Review

- Agent Definition
- PEAS description
  - (P)erformance Measure
  - (E)nvironment
  - (A)cutators
  - (S)ensors
- Environment Properties

Basic Types of Agent Programs

- Simple reflex agents
    - Condition-action rules on current percept
    - Environment must be fully observable

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- Learning agents
    - Makes improvements

Problem solving and search

Problem Solving

- Goal-based agent
- Decides what to do by finding sequences of actions that lead to desirable states

Goal Based Agent in Romania

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- “Goals help organize behavior by limiting objective that agent is trying to achieve”

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  - Decide how to quantify *best* solution
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  - Organize actions and states (graph structure, map)

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How find best sequence (path) of actions?

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Formulating problems

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  - Output: solution (as action sequence)
- [Step 4] Execution phase
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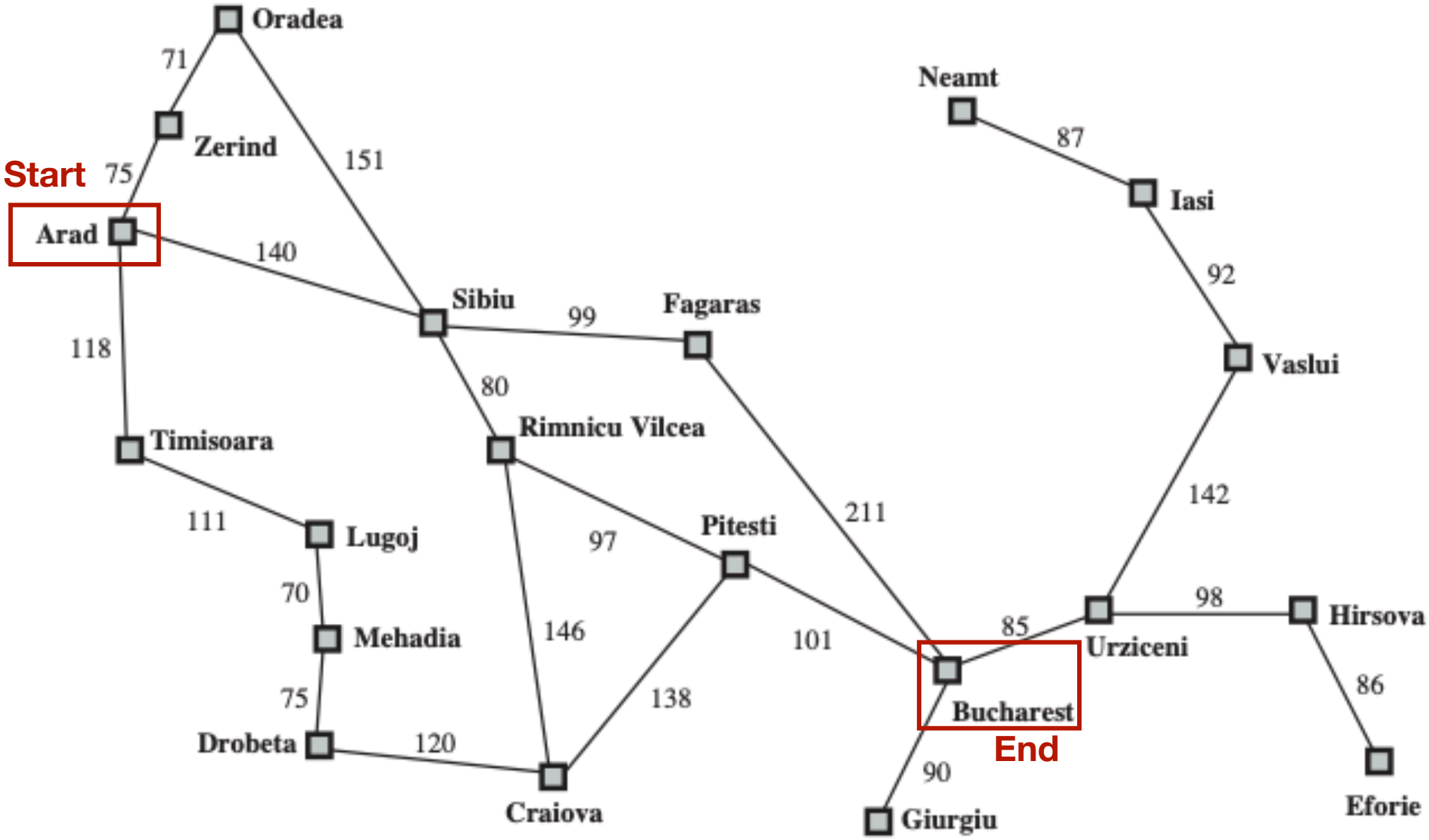
- [Step 5] Find a new goal (repeat from step 1)

Formulating Romania Visit



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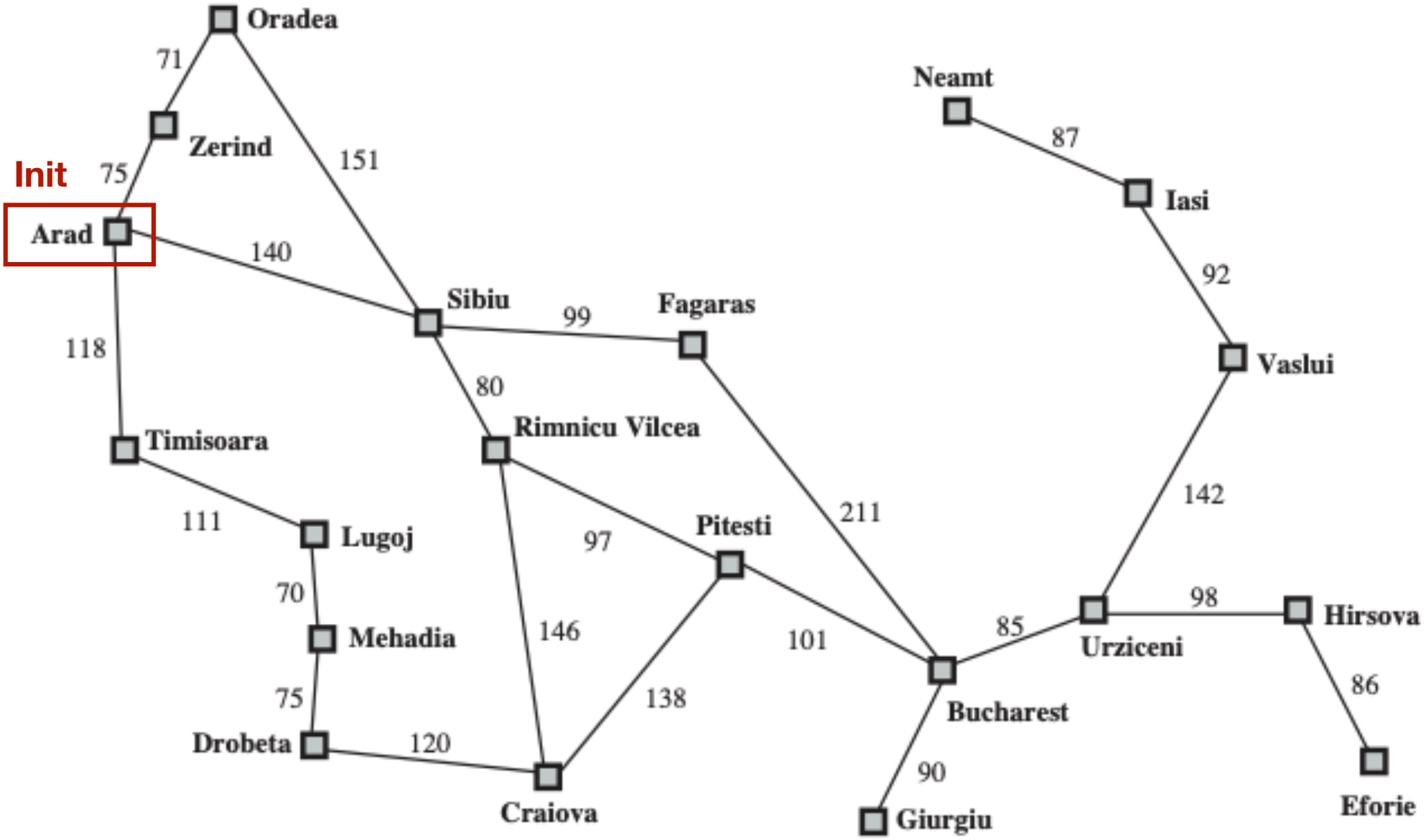

