

# STSCI/ILRST 4550 & ORIE 5550 – Applied Time Series Analysis

Cornell University, Spring 2019

Dr. Maryclare Griffin

## Home Page

All course materials will be posted at:  
<https://maryclare.github.io/atsa>

## Class Location and Times

STSCI 4550 / ILRST 4550 / ORIE 5550  
Applied Time Series Analysis  
4CR Graded  
LEC: Ives 305, T/R 02:55PM – 04:10PM  
DIS: Ives 305, F 11:15AM – 12:05PM

## Instructors

- Dr. Maryclare Griffin  
OH: Mon. 2:00pm-4:00pm, Th. 9:00am-11:00am  
1196 Comstock  
Email: [maryclare@cornell.edu](mailto:maryclare@cornell.edu)
- TA: Megan Gelsinger  
OH: Weds. 9:00am-11:00am  
Comstock B104  
Email: [mlg276@cornell.edu](mailto:mlg276@cornell.edu)

## Emails

- Include 4550 or 5550 in the email subject line. The instructors cannot guarantee that emails that do not contain either 4550 or 5550 in the email subject line will be read and responded to.
- The instructor and teaching assistant will respond to emails at their discretion.

## Academic Integrity

Students are expected to abide by Cornell's Code of Academic Integrity, which can be found at: <https://cuinfo.cornell.edu/aic.cfm>. The instructor and teaching assistant can and may report apparent violations to the appropriate hearing Hearing Board.

## Course Objectives

After this course, students should be able to:

- Perform exploratory time series data analysis;
- Understand, explain and know the relative merits of several classical time series models, including but not limited to AR, MA, ARMA, ARIMA, ARCH, GARCH, and state-space models;
- Fit several series models to data using R;
- Interpret time series analysis results.

## Lecture Notes and Textbooks

Course notes will be posted as the semester progresses. You will be responsible for any material that has been covered in the course notes for exams, homeworks, and projects. The course notes will be based on the following textbooks, which are available for free to download via the Cornell Library.

- Primary:
  - Shumway and Stoffer (2006), *Time Series Analysis and Its Applications With R Examples*, 2nd Ed.
- Secondary:
  - Chan (2010), *Time Series: Applications to Finance with R and S-Plus<sup>®</sup>*, 2nd Ed.
  - Cowpertwait and Metcalfe (2009), *Introductory Time Series with R*.
  - Tsay (2010), *Analysis of Financial Time Series*, 3rd Ed.

## Labs

Students are strongly encouraged to attend labs. Although attending labs is not required, failure to attend labs may put students at a disadvantage. Material that is covered in labs but not in class may be included on exams or homeworks.

# Syllabus

A preliminary syllabus is given below:

- Week 1: Introduction and Review
- Weeks 2-3: AR, MA, ARMA
- Weeks 4-5: ARIMA, ARCH, GARCH
- Weeks 6-9: Spectral Analysis & Filtering
- Week 10: Spring Break!
- Weeks 11-13: State-Space Models
- Weeks 14-15: TBD Special Topics, e.g.:
  - Vector Autoregressive (VAR) models
  - Prophet, free software from Facebook
  - Student Suggestions

## Grading policy

Grades will be computed according to:

Exams	40%
Homeworks (lowest grade dropped)	25%
Project	30%
Participation	5%

Students may work together on homeworks and the project, but each student must independently write up and submit their own homework or project in their own words. Students must list any students they worked with in homeworks or the project, and must cite any references used.

Re-grading requests must be submitted to the instructor within two weeks of the grade being received. If granted, a complete re-grade will be performed and the new grade can be higher or lower.

### Exams

Exams will be completed independently. Preliminary exam dates are:

- Friday, 2/22/2019;
- Tuesday, 3/26/2019;
- Friday, 5/3/2019.

Exams will not be cumulative.

No make-up exams will be considered, unless a student misses an exam due to a documented illness or family emergency. Please notify the instructor via email if you may miss an exam as soon as promptly as possible.

## Homeworks

Homeworks will be posted at least one week before they are due and due by 12:00pm on Thursdays. This will let the instructor and teaching assistant draw on completed homeworks for Thursday lectures and Friday lab sessions.

Completed homeworks must be submitted online via Blackboard. Solutions to problems that require use of R must be written up using R Markdown, and all relevant code for replication must be included. When R is used, raw R output alone will not constitute a complete solution. Instead, students will be expected to translate R output into words, possibly accompanied by well-annotated graphics and tables.

If homeworks are submitted  $d$  days late, the grade you receive  $x$  will be related to the grade given by the grader  $y$  according to  $x = y/2^d$ . If there is an exam the Friday after homework is due, homeworks do need to be submitted and will not be graded.

## Project

Students will be asked to select one of several approved datasets and independently complete a five page writeup containing:

- Exploratory data analysis;
- Application of two methods learned in class;
- Discussions of the methods' appropriateness.

R code reproducing all results must be submitted with the writeup. Tentatively, a final draft of the entire project will be due Tuesday, 5/7/19 by 11:59pm, submitted online via Blackboard. The due date and details of the project will be confirmed at least one week before the final draft is due.

Parts of the project will also be woven into homeworks. The final draft will count towards the 30% of your grade based on the project, whereas parts woven into homeworks will count towards the 25% of your grade based on homeworks.

## Participation

Students will start out with perfect participation grades, which may be reduced if the instructor or teaching assistant observes poor participation. This includes but is not limited to:

- Repeated unexcused lecture or lab absences;
- Talking during exams;
- Failure to stop working on and turn in an exam when the end of the exam period is announced.

## Computing and Typesetting

This course will use R for all computing:

<http://cran.r-project.org>

Students must typeset homeworks and the project using R Markdown:

<http://rmarkdown.rstudio.com>

R Markdown is easily used from within RStudio:

<https://www.rstudio.com/products/rstudio>

## Students with Disabilities

The instructor and teaching assistant are committed to implementing a course that is accessible to students with disabilities. We hope that students feel welcome meeting with us to discuss disability-related accommodations and learning needs. We also would like to make sure students are aware of Student Disability Services (SDS), which works “to ensure that all aspects of student life are accessible, equitable and inclusive of individuals with disabilities.” SDS can be contacted by email at [sds\\_cu@cornell.edu](mailto:sds_cu@cornell.edu) and by phone at (607)-254-4545.

Students who have been deemed eligible for disability services by SDS should submit their SDS accommodation letters to the instructor or teaching assistant as early as possible so that there is time to have the approved accommodations arranged. If immediate accommodations for equal access are needed, please speak with or email the instructor or contact SDS. Last, if you have questions or concerns about your accommodations please contact SDS.

Students who have not been deemed eligible for disability services by SDS but believe they may have a disability in any area such as mental health, attention, learning, chronic health, sensory, or physical should contact SDS to schedule a meeting to discuss their access and accommodation options.

## Prerequisites

- Calculus
- Applied Linear Regression
  - STSCI 4030 (or equivalent): Linear Models with Matrices
- Probability and Mathematical Statistics
  - STSCI 3080/5080: Probability Models and Inference
  - Math 4710: Basic Probability
  - ORIE 3500/5500: Engineering Probability and Statistics II