Q1. Candy Grab

In this activity, you'll play the Candy Grab game in small groups. Two players will alternate turns. Start with 11 discs in a pile. At each turn, the next player decides to take either one or two discs out of the pile. The player who takes the last disc wins. Play the game as many times as you can.

(a) For each game, record who started and the "sequence of states" as numbers of pieces left after each player takes some. Each sequence starts at 11 discs and should end at 0. After each game, work backwards to record whether each action (Take 1 or 2) resulted in a win or loss.

For example, suppose P1 starts with 5 pieces and the state sequence is 5, 3, 1, 0. We would mark down on row 1 (one piece left) in the Take 1 column that it was a win, i.e., P1 started with 1 piece, and took (1-0)=1 pieces and won. We would mark down in row 3 in the Take 2 column that it was a loss; P2 started with 3, took (3-1)=2 pieces and lost. We would mark down in row 5 in the Take 2 column that it was a win.

Sequence of States:

P1 Start: 11,	P2 Start: 11,
P1 Start: 11,	P2 Start: 11,
P1 Start: 11,	P2 Start: 11,
P1 Start: 11,	P2 Start: 11,

	Take 1		Take 2	
Pieces Left	Win	Loss	Win	Loss
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				

(b) Is there a pattern emerging in your data? Can you use the pattern to determine what action to take?

Q2. Agents and State Spaces

For each of the following examples, determine the size of the state space and the environment attributes. If the state space in infinite, you can write "Infinite".

Answer the poll questions to the randomly selected answers below to receive points for the activity.

(a) An agent controls the elevator in a 10-story building. On each floor, the doors can be open or closed. The elevator can also be "moving" between floors. How many states could the agent be in?

State space:
22 or 21

(10 floors + moving state)*(open vs closed state) $= 11 * 2 = 22$ or 21 if you believe in safety and the door could never be open while moving.

●	Single Agent	or ○	Multi-agent
●	Discrete	or ○	Continuous
●	Static	or ○	Dynamic
●	Deterministic	or ○	Stochastic
●	Fully Observable	or ○	Partially Observable

(b) A team of multiple flying drones are navigating in an open-air arena against another team. Weather affects the drones as they fly around. A single decision maker program decides the actions of all the drone agents on the same team but cannot control the other team. The drones can each can move at **any angle in any direction for any amount of time**. Each drone has a small camera on it for observing the environment.

State space:
Infinite

Infinite because of the continuous state space.

○	Single Agent	or ●	Multi-agent
○	Discrete	or ●	Continuous
○	Static	or ●	Dynamic
○	Deterministic	or ●	Stochastic
○	Fully Observable	or ●	Partially Observable

(c) Hopscotch is a game where 10 squares are drawn in chalk on the ground and labeled 1-10. Players take turns being the "stone skipper" by standing in a "start state" throwing a small stone randomly onto one of the 10 squares, and then hopping on the squares in order; the player must hop OVER the square with the stone in it and not enter that square.

Suppose there are two distinct players who take turns being the "skipper" or the "waiter". Consider the states of both players and stone in the middle of the game. Ignore the state where the player is holding the stone, but do consider when they have not started jumping yet. Assume the game is played on a flat surface. How many states are there in hopscotch?

State space:
$2 * (10 * 10)$

Each player could be the skipper or the waiter. For the skipper, there are 10 places the stone can be and 10 places they can be (start state plus all but the locations except the stone's).

○	Single Agent	or ●	Multi-agent
●	Discrete	or ○	Continuous
●	Static	or ○	Dynamic
○	Deterministic	or ●	Stochastic
●	Fully Observable	or ○	Partially Observable