STAT 4825/5825 Applied Time Series
University of Connecticut
Fall 2022

Course:

    Lectures: Tuesdays & Thursdays 11:00 am - 12:15 pm, MONT 321

Instructor:

    Yao Zheng

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    Office: AUST 307

    Office Hours: Fridays 12:00 pm - 2:00 pm or by appointment.

Grader:

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Course Objectives: At the end of the course, students should be able to

- understand fundamental concepts and structures of time series data: stationarity, trends, stochastic components, seasonality, etc.
- visualize and explore time series data using various tools: time plot, autocorrelation/partial autocorrelation plot, stationarity tests, etc.
- have a comprehensive understanding of statistical techniques and procedures to model and analyze various forms of time series data
- implement time series techniques to analyze real-world datasets in R

Text/References:

- Cryer, J. and Chan, K.-S. (2008). *Time Series Analysis: With Applications in R.* Springer-Verlag, New York, 2nd edition. R scripts available at the textbook website `http://homepage.divms.uiowa.edu/~kchan/TSA.htm`. The corresponding R package is `TSA`.
- Shumway, R. H. and Stoffer, D. S. (2017). *Time Series Analysis and Its Applications: With R Examples.* Springer, 4th edition. The corresponding R package is `astsa`.
- Additional materials and references provided by the instructor.

Computing/Software: This course uses R (`http://www.r-project.org/`) and R Studio (`https://rstudio.com/products/rstudio/download/`), and assumes that you have prior experience with the R language.

Grading:

    Homework: 50%

    Midterm exam: 20% (**Thursday, October 27, in class**)

Final project & presentations: 30%

    – Interim speed presentations will be given in class one week after the midterm exam.

    – Final presentations will be given in class during the week of December 5.

    – The project report will be due on **Friday, December 16, at 11:59 pm**.

Homework: There will be about 4-7 homework assignments. The lowest homework grade will be dropped at the end of the semester.

- There will be analytical and R programming/data analysis questions. R source code (clearly annotated) should be submitted together with output/plots and interpretations. Please do not print out the raw dataset unless necessary. You are encouraged to use R Markdown to typeset your homework.
- Please read the instructions for each homework assignment carefully. Your work may be penalized if you do not comply with the instructions.
- All homework assignments must be submitted as PDF files through the HuskyCT course website. You may submit each assignment only once.
- You may and in fact encouranged to consult among yourselves or with the instructor. However, each student must submit his/her own work. No credit will be given for submitted assignments exhibiting duplication or copying of solutions (from peers or existing solutions).
- Homeworks submitted after the deadline will be accepted with 50% points deducted if the solution has not been posted on HuskyCT. Otherwise, it will not be accepted **without exception**.

Midterm Exam: This will be an in-class, open-book, open-notes exam. You will access the exam on the HuskyCT course website.

- The questions will be similar to those in your homework assignments.
- Since there will be R programming/data analysis questions, you will need to bring your laptop to the exam. The answers to the R programming/data analysis part of the exam should be submitted in PDF format through HuskyCT.
- The answers to the analytical questions can be either handwritten or typed, and can be submitted either physically or through HuskyCT.

Final Project: This will be an individual project consisting of two parts.

- Part 1: Collect a time series dataset from a public repository, conduct data wrangling/cleaning, visualization, and exploratory data analysis using R.
- Part 2: Pick one or multiple time series you collected in Part 1 and conduct statistical modeling and analysis using what you have learned in this course. You are free to choose the specific dataset and methods based on your interests.

More detailed guidelines will be given later. The final project will graded based on the following components.

- **Interim presentation for Part 1:** You will give a speed presentation on Part 1 of your project in class one week after the midterm exam. The purpose of this informal presentation is to show that your project is on track.
- **Final presentation for Part 2:** You will give a 5-10 minutes' final presentation on your project during the week of December 5.
- **Final project report:** The report will be due on **Friday, December 16, at 11:59 pm**. The report should be in PDF format, about 10-20 pages, double-spaced, including figures, tables, and references. The R code and dataset for reproducing your results should be submitted separately.

Topics: The tentative plan for the course is as follows.

- Introduction, Fundamental Concepts of Time Series
- Deterministic Time Series Regression Methods
- Time Series Smoothing Methods
- ARIMA Models (Non-seasonal and Seasonal)
- Multivariate Time Series Models
- Conditionally Heteroscedastic Time Series
- Deep Learning

Student Responsibilities and Resources: As a member of the University of Connecticut student community, you are held to certain standards and academic policies. In addition, there are numerous resources available to help you succeed in your academic work. Review these important standards, policies and resources, which include:

- The Student Code
    - Academic Integrity
    - Resources on Avoiding Cheating and Plagiarism
- Copyrighted Materials
- Credit Hours and Workload
- Netiquette and Communication
- Adding or Dropping a Course
- Academic Calendar
- Policy Against Discrimination, Harassment and Inappropriate Romantic Relationships
- Sexual Assault Reporting Policy