Probability with Engineering Applications

Lecture Notes for ECE 313

Fall 1997

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Preface

These lecture notes, intended as a *supplement* to the required textbook for ECE 313: S. Ross, *A First Course in Probability* (5th edition) Prentice-Hall 1997, are based on the material that I used to teach ECE 313 in Fall 1997. The lecture notes (in Portable Document Format) were made available to interested students via the course home page. Most students did print them out for ease in reading. Many even brought the notes to class to save themselves the trouble of frantically scribbling notes during classroom discussions.

Not everything in these lecture notes was covered in class in Fall 1997. In contrast, I was able to cover all the material in Spring 1997 when I used viewgraphs and did not spend as much time writing on the blackboard. I have embellished the lecture material with some comments and remarks as well as several exercises, all of which are intended to help students understand the concepts presented in class. In some instances, the comments remind students of key facts that make it clear how a particular statement made in class (and in the notes) follows from the previously presented results. The comments occasionally have a few details that were skipped in classroom discussion, or (horrors!) they sometimes suggest that students work out the details of some derivation all by themselves. Some of these comments (usually in paraphrased form) were made orally during the lectures, and their inclusion in the lecture notes saved students the trouble of scribbling down these pearls of wisdom.

Other information about ECE 313, including problem sets from the Fall 1997 and Spring 98 offerings of ECE 313, can be found on the ECE Department Web Server with URL *http://www.ece.uiuc.edu/~ece313/*

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Urbana, Illinois
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ECE 313: Probability with Engineering Applications

Syllabus

	Hours
Approaches to Probability	5
Subjective approach, classical approach, relative frequency approach, modeling issues; the axiomatic approach. Consequences of the axioms and examples, use of Venn diagrams and Karnaugh maps, principle of inclusion and exclusion.	
Conditional Probability	6
Definition of conditional probability, theorem of total probability, Bayes' formula and its use. Bayes' rule for deciding among competing hypotheses, maximum-likelihood (ML) rule, Type I and Type II errors	
Independence and Independent Trials	6
Stochastic independence of two events, Independence of multiple events, Reliability of systems and networks, Independent experiments and trials,	
Random Variables	12
Definition, Cumulative Distribution Function of a random variable: Discrete and continuous random variables: Mean and variance: mean, mode and median as measures of location, Markov's inequality; variance, Chebyshev's inequality and variance as a measure of spread. Examples of discrete and continuous distributions: Function of a random variable: expectation of a function of a random variable. Conditional Distributions: Reliability and Hazard rates: Hypothesis testing: Maximum-likelihood estimation of parameters of distributions:	
Many Random Variables	11
Joint distributions, covariance and correlation coefficient, jointly Gaussian random variables. Sums of random variables, other functions of many random variables, conditional distributions. Linear regression	
Limit Theorems	2
Markov's Inequality, Chebyshev's Inequality, Weak law of large numbers and central limit theorem	
Exams	
Total	44

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