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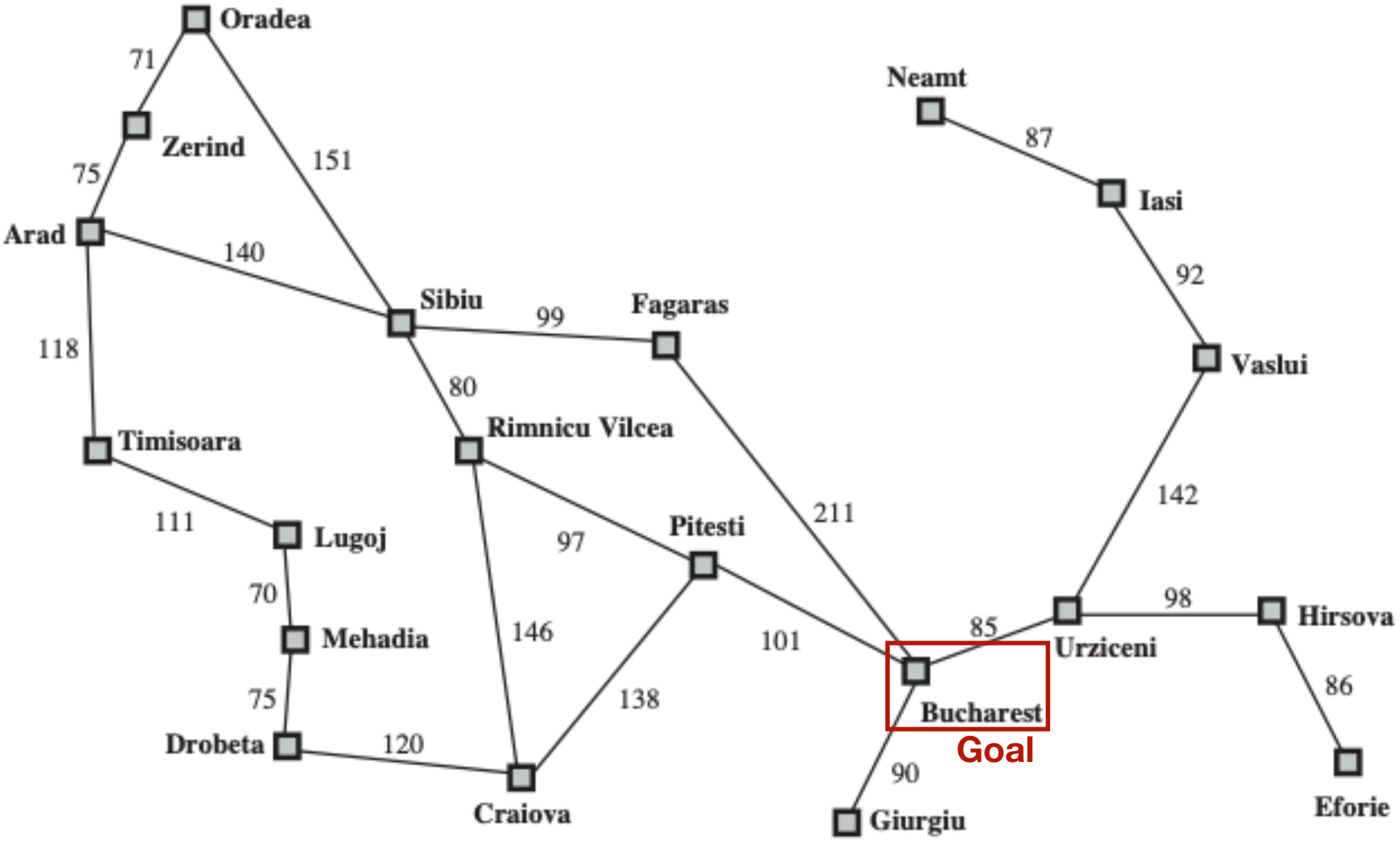

Goal Based Agent Environment

- Static
  - Formulating and solving problem in a fixed environment
- Fully observable
  - All states knowable
- Discrete
  - Cities are nodes, actions are links
- Deterministic
  - No randomness assumed
- Agent
  - Single

Well-Defined Problems and Solutions

A problem is defined by four items

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2. Actions/Operators
3. Goal test
4. Path cost

