TS Module 9: Non-stationary time series advanced HW

(The attached PDF file has better formatting.)

Homework assignment: random walk time series

A bank firm offers a set of investments as lifetime birthday gifts. Each investment buys shares of a stock that follow a random walk. For simplicity, assume the random walk is arithmetic: the share price can be positive or negative. The share price is $Y_t = Y_{t-1} + \alpha + \epsilon_t$, where α is a constant and ϵ_t has a constant variance σ^2_t

A. Investment #1 buys 100 shares of the stock on each birthday. The value of Investment #1 at time t is the value of all the shares bought so far. What is the time series followed by the value of Investment 1?

B. Investment #2 buys X_t shares of the stock on each birthday, where X_t is a white noise process with mean of 100 and standard deviation of 10. The value of Investment #2 at time t is the value of all the shares bought so far. What is the time series followed by the value of Investment #2?

C. Investment #3 buys Z_t shares of the stock on each birthday, where Z_t is a random walk = $X_t + X_{t-1}$. The value of Investment #3 at time t is the value of all the shares bought so far. What is the time series followed by the value of Investment #3?

The type of time series means the number of differences to make it stationary, not the parameters or the ARIMA form. For each investment, give a brief explanation of whether one needs to take first, second, or third differences to make the time series stationary.