

Spring 2017

University of Akron
Department of Statistics

3470:577
**Advanced Topics: Time Series
Analysis**

Time and Place: MWF 4:25 - 5:15pm CAS 108
Instructor: Nao Mimoto
Office: CAS 413
Phone: (330) 972-8011
Email: nmimoto@uakron.edu
Office Hours: MW 1:00-3:00 and by appointment
Prerequisite: 3470:450 or 451 or 461 or equivalent or permission of instructor.

Course Description: Stationarity. ARIMA modeling with seasonality. Parameter estimation, model diagnostics and forecasting. Regression with autocorrelated errors. Cointegration and Multivariate ARMA models. Heteroscedasticity and Long-memory models.

Textbook: Cryer (2008) Time Series Analysis. 2nd Ed. Springer.

Grading Scale: Grading is based on homework and exam scores according to the following schemes, and a course grade will be given according to the following scale:

Homeworks (4)	35%
In-class Assignments (2)	15%
Modeling Assignments (2)	30%
Final project	20%

A		B		C		D	
90%		80%		70%		60%	

A plus/minus grade may be assigned if a student's total fall just below one of the cut-offs.

Homework: Four homework sets will be assigned throughout the semester and will be collected in class. Emphasis will be on conceptual and theoretical aspects of basic models. (due Jan 30, Feb 6, Feb 13, Feb 20)

In-class modeling assignments: There will be two “Lab” days around the middle of the semester, in which students will model and forecast given time series using the software R. Instructor's help will be available on site. This is intended to bring all students up to pace with R coding necessary for time series analysis.

Modeling assignments: Student will be given textbook datasets and asked to demonstrate various model fitting and forecasting techniques covered in class. Students will submit a written report with R code and figures.

Final Project: As group of three or less, students are expected to complete final project, which analyzes the real time series dataset taken from online data repository using what they have learned in this course. Students will submit written report of the analysis of their findings and give 10min presentation in the last week of the semester.

Course Outline:

Week

1. Stationarity
 - Concept of weak and strong stationarity. ACF and sample ACF.
2. Trends
 - Deterministic Trends vs Random Trends. Random walk with and without drift.
3. Autoregressive Models (**Assignment 1 due**)
 - Parameter estimation. Stationarity condition. Causal representation.
4. Moving Average Models (**Assignment 2 due**)
 - Parameter estimation. Stationarity condition. Inverted representation.
5. ARMA model (**Assignment 3 due**)
 - Stationarity condition.
6. Integrated ARMA model (**Assignment 4 due**)
 - Box-Jenkins methodology. Indication for over/underdifferencing.
7. Review (**In-Class project 1**)
8. Seasonal Model - SARIMA model, Test for presence of seasonal component.
9. Regression With Correlated Errors (**In-Class project 2**)
 - Deterministic trend with covariates. ARIMAX model.
10. Heteroscedasticity
 - Identification, Generalized autoregressive heteroscedastic model.
11. Structural Stability (**Modeling Project 1 due**)
 - Parameter consistency. Identification and hypothesis test.
12. Cointegration
 - Concept of cointegration. Granger method.
13. Vector AR Models and Long-Memory Time Series. (**Modeling Project 2 due**)
 - Long-range dependence and fractal integrated models.
14. Spectral Analysis
 - Spectral representation of autocovariances. Fourier Transformation.
15. Final Project Presentation

ADA: Any student who feels he/she may need an accommodation based on the impact of a disability should contact the Office of Accessibility at (330) 972-7928. The office is located in Simmons Hall room 105. Their web page can be viewed at <http://www.uakron.edu/access/>.

Disclaimer: The instructor reserves the right to make any changes he considers academically advisable. Changes will be announced in class and on the course web site. It is your responsibility to keep up with any changed policies and assignments.

Academic Honesty: The use of a crib sheet as well as copying homework, quizzes, or examinations constitutes academic dishonesty and will be referred to the Student Discipline Office. Please refer to the University of Akrons Academic Dishonesty Policies Publication for a more detailed discussion about Academic Dishonesty.

Table 1: **Important Dates**

Jan 20	Last day to add (no signatures required)
Jan 26	Last day to add (with Instructor, Advisor, and Dean signatures)
Jan 26	Last day to drop without "WD" appearing on academic record (no signatures required)
Mar 2	Last day to drop