Assignment No:02

Assignment On: Artificial Intelligence Problems

Course Title: Artificial Intelligence
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Problem 1:

Missionaries and Cannibals Problem: Three Missionaries and three cannibals are on the left bank of a river. There is a boat on their side of the river that can be used to carry one or two people. The goal is to use this boat to cross the river in such a way that cannibals never outnumber missionaries on either bank of the river.

Solution:

Initial state:

It is the state when Cannibals and Missionaries are on the left bank of the river with boat.
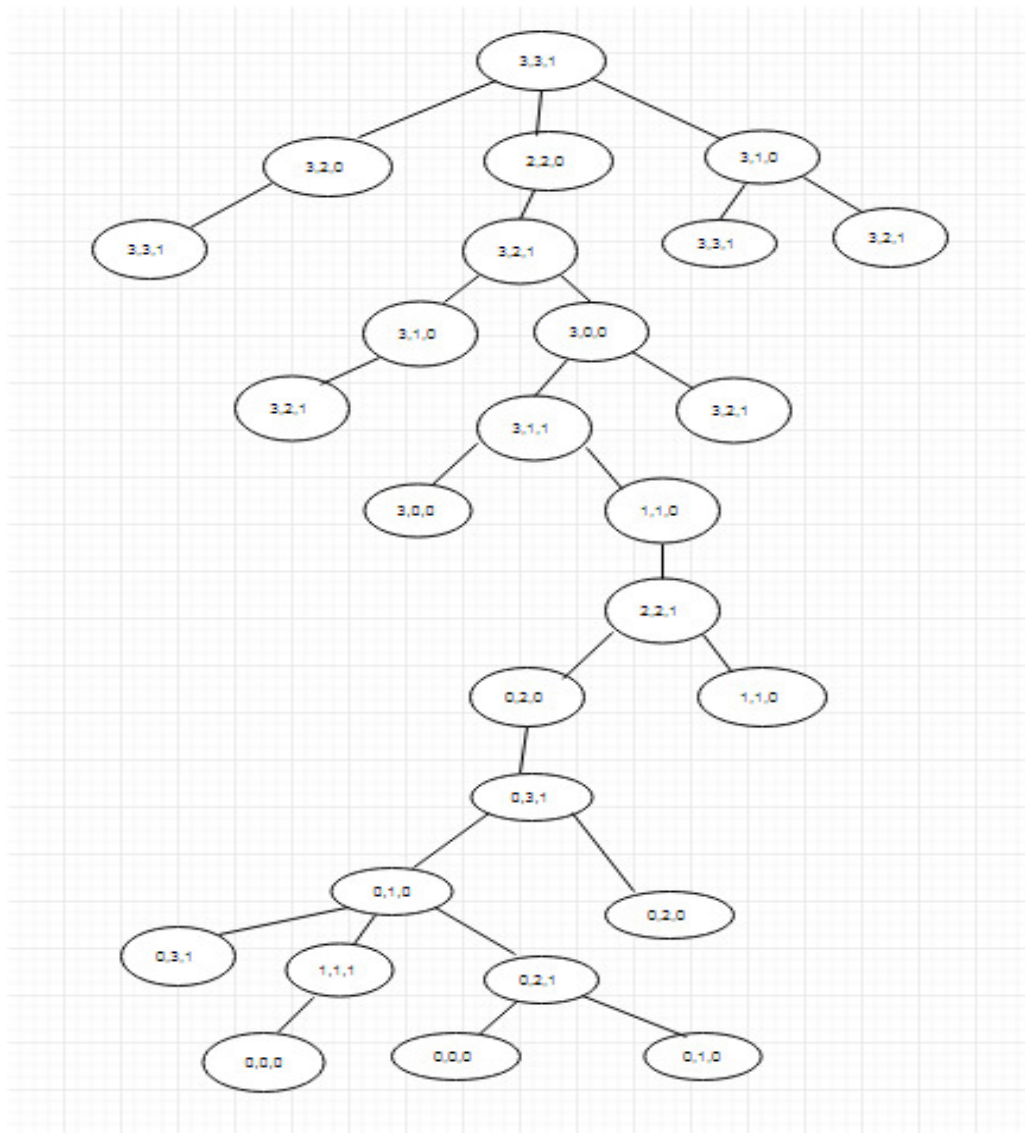I stated this state with (3,3,1)

