M4-08: Discovering the Law of Large Numbers in Python

Part of the "Simulation and Distributions" Learning Badge

Video Walkthrough: *https://discovery.cs.illinois.edu/m4-08/*

The Law of Large Numbers

The law of large numbers informs us that the **average** result will tend to the expected value the more trials or simulations we run.

Puzzle #1: Write a simple simulation that simulates rolling two six-sided dice and recording the sum of both rolls:

Simulation:	

Calculating our Cumulative Average

The pandas library provides a **cumulative sum function** -- `cumsum()` -- that calculates the current column sum up to the current row in the dataset.

Puzzle #2: Calculating the cumulative sum by hand for a possible set of rolls, and then a cumulative average:

index	diceTotal	cumsum	
0	7		
1	10		
2	4		
3	7		
4	12		
5	5		
6	7		

Discovering the Law of Large Numbers

Puzzle #3: Create a line plot of the your cumulative average function, focusing on just the first 10 rows, filling out the table below:

Rows	What is the range of data of the right half of the graph?
`[0:10]`	
`[0:100]`	
`[0:10000]`	
`[0:100000]`	

Analysis:

(a): What is the expected result when rolling two dice and calculating the sum?

(b): What happens to the cumulative average as we show more and more simulations?