Stat135, Spring 21
Concepts of Statistics

Course description

The course is an introduction to the basic theory of Statistics and its applications to concrete problems. We will become familiar with the theory of estimation and hypothesis testing as well as other important topics such as linear regression (least square methods) and the analysis of variance. We will study most of Chapters 6, and 8 to 14 in the text and review the material in earlier chapters as needed.
Practical implementation of the methods we will learn about will be an important part of the class. This will be done through the statistical software R.

Pre-requisites: A course in **probability theory equivalent to Stat 134**. For instance, I expect you to know very well how to compute mean, variance, etc.... Also I expect you know the law of large numbers and central limit theorem. See reminder handout on bCourses.
Familiarity with linear algebra (matrix operations, inverse of matrix, possibly eignevalues). Needed in the study of regression.
Good calculus skills, including multivariable calculus.
Some knowledge of R/Python – ability to import data in R; basic data analytic capabilities

Text: John Rice, Mathematical Statistics and Data Analysis.
3rd Edition is preferred – but 2nd edition will do.
Note: the price of this textbook has increased beyond reason.
Please don't spend that much on it (a used copy or a rental will do of course). The book is a good reference and I will assign the problems from it (3rd edition).
Beyond that we will not make a very intense use of the book.
The textbook is still much better than the other ones I looked at, many of which contained serious mistakes.

A possible alternative (not as good as Rice) is Devore and Berk.
You can find it at this link:
http://link.springer.com/book/10.1007%2F978-1-4614-0391-3

After you log-in into Calnet, you can download that book for free through spingerlink.
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Instructor
Noureddine El Karoui

GSIs

Lectures

Tuesday, Thursday 9:30-11:00 online

Grading (tentative)

You will have *weekly homework*. They will be due on Thursdays. They will always be due on **Monday by 11:59 pm**. Assignments will be posted on the website. We will drop your 2 lowest grades. Homework will count for *20%* of your grade. No late homework will be accepted. Homework may include data analysis in R.

Things may change regarding mid-term and final. I.e. I may increase the number of midterms and give them different weight.

There will be **one** midterm, one final, weekly homework (that may include data analysis in R).

The ***midterm*** will count for ***30%*** of your grade. If your final grade is higher than your mid-term grade, it will replace that grade. There will be no make-up midterms. The midterm will be **closed book**.

The ***Final*** will count for ***50%*** of your grade. There will be no alternative times. The final will be closed book.

Rules for the assignments

You are welcome to discuss the homework in small groups (2-3). You will need to write-up individually your own work and do your own computing. All the homework, code etc… need to be different from one person to another. (Changing the name of variables in code work does not make the codes different…)
No collaboration is allowed for exams (mid-terms and Final).
Typically I may give a long problem set; tell you on what problems you will be graded in detail; and you will get credit for seriously attempting the other problems.

Tentative schedule

Week	Topics
1	Intro + Param Estimation
2	Parameter Estimation (General and method of moments)
3	Parameter estimation (ML; examples and asymptotic theory)
4	Parameter Estimation (ML Continued; Efficiency)
5	Summarizing Data (qq-plots; measures of location and dispersion); Bootstrap
6	Testing (NP lemma)
7	Testing (LR tests; duality of CI and Tests)
8	Review and Midterm
9	Linear regression
10	Linear regression (cont'd; brief discussion of logistic regression)
11	Comparing two samples (param and non-param)
12	Comparing two samples; intro to ANOVA
13	ANOVA cont'd; Properties of Normal Distribution
14	Bayesian approach
15	Bayesian Approach and wrap-up