Successor Function:

Cannibals never outnumbered the missionaries on either side of the river. Which means the missionaries will always be more in number than the cannibals.
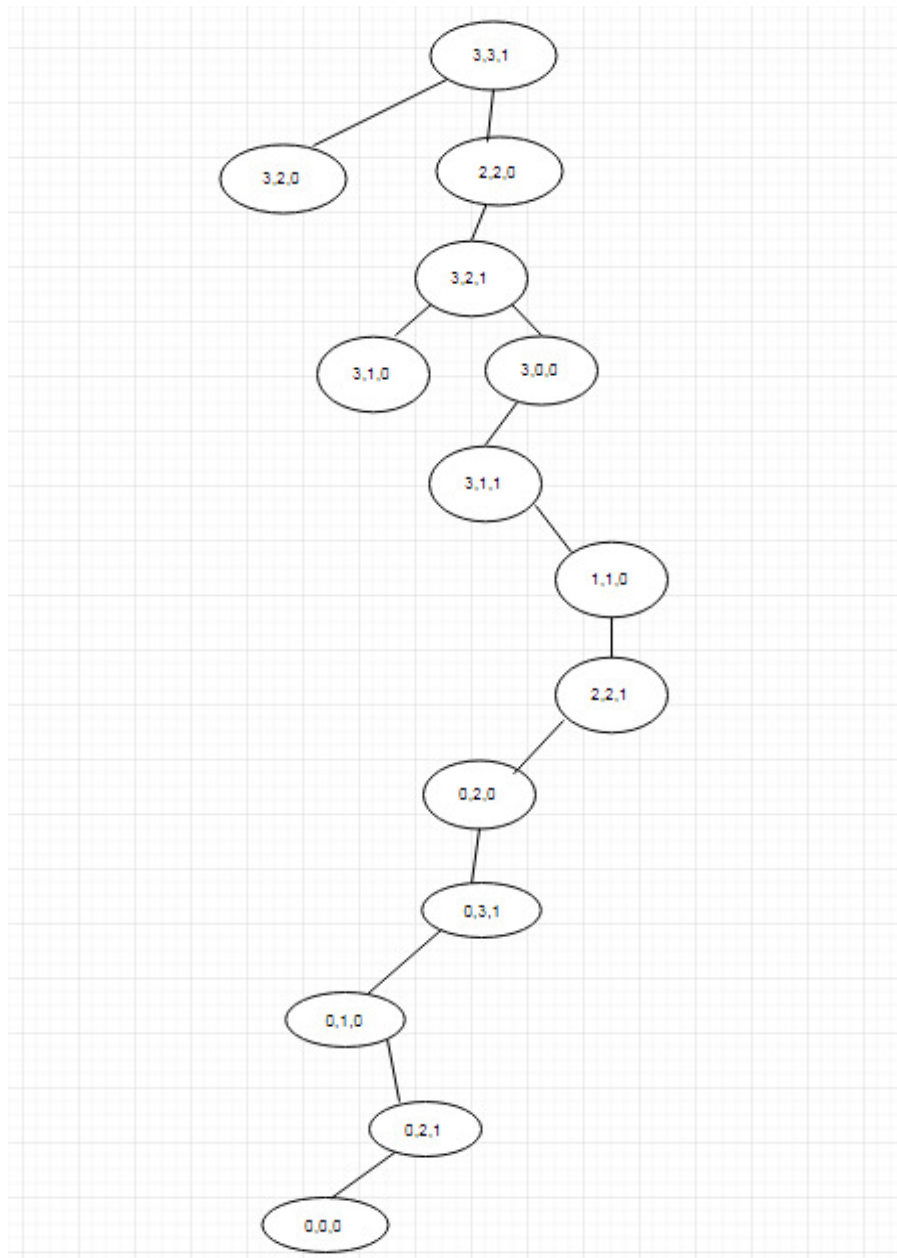
Final state:

Final state is they all cross the river and go to the other side. Which I stated as (0,0,0).

