INT404 ARTIFICIAL INTELLIGENCE

Tutorial 1

Principles of a production system by example: Water Jug Problem

Problem: given two water jugs (4 liter & 3 liter); neither has any measuring markers on it. there is a pump that can use to fill the jugs with water. **How can you get exactly 2 liter water in 4 liter jug?**

Solution:

Let us assume that x & y represents the content of 4L and 3L jugs respectively.

The content of the two jugs will be represented by (x, y). The start state is (0,0),

goal state is (2,n). The set of possible PRs are listed below.

1. (x, y) if x < 4 → (4, y) = fill the 4 L jug.
2. (x, , y) if y < 3 → (x, 3) = fill the 3 L jug.
3. (x, y) if x > 0 → (x-d, y) = pour some water out of the 4 L jug.
4. (x, y) if y > 0 → (x, y-d) = pour some water out of the 3 L jug.
5. (x, y) if x > 0 → (0, y) = empty the 4 L jug on the ground.
6. (x, y) if y > 0 → (x, 0) = empty the 3 L jug on the ground.

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5. (x, y) if x > 0 → (0, y) = empty the 4 L jug on the ground.
6. (x, y) if y > 0 → (x, 0) = empty the 3 L jug on the ground.

7. (x, y) if x + y >=4 & y > 0 = (4, y-(4-x)) = pour water from 3L jug into 4L jug until the 4L jug is full.

8.(x, y) if x + y >= 3 & x > 0 = (x-(3-y), 3) = pour water from 4L jug into 3L jug until the 3L jug is full.

9.(x, y) if x + y <= 4 & y > 0 → (x + y, 0) = pour all the water from 3L jug to 4L jug.

10.(x, y) if x + y <= 3 & x > 0 → (0, x + y) = pour all the water from 4L jug to 3L jug.

11.(0, 2) = (2, 0) = pour the 2L from 3L jug to 4L jug.

12.(2, y) = (0, y) = empty the 2L from 4L jug on the ground.

1. (x, y) if x < 4 → (4, y)
2. (x, , y) if y < 3 → (x, 3)
3. (x, y) if x > 0 → (x-d, y)
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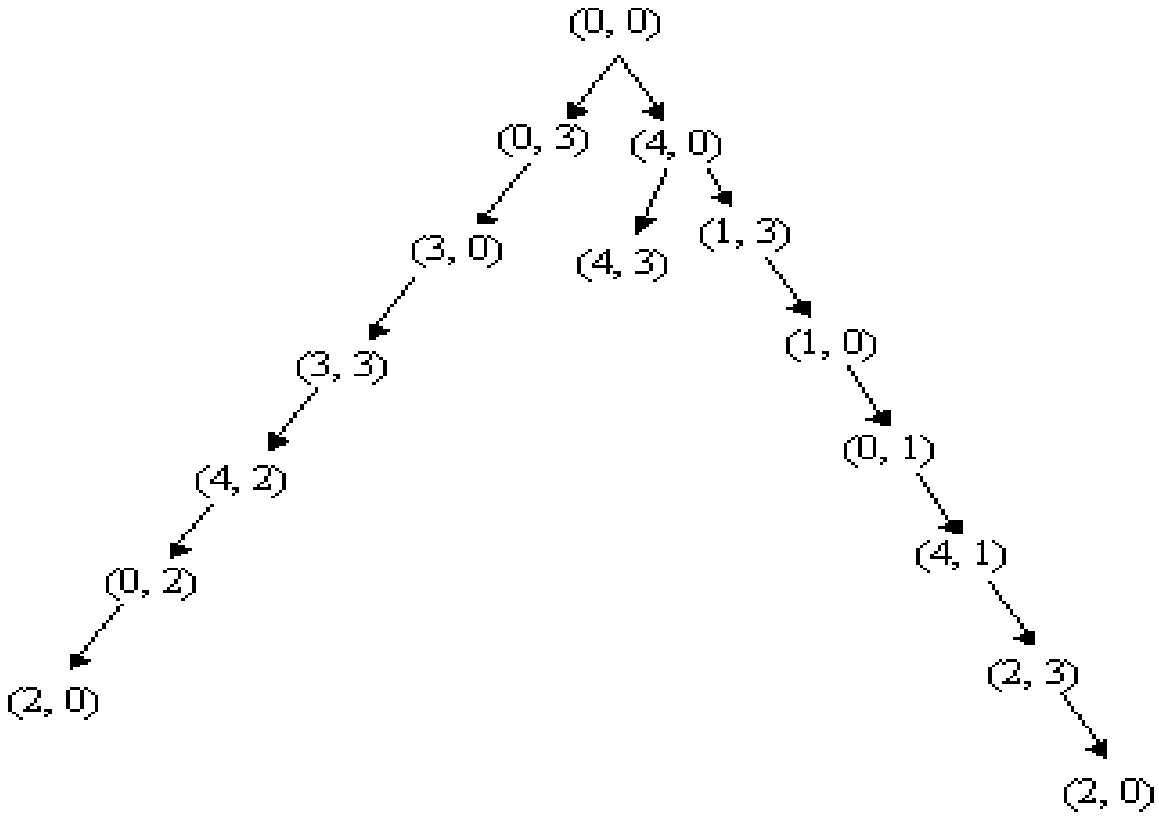
7. (x, y) if x + y >=4 & y > 0 = (4, y-(4-x))
8. (x, y) if x + y >= 3 & x > 0 = (x-(3-y), 3)
9. (x, y) if x + y <= 4 & y > 0 → (x + y, 0)
10. (x, y) if x + y <= 3 & x > 0 → (0, x + y)
11. (0, 2) = (2, 0)
12. (2, y) = (0, y)

4L	3L	Rule Applied

One solution

4L	3L	rule applied
0	0	
		2
0	3	
		9
3	0	
		2
3	3	
		7
4	2	
		5 or 12
0	2	
		9 or 11
2	0	

To keep track of the reasoning process, we draw a state-space for the problem. The leaves generated after firing of the rules should be stored in WM.


(0, 0)
(0, 3)
(4, 0)
(3, 0)
(4, 3)
(1, 3)
(3, 3)
(1, 0)
(4, 2)
(0, 1)
(0, 2)
(4, 1)
(2, 0)
(2, 3)
(2, 0)