SYLLABUS FOR STATISTICS 100B - LECTURE 1 INTRODUCTION TO MATHEMATICAL STATISTICS FALL QUARTER 2020

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Lecture	Day	Class Time	Location
Lecture 1	MWF	12:00 - 12:50	Online - Recorded

Section	Day	Discussion Time	Location
1A	R	16:00 - 16:50	Online - Recorded
1B	R	17:00 - 17:50	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 announced by email every Friday. The office hours during the week are M 18:00-20:00, TR 14:00 - 16:00, WF 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, 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 $(t, \chi^2, \text{ and } F)$ 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.
- 8. Method of moments and method of maximum likelihood. Simple regression. Asymptotic properties of maximum likelihood estimates for the univariate and multi-parameter case. Fisher information.
- 9. Order statistics.

- 10. Data reduction: Sufficient statistics.
- 11. Factorization theorem.
- 12. Minimal sufficiency and MVUE.
- 13. Lehmann and Scheffé theorem.
- 14. Rao-Blackwell theorem.
- 15. Confidence intervals.
- 16. 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) at (310) 825-1501. Resources on Equity, Diversity, and Inclusion: https://equity.ucla.edu/know/.

COVID-19 RESOURCES:

You can find information for students related to COVID-19 here: https://covid-19.ucla.edu/information-for-students/.

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 exams that are required for all students and then each student will choose a type of assessment that she or he believes is more appropriate.

- 1. Final exam (30%): Required. The final exam is scheduled on Friday, 18 December, 3-6 pm. You can take the final exam starting at 6 pm on Thursday, 17 December. The exam must be uploaded 3 hours after downloading and completed before 6 pm on Friday, 18 December.
- 2. Midterm 1 (20%): You have the option of taking a timed 2-hour midterm, a 24-hour midterm, an oral exam, or writing a paper. The timed exam will be on Tuesday, 27 October from 6-8 pm. The 24-hour exam will be assigned on Monday, 26 October at 8 pm and it will be due in 24 hours. The oral exam will take place during week 4. The topic of the paper will be assigned at the beginning of week 4 and it will be due by Thursday, 29 October at 8 pm.
- 3. Midterm 2 (20%): This will be a 2-hour exam assigned on Wednesday, 18 November and can be taken starting at 8 pm. The exam must be uploaded 2 hours after downloading and completed before 8 pm on 19 November.
- 4. Weekly quizzes (15%): There will be a quiz every week and students are required to take 2 quizzes in the first 5 weeks and 3 quizzes in the last 5 weeks. The days and times will vary.
- 5. Weekly homework (15%).

Note: Students will choose the type of assessment for midterm 1 at the end of week 3. All the assignments must be uploaded before the due day/time on Gradescope (https://www.gradescope.com).

The course grade will be based on the calculation

 $\label{eq:Final score} {\rm Final\ score} = 0.15 \times {\rm Homework}/{\rm Labs} + 0.15 \times {\rm Quizzes} + 0.20 \times {\rm Midterm1} + 0.20 \times {\rm Midterm2} + 0.30 \times {\rm Final\ score} + 0.30 \times {\rm Final\ score} + 0.30 \times {\rm Homework}/{\rm Labs} + 0.15 \times {\rm Quizzes} + 0.20 \times {\rm Midterm1} + 0.20 \times {\rm Midterm2} + 0.30 \times {\rm Final\ score} + 0.30 \times {\rm Final\ score} + 0.30 \times {\rm Homework}/{\rm Labs} + 0.15 \times {\rm Quizzes} + 0.20 \times {\rm Midterm1} + 0.20 \times {\rm Midterm2} + 0.30 \times {\rm Homework}/{\rm Labs} + 0.15 \times {\rm Quizzes} + 0.20 \times {\rm Midterm1} + 0.20 \times {\rm Midterm2} + 0.30 \times {\rm Homework}/{\rm Midterm2} + 0.30 \times {\rm$

and the choice of midterm 1 will be taken into consideration.

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

IMPORTANT DATES: First lecture: 02 October. Last lecture: 11 December. Holidays: Wednesday, 11 November (Veterans Day), Thursday-Friday, 26-27 November (Thanksgiving).

EXAMS:

All exams are open notes. You can use your class notes, handouts, homework, homework solutions, your statistical tables, in general all the material posted on the course website, the CCLE website, and any calculator or R.

Good luck!!!