Book Reviews

(Publishers are invited to send books for review to Dr. Gary G. Koch, Department of Biostatistics, School of Public Health, University of North Carolina, Chapel Hill, North Carolina 27514)


While the statistics journals have been replete with articles concerning nonparametric techniques for many years, there has been a dearth of books on the subject until recently. Fraser's book [2] was the sole treatise in the theoretical area until Hajek and Sidak [3]. Similarly, Siegel [1956] and Tate and Clelland [1957] represent the only early attempts to present nonparametric methods to the applied user. However, in the past five years there has been a flurry of publications in both the theoretical and applied areas. Statisticians lament that a book like Siegel [7] (see Savage [5]) seems to persist as the primary handbook source for users, since that book focuses only on significance tests, gives little attention to their properties, contains erroneous statements, and does not include any of the procedures developed in the last eighteen years.

Conover's book [1] should probably be considered the first note-worthy attempt to update and replace Siegel (see Sen [6]), although some feel it is appropriate for a more sophisticated audience. Nonparametric Statistical Methods by Hollander and Wolfe is of the same genre and a welcome addition to the literature, since its scope is broader and more current than any other book presently available at the same level.

The statistical methods covered in this book include not only the familiar nonparametric estimators, tests and confidence procedures, but also many techniques which have probably never actually been used in a practical problem of data analysis. The experimental situations described in sequence over 253 pages are the dichotomous data problem, the one-sample location problem, the two-sample location problem, the two-sample dispersion problem, the one-way and two-way layouts (the k-sample location problem), the two-variable independence (association) problem, regression problems involving slopes, and some miscellaneous methods designed for broad alternatives.

The remainder of the book consists of extensive Tables and Charts (176 pages), Glossary (32 pages), Bibliography (24 pages), and Index. The Bibliography includes a large number of journal articles which expand on the properties of those procedures included in the text. The Tables and Charts include 27 tables useful for inference plus a square root table and a table of natural logarithms. The two charts present percentile points for Student's t distribution and the chi-square distribution in a rather atypical format. This is perhaps the best collection of tables in any nonparametrics book. Whenever practical and possible, exact tail probabilities are given instead of critical values at selected levels of significance. Whenever practical and possible, exact tail probabilities are given instead of critical values at selected levels of significance. Each table is headed by a brief but concise explanatory note concerning its use. The two charts are probably unfamiliar to most practitioners and are more difficult to read than the more traditional method of tabulation.

The Preface states that the goal of this book is primarily to make scientists other than statisticians aware of nonparametric methods, and secondarily to produce a handbook of these techniques. Although not mentioned therein as a specific goal, the book is intended for use as a text for a formal course; it has been class tested extensively with senior students at Florida State University in the Department of Psychology and Statistics. The book is nonmathematical, with the only prerequisite an introductory statistics course.

Siegel's book has also been used as both a textbook and handbook. However, its intended audience was behavioral scientists, while Hollander and Wolfe are apparently trying to provide a handbook for persons engaged in quantitative research in all scientific areas, whether natural, physical, medical, behavioral, or human. The authors' means of enticing such a broad audience is by inclusion of examples which apply the methods to data from actual experiments in the fields of astronomy, biology, criminology, education, engineering, environmental science, geology, home economics, medicine, oceanography, physics, psychology, sociology and space science.

For each particular statistical technique included, the methodology discussion includes (when applicable) the step-by-step procedure, large sample approximation, means of dealing with ties, a numerical example, comments, properties, references and problems. The fact that this format is followed consistently throughout the book effectively places it in the category of a useful and valuable handbook. However, the resulting sterility and roteness discourages reader interest and thereby detracts from its appeal as a textbook, particularly for undergraduates or for those scientists who consider statistical methods primarily a necessary evil in their research. While a less formal and concise style would detract from the book's value as a handbook, it would elicit more reader interest and thereby enhance its contribution to pedagogy. The total lack of availability of answers and/or solutions to any problems is a detriment to usefulness as either a textbook or a handbook for self-instruction.

