MATH38031 - 2009/2010

General Information

- Title: Applied Time Series
- Unit code: MATH38031
- Credits: 10
- Prerequisites: MATH20701, MATH20802 or MATH20812
- Co-requisite units: None
- School responsible: Mathematics
- Members of staff responsible: Dr. Georgi Boshnakov

Specification

Aims

To introduce the basic concepts of the analysis of time series in the time domain and the complete model building cycle. To provide the students with experience in analysing time series data with standard software, including freely available software and models used by government statistical offices and central banks in EU and USA.

Brief Description of the unit

Time series analysis deals with data collected over time. Such data are very common in society, science, engineering, finance, and may represent, for example, daily temperatures, daily stock prices, quarterly economic indicators, monthly house prices. The purpose of the analysis of a time series may be to predict future values, to discover trends and periodicities, or to better understand the underlying process for decision purposes.

Learning Outcomes

On successful completion of this course unit students will

- have understanding of the basic time series concepts;
- be able to build models to time series data and critically assess them using a variety of methods for exploration of time series data, identification and models selection.

Future topics requiring this course unit

This course is not a prerequisite for other courses but may be helpful for the following.

- The knowledge and skills developed by this course are essential for anybody who applies statistical methods and will be useful for most statistics courses in later years.
- Practical Statistics 2.

Syllabus

1. Introduction. Characteristics of time series: trend, seasonality, autocorrelation. Graphical exploration of time series. Box-Cox transformations. [2]
2. Stationary time series. Estimation of the mean. Estimation of the autocorrelation and partial autocorrelation functions. Autoregressive models of first and second order. Integrated time series. [2]
3. Introduction to model building: identification, estimation, diagnostics, inference. ARIMA models. [8]
4. Prediction: presentation and evaluation of predictions, residuals. [2]
5. Modelling seasonality and trend with ARIMA models. [4]
6. Regression ARIMA models. [4]

7. Classical smoothing and seasonal decomposition methods and their relation to ARIMA models. [2]

Textbooks

- Shumway, Robert H., Stoffer, David S., *Time Series Analysis and Its Applications, With R Examples*, Springer Texts in Statistics, 2nd ed., 2006.
- C Chatfiled, *The analysis of Time Series: An Introduction*, 5th ed., Chapman \& Hall, CRC Press, 2001.
- G Janacek. *Practical Time Series*, Arnold, 2001.
- P J Brockwell and R A Davis, *An Introduction to Time Series and Forecasting*, 2nd ed., Springer, 2002.

Teaching and learning methods

Two lectures and one examples/computer class each week. In addition students should expect to spend at least four hours each week on private study for this course unit.

Assessment

Coursework: 20%
End of semester examination: two hours weighting 80%

Arrangements