

School of Mathematical and Statistical Sciences

Department of Statistical and Actuarial Sciences

SS4861B & SS9861B COURSE OUTLINE¹

By Ricardas Zitikis

1. General course information

SS4861B & SS9861B: Time Series

2018{2019 Winter term: January 7 { April 9, 2019

Lecture room: WSC 240

Day and time: Tuesday 12:30{2:30 pm & Thursday 1:30{2:30 pm

Requirements

Antirequisites: former SS3861A/B

Prerequisites: a minimum mark of 60% in both SS3858A/B and SS2864A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor information

Office: WSC 274

Office hours are to be used for sorting out individual bureaucratic issues, and not for individual tutoring. Subject-matter questions, discussions, and consultations are very much welcome during the class time, so that everybody would be treated equally and benefit equally.

E-mail: zitikis@stats.uwo.ca

When contacting by email, students must use their Western (...uwo.ca) email addresses.

3. Course description

Objectives

Study of time series models and their analysis

Enhancement of statistical intuition and technical prowess

Increased confidence when facing statistical challenges

Auxiliary preparation to meet actuarial (e.g., SOA) and PhD requirements

Topics

Model building (AR, MA, ARMA, ARIMA, ARFIMA, ARCH, GARCH, and so on); forecasting; dynamic regression; applications in finance, biology, economics, and other areas.

Learning outcomes

A bird's view of time series

Familiarity with time-series models, techniques, and methods of analysis

¹To accommodate feedback from students and administrators, the course outline is subject to revision up till and including the first class. This version was prepared on **December 6, 2018**.

4. Detailed lecture descriptions

Students are expected to have refreshed their knowledge of these fundamentals:

Probability and Statistics: basic properties of the mean, variance, and covariance, and their calculation in the case of sums of random variables; convergence

Lecture 12: $AR(p)$ time series

autoregressive time series, characteristic polynomials, complex variables, roots of polynomials, causal and non-causal solutions

Lecture 13: $MA(q)$ time series

stationarity and causality, characteristic polynomial, invertibility, mean, variance, and autocovariance, parameter estimation

Lecture 14: Forecasting $MA(q)$ time series

practicality issues, historical data, the need for invertibility, goodness of forecasts

Lecture 15: ARMA and ARIMA time series

Taylor and Pade approximations, stationarity, Laurent series, causality, invertibility, integration and differencing

Lecture 16: Fractionally integrated time series

fractional differencing, extended binomial formula, stationarity, invertibility, fractionally integrated noise, short and long memory

Lecture 17: Model selection

choosing a likely model, Yule-Walker equation, partial autocorrelation function, Akaike information criterion and its variations

Lecture 18: Conditionally heteroscedastic time series

history, conditional mean, conditional variance, checking white-noise conditions

Lecture 19: ARCH time series

meaning, ARCH(1) solution, strict and weak stationarity, Bougerol-Picard result

Lecture 20: GARCH time series

meaning, GARCH(1,1) solution, strict and weak stationarity, Nelson and Bougerol-Picard results, ARCH and AR parallels, GARCH and ARMA parallels

Lecture 21: Introduction to multivariate time series

Lecture Model selection

5. [Course materials \(not required\)](#)

Excellent source of additional information (when/if students wish to supplement my OWL-posted lecture slides with more details)

7. Accommodation and accessibility

If documentation (medical or otherwise) is required, it can only be collected by the student's Dean's Office/Academic Counselling unit.

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible. If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in WSC 140, and can be contacted at sci_bmsac@uwo.ca

For further information, please consult the university's medical illness policy at http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf