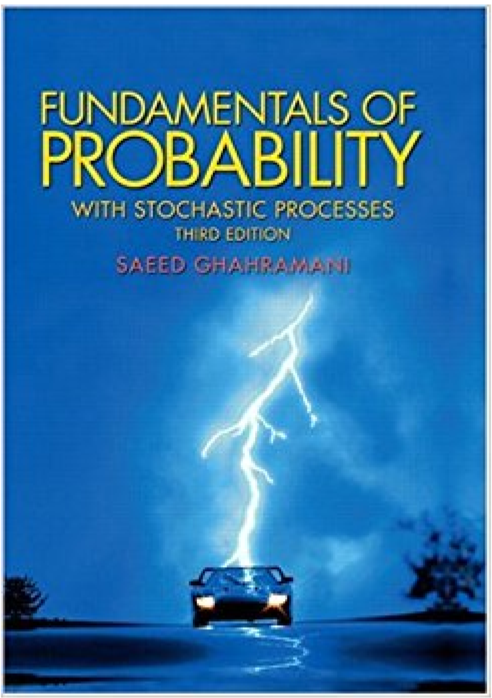
Fundamentals Of Probability, With Stochastic Processes (3rd Edition)



Synopsis

Presenting probability in a natural way, this book uses interesting, carefully selected instructive examples that explain the theory, definitions, theorems, and methodology. Fundamentals of Probability has been adopted by the American Actuarial Society as one of its main references for the mathematical foundations of actuarial science.   Topics include: axioms of probability; combinatorial methods; conditional probability and independence; distribution functions and discrete random variables; special discrete distributions; continuous random variables; special continuous distributions; bivariate distributions; multivariate distributions; sums of independent random variables and limit theorems; stochastic processes; and simulation.   For anyone employed in the actuarial division of insurance companies and banks, electrical engineers, financial consultants, and industrial engineers.

Book Information

Paperback: 644 pages

Publisher: Pearson; 3 edition (August 1, 2004)

Language: English

ISBN-10: 0131453408

ISBN-13: 978-0131453401

Product Dimensions: 7.4 x 1.3 x 9 inches

Shipping Weight: 2.4 pounds

Average Customer Review: 2.9 out of 5 stars   24 customer reviews

Best Sellers Rank: #237,486 in Books (See Top 100 in Books)   #17 inÂ Books > Science & Math > Mathematics > Applied > Stochastic Modeling   #864 inÂ Books > Textbooks > Science & Mathematics > Mathematics > Statistics   #1216 inÂ Books > Science & Math > Mathematics > Applied > Probability & Statistics

Customer Reviews

This one- or two-term basic probability text is written for majors in mathematics, physical sciences, engineering, statistics, actuarial science, business and finance, operations research, and computer science. It can also be used by students who have completed a basic calculus course. Our aim is to present probability in a natural way: through interesting and instructive examples and exercises that motivate the theory, definitions, theorems, and methodology. Examples and exercises have been carefully designed to arouse curiosity and hence encourage the students to delve into the theory with enthusiasm.   Authors are usually faced with two opposing impulses. One is a tendency to put too much into the book, because everything is important and everything has to be said the author's way! On the other hand, authors must also keep in mind a clear definition of the focus, the level, and the audience for the book, thereby choosing carefully what should be "in" and what "out." Hopefully, this book is an acceptable resolution of the tension generated by these opposing forces.

