Time Series Analysis (MATh5845)

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Week 1, T2 2023

Welcome to Time Series Analysis (MATh5845)!

- **Lecturer: Dr. Atefeh Zamani**
  - **Education**
    - Ph.D. in Mathematical Statistics
    - Master of Data Science
  - **Research interest**
    - Functional data analysis
    - Time series Analysis
  - **Contact**
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      Please make sure to mention ”MATH5845” in the subject of the email.

What is time series? Why we need it?

- *Time series* is a type of data that records the values of a variable over time, usually at regular intervals.
- We need time series because it allows us to *analyze the past* behavior and patterns of the variable, and to *forecast* its future values based on historical trends.
- Time series can be used for various purposes, such as understanding the seasonality and cyclicality of a phenomenon, detecting outliers and anomalies, identifying causal relationships between variables, and testing hypotheses and models.

Forecast or prediction? Why?

Structure and Resources: Topics

- **Week 1**: Introduction to time series
- **Week 2**: Time series regression
- **Week 3**: ARMA models
- **Week 4**: ARIMA models
- **Week 5**: Prediction in time series
- **Week 7**: Spectral analysis- Part 1
- **Week 8**: Spectral analysis- Part 2
- **Week 9**: Additional time domain topics
- **Week 10**: State space models

Structure and Resources: Lectures

4 Hours/Week:

- Mon 13:00 - 15:00 **Colombo Theatre A** (K-B16-LG03)
- Tue 14:00 - 16:00 **Mathews Theatre A** (K-D23-201)

What to expect:

- Introduce topics; prove some results.
- Demonstrate examples in `R`.
- Answer questions as they arise. (Please ask!)
- Revise topics and provide clarification.
- Provide general feedback on assessments.

Structure and Resources: Moodle Site

- Post lecture slides in advance of the lecture.
- Answer questions on the discussion forum.
- Post assessments.

Structure and Resources: Texts

- Shumway, R.H., & Stoffer, D. S. (2000), Time series analysis and its applications. New York: springer.
- Brockwell, P.J., & Davis, R.A. (2009). Time series: theory and methods. Springer science & business media.

If you need some elementary resources:

- Brockwell, P.J., & Davis, R.A. (Eds.). (2016). Introduction to time series and forecasting. New York, NY: Springer New York.

Lecture Notes??

Expectations: Theory and Practice

- This course covers both theory and practice.
- Assessments and final exam will be on theory and proofs and practical questions.
- Understanding of theoretical concepts needed for application.

Expectations: Software

- This course is offered in R.
- Software demonstrations during lectures.
- You can find a wide range of resources here.

What about Python??

- Huang, C., & Petukhina, A. (2022). Applied Time Series Analysis and Forecasting with Python. Springer Nature.

Expectations: Assessments

- **2 Assignments** (Due on Week 4 and Week 9)
  - Equal weights: 20% each. (1/4 Theory, 3/4 Practice)

- **Final exam**: During the exam period (**IN-PERSON**)
  - Weighted 60% (3/4 Theory, 1/4 Practice)