SYLLABUS FOR STATISTICS 100B - LECTURE 1
INTRODUCTION TO MATHEMATICAL STATISTICS
WINTER QUARTER 2021

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WWW: `http://www.stat.ucla.edu/~nchristo/statistics100B/`
Office hours: MRF 15:00 - 17:00, TW 17:00-19:00, Saturday 12:00 - 14:00, Sunday 18:00 - 20:00

Lecture	Day	Class Time	Location
Lecture 1	MWF	13:00 - 13:50	Online - Recorded

Section	Day	Discussion Time	Location
1A	R	17:00 - 17:50	Online - Recorded
1B	R	18:00 - 18:50	Online - Recorded

Teaching Assistant: Stephen Smith.

OFFICE HOURS:
Office hours are offered every day including Saturdays and Sundays. Do not hesitate to come to office hours if you have any questions. It will be great to see you! The weekend office hours will be on Saturday 12:00 - 14:00 and Sunday 18:00 - 20:00. The office hours during the week are MRF 15:00 - 17:00, TW 17:00-19:00.

RESOURCES:
Textbook (optional):
John Rice, *Mathematical Statistics and Data Analysis,* Third Edition, Duxbury Press, 2006.

Handouts can be accessed at `http://www.stat.ucla.edu/~nchristo/statistics100B/`.

Probability and Statistics EBook (freely available at):
`http://wiki.stat.ucla.edu/socr/index.php/EBook`.

Software:
`R`, `RStudio` (can be downloaded freely from `http://cran.stat.ucla.edu` and `https://www.rstudio.com`).
Statistics Online Computational Resource (SOCR), freely available at: `http://www.socr.ucla.edu`.

COURSE PREREQUISITES:
Statistics 100A or Mathematics 170A, 170E.

COURSE DESCRIPTION AND OBJECTIVES:
Statistics 100B mainly deals with parameter estimation of various distributions and models. The problem is stated as follows: Suppose $X_1, X_2, \ldots, X_n$ are i.i.d. random variables from a distribution with pdf $f(x;\theta)$, where θ is unknown. Given this sample we would like to find an estimate of the parameter θ. We will also discuss properties of estimators, interval estimation, and the theory of statistical tests. Exponential families, moment generating functions, distributions related to normal (t, χ^2, and F) will be discussed at the beginning of the course.

COURSE TOPICS

1. Exponential families.
2. Moment generating functions of random variable. Distribution of a function of a random variable. Joint probability distribution of functions of random variables.
3. Random vectors.
4. Joint moment generating functions for a random vector, multivariate normal distribution.
5. The central limit theorem and the law of large numbers. The distribution of the sample mean and sum of n independent and identically distributed random variables.
6. The χ^2, t, and F distributions.
7. Estimation and properties of estimators. Cramér-Rao inequality. Information and information matrix.
8. Method of moments and method of maximum likelihood. Estimation of the simple regression model using the method of maximum likelihood. Asymptotic properties of maximum likelihood estimates for the univariate and multi-parameter case.
9. Order statistics.

10. Data reduction: Sufficient statistics.
11. Factorization theorem.
12. Minimal sufficiency, Lehmann and Scheffé theorem.
13. Rao-Blackwell theorem, minimum variance unbiased estimators (MVUE).
14. Confidence intervals.
15. Hypothesis testing. Neyman-Pearson lemma, power functions and likelihood ratio tests.

COURSE POLICIES:
Zoom etiquette:

- If you can, please be on time and be prepared with your device charged. Make sure all tech works 5-10 minutes before the meeting.
- Mute yourself to eliminate background noise. You can unmute yourself when asking a question.
- You can also use the chat function when needed so the instructor can respond to questions promptly.
- All lectures will be delivered live and attendance is highly recommended. The lectures will be recorded and the videos will be posted on CCLE on the same day.

ACCOMODATIONS:
Students needing academic accommodations should contact the Center for Accessible Education (CAE): `http://www.cae.ucla.edu`) or call (310) 825-1501.

STUDENT RESOURCES:

- Student resources for remote learning: `https://teaching.ucla.edu/resources/students/` .
- COVID-19. You can find information for students related to COVID-19 here: `https://covid-19.ucla.edu/information-for-students/`.
- Counseling and psychological services (CAPS): `https://www.counseling.ucla.edu` .
- Resources on Equity, Diversity, and Inclusion: `https://equity.ucla.edu/know/`.
- Undocumented Student Program (USP): `https://www.usp.ucla.edu` .
- Students can embrace their identities - LGBTQ Center: `https://www.lgbt.ucla.edu` .

ACADEMIC INTEGRITY:
You are expected to adhere to the honor code and code of conduct. As a student and member of the University community, you are here to get an education and are, therefore, expected to demonstrate integrity in your academic endeavors. All students must uphold University of California Standards of Student Conduct as administered by the Office of the Dean of Students. Students are subject to disciplinary action for several types of misconduct, including but not limited to: cheating, multiple submissions, plagiarism, prohibited collaboration, facilitating academic dishonesty, or knowingly furnishing false information. You may have assignments or projects in which you work with a partner or with a group. For example, you are welcome, and even encouraged, to work with others to solve homework problems. Even though you are working together, the assignment you submit for a grade must be in your own words, unless you receive specific instructions to the contrary. For more information about academic integrity, please go to `http://www.deanofstudents.ucla.edu/`.

COURSE GRADES:
We will maintain the academic rigor of an upper division mathematical course in statistics while being flexible in student assessment. There will be two midterm exams, weekly homework, a final exam, and participation credit.

1. Final exam (30%): The final exam is scheduled on Thursday, 18 March, 15:00-18:00.
2. Midterm 1 (20%): This will be a 2-hour exam assigned on Wednesday, 27 January and can be taken starting at 20:00. The exam must be uploaded 2 hours after downloading and completed before 20:00 on 28 January.
3. Midterm 2 (20%): This will be a 2-hour exam assigned on Wednesday, 24 February and can be taken starting at 20:00. The exam must be uploaded 2 hours after downloading and completed before 20:00 on 25 February.
4. Weekly homework (15%). There is flexibility on the submission due dates. Homework can still be uploaded 48 hours after the due date. Part of the homework will be discussed during TA sessions. All homework assignments will be uploaded on `Gradescope` (`https://www.gradescope.com`).
5. Participation Credit (15%): I will meet with small groups of students (about 8-10 students) twice during the quarter. Each meeting will be between 30-45 minutes. The first meeting will take place between weeks 2-3 and the second meeting between weeks 8-9. A signup form will be available by the end of week 1. If you have any concerns or questions do not hesitate to ask. We will accommodate each student in case there is a time conflict.

The course grade will be based on the calculation

$$\text{Final score} = 0.15 \times \text{Homework} + 0.15 \times \text{Participation} + 0.20 \times \text{Midterm1} + 0.20 \times \text{Midterm2} + 0.30 \times \text{Final}$$

COMMUNICATION:
Please keep a current e-mail address with my.ucla.edu in order to receive class announcements and reminders.

IMPORTANT DATES:
First lecture: Monday, 04 January.
Last lecture: Friday, 12 March.
Holidays: Monday, 18 January (Martin Luther King, Jr.) and Monday 15 February (Presidents' Day).

EXAMS:
Midterm 1: Due by Thursday, 28 January at 20:00
Midterm 2: Due by Thursday, 25 February at 20:00
Final exam: Thursday, 18 March, 15:00 - 18:00

Good Luck !!!