when, in 1914, J. E. Littlewood proved that the expression $\pi(x) - \operatorname{li} x$ changes sign on an infinite sequence of numbers x tending to infinity. The first numerical estimate of a sign change beyond x_0, by S. Skewes, was the prodigious number $10^{10^{10^{100}}}$. It is now known, through the work of H. te Riele, that a change of sign occurs before $7 \cdot 10^{360}$.

In summary, this is a delightful book to read and will be well received. It contains much material for either a basic course on the distribution of prime numbers or a mathematical history course on the subject. The bibliography itself will make this book attractive to practicing number theorists. Professor Narkiewicz is to be congratulated warmly on his contribution to the literature of prime number theory.

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Measuring Computer Performance: A Practitioner's Guide. *By David J. Lilja.* Cambridge University Press, Cambridge, UK, 2000. $39.95. xv+261 pp., hardcover. ISBN 0-521-64105-5.

Measuring computer performance has always been more of an art than a science. Lilja's book attempts to put more science into the process. *Measuring Computer Performance* sets out the fundamental techniques used in analyzing and understanding the performance of computer systems. Throughout the book the emphasis is on practical methods of measurement, simulation, and analytical modeling.

The author discusses performance metrics and provides detailed coverage of the strategies used in benchmarking programs. He gives intuitive explanations of the key statistical tools needed to interpret measured performance data. He also describes the general techniques used in the design of experiments and shows how the maximum amount of information can be obtained for the minimum effort.

The first chapter begins with an introduction to the basic ideas of measurement, simulation, and analytical modeling. It describes some of the common goals of computer systems performance analysis. The problem of choosing an appropriate metric of performance is discussed in Chapter 2, along with some basic definitions of speedup and relative change.

The next three chapters provide an intuitive development of several important statistical tools and techniques. Chapter 3 presents standard methods for quantifying average performance and variability. It also introduces the controversy surrounding the problem of deciding which of several definitions of the mean value is most appropriate for summarizing a set of measured values. The model of measurement errors developed in Chapter 4 is used to motivate the need for statistical confidence intervals. The ideas of accuracy, precision, and resolution of measurement tools are also presented in this chapter. Techniques for comparing various system alternatives in a statistically valid way are described in Chapter 5. This presentation includes an introduction to the analysis of variance, which is one of the fundamental statistical analysis techniques used in subsequent chapters.

While Chapters 3–5 focus on the use of interpretation of measured data, the next two chapters emphasize tools and techniques for actually obtaining these quantities. Chapter 6 begins with a discussion of the concepts of events. It also describes several different types of measurement tools and techniques, including interval timers, basic block counting, execution-time sampling, and indirect measurement. The underlying ideas behind the development of benchmark programs are presented in Chapter 7, along with a brief description of several standard benchmark suites.

Chapter 8 uses a discussion of linear regression modeling to introduce the idea of developing a mathematical model of a system from measured data. Chapter 9 presents techniques for designing experiments to maximize the amount of information obtained while minimizing the amount of effort required to obtain this information. The fundamental problems involved in simulating systems are discussed in Chapter 10. Finally, Chapter 11 concludes the text with a presentation of the fundamental analysis modeling techniques derived from queuing theory.

In addition, a glossary of some of the more important terms used in the text is presented in Appendix A. Several common probability distributions that are frequently used in simulation modeling are described in Appendix B. Appendix C tabulates critical values used in many statistical tests described in the earlier chapter.

The book can be used as a primary text in a one-semester course for advanced undergraduate and beginning graduate students in computer science and engineering who need to understand how to rigorously measure the performance of computer systems. The book is very informative, with a rich collection of examples, exercises, and references. As such, this book would be an important addition to the collection of anyone interested in measuring computer performance.

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Self-Organization and the City. *By Juval Portugali.* Springer-Verlag, New York, 1999. $99.00. xvii+352 pp., hardcover. ISBN 3-540-65483-6.

As it says on the back cover, this book combines the theory of complex self-organizing systems with the social theory of cities and urbanism. This combination of natural sciences and humanities is not so frequently met. The synergetical approach as developed by Haken in the 1970s has facilitated the extended use of concepts and methods of the exact sciences to complex dynamical structures in the life sciences. Mathematicians have their theories of bifurcation and chaos to explain sudden change in systems. In physics comparable changes are seen as phase transitions and critical behavior is captured in prototype systems such as the sandpile model. In the life sciences there are phenomena that can be better understood by analogy with physical systems: self-organization is a prominent case. From this book and other studies one can become convinced of the general validity of principles about the way that "players'" interaction may lead to a spatiotemporal structure. In the book nice examples of applying cellular automata to city development are given. This makes it unnecessary to come up with Benard's experiment on spatial structures in convective flow to explain hexagonal compartments in ideal cities. Self-organization in slime mold populations and plasticity in neural processes would have provided a more inspiring analogy.

The reader should not expect practical tools for city planning from this book: it is a completely worked-out case study of self-organization using synergetics. The ideas behind the part on "Planning in a Self-Organizing City" are not so clear: Why does self-organization need planning? Some sociological theories of the city, such as Weber's theory of the ideal city and Wittgenstein's network theory, could also have been left out, as self-organization plays no role in them. However, the connection Alexander makes between a physical object (from the city of Jericho to Chicago) that changes in time and the notion one has of it has interesting mathematical potential in, e.g., set theory and continuation theory. From the other side this concept can be linked to Mead's symbolic interactionism in sociology.

At its start in the 18th century, sociology was strongly influenced by natural science with its successes (positivism). However, sociology quickly went its own way as this approach was unrewarding at that time. Maybe the two are merging again. We see it already in Hagerstrand's theory of the spread of innovations, which comes very close to Fisher's model of the spread of a genotype in a population: both belong to the more general class of reaction diffusion systems. This book makes a strong case for a next step guided by the theory of synergetics.

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Regular Variation and Differential Equations. *By Vojislav Marić.* Springer-Verlag, New York, 2000. $29.80. x+127 pp., softcover. ISBN 3-540-67160-9.

A positive measurable function defined on a half-line is called regularly varying (at infinity) of index α if, for some $\alpha \in R$ and