



Artificial Intelligence

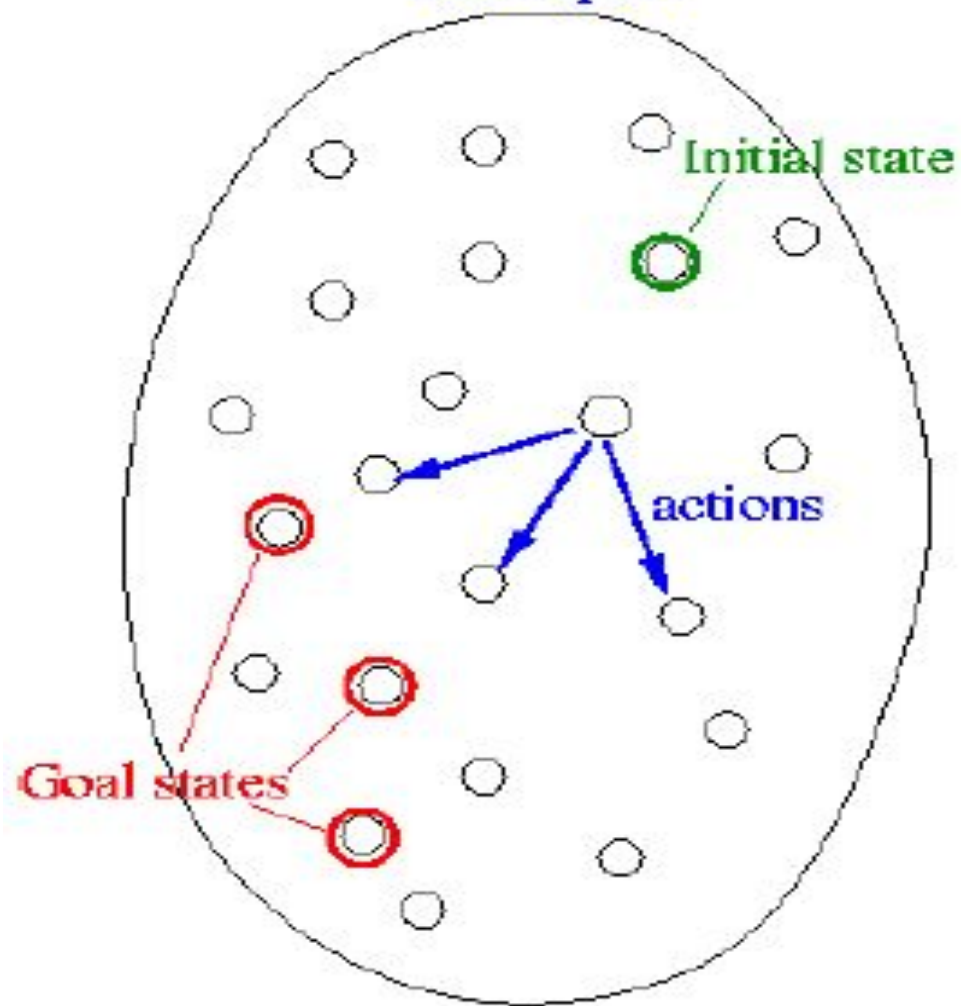
Lecture: Problem Solving using Search (Single agent search)

Search Problem

A search problem consists of the following:

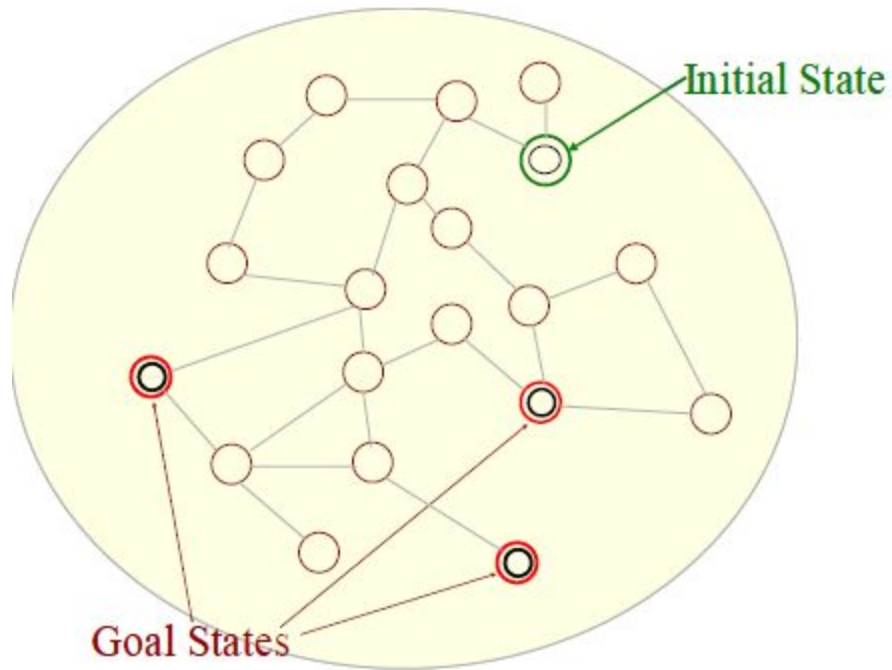
- S : the full set of states
 - s_0 : the initial state
 - $A: S \rightarrow S$ is a set of operators
 - G is the set of final states.

