Course Syllabus

M-MATH-102911, T-MATH 105874

Time Series Analysis

Summer Semester 2022

Lecture (0161100): Tuesday 14:00–15:30, 20.30 SR 3.068, Prof. Dr. Tilmann Gneiting
Tutorial (0161110): Thursday 11:30–13:00, 20.30 SR 2.067, Benedikt Schulz

Course Contents and Prerequisites

A time series is a sequence (x_t) of data where the subscript t indicates the time at which the datum x_t was observed. The course provides an introduction to the theory and practice of statistical time series analysis. Topics covered include stationary and non-stationary stochastic processes, autoregressive and moving average (ARMA) models, model selection and estimation, state-space models and the Kalman filter, forecasting and forecast evaluation, and an outline of spectral techniques.

Knowledge of the contents of modules M-MATH-101321 (Introduction to Stochastics) and M-MATH-101322 (Probability Theory) is essential. Furthermore, familiarity with the contents of module M-MATH-103220 (Statistics) is strongly recommended.

Tentative Weekly Schedule

April 19	Introduction
April 26	Stationary processes
May 3	Trend and seasonality
May 10	Forecasting
May 17	Forecasting
May 24	ARMA models
May 31	ARMA models
June 14	Identification and estimation for ARMA processes
June 21	Identification and estimation for ARMA processes
June 28	ARIMA and SARIMA models
July 5	Multivariate time series models
July 12	Multivariate time series models
July 19	State-space representations and the Kalman filter
July 26	Spectral analysis

This schedule is tentative and may change. Anticipated dates for tutorial sessions are Thursday, April 28, May 12, May 19, June 2, June 23, July 7, and July 21.

Tentative dates for oral exams are Tuesday, July 26, Tuesday, August 2, Thursday, August 4, and Tuesday, October 25.

Literature

Textbooks on time series analysis include Brockwell and Davis (1991, 2016), Chatfield and Xing (2019), and Shumway and Stoffer (2017).

Statistical Software for Time Series

The problem sets will frequently require the use of a suitable statistical programming language. Any code discussed in class meetings will be in the R language. While you are also encouraged to use R, feel free to work with your standard language if it is suitable.

Disclaimer

At the time of writing, instruction at universities worldwide remains subject to major disruption. All information is tentative. In particular, class sessions may need to be held in online format.

References

Brockwell, P. J. and Davis, R. A. (1991). *Time Series, Theory and Methods*, second edition. Springer.

Brockwell, P. J. and Davis, R. A. (2016). *Introduction to Time Series and Forecasting*, third edition. Springer.

Chatfield, C. and Xing, H. (2019). *The Analysis of Time Series. An Introduction with R*, seventh edition. Chapman & Hall/CRC.

Shumway, R. H. and Stoffer, D. S. (2017). *Time Series Analysis and Its Applications: With R Examples*, fourth edition. Springer.