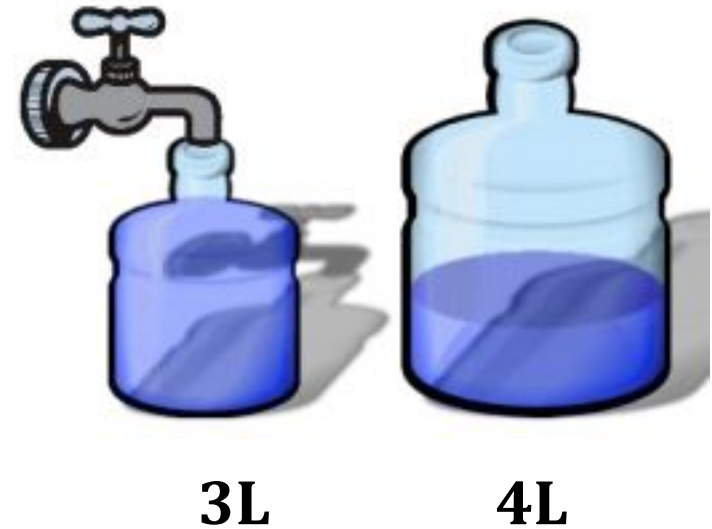# AI Lab 2 - Search

The Jugs Puzzle

We are given 2 jugs, a 4 liter(x L) one and a 3 liter(y L) one. Neither has any measuring markers on it. A pump can be used to fill the jugs with water. How can we get exactly 2(z L) liters of water into any of the jugs?

3L   **4L**

Problem Solving Agent

- We are going to develop an agent.
- The agent will perform a sequence of actions.
- Will try to reach the goal. (2L in one of the bottles)

Characteristics of the Problem Solving Agent

- Problem Formulation:
  - Define State –limited
  - Define the actions– limited
- Goal Formulation
- Environment Characteristics:
  - Observable – the agent knows
  - Discreet – Finite no of states
  - Deterministic – one action, one state

Search Problem Characteristics

- **Initial State** – (0,0)
- **Actions Set** –
    - Empty left
    - Empty Right
    - Fill Left
    - Fill Right
    - Transfer from left to right
    - Transfers from right to left

Search Problem Charactersitics

- **Transition Model** -
  - (0,0)-----fill left--▯ (3,0)