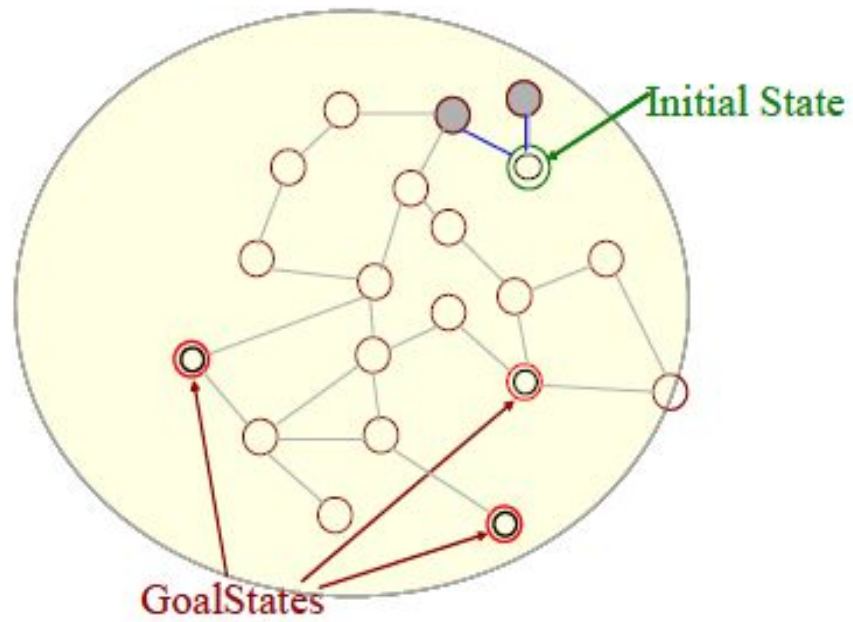
State Space

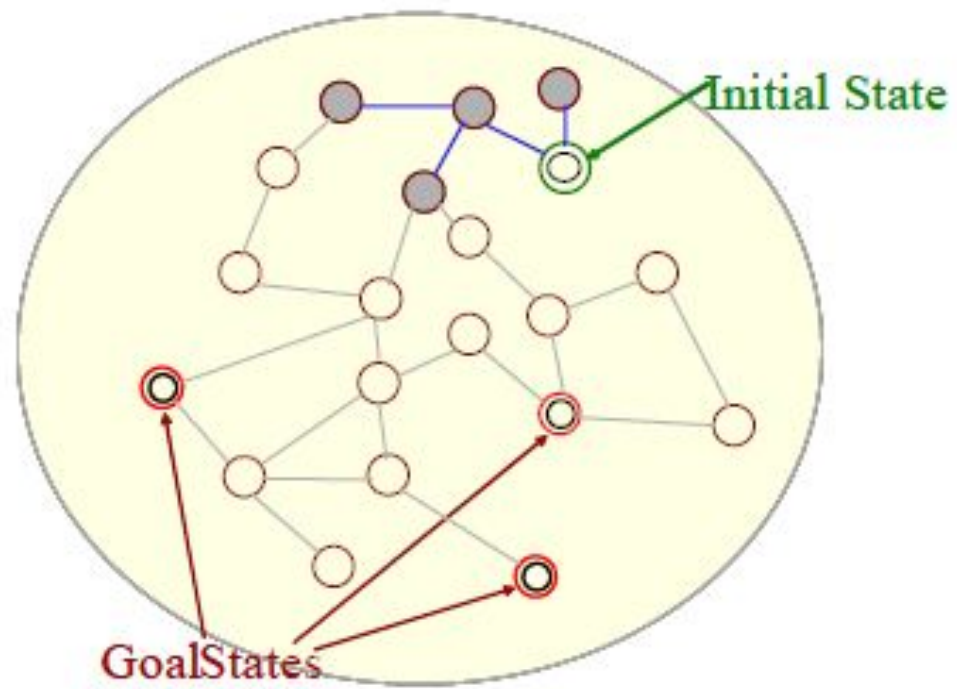


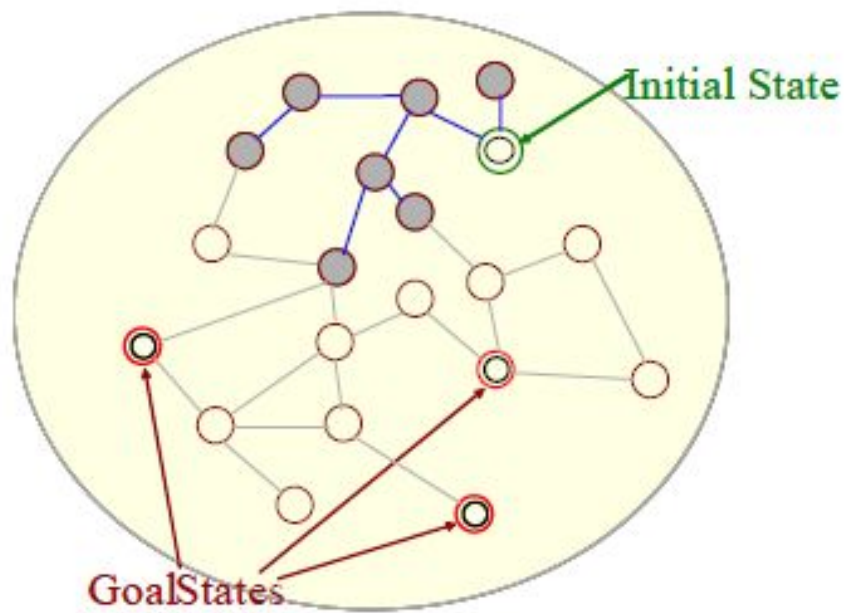
- The **search problem** is to find a sequence of actions which transforms the agent from the initial state to a goal state $g \in