

MSAN 604: Time Series Analysis

Fall 2016

Lecture Information:

Section 1: TR 10:00am – 12:00pm @ 101 Howard, Room 155

Section 2: TR 1:00pm – 3:00pm @ 101 Howard, Room 529

Instructor: Nathaniel T. Stevens

Office: Harney Science Center 209

Email: ntstevens@usfca.edu

Office Hours: TR by appointment

Phone: ext. 6734

Course Description:

A survey of the theory and methods of time series models, with a particular emphasis on financial and business applications. Tools for model identification, estimation, assessment, and forecasting in stationary, non-stationary and seasonal contexts are developed. Smoothing methods and trend/seasonal decomposition methods are covered as well, including moving average, exponential, Holt-Winters, and Lowess smoothing techniques. Time permitting, volatility clustering with ARCH and GARCH methods and multivariate time series approaches will be considered. The primary statistical software used in this course will be R.

Course Homepage:

The course homepage is on Canvas (<https://myusf.usfca.edu>). It is my expectation that you regularly visit this webpage to download course material and receive important announcements.

Textbook:

Introduction to Time Series and Forecasting, 2nd edition by Peter J. Brockwell and Richard A. Davis. Springer Texts in Statistics.

Other reading:

Introduction to Time Series Analysis and Forecasting, by Douglas C. Montgomery, et al. Wiley Series in Probability and Statistics.

Introductory Time Series with R, by Paul S.P. Cowpertwait and Andrew V. Metcalfe. Springer Texts in Statistics.

Time Series Analysis: Forecasting and Control, 5th edition, by George E.P. Box, et al. Wiley Series in Probability and Statistics.

Attendance Policy:

This course meets for only seven weeks. It will be short and intense. Consequently, you may only miss class under the most dire of circumstances. These circumstances should be both unusual and documentable. While no portion of your final grade is specifically dedicated to attendance, your entire final grade is indirectly influenced by attendance. It is in your best interest to maintain perfect attendance.

Assessment:

1. Assignments (15%)

- There will be three (3) assignments, each worth 5% of your final grade. These assignments will combine written solutions with computation in R, and will be due at the beginning of lectures according to the schedule below.
- You are expected to complete assignments independently and submit your own work. Cheating is a serious offence, and will be treated as such. Please refer to the Academic Integrity section below.
- If you fail to submit an assignment and have a **valid** reason with supporting documentation, the weight from that assignment will be carried to the final exam. If the reason is not deemed valid, you will receive a mark of 0.
- **I will not accept late assignments under any circumstances.**

Assignment	Due Date
1	Thursday November 3 rd
2	Thursday November 17 th
3	Tuesday December 6 th

2. Quizzes (30%)

- There will be five (5) in-class quizzes, though only the best four (4) will be counted toward your final grade. Thus, the best four quizzes are each worth 7.5% of your final grade. These quizzes will be written during the first 30 minutes of Thursday lectures according to the schedule below.
- The in-class quizzes will be centered on definitions, concepts, and simple computations, as well as interpretation of pre-generated statistical output.
- If a quiz is missed for a **valid** reason, and you have supporting documentation, the weight from that quiz will be carried to the final exam. If the reason is not deemed valid, you will receive a mark of 0.
- **I will not offer “make up” quizzes for any reasons.**

Quiz	Due Date
1	Thursday October 27 th
2	Thursday November 3 rd
3	Thursday November 10 th
4	Thursday November 17 th
5	Thursday December 1 st

3. Project (15%)

- There will be a final group project in this course that will involve working with a real time series data set. Your ability to accurately and effectively model, estimate, and forecast within this framework will be assessed. Your ability to clearly communicate your analysis and results will also be assessed. More details related to this final project will be released midway through the module.
- You will work in groups of size three or four, and group membership will be randomly assigned and non-negotiable.
- The final project is due **Friday December 13th by 5:00pm.**

4. Final Exam (40%)

- There will be a 2-hour, closed book, cumulative final exam on **Friday December 13th, from 10:00am to 12:00pm** in 101 Howard, Room 155/156. Please refrain from booking holiday travel before this date.
- The format of the final exam will mimic that of assignment and quiz questions. Specifically, short answer statistical calculations, proofs, written responses, R computation, and R output interpretation can all be expected.

Final Grade Calculation:

The objective grade is converted to a letter grade by the following table.

