A Water Jug Problem.

You are given two jugs, a 4 gallon one and a 3-gallon one. Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can we get exactly 2 litres of water into 4-litre jug.

State space is the set of ordered pairs of integers (x,y)

State : (x, y).

$x = 0, 1, 2, 3$ or 4. $y = 0, 1, 2, 3$.

Start state : (0, 0)

Goal state : (2, n) for any n.

Production rules

1.	$(x, y) \rightarrow (4, y)$ if $x < 4$	Fill the 4-gallon Jug.
2.	$(x, y) \rightarrow (x, 3)$ if $y < 3$	Fill the 3-gallon Jug.
3.	$(x, y) \rightarrow (x-d, y)$ if $x > 0$	Pour some water out of the 4-gallon jug.
4.	$(x, y) \rightarrow (x, y-d)$ if $y > 0$	Pour some water out of the 3-gallon jug.
5.	$(x, y) \rightarrow (0, y)$ if $(x > 0)$	Empty the 4-gallon jug on the ground.
6.	$(x, y) \rightarrow (x, 0)$ if $(y > 0$	Empty the 3-gallon jug on the ground.
7.	$(x, y) \rightarrow (4, y-(4-x))$ if $(x+y \geq 4, y > 0$	Pour water from the 3 gallon jug into the 4 gallon jug until the 4 gallon jug is full

8. (x, y) → $(x-(3-y), 3)$ Pour water from 4-gallon jug into 3-gallon jug until the 3-gallon jug is full
if $(x+y \geq 3 x>0$

9. (x, y) → $(x+y, 0)$ Pour all water from 3-gallon jug into 4-gallon jug.
if $(x+y \leq 4, y>0$

10. (x, y) → $(0, x+y)$ Pour all water from 4-gallon jug into 3-gallon jug.
if $(x+y \leq 3, x>0$

11. $(0, 2)$ → $(2, 0)$ Pour the 2 gallons From 3-gallon jug into the 4-gallon jug

12 (x, y) → $(0, y)$ Empty the 2 gallons in the 4-gallon jug on ground

Solution to Water Jug problem

1. Current state = $(0, 0)$.
2. Loop until reaching the goal state $(2, 0)$.
   - Apply a rule whose left side matches the current state
   - Set the new current state to be resulting state

Gallons in 4-Gallon jug	Gallons in 3-gallon jug.	Rule applied
0	0	2
0	3	9
3	0	2
3	3	7
4	7	5 or 12
0	2	9 or 11.
2	0	