Water-Jug Problem →

Our Initial State : (0,0)

Goal state : (2, y) where $0 \le y \le 3$.

State Representation & Initial state →

We will represent a state of the problem as a tuple (x,y) where x represents the amount of water in the 4-litre jug and y represents the amount of water in the 3-litre jug.
[Where - $0 \le x \le 4$ and $0 \le y \le 3$].

★ Operations performed in the problem →

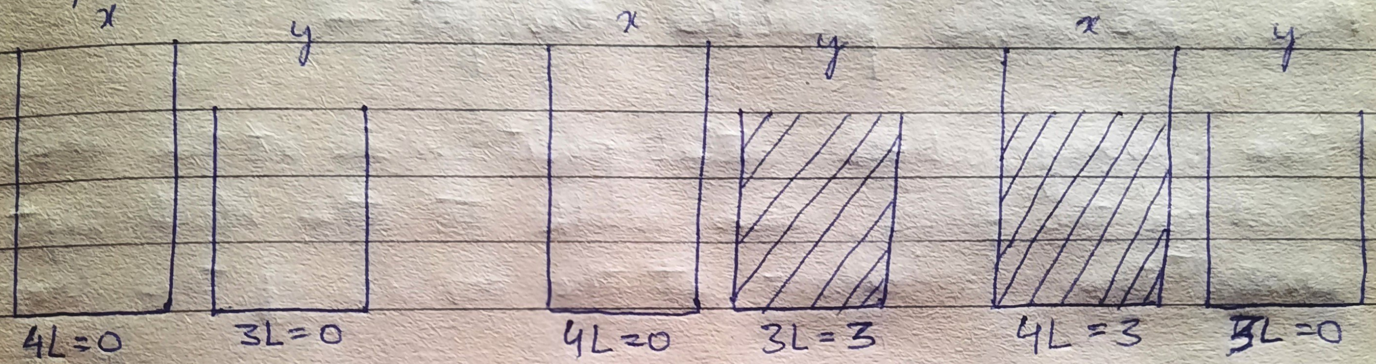
We must define a set of ~~problems~~ operatons that will take us from one state to another.

	must be		
1) Fill 4-litre jug	$x < 4$	→	$(4, y)$.
2) Fill 3-litre jug	$y < 3$	→	$(x, 3)$.
3) Empty 4L jug on ground	$x > 0$	→	$(0, y)$.
4) Empty 3L jug on ground	$y > 0$	→	$(x, 0)$.
5) Pour water from 3L jug into 4L jug	$0 < x+y \ge 4$ & $y > 0$	→	$(4, y-(4-x))$
6) Pour water from 4L jug into 3L jug	$0 < x+y \ge 3$ & $x > 0$	→	$(x-(3-y), 3)$.

7) Pour all water from 3L jug into 4L jug $\quad 0 < x+y \leq 4$ & $y \geq 0 \longrightarrow (x+y, 0)$.

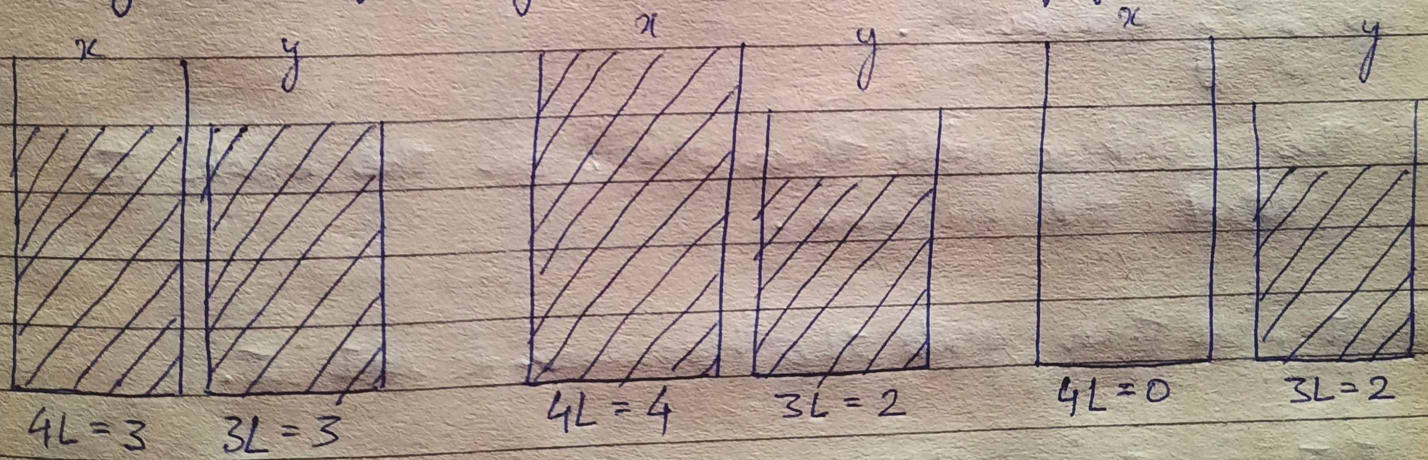
8) Pour all water from 4L jug into 3L jug $\quad 0 < x+y \leq 3$ & $x \geq 0 \longrightarrow (0, x+y)$.

