Tutorial Sheet 5

1
Identify as specific ARIMA models, i.e., what are p, d and q and what are the values of the parameters- the ϕ's and the θ's?

(a)$Y_t = Y_{t-1} - 0.25Y_{t-2} + e_t - 0.1e_{t-1}$.

(b)$Y_t = 2Y_{t-1} - Y_{t-2} + e_t$.

(c)$Y_t = 0.5Y_{t-1} - 0.5Y_{t-2} + e_t - 0.5e_{t-1} + 0.25e_{t-2}$.

2
For each of the ARIMA models below, give the values for $E(\nabla Y_t)$ and $Var(\nabla Y_t)$.

(a)$Y_t = 3 + Y_{t-1} + e_t - 0.75e_{t-1}$.

(b)$Y_t = 10 + 1.25Y_{t-1} - 0.25Y_{t-2} + e_t - 0.1e_{t-1}$.

(c)$Y_t = 5 + 2Y_{t-1} - 1.7Y_{t-2} + 0.7Y_{t-3} + e_t - 0.5e_{t-1} + 0.25e_{t-2}$.

3
Consider two models:

$A : Y_t = 0.9Y_{t-1} + 0.09Y_{t-2} + e_t.$

$B : Y_t = Y_{t-1} + e_t - 0.1e_{t-1}.$

(a) Identify each as a specific ARIMA model, i.e, what are p, d and q and what are the values of the parameters- the ϕ's and the θ's?

(b) In what way are the two models different?

(c) In what way are the two models similar? (Compare ψ weights and π weights.)

When the AR process is expressed as an MA(∞) process, the ψ weights are the e coefficients.

When the MA process is expressed as an AR(∞) process, the π weights are the Y coefficients.

4
Non-stationary ARIMA series can be simulated by first simulating the corresponding stationary ARMA series and then "integrating" it (really partially summing it).

Use statistical software to simulate a variety of IMA(1,1) and IMA(2,2) series with a variety of parameter values.

Note any stochastic "trends" in the simulated series.

5
The datafile 'winnebago' contains monthly units sales of recreational vehicles from Winnebago Inc., from November 1966 through February 1972.

(a) Display and interpret the time series plot for these data.

(b) Now take natural logarithms of the monthly sales figures and display the time series plot of the transformed values. Describe the effects of the logarithms on the behaviour of the series.

(c) Calculate the fractional relative changes, $(y_t - Y_{t-1})/Y_{t-1}$, and compare them with the differences of natural logarithms, $\nabla \log(Y_t) = \log(Y_t) - \log(Y_{t-1})$. How do they compare for smaller values and for larger values?

6
The datafile 'SP' contains quarterly Standard & Poor's Composite Index stock price values from the first quarter of 1936 through the fourth quarter of 1977.

(a) Display and interpret the time series plot for these data.

(b) Now take natural logarithms of the monthly sales figures and display the time series plot of the transformed values. Describe the effects of the logarithms on the behaviour of the series.

(c) Calculate the fractional relative changes, $(y_t - Y_{t-1})/Y_{t-1}$, and compare them with the differences of natural logarithms, $\nabla \log(Y_t) = \log(Y_t) - \log(Y_{t-1})$. How do they compare for smaller values and for larger values?

7
The datafile 'airpass' contains international airline passenger monthly totals in thousands flown from January 1960 through December 1971.

(a) Display and interpret the time series plot for these data.

(b) Now take natural logarithms of the monthly sales figures and display the time series plot of the transformed values. Describe the effects of the logarithms on the behaviour of the series.

(c) Calculate the fractional relative changes, $(y_t - Y_{t-1})/Y_{t-1}$, and compare them with the differences of natural logarithms, $\nabla \log(Y_t) = \log(Y_t) - \log(Y_{t-1})$. How do they compare for smaller values and for larger values?

8
The datafile 'larain' contains yearly rainfall in Los Angeles as shown in Lecture 1.

The QQ plot of these data in Lecture 3 showed us that the data were not normal.

(a) Use software to produce a BoxCox plot and determine the best value of 'λ' for a power transformation of the series.

(b) Display a QQ plot of the transformed data. Are they more normal?

(c) Produce the time series plot of the transformed values.

(d) Use the transformed values to display a plot of Y_t versus Y_{t-1}. Should we expect the transformation to change the dependence or lack of dependence in the series?

9
The datafile 'JJ' contains quarterly earnings per share for the Johnson & Johnson Company from 1960 through 1980.

(a) Display and interpret the time series plot for these data.

(b) Use software to produce a BoxCox plot and determine the best value of 'λ' for a power transformation of the series.

(c) Display the time series plot of the transformed values. Does this plot suggest that a stationary model might be appropriate?

(d) Display the time series plot of the differences of the transformed values. Does this plot suggest that a stationary model might be appropriate?