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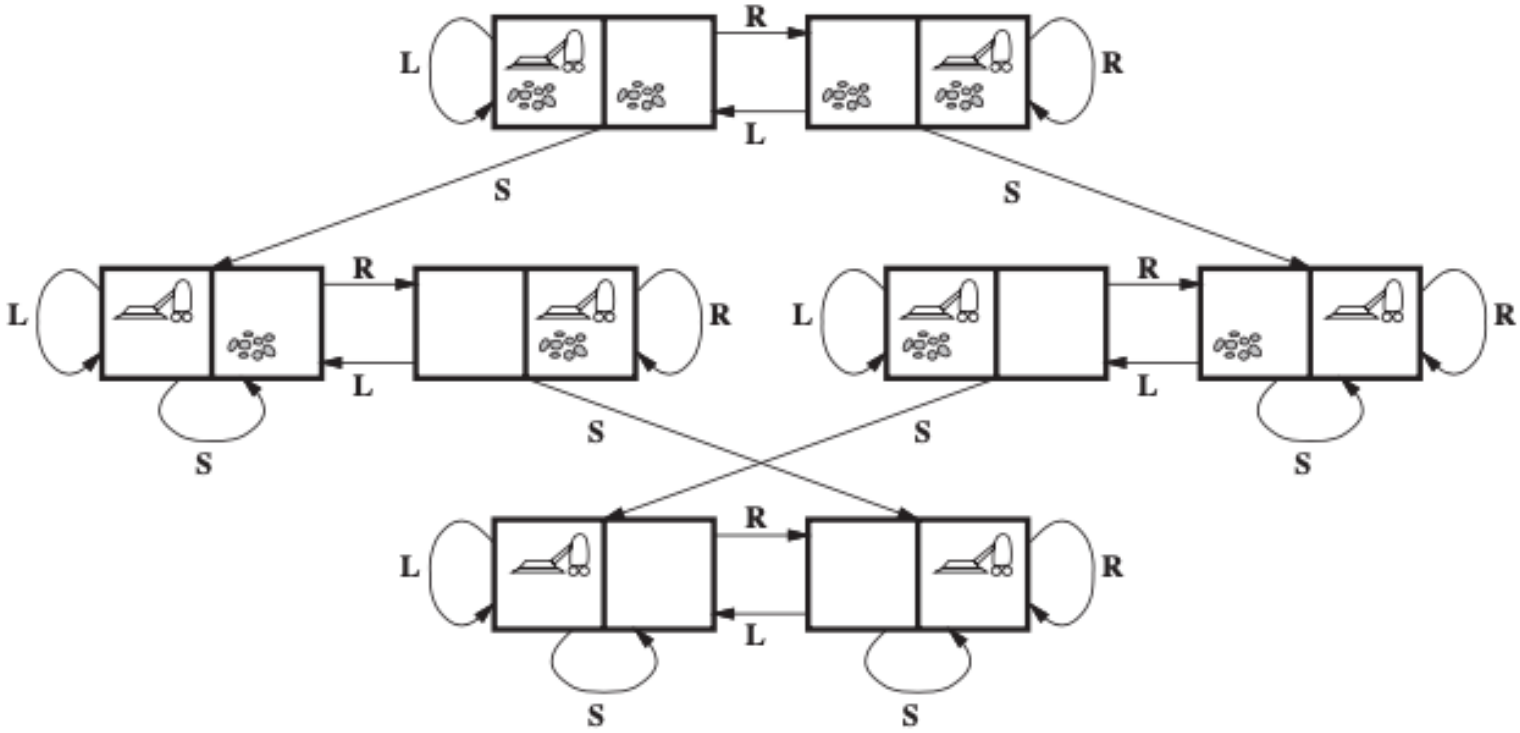
A solution is a sequence of operators leading from the initial state to a goal state & Optimal solution has lowest path cost

Toy Problem: Vacuum World



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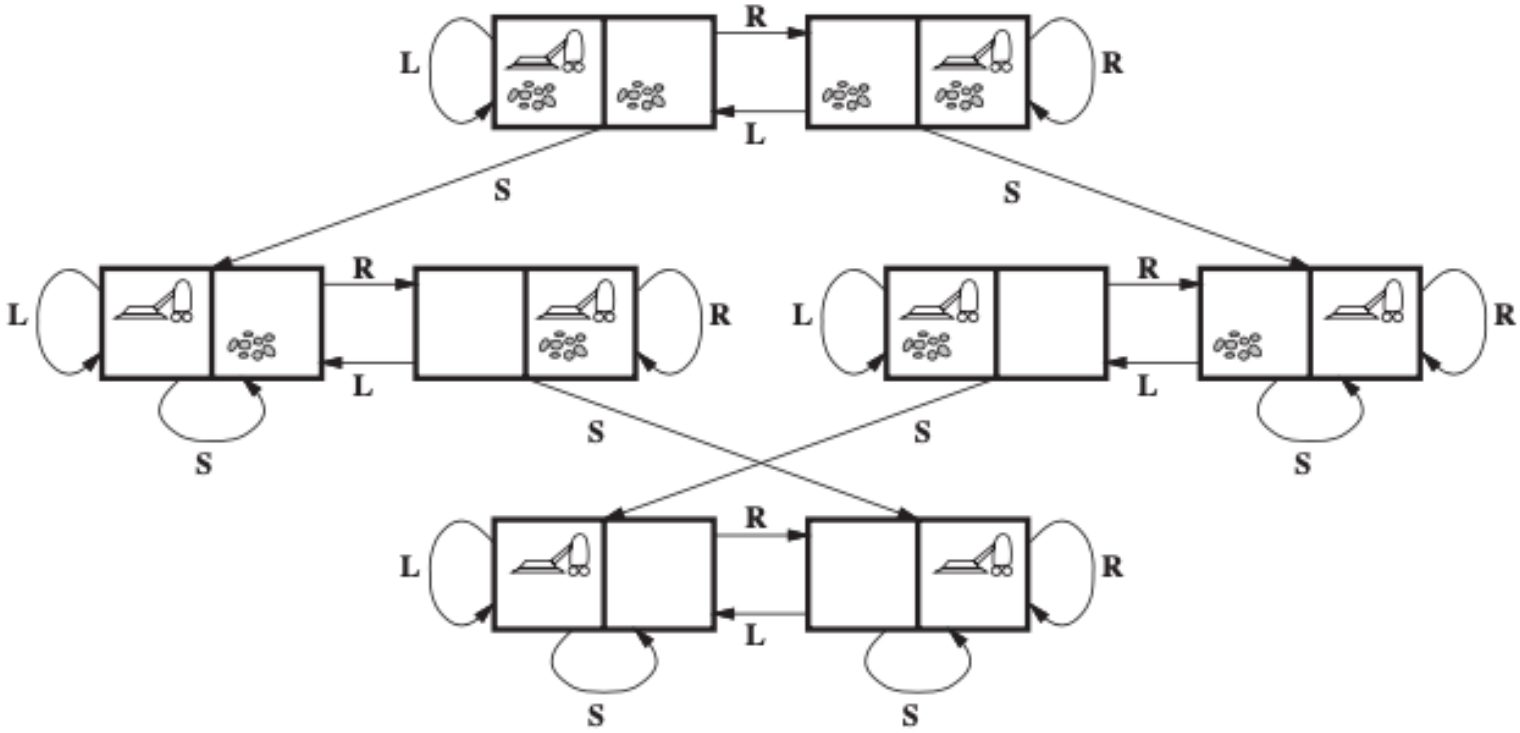

