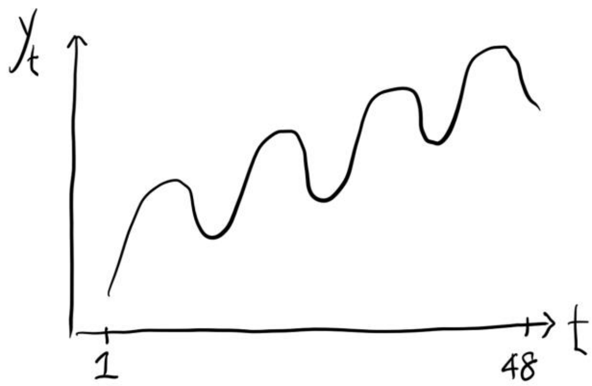
National Taiwan University
Institute of Industrial Engineering
Jakey BLUE

Time Series Analytics

111-1 Homework #01

Due at 23h59, September 11, 2021; files uploaded to NTU-COOL

1. (10%) Write down the scientific procedures to simulate a time series of length 48 similar to the trend below. Use any functions you prefer.



2. (10%) Simulate a time series of length 48 following the settings below
$$Y_t = \cos\left[2\pi\left(\frac{t}{12} + \Phi\right)\right] \text{ for } t = 0, 1, 2, \dots, 47,$$
where Φ is selected from a uniform distribution on the interval $[0, 1]$.

3. (10%) X and Y are two dependent random variables and $\mathrm{V}[X] = \mathrm{V}[Y]$, find $\mathrm{COV}[X+Y, X-Y]$.

4. (15%) Suppose $\mathrm{E}[X] = 3, \mathrm{V}[X] = 9, \mathrm{E}[Y] = 4, \mathrm{V}[Y] = 16$, and $\mathrm{Corr}(X, Y) = 0.25$. Find:
   a. $\mathrm{V}[X+Y]$
   b. $\mathrm{COV}[X, X+Y]$
   c. $\mathrm{Corr}(X+Y, X-Y)$