Programming Literacy Test (SAMPLE)

Instructions:

1. The test is 60 minutes long.
2. You can use Python or R to complete this test.
3. To access the programming environment, log onto the Sloan Remote Lab using your MIT ID: https://sloan-remote.mit.edu/.
4. Save all your code as a single file in the folder PLT. Name the file in the following format:

   MITID_LastName_FirstName.txt

5. Do not communicate with anyone during the test.
6. No materials outside the programming environment are allowed. You are allowed to use the help files within the programming environment.

Part I: Simulating a random walk.

Consider the following model:

$$x_t = x_{t-1} + \sigma\epsilon_t. \tag{1}$$

In this model σ is a constant, and ϵ_t (for $t = 1, 2, \ldots, T$) are independent and identically distributed, taking the value 1 and -1 with probability 0.5.

1. Write a function that simulates a path of x_t for T periods.
   - The function should take the following parameter values as input: T, σ, x_0.
   - The function should produce the following output: the time series of simulated values of x_t.
2. Use the function you have written above to do the following:
   (a) Simulate a time series of x using the following parameter values: $T = 60, \sigma = 0.1, x_0 = 1$.
   (b) Plot the time series, add proper labels and title, and save it as a PDF file under the name "MITID_path.pdf".

Part II: Working with market data.

Download the data file `CPIAUCSL.csv` for Consumer Price Index from `http://obelix.mit.edu/brexit/` and perform the following tasks.

1. The data are monthly consumer price indices for all urban consumers. They reflect how price levels have changed over time. First compute the monthly inflation, defined using the formula below:

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}, \tag{2}$$

   where P_t is the price index in month t.

2. Split the sample into two halves. Compute the mean and standard deviation of the monthly inflation rates π_t over each of the two subsamples.

3. Plot the monthly inflation series. Add to the plot two horizontal lines to mark the average inflation rates in the two subsamples computed above. Label the axes properly, and save the plot as a PDF under the name "MITID_inflation.pdf".