



Elements of Stochastic Modeling. (Book Review). Clyde H. Schoolfield Jr. *The American Statistician* 58.4 (Nov 2004): p360(2).

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Elements of Stochastic Modeling.

K. BOROVKOV. River Edge, NJ: World Scientific Publishing Co., Inc., 2003, xiii + 342 pp., \$48.00 (H). \$25.00 (P). ISBN (H): 981-238-300-X; ISBN (P): 981-238-301-8.

This very well-written text is intended to form the basis of a one-semester course in stochastic processes. It is not as comprehensive a treatment of the subject as one would find in, for example, Karlin and Taylor (1975) or Grimmett and Stirzaker (2001), but its presentation is on the same level with such texts as Ross (1995) and Taylor and Karlin (1998). It differs from the aforementioned texts in the choice of topics covered.

After a brief introduction in Chapter 1, the text proceeds to a rather comprehensive review of probability theory in Chapter 2. In addition to the topics one would expect in such a review, the chapter includes discussions of limit theorems, generating functions, and even utility functions. The exposition is at a somewhat intermediate level: more advanced than Ross (2003), but not as advanced as Billingsley (1995). This chapter would serve as a very good review of probability theory, but not as a substitute for a prerequisite course in the subject.

The heart of the subject matter is presented in Chapters 3, 5, and 6. It is in these chapters that the author introduces Markov chains and continuous-time Markov processes. The presentation includes a number of examples interspersed with the definitions and theorems. There are subsections on random walks, Poisson processes, birth-and-death processes, and time-inhomogeneous processes.

The chapters mentioned thus far make up about one-half of the text; the remainder of the text is devoted to special topics. Chapter 7 gives a nice introduction to queueing theory. Chapter 8 is a very brief (10 pages) introduction to renewal theory--which, to be fair, is as much material on the subject as I present in my own course on stochastic processes.

There are three chapters on topics that one does not often find covered in such detail in texts on stochastic processes. Chapter 4 is devoted to a very good introduction to Markov decision processes. Chapter 9 is an introduction to time series, a subject rarely encountered in these texts. Finally, Chapter 10 is an introduction to simulation that even includes a short subsection on Markov chain Monte Carlo.

Certain topics often covered in courses on stochastic processes are not to be found in this text: these include branching processes, Brownian motion, and martingales. According to the author, the text was developed from lecture notes for a one-semester course in stochastic modeling. So it is certainly understandable that the text would be limited to topics that the author wishes to emphasize in the short time available in a one-semester course.

Each chapter includes numerous references to specialized texts on the various topics. Also included at the end of each chapter is a section of problems, which progress from rather elementary to rather advanced. The answers (and sometimes solutions) to all of the problems are found at the end of the text. Throughout the text are to be found short passages on more advanced topics that give a deeper insight to the material. And one of the most enjoyable aspects of the text are its frequent historical and etymological footnotes.

In summary, this is a very well-written brief introduction to stochastic modeling and related topics. This is a text that every professional in the field might want to consider adding to his bookshelf. For those instructors who like the choice of topics covered, it is also a nice candidate for a very advanced undergraduate or beginning graduate course in stochastic processes for students in various fields who have very good mathematical backgrounds and previous courses in probability theory.