Ma 351 Theory of Probability (Fall 2013)

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. M,T,Th: 2-3:20; W:9:30-10:50; 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 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.
- Apply course material to model problems in actuarial science.

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 consist of a combination of online homework (WebWorK) and hand-in assignments. The WebWorK web site is https://courses1.webwork.maa.org/webwork2/etown-ma351. Your username is the same as your email username, and your initial password is your 7-digit student id number. You are encouraged to work together and help each other on these assignments, but you must write up your own solutions to hand-in assignments.

Exams. There will be three in-class exams, tentatively scheduled for Wednesday September 18, Friday October 18, and Friday November 22. Your comprehensive final exam is scheduled for Monday, December 9, 7:30 to 10:30 a.m. **No graphing 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: 25% In-Class Exams: 50% Final Exam: 25%

Disability. Elizabethtown College welcomes otherwise qualified students with disabilities to participate in all of its courses, programs, services, and activities. If you have a documented disability and would like to request accommodations in order to access course material, activities, or requirements, please contact the Director of Disability Services, Lynne Davies, by phone (361-1227) or e-mail daviesl@etown.edu. If your documentation meets the colleges documentation guidelines, you will be given a letter from Disability Services for each of your professors. Students experiencing certain documented temporary conditions, such as post-concussive symptoms, may also qualify for temporary academic accommodations and adjustments. As early as possible in the semester, set up an appointment to meet with me, the instructor, to discuss the academic adjustments specified in your accommodations letter as they pertain to my class.

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

Insurance Topics
Mixtures of Distributions
Applications to Insurance

Chapter 8: Limit Theorems
8.3 The Central Limit Theorem