Instructors should enjoy the versatility of this text. They can choose their favorite problems and exercises from a collection of 1558 and, if necessary, omit some sections and/or theorems to teach at an appropriate level.   Exercises for most sections are divided into two categories: A and B. Those in category A are routine, and those in category B are challenging. However, not all exercises in category B are uniformly challenging. Some of those exercises are included because students find them somewhat difficult.   I have tried to maintain an approach that is mathematically rigorous and, at the same time, closely matches the historical development of probability. Whenever appropriate, I include historical remarks, and also include discussions of a number of probability problems published in recent years in journals such as Mathematics Magazine and American Mathematical Monthly. These are interesting and instructive problems that deserve discussion in classrooms.   Chapter 13 concerns computer simulation. That chapter is divided into several sections, presenting algorithms that are used to find approximate solutions to complicated probabilistic problems. These sections can be discussed independently when relevant materials from earlier chapters are being taught, or they can be discussed concurrently, toward the end of the semester. Although I believe that the emphasis should remain on concepts, methodology, and the mathematics of the subject, I also think that students should be asked to read the material on simulation and perhaps do some projects. Computer simulation is an excellent means to acquire insight into the nature of a problem, its functions, its magnitude, and the characteristics of the solution. Other Continuing Features The historical roots and applications of many of the theorems and definitions are presented in detail, accompanied by suitable examples or counterexamples. As much as possible, examples and exercises for each section do not refer to exercises in other chapters or sections—a style that often frustrates students and instructors. Whenever a new concept is introduced, its relationship to preceding concepts and theorems is explained. Although the usual analytic proofs are given, simple probabilistic arguments are presented to promote deeper understanding of the subject. The book begins with discussions on probability and its definition, rather than with combinatorics. I believe that combinatorics should be taught after students have learned the preliminary concepts of probability. The advantage of this approach is that the need for methods of counting will occur naturally to students, and the connection between the two areas becomes clear from the beginning. Moreover, combinatorics becomes more interesting and enjoyable. Students beginning their study of probability have a tendency to think that sample spaces always have a finite number of sample points. To minimize this proclivity, the concept of random selection of a point from an interval is introduced in Chapter 1 and applied where appropriate throughout the, book. Moreover, since the basis of simulating indeterministic problems is selection of random points from (0, 1), in order to understand simulations, students need to be thoroughly familiar with that concept. Often, when we think of a collection of events, we have a tendency to think about them in either temporal or logical sequence. So, if, for example, a sequence of events A1, A2, . . . , An occur in time or in some logical order, we can usually immediately write down the probabilities P(A1), P(A2 A1), ..., P(An A1A2 . . . An-1) without much computation. However, we may be interested in probabilities of the intersection of events, or probabilities of events unconditional on the rest, or probabilities of earlier events, given later events. These three questions motivated the need for the law of multiplication, the law of total probability, and B ayes' theorem. I have given the law of multiplication a section of its own so that each of these fundamental uses of conditional probability would have its full share of attention and coverage. The concepts of expectation and variance are introduced early, because important concepts should be defined and used as soon as possible. One benefit of this practice is that, when random variables such as Poisson and normal are studied, the associated parameters will be understood immediately rather than remaining ambiguous until expectation and variance are introduced. Therefore, from the beginning, students will develop a natural feeling about such parameters. Special attention is paid to the Poisson distribution; it is made clear that this distribution is frequently applicable, for two reasons: first, because it approximates the binomial distribution and, second, it is the mathematical model for an enormous class of phenomena. The comprehensive presentation of the Poisson process and its applications can be understood by junior- and senior-level students. Students often have difficulties understanding functions or quantities such as the density function of a continuous random variable and the formula for mathematical expectation. For example, they may wonder why f xf (x) dx is the appropriate definition for E(X) and why correction for continuity is necessary. I have explained the reason behind such definitions, theorems, and concepts, and have demonstrated why they are the natural extensions of discrete cases. The first six chapters include many examples and exercises concerning selection of random points from intervals. Consequently, in Chapter 7, when discussing uniform random variables, I have been able to calculate the distribution and (by differentiation) the density function of X, a random point from an interval (a, b). In this way the concept of a uniform random variable and the definition of its density function are readily motivated. In Chapters 7 and 8 the usefulness of uniform densities is shown by using many examples. In particular, applications of uniform density in geometric probability theory are emphasized. Normal density, arguably the most important density function, is readily motivated by De Moivre's theorem. In Section 7.2, I introduce the standard normal density, the elementary version of the central limit theorem, and the normal density just as they were developed historically. Experience shows this to be a good pedagogical approach. When teaching this approach, the normal density becomes natural and does not look like a strange function appearing out of the blue. Exponential random variables naturally occur as times between consecutive events of Poisson processes. The time of occurrence of the nth event of a Poisson process has a gamma distribution. For these reasons I have motivated exponential and gamma distributions by Poisson processes. In this way we can obtain many examples of exponential and gamma random variables from the abundant examples of Poisson processes already known. Another advantage is that it helps us visualize memoryless random variables by looking at the interevent times of Poisson processes. Joint distributions and conditioning are often trouble areas for students. A detailed explanation and many applications concerning these concepts and techniques make these materials somewhat easier for students to understand. The concepts of covariance and correlation are motivated thoroughly. A subsection on pattern appearance is presented in Section 10.1. Even though the method discussed in this subsection is intuitive and probabilistic, it should help the students understand such paradoxical-looking results as the following. On the average, it takes almost twice as many flips of a fair coin to obtain a sequence of five successive heads as it does to obtain a tail followed by four heads. The answers to the odd-numbered exercises are included at the end of the book. New To This Edition Since 2000, when the second edition of this book was published, I have received much additional correspondence and feedback from faculty and students in this country and abroad. The comments, discussions, recommendations, and reviews helped me to improve the book in many ways. All detected errors were corrected, and the text has been fine-tuned for accuracy. More explanations and clarifying comments have been added to almost every section. In this edition, 278 new exercises and examples, mostly of an applied nature, have been added. More insightful and better solutions are given for a number of problems and exercises. For example, I have discussed Borel's normal number theorem, and I have presented a version of a famous set which is not an event. If a fair coin is tossed a very large number of times, the general perception is that heads occurs as often as tails. In a new subsection, in Section 11.4, I have explained what is meant by "heads occurs as often as tails." Some of the other features of the present revision are the following: An introductory chapter on stochastic processes is added. That chapter covers more in-depth material on Poisson processes. It also presents the basics of Markov chains, continuous-time Markov chains, and Brownian motion. The topics are covered in some depth. Therefore, the current edition has enough material for a second course in probability as well. The level of difficulty of the chapter on stochastic processes is consistent with the rest of the book. I believe the explanations in the new edition of the book make some challenging material more easily accessible to undergraduate and beginning graduate students. We assume only calculus as a prerequisite. Throughout the chapter, as examples, certain important results from such areas as queuing theory, random walks, branching processes, superposition of Poisson processes, and compound Poisson processes are discussed. I have also explained what the famous theorem, PASTA, Poisson Arrivals See Time Average, states. In short, the chapter on stochastic processes is laying the foundation on which students' further pure and applied probability studies and work can build. Some practical, meaningful, nontrivial, and relevant applications of probability and stochastic processes in finance, economics, and actuarial sciences are presented. Ever since 1853, when Gregor Johann Mendel (1822-1884) began his breeding experiments with the garden pea Pisum sativum, probability has played an importaut role in the understanding of the principles of heredity. In this edition, I have included more genetics examples to demonstrate the extent of that role. To study the risk or rate of "failure," per unit of time of "lifetimes" that have already survived a certain length of time, I have added a new section, Survival Analysis and Hazard Functions, to Chapter 7. For random sums of random variables, I have discussed Wald's equation and its analogous case for variance. Certain applications of Wald's equation have been discussed in the exercises, as well as in Chapter 12, Stochastic Processes. To make the order of topics more natural, the previous editions' Chapter 8 is broken into two separate chapters, Bivariate Distributions and Multivariate Distributions. As a result, the section Transformations of Two Random Variables has been covered earlier along with the material on bivariate distributions, and the convolution theorem has found a better home as an example of transformation methods. That theorem is now presented as a motivation for introducing moment-generating functions, since it cannot be extended so easily to many random variables. Sample Syllabi For a one-term course on probability, instructors have been able to omit many sections without difficulty. The book is designed for students with different levels of ability, and a variety of probability courses, applied and/or pure, can be taught using this book. A typical one-semester course on probability would cover Chapters 1 and 2; Sections 3.13.5; Chapters 4, 5, 6; Sections 7.1-7.4; Sections 8.1-8.3; Section 9.1; Sections 10.1-10.3; and Chapter 11.   A follow-up course on introductory stochastic processes, or on a more advanced probability would cover the remaining material in the book with an emphasis on Sections 8.4, 9.2-9.3, 10.4 and, especially, the entire Chapter 12.   A course on discrete probability would cover Sections 1.1-1.5;

