***Due: Wednesday, February 12th, 11:59 PM***

Late Submissions not accepted.

**Miscellaneous Assignment:  Missionaries and Cannibals.**

The missionaries and cannibals problem is usually stated as follows. 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).

Formulate the problem precisely, making only those distinctions necessary to ensure a valid solution. Draw a diagram of the complete state space.

**Hints:**

* You will need to come up with an appropriate encoding scheme.  Include an explanation of your encoding scheme.
* You can draw the state space diagram on paper, take a picture on your phone, and copy and paste that into a word document.
* Alternatively, you could use some form of diagramming software such as draw.io.
* Do a good job on this assignment as your first programming project will be based on it.

**Submission Instructions:**

* Submit your work in PDF or in word format through Blackboard.
* Ensure the diagram is readable.  You will not receive credit if it is not.
* Do not zip up or otherwise compress your submission.

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2/10/2020

CS 461

Homework 3

Missionaries and cannibals must get from one side of the river to the other.

Cannibals can’t outnumber missionaries.

M = missionaries

C = cannibals

B = boat (capacity of 2 people)

States:

Side1 = Left side of river

Side2 = Right side of river

Initial State: Side1{M, M, M, C, C, C, B}, Side2{ }

Actions: Move boat left or right with 1 or 2 people (M, MC, MM, CC, or C)

Transition Model: Move the boat from one side of the river to the other, resulting in a change

in the number of missionaries and cannibals on each side of the river.

Goal Test: Move all the missionaries and cannibals to the right side of the river. The goal state

has been fulfilled if the left side is empty.

Path Cost: The number of times the boat moves across the river.

Final State: Side1{ }, Side2{M, M, M, C, C, C, B}

Missionaries and Cannibals State Space Diagram

|  |  |  |
| --- | --- | --- |
| Side1 | River | Side2 |
| M, M, M, C, C, C, B |  |  |

C M, C C, C

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Side1 | River | Side2 |  | Side1 | River | Side2 |  | Side1 | River | Side2 |
| M, M, M, C, C |  | C, B |  | M, M, C, C |  | M, C, B |  | M, M, M, C, |  | C, C, B |

M C

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Side1 | R | Side2 | M, M | Side1 | R | Side2 | C | Side1 | R | Side2 | C, C | Side1 | R | Side2 |
| M, C |  | M, M, C, C, B |  | M, M, M, C, B |  | C, C |  | M, M, M |  | C, C, C, B |  | M, M, M, C, C, B |  | C |

M, C

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Side1 | R | Side2 | M, M | Side1 | R | Side2 | C | Side1 | R | Side2 | C, C | Side1 | R | Side2 |
| M, M, C, C, B |  | M, C |  | C, C |  | M, M, M, C, B |  | C, C, C, B |  | M, M, M |  | C |  | M, M, M, C, C, B |

M C

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Side1 | River | Side2 |  | Side1 | River | Side2 |  | Side1 | River | Side2 |
| C, B |  | M, M, M, C, C, |  | M, C, B |  | M, M, C, C |  | C, C, B |  | M, M, M, C |

C M, C C, C

|  |  |  |
| --- | --- | --- |
| Side1 | River | Side2 |
|  |  | M, M, M, C, C, C, B |