Missionaries and Cannibal problem

Problem: **Three missionaries and three cannibals find themselves on one side of a river. They have agreed that they would all like to get to the other side. There is just one boat and they all have to cross the river. The cannibals eat humans so the missionaries do not trust them and do not want to be stuck with them. The missionaries always want to be in majority on both sides of the river to be safe. So the missionaries want to manage trip across the river in such a way that the number of missionaries on either side of the river is never less than the number of cannibals who are on the same side. The boat can carry two people at a time.**

How can the missionaries and cannibals cross to the other side?

Solution:

Given,

A boat can take only 2 passengers from one side to other.

Let M = No. of Missionaries.

Let C = No. of Cannibals.

At the point when cannibals will eat missionaries: M<C

At the point when cannibals will not eat missionaries: $M \geq C$

How we will get to the goal state?

1. **At initial state , 3 cannibals and 3 missionaries present on one side of a river.**

2. **1 cannibal and 1 missionary will enter the boat and 1 cannibal will reach other end of the river.**

3. ***Next missionary in the boat will reach and land on the other end where 2 missionaries and 2 cannibals present.***
   Now , no. of missionaries become 3 and cannibals become 2 on the other end.

4. ***2 cannibals will enter the boat and 1 will reach the other end ,***

5. ***Now if any missionary travel other end cannibals will eat them. Therefore cannibal inside the boat will reach the other end where missionaries were present.***

And 2 missionaries will enter the boat.

6. ***One missionary will reach the other shore but there are 2 cannibals present they might eat him, hence one of the cannibal enter boat with the missionary present.***

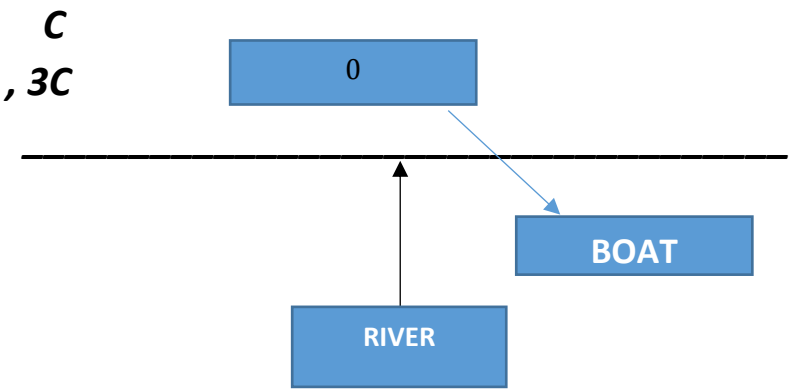
7. ***The cannibal in the boat will reach the other shore , while left missionary will jump in the boat as two cannibal might eat him on that shore . The two missionaries in the boat then reach the other end of the river.***

8. ***Now the one cannibal present where 3 missionaries present, that cannibal will jump in the boat and will bring one of the cannibal to other end of the river.***

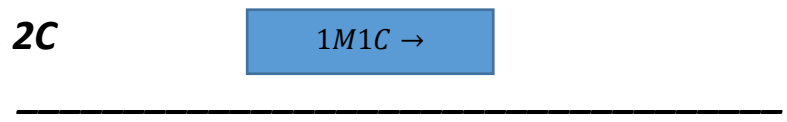
9. ***Next the cannibal present in the boat will bring other one to the other end and both will reach the other shore of the river thus goal state is reached.***

Now lets do it in Artificial Intelligence way:

1. ***lets take constraint seeing the initial state(x,y,0)***
   Initial state:



2.



3.

2M ,2C | $\leftarrow 1M$ | ***0M 1C***

4.

3M ,2C | 0 | ***0M 1C***

5.

3M ,0C | 2C→ | ***0M 1C***

6.

3M ,0C | ←1C | ***0M 2C***

7.

3M ,1C | 0 | ***0M 2C***

8.

1M ,1C | 2M→ | ***0M 2C***

9.

1M ,1C ←1M1C ***1M 1C***

10.

0M ,2C 2M→ ***1M 1C***

11.

0M ,2C 0 ***3M 1C***

12.

0M ,2C ←1C ***3M 0C***

13.

0M ,1C 2C→ ***3M 0C***

14.

0M ,1C ←1C ***3M 1C***

15.

0M ,0C 2C → ***3M 1C***

16.

0M ,0C 0 ***3M 3C***

Table representing Missionaries and Cannibal problem:

Missionary and Cannibals at one end		*Boat*	*Missionary and Cannibals at other end*	
3M	***3C***	***0***	***0M***	***0C***
2M	***2C***	***1M1C→***	***0M***	***0C***
2M	***2C***	***←1M***	***0M***	***1C***
3M	***2C***	***0***	***0M***	***1C***
3M	***0C***	***2C→***	***0M***	***1C***
3M	***0C***	***←1C***	***0M***	***2C***
3M	***1C***	***0***	***0M***	***2C***
1M	***1C***	***2M→***	***0M***	***2C***
1M	***1C***	***←1M1C***	***1M***	***1C***

0M	*2C*	*2M→*	*1M*	*1C*
0M	*2C*	*0*	*3M*	*1C*
0M	*2C*	*←1C*	*3M*	*0C*
0M	*1C*	*2C→*	*3M*	*0C*
0M	*1C*	*←1C*	*3M*	*1C*
0M	*0C*	*2C→*	*3M*	*1C*
0M	*0C*	*0*	*3M*	*3C*