While the prerequisite knowledge is stated accurately, the reader needs a great facility for dealing with symbols and substituting in formulas. Most introductory courses in applied statistics simply would not develop enough algebraic sophistication for readers to handle effectively some of the techniques described and to understand the comments made. Even the descriptions of some procedures, while quite logical, accurate and precise, frequently involve notation and symbolism which are far from elementary. Without considerable motivation or the aid of an instructor, the reader may lose sight of or interest in the ultimate procedure.

The comments given for all techniques are usually quite varied in level, completeness and difficulty, and some seem quite esoteric for the intended audience. Many comments are replete with references, but in most cases these references are to articles which cannot be comprehended without considerable formal training in statistics. While these references would contribute substantially to an intermediate or advanced course for statistics majors, or to a reference book for statisticians, they add little with respect to either of the goals stated in the Preface.

The properties listed for tests usually include only consistency and asymptotic efficiency. Little attention is given to power, small sample properties, accuracy of large sample
approximations, the consequence of weakening the assumptions or the effect of ties on reliability.

For each procedure which is fully covered, one numerical example is worked through and a few problems, all representing data from actual experiments, are given. There are approximately 45 examples and 126 problems. However, new data are not given for each example, and some problems are more theoretical than applied. There are about 40 actual data situations, rather unevenly distributed among the various sciences. In fact, almost half of the experiments described are from the biomedical area. Such experiments frequently involve terms, processes and substances that are unfamiliar to scientists in other areas, and thus elicit little interest from readers outside the relevant field. The social and behavioral sciences are relatively poorly represented, and yet nonparametric statistical methods are particularly useful to such experimenters. The relatively small number and narrow representation of problems and examples, plus the fact that no answers are given for any problems, detract considerably from the book's usefulness as a general handbook and textbook.

The major difficulty with the book is the relegation of definitions to the Glossary in the Appendix. Reading would be greatly simplified if concepts such as asymptotic relative efficiency or consistency of a test, probably unfamiliar terms to most members of the intended audience, were defined in the text. Barring that, some symbols should be used in the text to indicate that a new term is being introduced and it is explained in the Glossary. While the Glossary gives an example (with page number) of usage in this book for most terms defined, no system of reference to the Glossary is adopted in the text.

The scope of any nonparametric book should rightly be considered the prerogative of the author. However, omission of simple and useful procedures such as the Kolmogorov-Smirnov tests (goodness-of-fit and equality of two or more distributions), and chi-square tests (goodness-of-fit tests and contingency table analysis), leaves a serious lack in the repertoire of potential users of nonparametric methods. Procedures based on runs, multivariate topics and univariate sequential methods are likewise omitted. Only certain procedures are included for those data situations covered. For example, rank correlation and normal scores tests are omitted, even though they are easier to apply and understand than some of the techniques selected for inclusion, for example the bivariate symmetry test. On the other hand, the inclusion of confidence interval procedures and multiple comparisons techniques is a moral and unexpedience of this book's scope. An explanation of P-values or associated probability is a useful alternative to traditional methods of hypothesis testing where a particular level is selected in advance is somewhat hidden on page 20, Comment 8. The discussion of choice of levels in discrete null distributions is inadequate; for example, nominal level versus exact level is given little attention. For the two-sample dispersion problem, the Ansari-Bradley test is presented instead of the Siegel-Tukey test. The former procedure requires a special table, the formulas for its mean and variance differ depending on whether the total sample size is odd or even. Further, the only confidence procedure given for dispersion parameters is based on rank-like tests. These simple methods which correspond to the Mann-Whitney-Wilcoxon and Sukhatme test procedures (see Noether [4]) are not mentioned.

In summary, the authors have provided a well-documented, well-referenced and concise summary of a number of selected nonparametric procedures. Their proper usage is illustrated by actual experimental situations. The authors' primary goal is thereby fully achieved. The selectivity of techniques limits this book's usefulness as a handbook or reference, and its concision hampers classroom effectiveness. On the other hand, students and research workers interested in applying nonparametric methods would benefit from a thorough acquaintance with this volume. This book is for readers who want good tables, a large assortment of topics with a wide range of complexities, and who are unconcerned with solved problems or a wide range of examples.