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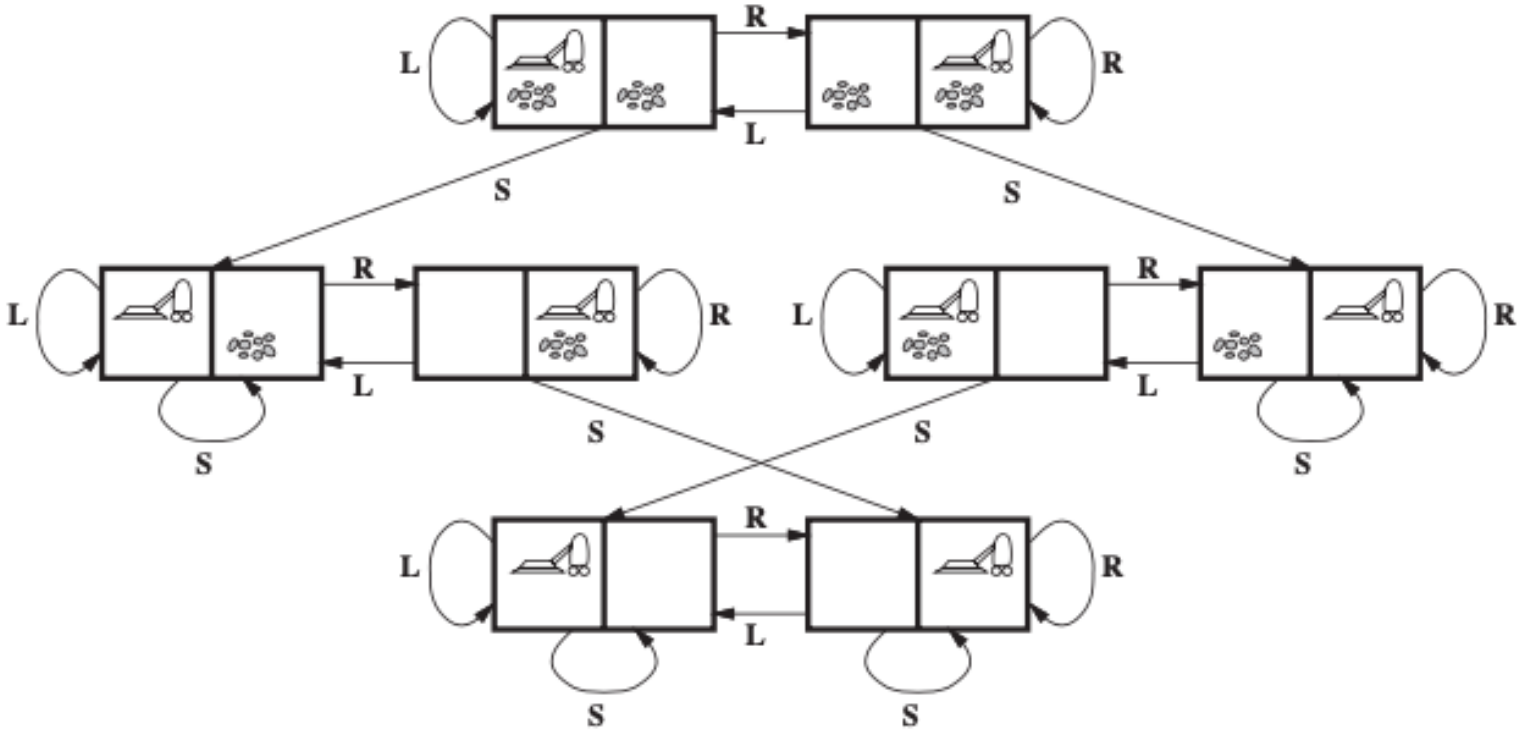

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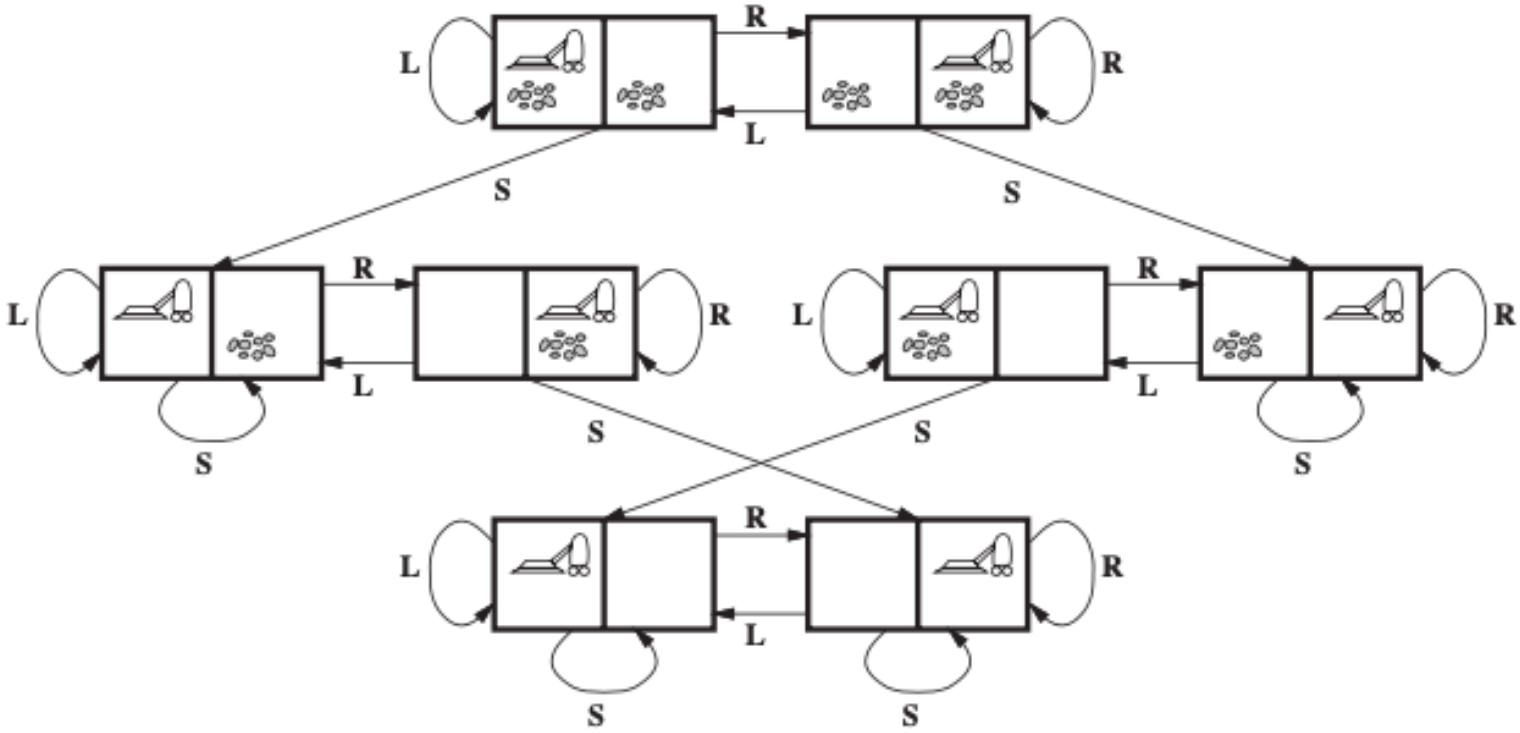

