Missionaries and Cannibals problem & Water Jug Problem

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Missionaries and Cannibals Problem

Informal problem description:

- Three missionaries and three cannibal are one side of the river, they wish to cross
- A boat is available that can hold at most two people.
- You must never leave a group of missionaries outnumbered by cannibals.

➢ Find an action of sequence that brings everyone safely to the opposite bank.

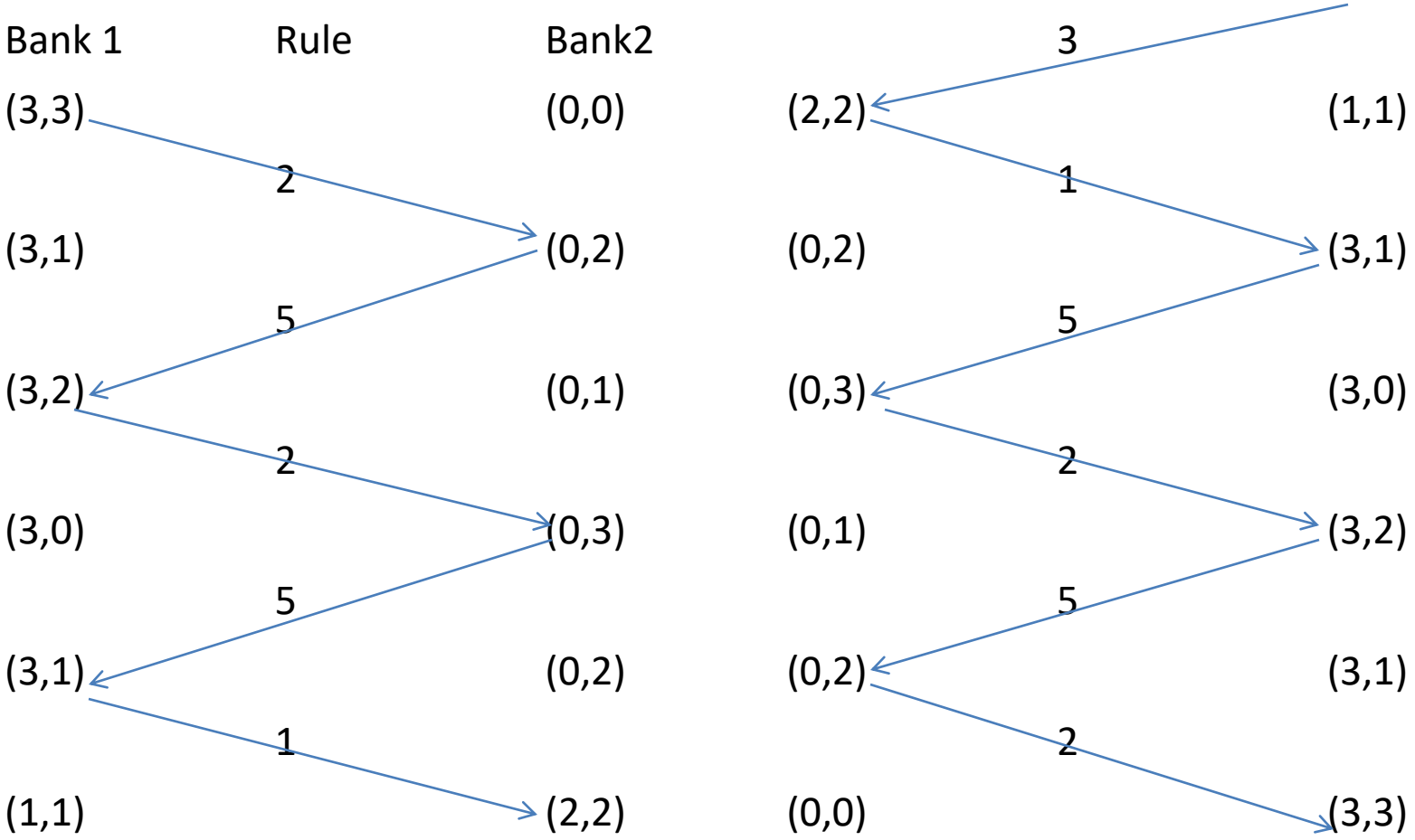
Missionaries and Cannibals Problem

- States: triple(m,c,k) with (0<=m,c<=3) where m, c and K represent the number of missionaries, cannibals and boat currently at the original bank.
- Initial State: (3,3,1) (0,0,0)
- Goal State: (0,0,0) (3,3,1)
- Path Cost: 1 unit per crossing

Production Rules

Rule No	Production Rule and Action
1	(m,c): Two Missionaries can go only when m-2>=c or m-2=0 in one bank and m+2>=c in the other bank
2	(m,c): Two cannibals can cross the river when c-2<=m or m=0 in one bank and m>=c+2 or m=0 in the other bank
3	(m,c): One Missionaries and One Cannibals can go only when m-1>=c-1 or m=0 in one bank and m+1>=c+1 in the other bank
4	(m,c): One Missionary can go only when m-1>=c or m-1=0 in one bank and m+1>=c in the other bank
5	(m,c): One Cannibals can go only when m>=c-1 or m=0 in one bank and m>=c+1 or c=0 in the other bank

One Solution



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.

Now can you get exactly 2 gallons of water in the 4-gallon jug?

Problem Formulation

States: tuple (x,y), 0<=x<=4 and 0<=y<=3

Initial State: (0,0)

Goal State: (2,y)

Production Rules:

Rule No	Action
1. Fill the 4-gal Jug	(x,y) → (4,y) X<4
2. Fill the 3-gal Jug	(x,y) → (x,3) Y<3
3. Empty 4-gal jug on ground	(x,y) → (0,y) X>0

Problem Formulation

Production Rule:

4. Empty the 3-gal jar on ground	(x,y) → (x,0) Y>0
5. Pour water from 3 gal to fill 4-gal jar	(x,y) → (4,y-(4-x)) X+y>=4
6. Pour water from 4 gal to fill 3-gal jar	(x,y) → (x-(3-y)),3) X+y>=3
7. Pour all water from 3 gal to 4 gal	(x,y) → (x+y,0) X+y<4
8. Pour all water from 3 gal to 4 gal	(x,y) → (0,x+y) X+y<3

One Solution

State	Rule No
(0,0)	
	1
(4,0)	
	6
(1,3)	
	4
(1,0)	
	8
(0,1)	
	1
(4,1)	
	6
(2,3)	

Wolf, Goat and Cabbage Problem

- A farmer wants to cross a river and take with him a wolf, a goat, and a cabbage.
- There is a boat that can fit himself plus either the wolf, the goat, or the cabbage.
- the wolf will eat the goat and the goat will eat the cabbage if they are alone on the shore.
- How can the farmer bring the wolf, the goat, and the cabbage across the river?

Problem Formulation

Try Yourself