Spring 2018

University of Akron

Department of Statistics

3470:477
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:	MWF 2:00-3:00 and by appointment
Course Web Page:	`gozips.uakron.edu\~nmimoto\477`
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.

Learning Objective: 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. (Available from UA library)

References: Shumway (2011) Time Series Analysis and its Applications with R Rxamples. Springer.

R software: This class uses statistical software R. It is a free software that can be downloaded from http://www.r-project.org/ and installed on your PC/Mac/Linux. Each lecture, theoretical findings and statistical properties discussed will be demonstrated using R.

Class Web Page: Lecture slides, sample R code, Homework assignments and other class materials/announcements will be posted on the course web page listed above.

Homework Assignments: There are daily computer assignment and weekly take-home assignments. The lowest take-home scores will be dropped when calculating total points.

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. Some homework may be online (Brightspace). Emphasis will be on the conceptual and theoretical aspects of various time series models.

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 real-life datasets and asked to demonstrate various model fitting and forecasting techniques, as well as to show understanding of their theoretical implications and limitations within a practical context. 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 analizes the real time series dataset taken from online data repositry using what they have learned in this course. Dataset may be Financial/Economic, Hydrological/Climate, or

other type. Students will submit written report of the analysis of their findings and give 10min presentation in the last week of the semester.

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

Course Outline:

Week

1. Stationarity
   - Concept of week 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