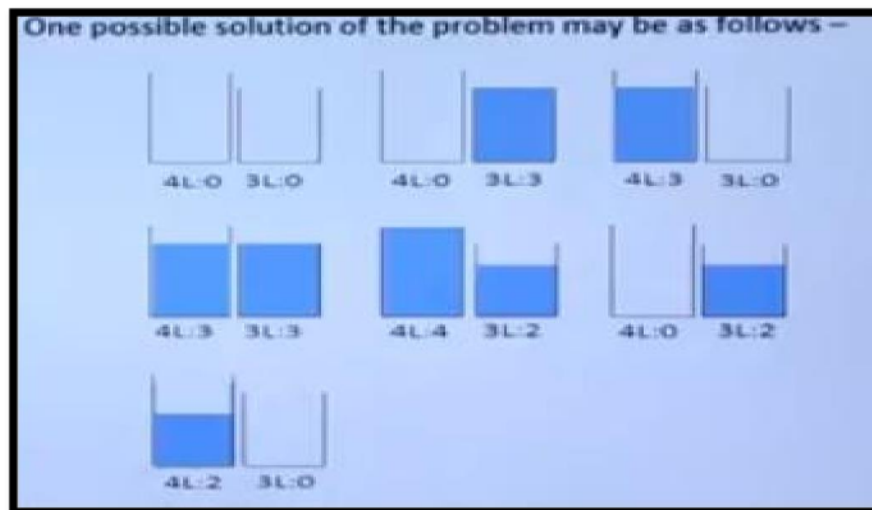


## Water Jug Problem

A Water Jug Problem: You are given two jugs, a 4-gallon one and a 3- gallon one, a pump which has unlimited water which you can use to fill the jug, and the ground on which water may be poured. Neither jug has any measuring markings on it. How can you get exactly 2 gallons of water in the 4-gallon jug?



To solve this we have to make some assumptions not mentioned in the problem. They are:

- We can fill a jug from the pump.
- We can pour water out of a jug to the ground.
- We can pour water from one jug to another.
- There is no measuring device available.

Operators — we must define a set of operators that will take us from one state to another.

Sr.	Current State	Next State	Descriptions
1	$(x, y)$ if $x < 4$	$(4, y)$	Fill the 4 gallon jug
2	$(x, y)$ if $y < 3$	$(x, 3)$	Fill the 3 gallon jug
3	$(x, y)$ if $x > 0$	$(x - d, y)$	Pour some water out of the 4 gallon jug
4	$(x, y)$ if $y > 0$	$(x, y - d)$	Pour some water out of the 3 gallon jug
5	$(x, y)$ if $y > 0$	$(0, y)$	Empty the 4 gallon jug
6	$(x, y)$ if $y > 0$	$(x, 0)$	Empty the 3 gallon jug on the ground
7	$(x, y)$ if $x + y \geq 4$ and $y > 0$	$(4, y - (4 - x))$	Pour water from the 3 gallon jug into the 4 gallon jug until the 4 gallon jug is full
8	$(x, y)$ if $x + y \geq 3$ and $x > 0$	$(x - (3 - y), 3)$	Pour water from the 4 gallon jug into the 3-gallon jug until the 3 gallon jug is full
9	$(x, y)$ if $x + y \leq 4$ and $y > 0$	$(x + y, 0)$	Pour all the water from the 3 gallon jug into the 4 gallon jug
10	$(x, y)$ if $x + y \leq 3$ and $x > 0$	$(0, x + y)$	Pour all the water from the 4 gallon jug into the 3 gallon jug
11	$(0, 2)$	$(2, 0)$	Pour the 2 gallons from 3 gallon jug into the 4 gallon jug
12	$(2, y)$	$(0, y)$	Empty the 2 gallons in the 4 gallon jug on the ground

There are several sequences of operations that will solve the problem.

One of the possible solutions is given as:

Gallons in the 4-gallon jug	Gallons in the 3-gallon jug	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	--

**Output:** 4-gallon jug with 2-liter water.

**Code:**

```
def pour(jug1, jug2):  
    max1, max2, fill = 3, 4, 2 #Change maximum capacity and final capacity  
    print("%d\t%d" % (jug1, jug2))  
  
    if jug2 is fill:  
        return elif jug2 is  
max2:    pour(0, jug1)  
elif jug1 != 0 and jug2 is 0:  
    pour(0, jug1) elif jug1 is  
fill:    pour(jug1, 0) elif  
jug1 < max1:  
    pour(max1, jug2) elif jug1  
< (max2-jug2):    pour(0,  
(jug1+jug2)) else:  
  
    pour(jug1-(max2-jug2), (max2-jug2)+jug2) print("JUG1\tJUG2")  
  
pour(0, 0)
```

**OUTPUT:**

JUG1 (max capacity 3gl)	JUG2 (max capacity 4gl)
0	0
3	0
0	3
3	3
2	4
<b>0</b>	<b>2</b>