

# THE ANNALS of STATISTICS

AN OFFICIAL JOURNAL OF THE  
INSTITUTE OF MATHEMATICAL STATISTICS

## Asymptotic Theory

Probability inequalities for likelihood ratios and convergence rates of sieve MLEs WING HUNG WONG AND XIAOTONG SHEN	339
Uniform coverage bounds for confidence intervals and Berry-Esseen theorems for Edgeworth expansion . . . . . PETER HALL AND BING-YI JING	363
Estimating the real parameter in a two-sample proportional odds model . COLIN O. WU	376
Dual likelihood . . . . . PER ASLAK MYKLAND	396

## Censored and Truncated Data

The central limit theorem under random censorship . . . . . WINFRIED STUTE	422
On strong uniform consistency of the Lynden-Bell estimator for truncated data KANI CHEN, MIN-TE CHAO AND SHAW-HWA LO	440
An omnibus test for independence of a survival time from a covariate IAN W. MCKEAGUE, A. M. NIKABADZE AND YANQING SUN	450

## Curve Estimation

Efficient estimation of monotone boundaries A. P. KOROSTELEV, L. SIMAR AND A. B. TSYBAKOV	476
Dimension of the singular sets of plane-fitters . . . . . STEVEN P. ELLIS	490
Asymptotical minimax recovery of sets with smooth boundaries E. MAMMEN AND A. B. TSYBAKOV	502
Finite-sample confidence envelopes for shape-restricted densities NICOLAS W. HENGARTNER AND PHILIP B. STARK	525
Model estimation in nonlinear regression under shape invariance ALOIS KNEIP AND JOACHIM ENGEL	551

## Decision Theory

Estimation of a loss function for spherically symmetric distributions in the general linear model. . . . . DOMINIQUE FOURDRINIER AND MARTIN T. WELLS	571
A note on admissibility when precision is unbounded CHARLES ANDERSON AND NABENDU PAL	593
Admissibility and minimaxity of the UMVU estimator of $P(X < Y)$ QIQING YU AND Z. GOVINDARAJULU	598

## Random Fields

Testing for a signal with unknown location and scale in a stationary Gaussian random field . . . . . DAVID O. SIEGMUND AND KEITH J. WORSLEY	608
Estimating the number of peaks in a random field using the Hadwiger characteristic of excursion sets, with applications to medical images K. J. WORSLEY	640

## Time Series

Autoregression quantiles and related risk-scores processes HIRA L. KOUL AND A. K. MD. E. SALEH	670
Blind deconvolution of linear systems with multilevel nonstationary inputs TA-HSIN LI	690

## Correction

The relationship between sufficiency and invariance with applications in sequential analysis . . . . . W. J. HALL, R. A. WIJSMAN AND J. K. GHOSH	705
---	-----

---

Vol. 23, No. 2—April 1995

# INSTITUTE OF MATHEMATICAL STATISTICS

(Organized September 12, 1935)

*The purpose of the Institute is to foster the development and dissemination of the theory and applications of statistics and probability.*

---

## OFFICERS AND EDITORS

- President:** David R. Brillinger, Department of Statistics, University of California, Berkeley, California 94720-0001
- President-Elect:** James O. Berger, Department of Statistics, Purdue University, West Lafayette, Indiana 47907-1399
- Past President:** Stephen M. Stigler, Department of Statistics, University of Chicago, 5734 University Avenue, Chicago, Illinois 60637
- Executive Secretary:** Hari G. Mukerjee, Department of Mathematics and Statistics, Wichita State University, Wichita, Kansas 67208-0033
- Treasurer:** Miriam Gasko Donoho, Department of Marketing and Quantitative Studies, College of Business, San Jose State University, 1 Washington Square, San Jose, California 95192-0069
- Program Secretary:** Jon A. Wellner, Department of Statistics GN-22, University of Washington, Seattle, Washington 98195
- Editors, *The Annals of Statistics*:** Lawrence D. Brown, Department of Statistics, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6302; John Rice, Department of Statistics, Evans Hall, University of California, Berkeley, California 94720
- Editor, *The Annals of Probability*:** James W. Pitman, Department of Statistics, University of California, Berkeley, California 94720-0001
- Editor, *The Annals of Applied Probability*:** Richard L. Tweedie, Department of Statistics, Colorado State University, Fort Collins, Colorado 80523
- Executive Editor, *Statistical Science*:** Paul Switzer, Department of Statistics, Sequoia Hall, Stanford University, Stanford, California 94305
- Editor, *The IMS Bulletin*:** Susan R. Wilson, Centre for Mathematics and its Applications, School of Mathematical Sciences, Australian National University, Canberra ACT 0200, Australia
- Editor, *IMS Lecture Notes—Monograph Series*:** David Ruppert, School of Operations Research and Industrial Engineering, E & TC Building, Cornell University, Ithaca, New York 14853-7501
- Managing Editor:** John R. Collins, Department of Mathematics and Statistics, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Canada T2N 1N4
- Managing Editor:** Paul J. Smith, Director, Statistics Laboratory, Department of Mathematics, University of Maryland, College Park, Maryland 20742

---

**Journals.** The scientific journals of the Institute are *The Annals of Applied Statistics*, *The Annals of Probability*, *The Annals of Statistics* and *Statistical Science*. The news organ of the Institute is *The Institute of Mathematical Statistics Bulletin*.

