# STAT 5383 – Time Series Analysis

## Fall 2019

**General Information:**

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| Class hours: | MWF 12:55–1:45pm, SCEN 205 |
| Webpage: | `https://learn.uark.edu` |
| Instructor: | Giovanni Petris, *GPetris@uark.edu* |
| Office: | SCEN 314 |
| Office Hours: | Wednesday 2:30–3:20pm, or by appointment. |

**Texts:** Petris, Petrone, and Campagnoli (2009), *Dynamic Linear Models with R.*

**Objectives:** Data collected over time at regular intervals typically require, for their statistical analysis, methods that account for their serial correlation. While correlation makes the analysis and estimation procedures more complicated, it can also be leveraged to produce reliable forecasts of future observations, together with a realistic assessment of their uncertainty. In this course you will learn how to specify, or identify, a model for a particular data set and how to estimate unknown parameters using the statistical computing environment R. A particular emphasis will be given to the construction of point forecasts and forecast intervals for future observations.

**Assessment:** The final grade will be based on one in-class midterm, homework, and a final project. Homework will be assigned on a regular basis. You may discuss an assignment with other students but the written solution to homework problems must be your own.

**Course grade:** The course grade is divided as follows:

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| Midterm: | 30% |
| Homework: | 30% |
| Final project: | 40% |

**Prerequisites:** A basic course in probability and statistics, together with elementary matrix calculus, provides sufficient background to follow the methodological part of the course. Illustrations and practical examples will be carried out using the statistical computing environment R, which the student is assumed to be familiar with.

**Tentative course outline:**

- Exploratory tools and time series visualization
- State space models (SSM); filtering, smoothing, forecasting
- Linear Gaussian SSMs
  - Trend models
  - Modeling seasonality and cycles: seasonal factors and Fourier coefficients
  - Explanatory variables: interventions, dynamic regression

  - Multivariate observations: Seemingly Unrelated Time Series Equations, factor models
- Partially Gaussian SSMs (e.g., count data, stochastic volatility)
- Nonlinear non-Gaussian SSMs
- Autoregressive Moving Average (ARIMA) models
- Spectral theory

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