

# TEACHING A COURSE ON TIME SERIES.

1. *Introduction.* Teaching a course on time-series analysis for the first time can be a daunting challenge, even for the more experienced teacher. The topic is atypical in that successive observations are usually NOT independent, model building is often more difficult than in other areas, and an excursion into spectral analysis requires more mathematics than some students can handle. Nevertheless, the topic is well worth teaching, because (1) there are some very interesting theoretical problems, and (2) the majority of data collected in practice are in the form of time series.

2. *Syllabus.* Assuming a typical course of perhaps 20 lectures, plus some problem classes, the core syllabus should include: The time plot; Sources of variation, including trend, seasonality and other cyclic variation; Autoregressive (AR), moving average (MA), ARMA, and integrated ARMA (ARIMA) models; Forecasting methods including simple exponential smoothing and some of its variants. There are many additional topics that could be included, but do not try to cover too much. If spectral analysis is to be included, some revision of Fourier analysis and the Fourier transform is advisable. However, this topic is arguably unwise, except for engineering students who are happier in the frequency domain. Statistics students typically find the material very difficult. It may be better to spend some time on state-space (or structural) models and the Kalman filter. Students may also be interested to see an example of a non-linear model and perhaps even a mention of chaos. Optional topics include spelling out the dangers of applying multiple regression to time-series data, and introducing transfer function models (for open-loop data) and vector AR (VAR) models for closed-loop data.

3. *Teaching.* Lectures should be supplemented by getting students to analyse real data. There is plenty of data available via the Web (e.g. StatLib) and many packages for analysing time series. For the novice, MINITAB is as good as any, but some people use R (the free S-PLUS look-alike).

4. *Learning.* Only by analysing real data will students learn how to analyse time series. This is especially true in regard to understanding ARIMA modelling.

5. *Assessment.* In addition to a formal written exam, it is recommended that some form of continuous assessment is included to encourage students to analyse data. As regards an exam, there is no doubt that ARIMA models are the best source of exam questions!

6. *Textbooks.* There are several good books available now, and the choice depends partly on the students' background. Possible texts include:

Chatfield, C. (2003) *The Analysis of Time Series*, 6th edn. Chapman & Hall/CRC Press.

Brockwell, P.J. and Davis, R.A. (2002) *Introduction to Time Series and Forecasting*, 2nd edn. Springer.

Wei, W.W.S. (1990) *Time Series Analysis*. Addison-Wesley.