G$. A search problem is represented by a 4-tuple $\{S, s_o, A, G\}$.

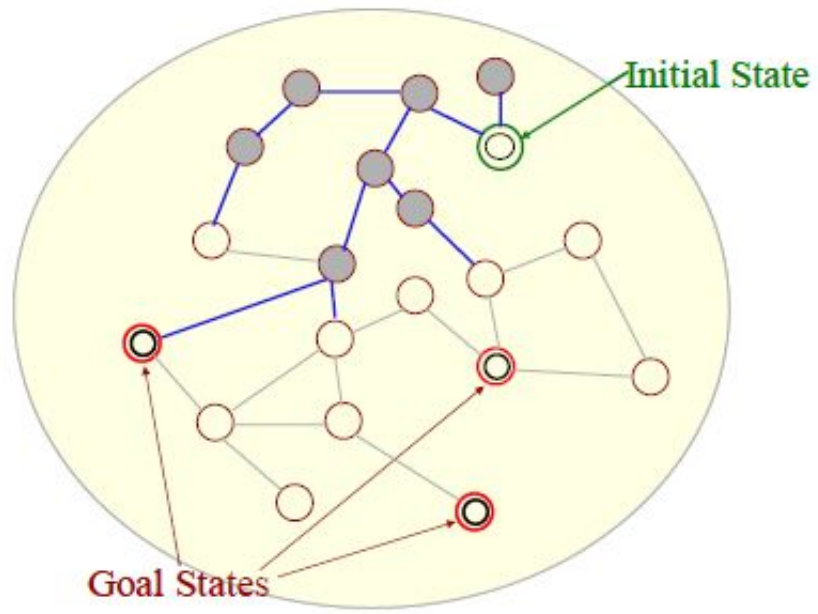
- S: set of states
- $s_o \in S$: initial state
- A: $S \times S$ operators/ actions that transform one state to another state
- G : goal, a set of states.

