Fall 2019

MATH 662-101: Probability Distributions

S. Dhar

NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 662: Probability Distributions
Fall 2019 Graduate Course Syllabus

NJIT Academic Integrity Code: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

COURSE INFORMATION

Course Description: Probability, conditional probability, random variables and distributions, independence, expectation, moment generating functions, useful parametric families of distributions, transformation of random variables, order statistics, sampling distributions under normality, the central limit theorem, convergence concepts and illustrative applications.

Number of Credits: 3

Prerequisites: MATH 341 or MATH 333, and departmental approval.

Course-Section and Instructors

Course-Section	Instructor
Math 662-101	Professor S. Dhar

Office Hours for All Math Instructors: Fall 2019 Office Hours and Emails

Required Textbooks:

Title	*Introduction to Mathematical Statistics*
Author	Hogg, McKean, and Craig
Edition	8th
Publisher	Pearson
ISBN #	978-0134686998

University-wide Withdrawal Date:The last day to withdraw with a **W** is **Monday, November 11, 2019**. It will be strictly enforced.

POLICIES

DMS Course Policies: All DMS students must familiarize themselves with, and adhere to, the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. DMS takes these policies

very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

Homework/ Quizzes	15%
Class Participation (please see rubric)	10%
Midterm Exam I	20%
Midterm Exam II	20%
Final Exam	30%

Tentative Grading Scale: Your final letter grade will be **based on a curve** that ensures at least few A's. Practice problems, HW and Quiz assignments are posted on Math 662 course page. Homework is generally due within a week unless announced otherwise by the instructor. Solutions to the assignments will be handed out in class and discussed (please see the Math 662 Course page). Late homework cannot be accepted, since the solutions are already handed out.

Attendance Policy: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the Math Department's Attendance Policy. This policy will be strictly enforced. Class attendance and participation: please see rubric at the end of this document.

Homework Policy: No late homework will be accepted. Extensions may be granted at the instructor's discretion if sought **beforehand.**

Discussing homework with classmates and the instructor is encouraged. However, all homework are to be written and completed individually. Please refer to the university honor code (http://integrity.njit.edu/) if there are any ambiguities.

Quizzes: Quizzes may be given in class. These may be pop quizzes. There is no make-up for missed quizzes.

Course Policies: It is required that the student read the textbook for the material already covered in class by the instructor and confirm that the basic solved problems are understood and practice solving textbook problems. More explicitly, students must work on the examples and exercises and problems from the textbook on the topics already covered in class, and learn to solve them correctly. The student should compare his or her answers with those given at the end of the textbook or by the instructor. Instructor holds the right to modify in class exams, homework, quizzes dates in the best interest of the class. Official announcements are made using NJIT student emails or emails provided by students to NJIT as official emails.

- Any complaints regarding grading have to be presented immediately after receiving the graded quizzes / tests.
- Looking into your neighbors work during exams is not allowed. Keeping eyes hidden using hats, caps, etc. during exams is not allowed.
- Instructors will maintain a detailed record of you attendance which is reported to the NJIT administration.
- The use of laptops, cell phones, beepers, or any sort of communication devices (text messaging, internet, notepad, etc.) during regular classes, exams and quizzes are not allowed. Please note that the laptop should remain shut down during lecture time in class.
- No eating allowed during the class and exams periods. You are expected to remain in the classroom for the entire class period. Wandering in and out of the classroom is not allowed.

Exams: There will be one midterm exam held in class during the semester and one comprehensive final exam. Exams are held on the following days:

Exam I	October 9, 2019
Exam II	November 13, 2019
Final Exam Week	December 14 - 20, 2019

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the Math Department's Examination Policy. This policy will be strictly enforced.

Makeup Exam Policy: To properly report your absence from a midterm or final exam, please review and follow the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

ADDITIONAL RESOURCES

Accommodation of Disabilities: Disability Support Services (DSS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services at 973-596-5417 or via email at lyles@njit.edu. The office is located in Fenster Hall, Room 260. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Disability Support Services (DSS) website at:

- https://www.njit.edu/studentsuccess/accessibility/

Important Dates (See: Fall 2019 Academic Calendar, Registrar)

Date	Day	Event
September 3, 2019	T	First Day of Classes
September 13, 2019	F	Last Day to Add/Drop Classes
November 11, 2019	M	Last Day to Withdraw
November 26, 2019	T	Thursday Classes Meet
November 27, 2019	W	Friday Classes Meet
November 28-29, 2019	R-F	Thanksgiving Recess
December 11, 2019	W	Last Day of Classes
December 12, 13 2019	R & F	Reading Days
December 14-20, 2019	F – R	Final Exam Period

Course Outline

Lecture	Date	Topic
1	9/4	**CHAPTER 1:** ***Probability & Distributions*** The probability set function, conditional probability and independence, random variables, discrete and continuous random variables, probability mass functions (p. m. f.) and density functions (p. d. f.).
2	9/11	**CHAPTER 1:** ***Probability & Distributions*** Transformations, expected value of a random variable, some special expectations.
3	9/18	**CHAPTER 1:** ***Probability & Distributions*** Moment generating functions (m. g. f.), important inequalities. Functions of a single r. v., the generalized inverse of a c. d. f., a transformation of any r. v. leading to uniform distribution, relationship to simulation.

