Artficial Intelligence

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Homework 2

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Missionaries and Cannibals

1. Precisely formulate the problem by:

   (a) Define a state by giving the minimal set of information needed to uniquely identify it.

   A state will be able to be identified by the following:

   - Which side of the river you (the boat) are on (Right / Left)
   - Number of cannibals present
   - Number of missionaries present

   (b) Specifying the initial state

   The initial state will be on the Left side of the river with 3 Missionaries and 3 Cannibals

   (c) Defining a function ACTIONS(s) for an arbitrary state s which returns the set of actions that can be executed in state s. The actions available to an arbitrary state s are:

   - Cross(numCannibals, numMissionaries): Crosses the river with the specified number of cannibals/missionaries, because there are only 2 sides possible there is no need to specify direction. May result in a dead state based on this action, and the maximum number occupants may not exceed 2.

   (d) Defining a transition model by specifying a function RESULT(s,a) which returns the state that results from executing action a in state s. Transition Model:

   - RESULT(s, CROSS(numCannibals, numMissionaries)): Switches the agent to the opposite state along with the modified number of cannibals/missionaries ferried. This costs one point.

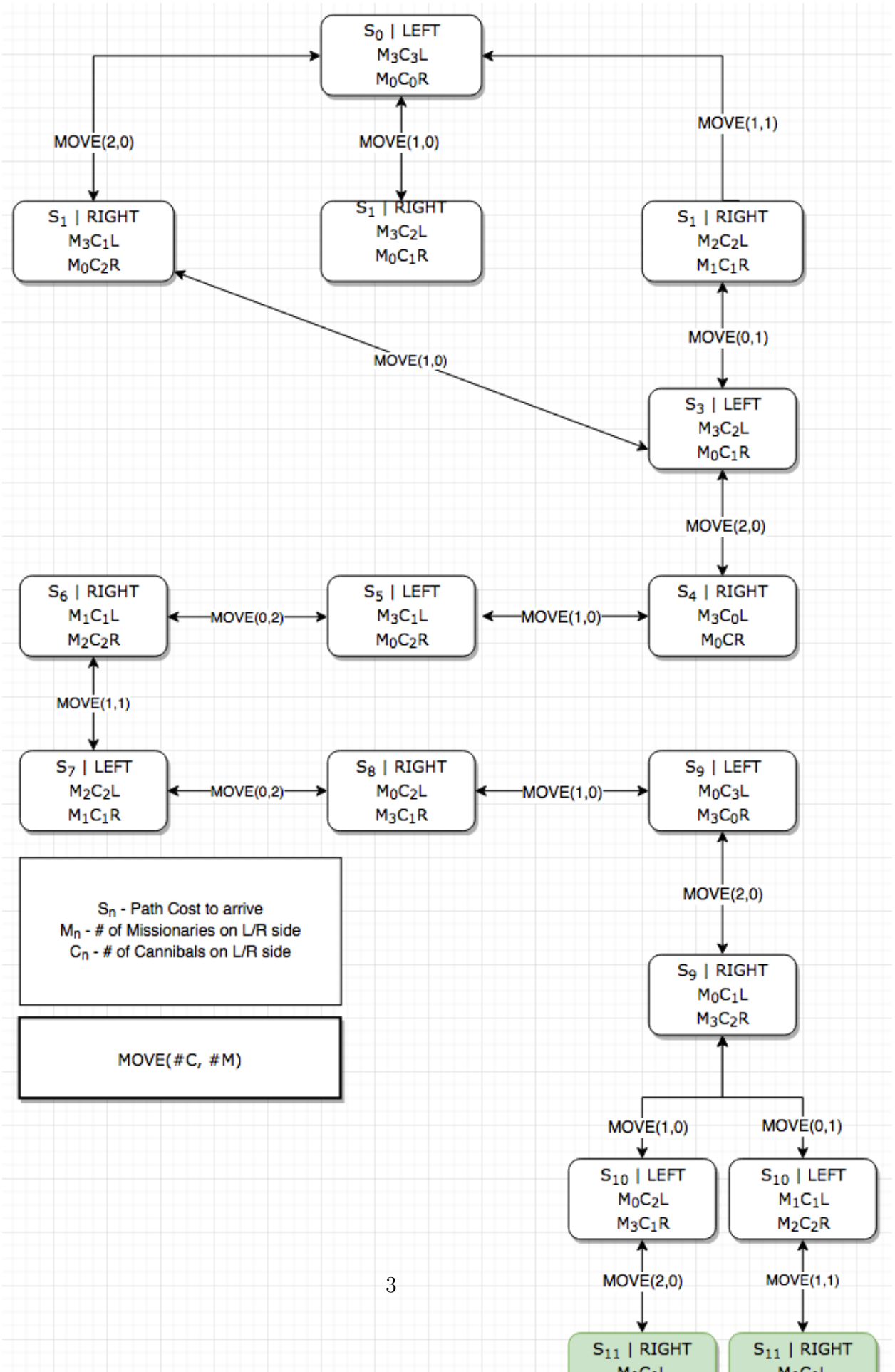
   (e) Defining a test to determine whether a given state is a goal state.

