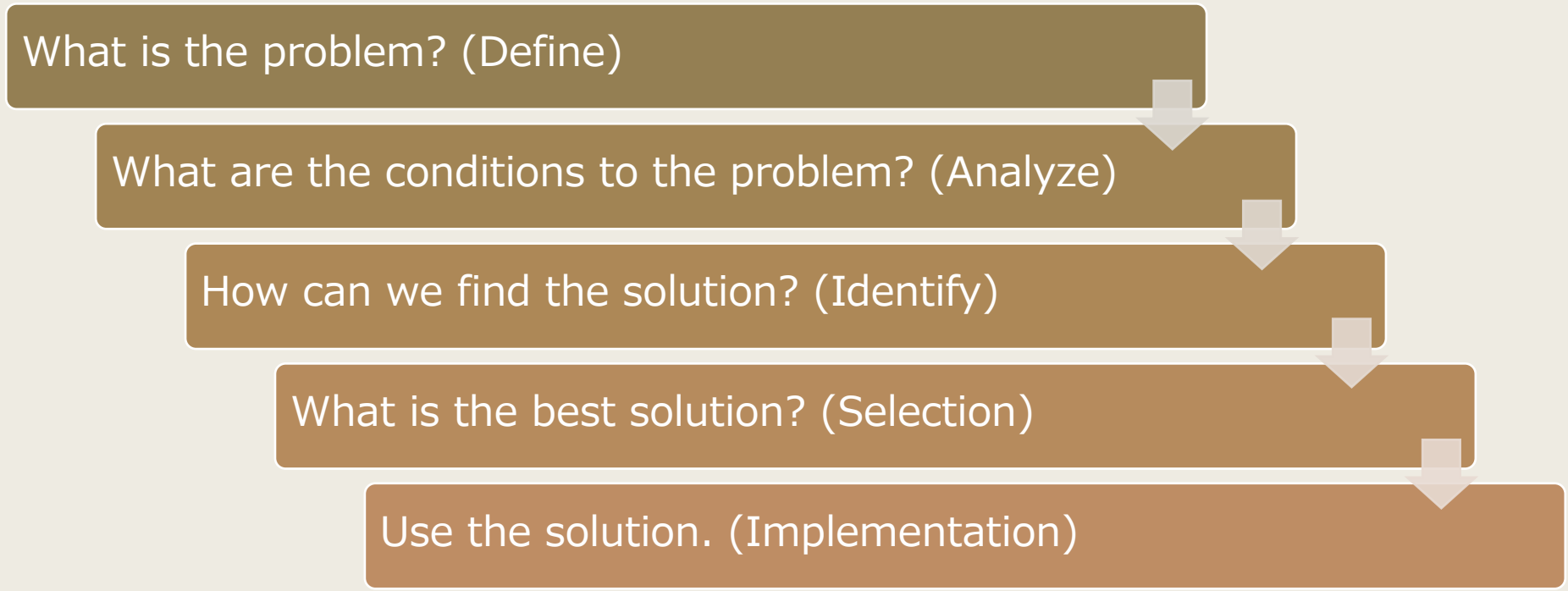



*"How to go about doing so?"*

*"What are the solutions?"*

*"Which is the best solutions?"*

# Problem Solving in AI



# Problem Searching

*Measuring the Problem-solving performance*

- Completeness
