Understanding Probability

Chance events are commonplace in our daily lives. Every day we face situations where the result is uncertain, and, perhaps without realizing it, we guess about the likelihood of one outcome or another. Fortunately, mastering the concepts of probability can cast new light on situations where randomness and chance appear to rule.

In this fully revised second edition of *Understanding Probability*, the reader can learn about the world of probability in an appealing way. The author demystifies the law of large numbers, betting systems, random walks, the bootstrap, rare events, the central limit theorem, the Bayesian approach, and more.

This second edition has wider coverage, more explanations and examples and exercises, and a new chapter introducing Markov chains, making it a great choice for a first probability course. But its easy-going style makes it just as valuable if you want to learn about the subject on your own, and high school algebra is really all the mathematical background you need.

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Chance Rules in Everyday Life

Second Edition

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CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9780521701723

First published 2007

Printed in the United Kingdom at the University Press, Cambridge

A catalog record for this publication is available from the British Library

ISBN 978-0-521-70172-3 paperback

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Preface

When I was a student, a class in topology made a great impression on me. The teacher asked me and my classmates not to take notes during the first hour of his lectures. In that hour, he explained ideas and concepts from topology in a nonrigorous, intuitive way. All we had to do was listen in order to grasp the concepts being introduced. In the second hour of the lecture, the material from the first hour was treated in a mathematically rigorous way and the students were allowed to take notes. I learned a lot from this approach of interweaving intuition and formal mathematics.

This book, about probability as it applies to our daily lives, is written very much in the same spirit. It introduces the reader to the world of probability in an informal way. It is not written in a theorem-proof style. Instead, it aims to teach the novice the concepts of probability through the use of motivating and insightful examples. In the book, no mathematics are introduced without specific examples and applications to motivate the theory. Instruction is driven by the need to answer questions about probability problems that are drawn from real-world contexts. Most of the book can easily be read by anyone who is not put off by a few numbers and some high school algebra. The informal yet precise style of the book makes it suited for classroom use, particularly when more self-activation is required from students. The book is organized into chapters that may be understood if read in a nonlinear order. The concepts and the ideas are laid out in the first part of the book, while the second part covers the mathematical background. In the second part of the book, I have chosen to give a short account of the mathematics of the subject by highlighting the essentials in about 200 pages, which I believe better contributes to the understanding of the student than a diffuse account of many more pages. The book can be used for a one-quarter or one-semester course in a wide range of disciplines ranging from social sciences to engineering. Also, it is an ideal book to use as a supplementary text in more mathematical treatments of probability.

The book distinguishes itself from other introductory probability texts by its emphasis on why probability works and how to apply it. Simulation in interaction with theory is the perfect instrument to clarify and to enliven the basic concepts of probability. For this reason, computer simulation is used to give the reader insights into such key concepts as the law of large numbers, which come to life through the results of many simulation trials. The law of large numbers and the central limit theorem are at the center of the book, with numerous examples based on these main themes. Many of the examples deal with lotteries and casino games. The examples help the reader develop a "feel for probabilities." Good exercises are an essential part of each textbook. Much care has been paid to collecting exercises that appeal to the understanding and creativity of the reader rather than requiring the reader to plug numbers into formulas. Several of the examples and exercises in this book are inspired by material from the website of "Chance News." This website contains a wealth of material on probability and statistics. Finally, the text is enlivened with cartoons combining chance and humor, which were supplied by www.cartoonstock.com.

New to this edition

The first edition of the book was very well received, notably by people from outside the field of mathematics. Many readers expressed in their correspondence that they enjoyed the style of the book with its Parts One and Two, where the informal Part One motivates probabilistic thinking through many fascinating examples and problems from the real world and Part Two teaches the more formal mathematics. The comments and recommendations helped me to improve the book further. Part One has remained largely the same, but Part Two has been changed and expanded. The second part has been made self-contained for a first course in probability by adding more explanations and examples in almost every chapter. Also, the second part has been expanded by adding an introductory chapter on Markov chains, particularly suited for students in computer science and engineering. In the same style as the other chapters, the topic of Markov chains is taught by presenting interesting and realistic examples. A solutions manual containing solutions to all of the exercises was prepared for instructors. Finally, educational software supporting this book can be freely downloaded from http://staff.feweb.vu.nl/tijms.