

Preface

This book treats the mathematics of queueing theory and some related areas, as well as the basic mathematical tools for the study of such models. It thus aims to serve as an introduction to queueing theory, to provide a thorough treatment of tools such as Markov processes, renewal theory, random walks, Lévy processes, matrix-analytic methods and change of measure, and to treat in some detail basic structures such as the $GI/G/1$ and $GI/G/s$ queues, Markov-modulated models, queueing networks, and models within the areas of storage, inventory and insurance risk. Within this framework the choice of topics is, however, rather traditional. The aim has been to present what I consider the basic knowledge in the area, not to advocate special directions in which the area is at present developing.

The first edition was published in 1987. This second edition incorporates about 100 extra pages containing an extended treatment of queueing networks and matrix-analytic methods as well as a number of additional topics, in particular Poisson's equation, the fundamental matrix, insensitivity, rare events and extreme values for regenerative processes, Palm theory, rate conservation, Lévy processes, reflection, Skorokhod problems, Loynes's lemma, Siegmund duality, light traffic, heavy tails, the Ross conjecture and ordering, and finite buffer problems.

Also, the references, typically given in the Notes following the separate sections, have been thoroughly updated. It should be noted, however, that these Notes are mainly intended as a first guidance for further reading, not as a bibliography or history of the subject. When a textbook or a survey paper dealing with a topic is available, this is the preferred reference rather than the original papers. Thus, details of priority are treated rather sporad-

ically. The principle has been to cite only the most important milestones and classical texts, but otherwise to make the references as up-to-date as possible. Thus, compared to the first edition, many older references have been removed.

The reader should be familiar with probability theory at the level of Breiman (1968), Chung (1974), Durrett (1991) or Shiryaev (1996). Most readers are likely to know large parts of Chapters I–II, which therefore may serve mainly as a refresher or reference part. However, one should note that I.5–8 has much material not usually included in introductory texts. How to read the rest of the book is a question of particular interests. The reader oriented towards queueing theory may want to concentrate first on Chapters III–IV and next on X–XII after having skimmed Chapters V, VI and VIII for needed background; the reader with more general interests will find Chapters V–IX and XIII more relevant.

The writing of both the first and the second editions of this book has been an immense pleasure to me. This is due not least to the interest shared by friends, colleagues and students. Their impact cannot be overestimated, and the list of people who in some way have influenced the book would be huge. Let me just mention and thank a few who have contributed with detailed comments on the second edition: Niels Hansen, Masakiyo Miyazawa, Mats Pihlsgård, Tomasz Rolski, Volker Schmidt, Karl Sigman and Anders Tolver Jensen. Most figures were done by Jane Bjørn Vedel (supported by MaPhySto, Aarhus) and my mother, Hanna Asmussen, typed much of the material that is close to the first edition.

Finally, I gratefully acknowledge the permission of World Scientific Publishing Co., Singapore, to incorporate some parts (XI.2 and XIII.3) which are close to the exposition in Asmussen (2000).

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