GX5004: HW 5

R and Python have extensive libraries online that can guide you on this assignment. Please feel free to work collectively on the challenging questions. [Total Points : 10 (5+5)]

1. Consider the AR(1) DGP presented in class: $y_t = \rho y_{t-1} + \epsilon_t$.
    a. For this exercise, set $\rho = 0.5$. Generate this DGP using 1,000 Gaussian white-noise draws from N(0,1) by letting $y_1 = \epsilon_1$. Plot this DGP. Run a linear regression to get the least-squares estimate of ρ. (You should include a constant in the regression.) Does your 95% confidence interval include 0.5?
    b. Repeat a. assuming $\rho = -0.5$.
    c. Repeat a. assuming $\rho = 1$. (This is called a random walk or unit root.)
    d. Submit code and results.
2. In this exercise, you will work with two independent random walks.
    a. Following 1c. above, generate two independent random walks of 1,000 observations, calling them Walk1 and Walk2. Fit the bivariate linear model that relates Walk1 to Walk2 and report your regression results.
    b. Recall the Monte Carlo simulation exercise in HW 4, Question 3c. Using a similar approach, repeat a. above 1,000 times, each time recording the estimated value of the slope coefficient of the bivariate regression. Generate a histogram of your 1,000 replications. How do these results compare to those you found in HW 4, Question 3c?
    c. Consider your results in 2b as well as the dispersion in your histogram. Is there something about independent unit roots that may lead one to find correlation when there is none?
    d. Submit code and results.