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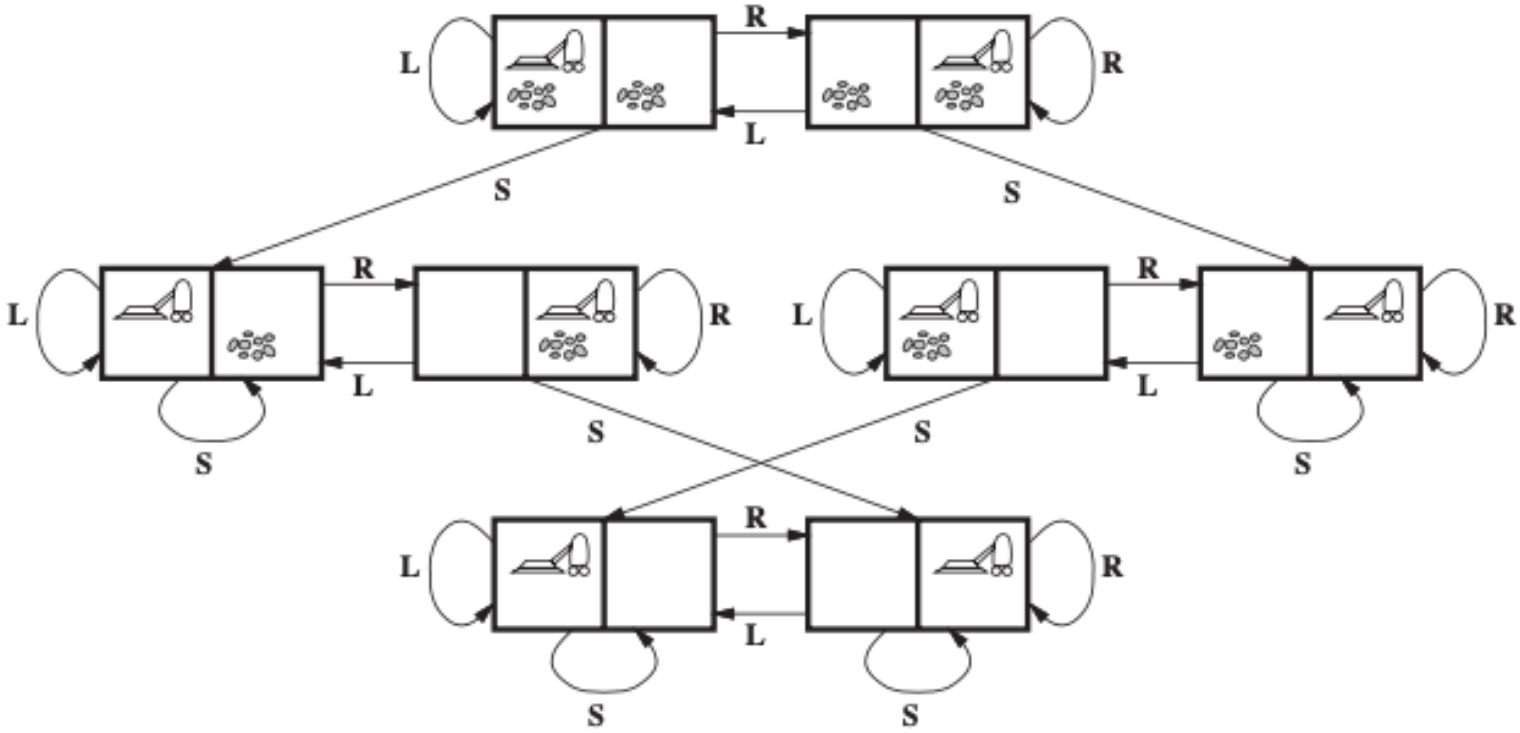

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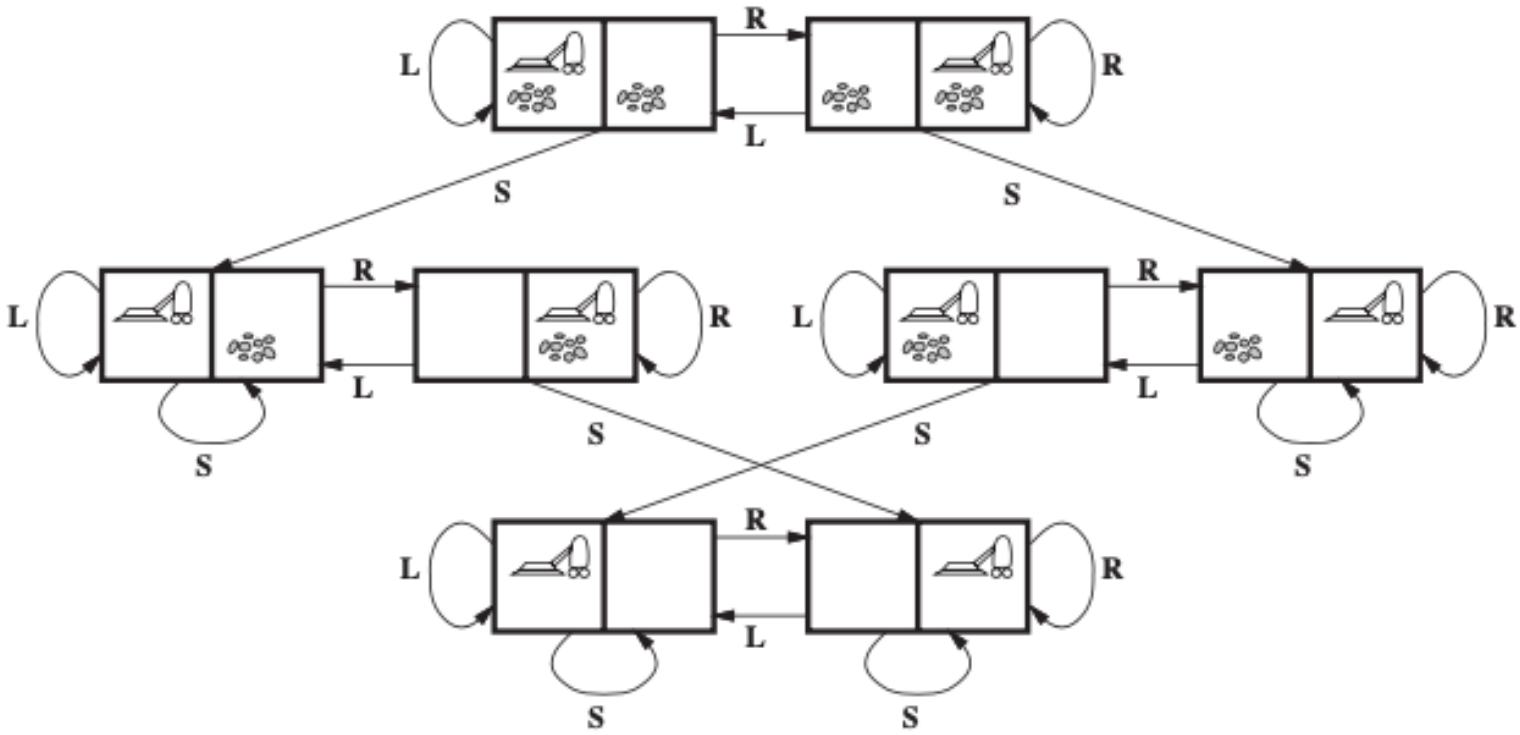