State space diagram is drawn below:

To solve this problem, I used DFS because it will take less steps than BFS.The solution is given below:

```
                              3,3,1
                    3,2,0            2,2,0
                                3,2,1
                        3,1,0          3,0,0
                                3,1,1
                                       1,1,0
                                       2,2,1
                              0,2,0
                              0,3,1
                    0,1,0
                        0,2,1
                0,0,0
```

Problem 2:

Lion, Lamb and grass problem: A person has one lion, one lamb and a bundle of grass. He wants to cross a river but there is only one boat and it can't sustain the weight of more than two articles at time. Also, he has to make sure that the lion doesn't eat the lamb and the lamb doesn't eat the grass. How will he get to the other side of the river with all three intact?

Solution:

Initial state:

It is the state when Lion, Lambs and grass are on the left bank of the river with boat.
I stated this state with (L,La,gs,1)
Where L=Lion
La=Lamb and gs=Grass ,
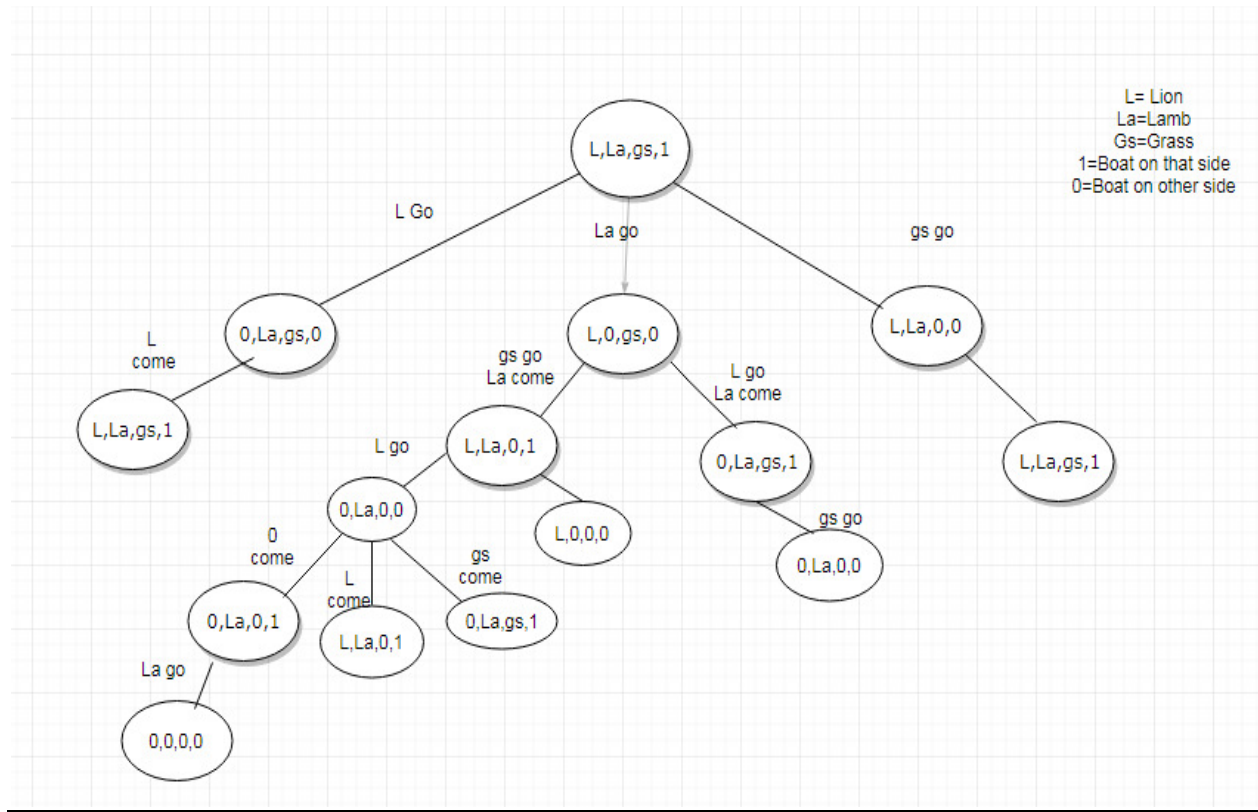1 means boat on that side and
 0 means boat on the other side.