Objective Grade	Letter Grade	Comments
97 – 100	A+	Outstanding
93 – 96	A	
90 – 92	A-	
87 – 89	B+	Good
83 – 86	B	
80 – 82	B-	
77 – 79	C+	Satisfactory
73 – 76	C	
70 – 72	C-	
67 – 69	D+	Passing but poor
63 – 66	D	
60 – 62	D-	
< 60	F	Failing

The letter grade may receive a subjective adjustment upward by one grade step, depending on your class participation and special circumstances.

Learning Objectives:

Any student who successfully completes this course should:

- Determine the properties of moving average and autoregressive models, as well as autoregressive moving average models, using elementary algebra and by taking expectations and conditional expectations;
- Understand the properties of moving average and autoregressive models, as well as autoregressive moving average (ARMA) models;
- Be familiar with unit root tests and discrete random walks;
- Be able to use R to perform the tasks of model selection, parameter estimation, and diagnostic testing related to the class of Box-Jenkins (ARIMA) models;
- Be able to model seasonal data (e.g., quarterly revenues, monthly inventories, etc.) using SARIMA models;
- Understand properties of ARCH and GARCH models, and how to undertake parameter estimation and model selection with respect to these classes of models using R;
- Be able to use ARCH and GARCH models for model volatility clustering and to forecast future volatilities;

- Have an understanding of the necessity for, and mechanics of, multivariate time series approaches; and
- Be able to model a specific time series provided by the instructor from start to finish.

Note on Laptops:

In general, you should have a laptop in class and you should have R and Microsoft Excel installed on that laptop before the course begins. You will be expected to use R on quizzes, and we will often use R in class. I ask that you be respectful of your classmates and me by refraining from surfing the web during my lectures. Use of your laptop should be reserved for note taking and computation in R.

Academic Integrity:

As a Jesuit institution committed to *cura personalis*—the care and education of the whole person—USF has an obligation to embody and foster the values of honesty and integrity. USF upholds the standards of honesty and integrity from all members of the academic community. All students are expected to know and adhere to the University's Honor Code. You can find the full text of the code online at www.usfca.edu/academic_integrity. The policy covers:

- Plagiarism — intentionally or unintentionally representing the words or ideas of another person as your own; failure to properly cite references; manufacturing references.
- Cheating — using any unapproved notes on exams or copying the work of another student whether consensual or not.
- Working with another person when independent work is required.

The policy of the MSAN program is the following:

- The first observed incident of cheating will result in a zero on the corresponding assessment. It will be reported to both the MSAN program director and the MSAN program assistant for tracking.
- The second observed incident of cheating **in any course** after the initial incident will result in a failing grade for the course. A student receiving a failing grade in any MSAN course cannot proceed to the next module of the program. These students will leave the program.

Students with Disabilities:

If you are a student with a disability or disabling condition, or if you think you may have a disability, please contact USF Student Disability Services (SDS) at 415 422-2613 within the first week of class, or immediately upon onset of disability, to speak with a disability specialist.

If you are determined eligible for reasonable accommodations, please meet with your disability specialist so they can arrange to have your accommodation letter sent to me, and we will discuss your needs for this course. For more information, please visit: <http://www.usfca.edu/sds> or call (415) 422-2613.

Behavioral Expectations:

All students are expected to behave in accordance with the Student Conduct Code and other University policies (see <http://www.usfca.edu/fogcutter/>). Open discussion and disagreement is encouraged when done respectfully and in the spirit of academic discourse. There are also a variety of behaviors that, while not against a specific University policy, may create disruption in this course. Students whose behavior is disruptive or who fail to comply with the instructor may be dismissed from the class for the remainder of the class period and may need to meet with the instructor or Director prior to returning to the next class period. If necessary, referrals may also be made to the Student Conduct process for violations of the Student Conduct Code.

Confidentiality, Mandatory Reporting, and Sexual Assault:

As an instructor, one of my responsibilities is to help create a safe learning environment on our campus. I also have a mandatory reporting responsibility related to my role as a faculty member. I am required to share information regarding sexual misconduct or information about a crime that may have occurred on USFs campus with the University. Here are other resources:

- To report any sexual misconduct, students may visit Anna Bartkowski (UC 5th floor) or see many other options by visiting our website: www.usfca.edu/student_life/safer
- Students may speak to someone confidentially, or report a sexual assault confidentially by contacting Counseling and Psychological Services at 415-422-6352.
- To find out more about reporting a sexual assault at USF, visit USFs Callisto website at: www.usfca.callistocampus.org.
- For an off-campus resource, contact San Francisco Women Against Rape (SFWAR) (415) 647-7273 (www.sfwar.org).