STAT 4320: MATHEMATICAL STATISTICS

COURSE INFORMATION AND SYLLABUS

Lectures. Monday and Wednesday, 1:45 PM–3:15 PM. Location: F50 Jon M. Huntsman Hall (JMHH).

Instructor. Bhaswar B. Bhattacharya

Office**:** 419 Academic Research Building
Email**:** bhaswar@wharton.upenn.edu
Office Hours**:** Thursday, 4:00 PM-5:00 PM.

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 lemma, goodness of fit, two-sample problem, likelihood-ratio tests.
- Linear regression: Multivariate regression model, geometry of least squares, model selection.
- Classification: Logistic regression, nearest-neighbors.
- Generalized linear models, ridge regression, LASSO.
- Resampling methods: Bootstrap, permutations tests, cross-validation.

Prerequisites. STAT 4300 and STAT 4310. *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. *No late homework will be accepted, but the lowest score will be dropped.*

Quiz. There will be two in-class quizzes on **October 7, 2024 (Monday)** and **November 18, 2024 (Monday)**. *The quizzes will be closed book with a small number of "cheat sheets" allowed. Books, other notes, and computers are not allowed.*

Midterm. There will be a in-class midterm on **October 23, 2024 (Wednesday)**. *The midterm will be closed book, but you are allowed to bring your class notes and homework solutions with you. Laptops, computers, phones are not allowed.*

Final Exam. There will be a 24 hour take-home final exam at the end of the semester. The date and time of the final exam will be announced later.

Grading. The course grade will be based on the homeworks, a midterm, and a final.

- Homework: 30% (lowest score dropped)
- Quiz 1: 10%
- Midterm: 20%
- Quiz 2: 10%
- Final: 30%

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.