Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Find a way to get everyone to the other side without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place. This problem is famous in AI because it was the subject of the first paper that approached problem formulation from an analytical viewpoint (Amarel, 1968).

1. Formulate the problem precisely, making only those distinctions necessary to ensure a valid solution. Draw a diagram of the complete state space.
2. Implement and solve the problem optimally using an appropriate search algorithm.

Ans

1. Formulating the problem:
State Space : All the combinations of 3 missionaries, 3 cannibals on both sides of the river and the position of the boat.

Initial State: All the Missionaries and Cannibals are on the same side
(3,3,1)-On the left side of the bank
(0,0,0)-On the right side of the bank

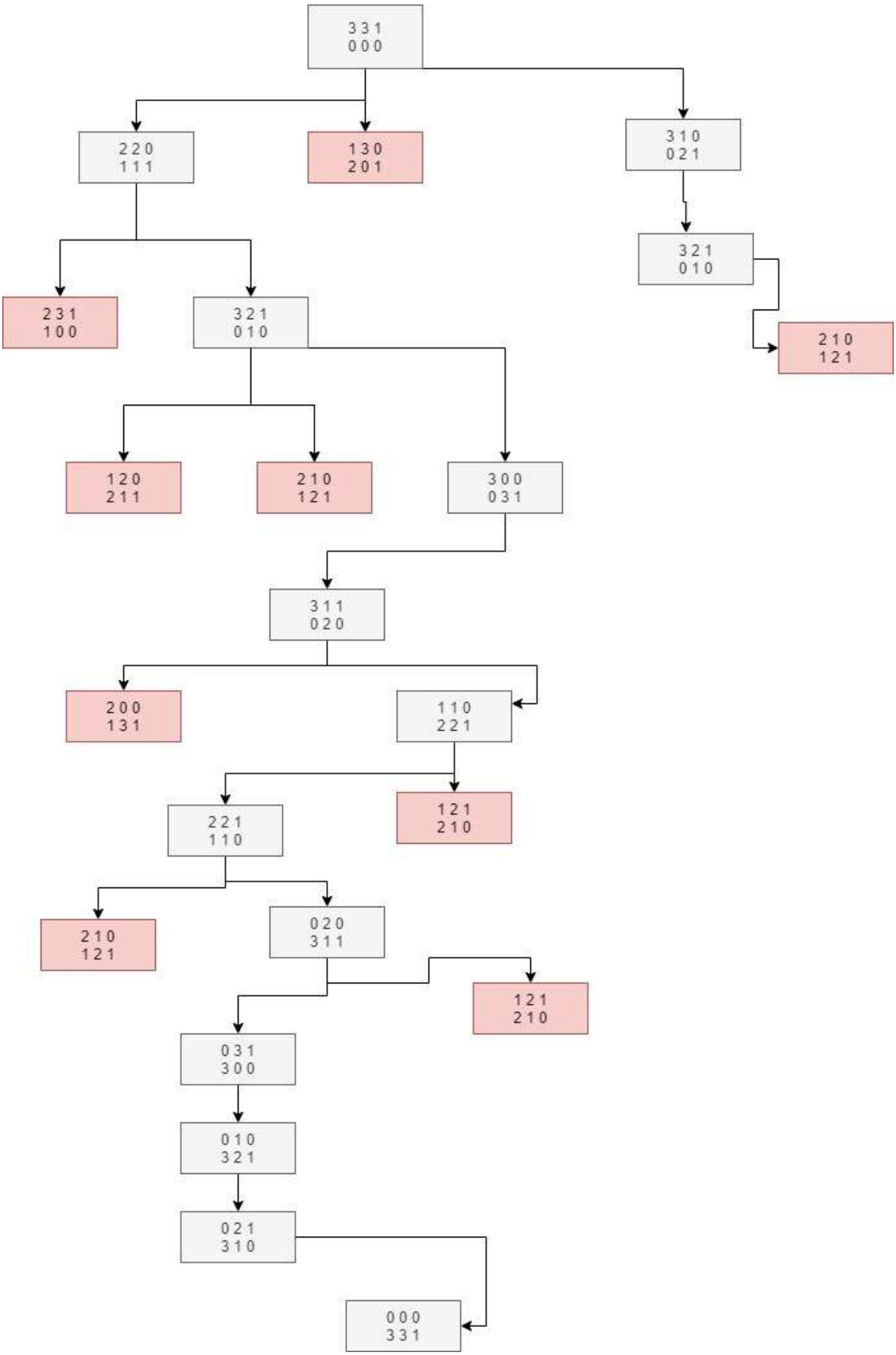
Successor Function: Each trip the boat can take two people at a time to the other coast and can come back.The possibilities are Two Cannibals,Two Missionaries,One Cannibal,One Missionary, One missionary and One Canniba). The value of each type(cannibal or missonary) will be reduced accordingly. We use BFS algorithm to find the valid solution.

Constraints : The number of Cannibals cannot be more than the number of missionaries on either coast.

Cost : The number of trips

Goal test: Check if all the people have been transported to the other side ie condition of the left bank is (0,0,0) and the other side is (3,3,1). If not, Repeat the trip with a different combination.

Diagram:
Initial Left Side - 3 3 1
Right side -0 0 0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