**Individual and Organizational Memberships.** All individual members pay basic membership dues of \$60. Each individual member must elect to receive at least one scientific journal for an additional amount, as follows: *The Annals of Applied Probability* (\$15), *The Annals of Probability* (\$29), *The Annals of Statistics* (\$25) or *Statistical Science* (\$10). Of the total due dues paid, \$29 is allocated to *The IMS Bulletin* and the remaining amount is allocated equally among the scientific journal(s) received. Reduced membership dues are available to full-time students, permanent residents of countries designated by the IMS Council and retired members. Retired members may elect to receive the *Bulletin* only for \$24. Organizational memberships are available to nonprofit organizations at \$450 per year and to for-profit organizations at \$750 per year. Organizational memberships include two multiple-readership copies of all IMS journals in addition to other benefits specified for each category (details available from the IMS Business Office).

**Individual and General Subscriptions.** Subscriptions are available on a calendar-year basis. Individual subscriptions are for the personal use of the subscriber and must be in the name of, paid directly by, and mailed to an individual. Individual subscriptions for 1995 are available to *The Annals of Applied Probability* (\$80), *The Annals of Probability* (\$85), *The Annals of Statistics* (\$90), *The IMS Bulletin* (\$50) and *Statistical Science* (\$75). General subscriptions are for libraries, institutions and any multiple-readership use. General subscriptions for 1995 are available to the *The Annals of Applied Probability* (\$90), *The Annals of Probability* (\$130), *The Annals of Statistics* (\$150), *The IMS Bulletin* (\$50) and *Statistical Science* (\$75). Air mail rates for delivery outside North America are \$80 per title (excluding the *The IMS Bulletin*).

**Permissions policy.** Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by the Institute of Mathematical Statistics, provided that the base fee of \$5.00 per copy, plus \$0.00 per page is paid directly to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, Massachusetts 01923. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transactional Reporting Service is 1050-5164/95 \$5.00 + 0.00.

**Correspondence.** Mail concerning membership, subscriptions, nonreceipt claims, copyright permissions, advertising or back issues should be sent to the IMS Business Office. Mail concerning submissions or editorial content should be sent to the Editor of the appropriate journal. Their addresses are listed above. Mail concerning the production of this journal should be sent to: Patrick Kelly, IMS Production Editor, Department of Statistics, 3000 Steinberg-Dietrich Hall, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6302.

***The Annals of Statistics* (ISSN 0090-5364),** Volume 23, Number 2, April 1995. Published quarterly by the Institute of Mathematical Statistics, 3401 Investment Boulevard #7, Hayward, California 94545-3819-18. Second-class postage paid at Hayward, California and at additional mailing offices.

**POSTMASTER:** Send address changes to *The Annals of Statistics*, Institute of Mathematical Statistics, 3401 Investment Boulevard #7, Hayward, California 94545-3819-18.

## EDITORIAL STAFF

### EDITORS

LAWRENCE D. BROWN  
JOHN A. RICE

### ASSOCIATE EDITORS

ANDREW R. BARRON	IAIN JOHNSTONE	MICHAEL NUSSBAUM
JAMES O. BERGER	JANA JUREČKOVÁ	MOSHE POLLACK
CHING-SHUI CHENG	AUGUSTINE KONG	ELIZABETH A. THOMPSON
PETER GREEN	HANS R. KÜNSCH	MICHAEL TITTINGTON
PETER GUTTORG	BRUCE G. LINDSAY	ANASTASIOS A. TSIATIS
PETER HALL	JOHN MARDEN	AAD W. VAN DER VAART
TREVOR HASTIE	RAHUL MUKERJEE	LARRY WASSERMAN
J. T. GENE HWANG	VIJAYAN N. NAIR	WING HUNG WONG
NICOLAS P. JEWELL	DEBORAH NOLAN	

