REVUE D'ANALYSE NUMÉRIQUE ET DE THÉORIE DE L'APPROXIMATION
Rev. Anal. Numér. Théor. Approx., vol. 38 (2009) no. 1, pp. 105–109
ictp.acad.ro/jnaat

BOOK REVIEWS

NICHOLAS J. HIGHAM, *Handbook of Writing for the Mathematical Sciences*, Second Ed., Philadelphia, 1998, ISBN 0-89871-420-6, XV + 302 pp.

The book starts with the brief chapter 1, *General Principles.* Some complementary reading is given in the second chapter, concerning dictionaries, thesauruses, usage and style guide for the English language, as well as technical and mathematical writing guides. Ch. 3 contains an interesting discussion on the mathematical elements (theorems, proofs, examples, definitions, notations, symbols, etc.) The English usage in the mathematical texts is treated in Ch. 4, while the following chapter contains additional topics for the non-native writers of English. Ch. 6 contains useful advises, examples, and counterexamples for writing a paper, starting with the title and ending with the reference list. Ch. 7 presents many examples of how to revise and improve a draft. Ch. 8 is entitled *Publishing a Paper*; it describes the refereeing process and also useful recommendations before and after submitting a manuscript. The following three chapters are dealing with the preparation and presenting (or defending) the theses, talks and posters. Ch. 13 deals with many useful aspects of TeX and LaTeX. The last chapter describes some aids and resources for writing and research. Finally, there are five appendices (A. *The Greek Alphabet*, B. *Summary of TeX and LaTeX*, C. *GNU Emacs – The Sixty + Most Useful Commands*, D. *Mathematical and Other Organizations*, E. *Winners of Prizes for Expository Writing*), a bibliography, a name index and a subject index.

The author realizes a lively presentation of the many facets of the mathematical writing, either deep or just informative, from do's and don'ts when writing a paper, to the five most cited papers in mathematics.

The recommendations and advises made throughout the book are pertinent and the situations presented may occur in the practice of every active mathematician. It is a real benefit to find all of them gathered in a single place.

We believe the book should be read not only by all the young mathematicians (not to mention the non-native writers of English) but also by the experienced ones.

Emil Cătinaş

J. L. HODGES, JR. and E. L. LEHMANN, *Basic concepts of probability and statistics*, Second Edition, SIAM, Philadelphia, PA, 2005, ISBN 0-89871-575-X, XX + 441 pp., Classics in Applied Mathematics, **48**.

This book contains a classical introduction to Probability and Statistics and has merited been included in the famous Classics in Applied Mathematics Series of SIAM.

The book is structured in two parts: I Probability (9 chapters) and II Statistics (6 Chapters), followed by a set of Tables, Selected Answers to Problems, Index and Example Index.

The first chapter introduces some elementary probability models. Chapter 2 deals with sampling, and then Chapter 3 with product models. In Chapter 4 it is discussed the conditional probability, independence, the Bayes' law. Chapter 5 treats the random variables, describing the expectation and variance. The following Chapter describes some special distributions: the binomial distribution, the hypergeometric distribution, the normal approximation, the Poisson approximation. The first part ends with Chapter 7, on multivariate distributions, where one deals with covariance and correlation of multivariate distribution.

The second part starts with Chapter 8, on estimation; unbiased estimation and its accuracy are dealt with. Chapter 9 deals with estimation in measurement and sampling models. Chapter 10 is on optimum methods of estimation. Chapter 11 introduces the tests of significance, the chi-square test for goodness of fit. Chapter 12 presents tests for comparative experiments: the Fisher-Irwin test for two-by-two tables, the Wilcoxon two-sample test, the Wilcoxon's test for paired comparisons. The last Chapter, Chapter 13, deals with the concept of power.

One of the distinctive features of this book is that it provides a mathematically rigorous introduction to the fundamental ideas of modern statistics for readers without a calculus background (from this point of view, it is highly suited for teaching students in economics or other faculties with less mathematical background).

The fact that – as the authors mention in the preface – "each section, nearly each sentence, was rigorously debated, drafted and then subjected to additional debate" resulted in an outstanding book, which even today maintains a modern outlook.

We highly recommend the book to all mathematicians interested in probability and statistics, and specially to instructors teaching these subject within mathematics departments.

Emil Cătinaş

Thomas W. O'Gorman, *Applied adaptive statistical methods. Tests of significance and confidence intervals*, ASA, Alexandria, Virginia and SIAM, Philadelphia, Pennsylvania, 2004, ISBN 0-89871-553-9, XIII + 174 pp.

