Problem 3.3 Formally Modeling a Search Problem

Answer:

Deterministic: Yes, it is deterministic, because the next state of the environment is completely determined by the current state and the action executed by the Tower of Hanoi solving agent.

Fully Observable: Yes, it is fully observable, because Tower of Hanoi solving agent has access to the complete state of the environment at each point in time.

Formally modelling the Tower of Hanoi as a Search Problem:

- **States:** For N disks, it will take $2^N - 1$ moves to solve puzzle. Therefore, states set,

  $S(N) = \{\langle a, b, c\rangle : a \in D, b \in D, c \in D, a + b + c = N\}\ where, D = \{0,1,2,3, \dots ,7\}, n(S) = 2^N$

- **Initial State:** Initially all disks will be at source peg A. So, $I = S_0 = \langle 7, 0, 0\rangle$

- **Goal State:** Finally, all disks will be at destination peg B. So, $G = S_g = \langle 0, 7, 0\rangle$

- **Actions:** Action will be moving a disk from one peg to another peg, so that no larger disk may be placed on top of a smaller disk. Therefore, actions set,

  $A = \{move(x, y) : x \in P, y \in P\}\ where\ P = \{peg\ A, peg\ B, peg\ C\}$

- **Transition model:** Given a state, $s = \langle a, b, c\rangle$, an action $a = move(x, y)$, Transition model

  $T(a, s) = S_a(s), where\ S_a = successor\ function\ for\ a, and\ S_a(s) = successor\ state\ of\ s$