REFERENCES


Jean D. Gibbons
University of Alabama


This book effectively presents a particular view of statistical inference which utilizes Bayes' theorem. Its strength lies in the breadth of coverage, and in the many realistic examples of the analysis of data.

Based upon a notion of ignorance relative to an experiment, the authors suggest that a prior distribution should be taken (locally) uniform in a parameter for which the likelihood function is exactly, if possible, approximately, if not, data translated, in the sense that changes in the data should only shift the likelihood function, not change its shape. This eventually leads them to take the prior density proportional to the square root of the Fisher information matrix, i.e., to Jeffreys' rule. They suggest that in certain situations this rule be modified, for example, when some parameters are viewed as independent of others, and in general used with caution. When such a prior distribution is used it is called noninformative, and described as the distribution of an unprejudiced observer, although no attempt is made to justify such language. In the remainder of the book their approach is illustrated in a number of important areas of inference, namely, standard normal theory, linear models, variance component problems, some general multivariate problems, choice of transformation of data, and robustness based upon the exponential power distributions. They emphasize the effectiveness of Bayesian approaches in assessing assumptions by means of broadening an initial model to allow additional parameters, and then, numerically, if neces-
sary, integrating out such parameters. There are 10 chapters, 6 tables, and a good reference list. There are no exercises.

The only major weakness in this book stems from the particular, seemingly self-contradictory, point of view taken by the authors in their choice of a prior distribution. Thus, on the one hand they pay lip service to the subjective theory of de Finetti and L. J. Savage; on the other hand, they try to be "objective" in their choice of a prior distribution after the fashion of Jeffreys. But, despite the fact that a subjective prior will often find, via a stable estimation argument, that his posterior distribution is well approximated using Jeffreys' prior distribution, these approaches are logically incompatible. Nowhere could this be more clear than in the curious discussion on page 45 of the dependence of their prior distribution upon the design of the experiment. The authors consider Bernoulli data consisting of 21 successes in 24 trials and observe that their prior distribution for the usual parameter depends upon whether the sample size $n = 24$ is fixed in advance, yielding a binomial distribution, or whether the number of successes $r = 21$ is fixed in advance, yielding a Pascal distribution, for the data. Of course the likelihood functions are identical, and the system of inference proposed by the authors thus violates the likelihood principle. The authors implicitly dismiss this principle with a comment to the effect that they do not find it very surprising that the inference should be different in the two situations. It is a little disappointing that the likelihood principle should meet such a fate (not with a bang but a whimper?). It is even more disappointing that the authors do not acknowledge that they are simultaneously dismissing the subjectivistic foundations to which they pay lip service. While it is true that choice of experiment sometimes does convey information about a parameter, for example, choice of the Pascal as opposed to the binomial in the above example suggests that the experimenter views the parameter as small, such information is of a highly subjective nature, and can hardly be routinely represented in terms of an additional factor $p^2$ in the prior density, as done by the authors. (One is led to wonder whether they would use a mixture of the two priors if the choice of sampling scheme were made by flip of a coin?) Plainly, the notion of ignorance relative to an experiment which the authors propose, whatever be its merits, is not compatible with the subjectivistic theory. Rather, within the subjectivistic theory such ignorance may or may not occur, and although life is pleasant when it does, it should not be forced in when not applicable. The authors are eventually led, incidentally, to the use of "prior" distributions which depend upon the data, nor merely upon the design of the experiment, in connection with their analysis of transformations. Their approach might then best be described as one of modulating a likelihood function by another function, which in certain instances is allowed to depend upon the data, and interpreting the product as a probability density for the parameter, given the data. Such methods may eventually prove fruitful, but since they cannot be justified in terms of maximizing subjective expected utility, or coherent behavior, upon what basis do they rest? While explicitly rejecting most non-Byesian criteria, the authors unfortunately fail to suggest alternative ways of judging the performance of their methods, apparently (in my opinion mistakenly) relying upon the usual subjectivistic criteria.

