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# CSC 540 INDIVIDUAL PROGRAMMING ASSIGNMENT, HW3

Your assignment is to use a random number generator to explore the game of roulette. A European roulette wheel has the following numbers:

> *Single zero wheel*: 0-32-15-19-4-21-2-25-17-34-6-27-13-36-11-30-8-23-10-5-24-16-33-1-20-14-31-9-22-18-29-7-28-12-35-3-26

Despite the true mathematics of the matter, "0" is considered neither "odd" nor "even" when someone bets on the ball landing in an odd or even slot. (This is another way in which the house always wins in gambling.)

Many movies and stories have people making outlandish amounts of money by placing a bet on a single number, winning, and then leaving the winnings on that same number and, miraculously, winning again. Let's assume that each of the 37 numbers is equally likely to come up on any spin of the wheel. How unlikely is that any number comes up twice in a row?  And how unlikely is it for the fabled, lucky bettor to win twice in a row by betting the same number? (Be careful… these are two different answers!)

It is relatively straightforward to answer both of these questions using logic and statistics. However, you are to do it using simulations. (Such simulations are called "Monte Carlo simulations." Really!) Use your random number generator as if it were a roulette wheel. Throw a random integer between 0 and 36 inclusive. Each random number generated will represent one spin of the wheel, with the small ball landing in the slot with that number.  Answer the following questions empirically using the results of your simulation:

A. On average, how often does a number come up two times in a row? On average, how often does a number come up three times in a row?

B. If you pick a PARTICULAR number, how long does it take for that number to come up twice in a row? Let's make the number 13, just for fun.

C. What is the longest run of evens in a row in your simulation? What is the longest run of odds in a row? (Remember that 0 is classified as neither odd nor even.)

You must do at least the following simulations. You may do more, but not less:

**1. Do 10,000 spins of the wheel and answer the questions above.**

Spins: 10000
Avg Spins to Land on Number: 992.3333333333334
Avg Match Two: 0.0266
Avg Match Three: 0.0006
Longest Run of Evens: 15
Longest Run of Odd: 8

**2. Do 1,000,000 spins and answer the questions above.**

Spins: 1000000
Avg Spins to Land on Number: 1394.9636363636364
Avg Match Two: 0.027004
Avg Match Three: 0.000738

Longest Run of Evens: 18
Longest Run of Odd: 14

**3. Do 10,000,000 spins and answer the questions above.**

Spins: 10000000
Avg Spins to Land on Number: 1376.6223323695442
Avg Match Two: 0.0270458
Avg Match Three: 0.0007369
Longest Run of Evens: 17
Longest Run of Odd: 17

**4. Do 100,000,000 spins and answer the questions above. (It may take a long time to run this.)**

Spins: 100000000
Avg Spins to Land on Number: 1366.5814964127092
Avg Match Two: 0.02701448
Avg Match Three: 0.00072638
Longest Run of Evens: 25
Longest Run of Odd: 23