4	9/25	**CHAPTER 2:** ***Multivariate Distributions*** Distribution of two random variables, transformations, conditional distributions and expectations.
5	10/2	**CHAPTER 2:** ***Multivariate Distributions*** Correlation coefficient, independent random variables, extension to several random variables.
6		**EXAM I: OCTOBER 9, 2019**
7	10/16	**CHAPTER 2**: ***Multivariate Distributions*****,** Some Special Distributions, Random vector transformation, Linear Combinations of Random Variables, binomial and related distributions: geometric, negative binomial. Hypergeometric distribution, Poisson distribution.
8	10/23	**CHAPTER 3:** ***Some Special Distributions*** Exponential, gamma, uniform distribution chi-squared, beta and normal distributions. Multivariate Normal distribution.
9	10/30	**CHAPTER 3:** ***Some Special Distributions*****,** ***Unbiasedness*** t and F-distributions, distribution of sample mean and variance under normality, mixture distributions.
10	11/6	**CHAPTER 5:** ***Convergence in Probability*****,** ***Convergence in Distribution***
11		**EXAM II: NOVEMBER 13, 2019**
12	11/20	**CHAPTER 4:** ***Sampling and Statistics*****,** ***Order Statistics***
13	12/4	**CHAPTER 5 :** ***Delta Method*****,** ***MGF Technique*****,** ***Central Limit Theorem***
14	12/11	**REVIEW**

Grade Criteria for Class Participation (out of a maximum of 4)

Once the student names are uniquely identified, from there onwards each student will receive a score of 0 to 4 at the end of the each class according to the following criteria:

0: Student is absent (please give proof of extenuating circumstance). Student has sustained attention on laptop/electronic devices. Not participating in the class at all. She/he is disruptive and says little or nothing in class. Contributions in class reflect inadequate preparation. Ideas offered are seldom substantive, provides few if any insights, and never a constructive direction for the class. Integrative comments are absent. If this person were not a member of the class, valuable class-time would be saved.

1: Student is present and not disruptive. Tries to respond when called on but does not offer much. Student demonstrates very infrequent involvement in class discussion. This person says little or nothing in class. Hence, there is not an adequate basis for evaluation. If this person were not a member of the class, the quality of discussion would not be changed.

2: Student demonstrates adequate preparation: knows basic facts, but does not show evidence of trying to interpret or analyze them. She/he offers straightforward information (e.g., straight from the textbook), without elaboration or very infrequently (perhaps once a class). Does not offer to contribute to discussion, but contributes to a moderate degree when called on. Student demonstrates sporadic involvement. Contributions in class reflect satisfactory preparation. Ideas offered are sometimes substantive, provides generally useful insights but seldom offer a new direction for the discussion. If this person were not a member of the class, the quality of discussion would be diminished somewhat.

3: Student demonstrates good preparation: knows covered course material well, has thought through implications of them. She/he offers interpretations and analysis of course material (more than just facts) to class. Student contributes well to discussion in an ongoing way: responds to other students' points, thinks through their own points, questions others in a constructive way, offers and supports suggestions that may be counter to the majority opinion. Student demonstrates consistent ongoing involvement. Contributions in class reflect thorough preparation. Ideas offered by the student are usually substantive; provide good insights, and sometimes direction for the class. If this person were not a member of the class, the quality of discussion would be diminished.

4: Student demonstrates excellent preparation: has analyzed covered course material exceptionally well, relating it to readings and other material (e.g., readings, course material, etc.). She/he offers analysis, synthesis, and evaluation of covered course material, e.g., puts together pieces of the discussion to develop new approaches that take the class further. Student contributes in a very significant way to ongoing discussion: keeps analysis focused, responds very thoughtfully to other students' comments, contributes to the cooperative argument-building, suggests alternative ways of approaching material and helps class analyze which approaches are appropriate, etc. She/he demonstrates ongoing very active involvement. Contributions in class reflect exceptional preparation. Ideas offered are always substantive, and provide one or more major insights as well as direction for the class. If this person were not a member of the class, the quality of discussion would be diminished markedly.

The average score out of the maximum of 4 is used to calculate the class participation score.