Preface to the Second Edition

In addition to correcting typos and errors and making a better presentation, the main effort in preparing this new edition is adding some new material to Chapter 1 (Probability Theory) and a number of new exercises to each chapter. Furthermore, two new sections are created to introduce semiparametric models and methods (§5.1.4) and to study the asymptotic accuracy of confidence sets (§7.3.4). The structure of the book remains the same.

In Chapter 1 of the new edition, moment generating and characteristic functions are treated in more detail and a proof of the uniqueness theorem is provided; some useful moment inequalities are introduced; discussions on conditional independence, Markov chains, and martingales are added, as a continuation of the discussion of conditional expectations; the concepts of weak convergence and tightness are introduced; proofs to some key results in asymptotic theory, such as the dominated convergence theorem and monotone convergence theorem, the Lévy-Cramér continuity theorem, the strong and weak laws of large numbers, and Lindeberg's central limit theorem, are included; and a new section (§1.5.6) is created to introduce Edgeworth and Cornish-Fisher expansions. As a result, Chapter 1 of the new edition is self-contained for important concepts, results, and proofs in probability theory with emphasis in statistical applications.

Since the original book was published in 1999, I have been using it as a textbook for a two-semester course in mathematical statistics. Exercise problems accumulated during my teaching are added to this new edition. Some exercises that are too trivial have been removed.

In the original book, indices on definitions, examples, theorems, propositions, corollaries, and lemmas are included in the subject index. In the new edition, they are in a separate index given in the end of the book (prior to the author index). A list of notation and a list of abbreviations, which are appendices of the original book, are given after the references.

The most significant change in notation is the notation for a vector. In the text of the new edition, a k-dimensional vector is denoted by $c = (c_1, ..., c_k)$, whether it is treated as a column or a row vector (which is not important if matrix algebra is not considered). When matrix algebra is involved, any vector c is treated as a $k \times 1$ matrix (a column vector) and its transpose c^τ is treated as a $1 \times k$ matrix (a row vector). Thus, for $c = (c_1, ..., c_k)$, $c^\tau c = c_1^2 + \cdots + c_k^2$ and cc^τ is the $k \times k$ matrix whose (i, j)th element is $c_i c_j$.

I would like to thank reviewers of this book for their constructive comments, the Springer-Verlag production and copy editors, students in my classes, and two teaching assistants, Mr. Bin Cheng and Dr. Hansheng Wang, who provided help in preparing the new edition. Any remaining errors are of course my own responsibility, and a correction of them may be found on my web page http://www.stat.wisc.edu/˜shao.

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