The book is intended as an introduction to the modern adaptive statistical methods developed since the mid seventies. The first Chapter introduces the basic notions. Chapter 2 presents an adaptive two-sample test that is not based on ranks. Chapter 3 describes a general adaptive testing method using the adaptive weighting procedures described in the previous chapter. Chapter 4 presents several examples of adaptive tests: for equality of means in a one-way layout, for the slope in a simple linear regression, for regression coefficients in a multiple regression, for interaction with a two-way layout and for the treatment effect in a multicenter clinical trial. They are also accompanied by detailed instructions on the use of the statistical software needed to compute them, using the SAS macros from Appendix A. The general testing procedure is modified in chapter 5 in order to be applied for paired data. The next Chapter considers techniques for constructing adaptive confidence intervals. Chapter 7 reviews some robust methods of estimation and presents an adaptive estimation procedure for estimating any parameter in a linear model. Chapter 8 contains several adaptive methods, including an adaptive estimation procedure for one-way layouts, which can be performed using the general adaptive testing method. This chapter also describes Büning's rank-based test for the one-way layout and addresses the robustness of the adaptive method when ties are present or when unequal variances are found in the populations.

The book provides o unified approach in presenting recent results in the field. The SAS macros discussed in the text (also available on the web page of the authors) make the adaptive tests easy to use for many real world problems.

The book is recommended as a supplementary text in courses, on regression analysis and, of course, to all specialists in statistics.

Emil Cătinaş

R. Peck, L.D. Haugh, A. Goodman, *Statistical case studies. A collaboration between academe and industry*, ASA, Alexandria, Virginia, and SIAM, Philadelphia, Pennsylvania, 1998, ISBN 0-89871-413-3, XXXI + 282 pp.

This book is the result of the collaboration between statisticians in industry/business/government and colleagues in academe. It contains 20 case studies with real data sets that have not beet simplified for classroom use:

Ch. 1. Are the fish safe to eat? Assessing mercury level in fish in Maine lakes, J. A. Hoeting and A. R. Olsen. Ch. 2. Chemical assay validation, R. Reeve and F. Giesbrecht. Ch. 3. Automating a manual telephone process, M. Batcher, K. Cecco and D. Lin. Ch. 4. Dissolution method equivalence, R. Reeve and F. Giesbrecht. Ch. 5. Comparison of hospital length of stay between two insurers for patients with pediatric asthma, R. L. Houchens and N. Schoeps. Ch. 6. Comparing nonsteroidal anti-inflammatory drugs with respect to stomach damage, T. Filloon and J. Tubbs. Ch. 7. Validating an assay of viral contamination, L. I. Kuei Lin and W. R. Stephenson. Ch. 8. Control charts for quality characteristics under nonnormal distributions, Y-M. Chou, G. D. Halverson and S. T. Mandraccia. Ch. 9. Evaluation of sound to improve customer value, J. R. Voit and E. Walker. Ch. 10. Improving integrated circuit manufacture using a designed experiment, V. Czitrom, J. Sniegowski and L. D. Haugh. Ch. 11. Evaluating the effects of nonresponse and the number of response levels on survey samples, R. K. Smidt and R. Tortora. Ch. 12. Designing an experiment to obtain a target value in the chemical processes industry, M. C. Morrow, T. Kuczek and M. L. Abate. Ch. 13. Investigating flight response of pacific brant to helicopters at Izembek Lagoon, Alaska by using logistic regression, W. P. Erickson, T. G. Nick and D. H. Ward. Ch. 14. Estimating the biomass of forage fishes in Alaska's Prince William sound following the Exxon Valdez oil spill, W. Taam, L. McDonald, K. Coyle and L. Halderson. Ch. 15. A simplified simulation of the impact of environmental interference on measurement systems in an electrical components testing laboratory, D. A. Fluharty, Y. Wang and J. D. Lynch. Ch. 16. Cerebral blood flow cycling: anesthesia and arterial blood pressure, M. H. Kutner, K. A. Easley, S. C. Jones and G. R. Bryce. Ch. 17. Modeling circuit board yields, L. Denby, K. Kafadar and T. Land. Ch. 18. Experimental design for process settings in aircraft manufacturing, R. M. Sauter and R. V. Lenth. Ch. 19. An evaluation of process capability for fuel injector process using Monte Carlo simulation, C. Lee and G. A. D. Matzo. Ch. 20. Data fusion and maintenance policies for continuous production processes, N. D. Singpurwalla and J. N. Skwish.

The collection of this case studies illustrates real applications of statistical methodology to solve practical problems. It is a different approach – as opposed to an academic view – on one hand on the important aspects to be taught and on the other hand on presenting simplified settings.

This book is highly recommended for instructors teaching statistics. Each case contains in the end a summary on the level of the case, necessary tools, objectives and different comments.

The book is highly recommended to all statisticians, theoreticians on practitioners alike, bringing up actual problems which are faced in practice.

Emil Cătinaş

Jenny A. Baglivo, *Mathematica laboratories for mathematical statistics. Emphasizing simulation and computer extensive methods*, SIAM, Philadelphia, PA, 2005, ISBN 0-89871-566-0, XX + 260 pp.

The book contains a concise introduction to the concepts of probability theory and mathematical statistics. It is accompanied by a CD containing laboratory materials and problems.

The 15 chapters are structured as follows.