- Optimality
- Time Complexity
- Space Complexity

# Types of Search Algorithms

**Uninformed (Blind Search)**

Breadth First Search

Depth First Search

Depth Limited Search

Bidirectional Search

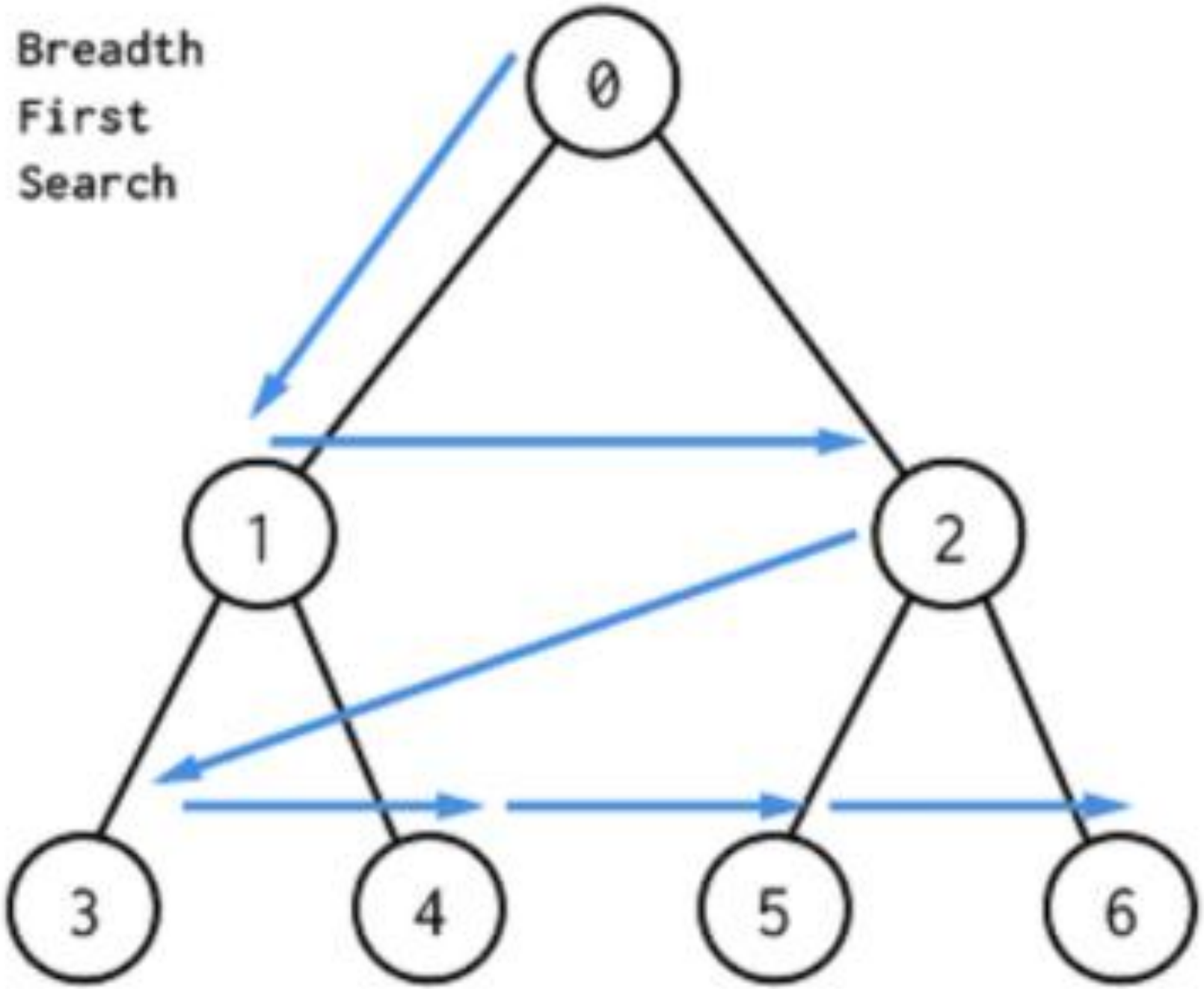