I would not like, however, to leave the reader with a negative impression of this book. It is a very valuable reference source, containing material that is not generally known, nor readily available, elsewhere. There seem to be few errors. I am at present using it as a text for a course in Bayesian inference, for which purpose, when suitably supplemented, I find it very well adapted.

Bruce M. Hill
University of Michigan


Otnes and Enochson offer their book first as a tool and a reference for those actively engaged in digital data analysis and second for use in "a graduate level course in time series analysis for students in engineering and related fields." It is written from an engineering point of view rather than a statistical one. Statistical concepts employed (moments of a distribution, stationarity) are defined heuristically rather than rigorously. The book is accessible to anyone with a background of calculus and elementary real and complex analysis.

The authors start by presenting statistical concepts to be used in the rest of the book. They discuss data records as "time histories" which may be either deterministic (a sample of a sine wave, for example) or random (an observation of a stochastic process). Fourier transforms, convolutions, the autocorrelation function and power spectrum, the sampling theorem, and resolution in the frequency domain are also discussed in Chapter 1. As this list suggests, the title of the book should perhaps be "Digital Spectral Analysis". Most of the book deals with filtering and spectral estimation and is most applicable to the analysis of vibration, acoustic, or similar data for which a frequency domain description is sought.

Chapter 2, Preprocessing of Data, and Chapter 10, Probability Density Function Computations, are exceptions. Chapter 2, like the first chapter, contains little that will be new to the experienced time series analyst but is a good introduction for the novice. Simple explanations of analog-to-digital converters, magnetic tape, and other components of a data acquisition system are given. There are good discussions of digitization error and of such practical problems as removing bad data points and trends and scaling plots. Chapter 10 applies to any data, not just time series, and is largely devoted to recipes for computing histograms and chi-square tests for normality.

Chapter 3 deals with data filtering, particularly recursive digital filtering. There are computational recipes for numerous filters (sine and tangent Butterworth and Chebyshev), as well as a discussion of instability problems due to computer round-off error.

Chapter 4 discusses the discrete Fourier transform and fast Fourier transform (FFT). Chapters 5 through 8 deal with spectral and cross-spectral density computations by three different methods, via the correlation function, the direct FFT, and using filters. Good discussions of leakage and confidence bands for spectral estimates are included. A number of efficient methods of computing correlation functions, including the approach via the FFT, are presented.

Chapter 9 deals with the estimation of frequency response functions of linear systems and of coherence. Computation of confidence limits for coherence estimates is discussed. Finally, suggestions are offered for applying such multivariate techniques as principal component analysis to the spectral density matrix when relationships among several time series are being studied. The final chapters treat non-stationary time series and present examples of the computations discussed in the book, performed on generated data.

This book is more likely to be valuable as a reference than
as a text, though much of the material could be used in the course envisioned by the authors, and they do include some problems. Its weakness is that it contains more than most people want to know about some aspects of digital time series analysis (FFT algorithms, for example) and neglects others or loses sight of the big picture in all the details. For example, the chapter on filtering includes virtually no discussion (except in terms of passing specified frequencies) of why filters should be used on data at all.

A warning to any user: Four pages of errata came with the book, and I found a page more. Some errors are minor, but many involve sloppy notation, missing factors of two, etc., which would be particularly confusing to the relatively unsophisticated time series analysts who are likely to be the book’s primary audience.

Judith Zeh Nelson
University of Washington


Volume 1 of Biometrika Tables for Statisticians, issued in 1954, updated and revised versions of BTS published earlier by K. Pearson. Volume 1 was planned to include “the most essential tools of the statistician’s trade” and contained tables published in Biometrika and elsewhere. Many tables have been published since Volume 1 appeared and, while some of these were included in later revisions of Volume 1, there is a need for a book of tables associated with statistical methodology developed more recently. It is obvious that one volume could not summarize all of the new tables which have appeared in the recent statistical literature. The authors point out that “Volume 2 is one of the many possible companions to Volume 1.”

Some of the tables in Volume 2 supplement, (tables in Volume 1 by providing additional decimal places, fractional degrees of freedom, wider range of arguments, and probability integrals in place of percentage points. The 69 tables in Volume 2 cover 232 pages and are grouped into ten chapters as summarized below.

