Preface

This book arose from a series of lectures I gave at the University of Nijmegen (Holland). It presents an introduction to mathematical statistics and it is intended for students already having some elementary mathematical background. In the text theoretical results are presented as theorems, propositions or lemmas, of which as a rule rigorous proofs are given. In the few exceptions to this rule references are given to indicate where the missing details can be found.

In order to understand the proofs, an elementary course in calculus and linear algebra is a prerequisite. However, if the reader is not interested in studying proofs, this can simply be skipped. Instead one can study the many examples, in which applications of the theoretical results are illustrated. In this way the book is also useful to students in the applied sciences.

To have the starting statistician well prepared in the field of probability theory, Chapter I is wholly devoted to this subject. Nowadays many scientific articles (in statistics and probability theory) are presented in terms of measure theoretical notions. For this reason, Chapter I also contains a short introduction to measure theory (without getting submerged by it). However, the subsequent chapters can very well be read when skipping this section on measure theory and my advice to the student reading it is therefore not to get bogged down by it.

The aim of the remainder of the book is to give the reader a broad and solid base in mathematical statistics. Chapter II is devoted to estimation theory. The probability distributions of the usual elementary estimators, when dealing with normally distributed populations, are treated in detail. Furthermore, there is in this chapter a section about Bayesian estimation. In the final sections of Chapter II, estimation theory is put into a general framework. In these sections, for example, the information inequality is proved. Moreover, the concept of maximum likelihood estimation and that of sufficiency are discussed.

In Chapters III, IV and V the classical subjects in mathematical statistics are treated: hypothesis testing, normal regression analysis and normal analysis of variance. In these chapters there is no "cheating" concerning the notion of statistical independence. Chapter VI presents an introduction to non-parametric statistics. In Chapter VII it is illustrated how stochastic analysis can be applied in modern statistics. Here subjects like the Kolmogorov-Smirnov test, smoothing techniques, robustness, density estimation and bootstrap methods are treated. Finally, Chapter VIII is about vectorial statistics. I sometimes find it annoying, when teaching this subject, that many undergraduate students do not seem (or indeed not anymore) to be aware of the fundamental theorems in linear algebra. To meet this need I have given a summary of the main results of elementary linear algebra in §VIII.1.

The book is written in quite simple English; this might be an advantage to students who do not have English as their native language (like myself).

The text contains some 260 exercises, which vary in difficulty. Ivo Alberink, one of my students, has expounded detailed solutions of all these exercises in a companion book, titled:

Mathematical Statistics
Problems and Detailed Solutions

Ivo has also read this book (which you now have in front of you) in a critical way. The many discussions which arose from this have been very useful. I wish to thank him for this. I hereby also wish to thank Inge Stappers, Flip Klijn and many other students at the University of Nijmegen. They too read the text critically and gave constructive comments. Furthermore I would like to thank Alessandro di Bucchianico and Mark van de Wiel from the Eindhoven University of Technology for providing most of the statistical tables.

Finally, I am very indebted to the secretariat of the department of mathematics in Nijmegen, in particular to Hanny Heitink. She did almost all the typewriting, a colossal amount of work.

Nijmegen, March 1998

Wiebe R. Pestman