Tutorial Sheet 10

Q10.1

Consider the Alert, Canada, monthly carbon dioxide time series in the file named "co2."

(a) Fit a deterministic seasonal means plus linear time trend model to these data. Are any of the regression coefficients statistically significant?

(b) Calculate and interpret the sample auto-correlation function (acf) of the residuals from this model.

Q10.2

The monthly airline passenger time series are in the file named "airpass."

(a) Display and interpret the time series plots of both the original series and the logarithms of the series.

(b) Display and interpret the time series plot of the difference of the logarithms of the series.

(c) Display and interpret the time series plot of the seasonal difference of the first difference of the logarithms of the series.

(d) Calculate and interpret the sample acf of the seasonal difference of the first difference of the logged series.

(e) Fit an Arima$(0,1,1) \times (0,1,1)_{12}$ model to the logged series.

(f) Investigate diagnostics for this model, including auto-correlation and normality of residuals.

(g) Produce forecast, with limits, for this series with a lead time of two years.

Q10.3

Consider the monthly electricity generation in the U.S. time series in the file named "electricity."

(a) Display and interpret the time series plots of both the original series and the logarithms of the series.

(b) Display and interpret the time series plot of the difference of the logarithms of the series.

(c) Calculate and interpret the sample acf of the first difference of the logged series.

(d) Display and interpret the time series plot of the seasonal difference of the first difference of the logarithms of the series.

(d) Calculate and interpret the sample acf of the seasonal difference of the first difference of the logged series. What model would you suggest for this transformed series?

Q10.4

Consider the quarterly earnings per share for 1960-1980 of the U.S. company Johnson & Johnson in the file named "JJ".

(a) Display and interpret the time series plots of both the original series and the logarithms of the series.

(b) Display and interpret the time series plot of the difference of the logarithms of the series.

(c) Calculate and interpret the sample acf of the first difference of the logged series.

(d) Display and interpret the time series plot of the seasonal difference of the first difference of the logarithms of the series. For quarterly data, a season is of length 4.

(e) Calculate and interpret the sample acf of the seasonal difference of the first difference of the logged series.

(f) Fit an Arima$(0,1,1) \times (0,1,1,)_4$ model to the logged series.

(g) Investigate diagnostics for this model, including auto-correlation and normality of residuals.

(h) Produce forecast, with limits, for this series with a lead time of two years.

Q10.5

The file named "boardings" contains monthly data on the number of people who boarded transit vehicles (mostly light rail trains and city buses) in Denver, Colorado for August 2000 through December 2005.

(a) Produce the time series plot for these data using plotting symbols to help assessment of seasonality. Is a stationary model reasonable?

(b) Calculate and plot the sample acf for this series. At which lags are there significant auto-correlations?

(c) Fit an ARMA(0,3)$\times(1,0)_{12}$ model to these data and assess the significance of the estimated coefficients.

(d) Overfit an ARMA(0,4)$\times(1,0)_{12}$ model to these data and interpret the results.