

STATS 3005 Time Series III
Assignment 3
2018

Assignment 3 is due by 5pm on Friday 7th September 2018.
Assignments are to be submitted in the hand-in box on Level 6, Ingkarni Wardli

1. Let $\{U_t\}$ be a white noise sequence, and let the series $\{Y_t\}$ be defined by

$$Y_t = \sum_{j=0}^m U_{t-j}/(m+1).$$

Show that the autocorrelation function for $\{Y_t\}$ is

$$\rho_k = \begin{cases} \frac{(m+1-k)}{(m+1)} & k = 0, 1, 2, \dots, m \\ 0 & \text{otherwise.} \end{cases}$$

2. The file `electricity.csv` contains the Australian monthly electricity production from January 1956 to August 1995.
- (a) Read the data into R and construct a time series object.
 - (b) Plot the log transformed series and also its periodogram. Describe and interpret the main features of the periodogram.
 - (c) Detrend the log transformed series by calculating residuals from a cubic regression on time. Plot the detrended data and its periodogram. Describe and interpret the main features of the periodogram.
 - (d) Estimate the periodic component corresponding to the dominant frequency in the residual series and plot it over a cycle of 12 months.
3. This question is concerned with the sunspot data available as the built-in dataset `sunspots` in R.
- (a) Obtain the residual series from a cubic regression on time.
 - (b) Obtain and interpret the cumulative periodogram for the residual series.
 - (c) Obtain and interpret the periodogram from the residual series.
 - (d) Identify the dominant frequency and express its period in years.
 - (e) Estimate the periodic component corresponding to the dominant frequency of the residual series and add it to a time series plot of that series.

[Assignment total: 20 marks]