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Search Problems

Many problems can be understood as search problems. A search problem is any problem which involves a:

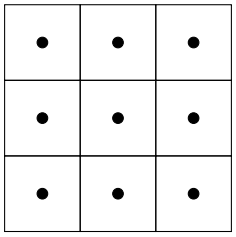
- Set of possible states
- A start state
- A goal state
- A successor function (a function which returns what states can be achieved from a given state)

In other words, it's a problem where we must determine a set of actions (that fall within our successor function) to achieve our goal state from our start state.

Pathfinding as a Search Problem

1. Set of Possible States

Each state is a position on a grid. Here is the full set of states for a 3x3 grid:



This represents 9 possible states (positions), arranged in a 3x3 grid.

2. Start State

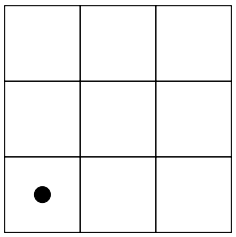


Figure 1: Start state: character begins in the bottom-left corner

3. Goal State

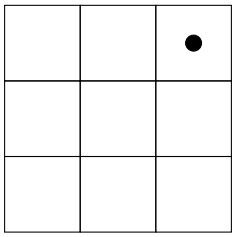
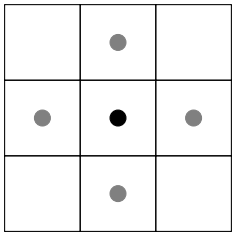


Figure 2: Goal state: character must reach the top-right corner

4. Successor Function

From any given position, the character can move one square up, down, left, or right (if within bounds). For example, from the center of the grid:



From the center, the successor function returns:

- Move up: (1,2)
- Move down: (1,0)
- Move left: (0,1)
- Move right: (2,1)

Thus, the problem of pathfinding — determining how to move from the start state to the goal state — is clearly a search problem. However, search problems extend beyond pathfinding. The Tower of Hanoi is a famous example.

Excellent overview found here.

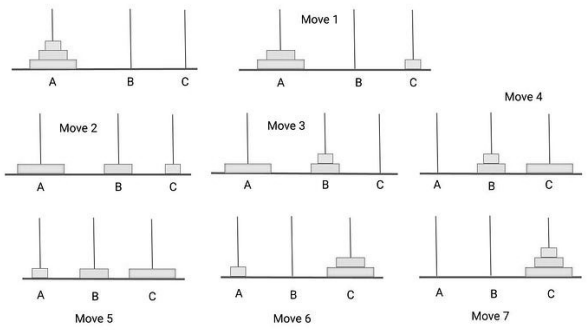


Figure 3: The Tower of Hanoi, Solved