   If the agent us on the Right side of the river with 3 missionaries and 3 cannibals you are in the goal state.

   (f) Defining the step cost (which also gives us the past cost as that's merely the sum of all the step costs associated with a path).

   Every instance of CROSS() called costs one step.

2. Professional render a diagram of the complete state space employing appropriate software such as Microsoft Visio or the free open-source software Dia.


S0 | LEFT
M3C3L
M0C0R
MOVE(2,0)
MOVE(1,0)
MOVE(1,1)
S1 | RIGHT
M3C1L
M0C2R
S1 | RIGHT
M3C2L
M0C1R
S1 | RIGHT
M2C2L
M1C1R
MOVE(0,1)
MOVE(1,0)
S3 | LEFT
M3C2L
M0C1R
MOVE(2,0)
S6 | RIGHT
M1C1L
M2C2R
MOVE(0,2)
S5 | LEFT
M3C1L
M0C2R
MOVE(1,0)
S4 | RIGHT
M3C0L
M0CR
MOVE(1,1)
S7 | LEFT
M2C2L
M1C1R
MOVE(0,2)
S8 | RIGHT
M0C2L
M3C1R
MOVE(1,0)
S9 | LEFT
M0C3L
M3C0R
Sn - Path Cost to arrive
Mn - # of Missionaries on L/R side
Cn - # of Cannibals on L/R side
MOVE(#C, #M)
MOVE(2,0)
S9 | RIGHT
M0C1L
M3C2R
MOVE(1,0)
MOVE(0,1)
S10 | LEFT
M0C2L
M3C1R
S10 | LEFT
M1C1L
M2C2R
MOVE(2,0)
MOVE(1,1)
S11 | RIGHT
S11 | RIGHT

3. Find and report a path in the state space from the initial state to a goal state (i.e., a solution).

   (a) MOVE(1,1) – Cross with 1 Missionary and 1 Cannibal
   (b) MOVE(0,1) – Cross with 1 Missionary
   (c) MOVE(2,0) – Cross with 2 Cannibals
   (d) MOVE(1,0) – Cross with 1 Cannibal
   (e) MOVE(0,2) – Cross with 2 Missionaries
   (f) MOVE(1,1) – Cross with 1 Missionary and 1 Cannibal
   (g) MOVE(0,2) – Cross with 2 Missionaries
   (h) MOVE(1,0) – Cross with 1 Cannibal
   (i) MOVE(2,0) – Cross with 2 Cannibals
   (j) MOVE(1,0) – Cross with 1 Cannibal
   (k) MOVE(2,0) – Cross with 2 Cannibals