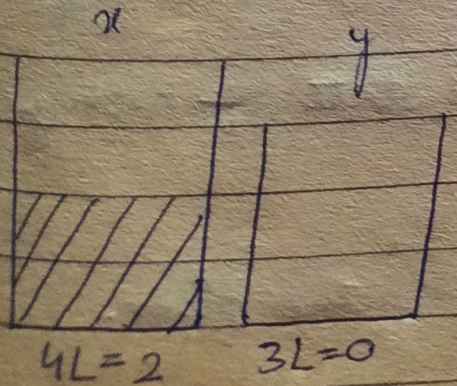
- One possible solution of the problem can be →



3L jug must be filled again

4L jug is emptied





finally, the 3L jug having 2 litres of water is completely poured into the 4L jug.

i.e. = $(2, y)$ where $0 \leq y \leq 3$.

Monkey Banana Problem →

In this problem,
Monkey is on the floor, at door. A block is on floor, at window. Banana is hanging from the ceiling ~~at~~ of the room (in the middle).

Problem → How the monkey can get the banana?

- Here, are some possible attempts →

1) The monkey, whose initial position is at the door, and on the floor, can walk to the block kept ~~under~~ at the window at the corner of the room.

2) The monkey will then drag the block all the way to the middle of the room, under the hanging banana.

3) The monkey will then climb on the block to reach the banana.

4) It will then grab the banana & eat it.

- States in this problem can be described as:-

Let, ~~the~~ (x, w, y, K) represent the state of mokey ~~and~~ banana problem.

x: horizontal position of monkey on the floor.

w: Monkey's position on the block.
where, $w = 1$ (if it climbs the block) YES.
$w = 0$ NO.

y: Horizontal position of the block on the floor.
and,
k: Monkey grabbing the banana.
if $k=1$ YES
$k=0$ NO.

Horizontal position of monkey   got the banana yet

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move (state(middle, onbox, middle, has not), → from this state
      grab, → action
      state (middle, onbox, middle, has)). → to this state
move (state(P, onfloor, P, H),
      climb,
      state (P, onbox, P, H)).
move (state(P1, onfloor, P1, H),
      push (P1, P2),
move (state( P2, onfloor, B, H),
      walk (P1, P2),
      state (P2, onfloor, B, H)).
canget(state (_,_,_, has)).
canget (state 1) :-
      move (state 1, _, state 2),
      canget (state 2).
```

Here,
P = initial state value, H = whether it has/has not got banana.

Missionaries & Cannibals Problem →

The problem says, that there are :-

3 Missionaries and 3 cannibals on one side of the river.

→ All of them wants to cross the river.

But there's a condition;

→ On the same side of the river, missionaries cannot be less than the Cannibals.

→ There is only 'one' boat available, that can carry only two of them, at a time.

• **State Representation →**

Let, us consider, variables - R, M & C.
where,

R = River side

1 Start

2 End

M = No. of Missionaries

C = No. of Cannibals.

State space →

Initial State → $\langle 1, 3, 3 \rangle$ (R M C) $\langle 2, 0, 0 \rangle$ (R M C)

In first step, two cannibals were sent to River side 2.

$\therefore \langle 1,3,1 \rangle \ \langle 2,0,2 \rangle$

Then, 1 cannibal returned to Riverside 1.

$\therefore \langle 1,3,2 \rangle \ \langle 2,0,1 \rangle$

Then, 2 cannibals were again sent to the River side 2.

$\therefore \langle 1,3,0 \rangle \ \langle 2,0,3 \rangle$

1 cannibal returned again,

$\therefore \langle 1,3,1 \rangle \ \langle 2,0,2 \rangle$

Then, 2 missionaries were sent,

$\therefore \langle 1,1,1 \rangle \ \langle 2,2,2 \rangle$

1 cannibal & 1 missionary came back to the river side 1,

$\therefore \langle 1,2,2 \rangle \ \langle 2,1,1 \rangle$.

2 missionaries were again sent to river side 2.

$\therefore \langle 1,0,2 \rangle \ \langle 2,3,1 \rangle$

1 cannibal is again sent back to river side 1.

$\therefore \langle 1,0,3 \rangle \ \langle 2,3,0 \rangle$

Then, 2 cannibals came to river side 2,

$\therefore \langle 1,0,1 \rangle \ \langle 2,3,2 \rangle$

1 cannibal returned with ~~bot~~ boat to river side 1.

$\therefore \langle 1,0,2 \rangle \ \langle 2,3,1 \rangle$

In the last step, the remaining 2 cannibals will finally go to the river side 2.

$\therefore \langle 1,0,0 \rangle \ \langle 2,3,3 \rangle$

which is our goal state.