Kathmandu University
Dhulikhel Kavre

COMP 472

Report
Assignment 1

Missionary and Cannibal Problem

Submitted By:

Anup Sedhain (43)

Aazad Dahal (67)

Submitted To:

Mr. Santosh Khanal

DOCSE

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Introduction

The missionaries and cannibals is an artificial intelligence problem that deals with same number of missionaries and cannibals. They must cross a river using a boat which can carry at most two people. The missionaries cannot be outnumbered by the cannibals otherwise they get eaten.

Here, we have taken 3 missionaries and 3 cannibals on one side of the river bank. Our task here is to take all of them to the other side of the bank without letting the missionaries getting outnumbered.

Validity

- The boat can carry at most 2 of them.
- The boat can also travel itself without a missionary or a cannibal on it.
- On both sides of the river bank the missionaries should not be outnumbered by the cannibals.

Design and implementation

Software used:

- Editor used - Atom
- Language used – Python3.6
- Operating system used – Linux
- Graphics library used – PyGame

Algorithm used:

- Breadth First Search Algorithm

Methodology

We have denoted the position of the missionaries, cannibals and boat by (missionaryLeft, cannibalLeft, boat, missionaryRight, cannibalRight).

If the value of boat is ‘left’, then the boat is on the left side of the river. Similarly, if the value of boat is ‘right’, then the boat is on the right side of the river.

We consider that at the beginning all the missionaries and cannibals are on the left bank of the river.

Our initial state is (3, 3, left, 0, 0) which signifies that all 3 missionaries and 3 cannibals are on the same side of the river and the boat is on the left side of the river.

Our goal state is (0, 0, right, 3, 3) which signifies that there are no missionaries and cannibals left on the left bank and the boat is on the right side of the river.

Classes and Functions Used

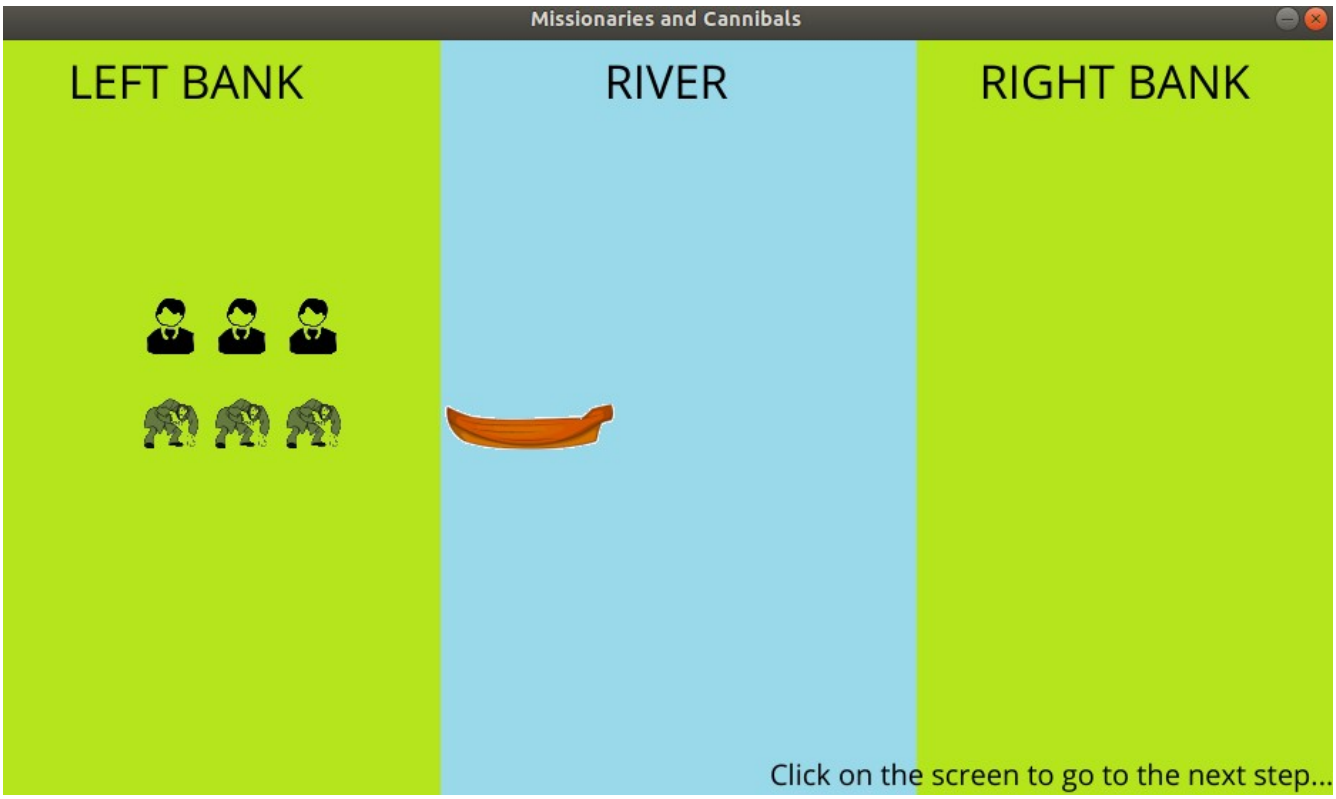
- **class** State():
    - It has the states which are possible (missionaryLeft, cannibalLeft, boat, missionaryRight, cannibalRight)
    - It contains the Goal State (0, 0, right, 3, 3)
    - Checks if the new state is valid or not.
- **function** successors(cur_state):
    - Finds the children for a given parent.
    - The possible states are:
        - If the boat is in left bank -
            1. Move 1 cannibal to right
            2. Move 2 cannibal to right
            3. Move 1 missionary to right
            4. Move 2 missionary to right
            5. Move 1 missionary and 1 cannibal to right
        - If the boat is in the right bank -
            1. Move 1 cannibal to left
            2. Move 2 cannibal to left
            3. Move 1 missionary to left
            4. Move 2 missionary to left
            5. Move 1 missionary and 1 cannibal to left
- **function** print_solution(solution):
    - Prints the possible state spaces
- **function** breadth_first_search():
    - In breadth first search we maintain a queue. It uses first in first out.
    - Place node into the list.
    - Dequeue a element from a list and find its decendents.
    - If the decendents are explored, if not add it to queue.
    - If queue is empty, goal cann’t be reached.
    - If queue is not empty dequeue next element and continue till we reach goal.