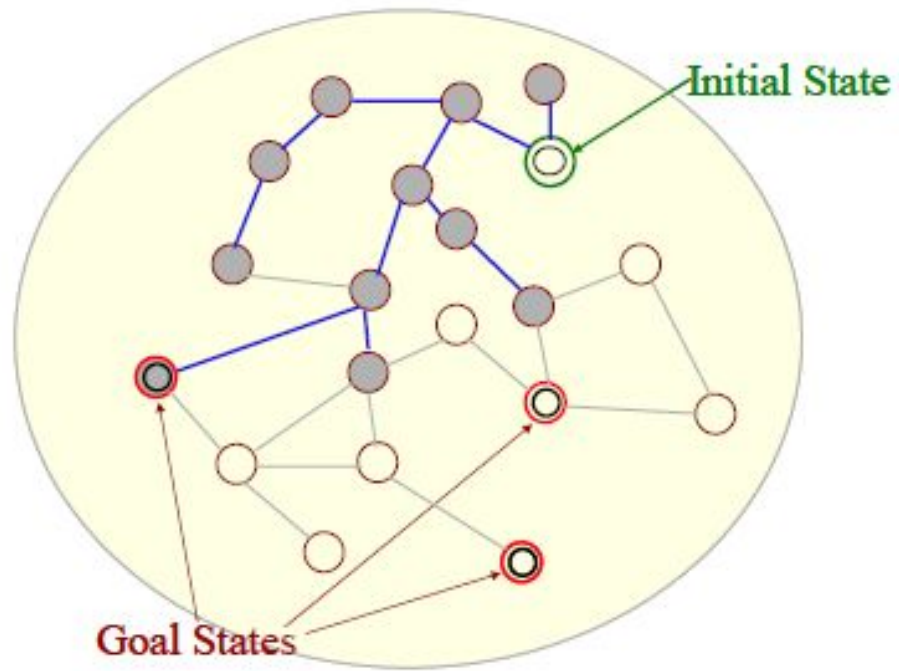






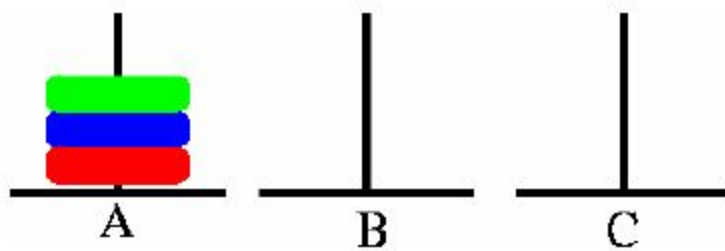




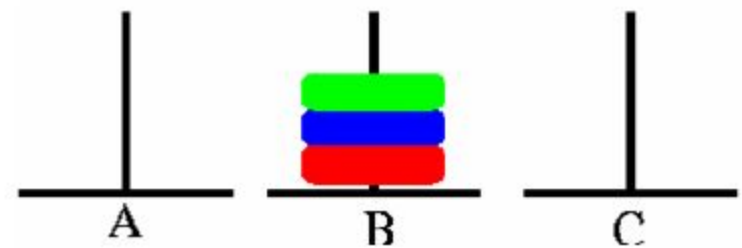


Example problem: Pegs and Disks problem

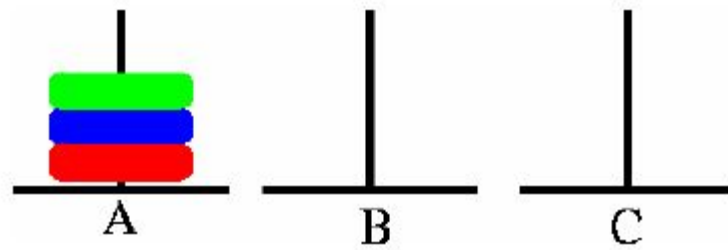
- Consider the following problem. We have 3 pegs and 3 disks.
- **Operators:** one may move the topmost disk on any needle to the topmost position to any other needle
- In the goal state all the disks are in the needle B as shown in the figure below.



