State Space Representation:

1. **State:**

   Each state is represented by a tuple (m, c, s) where m is the number of missionaries, c is the number of cannibals and s is the side of the boat.

   The target of the problem is to take all 3 missionaries and 3 cannibals on the right side where the capacity of the boat is it can only maximum of 2 individuals at a time.

   Start State = (3, 3, 1) => 3M, 3C and boat on left side
   Goal State = (0, 0, 0) => 0M, 0C and boat on the right side

2. **Operators**

   We have to reach the goal state with series of operators that change the state from one to another:

   operators = [(1, 0), (0, 1), (1, 1), (0, 2), (2, 0)]

   Where each pair *(x, y)* represents number of missionaries, number of cannibals to moved from either left to right or right to left.

3. **Constraints**

   Constraints are for each state , number of cannibals shouldn't outnumber number of missionaries on each sides.

State Space Tree Searched upto depth 13

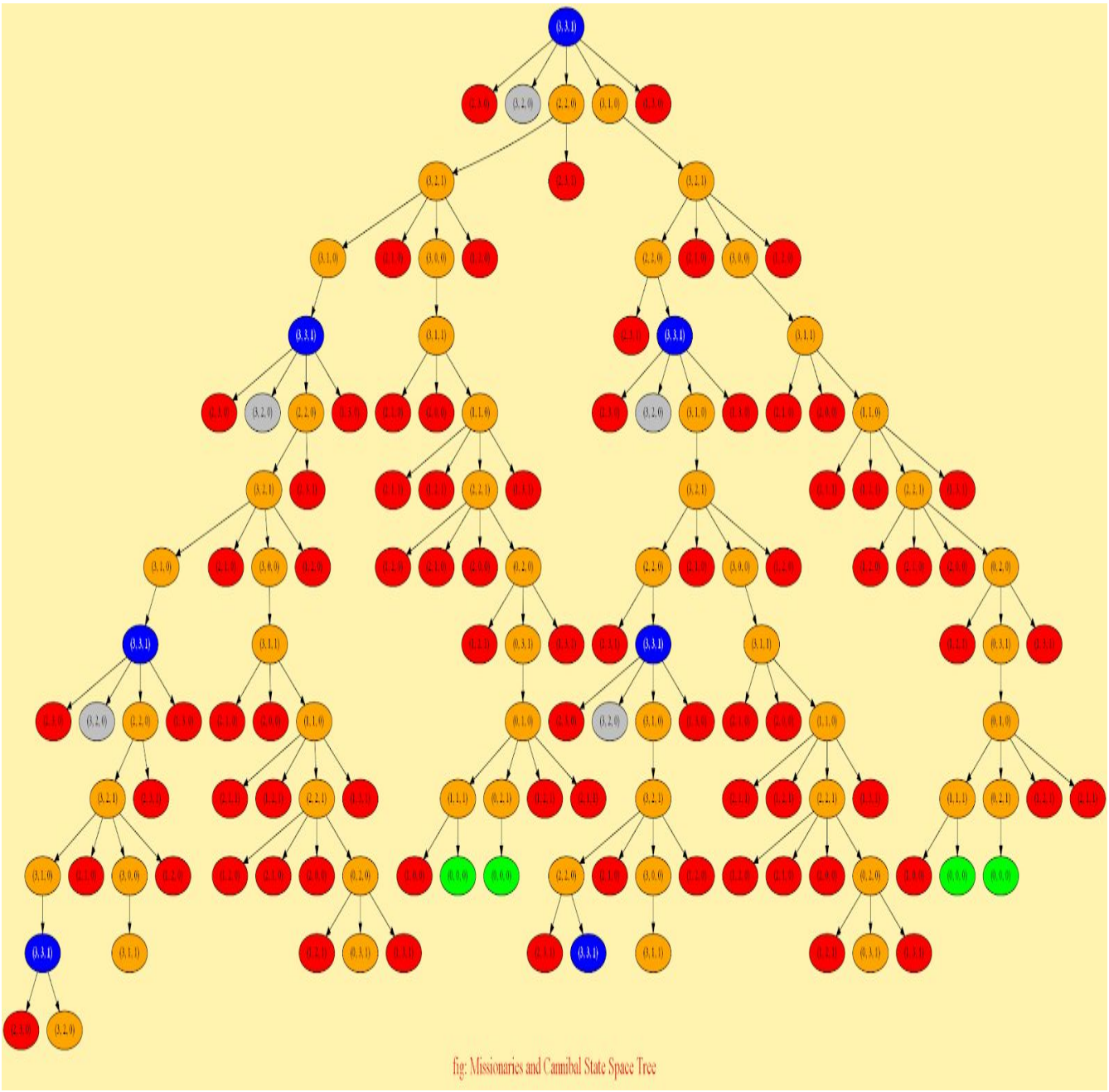


fig: Missionaries and Cannibal State Space Tree

Here node marked green are goal state and node marked red are killed state.

