

STAT 153: INTRODUCTION TO TIME SERIES COURSE OUTLINE FOR FALL 2022

UNIVERSITY OF CALIFORNIA, BERKELEY

- **Instructor:** Aditya Guntuboyina. Email: aditya@stat.berkeley.edu and Website: www.stat.berkeley.edu/~aditya
- **Lectures:** 3:30 pm to 4:59 pm on Tuesdays and Thursdays in 50 Birge Hall
- **Office Hours:** 1:30 am to 3:30 pm on Wednesdays in 422 Evans Hall
- **GSIs:** Michelle Yu (Email: michelle.yu@berkeley.edu) and Jeffrey (Yunzhe) Zhou (Email: ztzyz615@berkeley.edu)
- **GSI Lab Sections:** 9 am - 10:59 am or 11 am - 12:59 pm or 1 pm - 2:59 pm or 3 pm - 4:59 pm in 334 Evans Hall on Fridays. The first Lab Section will be on 02 September.
- **GSI Office Hours:** TBA (2 hours each GSI each week)

About the course: Time series is a set of numerical observations, each one being recorded at a specific time. This class aims to teach you how to analyze time series data. The primary objective of time series analysis is to develop mathematical models that provide plausible descriptions for sample time series data. We shall study several time series models in this class and we shall focus on the Bayesian approach.

Tentative list of topics: Trend and seasonality estimation through parametric models, ARIMA modeling, state space models and their sequential analysis (Kalman filter and Kalman smoother), Nonlinear state space models and their sequential analysis through Monte Carlo methods.

Prerequisites: Probability at the level of STAT 134 is required. Also required is some prior data analysis experience using standard software (such as R or Python or Matlab). Familiarity with standard statistical concepts such as maximum likelihood estimation will also be necessary.

Text: There is no required textbook for the class. You can use the following books as general references:

- *Time series analysis and its applications* by Shumway and Stoffer
- *Time series analysis by state space methods* by Durbin and Koopman
- *Introduction to Time Series Modeling with Applications to R* by Kitagawa

I will draw materials from these as well as many other books which will be referenced at the appropriate context.

Ed Discussion: I have created a site for this class at Ed Discussion and we will use this platform for Q & A.

Lecture Notes and R Code: I usually prepare typed notes for each lecture. I also show data analysis examples on R in class. I will post both the lecture notes and R code on bCourses after each lecture.

Homework assignments: Will be posted on bcourses according to the following schedule. The submissions will be handled via Gradescope.

- Homework One - will be posted on 02 September and due on 13 September
- Homework Two - will be posted on 16 September and due on 27 September
- Homework Three - will be posted on 30 September and due on 11 October
- Midterm on 18 October
- Homework Four - will be posted on 21 October and due on 01 November
- Homework Five - will be posted on 04 November and due on 15 November
- Homework Six - will be posted on 18 November and due on 29 November

You have a total of 5 late days that you can apply to your homework for the entire semester. No points will be awarded for any homework which brings the total late days to more than 5.

Exams: There will be two exams: Midterm and Final. The Midterm will be on 18 October in class. The Final exam will be on 16 December from 7 pm to 10 pm.

An important policy about the Final: Please drop this class if you are taking another class whose final exam is also from 7 pm to 10 pm on 16 December.

Assessment: Your final score for the class (out of 100) will be calculated as

$$54\% \text{ Homework} + 18\% \text{ Midterm} + 28\% \text{ Final}.$$

Each of the six homeworks will count equally towards the full homework grade.

Grade Complaints: If you have a complaint against an assigned homework or exam grade and want to talk to me about it, first send me a written request through email explaining your case clearly.

Academic Integrity: You are encouraged to work in small groups on homework problems. However, you must write up solutions on your own, and you must never read or copy the solutions of other students. Similarly, you may use books or online resources to help solve homework problems, but you must credit all such sources in your writeup and you must never copy materials verbatim. Any students found to be cheating automatically risks failing the class and being referred to the Office of Student Conduct. In particular, copying solutions, in whole or in part, from other students in the class or any other source without acknowledgement constitutes cheating.

Students with disabilities: If you need accommodations for any physical, psychological, or learning disability, please get in touch with me so that we can make the necessary arrangements.