

CSC 404 - ACTIVITY/PROJECT 1 - NAME:

Problem 1. On one bank of a river are **five** missionaries and **five** cannibals. There is one boat available that can hold up to **three** people and that they would like to use to cross the river. If the cannibals ever outnumber the missionaries on either of the river's banks, the missionaries will get eaten. How can the boat be used to safely carry all the missionaries and cannibals across the river? (Note - we also cannot have 2 cannibals and 1 missionary in a boat together.)

a. Solve the riddle by drawing a diagram indicating the movement of missionaries and cannibals.

[Hint/Spoiler: I solved it with 11 moves. A key step is to get to get the left shore (side 0) to MMMCCC i.e., (3,3) with a boat. Then, you send all of the missionaries across and then only work with cannibals to bring the rest across.]

(#M, #C) = (5, 5)

(4, 4)

(5, 4)

(5, 1)

(5, 2)

(2, 2)

(3, 3)

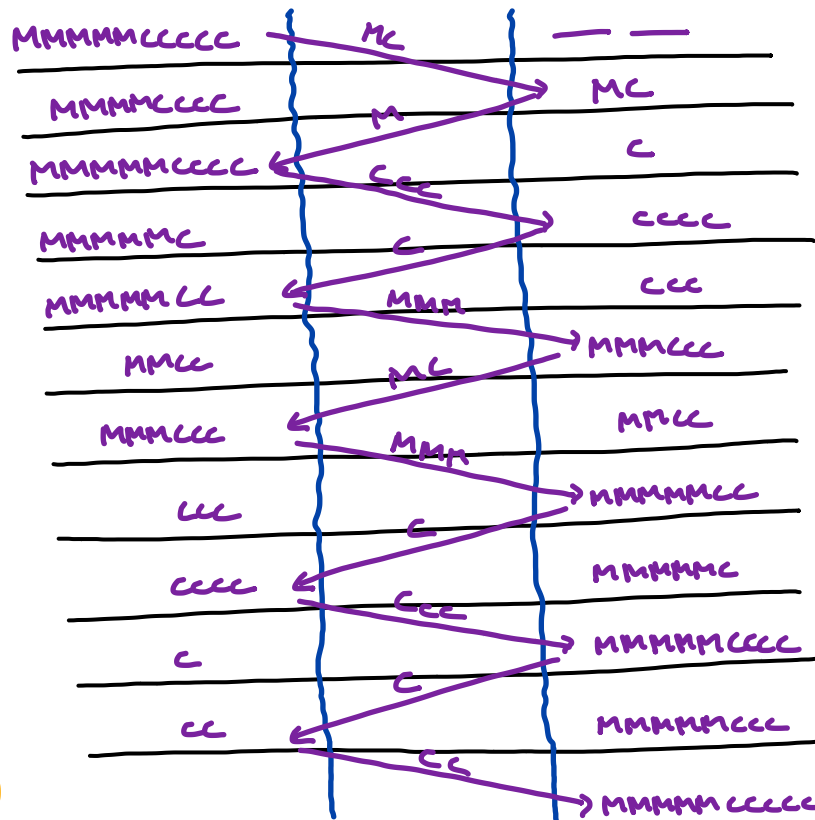
(0, 3)

(0, 4)

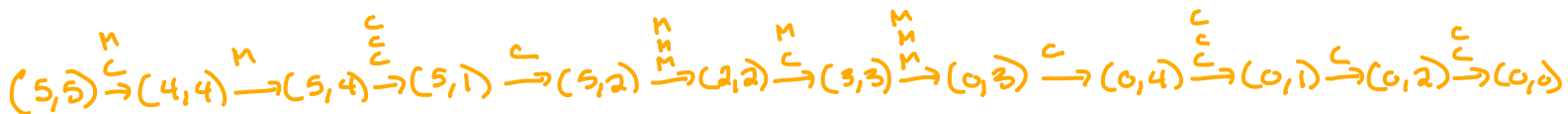
(0, 1)

(0, 2)

(0, 0)



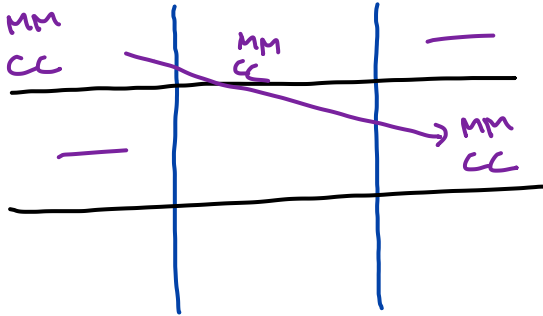
b. Represent the solution to the riddle as a state diagram. (Denote how you are encoding the information.)