Initial State

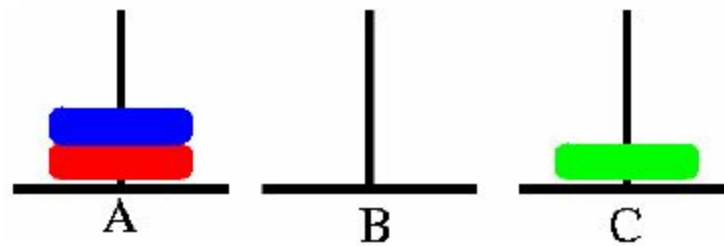


Goal State

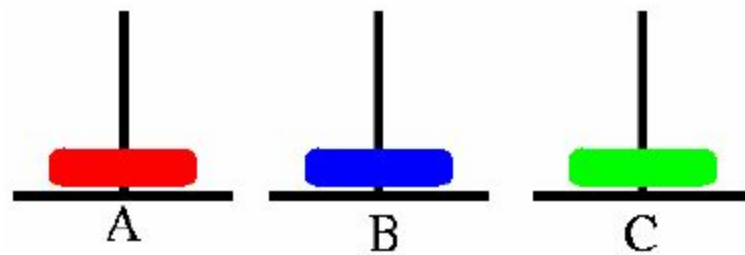


Initial State

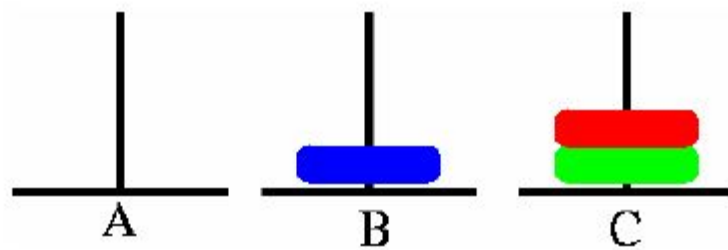
Step 1: Move A \rightarrow C



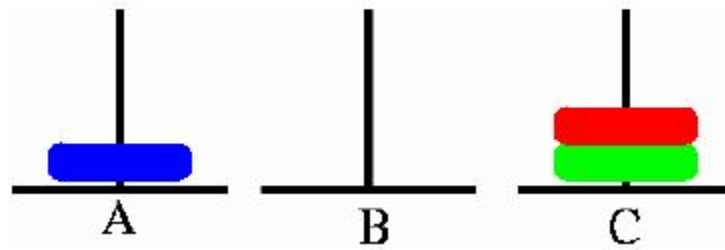
Step 2: Move A \rightarrow B



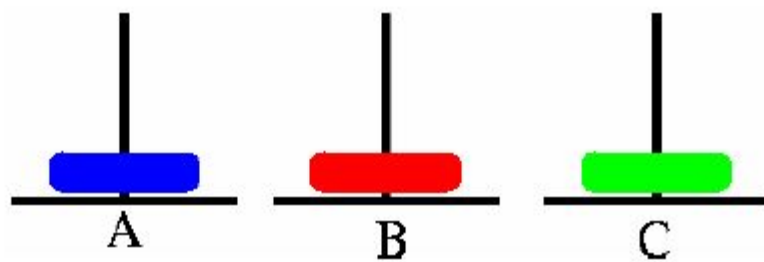
Step 3: Move A \rightarrow C



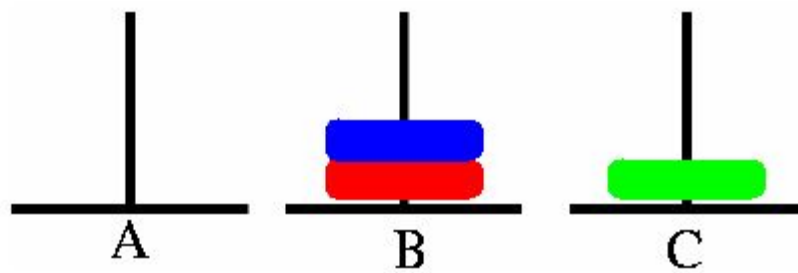
Step 4: Move B \rightarrow A



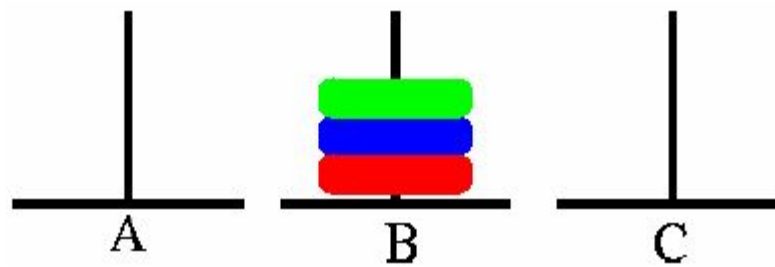
Step 5: Move C → B



Step 6: Move A \rightarrow B



Step 7: Move C → B



Goal State

Example: the 8-puzzle

- How would you use AI techniques to solve the 8-puzzle problem?