**Informed (Heuristic Search)**

Best First Search

A* Search

AO* Search

Hill Climbing

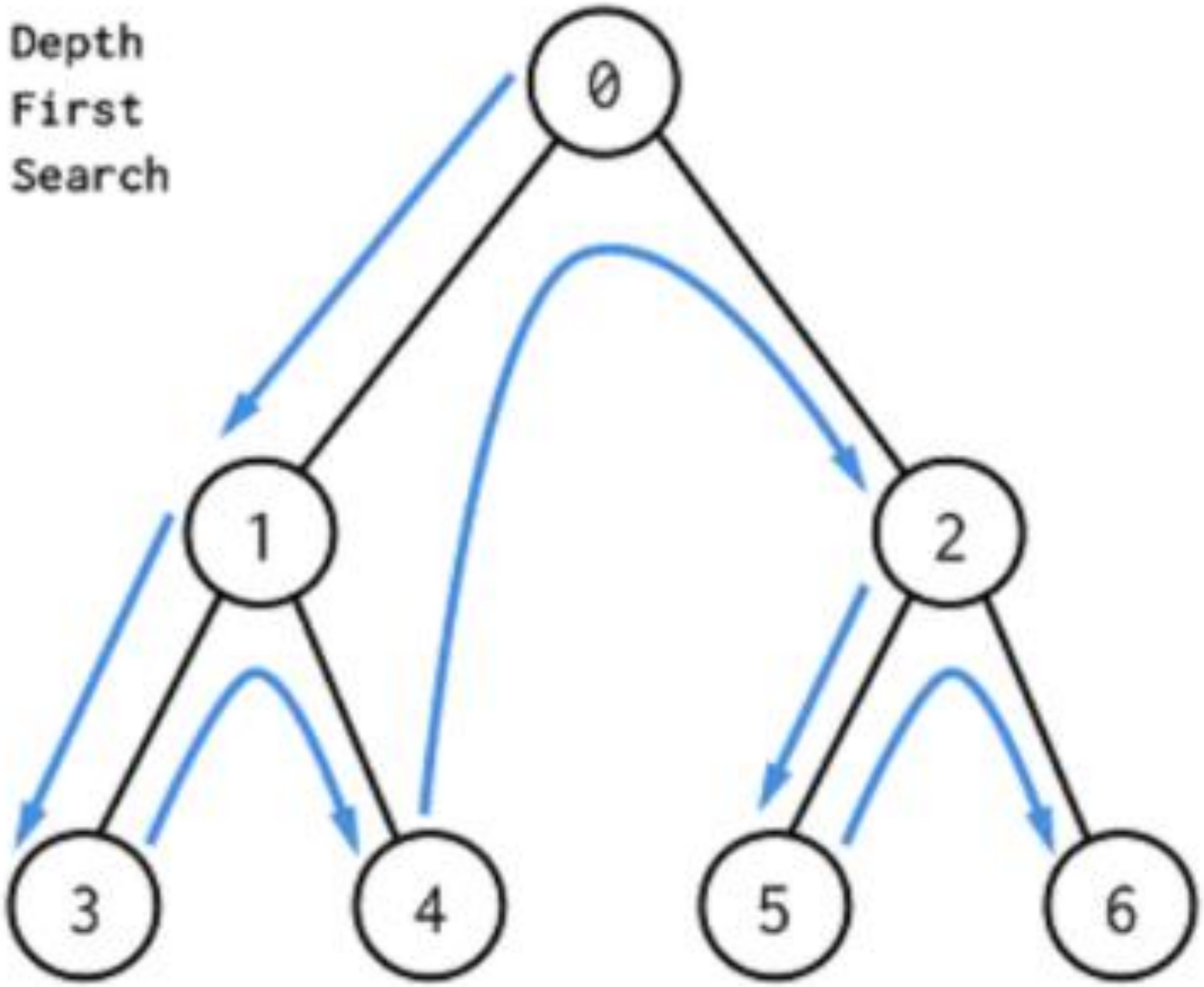



# Breadth First Search

Searches breadthwise (Left-to-right)

Queue(FIFO)

Completeness (PRO)
Lots of memory (CON)



