

# SDS 384-11

Theoretical Statistics  
Spring 2022  
Tu/Th 2-3:30

**Professor**  
**Class**  
**Office Hours**  
**Email**

Purnamrita Sarkar  
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TBD via Zoom  
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## Syllabus

### Course Delivery

Until January 31st, classes will be held via Zoom. Look at <https://zoom.its.utexas.edu/> for more information. Few things to remember, when you join you will be muted, and you will have to unmute yourself to talk. You can also use the raise hand feature to ask a question. In each class, there will be a preassigned moderator(s) who will keep an eye on who is raising hands/asking questions on chat, so that we have tons of communication.

### 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 group with two students. 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>.