Successor Function:

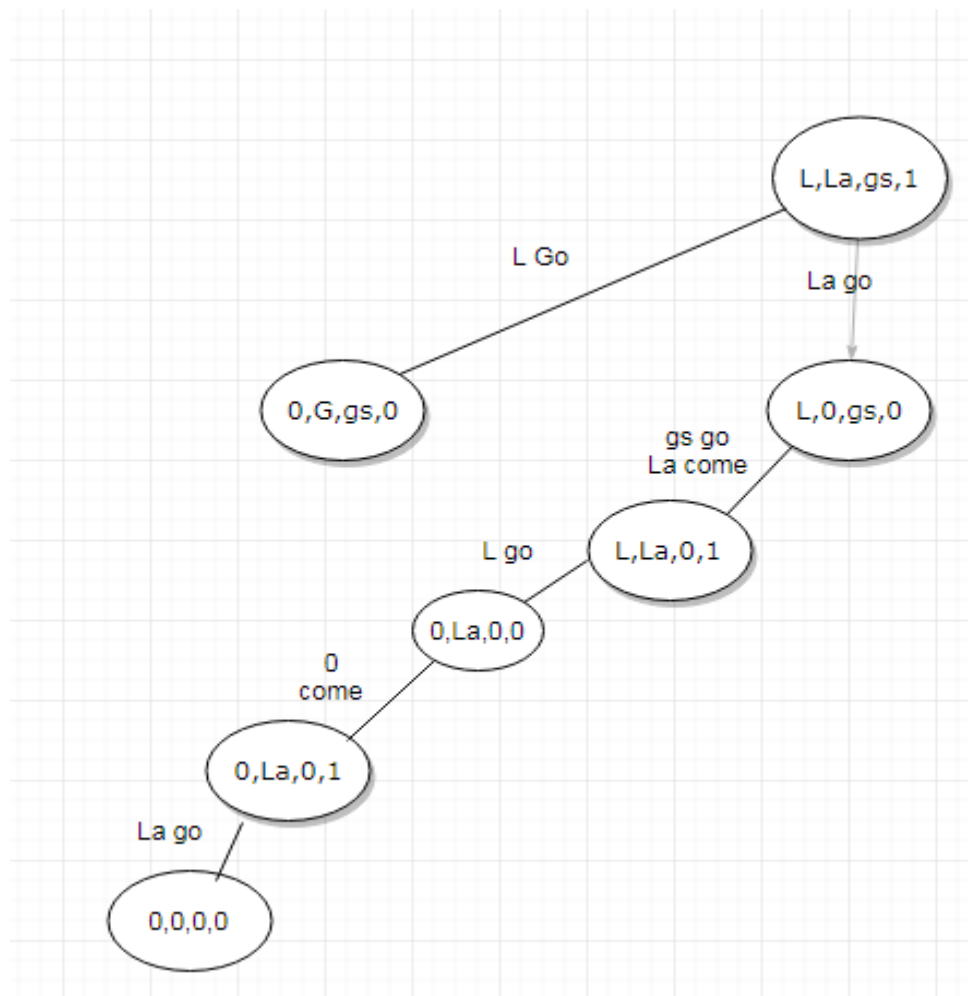Lion doesn't eat the Lamb and the Lamb doesn't eat the grass

Final state:

Final state is they all cross the river and go to the other side. Which I stated as (0,0,0,0).

State space diagram is drawn below:

L= Lion
La=Lamb
Gs=Grass
1=Boat on that side
0=Boat on other side

L,La,gs,1

L Go

La go

gs go

0,La,gs,0

L,0,gs,0

L,La,0,0

L
come

gs go
La come

L go
La come

L,La,gs,1

L go

L,La,0,1

0,La,gs,1

L,La,gs,1

0,La,0,0

L,0,0,0

gs go

0
come

gs
come

0,La,0,0

L
come

0,La,0,1

L,La,0,1

0,La,gs,1

La go

0,0,0,0

To solve this problem, I used DFS because it is optimal solution. The solution is given below:

The diagram shows a DFS tree with nodes and labeled edges:

- L,La,gs,1 — (L Go) — 0,G,gs,0
- L,La,gs,1 — (La go) — L,0,gs,0
- L,0,gs,0 — (gs go / La come) — L,La,0,1
- L,La,0,1 — (L go) — 0,La,0,0
- 0,La,0,0 — (0 / come) — 0,La,0,1
- 0,La,0,1 — (La go) — 0,0,0,0

Problem 3:

Man, Woman and two children problem: A man and a woman of equal weight, together with two children, each of half their weight, wish to cross a river using a boat which can only carry the weight of one adult. The goal is to use this boat to cross the river.

