STAT 4320: MATHEMATICAL STATISTICS

COURSE INFORMATION AND SYLLABUS

Lectures. Monday and Wednesday, 1:45 PM–3:15 PM. Location: F50 JMHH, from August 30.

Instructor. Bhaswar B. Bhattacharya

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Office Hours: TBA.

Teaching Assistant. TBA.

Course Description and Syllabus. This is an advanced undergraduate course on the theoretical aspects of statistical estimation, hypothesis testing, and their applications. The following is a (tentative) list of topics that will be covered in the class:

- Review of probability and linear algebra, multivariate normal distribution.
- Asymptotics and simulation.
- Method of moments and maximum likelihood estimation, Cramér-Rao.
- Hypothesis testing: Neyman-Pearson, goodness of fit, two-sample problem, likelihood-ratio tests.
- Linear regression: Multivariate regression model, geometry of least squares, model selection.
- Generalized linear models, ridge regression, LASSO.
- Resampling methods: Bootstrap, permutations tests, cross-validation.
- Nonparametric inference: Empirical distributions, sign and rank tests.

Prerequisites. STAT 4300, STAT 4310, a year of calculus, and introductory linear algebra. *Any student not having this background should contact the instructor immediately.*

Textbook and References. The class has no required textbook. Lectures are self-contained, and students are expected to take notes. Additional materials are given as handouts when necessary. The following books will serve as a good reference:

- G. Casella and R. L. Berger, *Statistical Inference*, 2nd Edition, 2002.
- L. Wassermann, *All of Statistics: A Concise Course in Statistical Inference*, Springer, 2004.

Homework. There will be 3 homeworks. Homeworks will be due on Mondays or Wednesdays and must be handed in during class or in the BBB's mailbox (located on the 4th floor of Academic Research Building) by 7:00 PM on the date the assignment is due. *No late homework will be accepted, but the lowest score will be dropped.*

Exams. There will be a 2 midterms and a take-home final exam.
- Midterm 1: **October 4** (Wednesday) in class.
- Midterm 2: **November 8** (Wednesday) in class.
- Final: 24 hour take home final. Date: TBA.

Grading. The course grade will be based on the homeworks, a midterm, and a final.
- Homework: 10% (lowest score dropped)
- Midterm 1: 25%
- Midterm 2: 25%
- Final: 40%

Collaboration policy. Collaboration is permitted, but you must submit your own write-up, in your own words and using your own code for the programming exercises. Please indicate at the top of your write-up the names of the students with whom you worked.

Statistical computing. Basic familiarity with statistical computing (preferably in R) will be assumed. Few homework assignments will involve coding and statistical analysis on datasets provided.