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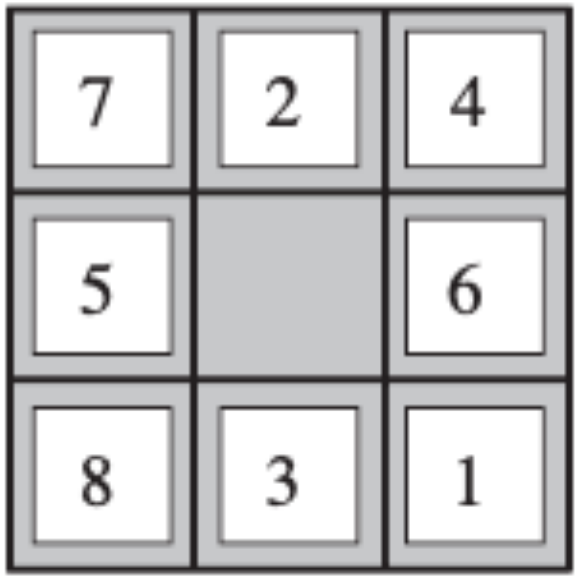
- **Path Cost:** Additive, each step costs 1

Toy Problem: 8 Puzzle



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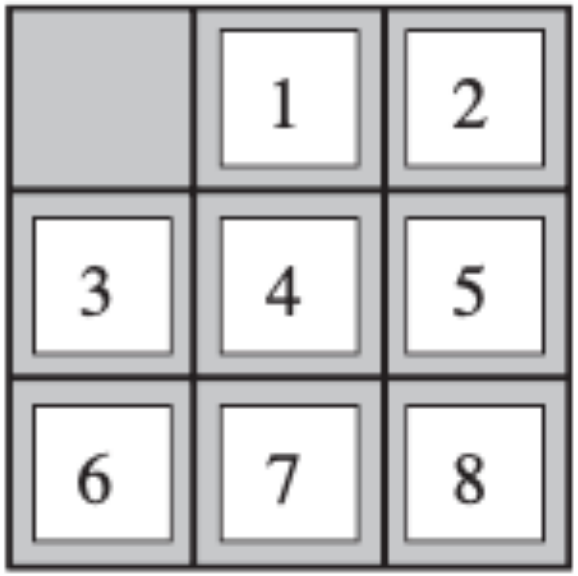

Goal State

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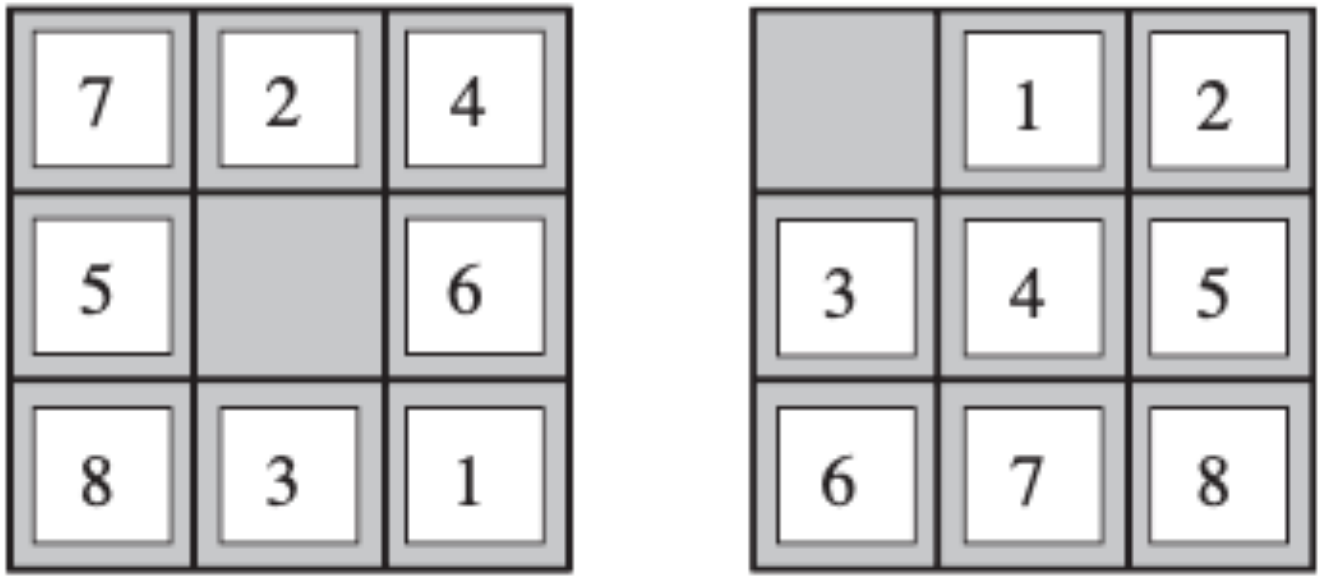

Start State

Goal State

- **States:**Integer (discrete) locations of each tile and blank
- **Initial State:** Any state
- **Actions:** (Left, Right, Up, Down)
- **Goal Test:** Matches goal configuration
- **Path Cost:** Additive, each step costs 1

