Planning and Knowledge Exercise

* 10.7
  + Figure 10.4(Page 371) shows a blocks-world problem that is known as the Sussman Anomaly. The problem was considered anomalous because the noninterleaved planners of the early 1970s could not solve it. Write a definition of the problem and solve it, either by hand or with a planning program.
    - Problem Definition:
      * **Init**(On(A,Table) ˄ On(B, Table) ˄ On(C, A) ˄ Block(A) ˄ Block(B) ˄ Block(C) ˄ Clear(B) ˄ Clear(C)

**Goal**(On(A, B) ˄ On(B, C))

**Action**(Move(b, x, y),

*PRECOND:* On(b, x) ˄ Clear(b) ˄ Clear(y) ˄ Block(b) ˄ Block(y) ˄

(b =/= x) ˄ (b =/= y) ˄(x =/= y),

*EFFECT:* On(b, y) ˄ Clear(x) ˄ ¬On(b, x) ˄ ¬Clear(y))

**Action**(MoveToTable(b, x),

*PRECOND:* On(b,x) ˄ Clear(b) ˄ Block(b) ˄ (b =/= x),

*EFFECT:* On(b, Table) ˄ Clear(x) ˄ ¬On(b, x))

* + - Solution:
      * Block A(A), Block B(B), Block C(C)
      * [MoveToTable(C, A), Move(B, Table, C ), Move(A, Table, B)]
  + A noninterleaved planner is a planner that, when given two subgoals G1 and G2, produces either a plan for G1 concatenated with a plan for G2, or vice versa. Explain why a noninterleaved planner cannot solve this problem
    - Because the Problem has multiple solutions, a noninterleaved problem will concatenate all of the possible solutions as one solution and resulting in an issue when the program moves past the first solution.
* 12.18
  + Consider a game played with a deck of just 8 cards, 4 aces, and 4 kings. The three players, Alice, Bob, and Carlos, are dealt two cards each. Without looking at them, they place the cards on their foreheads so that the other players can see them. Then the players take turns either announcing that they know what cards on their own forehead, thereby winning the game, or saying “I don’t know”. Everyone knows the players are truthful and are perfect at reasoning about beliefs
    - Game 1: Alice and Bob have both said “I don’t know” Carlos sees that Alice has 2 Aces(A-A) and Bob has 2 Kings(K-K). What should Carlos say?
      * (A-K)
    - Describe each step of Game 1 using the notation of modal logic
      * W0
    - Game 2: Carlos, Alice, and Bob all said “I don’t know” on their first turn. Alice holds K-K and Bob holds A-K. What should Carlos say on his second turn?
      * (A-A)
    - Game 3: Alice, Carlos, and Bob say “I don’t know” on their first turn, as does Alice on her second turn. Alice and Bob both hold A-K. What should Carlos Say?
      * (A-K)
    - Prove that there will always be a winner to this game.
      * There are only 3 Combinations of cards that can be revealed:
        + (A-A)
        + (A-K)
        + (K-K)
      * Each player only needs 3 turns Max to figure out which cards they have depending on the information revealed. They can also infer more information based on the other player’s guesses which will expedite the process a turn or two