Probabilistic Methods in Engineering and Science  
EE3384  
Syllabus – Spring 2015  

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1 General Information

- **Course ID:** Probabilistic Methods in Engineering and Science, EE3384-001, CRN-21575  
- **Time:** Monday and Wednesday, 4:30 pm – 5:50 pm  
- **Textbook:** [Kay05] and [Mat]  
- **Lecture Room:** CRBL C205  
- **Prerequisites:** MATH 2313 and EE 2353 each with a grade “C” or better  
- **Instructor:** von Borries – rvonborries@utep.edu  
- **Office:** Engineering Building 313  
- **Office Hours:** Monday and Wednesday 12:00 pm to 1:00 pm and 6:00 pm to 7:00 pm  
- **Version:** January 26, 2015.

2 Catalog Description

Problems involving discrete and continuous random variables, distribution functions, moments, statistical dependence, and an introduction to statistical methods. Emphasis to be on formulation of physical problems. Prerequisites: MATH 2313 and EE 2353 each with a grade “C” or better.

3 Student Outcomes

- Solve basic counting problems involving permutations and combination of equally-likely events (I).  
- Use elements of set theory and axioms of probability to determine the probability of complex events and apply Bayes’ theorem to the solution of conditional probability (C).  
- Solve problems involving independent events and independent random variables (C).  
- Determine marginal and Joint cumulative distribution functions, probability density functions and use them to compute various expected values of discrete and continuous random variables (C).
• Solve problems involving Gaussian, uniform, exponential, binomial and Poisson random variables (C).

• Compute probability density functions and cumulative density functions of a random variable (I).

• Compute expected values of sums of random variables and the covariance and correlation of pairs of random variables (C).

4 Syllabus

1. Introduction
   • What is probability?

2. Computer Simulation
   • Why use computer simulation?
   • Introduction to Matlab (You should have access to MATLAB).

3. Basic Probability
   • Review of set theory.
   • Properties of the probability function.
   • Combinatorics.

4. Conditional Probability
   • Joint events and the conditional probability.
   • Statistically independent events.
   • Bayes’ theorem.

5. Discrete Random Variables
   • Definition of discrete random variable.
   • Probability of discrete random variables.
   • Probability mass function.
   • Cumulative distribution function.

6. Expected Values for Discrete Random Variables
   • Determining averages from the probability mass function.
   • Expected values.
   • Variance of a random variable.
   • Estimating mean and variance.

7. Multiple Discrete Random Variables
8. **Conditional Probability Mass Functions**
   - Joint, conditional and marginal probability mass functions.
   - Mean of the conditional probability mass function.

9. **Continuous Random Variables**
   - Definition of continuous random variable.
   - Probability density function.
   - Cumulative distribution function.

10. **Expected Values for Continuous Random Variables**
    - Determining the expected value.
    - Expected values for important probability density functions.
    - Variance of a random variable.
    - Estimating mean and variance.

11. **Multiple Continuous Random Variables**
    - Jointly distributed random variables.
    - Marginal probability density functions and cumulative distribution functions.
    - Independence of multiple random variables.
    - Expected Values.

12. **Conditional Probability Density Functions**
    - Joint, conditional and marginal probability density functions.
    - Mean of the conditional probability density function.

13. **Introduction to Statistical Methods**

5. **Evaluation**
   - Homework 10
   - Participation 5
   - Exam I 20
   - Exam II 20
   - Exam III 20
   - Comprehensive 25

All exams in the classroom.
6 Grading

\[ A = 100 - 90\%, \quad B = 90 - 80\%, \quad C = 80 - 70\%, \quad D = 70 - 60\% \text{ and } F = 60 - 0\% . \]

7 Attendance

Class attendance is mandatory and will be monitored. Any student who has more than two unexcused absences will be dropped out of the EE3384.

8 Accommodations and Support Services

If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cassutep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

9 Related Reading

You will enjoy reading the following books related to probability and its applications: history [Sal02], chance [Mlo08], prediction [Sil12] and brain (multitasking) [Med14].

References


# 10 Calendar

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Exam 1: Chapters 1, 2, 3 and 4  
February 23  
Exam 2: Chapters 5, 6 and 7  
April 6  
Exam 3: Chapters 10, 11, 12 and 13  
May 6  
Exam Final: Comprehensive  
May 11, 4:00 pm to 6:45 pm  
Spring Break: No classes  
March 9–13
11 Reading Assignment I

11.1 Chapter 1
- Sections 1.1, 1.2, 1.3, 1.4 and 1.5.
- Problems 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.12, 1.13, 1.14 and 1.15.
- Binomial distribution

11.2 Chapter 2
- Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6 and Appendix 2A.
- Problems 2.1, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.15.
- Matlab: vector, stem, plot, axis, xlabel, ylabel, hist
- Matlab: rand, randn

11.3 Chapter 3
- Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7 and 3.8.

11.4 Chapter 4
- Sections 4.1 to 4.7.
- Problems 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.13, 4.14, 4.15, 4.19, 4.22, 4.24, 4.27, 4.32, 4.34, 4.35, and 4.42

12 Reading Assignment II

12.1 Chapter 5
- Sections 5.1 to 5.10.
- Problems 5, 8, 12, 19 to 21, 23 to 29 and 31.

12.2 Chapter 6
- Sections 6.1 to 6.6, (6.7), 6.8 and 6.9 (we will not study Section 6.7 in detail).
- Problems 1 to 8, 10, 13, 16 to 18, 21, 22, 25 and 27.
12.3 Chapter 7

- Sections 7.1 to 7.5 (7.6 and 7.7 concentrate on the material seen in the lectures).
- Problems 2, 3, 7, 8, 12, 14, 18, 22, 27, 28, 29 and 32.

13 Reading Assignment III

13.1 Chapter 10

- Sections 10.1 to 10.6, 10.7 (concentrate on the material seen in the lecture), 10.8 to 10.10.
- Problems 1, 2, 4 to 6, 10 to 13, 20, 21, 28, 33, 41, 45, 48 to 51.

13.2 Chapter 11

- Sections 11.1 to 11.6, 11.8 to 11.10.
- Problems 1, 2, 10, 11, 17, 20, 23, 24, 27, 30, 31, 33, 35, 36.

13.3 Chapter 12

- Sections 12.1 to 12.7, 12.9 and 12.11.
- Problems 6 to 9, 11, 14, 15, 18, 19, 22, 25, 26, 28, 30, 52, 56.