Ma 351 Theory of Probability (Fall 2012)

Time and Place. M,W,F 8:00-9:20, E380

Instructor. Dr. Gabriela Sanchis, 384 G Esbenshade Hall, Office Phone: 361-1339

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Office Hours. T, Th: 9:00-10:00 a.m. and 1:30-2:30 p.m.; W: 9:30-10:30 p.m.; and by appointment.

Textbook. A First Course in Probability (8th Edition) by Sheldon Ross

Prerequisites. Ma 222 and Ma 235.

Course Objectives. To provide an elementary introduction to the mathematical theory of probability and the many diverse possible applications of the subject.

Learning Outcomes. Students will be able to:

- Define various probabilistic concepts.
- Apply combinatorial methods to compute probabilities of events where the sample space is finite or countably infinite.
- Compute conditional probabilities.
- Solve problems involving discrete and continuous random variables.
- Solve problems involving jointly distributed random variables.
- Compute moment-generating functions of random variables and use them to solve problems.
- Apply the Central Limit Theorem to solve problems.

Attendance. You are expected to attend all classes. Excessive amounts of absenteeism may result in a lower grade. If you do miss a class, it is your responsibility to obtain from a classmate any notes, assignments, handouts, or anything else you may have missed.

Homework. There will be weekly homework assignments which will be collected and graded. You may work together on these assignments, but you must write up and hand in your own solutions. To receive full credit on a problem, your solution must be complete, accurate, clearly written, and easy to follow. Homework must be turned in at the beginning of class on the due date. Your lowest homework grade will be dropped.

WebWorK. I will be using the on-line homework delivery system WebWorK. These online homeworks are optional. If you choose to do these assignments, they must be completed by the due dates, and they can replace up to three percent of an in-class test grade. There is a link to WebWork on the Blackboard course website, or you can point your browser to the url https://courses.webwork.maa.org/webwork2/etown-ma351/. To log in, use your network user id for your username, and your student id number for your password.

Exams. There will be three in-class exams, tentatively scheduled for Wednesday September 26, Friday October 26, and Friday November 30. Your comprehensive final exam is scheduled for Friday, December 14, 7:30 to 10:30 a.m. **No electronic devices of any kind (including calculators) are allowed on exams.**

Academic Integrity. All work must be one's own and must comply with the Standards of Academic Integrity defined in the Elizabethtown College Catalog (see http://catalog.etown.edu/ and then click on **Academic Policies** in the menu on the left, and then on **Academic Judicial System**). More specifically, no collaboration is allowed on exams. Collaboration on homework is allowed as described above in the section on homework.

Grading. 94-100 A; 90-93 A-; 87-89 B+; 83-86 B; 80-82 B-; 77-79 C+; 73-76 C; 70-72 C-; 67-69 D+; 63-66 D; 60-62 D-; below 60 F

Course grades will be calculated according to the following weighting:
Homework: 21% In-Class Exams: 54% Final Exam: 25%

Disability. Elizabethtown College welcomes otherwise qualified students with disabilities to participate in all of its courses, programs, and activities. If you have a documented disability and require accommodations to access course material, activities, or requirements, you must:

(1) Contact the Director of Disability Services, Lynne Davies, in the Center for Student Success, BSC 228, by phone (361-1227) or email daviesl@etown.edu.
(2) Meet with me, the instructor, within two weeks of receiving a copy of the accommodation letter from Disability Services to discuss your accommodation needs and their implementation.

Tentative List of Topics

Chapter 1: Combinatorial Analysis
1.1 Introduction
1.2 The Basic Principle of Counting
1.3 Permutations
1.4 Combinations
1.5 Multinomial Coefficients

Chapter 2: Axioms of Probability
2.1 Introduction
2.2 Sample Space and Events
2.3 Axioms of Probability
2.4 Some Simple Propositions
2.5 Sample Spaces Having Equally Likely Outcomes

Chapter 3: Conditional Probability and Independence
3.1 Introduction
3.2 Conditional Probabilities
3.3 Bayes' Formula
3.4 Independent Events
3.5 $P(\cdot|F)$ is a Probability

Chapter 4: Random Variables
4.1 Random Variables
4.2 Discrete Random Variables
4.3 Expected Value
4.4 Expectation of a Function of a Random Variable
4.5 Variances
4.6 The Bernoulli and Binomial Random Variables
4.7 The Poisson Random Variable
4.8 Other Discrete Probability Distributions
4.9 Expected Value of Sums of Random Variables
4.10 Properties of the Cumulative Distribution Function

Chapter 5: Continuous Random Variables
5.1 Introduction
5.2 Expectation and Variance of Continuous Random Variables
5.3 The Uniform Random Variable
5.4 Normal Random Variables
5.5 Exponential Random Variables
5.6 Other Continuous Distributions
5.7 The Distribution of a Function of a Random Variable

Chapter 6: Jointly Distributed Random Variables
6.1 Joint Distribution Functions
6.2 Independent Random Variables
6.3 Sums of Independent Random Variables
6.4 Conditional Distributions: Discrete Case
6.5 Conditional Distributions: Continuous Case
6.6 Order Statistics

Chapter 7: Properties of Expectation
7.1 Introduction
7.2 Expectation of Sums of Random Variables
7.3 Moments of the Number of Events that Occur
7.4 Covariance, Variance of Sums, and Correlations
7.5 Conditional Expectation
7.7 Moment-Generating Functions

Chapter 8: Limit Theorems
8.1 Introduction
8.2 Chebyshev's Inequality and the Weak Law of Large Numbers
8.3 The Central Limit Theorem