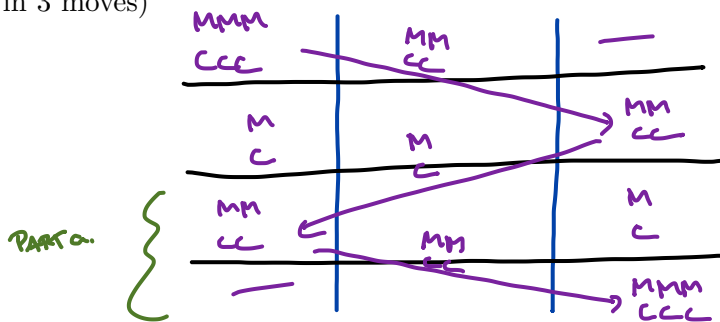
Problem 2 (Bonus). Attempts at implementing a search algorithm (in a language of your choice) to construct a path from initial state to end state in the Farmer River Crossing Riddle or Missionaries and Cannibals Riddle?

Problem 3. On one bank of a river are N missionaries and N cannibals. There is one boat available that can hold up to **four** people and that they would like to use to cross the river. If the cannibals ever outnumber the missionaries on either of the river's banks, the missionaries will get eaten. How can the boat be used to safely carry all the missionaries and cannibals across the river?

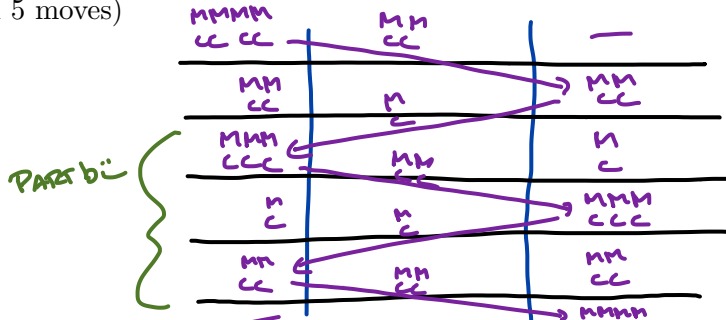
- a. If $N = 2$, how can the boat be used to safely carry all the missionaries and cannibals across the river? (Solve in 1 move)



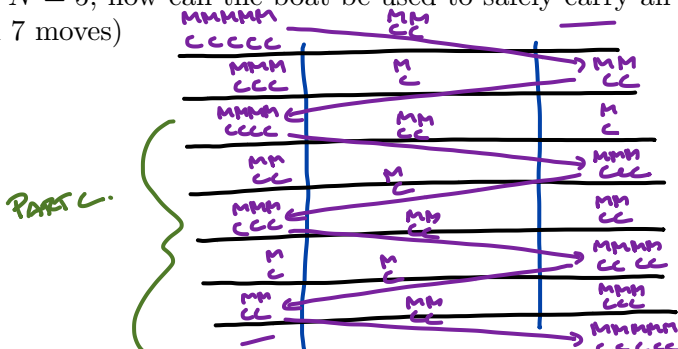
- b. If $N = 3$, how can the boat be used to safely carry all the missionaries and cannibals across the river? (Solve in 3 moves)



- c. If $N = 4$, how can the boat be used to safely carry all the missionaries and cannibals across the river? (Solve in 5 moves)



- d. If $N = 5$, how can the boat be used to safely carry all the missionaries and cannibals across the river? (Solve in 7 moves)



- e. (Bonus) Can you say anything in general? Are there any patterns/strategies that emerge?