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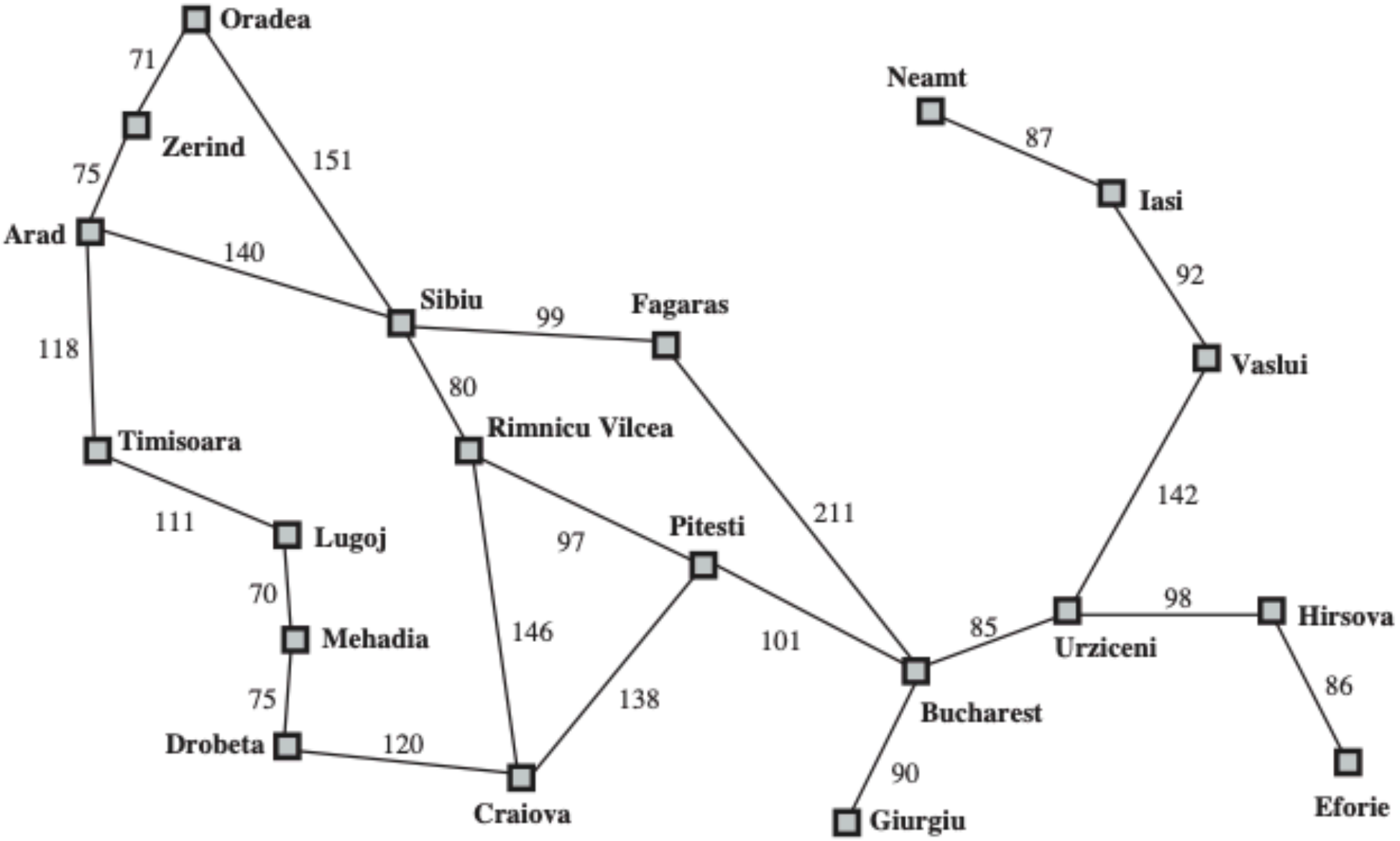
  - Which state to examine (and expand) next?
    - Use search strategy

Romania Visit: Searching For Solution



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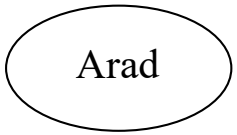

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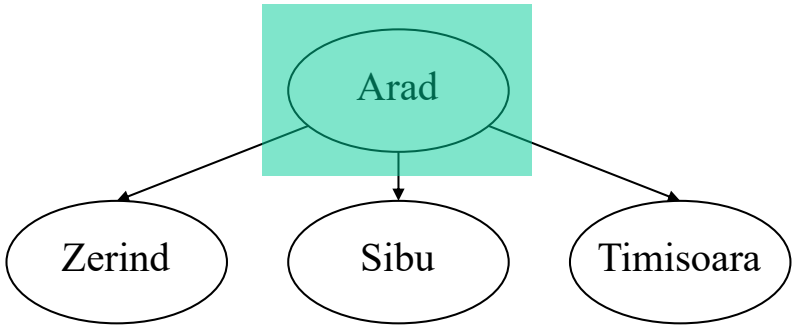

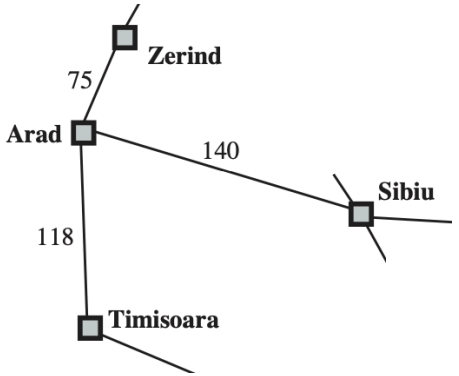

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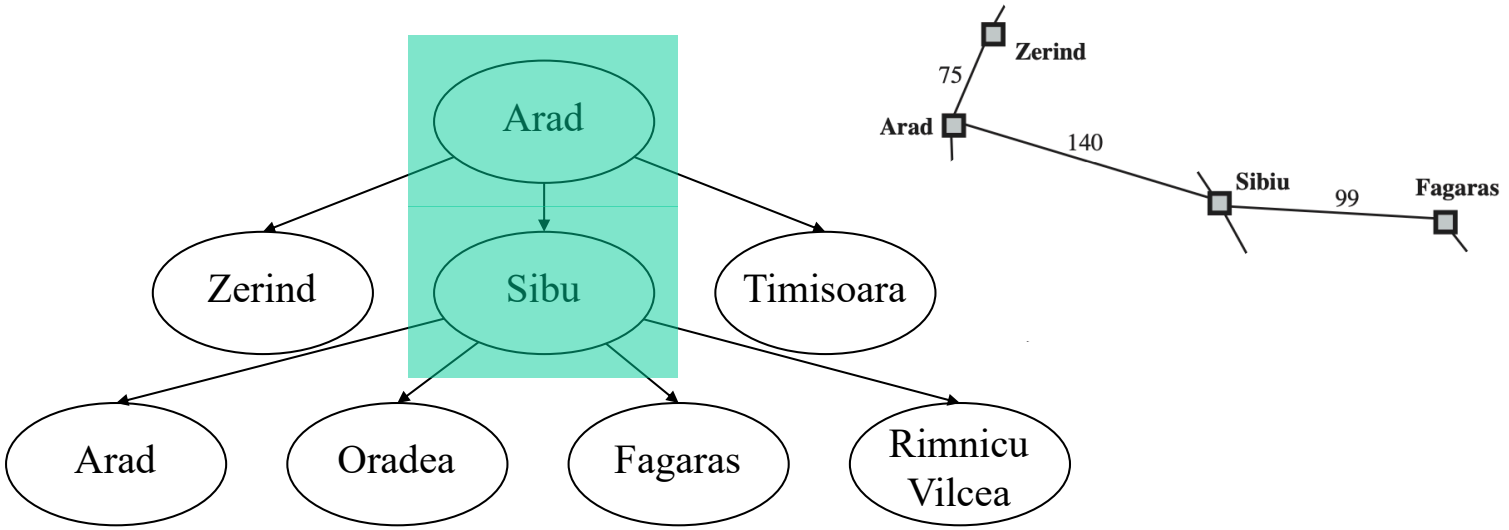

