Time series Modeling & Analysis

DATS 6450

Homework # 1- Nonstationary process and removing trend from time series data (1^{st} , 2^{nd} differencing and logarithmic transformation)

Using the Python program and the required libraries perform the following tasks:

1- Load the time series data called AirPassengers.csv.
2- This date relates to the air passengers between 1949-1960.
3- Write a Python code to display the first 5 rows of the data on the console.
4- Explore the dataset by plotting the entire dataset, where you can learn more about the data set pattern (trend, seasonality, cyclic, …). Add the label to the horizontal and vertical axis as Month and Sales Number. Add the title as "Air passengers Dataset without differencing". Add an appropriate legend to your plot. Do you see any trend, seasonality, or cyclical behavior in the plotted dataset? If yes, what is it?
5- Run an ADF-test and check if the dataset is stationary or not. Is the dataset non-stationary? Justify your answer. Calculate the average over the entire dataset and show the average plot.
6- If the answer to the previous question is non-stationary, write a python code that detrend the dataset by 1^{st} difference transformation. Plot the detrended dataset.
7- Is the detrended dataset stationary? Justify your answer by running an ADF-test. Plot the average and variance over the entire dataset.
8- If the first differencing did not make the dataset to be stationary, then try 2^{nd} differencing and repeat 7.
9- If the 2^{nd} differencing did not make the dataset to be stationary, then perform the 1^{st} differencing followed by logarithmic transformation. The repeat step 7.
10- If the procedures in step 6, 8 & 9 did not make the dataset to be stationary (pass the ADF-test with 95% or more confidence interval) then stop.
11- Write a report and answer all the above questions. Include the required graphs into your report.

Submission Guidelines:

A. Be ready to upload the **solution report (as a single pdf**) plus **the .py file** through BB or quiz will be given.
B. The softcopy of the developed Python code .py must also be submitted separately. Please make sure the developed python code runs without any error by testing it through Pycharm software. **The developed python code with any error will subject to 50% points penalty.**
C. Homework is not required to be written in a formal format. Please make sure to answer all questions and include the required graphs/table/chart if applicable.