

MATH-342

Time series

Olhede Sofia Charlotta

Cursus	Sem.	Type
Data Science	MA2, MA4	Opt.
Financial engineering minor	E	Opt.
Financial engineering	MA2, MA4	Opt.
Mathematics	BA6	Opt.
Mineur STAS Russie	E	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

A first course in statistical time series analysis and applications, including practical work.

Content

- Motivation; basic ideas; stochastic processes; stationarity; trend and seasonality.
- Autocorrelation and related functions.
- Stationary linear processes: theory and applications.
- ARIMA, SARIMA models and their use in modelling.
- Prediction of stationary processes.
- Spectral representation of a stationary process: theory and applications.
- Financial time series: ARCH, GARCH models.
- State-space models: dynamic linear models, Kalman filter.
- Other topics as time permits.

Learning Prerequisites**Required courses**

Probability and Statistics

Recommended courses

Probability and Statistics for mathematicians. A course in linear models would be valuable but is not an essential prerequisite.

Important concepts to start the course

The material from first courses in probability and statistics.

Learning Outcomes

By the end of the course, the student must be able to:

- Recognize when a time series model is appropriate to model dependence
- Manipulate basic mathematical objects associated to time series
- Estimate parameters of basic time series models from data
- Critique the fit of a time series model and propose alternatives

- Formulate time series models appropriate for empirical data
- Distinguish a range of time series models and understand their properties
- Analyze empirical data using time series models

Teaching methods

Ex cathedra lectures and exercises in the classroom and at home.

Assessment methods

Written exam

Supervision

Office hours	No
Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

A polycopié of the course notes will be available.

Ressources en bibliothèque

- [Dynamic Linear Models with R / Petris, Petrone & Campagnoli](#)
- [Analysis of Financial Time Series / Tsay](#)
- [Introduction to Time Series and Forecasting / Brockwell & Davis](#)
- [\(electronic version\)](#)
- [Time Series Analysis and its Applications, with R Examples / Shumway & Stoffer](#)
- [\(electronic version\)](#)
- [\(electronic version\)](#)
- [\(electronic version\)](#)

Notes/Handbook

- Brockwell, P. J. and Davis, R. A. (2016) Introduction to Time Series and Forecasting. Third edition. Springer.
- Shumway, R. H. and Stoffer, D. S. (2011) Time Series Analysis and its Applications, with R Examples. Third edition. Springer.
- Tsay, R. S. (2010) Analysis of Financial Time Series. Third edition. Wiley.
- Percival, D.P. and Walden A. T. (1994) Spectral Analysis for Physical Applications. CUP.