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<td>Tables for Multivariate Analysis</td>
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<td>VIII</td>
<td>Goodness of Fit Tests Based on the Empirical Distribution Function</td>
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As the practicing statistician looks over these chapter headings, he might be inclined to conclude that this publication will be of little use to him. Fortunately, this is not the case. As in Volume 1, a large introduction to the underlying theory and methods of application of the tables is included. In Volume 2 the introduction covers 111 pages and includes 65 examples of the use of the tables. Over 80% of the examples involve real data collected in experimental investigations. Many will feel that the introduction alone is worth the purchase price.

The examples include calculation of confidence limits for several parameters such as the mean of a Poisson distribution, the ratio of two variances ($\sigma_1^2/\sigma_2^2$), the binomial parameter $p$, the coefficient of variation, the multiple correlation coefficient, and the median. Other examples illustrate the comparison of means of two exponential distributions, combining evidence from several experiments, testing for randomness and normality, estimation of the mean and standard deviation using order statistics, setting of specifications and computation of tolerance limits in quality control problems, testing for homogeneity of variances, comparison of mean vectors and covariance matrices, power and sample size calculations, graduation of empirical distributions, nonparametric analyses, and quantal assay and estimation of the LD$_{50}$ to name a few.

A reading of the examples may suggest applications of statistical methodology which had not occurred to the reader before.

Another important use of the introduction is that it also serves as a brief review of the literature on the topics covered by each of the ten chapters. The amount of the statistical literature is growing exponentially; and while most practicing statisticians are generalists and need to keep up on all aspects of statistical methodology, it becomes impossible to do so and at the same time contribute to the solution of real problems. If one is confronted with a problem in a certain area, and it has been some time since he used this particular statistical methodology, he can refer to this volume and get a quick review of the literature.

This reviewer found the sections on testing the form of the distribution function (i.e., normal, lognormal, exponential), fitting of univariate frequency distributions, and quantal assay particularly useful. Statisticians using other techniques will no doubt find other sections useful to them.

Another strong point of Volume 2 is the chapter on interpolation in statistical tables. This topic is given little attention in the statistical literature and, as the authors point out, linear interpolation is inaccurate in many instances. Many distribution functions are highly nonlinear even over a small range. Interpolation techniques are illustrated in numerical examples throughout the text.

While space does not permit a complete summary of all the tables, the following should give one a general impression of the types of tables contained in Volume 2.

Chapter I contains tables associated with the normal probability function including values of $X$ and $Z$ in terms of $P$, differential coefficients $D^nZ(X)$, percentage points of the chi-square and $F$ distributions for integral and fractional degrees of freedom, and probability integrals of the extreme standardized deviate from the population mean, extreme standardized deviate from the sample mean, and the mean deviation from the sample mean.

The tables in Chapter II give expected values, variances, and covariances of normal order statistics, coefficients for estimating the mean and standard deviation from $k$ normal order statistics, moments and moment ratios of the extreme values in normal samples, statistics associated with the Shapiro-Wilk $W$ test for normality, and expected values of
order statistics in samples from negative exponential, gamma, and half-normal distributions.

Chapter III gives lower tail critical values for the Wilcoxon two-sample rank-sum test and the probability integral and lower percentage points for the Wilcoxon paired rank test. The tables in Chapter IV are associated with the noncentral t, \( t \), \( F \), and chi-square distributions and include values and confidence limits for noncentral parameters and coefficients to assist the determination of moments. Charts for power and sample size calculations are also included.

Chapter V contains tables which aid in the fitting of the Pearson and Johnson \( S_2 \) and \( S_3 \) univariate frequency distributions. Tables for the maximum likelihood estimator of \( p \) in the gamma (Type III) distribution and the coefficients in the expansions for the bias and variance of the maximum likelihood estimator \( \hat{p} \) are also included.

The tables in Chapter VI are used in the analysis of quantal assay data by the techniques of minimum norm chi-square, minimum logit chi-square, and maximum likelihood logistic. Probit analysis was described in Volume I.

