

Modeling and Analysis: An Introduction to Performance Evaluation Methodology, Hisashi Kobayashi, Addison-Wesley Publishing Company, Reading, Massachusetts, 1978. 446 pp. (ISBN 0-201-14457-3, \$18.95).

In the writing of this book, Dr. Kobayashi set for himself an extremely ambitious goal: a single-volume presentation of the theoretical basis of system performance evaluation methodology. I believe that he has been almost completely successful in achieving this goal.

The need addressed by this book is a genuine one. The combination of mathematics, operations research, and computer science skills required of a first-class computer performance analyst is rarely acquired accidentally. Unfortunately, computer science curricula do not usually guarantee sufficient exposure to the necessary non-computer science theory, which has carried over into the practice of computer performance evaluation, with most analysts in the field able to employ only the most primitive of analysis techniques. The book at hand provides an up-to-date presentation of a range of computer performance analysis techniques, both elementary and advanced.

Books

Modeling and Analysis: An Introduction to System Performance Evaluation Methodology is intended to be suitable as a text for a two-quarter advanced course in a Computer Science/Engineering curriculum. As is appropriate for such a course, it assumes a basic knowledge of computer hardware and software, but no advanced mathematics beyond college calculus and matrix algebra. Dr. Kobayashi provides an overall unity to his approach by treating computer systems strictly from the point of view of random processes. After a brief introductory chapter in which the fundamental concepts of the methodology are introduced (e.g., workload characterization, modeling, performance measures, etc.), he lays the basic theoretical foundation in an ambitious one-chapter summary of Probability Theory. In a similar fashion, the subjects of Queueing Theory, Simulation Methods, and Data Analysis are addressed in the remaining chapters. Although the basic exposition of these topics is abstract, the examples and exercises are used to place them in a computer performance context. A conscientious effort has been made to capture the current state of the art in each of these areas with extensive "Discussion and Further Reading" sections and bibliographies pointing the reader to the results of the latest research, up through early 1978 in some cases. (The field, however, refuses to stand still. There are, for example, more recent and much improved methods of calculating the marginal distributions and the related utilization and throughput statistics at the individual service stations than those given in section 3.10.3.)

The book must be given high marks for its comprehensiveness. The basis of almost every analysis technique which may be relevant to a "complete" performance analyst is thoroughly developed from its fundamental concepts through examples of its application. The exposition is rigorous and almost completely without digressions. Hardly a line is wasted, with the well chosen exercises forming an essential element in the development of the subject. The writing is crystal clear and there is a natural flow from topic to topic. On the other hand, the terseness of the presentation and the rapidity with which concepts build on each other may cause some difficulty for a neophyte student.

In reviewing a book on this subject, one cannot avoid some comparison with Dr. Kleinrock's already classic two-volume *Queueing Systems*, the second volume of which is dedicated to the modeling and analysis of computer systems. The comparative value of Dr. Kobayashi's book lies in its unified treatment of the various disciplines (including queueing analysis) which collectively form the basis of a comprehensive performance evaluation methodology. As one might expect, however, Kleinrock must be preferred in the specific area of its queueing systems topic for its greater detail and more extensive application-oriented examples. Even in this specialized area, however, it is somewhat surprising how credibly Dr. Kobayashi's far briefer treatment compares.

Modeling and Analysis: An Introduction to Systems Performance Evaluation Methodology is undeniably an outstanding reference work. It should make an excellent classroom text, although its otherwise desirable qualities of comprehensiveness and terseness may place greater demands than usual on the teaching skills of an instructor.

Thomas Giammo

Probability, Statistics, and Queueing Theory with Computer Science Applications, Arnold O. Allen, Academic Press, New York, New York, 1978. 390 pp. (ISBN 0-12-051050-2, \$29.50).

Performance evaluation and capacity planning have become an essential requirement for the computer installation manager and the computer systems engineer and analyst. The techniques and methodology for evaluating computer system performance and capacity are nicely described in Dr. Allen's excellent book. The use of computer-oriented examples is instructive as well as refreshing. The book is well organized, and the material is presented in an orderly, clear, and understandable manner.

The book is not unexpectedly divided into three parts. Part One is an effective review of Probability and Random Variables, Proba-

bility Distributions, and Stochastic Processes. With a judicious choice of topics and with examples and exercises that are very good, the author quickly surveys Probability from Sample Spaces to Markov Chains. But the topics have been carefully chosen (for example, the Erlang distribution, the hyperexponential distribution, the Poisson process, and the birth-and-death process) to lead naturally into Queueing Theory.

Part Two contains two chapters, one on Queueing Theory and the second on Queueing Theory Models of Computer Systems. The theory of Probability is applied to the study of queues. Computer problems are treated using models based on the birth-and-death process and on the embedded Markov Chain. The author also briefly considers priority queues. There is a useful section on approximation and graphical methods. Included is the particular graph, called "system map," that in this reviewer's opinion deserves to be more widely used. The discussion of finite population queuing models and queuing networks is particularly well done and appears to be unique in introductory books. This part of the book provides an introduction to the most important aspects of queuing theory for the computer practitioner and also provides a foundation for the reader who wishes to pursue the subject in more advanced treatises.

Part Three contains two elementary chapters on Estimation and Hypothesis Testing. While the material is basic and contains nothing really new, its inclusion adds completeness to the book. The clarity and lightness of the author's style and the use of computer-related examples and exercises add to the utility of the book. The short section on estimating queuing system parameters is a good example of the care and thoughtfulness with which the author considered his intended audience.

Probability, Statistics, and Queueing Theory with Computer Science Applications is an introductory text for the advanced undergraduate student that is readable and authoritative. It can also be recommended for the computer professional as a refresher or as a guide to the subject. Dr. Allen has written a very useful book that is a welcome addition to the literature.

Stanley Winkler

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