Time series Modeling & Analysis

DATS 6450

LAB # 3 (Autocorrelation Function)

Using the Python program and using only the "numpy" and "matplotlib" library perform the following tasks:

1- Let suppose y vectors is given as y(t) = [3, 9, 27, 81,243]. Without use of python or any other computer program, manually calculate the $\tau_0, \tau_1, \tau_2, \tau_3, \tau_4$. Display the ACF (two sided) on a graph (no python).

2- Using Python program, create a white noise with zero mean and standard deviation of 1 and 1000 samples. Plot the generated WN versus number of samples. Plot the histogram of generated WN. Calculate the mean and std of generated WN. You can use the following command to generate WN~(0,1): (import numpy as np, T # of samples)

```
np.random.normal(mean, std, size=T)
```

3- Write a python code to estimate Autocorrelation Function. Note: You need to use the equation (1) given in lecture 4.
   a. Plot the ACF for the generated data in step 2. The ACF needs to be plotted using "stem" command.
   b. Write down your observations about the ACF plot, histogram, and the time plot of the generated WN.

4- Load the time series dataset tute1.csv (from LAB#1)
   a. Using python code written in the previous step, plot the ACF for the "Sales" and "Sales" versus time next to each other. You can use subplot command.
   b. Using python code written in the previous step, plot the ACF for the "AdBudget" and "AdBudegt" versus time next to each other. You can use subplot command.
   c. Using python code written in the previous step, plot the ACF for the "GDP" and "GDP" versus time next to each other. You can use subplot command.
   d. Write down your observations about the correlation between stationary and non-stationary time series (if there is any) and autocorrelation function?
   e. The number lags used for this question is 20.

Upload a formal **report (as a single pdf**) plus **the .py file** through BB by the due date.