Kathmandu University

Department of Computer Science and Engineering

Dhulikhel, Kavre

A Report

On

"Missionaries and Cannibals Game"

[Course Code: COMP 472]

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Chapter 1: Introduction

1.1. Problem Definition

Three missionaries and three cannibals, along with one boat that fits at most two people (and requires at least one for operation), are on the right bank of a river. The most salient thing about missionaries and cannibals in "cohabitation" is that if ever the cannibals in any one spot outnumber the missionaries, the outnumbered missionaries will be consumed. The goal of this problem is to get all six individuals safely across the river from the left bank to the right bank.

State:

The given initial state is [3, 3, 0] and the goal state is [0, 0, 1] where the first element represents the number of missionaries, second one represents number of cannibals and the third is the position of canoe. 0 represents the boat in right bank and 1 represents the boat in left bank.

Possible Actions:

There must be one operator on the canoe for it to move across the banks. While moving the missionaries and cannibals we must ensure that at both bank the number of cannibals must not exceed number of missionaries. At any point the possible state of the canoe can be on of the:

[1,0],[1,1],[0,2],[0,1],[2,0]

1. One missionary and zero cannibal
2. One missionary and one cannibal
3. Zero missionary and two cannibals
4. Zero missionary and one cannibal

5. Two missionaries and zero cannibal

Goal:

All the missionaries and the cannibals on the left bank must reach the right bank without cannibals eating the missionaries.

Chapter 2: Implementation

The solution for the missionaries and cannibals game was found using the state space tree. The node represents the current state of the left bank and the edges represent the number of missionaries and cannibals moved across the river in the canoe. The tree was searched using breadth first search. Three different classes were created: Bank, Node and game.

Bank

The bank keeps track of number of missionaries and cannibals in the bank. It contains a function to check whether the bank is valid or not.

Node

The node class keeps track of its color, generated, banks, children and the parent. The parent of root is set to none. It contains a function to check whether the node is valid or invalid. A queue of generated nodes is kept to keep track of recurring nodes. Recursion is used to generate from the root. At first the root is passed and its children are appended to the list then the node generation is done recursively by passing the successive node on the queue.

game

The game takes an initial state and generates the state space tree from that state. The nodes are color coded. Light green represents generated node, coral color node represents dead node i.e. missionaries get eaten and thus game ends. The yellow nodes represent the state which has already been generated. The goal state is represented by light blue color.

Chapter 3: Findings

The generated State space tree form the program is as below:

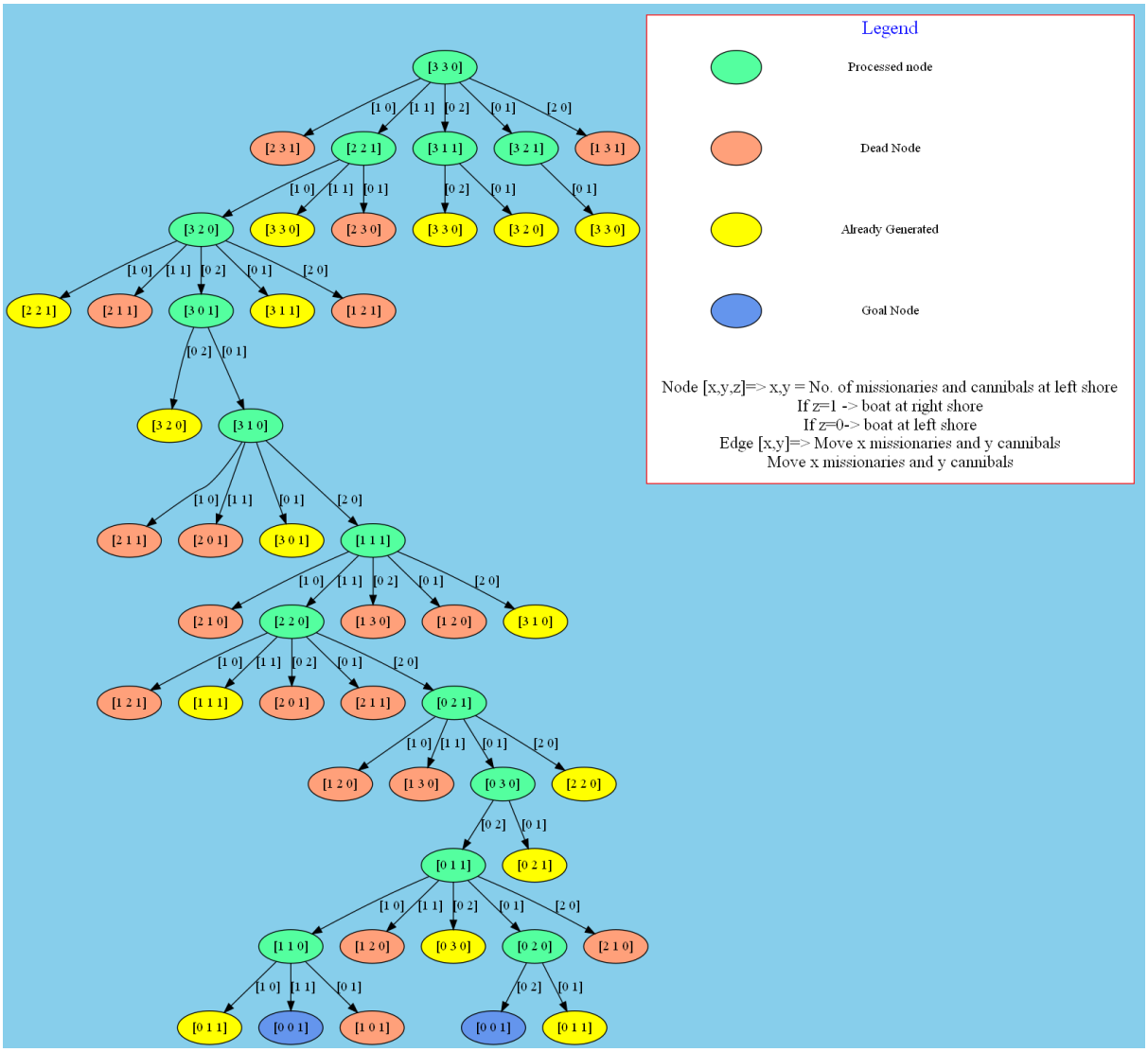

Figure 1: State Space Tree of Missionaries and Cannibals Game

Appendix 1

Source Code: https://github.com/ch-ankit/missionaries_and_cannibals