Hofstra University

Department of Mathematics

MATH 138-01 ***Mathematical Probability and Statistics II*** Spring 2025

Class Time: MW 8:00 A.M.-9:25 A.M. *Class Room*: Breslin Hall 0025

Instructor: Angel Pineda, Ph.D.
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Personal Zoom Meeting ID:
https://hofstra.zoom.us/my/angel.pineda

Office: Roosevelt 315C
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Office Hours: Monday: 10:15 A.M.-11:45 A.M.
Wednesday: 7:00 A.M.-7:45 A.M. and 9:40 A.M.-10:25 A.M.
Office hours will be held both in person and over Zoom by request

Textbook: Modern Mathematical Statistics with Applications (Springer Texts in Statistics) 3rd ed. 2021 Edition by Jay L. Devore, Kenneth N. Berk & Matthew A. Carlon.

Software: R and RStudio (available for free)
https://cran.rstudio.com/
https://posit.co/download/rstudio-desktop/

Course Description:
The following topics are covered over two semesters in MATH 137 and this course: discrete and continuous probability distributions, characteristics of distributions, sampling theory, estimation, hypothesis testing, correlation, regression and other topics.

Prerequisites:
MATH 073 Analytic Geometry and Calculus III and Math 137 Mathematical Probability and Statistics I.

Course Objectives:
After completing this course, the students should be able to:

- Characterize and compute probabilities with bivariate distributions.
- Understand and apply conditional distributions.
- Understand and apply transformations of multiple random variables.
- Understand and apply the method of moments and maximum likelihood for parameter estimation.
- Understand and apply hypothesis testing and parameter estimation for differences in proportions.
- Understand and apply likelihood ratio tests.
- Understand and apply analysis of variance.
- Understand and apply multiple linear regression.
- Understand and apply chi-squared tests.
- Utilize statistical language R (using RStudio) to verify theory and solve data science problems.
- Communicate your knowledge of statistical ideas effectively.

Relevance for Future Actuaries:
Along with preparing students for future practice and study in statistics, computer science and mathematical sciences in general, this course in combination with MATH 137, will help students prepare for the probability exam for actuaries:
https://www.soa.org/4a4bea/globalassets/assets/files/edu/2025/2025-01-exam-p-syllabus.pdf
In addition, this course, in combination with MATH 137, is designed to provide Validation by Educational Experience (VEE) credit in Mathematical Statistics:
https://www.soa.org/4ab486/globalassets/assets/files/edu/edu-vee-guidelines.pdf

Course Homepage (Canvas):
Here you will find four features that will be used in this course:

- *Email:* make sure that your email on Canvas is one that you check regularly. Homework assignments, announcements and other class related information will be sent via email.
- *Course Syllabus, Assignments and Modules:* information about the course, material covered each week, and assignments.
- *Discussions:* this online forum allows for students and faculty to communicate.
- *Grades:* students will be able to keep track of their grades online.

Assessment of Student Learning:
Homework and Quizzes (25 %)

Exam 1 (25 %): Wednesday, March 12
Exam 2 (25 %): Wednesday, April 23

Final Project (25 %)
Initial Project Presentation (in class): Wednesday, April 30
Initial R Markdown Document: Monday, May 5
Final Project Presentation: Monday May 12, 8:00 A.M. – 10:00 A.M.
Final R Markdown Document: Monday May 12, 8:00 A.M. – 10:00 A.M.

The class project will explore a topic of your choice applying probability and statistics. You will work by yourself or in pairs. The main idea is for you to find a problem that you are excited about which uses material from this course. Possible topics could be extensions of material in our text, may come from your own research projects, other classes or from outside sources. Details for the final project will be given after Exam 1

Tentative Grading Scale

Percent	93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	60-66	0-59
Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F

The exact grading scale will be determined after the final exam. The numerical scores in the tentative grading scale guarantee the associated letter grade but the instructor may change the scale to the student's benefit.

Dates to Remember

February 2:	Last day to add without department permission
February 17-18:	President's Break (No Classes)
February 23:	Last day to add/Last day to drop without a "W" on transcript
March 7:	Last day to file Pass/D/D+/Fail form
March 16-22:	Spring Break
March 17:	Mid-Semester Advisories due
April 10:	Last day to withdraw from individual courses
May 7:	Last Day of Classes/Last day to withdraw from all courses
May 8-9:	Snow/Study/Reading days

Class Policies

- Attendance is required. Students are expected to arrive on time.
- Failure to attend a class with an unexcused absence will result in a zero for quizzes given on that day. To receive an excused absence, proper documentation and instructor approval is needed.
- Late assignments will not be accepted after the solutions are distributed. In case assignments are handed in before the solutions are posted it will be marked 10% off for every day (or part thereof) it is late.
- No make-up exams will be given, unless you have a medical or family emergency. These emergencies require valid documentation. The grade for a missed exam is zero.
- Cell phones (or other technology not related to the class) in the classroom is only allowed with express permission of the instructor for special circumstances. In general cell phone or other potentially disruptive technology use is not allowed in class.