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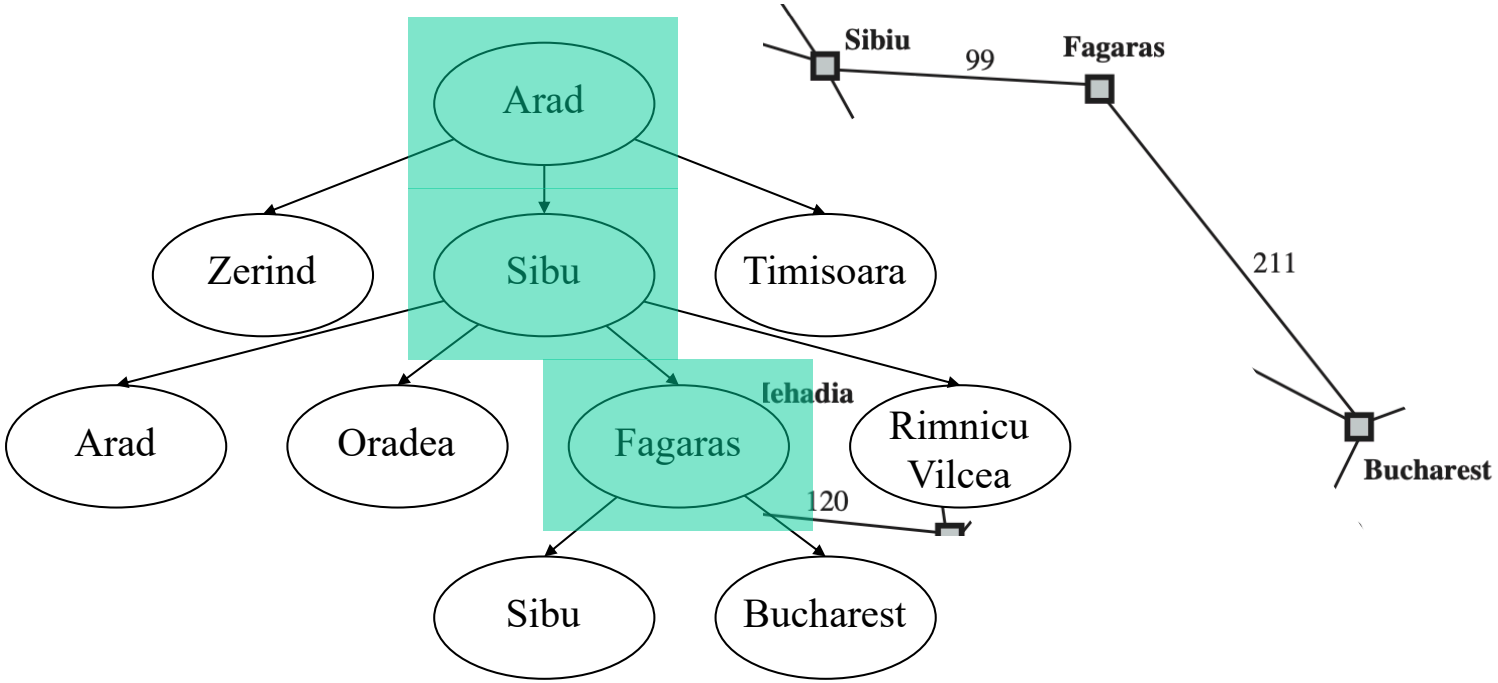

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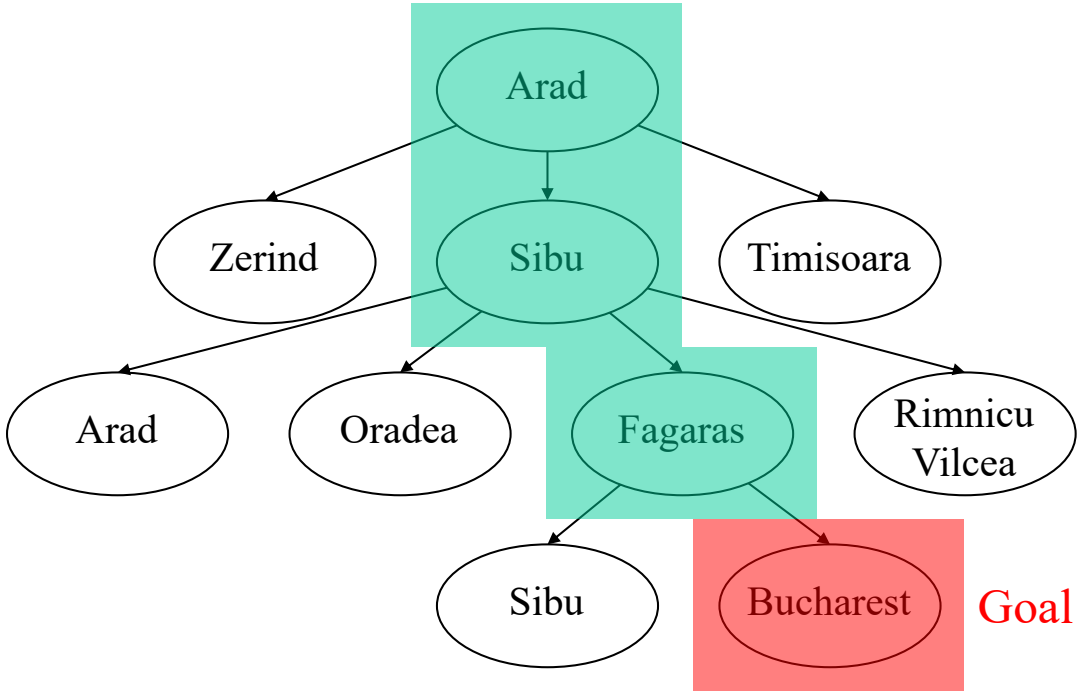

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- Space complexity
  - How much memory is needed to perform the search?

QuestionS