



Time Series Analytics

111-1 Homework #06

Due at 23h59, November 20, 2022; files uploaded to NTU-COOL

1. (20%) Simulate a time series y_t of length $n = 100$ following an ARMA(1,1) model with $\phi = 0.8$ and $\theta = 0.4$.
 - (a) Calculate and plot the **theoretical** autocorrelation function for this model. Plot sufficient lags until the correlations are negligible.
 - (b) Calculate and plot the **sample** ACF for your simulated series. How well do the values and patterns match the theoretical ACF from part (a)?
 - (c) Calculate and interpret the sample EACF for this series. Does the EACF help you specify the correct orders for the model?
 - (d) Repeat parts (b) and (c) with a new simulation using the same parameter values but sample size $n = 48$.
 - (e) Repeat parts (b) and (c) with a new simulation using the same parameter values but sample size $n = 200$.
2. (10%) Simulate an ARMA(1,1) series with $\phi = 0.7, \theta = -0.6, n = 48$ but with error terms from a t-distribution with degrees of freedom 6.
 - (a) Display the sample EACF of the series. Is an ARMA(1,1) model suggested?
 - (b) Estimate ϕ and θ from the series and comment on the results.
3. (20%) The data file named robot contains a time series obtained from an industrial robot. The robot was put through a sequence of maneuvers, and the distance from a desired ending point was recorded in inches.
 - (a) Display the time series plot of the data. Based on this information, do these data appear to come from a stationary or nonstationary process?
 - (b) Calculate and plot the sample ACF and PACF for these data. Based on this additional information, do these data appear to come from a stationary or nonstationary process?
 - (c) Calculate and interpret the sample EACF.
 - (d) Estimate the parameters of an AR(1) model and IMA(1, 1) for these data, respectively.
 - (e) Compare the results from parts (d) in terms of AIC and discuss the residual tests.