Homework Assignment 4

Submit the link to the GitHub repository where your code is located by 11:59PM, Tuesday, February 20. Your repository should include a separate .py file for each problem.

Problem 1: A Game of Chance (Weight 3).

You can enter in a game where you get to flip a fair coin 10 times, and you will receive $100 any time you get a "Head" after two consecutive "Tail"? If you need to pay $250 to enter in the game, estimate the expected reward using Monte Carlo simulation.

- This experiment involves 20 random events $\{E_1, E_2, E_3, \dots, E_{20}\}$, where each event E_i results in either of two outcomes {Head, Tail}.
- Whenever {Tail, Tail, Head} occurs, we receive $100
- If we use random variable X to denote the total reward, then:
    - $X = \$0 - \$250 = -\$250$ if {Tail, Tail, Head} never occurs
    - $X = \$100 - \$250 = -\$150$ if {Tail, Tail, Head} occurs once
    - $X = \$200 - \$250 = -\$50$ if {Tail, Tail, Head} occurs twice
    - And so on…
- Our goal is to estimate E$[X]$.

Develop a simulation model to get 1000 realization of X. Print the average of these realizations as an estimate for E$[X]$.

Hints: Create a class `Game` that has a method attribute `Simulate()` that flips a coin 20 times, find the number of times that {Tail, Tail, Head} occurs, and return the reward (as calculated above).

Problem 2: A Game of Chance with an Unfair Coin (Weight 1). Modify your model for Problem 1 so that you can specify the probability that a coin flip results in head. What is the average reward when this probability is 0.4?