SDS 384-11

Theoretical Statistics
Spring 2023
Tu/Th 2-3:30

Professor	Purnamrita Sarkar
Class	MEZ 1.210
Office Hours	TBD via Zoom
Email	purna.sarkar@austin.utexas.edu

Syllabus

Course Description

This course provides an introduction to theoretical frequentist Statistics. The first half of the course covers concentration of measure and U statistics, etc. The second half introduces basics from empirical processes, asymptotic testing and applications including bootstrap, subsampling, kernel regression etc.

We will cover

- Consistency of parameter estimates
  - Stochastic Convergence
  - Concentration inequalities
    - Sub-gaussian, sub-exponential random variables
    - Martingale methods
    - Lipschitz continuous functions of standard normal R.V's
    - Talagrand's inequality
  - Efron-Stein inequalities
- U Statistics and its applications in Statistics and Computer Science
- Uniform law of large numbers
  - VC classes
  - Covering numbers
  - Chaining and Dudley's entropy integral
- Bootstrap and subsampling

Prerequisites Students are expected to have a good familiarity with Calculus and undergraduate probability.

Textbook
This course is designed to be self-contained, and there is no required textbook. Two textbooks that you may find useful is:

- High dimensional Statistics: A Non-Asymptotic viewpoint, Martin Wainwright, Cambridge,
- Asymptotic Statistics, Aad van der Vaart. Cambridge. 1998.
- Convergence of Stochastic Processes, David Pollard. Springer. 1984. Available on-line at `http://www.stat.yale.edu/~pollard/1984book/`

Course website
https://psarkar.github.io/sds384.html

Evaluation Grading - 4-5 homeworks (55%), class participation (10%), Final Exam (35%)

Class participation 2% is for speaking up and asking questions. If you don't do that at all, you will lose this portion. 8% is for peer grading. You will be divided into 5 groups. Each HW, I will assign homeworks of 4 students to be graded by one student of the group assigned to that week (so the group will grade 8). I will grade the homeworks for the group. Thus, in the whole course of the class, any one of you will grade around 1 homework of 4 students.

Homework will be assigned biweekly and due via canvas. You will be expected to submit a PDF and latex version of your homework. Please do **not** include your names on your homework submission. *Please note that everyone has to submit their homework* ***written in their own words****. Nearly identical assignments from two persons will result in a zero grade for that entire HW.*

Exam There will be one in class final exam.

Attendance: The class modality will be in person. Attendance is recommended, but not mandatory. Masks and physical distancing are strongly recommended. If you are unwell, I strongly recommend staying at home. I will make the day's material available.

Requests for Regrade: Clerical requests will be corrected without hassle. Other regrading requests must be submitted in writing within 2 days of the assignment/exam return. Be aware that the entire assignment/exam will be subject to regrading, and grades may go up or down.

Students with Disabilities
Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259, `http://www.utexas.edu/diversity/ddce/ssd/`.

Religious Holidays
By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Scholastic Honesty

We expect students to behave with integrity. Students found Cheating on exams or homeworks will receive a score of zero for that exam or assignment, and may be subject to additional disciplinary action. For more information on the University of Texas scholastic dishonesty policy, see the 2006-2007 General Information Catalog, Appendix C.

Campus Safety

Please note the following recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, `http://www.utexas.edu/safety`:

- Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.
- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation should inform the instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors.
- Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
- Behavior Concerns Advice Line (BCAL): 512-232-5050
- Further information regarding emergency evacuation routes and emergency procedures can be found at: `http://www.utexas.edu/emergency`.