Chapter VII contains tables for multivariate analysis techniques such as Wilk's likelihood criterion, \( W = |A|/|A + B| \). Tables of the percentage points of the largest characteristic root of \( |B - t(A + B)| \), the extreme roots of \( |S^{-1} - CI| \), and the multiple correlation coefficient, \( R_c \), are included. Tables used in testing the equality of \( \lambda \) covariance matrices and the hypothesis \( \Sigma = \Sigma_0 \) are also given.

The tables in Chapter VIII are associated with goodness-of-fit tests and include percentage points for the statistics \( D_1, V_1, W_3, Z_1, \) and \( A \) in finite samples of \( n \) observations and the critical values for the Kolmogorov two-sample test. Chapter IX contains tables of percentage points for \( R/N \) (on circle), \( R/N \) (on sphere), \( S = \Sigma(\cos^2 \theta)/N \) (on sphere), and \( S_{\text{min}} \) and \( S_{\text{max}} \) (on sphere). Charts to determine the percentage points of \( R \) (on circle) and \( R \) (on sphere) and critical values for testing the equality of two modal vectors (on circle) and two modal vector (on sphere) are included. Tables for the estimation of \( \kappa \) for dispersion on a circle and sphere are also given.

The tables in Chapter X aid in interpolation and include coefficients for Bessel interpolation formula, four-point and five-point Lagrangian interpolation coefficients, and Lagrangeian coefficients for use with harmonic arguments.

The authors express a concern that some will find these tables of little use because of ready availability of the computer. Much statistical work is done away from the computer where tables of statistical functions are necessary. It is doubtful that the computer will make such a publication obsolete.

In conclusion, Volume 2 of Biometrika Tables for Statisticians is an appropriate companion to Volume 1. While Volume 2 is not as generally useful as Volume 1, it will be helpful to many statisticians.

Ronald D. Snec
E. I. du Pont de Nemours & Co., Inc.


The Authors state in the preface that this text is intended for an introductory course in probability and statistics for second-year students with only a pre-calculus knowledge of mathematics and, of course, no previous experience in statistics. The material is well organized in "classical" fashion; the topics covered include: probability, random variables, probability distributions, organization and presentation of data, estimation, hypothesis testing, goodness of fit and contingency tables, regression and correlation, analysis of variance and nonparametric statistics. No material is included (and perhaps rightly so) on the "decision analysis" approach to statistics. Each topic has, I think, the right amount of depth or coverage.

This book has a number of strong points which would make it suitable for a text at the suggested level. Perhaps the most important point is that the book is carefully written with very few minor slips and half-truths. One often finds in texts of this nature, numerous slips and other transgressions which are presumably permitted so that the student is not overburdened with details and the pre-calculus level is retained. Malik and Mullen have done an excellent job of a most difficult task: keeping the book usable at the level indicated and yet, giving careful statements of definitions, theorems and problems. As an example, they are successful in introducing continuous random variables.

No doubt, some of the aforementioned success is due to the numerous examples included: after virtually every definition and theorem and in many other situations examples are given. I liked, particularly, an example (page 171) in which twenty (20) different confidence intervals for the normal mean were given (the student was told \( \mu = 100 \)) and the student could see the end-points varying and could see which intervals included 100 and which did not. Many problems (with answers in the back of the book) are given. The book has a rather complete set of tables which also makes it useful.

The major shortcoming, it seems to me, is that no references are given for further reading. It would have been nice to have some references for the inquisitive student. There are also, as in any text, some slips but they are too few to mention. The level of typographical errors also seems low.

The Authors suggest that the text could also be used for a first course in probability. I must disagree with this idea but any further discussion of the point would be academic since it is unlikely that students at this second year level would be studying probability alone without better preparation in mathematics.

In summary, I can recommend this text for a first course at the level indicated.

Ray E. Schafer
Hughes Aircraft Company


This book consists of a collection of nearly 1000 different exercises covering the topics usually presented in a first course on the theory of functions of a complex variable. This field is today recognized as an essential part of the mathematical training of not only mathematicians but also of statisticians, engineers, physicists and other scientists. For this reason the book will be invaluable both to teachers and to students alike especially since the second part of the book contains solutions to the problems. Actually the scope of the book is a little wider than the title suggests, as an examination of the Chapter headings shows:

1. Complex numbers. Linear transformations.
2. Regularity conditions. Elementary functions.
3. Complex integration.
4. Sequences and series of analytic functions.
5. Meromorphic and entire functions.
6. The maximum principle.
8. The Dirichlet problem.
10. Univalent functions.