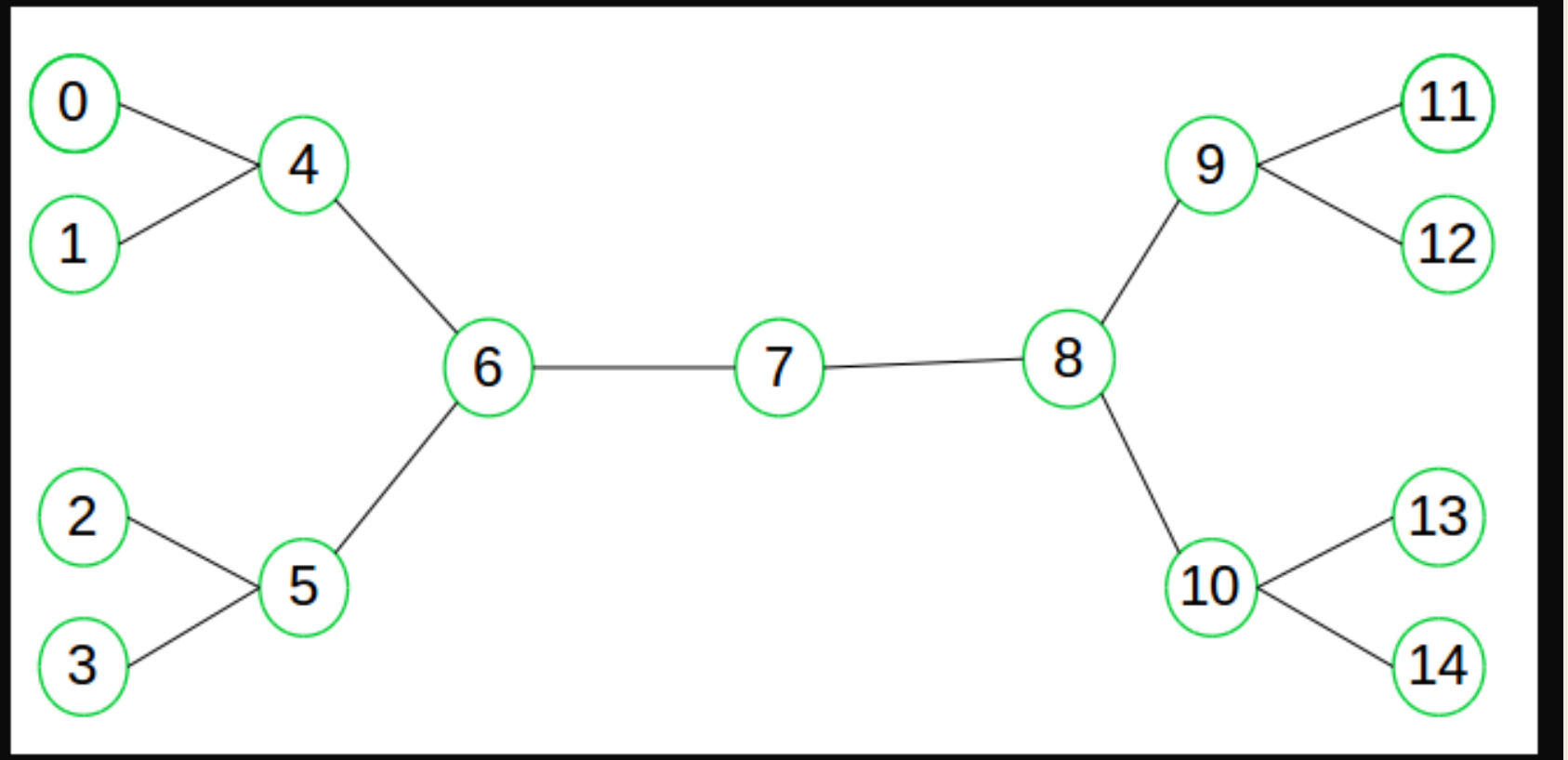

# Depth First Search

Searches from root node and follows each path.

Stack, Recursive

Less Memory & Time (PRO)
No Guarantee (CON)

Limited Search:
Predetermined limit




# Bidirectional Search Algorithm

Run two simultaneous searches.

