Queen Mary
University of London

School of Mathematical Sciences

MTH6139/MTH6139P Time Series   Assessed Coursework 1

Instructions

- Write your name and student number on your work, and submit it via QMplus.

- Include results, plots and `R` code as evidence to support your conclusions.

- Only brief explanations are needed, but these need to be in your own words.

- Your submission should be a pdf file.

- The total number of marks is 100.

Pneumonia and Influenza Data

Consider the pneumonia and influenza data available in the `R` package 'astsa'. The data are the monthly numbers of deaths per 10,000 people in the United States for 11 years, 1968-1978.

After loading the 'flu' data into `RStudio`, answer the following questions under the additive model $X_t = m_t + s_t + Y_t$.

Section 1

1. Plot the time series.

2. Explore possible transformations of the data to stabilise the variance.

3. Apply the first-order differencing operator ∇ to the transformed data.

4. Plot the detrended data.

5. Apply the lag-12 seasonal differencing operator ∇_{12} to the detrended data.

6. Plot the detrended and deseasonalised data.

Provide your observations and interpretations.

Marks: 40

Section 2

1. **Holt-Winters Exponential Smoothing.**

   (a) Plot the time series and the fitted values.

   (b) Plot the detrended and deseasonalised data.

2. **Brockwell and Davis Algorithm.**

   (a) Plot the time series and the fitted values.

   (b) Plot the detrended and deseasonalised data.

3. **Seasonal Indicator Regression.**

   (a) Plot the time series and the fitted values.

   (b) Plot the detrended and deseasonalised data.

Among these methods, which ones would you recommend to detrend and deseasonalise the pneumonia and influenza data. Explain why and support your conclusions with evidence.

Marks: 60