

Homework 3

Ma641 Time Series I

due by class time 6:15pm, Monday June 22, 2009

You can hand in the assignments either in class at the beginning of the lecture or using the elearn page. If you chose elearn please convert the report to pdf format before submitting.

Problem 1

Please read the documentation in the R help system for the function *arima.sim()*. If you chose to use your own method to generate time series data with known parameters you are welcome to do so.

- a. Search for 4 parameters ϕ_1, \dots, ϕ_4 such that the corresponding AR(4) model is stationary. Choose your own σ_a^2 value for the variance of the gaussian white noise. Generate 365 data points. Calculate ACF and PACF for the data that you generated.
- b. Repeat the above for another model AR(5) using once again parameters of your choice.
- c. Write a paragraph detailing the differences between the two graphs. What is the recommended order of the corresponding model based on the data and the graphs you plotted?
- d. Estimate the parameters present in the model. Benchmark the estimates with respect to the known parameter values. To this end use various methods and pay attention to the form of the model used (standard or alternate form).

Problem 2

- a. Search for 4 parameters $\theta_1, \dots, \theta_4$ such that the corresponding MA(4) model is invertible. Choose your own σ_a^2 value for the variance of the gaussian white noise. Generate 365 data points. Calculate ACF and PACF for the data that you generated.
- b. Repeat the above for another model MA(5) using once again parameters of your choice.
- c. Write a paragraph detailing the differences between the two graphs and what is the recommended order of the corresponding models based on the data.
- d. Using a method of your choice and the recommended order from the previous point estimate the parameters present in the model. Benchmark the estimates with respect to the known parameter values. Pay attention to the form of the model used (standard or alternate form).

IMPORTANT NOTE for parts d. in the problems above.

When you estimate the parameters if you find a big discrepancy between the estimated values and the known parameters that you used it means that you did not read the documentation of the functions used properly. In such a case you will receive a very low grade for this assignment. This is also the reason why the time allocated to this assignment is two weeks.

It is my belief that in applied work one of the most important issues for a researcher is to understand the methods and **more importantly** the software that implements the methods. For this reason I insist on this part of the assignment.

Problem 3 Generate a year worth of daily data for an ARMA(4,4) model generated using the combination of parameters in parts a. from the two problems above. Turn in the two graphs (ACF, PACF). What is the recommended order based on the graphs. Repeat part d. of the above problems with this model.

Any other problems assigned in class and not mentioned here count as bonus problems and they will earn bonus points for your assignment.