Water Jug Problem

Aim : To implement a water jug problem.

Theory :

You are on the side of the river. You are given a m litre jug and a n litre jug where 0 < m < n. Both the jugs are initially empty. The jugs don't have markings to allow measuring smaller quantities. You have to use the jugs to measure d litres of water where d < n. Determine the minimum number of operations to be performed to obtain d litres of water in one of jug.

The operations you can perform are:

Empty a Jug

Fill a Jug

Pour water from one jug to the other until one of the jugs is either empty or full.

There are several ways of solving this problem including BFS and DP

The operators to be used to solve the problem can be describes as shown below. They are represented as rules whose left side are matched against the currnent state and whose right side describes the new state that results from applying the rules.

We have two jugs a 4 gallon and a 3 gallon.

Consider the following Rule set:

1. (x,y)->(4,y) fill the 4 gallon jug

If x<4.

1. (x,y)->(x,3) fill the 3 gallon jug

If x<3

1. (x,y)->(x-d,y) pour some water out of the 4-gallon jug.

If x>0

1. (x,y)->(x-d,y) pour some water out of the 3-gallon jug.

If y>0

1. (x,y)->(0,y) empty the 4-gallon jug on the ground

If x>0

1. (x,y)->(x,0) empty the 3-gallon jug on the ground

If y>0

1. (x,y)->(4,y-(4-x)) pour water from the 3-gallon jug into the 4-gallon

If x+y>=4 and y>0 jug until the 4-gallon jug is full

1. (x,y)->(x-(3-y),3)) pour water from the 4-gallon jug into the 3-gallon

If x+y>=3 and x>0 jug until the 3-gallon jug is full.

1. (x,y)->(x+y,0) pour all the water from the 3-gallon jug into

If x+y<=4 and y>0 the 3-gallon jug.

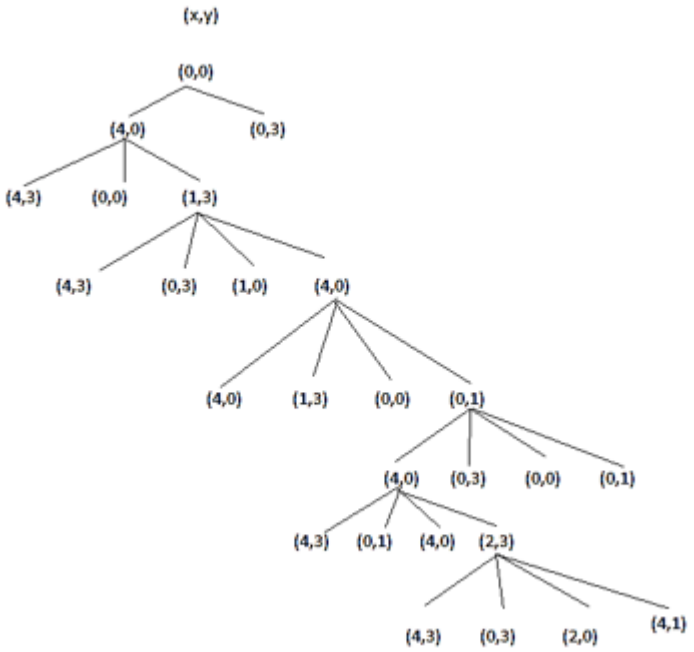
1. (x,y)->(0,x+y) pour all the water from the 4-gallon jug into

If x+y<=3 and x>0 the 3-gallon jug.

1. (0,2)->(2,0) pour the 2-gallon from the 3-gallon jug into the 4-gallon jug.
2. (2,y)->(0,x) empty the 2 gallon in the 4 gallon on the ground

Gallons in the 4-gallon jug	**Gallons in the 3-gallon**	**Rule Applied**
0	0	
0	3	2
3	0	9
3	3	2
4	2	7
0	2	5 or 12
2	0	9 or 11

One solution to the water jug problem.


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