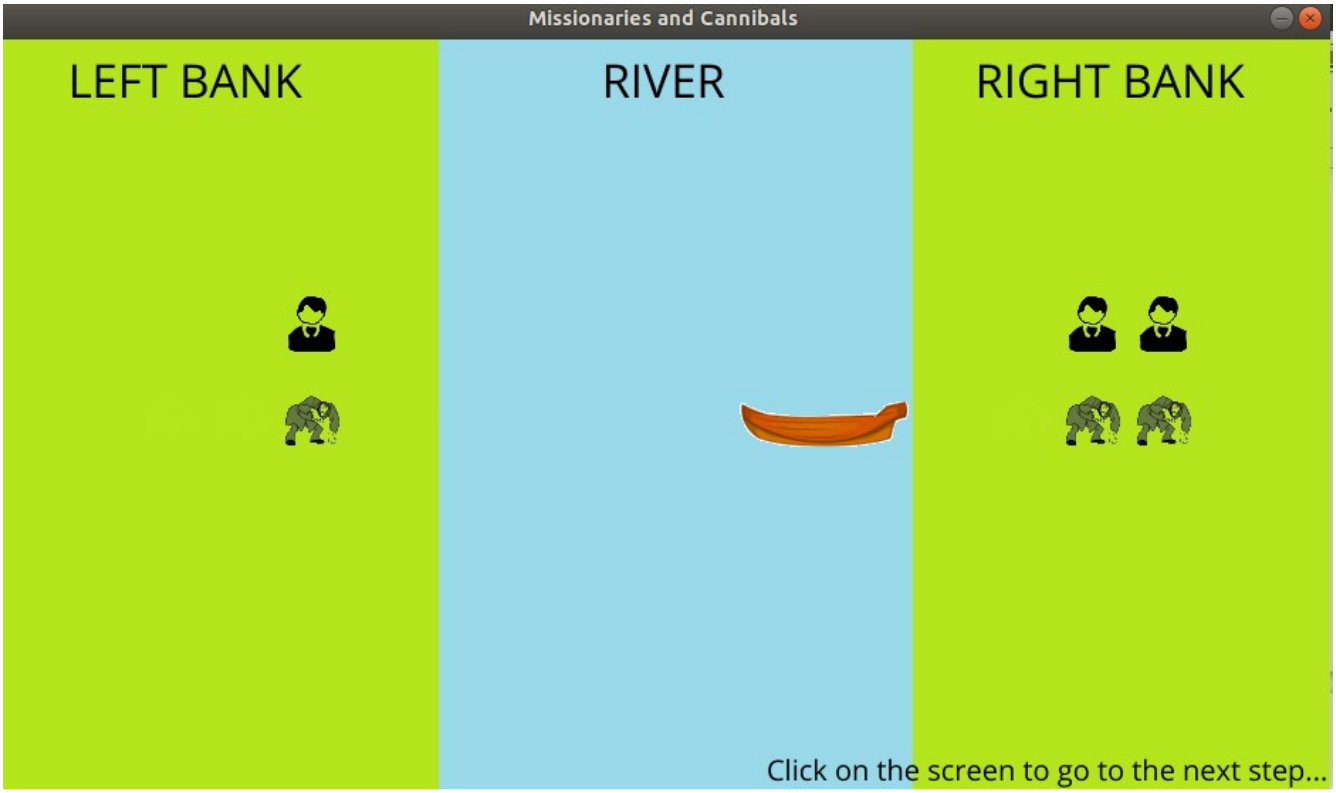
Output

In the console:

```
Missionaries and Cannibals solution:
(cannibalLeft,missionaryLeft,boat,cannibalRight,missionaryRight)
(3,3,left,0,0)
(1,3,right,2,0)
(2,3,left,1,0)
(0,3,right,3,0)
(1,3,left,2,0)
(1,1,right,2,2)
(2,2,left,1,1)
(2,0,right,1,3)
(3,0,left,0,3)
(1,0,right,2,3)
(1,1,left,2,2)
(0,0,right,3,3)
```

Graphical Representation:




Missionaries and Cannibals
LEFT BANK
RIVER
RIGHT BANK
Click on the screen to go to the next step...


Missionaries and Cannibals
LEFT BANK
RIVER
RIGHT BANK
BRAVO !

Conclusion

The given project was completed with much efficiency and effectiveness and the state space of the various states in question were properly oriented. Overall, this project was very helpful for us to understand the basics of AI.

Limitation

The graphics is the downside of our application since it has a simple interface.