BFS Search Tree:

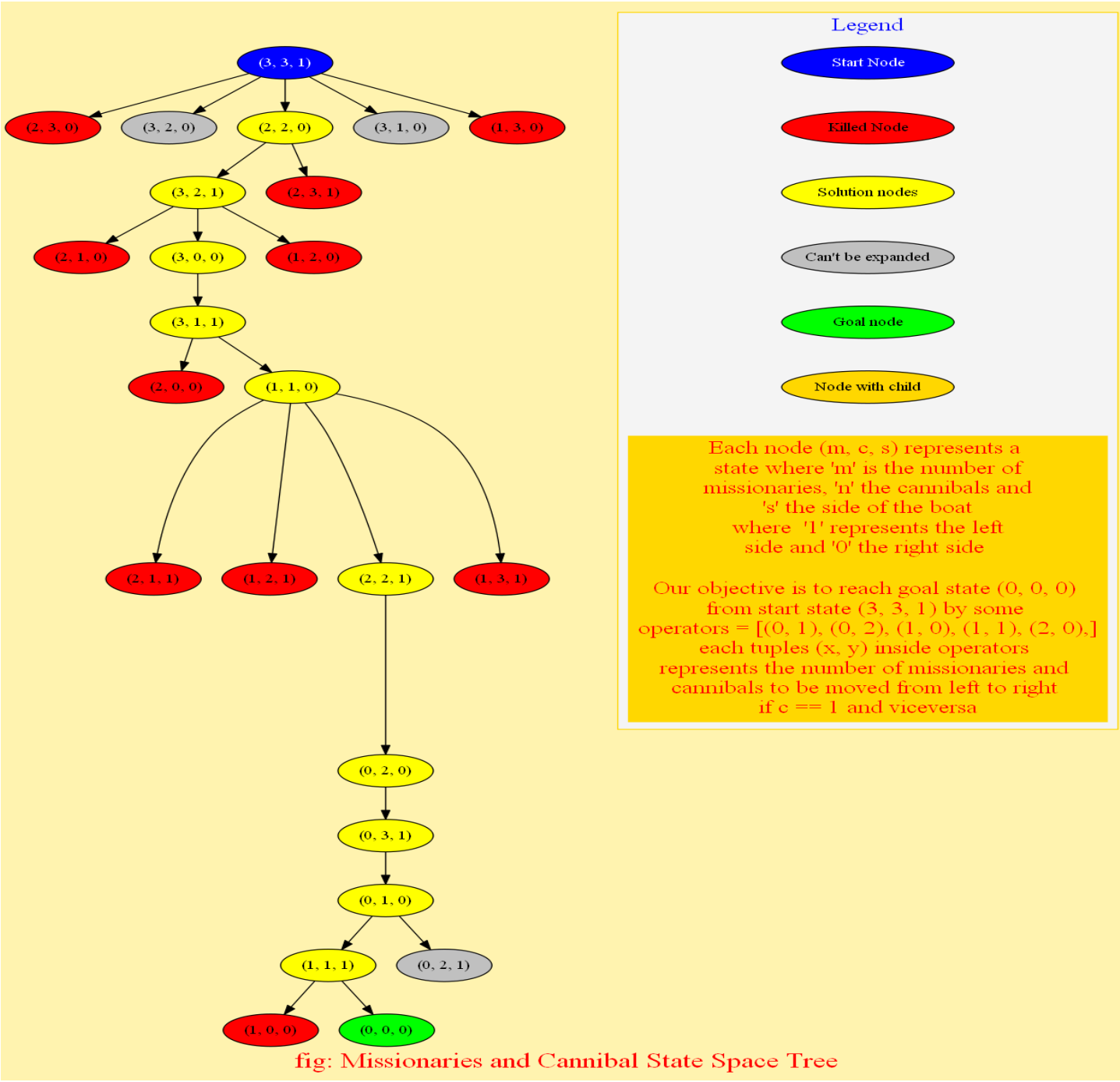