Chapters 2, 3, 4, and 5; The subsections Joint Probability Mass Functions, Independence of Discrete Random Variables, and Conditional Distributions: Discrete Case, from Chapter 8; the subsection Joint Probability Mass Functions, from Chapter 9; Section 9.3; selected discrete topics from Chapters 10 and 11; and Section 12.3. Web Site For the issues concerning this book, such as reviews and errata, the Web site http://mars.wnec.edu/~sghahram/probabilitybooks.html is established. In this Web site, I may also post new examples, exercises, and topics that I will write for future editions. Solutions Manual I have written an Instructor's Solutions Manual that gives detailed solutions to virtually all of the 1224 exercises of the book. This manual is available, directly from Prentice Hall, only for those instructors who teach their courses from this book.

I am an Applied Math | Probability and Statistics major undergrad student. I am taking Probability this semester. Going into the class, I had Calc III, Linear Algebra, and an intro Stats/Probability class completed. We started chapter three the third week into the semester. For many of the even exercises, there are not similar examples or similar odd-numbered problems to help with setup. I think it would be very helpful to have a Proofs/Abstract Math course in addition to a Combinatorics and/or Topology course completed Ã¢Â Â“ several undergrad and grad students in the class agree, both those that have completed those courses, and those that have not. A student solutions manual would also be helpful.

I was required to buy this book for my Probability for Engineers class and only needed to use it for the problems. The problems were fair and did a good job covering what was covered in the chapters. My issue with the book is the print quality. The cover is pixelated and looks like someone scanned it, saved it as a compressed image, and then sent it to the printer. The inside pages weren't much better. The content is the same, so if you plan to use it for a semester and get rid of it, then the paperback will do just fine.

Excellent, better condition than expected

Disappointed! Book arrived damaged.

In Great condition

This book is the terrible. Starting in chapter one, the book begins to taunt you with impossible examples and convoluted explanations of the material. To make matters worse, the problems at the end of each chapter seem to have been taken from a completely different subject, as they have almost nothing to do with the material covered in each section. This book is unlike any math book I've used and seemingly expects the reader to have a graduate degree in mathematics before even considering opening the front page. This book should not be used by anyone ever.

This book assumes you have a tight grasp of mathematical notation and earlier concepts covered in calculus. For most, the information will come across in a foreign language. A bit rough doesn't even begin to cover the communication issues in this book. Would def. avoid for any kind of classes or to learn from if you're just starting out.

This book has worked out great, and I got it for half the cost as the NCSU bookstore. The company that sold me the book did a great job packaging the book. No Damage, No Complaints.

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