DS 6373: Time Series: Unit 1 HW

Below are the homework (HW) problems for this Unit. You do not need to submit the solutions rather double check your solutions to the solutions posted. Solutions are on GihHub. This is intended to let the student think about the problem and attempt it without the temptation to first look at the solution. Please write any questions to the Wall or in an email to myself and/or bring them up during office hours or even in the next Live Session. Remember that the concepts covered below are fundamental to the course and are fair game for the midterm and final.

Most importantly … Have a blast!

EXERCISES

Applied Problems

Use R to work problems 1.2 through 1.7.

1.1 The following data are annual sales of a hypothetical company in millions of dollars:

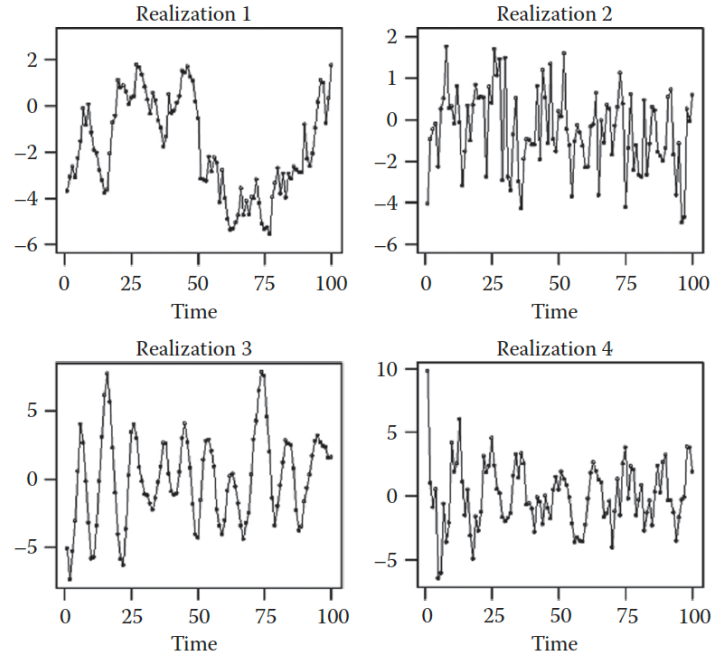
Period	Sales
1	76
2	70
3	66
4	60
5	70
6	72
7	76
8	80

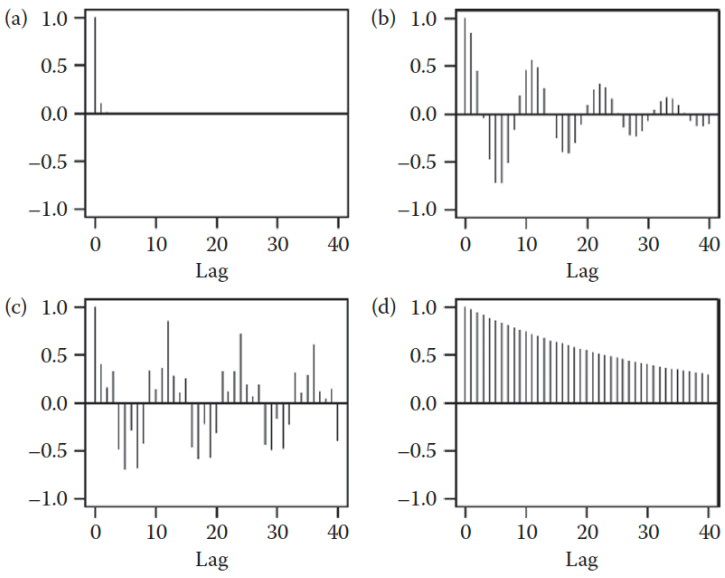
Compute by hand (i.e., calculator) the estimates $\hat{\gamma}_0$, $\hat{\gamma}_1$, $\hat{\rho}_0$, and $\hat{\rho}_1$.

1.2 Figure 1.1a shows a plot of West Texas intermediate crude oil prices from January 2000 to October, 2009, and Figure 1.19b shows monthly average temperatures for Pennsylvania for January, 1990 to December, 2009. These two data sets in `tswge` are `wtcrude` and `patemp`, respectively. For each of these realizations, plot the sample autocorrelations, periodogram, and a Parzen window-based spectral density estimate at the truncation point $M = 2\sqrt{n}$. Explain how these plots describe (or fail to describe) the behavior in the data

For problem 1.4 below… for this unit just match the realizations and the ACFs.

1.4 Following are displayed three sets of figures each containing four plots. The first set shows four realizations of length $n = 100$ each generated from a time series model. The second set contains four autocorrelation functions based on the models used to generate realizations (in random order), and the third set displays the four spectral densities. Match each realization with the corresponding autocorrelations and spectral density. Explain your answers.





1.6 Generate a realization of length $n = 100$ from the signal-plus-noise model

$$X_t = 3\cos(2\pi(0.05)t) + 1.5\cos(2\pi(0.35)t + 2) + a(t),$$

where a_t is $N(0,1)$ white noise. For these data, plot the

a. Realization

b. Sample autocorrelations

NOTE: A realization from the model

$$X_t = c_1\cos(2\pi f_1 t) + c_2\cos(2\pi f_2 t) + N_t,$$

where N_t is normal (0,1) white noise can be obtained using the `tswge` R function `gen.sigplusnoise.wge(n,b0,b1,coef,freq,psi,phi, vara,plot,sn)`.

See the R help for details.

For 1.6 also write a sentence or two about what you information you get from the acf… what is it suggesting about the process that is generating the data?