Divided into two subgraphs until intersection

Fast, less memory (PRO)
Must know goal state in advance (CON)

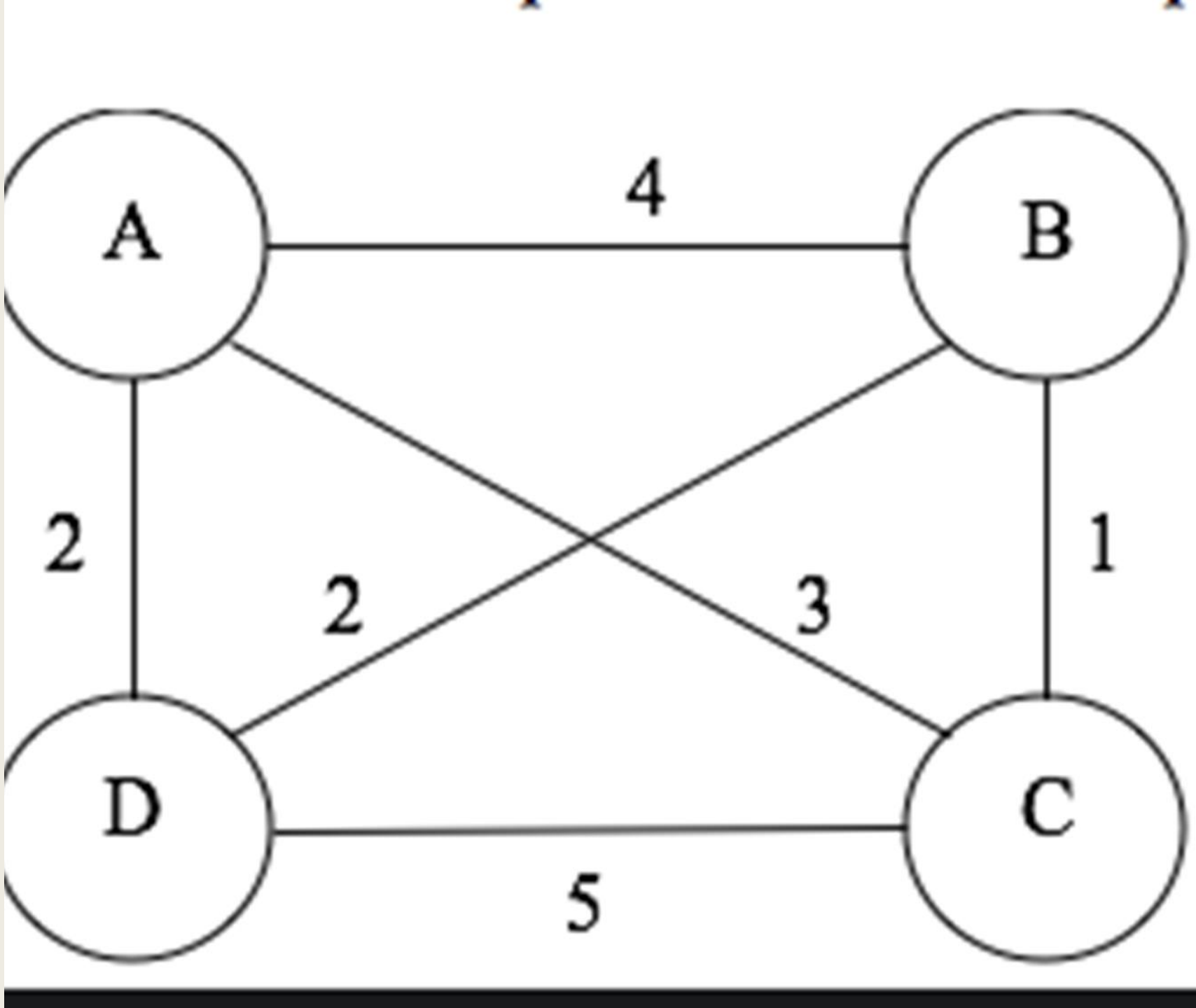
# Best First Search Algorithm (Greedy)

Known Information

Selects path best at the time

Uses the heuristic cost, uses open/closed list

Uses both BFS and DFS (PRO)
Can be stuck (CON)



