Course Title: APSTA-GE 2351: Probability

Lecture: Monday 12 pm – 1:40 pm at Silver room 414

Office Hours:
Monday 2:00 pm – 3:30 pm

Office Hours at: 246 Greene Street, Room 208 (zoom office hours available by request)

Course Description:

This is a course in the foundations of statistical inference techniques. Assuming some prior exposure to foundational and intermediate statistical methods, this course will first cover topics such as Kolgomorov's axioms of probabilities, basics of set theory, discrete combinatorial probability, Bayes' theorem, probability distributions and their properties and assumptions of dependence and independence. These topics are followed by the foundational topics of statistics: sampling distributions, the law of large numbers and the central limit theorem. This course will mix theoretical approaches with simulation-based illustrations of these main topics. The student will be expected to understand the mathematical theory and apply the topics covered to problem solving, and perform simulations in statistical programming language such as R.

Course Prerequisites:

- REQUIRED: an introductory course in probability and statistics (non-calculus based) such as APSTA-GE 2001 and 2002.
- Recommended co-requisites: APSTA-GE 2003 and APSTA-GE 2352

Learning Objectives:

By the end of the course, students will be able to:

1. Demonstrate an understanding of probability through problem solving and simulation approaches.
2. Demonstrate an understanding of statistical distribution theory, emphasizing the properties of and relationships among random variables.
3. Demonstrate an understanding of sampling distributions and identify the role of asymptotics and variability in statistical inference.

Course Requirements:

The grade for this course will be determined as follows:

- Problem sets (60%)
- Shiny App Completion (10%)
- Final Exam (30%) – to be scheduled by NYU during the official exam period

Grading Scheme:

The following system will be used to convert numerical grades to letter grades:

A	92.5 – 100
A-	89.5 – 92.5
B+	86.5 – 89.5
B	82.5 – 86.5
B-	79.5 – 82.5
C+	76.5 – 79.5
C	72.5 – 76.5
C-	69.5 – 72.5
D+	66.5 – 69.5
D	62.5 – 66.5
F	0 – 62.5

ASSIGNMENT DETAILS

- The problem sets are designed to understand the concepts introduced in class and sharpen theoretical and computational skills.
- Students are encouraged to work together in groups no larger than 3 people on homework but must each submit independently written work.

Required Readings:

Required:

- Introduction to Probability (Joseph Blitzstein and Jessica Hwang) – 1st or 2nd edition
    - 2nd Edition will be posted to NYU Brightspace

Supplemental Texts:
- Introduction to Probability and Statistics Using R, G. Jay Kerns (1st edition)
- Introduction to Mathematical Statistics by Hogg, McKean and Craig (7th edition)
- A First Course in Probability by Sheldon Ross (9th edition)

A schedule of assigned readings will be posted to NYU Brightspace.

Topics (subject to change):

Unit	Topic	Knowledge blocks
1 and 2	Basics of Probability and Comparison with Statistics	Kolgomorov's axioms, basics of set theory (unions, intersections, complements), sample space events, hypothesis testing, estimation
3	Combinatorics and discrete probability	Discrete combinatorics including counting problems, partitions, sampling and enumeration
4 and 5	Conditional probability	Birthday Problem, Conditional probability, Independence, Dependence, Law of total probability, Bayes' Theorem and its applications, Monty Hall exercise
6	Review	Review of Unit 1
7	Random Variables and their properties	PDFs, CDFs, distribution functions, expectation, variance
8 and 9	Known distributions and their properties (discrete)	Bernoulli, Binomial. Geometric, Negative Binomial, Poisson, Hypergeometric distributions
10	Known distributions and their properties (continuous)	Uniform, Gamma, Beta, Exponential, Poisson Process
11	Normal and T	Normal, T, Cauchy distributions
12 and 13	Multivariate distributions, Independence, Dependence	Multivariate Normal, multinomial, joint distributions, Conditional distributions, and marginal distributions, independence, conditional independence, correlation and covariance
14	Inequalities and Limit Theorems and Final Exam Review	Law of Large Numbers revisited; Central Limit Theorem, Review

Office Hours:

Office hours are for you…and for me. If you want to learn more about the topic, I am interested in your thoughts and connecting you with resources. If you are excited about something else you have learned and want to try to connect it to our content, I am interested in discussing. If you are struggling with material or concepts, I am interested in trying to figure out where the roadblocks are. Bottom line, I am interested in you and your learning. Feel free to attend office hours as you need!

Communicating with Me:

My preferred method of communication is for you to email me or have you attend my office hours. Please keep in mind that I may not be checking my email account outside of standard business hours (Monday - Friday, 9AM - 5PM). Because of this, it is best if you can email me with at least 48 hours of notice before you require a response. I am always happy to hear from you to make this course a positive learning experience.

Extensions and Late Policy:

Due dates for all assignments will be provided when the assignment is assigned. In general, my late policy is to deduct 10 points for every day the assignment is late. However, I understand that factors outside of school may affect your ability to complete assignments on time. If this is the case, please speak to me ahead of the due date so that we can find a solution, which may or may not include a short extension depending on the circumstances. If I do not hear from you and the assignment is late, it will be subject to my usual late policy.

Academic Integrity:

All students are responsible for understanding and complying with the NYU Steinhardt Statement on Academic Integrity. A copy is available at: http://steinhardt.nyu.edu/policies/academic_integrity

Please note that any resources consulted, including other people, must be cited in all work that you submit. A failure to do so is a violation of our academic integrity policy.

Students Accessibility:

NYU's Moses Center for Student Accessibility provides comprehensive services and programs for NYU undergraduate and graduate students with hearing and visual impairments, mobility impairments, learning disabilities and attention deficit disorders, chronic illnesses, and psychological impairments. The Moses Center functions to determine qualified disability status and to assist students in obtaining appropriate accommodations and services. I fully support qualified students utilizing these services and encourage students to seek out the Moses Center for more information if you want to be assessed.

The Center is located at 726 Broadway, 2nd Floor, New York, New York 10003. Phone and TTY: 212-998-4980; Fax: 212-995-4114

Mental Health:

With everything going on in the world, it is natural that you may be experiencing undue personal and/or academic stress during the semester. The NYU Wellness Exchange (212 443 9999) offers a range of services to assist and support you. I am available to speak with you about stresses related to your work in my course, and I can assist you in connecting with the Wellness Exchange. Additionally, if you anticipate any challenges with completing the assignments, readings, exams and other work required in this course, I encourage you to register with the Moses Center (212 998 4980) in advance so that you may be granted the proper academic accommodations.