Exploration Session 1: Artificial Intelligence

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What do you think of when you think “artificial intelligence”?

What is “intelligence”?

- Turing test
  - Discussion between human and computer
  - Computer passes if human cannot tell that it is a computer
- Chatterbot programs
  - ELIZA
  - ALICE (Artificial Linguistic Internet Computer Entity)
  - But are they “intelligent” if they don’t “understand”?

Is human-style intelligence possible?

Human brain

10^{11} neurons
10^{14} synapses
Cycle time: 10^{-3}sec

Computer

10^{7} transistors
10^{10} bits of RAM
Cycle time: 10^{-9} sec

Search

- Techniques for systematically finding or constructing solutions to problems
- Examples:
  - Games
  - Path planning
  - Natural language processing
  - Machine learning
  - Driving a car
- Most (if not all) problems in AI can be formulated as search problems

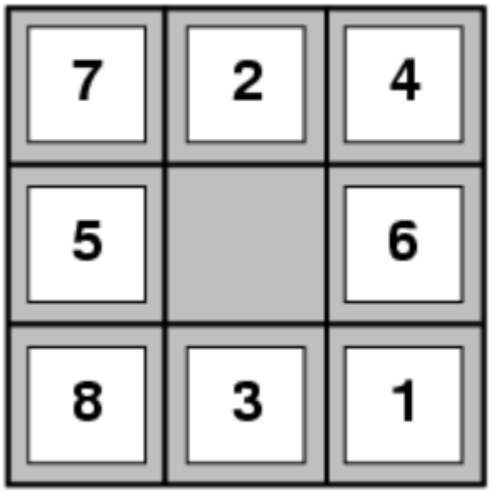
How search works

- Input
  - Set of states
  - Operators (and cost of each operator)
  - Start state
  - Goal state or test
- Output
  - Path from start state to goal state

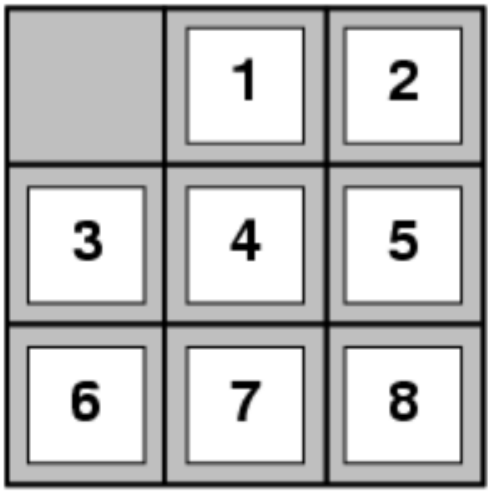
Example: 8-Puzzle

- 8 puzzle

- States?
- Operators?
- Goal state?
- Path cost?

