MT334 Time Series Analysis   2019-2020 Term 1

Lecturer: Dr Alexey Koloydenko

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Prerequisite: MT130 and MT232, also MT230 strongly recommended[1]

Teaching: 33hrs lectures+2hrs computer labs (see below for time and venue)

Time and location:

xxx TBA;

xxx TBA;

xxx TBA

Summative assessment: 2hr written examination - 90% of total marks

Coursework - 10% Ten five minute in-class quizzes (mini-tests). Best eight marks count 0.625% each (no make-up quizzes). *Quizzes are given in the beginning of the 3rd lecture of the week (first ten weeks).*

The relevant College examination rules apply to these minitests. In particular, you must not attempt to communicate with another candidate in any way during the minitest. You will also be asked to sit at least one seat apart from your neighbour. All books and notes must be closed and electronic devices removed from the desks. If unsure about the College examination rules, please consult Section 6 of Instructions to Candidates or talk to any academic member of our staff.

Mock quiz questions are posted on Moodle shortly after the second lecture of the week.

Formative assessment: There will be 8-11 worksheets in total, those will be posted on Moodle approximately one sheet per week. For eight of those, attempted solutions submitted by the due date will be marked. More detailed feedback on individual attempts can always be obtained from the lecturer during their office hours, do take advantage of this! *Sketch solutions are also part of the feedback* and those will be usually made available one week after the worksheet was assigned. Doing the worksheets on time is also important for successful completion of the quizzes (mini-tests). Some collective feedback on the quizzes is posted on Moodle as soon as the quizzes are marked (usually by the next lecture).

Aims

'Time series' refers to sets of observations arising sequentially in time but also to the mathematical models describing behaviour of such observations, for example, correlations between successive observations. Time series data are routinely collected and analysed in finance and economics, medicine, meteorology, agriculture, engineering, and other fields. This course aims *to expand the students' knowledge and experience of statistics by studying the theory and methods used in time series analysis and forecasting.*

Learning outcomes

On completion of the course the students should be able to:

- understand basic concepts and notions of time series analysis
- understand the standard theory around several prototype classes of time series models
- apply appropriate methods of times series analysis to a given set of data
- use R (statistical computing environment) to fit models to data sets, assess their fit, and make predictions
- explain and interpret statistical results in the context of time series and forecasting

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[1]becomes a prerequisite in 2020/2021, to be confirmed

Syllabus

Introduction and simple descriptive techniques: Some simple time series models; notions of trend and seasonality; linear filters; convolutions; local regression; estimation and elimination of trend and seasonal components; introduction to relevant functions of a suitable software environment (R)

Stationarity: Notions of weak and strict stationarity; autocovariance and autocorrelation functions; linear processes; modes of stochastic convergence

ARMA modelling: AR(p), MA(p), and ARMA(p,q) models; characteristic polynomials; conditions for stationarity; causality; model identification and invertibility

Inference: parameter estimation; confidence intervals and tests of hypotheses; forecasting; prediction intervals; Bartletts formula; Durbin-Levinson algorithm

Non-stationary time series: ARIMA models; random walk; identification and forecasting

Recommended texts Bedford Library has many texts on Time Series and Forecasting, and in particular on their applications to Econometrics. Two popular standard texts are:

- The Analysis of Time Series. An Introduction - C Chatfield (Chapman and Hall). Library Ref. 518.3 CHA (+ online)

- Introduction to Time Series and Forecasting - P J Brockwell (Springer Text in Statistics). Library Ref. 519.55 BRO (+ online)

- A more specialised text: Analysis of financial time series - Tsay, Ruey S., 2nd or 3rd ed., Wiley-Interscience, 2005, 2010 Main (Book) 330.0151 TSA Short Loan (Book) 330.0151 TSA Electronic

- Many free resources are available online, for example, via this website
  http://statlink.tripod.com/id14.html
  Most of these, however, go far beyond our scope.

- For general Probability and Statistics references, see Chapter 3 handout, last section References.

- A basic introduction to using R for time series

Office Hours

In the Autumn term, Dr Koloydenko will hold weekly office hours in McCrea xxx on
TBA and **TBA**.
If a student needs to see Dr Koloydenko at a different time, an appointment for a mutually convenient time may be made via email **alexey.koloydenko@rhul.ac.uk**, in person, or by phone x6421.

Computer Workshops

Please note that this module also includes a transferable skills/employability component (using the R software) which aims at enhancing employability of our students. *This is the only 3rd year Statistics module to include analysis of real life data.* This may give an impression that the workload for this module is somewhat higher than for the other 3rd year modules. However, please be assured that the amount of the examinable material is comparable with that in the other 3rd year modules (it may be a good idea to start looking at the past exam papers as soon as possible).
Venue: TBA PC Lab
3rd and 4th week of lectures: TBA.