- **Goal Test** –
  - isGoal(2,4)-> True
  - isGoal(1,1) ->False

- **Path Cost** – The cost of each action taken

function BREADTH-FIRST-SEARCH(*problem*) **returns** a solution, or failure

    node ← a node with STATE = *problem*.INITIAL-STATE, PATH-COST = 0
    if *problem*.GOAL-TEST(*node*.STATE) **then return** SOLUTION(*node*)
    frontier ← a FIFO queue with *node* as the only element
    explored ← an empty set
    loop do
        if EMPTY?(*frontier*) **then return** failure
        node ← POP(*frontier*)   /* chooses the shallowest node in *frontier* */
        add *node*.STATE to *explored*
        for each *action* **in** *problem*.ACTIONS(*node*.STATE) **do**
            child ← CHILD-NODE(*problem*, *node*, *action*)
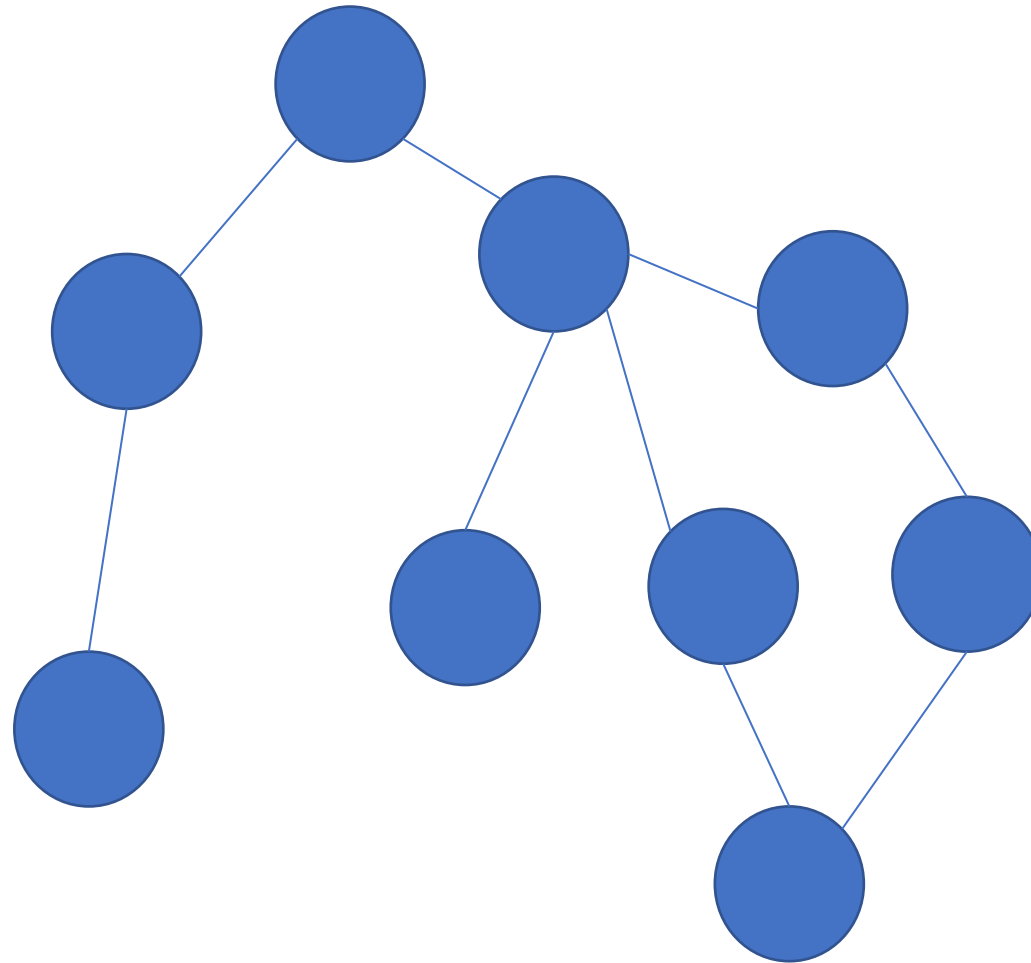   **if** *child*.STATE is not in *explored* or *frontier* **then**
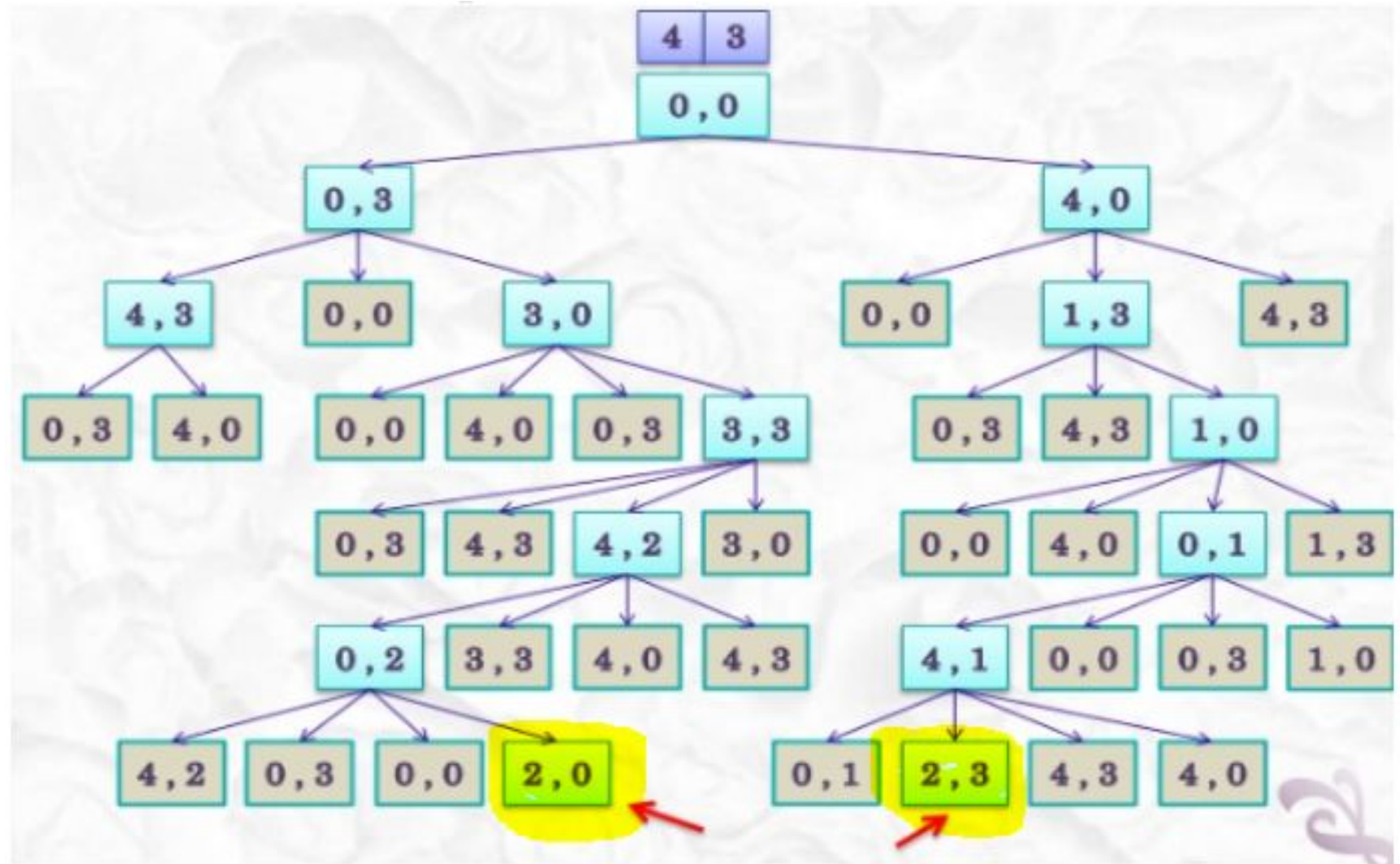   **if** *problem*.GOAL-TEST(*child*.STATE) **then return** SOLUTION(*child*)
                frontier ← INSERT(*child*, *frontier*)

Figure 3.11   Breadth-first search on a graph.

Previous BFS vs Current BFS

State Map

Lets Code!