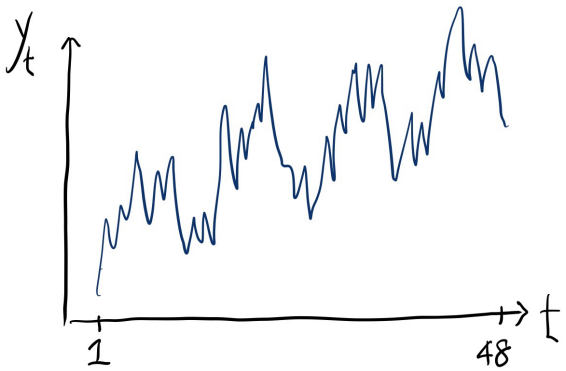
National Taiwan University
Institute of Industrial Engineering
Jakey BLUE

Time Series Analytics

111-1 Homework #02

Due at 23h59, September 18, 2022; files uploaded to NTU-COOL

1. (30%) Take what you have simulated for the Q1 of HW#01 and add a proper disturbance to it, for example, $\epsilon_t \sim N(0, 0.1^2)$, to make it more fluctuating and, therefore, unpredictable. Now, let's construct a mathematical model to predict it.



   a. Extend the time series to y_{54} using the same formula/procedures in HW#01.
   b. Define a proper disturbance for your time series.
   c. Identify the number of periods in a season and then deseasonalize the series using $y_1, y_2, \dots, y_{48}$.
   d. Calculate the seasonality factors (depending on how many periods in a season) using $y_1, y_2, \dots, y_{48}$.
   e. Finalize the model and validate the model performance via MSE and MAPE using $y_1, y_2, \dots, y_{48}$.
   f. Use the static model to calculate $\hat{y}_{49}, \hat{y}_{50}, \dots, \hat{y}_{54}$. Compare with the ground truth of $y_{49}, y_{50}, \dots, y_{54}$ and calculate the prediction MSE and MAPE accordingly.
   g. Modify the disturbance in (a) to change series (can be more or less fluctuating). Re-run the procedures (b)-(f). What can you conclude when comparing to the results in (e) & (f) with the previous disturbance.

2. (20%) Construct the Holt-Winter's model (Triple Exponential Smoothing model) for the same data in 1-(a) using $y_1, y_2, \dots, y_{48}$. Try to find the smoothing factors with better performance. Explain what you observe comparing with the results in 1-(e) & 1-(f).