Syllabus: Stats UB-103

Instructor: Joshua Loftus

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Office hours: by appointment Class hours: M/T/R 9:30-10:45am

Office: KMC 8-66 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.

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 laptop to class.

Tentative Outline

1. Experiments

    - RCTs
    - Observational

2. Description and graphing

    - Summaries
    - Histograms
    - Other common kinds of graphs

3. Probability definitions

- History/philosophy, random variables, expectation, variance
- Independence, basic theorems
- Bayes rule, common distributions, parameters

4. Probability in action

- Maximum likelihood, method of moments
- Sampling distributions
- Central limit theorem and binomial approximation
- delta-method, the "flaw of averages"

5. Confidence intervals

- Definition, means, proportions
- Where are the error bars?
- Resampling methods

6. Hypothesis tests

- Falsification, definition, relation to CIs
- Examples, one vs two sided
- p-values, controversies

7. Simple linear regression

- Lots of graphs, bivariate normal
- Correlation, prediction, transformation, estimation
- What could possibly go wrong?

8. Multiple linear regression

- Multivariate normal, some theorems
- Comparing two nested models

9. Other topics in regression

- Categorical variables
- Logistic regression
- High dimensional methods

10. Machine learning

- Model selection, validation
- Classification, ROC

It is possible the last item, machine learning, may be omitted if time does not permit.

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 3 in class midterms.

- **20%** for a comprehensive final exam.

- **20%** for homework.

- **20%** for a project.

- **10%** for 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.