# Traveling Salesman Problem Visualization (Greedy Algorithm)

https://www.youtube.com/watch?v=SC5CX8drAtU

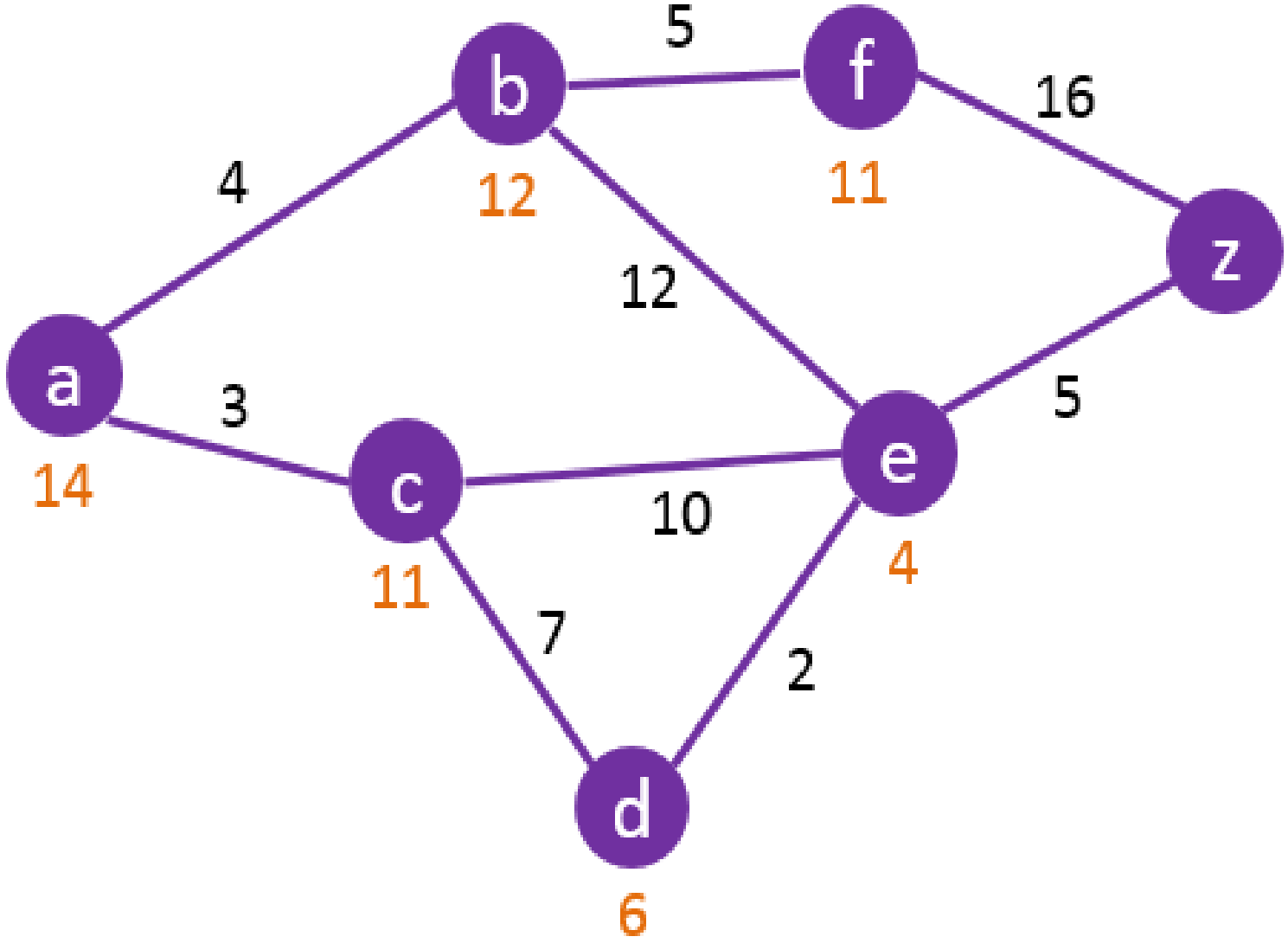
# A* Search Algorithm

Selects path best at the time

Uses the heuristic function and cost to reach the node

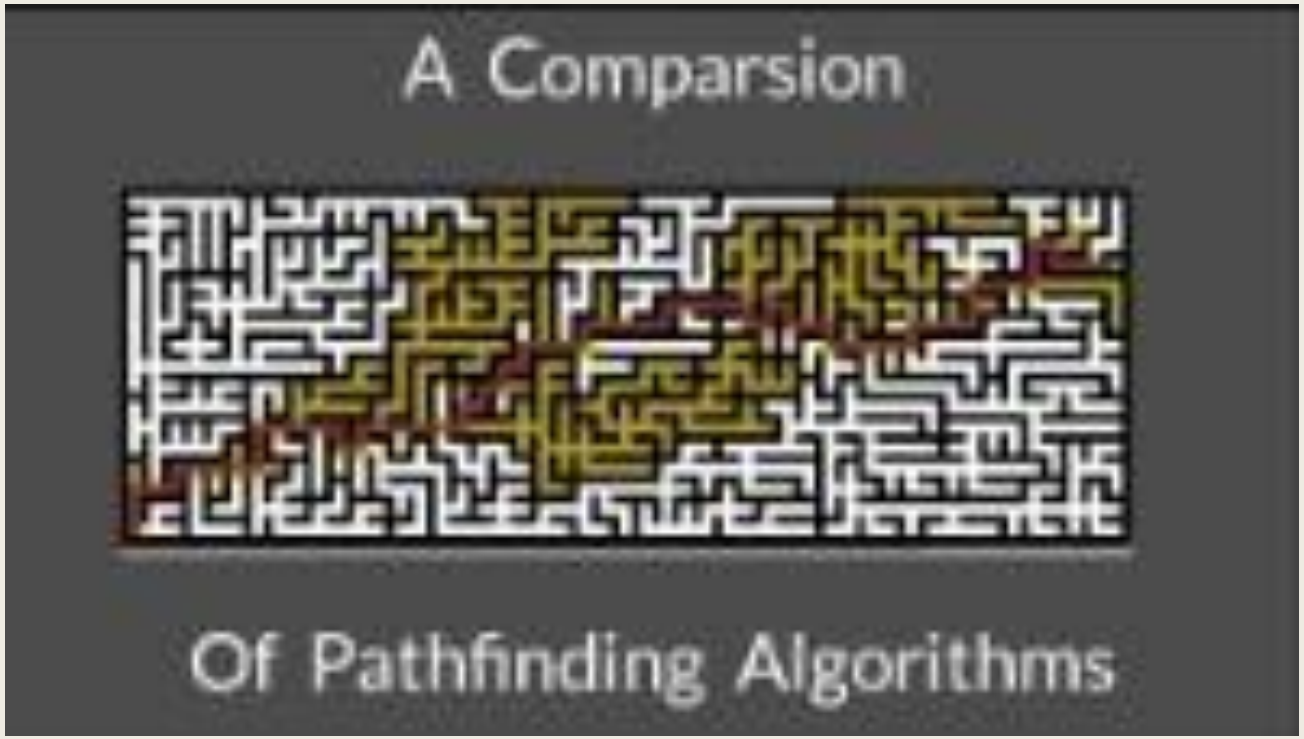
f(n) = h(n) + g(n)

Optimal and Complete(PRO)
Does not always produce shortest path(CON)




A* Search Algorithm

# A Comparison of Pathfinding Algorithms




https://youtu.be/GC-nBgi9r0U?t=72

# Reviewing these 2 Types of Search Algorithms

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## Uniformed Search Algorithm (Blind)

No additional information about states beyond that provided in the problem definition.

Generate successors and distinguish a goal state from a non-goal state.

(Brute Force)

## Informed Search Algorithm (Heuristic)

Uses problem-specific knowledge beyond the definition of the problem itself (heuristic values)

Find solutions more efficiently than can an uninformed strategy.

(Domain Knowledge)

# References


Russell, S. J., Norvig, P. Chang, M.-wei. (2020) Artificial intelligence a modern approach. Pearson Education Limited.

Erickson, J. (2019). Algorithms. Jeff Erickson. Textbook

"Traveling Salesman Problem Visualization" YouTube, uploaded by n Sanity, https://www.youtube.com/watch?v=SC5CX8drAtU

"A Comparison of Pathfinding Algorithms" YouTube, uploaded by John Song, https://youtu.be/GC-nBgi9r0U?t=72