Solution:

Initial state:

It is the state when man, woman and two children are on the left bank of the river with boat.
I stated this state with (2A,2C,1)
Where A=Adult
C=Children
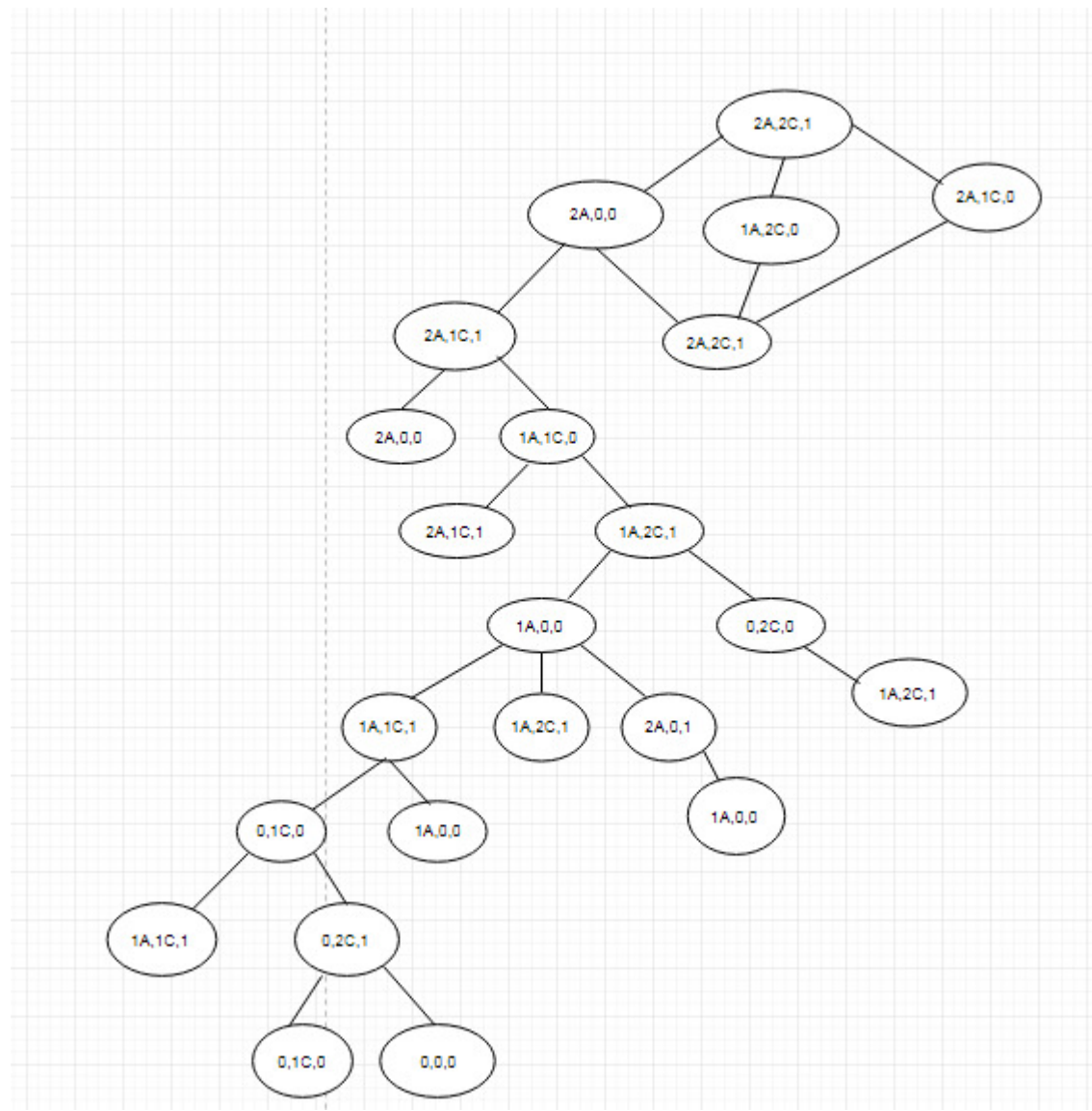1 means boat on that side and 0 means boat on the other side.

