

ENEE 324 Engineering Probability

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Text: A. Leon-Garcia, *Probability and Random Processes for Electrical Engineering*, 2nd ed., Addison-Wesley, 1994

HOMEWORK

- Homework will be assigned each week after the related material is presented in class. It may be assigned Monday and/or Wednesday.
- Homework is due at the beginning of the next class after it was assigned.
- Late homework will not be accepted but the two lowest scores will be dropped.
- Homework solutions will be discussed in the recitation sections.

EXAMS

There will be two exams during the semester and a comprehensive final exam. All exams will be **closed book**. No calculators, notebook computers, etc., will be allowed.

Final Exam Date: Saturday, December 16, 8:00am – 10:00 am

	Chapters	Percent of Grade
EXAM 1	1–3	25
EXAM 2	4–6	25
FINAL EXAM	Comprehensive	40
Homework		10

COURSE OUTLINE

I. Introduction (Chapter 1)

A. Reasons for studying probability

- B. Brief history
- II. Basic Concepts of Probability (Chapter 2)
 - A. Elementary set theory
 - B. Random Experiments
 - 1. experiments and outcomes
 - 2. The sample space
 - 3. events
 - C. The Probability Space
 - 1. Probability Measure
 - 2. Axioms of Probability
 - 3. Useful corollaries
 - 4. Discrete and continuous sample spaces
 - D. Discrete Probability Spaces
 - 1. Permutaions and Combinations
 - 2. Probabilities for experiments with equally likely outcomes
 - E. Conditional Probability
 - 1. Definition
 - 2. Total Probability Rule
 - 3. Probability Trees
 - 4. Bayes' Rule
 - F. Independent Events
 - G. Repeated Experiments
- III. One-Dimensional Random Variables (Chapter 3)
 - A. Definition of a random variable
 - B. Discrete random variables
 - 1. Probability mass function
 - 2. Examples – uniform, binomial, Poisson
 - C. Cumulative distribution function (cdf)
 - D. Probability density function (pdf)
 - E. Continuous random variables
 - 1. Examples – uniform, exponential, Gaussian, ...
 - F. One function of one random variable
 - 1. Finding new cdf and then pdf
 - 2. New pdf from old by Transformation Theorem

- IV. Two and Higher Dimensional Random Variables (Chapter 4)
 - A. Joint and marginal probability mass functions
 - B. Joint cdf and pdf
 - C. conditional pdf
 - D. Independent random variables
 - E. One function of two random variables
 - F. Two functions of two random variables
 - G. Extension to higher dimensional random variables
- V. Expected Values (Chapters 3 and 4)
 - A. The mean or expected value of a random variable (3.6)
 - B. Expected value of a function of a random variable (3.6)
 - C. Variance (3.6)
 - D. Chebyshev's Inequality (3.7)
 - E. Covariance and correlation coefficient (4.7)
 - F. Moment generating and characteristic functions (3.9, 4.7, 4.8)
- VI. Limit Theorems (Chapter 5)
 - A. Law of Large Numbers
 - B. Central Limit Theorem
- VII. Random or Stochastic Processes (Chapter 6)
 - A. Ensemble of sample functions
 - B. n-th order statistics
 - C. Mean and autocorrelation functions
 - D. Random telegraph and binary random waves
- VIII. Stationary Random Processes (Chapters 6 and 7)
 - A. Definition of wide-sense stationarity
 - B. Mean and autocorrelation functions
 - C. Power spectral density
 - D. Stationary processes and linear, time-invariant systems
 - E. Thermal noise
 - F. Shot noise
- IX. Selected Additional Topics