In a few of the chapters some preliminary material covering mainly basic definitions is inserted although this is certainly not sufficient for this book to be regarded as a text. The book appears to be surprisingly free of typographical errors and mistakes. This could be partly due to the fact it is an enlarged and revised English edition of a Polish version first published in 1962. In conclusion, it is a useful addition to the library of any teacher of complex variable theory.

Jeffrey J. Hunter
University of Auckland


This publication contains the proceedings of a conference organized by the Bolyai Janos Mathematical Society in Gyor, Hungary, September 1971. The purpose of the conference was to bring together mathematicians, economists, and engineers to discuss applications of operations research to inventory control and water storage. Specific papers appearing in the publication are:

1. “The hurst phenomenon and the range of sums of random variables,” by G. N. Alexander
2. “Investigation on the water demand distribution concerning the irrigation systems in the Tisza Valley,” by A. Barasz, L. David, and M. Kropf
5. “Recent papers in first emptiness problems of storage,” by J. Gani and J. Matthews
6. “Reduction of the on-hand inventory on given level of reliability,” by L. Gerencser
8. “Some statistical results for inventory models with state dependent leadtimes,” by C. M. Harris
10. “On minimizing water loss by modifying lock dates,” by B. Djordjevic and S. Opricovic
11. “The error term in limit theorems for sums of random numbers of the same state dependent leadtimes,” by C. M. Harris
12. “Some results concerning reliability-type inventory models,” by Z. Laszlo
13. “Lagerhaltungsmodell fur nichtstationare Nachfrage,” by Q. Mann
15. “Allowing for the effect of planning in stochastic models: A controlled-variability approach to water resource allocation,” by J. Tomko
16. “Inventory control with unknown demand distribution: A discrete time-discrete level case,” by J. Wessels
20. “On minimizing water loss by modifying lock dates,” by J. Stahl
23. “Produktion und Vorrata in Betriebsmodellen,” by L. Uncovsky
24. “Inventory control with unknown demand distribution: A discrete time-discrete level case,” by J. Wessels
27. “Matrix-arithmetical relations in the dimensioning of dams and in the study of the operation of large lakes,” by I. Zsuffa

G. G. K.


Harald Bergstrom is professor in mathematical statistics at the Chalmers Institute of Technology and the University of Goteborg, Sweden. This publication contains a collection of papers contributed in his honour on the occasion of his sixty-fifth birthday. Specific papers appearing in the publication are:

1. “On the equivalence principle in fluctuation theory,” by E. Sparre Andersen
2. “Asymptotic power and expected sample size of SPR-tests in one parameter exponential families,” by S. Holm
3. “A limit theorem for sums of random numbers of i.i.d. random variables,” by P. Jagers
4. “A canonical representation of symmetrically distributed random measures,” by O. Kallenberg
5. “A characterization of the multi-variate negative binomial distribution,” by E. Lukacs
6. “A note on logarithmic concave measures,” by A. Prekopa
7. “Note on spherical harmonics,” by M. Rao
8. “On a random transformation of a point process to a Poisson process,” by M. Rudemo
10. “Summing variances in $L_p$,” by V. V. Yurinskii

G. G. K.
Forecasting the demand for telephones in Australia . . . . . . . M. N. Bhattacharyya

Predictive mean square error and stochastic regressor variables . . . . . . . . . S. C. Narula

A model for the occurrence of north winds at Kingston, Jamaica . . . . . . . . Z. Ali

The estimation of treatment means by designed experiments . . . . . . . . . . . . S. C. Pearce

Two-sample problems for a dichotomous variable with missing data
Janet D. Elashoff and R. M. Elashoff

Asymptotic mean square error of predicting more than one step ahead using a regression method . . . . . . . . R. J. Bhansali

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