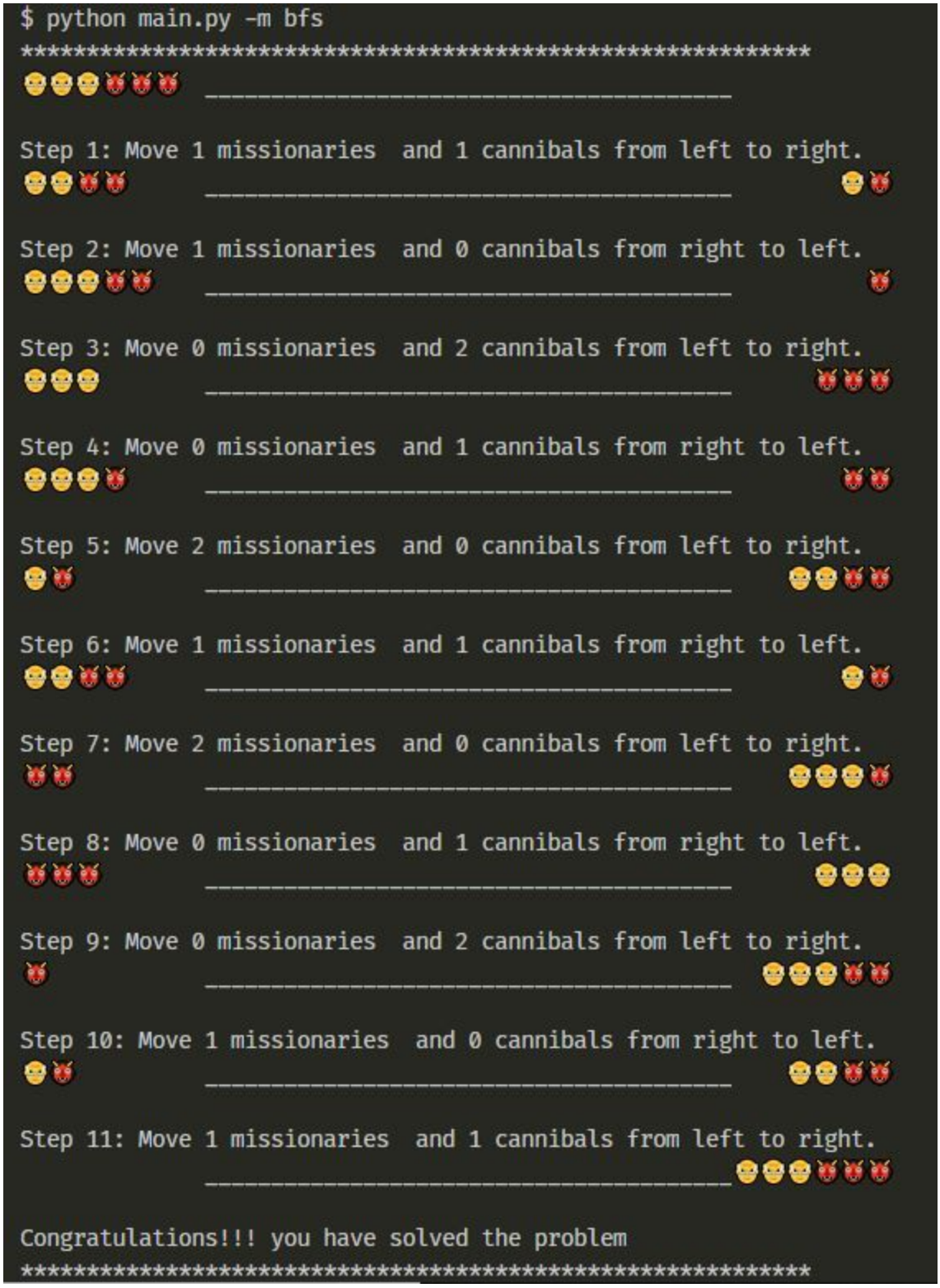