Chapter 1 contains the basic concepts and axioms of probability. Chapters 2 and 3 present discrete and continuous families of probability distributions. Chapter 4 introduces the mathematical expectation, the variance, standard deviation, functions of two or more random variables. Chapter 5 deals with limit theorems: law of large numbers, central limit theorem, and moment generating functions. In Chapter 6 is made the transition to statistics: distributions related to the normal distribution, random samples from normal distributions, and multinomial experiments. Chapter 7 is devoted to the estimation theory: the properties of point estimators, interval estimation, method of moments and maximum likelyhood estimation. Hypothesis testing theory is described in Chapter 8: property of tests, approximate tests and likelyhood ratio tests. Chapter 9 introduces methods for estimating quantiles of continuous distributions and for constructing confidence intervals for quantiles based on order statistics. Chapter 10 considers statistical methods for comparing independent random samples from two continuous distributions. The permutation analysis is introduced in Chapter 11, using definitions and applications in the two sample and paired sample setting, and then correlation analysis. Chapter 12 introduces the bootstrap analysis (bootstrap estimation methods and bootstrap hypothesis testing methods). In Chapter 13 are considered methods for comparing more than two samples, under both population and randomization sampling models. The last two chapters contain the linear least squares analysis and resp. contingency table analysis.

The book is suitable both for instructors and students teaching/learning mathematical statistics. The accompanying CD with laboratory activities (written as Mathematica notebooks) containing text, data, computations and graphics, plays an important role in understanding the described phenomena and the use of statistics in solving real life problems.

Emil Cătinaş

John C. Strikwerda, *Finite Difference Schemes and Partial Differential Equations*, SIAM, Philadelphia, PA, 2004, ISBN 0-89871-567-9, XII + 434 pp.

The book presents an analysis which is useful for the mathematical study of hyperbolic, parabolic and elliptic partial differential equations (PDE). In the first chapter, hyperbolic PDE, after a short introduction to the hyperbolic equations and to the systems of hyperbolic equations, the author presents how the solutions to a hyperbolic equation, respectively, to a system of hyperbolic equations, is determined by the boundary conditions. Referring to this equation it is presented an introduction to finite difference scheme, the concepts of numerical convergence, consistency, stability and the relation between these. The next chapter treats these concepts using Fourier analysis. Ch. 3 develops two schemes of second order accuracy (Lax-Wendroff and Crank-Nicolson schemes) and the r-order accuracy of homogeneous equations and show their stability. It is also given some extrapolation formulas used for boundary conditions and it is presented the Thomas algorithm for solving tridiagonal systems. A generalization of the criteria of stability for multistep schemes is given in Ch. 4. The next chapter, Ch. 5 contains a general principle for hyperbolic PDE for reducing the amplitude and the speed of oscillations of the solutions obtained with finite difference methods. Ch. 6 starts with some examples of parabolic PDEs and lists the numerical methods (e.g., Crank-Nicolson) applicable for these. Also, it is given the stable criteria applied for the numerical schemes mentioned above. An extension of the principle of convergence and stability for the finite difference methods of the system of parabolic PDE is presented in the Ch.7. Some complex methods, like the alternating direction implicit method, the Douglas-Rachford method are described very detailed. Ch. 8 deals with other useful complex examples, such as second order time-dependence equations in one, two and three space dimensions and prescribes several formulas for discretizing the boundary conditions in these

cases. Ch. 9 comes with theoretical results to the problem of well-posed initial value for equations with high order time derivative, for a system of equations in one order time derivated and for nonhomogeneous equations. Ch. 10 gives an analysis of the convergence of the numerical solution for the problem with well-posed initial conditions in terms of operatorial functions. The study is realized for one-step and multistep schemes of equations only with constant coefficients. The dependence of the stability of finite difference schemes by the initial value are presented in Ch. 11. This are proved using the Laplace transformation and the matrix method. Also, the author presents the method of determining if the boundary conditions for initial value problems are well-posed. Ch. 12 starts the study of the elliptic PDEs. The author introduces a principle of maximum for the second-order equations to study the extremum of elliptic equations. Also, it is given finite difference schemes for this type of equations and it is estimated an approximation between the exact and the numerical solutions. Ch. 13 gives an analysis and implements the algorithms of the numerical schemes which are suited for the elliptic equations. Also, it is presented the eigenvalue problem for the discrete Laplacian operator in a rectangle. Again the dependence of the property of uniqueness of the solutions by the boundary conditions it is researched for the elliptic equations. The last chapter, Ch. 14, analyzes two important methods useful for all types of equations presented in this book, (hyperbolic, parabolic and elliptic). These methods are the steepest descent and the conjugate gradient methods applicable for solving linear systems of equations for the particular case when the coefficients matrix is symmetrically and positive definite. Finally, there are three appendices (A. Matrix and Vector Analysis, B. A Survey of Real Analysis and C. Survey of Results from Complex Analysis), a bibliography and a subject index.

The book offers a difficult theme, the analysis of the convergence and the stability of the numerical solutions for the equations which characterizes practical problems. Throughout, readers are challenged to understand the practicability of mathematical concepts for the numerical schemes. The author provides a rigorous, self-contained development of the partial differential equations and discusses numerous examples making the theory more understandable.

We believe that the book should be read not only by the students as course notes, but also by the researchers in the domain of applied mathematics.

Cornelia Revnic