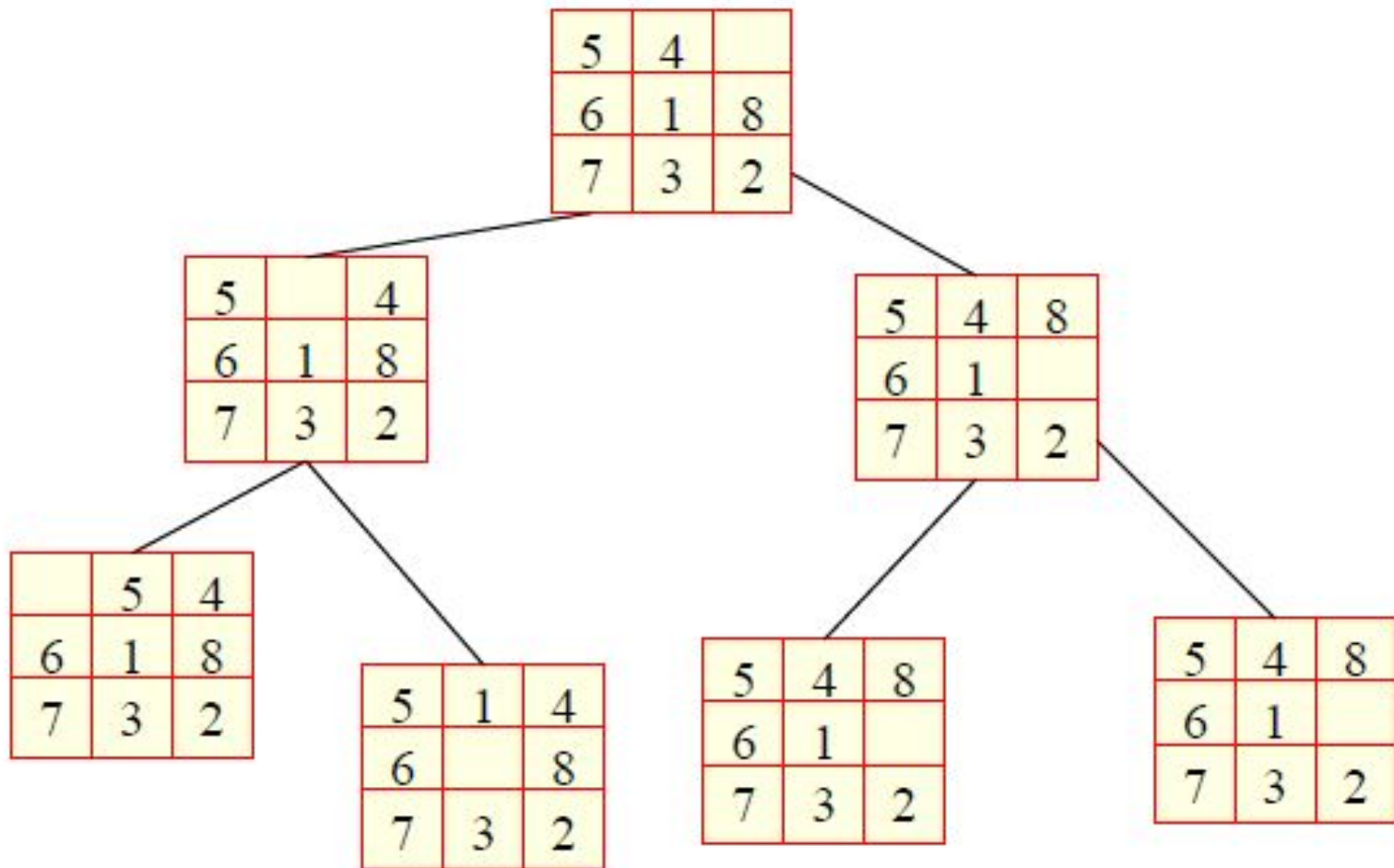
5	4	
6	1	8
7	3	2

Initial State

1	4	7
2	5	8
3	6	

Goal State

8-puzzle partial state space



Problem Definition - Example, 8 puzzle

- The state space representation for this problem is summarized below:
 - **States:** A state is a description of each of the eight tiles in each location that it can occupy.
 - **Operators/Action:** The blank moves left, right, up or down
 - **Goal Test:** The current state matches a certain state (e.g. one of the ones shown on previous slide)
 - **Path Cost:** Each move of the blank costs 1



Thank You!

Any Questions?