

Syllabus: Stats UB-103

Instructor: Joshua Loftus

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Class hours: Tu/Th/F 2:00-3:15pm

Classroom: Tisch 201

Course Description

This course examines modern statistical methods as a basis for decision making in the face of uncertainty. Topics include probability theory, discrete and continuous distributions, hypothesis testing, estimation, and statistical quality control. With the aid of computers, these statistical methods are used to analyze data. Also presented are an introduction to statistical models and their application to decision making. Topics include the simple linear regression model, inference in regression analysis, sensitivity analysis, and multiple regression analysis.

Exam schedule

Tentative dates for in-class midterms: TBD.

Required Materials

- We will make use of a number of free resources linked on the course page.
- On certain days students will be asked to bring a computer to class.

Tentative Outline

Items listed under “topics” and the last section, on machine learning, should be considered outside of the core concepts of the class. They are included to indicate the context and importance of the core concepts in the “modern” era of data science and machine learning. Homework and

exam questions will not require specific knowledge of these topics, and will only relate to the topics at most by asking how a particular core concept can be applied to them.

1. Measurement and experiments

- Reliability and validity
- Randomized controlled trials
- Observational studies, confounding

2. Description and visualization

- Summarizing data
- Histograms
- Other visualizations

3. Probability basics

- History, games, sets, counting
- Random variables, expectation, variance
- Theorems: Chebyshev, Bayes

4. Probability in statistics

- Estimation, bias and variance
- Sampling distributions, central limit theorem
- Topics: Stein's paradox, error propagation

5. Confidence intervals and tests

- Intervals, error bars, t -distribution
- Interpretation
- Hypotheses, falsification
- Bootstrap and resampling methods
- Topics: multiple testing

6. Regression

- Covariance, correlation, simple regression
- Prediction, intervals, tests, and interpretation
- Non-linearity, transformations, discrete predictors
- Multiple regression
- Topics: logistic regression, mixed effects models, causal inference

7. Machine learning

- Model selection, complexity, validation
- Classification

Course Policies

General Rules

- Be on time to class. Attendance is part of the grade.
- Do not use mobile devices in class. Laptops may be used only for taking notes.
- Late submission of assignments may be permitted with prior notice and on a case-by-case basis, but is generally highly discouraged and may result in half credit for the assignment.

Grading Policy

Final grades will be determined as follows:

- 30% distributed equally for 2 in class midterms.
- 30% for homework.
- 20% for a final project.
- 20% for participation.

Attendance is included under participation.

Code of Conduct

All students are expected to follow the Stern Code of Conduct <http://www.stern.nyu.edu/uc/codeofconduct>. A student's responsibilities include, but are not limited to, the following:

- A duty to acknowledge the work and efforts of others when submitting work as one's own. Ideas, data, direct quotations, paraphrasing, creative expression, or any other incorporation of the work of others must be clearly referenced.
- A duty to exercise the utmost integrity when preparing for and completing examinations, including an obligation to report any observed violations.
- To minimize the temptation for copying or sharing during an exam, there will be multiple versions of every exam, and the seating order will be randomly assigned.

Accommodations for Different Abilities

If you are qualified for academic accommodation of any kind during this course, you must notify me at the beginning of the course and provide a letter from the Moses Center for Students with Disabilities (CSD, 998-4980, www.nyu.edu/csd) verifying your registration and outlining the accommodations they recommend. If you will need to take an exam at the CSD, you must submit a completed Exam Accommodations Form to them at least one week prior to the scheduled exam time to be guaranteed accommodation.

Health and Wellness

To access the University's health and mental health resources, contact the NYU Wellness Exchange. You can call its private hotline (212-443-9999), available 24 hours a day, seven days a week, to reach out to a professional who can help to address day-to-day challenges as well as other health-related concerns.