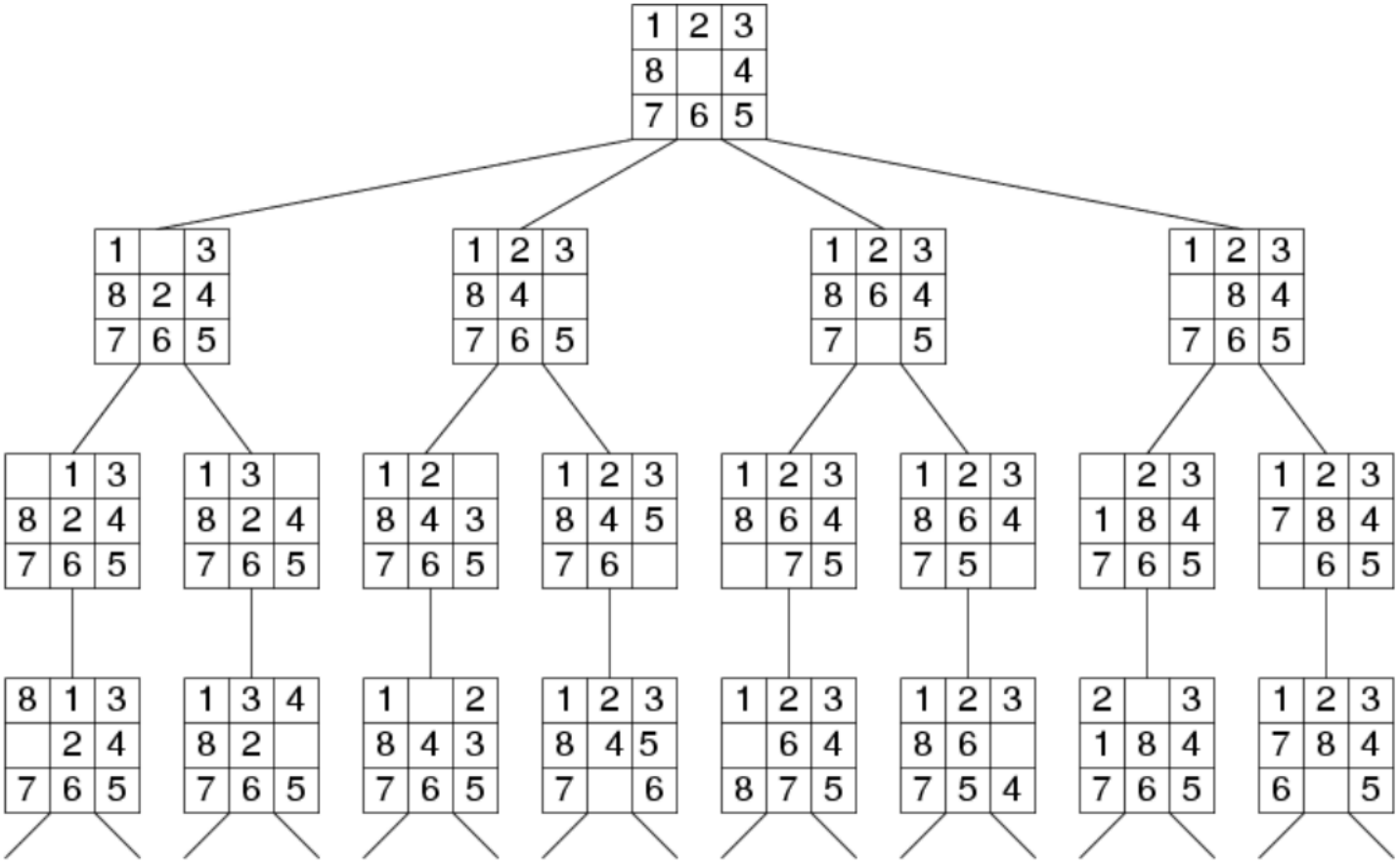


Start State



Goal State

8-Puzzle Search Tree



Types of Search Strategies

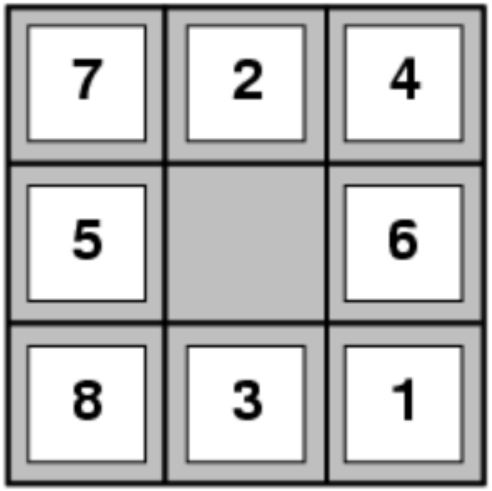
- Which order will we traverse the nodes in the search tree?
- Uninformed search
  - Depth-first search
    - Explore all children before backtracking
  - Breadth-first search
    - Explore all nodes at the same level first
  - Iterative-deepening search
    - Combines the best parts of depth-first and breadth-first

Smarter strategies: Informed search

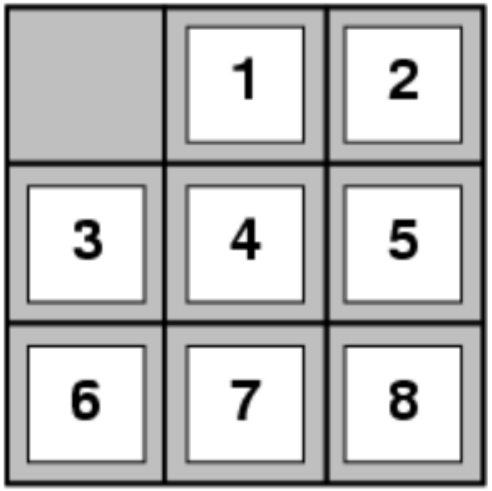
- How can we make search even better?
- Determine how "good" each child node is, and choose the "best"
- Use a heuristic function, f(n) = h(n), to estimate the cost from the node to the goal state, and choose the node with the lowest cost
- This is called *best-first search*

Example: 8-Puzzle

- What might be a good heuristic function?



Start State



Goal State

Search in action

- Depth-first search
  - http://www.youtube.com/watch?v=dtoFAvtVE4U&feature=relmfu
- Breadth-first search
  - http://www.youtube.com/watch?v=z6lUnb9ktkE&feature=relmfu
- Heuristic best-first search
  - http://www.youtube.com/watch?v=huJEgJ82360&feature=relmfu

Real-life example

- Deep Blue: chess-playing computer developed by IBM
- Defeated world champion chess master Garry Kasparov in 1997
- Used informed search
  - Huge processing capacity
  - Heuristic function that took into account hundreds of factors of each state
  - Also used start-game and end-game databases of good moves

xkcd.com

ALICE - http://alice.pandorabots.com/