

Time series Analysis & Modeling

DATS 6450

LAB # 6 - Time series decomposition

The main purpose of this LAB is to write a python program that applies the time series decomposition methods discussed in the lecture on the real dataset. There are 4 decomposition methods discussed in the lecture.

Procedures:

1- Using the Python program to load the 'Airpassengers.csv'. Then write a python function that implement moving average of order m . The program should be written in a way that when it runs, it should ask the user to input the order of moving average. If m is odd, then the software must ask a user to enter the folding order which must be odd (Hint: You need to exclude the case $m=1,2$ and display a message that $m=1,2$ will not be accepted). If m is even, then the software must ask a user to enter the folding order. In the latter case the folding order must be even. Then the code should calculate estimated trend-cycle using the following equation where y is the original observation. You are only allowed to use numpy and pandas for this question.

$$\hat{T}_t = \frac{1}{m} \sum_{j=-k}^k y_{t+j}$$

3- Using the function developed in the previous step plot the estimated cycle-trend versus the original dataset (plot only the first 50 samples) for 3-MA, 5-MA, 7-MA, and 9-MA. Plot the detrended data on the same graph. Add an appropriate title, x-label, y-label, and legend to the graph.

4- Using the function developed in the step 1 plot the estimated cycle-trend versus the original dataset (plot only the first 50 samples) for 2x4-MA, 2x6-MA, 2x8-MA, and 2x10-MA. Plot the detrended data on the same graph. Add an appropriate title, x-label, y-label, and legend to the graph.

5- Compare the ADF-test of the original dataset versus the detrended dataset using the 3-MA. Explain your observation.

6- Apply the STL decomposition method to the dataset. Plot the trend, seasonality, and reminder in one graph. Add an appropriate title, x-label, y-label, and legend to the graph.

```
from statsmodels.tsa.seasonal import STL
STL = STL(...)
res = STL.fit()
```

7- Calculate the seasonally adjusted data and plot it versus the original data. Add an appropriate title, x-label, y-label, and legend to the graph.

8- Calculate the strength of trend using the following equation and display the following message on the console:

The strength of trend for this data set is _____

9- Calculate the strength of seasonality using the following equation and display the following message on the console:

The strength of seasonality for this data set is _____

10- Based on the results in the previous steps, is this data set strongly seasonal or strongly trended? Justify your answer.

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