Calculator Policy
You are permitted to use any calculator during this course. For students taking the actuarial exams, it is recommended that you use one of the calculators on this list:
https://www.soa.org/education/exam-req/exam-day-info/edu-id-calculators/#calculators

Suggestions for Success

- The course requires a time commitment of about 6-9 hours outside of class time per week (2-3 per class hour). The material builds on itself, so it is very important not to fall behind.
- Find a study partner or group.
- Treat your homework and quizzes as a study guide for future exams. Write solutions to problems in a neat and organized fashion.
- Read the textbook. It will complement the presentation in lecture and help give you the big picture of the material.
- I encourage you to come to office hours regularly.

Academic honesty
You are expected to follow the Hofstra University Honor Code at all times. All forms of academic dishonesty are serious ethical and professional infractions. Hofstra's policy on academic honesty reads: "The academic community assumes that work of any kind – whether a research paper, a critical essay, a homework assignment, a test or quiz, a computer program, or a creative assignment in any medium - is done, entirely and without unauthorized assistance, by the individual(s) whose name(s) it bears." See the "Procedure for Handling Violations of Academic Honesty by Undergraduate Students at Hofstra University" (https://www.hofstra.edu/fps/11.html) for a detailed discussion of dishonesty and Hofstra's procedures for handling violations. Violations will be reported.

Working together with other students in the HW and the project is allowed and encouraged. In fact, having a study group is one of the ways that you can learn the material better. At the time of submitting your HW or your project, make sure that you write the solutions yourself and understand the submitted work. *You can use online sources to help you understand the problems and get ideas for the solutions but copying solutions online without working them out and writing them up yourself is cheating.*

Use of AI tools is permitted with acknowledgement. You may use AI/ML in this course if you use clear and accurate citations in the assignment submission where and how AI/ML tools have been used. *You should understand and be able to explain any solution generated by AI.* Any assignment that was completed with AI/ML tools must contain an appropriate citation. For example, when citing Chat GPT follow the guidelines here:
https://apastyle.apa.org/blog/how-to-cite-chatgpt

The academic integrity information allowing AI with acknowledgement is included here:
https://www.hofstra.edu/provost/policies-wording-syllabi-ai-acknowledgement.html

Accessibility
If you believe you need accommodations for a disability, please contact Student Access Services (SAS). In accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, qualified individuals with disabilities will not be discriminated against in any programs or services available at Hofstra University. Individuals with disabilities are entitled to accommodations designed to facilitate full access to all programs and services. SAS is responsible for coordinating disability-related accommodations and will provide students with documented disabilities accommodation letters as appropriate. Since accommodations may require early planning and are not retroactive, please contact SAS as soon as possible. All students are responsible for providing accommodation letters to each instructor and for discussing the specific accommodations needed with them and how they can be best implemented in each course. For more information on services provided by the university and for submission of documentation, please contact Student Access Services, 107 Student Center, (516) 463-7075.

Religious observances
If you have a religious obligation that conflicts with your participation in the course, you are responsible for notifying me far enough in advance for us to discuss your situation and agree on accommodations. For more information, see Part II(B) of "Academic Freedom and Civil Liberties of Students at Hofstra University" (https://www.hofstra.edu/fps/12.html).

Diversity
Hofstra University fosters a belief in an inclusive intellectual community, enriched and enhanced by the representations of diversity on the campus and within its learning spaces. Students from diverse backgrounds and perspectives will be well served in this education experience, and learning needs will be a priority in and out of the classroom. The diversity of identities and experiences that students bring to this class will be viewed as a resource, strength, and benefit. It is the goal and the responsibility of the instructor to present materials and activities respectful of diversity dimensions - race, gender, sexuality, ability, age, socioeconomic status, ethnicity, religion, culture, and other visible and nonvisible identities.

If you have any concerns about the class environment, I encourage you to speak with me. If you'd like to discuss issues related to your identity or how you might identify or are looking to connect with other students with identities similar to your own, please contact the Office of Intercultural Engagement and Inclusion at (516) 463-6957 or IEI@hofstra.edu. If you've experienced or been a witness to a discriminatory incident, please contact the university's Chief Diversity and Inclusion Officer at diversityinclusion@hofstra.edu.

Discriminatory harassment, relationship violence, and sexual misconduct
Hofstra prohibits sexual and other discriminatory harassment, stalking, domestic and dating violence, sexual assault and other sexual misconduct. If you or someone you know believes they have been subjected to any of these offenses, help is available. To make a report, or for more information (see https://www.hofstra.edu/title-ix/about.html), please contact the Title IX Officer for Student Issues at (516) 463-5841 or StudentTitleIX@hofstra.edu or Public Safety at (516) 463-6606. Confidential resources and support are also available from medical and counseling professionals in the Student Health and Counseling Center at (516) 463-6745 and clergy in the Interfaith Center.

Tentative Timeline

1. Joint Probability Distributions [3 weeks]
2. Method of Moments, Maximum Likelihood and Sufficiency [2 weeks]
3. Confidence Intervals and Hypothesis Testing for Proportions [1 week]
4. Likelihood ratio tests and multiple hypothesis testing [1 week]
5. Analysis of Variance [2 weeks]
6. Multiple Linear Regression [3 weeks]
7. Chi-squared tests [1 week]
8. Optional topics: Non-parametric Methods, Bayesian Estimation [2 weeks]

The material in this syllabus may be changed at the instructor's discretion. Any changes will be communicated to the students.