Preface

The goal of this book is to introduce statisticians, and other researchers with a background in mathematical statistics, to empirical processes and semiparametric inference. These powerful research techniques are surprisingly useful for studying large sample properties of statistical estimates from realistically complex models as well as for developing new and improved approaches to statistical inference.

This book is more of a textbook than a research monograph, although a number of new results are presented. The level of the book is more introductory than the seminal work of van der Vaart and Wellner (1996). In fact, another purpose of this work is to help readers prepare for the mathematically advanced van der Vaart and Wellner text, as well as for the semiparametric inference work of Bickel, Klaassen, Ritov and Wellner (1997). These two books, along with Pollard (1990) and Chapters 19 and 25 of van der Vaart (1998), formulate a very complete and successful elucidation of modern empirical process methods. The present book owes much by the way of inspiration, concept, and notation to these previous works. What is perhaps new is the gradual—yet rigorous—and unified way this book introduces the reader to the field.

The book consists of three parts. The first part is an overview that concisely covers the basic concepts in both empirical processes and semiparametric inference, while avoiding many technicalities. The second part is devoted to empirical processes, while the third part is devoted to semiparametric efficiency and inference. In each of the last two parts, the chapter following the introductory chapter is devoted to the relevant mathematical concepts and technical background needed for the remainder of the

part. For example, an overview of metric spaces—which are necessary to the study of weak convergence—is included in Chapter 6. Thus the book is largely self contained. In addition, a chapter devoted to case studies is included at the end of each of the three parts of the book. These case studies explore in detail practical examples that illustrate applications of theoretical concepts.

The impetus for this work came from a course the author gave in the Department of Statistics at the University of Wisconsin-Madison, during the Spring semester of 2001. Accordingly, the book is designed to be used as a text in a one- or two-semester sequence in empirical processes and semiparametric inference. In a one-semester course, most of Chapters 1–10 and 12–18 can be covered, along with Sections 19.1 and 19.2 and parts of Chapter 22. Parts of Chapters 3 and 4 may need to be skipped or glossed over and other content judiciously omitted in order fit everything in. In a two semester course, one can spend the first semester focusing on empirical processes and the second semester focusing more on semiparametric methods. In the first semester, Chapters 1 and 2, Sections 4.1–4.3, Chapters 5–10, 12–14 and parts of Chapter 15 could be covered, while in the second semester, Chapter 3, Sections 4.4–4.5, the remainder of Chapter 15, and Chapters 16–22 could be covered in some detail. The instructor can utilize those parts of Chapter 11 and elsewhere as deemed appropriate. It is good to pick and choose what is covered within every chapter presented, so that the students are not given too much material to digest.

The books can also be used for self-study and can be pursued in a basically linear format, with the reader omitting deeper concepts the first time through. For some sections, such as with Chapter 3, it is worth skimming through to get an outline of the main ideas first without worrying about verifying the math. In general, this kind of material is learned best when homework problems are attempted. Students should generally have had at least half a year of graduate level probability as well as a year of graduate level mathematical statistics before working through this material.

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