# Information about the exam in the course "Time Series Analysis"

The exam is oral and lasts for 20 minutes. The exact dates within the period January 31 – February 18 are decided by the administration. Typical possible questions are

- Stationarity: How is it defined, can you sketch different time series plots where stationarity is not a reasonable assumption, or decide in a concrete example whether assuming stationarity is appropriate, which techniques can be used to reduce a non-stationary series to a stationary one, what are the implications of stationarity on the means and the covariances of the series ?

- Autocovariances and spectrum: How are they defined, which properties does an autocovariance function have, how do we estimate the autocovariance function, which properties of the time series are reflected in the autocovariance function or the spectrum, can you compute the autocovariance of a (simple) linear moving average, how does R give information about the statistical significance of estimated autocorrelations, how does the acf affect the error of the arithmetic mean or of the least squares estimator in a regression model ?

- Estimation of the spectrum: How is the periodogram defined, what are its main properties, what is a taper and why is it a good idea to use one, why is it necessary to smooth the periodogram, what happens if we smooth too much or too little, why are spectral estimates always plotted in log scale, how can AR models be used for spectral estimation ?

- ARMA models: How are they defined, what does causality and invertibility mean, what are the conditions on the coefficients for causality and invertibility, can you derive a causal representation for an AR(1), what are the main properties of the autocovariances of an AR, MA or ARMA model, what is the one-step prediction in such a model, how can you estimate the parameters for given model orders, what methods are available for choosing the orders ?

This list is not exhaustive. You should be able not only to give a brief answer to questions, but rather to explain what is behind a definition, how a results connects to other things, what the implications for the analysis of data are, etc. There is no need to memorize complicated formulae, but you should be able to do simple computations which need only an understanding of the definitions and basic rules of probability. Students of mathematics should be able to do slightly more difficult computations than the others. Questions about wavelets, multivariate time series analysis and long-range dependence will only be given to students who show that they have learnt and understood all the basic topics well and thus will get good grades anyhow.

If you have questions, you can ask them on January 17 and 24 2011 from 1 to 3 pm. The room (in the main building) will be announced on my web page. If you find mistakes or things that make no sense at all to you in the script, please let me know by email any time.

H. R. Künsch, December 16, 2010