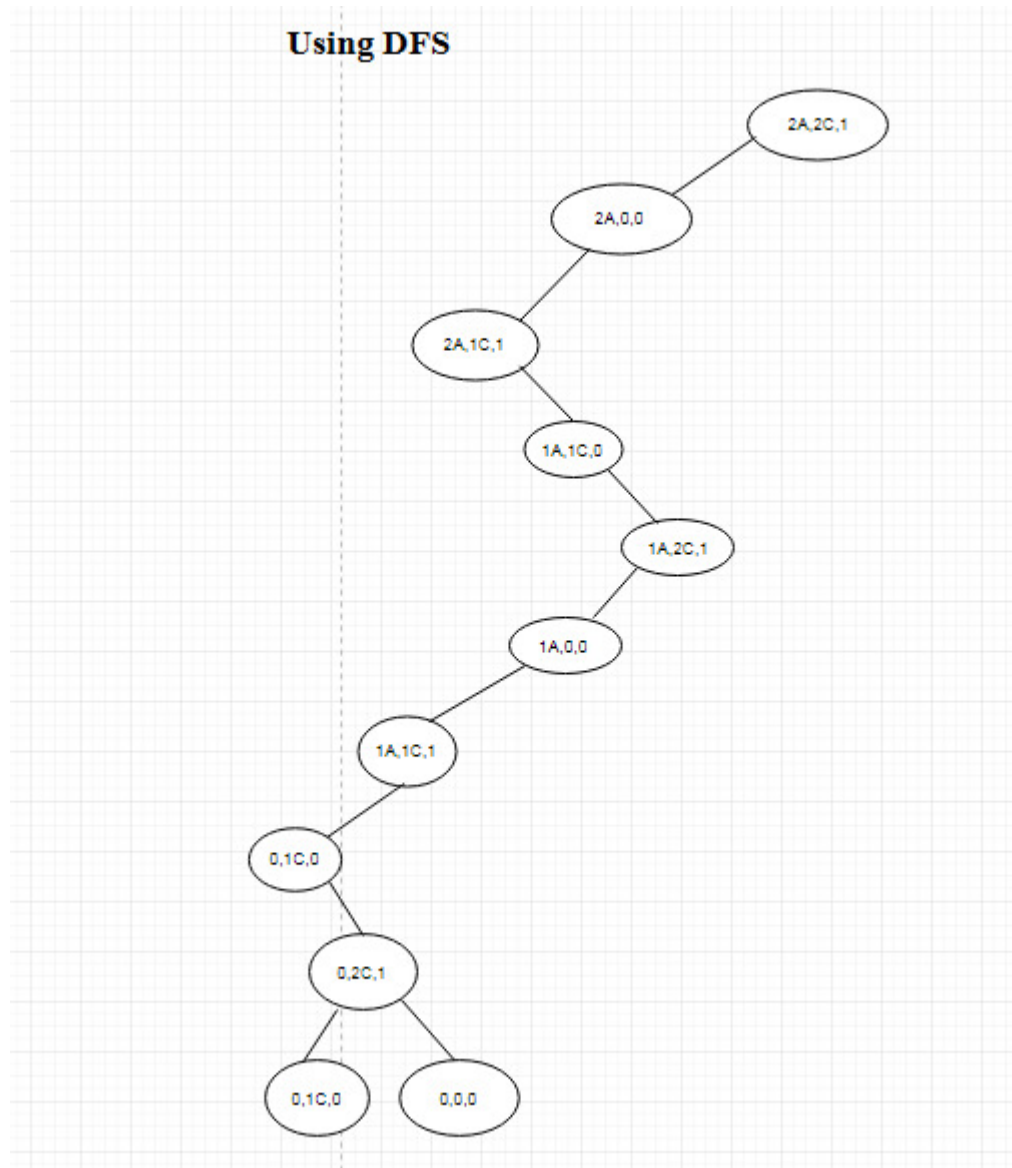## Successor Function:

Goal is to use this boat to cross the river.

Final state:

Final state is they all cross the river and go to the other side. Which I stated as (0,0,0).

State space diagram is drawn below:

To solve this problem, I used DFS because it is optimal solution. The solution is given below:

Using DFS

References

[Book].
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Introduction to Artificial Intelligence [Online] // https://courses.cs.washington.edu. - 2014. - https://courses.cs.washington.edu/courses/cse415/14sp/assignments/hw1/hw1.html.