MATH 545: TIME SERIES ANALYSIS
FALL 2017

Instructor :	David A. Stephens (Burnside 1225)
Email :	david.stephens@mcgill.ca
Office Hours :	Monday, Wednesday 12:00-14:00
Textbooks :	*Introduction to Time Series and Forecasting* (2nd Edition) P. J. Brockwell and R. A. Davis.
	Time Series Analysis and its Applications with R Examples (3rd Edition) R. H. Shumway and D. S. Stoffer.
	Introductory Time Series with R P. S. P. Cowpertwait and A. V. Metcalfe
Web Site :	http://www.math.mcgill.ca/dstephens/545/
Method of Assessment :	Assignments/Mini-Projects, Midterm, Final (see p. 2)

TARGET SYLLABUS

1. **INTRODUCTION**
   - 1.1 Covariance, Dependence and Stationarity
   - 1.2 Simple Stationary Models
     - 1.2.1 Autoregressive Processes
     - 1.2.2 Moving Average Processes
     - 1.2.3 Linear Processes
   - 1.3 Trends and Seasonality
   - 1.4 Forecasting

2. **ARMA MODELS: ESTIMATION AND FORECASTING**
   - 2.1 Basic Properties
     - 2.1.1 ARMA(p, q) models
     - 2.1.2 Autocorrelation and Partial Autocorrelation Functions
     - 2.1.3 Forecasting
   - 2.2 Estimation and Model Selection
     - 2.2.1 Method of Moments
     - 2.2.2 Maximum Likelihood
     - 2.2.3 Residual Checking
     - 2.2.4 Model Selection

3. **NON-STATIONARY AND SEASONAL MODELS**
   - 3.1 ARIMA Models
   - 3.2 Unit Roots
   - 3.3 Seasonal Models
   - 3.4 Estimation, Hypothesis Testing and Forecasting

4. **STATE-SPACE MODELS**
   - 4.1 State-Space Formulation
   - 4.2 Structural Models
   - 4.3 State-Space Formulation of ARIMA Models
   - 4.4 Filtering and Smoothing: The Kalman Filter and EM Algorithm

5. **FINANCIAL TIME SERIES MODELS**
   - 5.1 Parameter-Driven Models
   - 5.2 Observation-Driven Models
   - 5.3 Conditional Heteroscedastic Models: ARCH, GARCH and Stochastic Volatility.

6. **ADVANCED TOPICS**
   - 6.1 Multivariate Time Series Models
     - 6.1.1 Multivariate Time Series Models
     - 6.1.2 Multivariate ARMA Models
   - 6.2 Spectral Analysis
     - 6.2.1 Spectral Representations of Stationary Processes
     - 6.2.2 Spectral Representations of ARMA Models
     - 6.2.3 Estimation

EVALUATION

Please note that the method of evaluation for this class will be **on the following basis only**:

Assignments/Projects:	using the `R` programming language;
Midterm:	Wednesday October 11th 2017;
Final:	3hr exam.

Final mark for course: the larger of

$$25\ \%\ \text{Assignments} + 15\ \%\ \text{Midterm} + 60\ \%\ \text{Final}$$

and

$$25\ \%\ \text{Assignments} + 75\ \%\ \text{Final}.$$

There will no opportunity for make-up work in place of any aspect of the course assessment.

MCGILL UNIVERSITY POLICY STATEMENTS

The following three statements are included in this course outline, in keeping with Senate resolutions:

1. *McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the* ***Code of Student Conduct and Disciplinary Procedures****. For more information, see*

   `www.mcgill.ca/students/srr/honest/`

   [*Approved by Senate on 29 January 2003*]

2. *In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.*

   [*Approved by Senate on 21 January 2009*]

3. *Instructors who may adopt the use of text-matching software to verify the originality of students' written course work must register for use of the software with Educational Technologies and must inform their students before the drop/add deadline, in writing, of the use of text-matching software in a course.*

   [*Approved by Senate on 1 December 2004*]

If you need special examination arrangements or accommodations, please contact the **Office for Students with Disabilities** at 514–398–6009.

David A. Stephens.
August 2017