fig: Missionaries and Cannibal State Space Tree

Here, the solution path is represented by nodes marked in yellow.
The solution is displayed in more readable form on console.

Displaying Solution Steps:


$ python main.py -m bfs
****
Step 1: Move 1 missionaries and 1 cannibals from left to right.
Step 2: Move 1 missionaries and 0 cannibals from right to left.
Step 3: Move 0 missionaries and 2 cannibals from left to right.
Step 4: Move 0 missionaries and 1 cannibals from right to left.
Step 5: Move 2 missionaries and 0 cannibals from left to right.
Step 6: Move 1 missionaries and 1 cannibals from right to left.
Step 7: Move 2 missionaries and 0 cannibals from left to right.
Step 8: Move 0 missionaries and 1 cannibals from right to left.
Step 9: Move 0 missionaries and 2 cannibals from left to right.
Step 10: Move 1 missionaries and 0 cannibals from right to left.
Step 11: Move 1 missionaries and 1 cannibals from left to right.
Congratulations!!! you have solved the problem
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DFS Search Tree

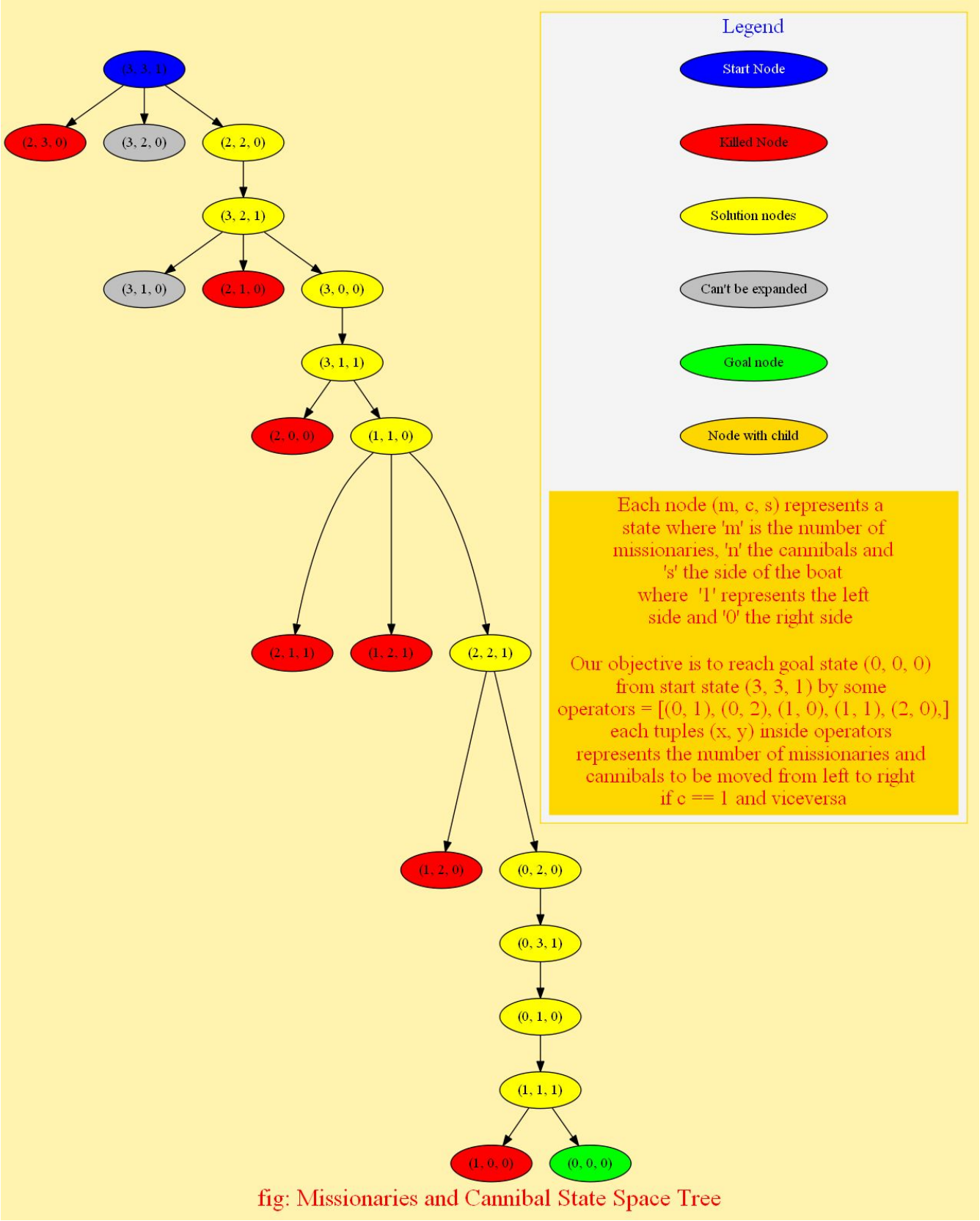

fig: Missionaries and Cannibal State Space Tree

Which performed better?
For BFS we had to explore total 25 nodes.
For DFS we had to explore total 21 nodes.
So, DFS performed better in our case.

The complete code is available at:
https://github.com/sarangbishal/Missionaries-and-Cannibals-Problem