### EDITORIAL ASSISTANTS

JUDY EVANS  
SHARON HURLEY

---

MANAGING EDITOR  
JOHN R. COLLINS

PRODUCTION EDITOR  
PATRICK KELLY

---

### PAST EDITORS

#### THE ANNALS OF MATHEMATICAL STATISTICS

H. C. CARVER, 1930–1938	WILLIAM KRUSKAL, 1958–1961
S. S. WILKS, 1938–1949	J. L. HODGES, JR., 1961–1964
T. W. ANDERSON, 1950–1952	D. L. BURKHOLDER, 1964–1967
E. L. LEHMANN, 1953–1955	Z. W. BIRNBAUM, 1967–1970
T. E. HARRIS, 1955–1958	INGRAM OLKIN, 1970–1972

#### THE ANNALS OF STATISTICS

INGRAM OLKIN, 1972–1973	MICHAEL D. PERLMAN, 1983–1985
I. R. SAVAGE, 1974–1976	WILLEM R. VAN ZWET, 1986–1988
RUPERT G. MILLER, JR., 1977–1979	ARTHUR COHEN, 1988–1991
DAVID V. HINKLEY, 1980–1982	MICHAEL WOODROOFE, 1992–1994

---

## EDITORIAL POLICY

As editors of *The Annals of Statistics*, it is our policy to publish research of the highest quality reflecting the many facets of contemporary statistics. Primary emphasis is placed on importance and originality.

The discipline of statistics has deep roots in classical mathematical analysis, from which it derives rigor, coherence, and clarity, and is also dependent on roots in substantive scientific areas for its historical foundation and continued vitality. In the last twenty years, computational developments have had profound consequences which should also be reflected in the *Annals*. Consequently, our policy is to continue to play a special role in presenting research at the forefront of mathematical statistics, especially the more important and deep advances in the theory underlying statistical science. At the same time, we also intend to publish papers relating to the role of statistics in interdisciplinary investigations of the major scientific and social problems of our time and to emphasize developments in computational methodology. Mathematical depth and difficulty will not be the principle criteria with respect to which submissions in the latter categories are evaluated. Fundamentally, we seek a broad spectrum of papers which intellectually enriches our profession.

Most papers should contain an introduction which presents a discussion of the context and importance of the issues they address and a clear, non-technical description of the main results. The introduction should be accessible to a wide range of readers. Thus, for example it may be appropriate in some papers to present special cases or examples prior to general, abstract formulations, while in other papers discussion of the general scientific context of a problem might be a helpful prelude to the body of the paper.

---

Manuscripts submitted to *The Annals of Statistics* should be sent to:

Lawrence D. Brown and John A. Rice  
Editors  
Department of Statistics  
University of Pennsylvania  
Philadelphia, PA 19104-6302

## IMS CORPORATE MEMBERS

AT & T BELL LABORATORIES  
Murray Hill, New Jersey

GENERAL MOTORS CORPORATION  
Research Laboratories  
Warren, Michigan

BELL COMMUNICATIONS RESEARCH  
Morristown, New Jersey

INTERNATIONAL BUSINESS MACHINES CORP  
Thomas J. Watson Research Center  
Yorktown Heights, New York

## IMS INSTITUTIONAL MEMBERS

ABERDEEN UNIVERSITY  
Queen Mother Library  
Aberdeen, Scotland

ACADEMIA SINICA  
Inst of Statistical Science  
Taipei, Taiwan

AMERICAN UNIVERSITY  
Dept of Mathematics and Statistics  
Washington, DC

ARIZONA STATE UNIVERSITY  
Committee on Statistics  
Dept of Mathematics and Dept of  
Decision and Information Systems  
Tempe, Arizona

AUSTRALIAN NATIONAL UNIVERSITY  
Canberra, ACT, Australia

BOWLING GREEN STATE UNIVERSITY  
Dept of Mathematics and Statistics  
Bowling Green, Ohio

CALIFORNIA STATE UNIVERSITY  
AT FULLERTON  
Dept of Mathematics  
Fullerton, California

CASE WESTERN RESERVE UNIVERSITY  
Dept of Mathematics and Statistics  
Cleveland, Ohio

CORNELL UNIVERSITY  
Dept of Mathematics  
Ithaca, New York

DALHOUSIE UNIVERSITY  
Killam Memorial Library  
Halifax, Nova Scotia, Canada

DUKE UNIVERSITY  
Mathematics and Physics Library  
Durham, North Carolina

FLORIDA STATE UNIVERSITY  
Dept of Statistics  
Tallahassee, Florida

GEORGE WASHINGTON UNIVERSITY  
Dept of Statistics  
Washington, DC

HARVARD UNIVERSITY  
Cabot Science Library  
Cambridge, Massachusetts

HARVARD UNIVERSITY  
Dept of Biostatistics  
Boston, Massachusetts

HARVARD UNIVERSITY  
Dept of Statistics  
Cambridge, Massachusetts

INDIAN STATISTICAL INSTITUTE  
Library  
Calcutta, India

INDIANA UNIVERSITY  
Dept of Mathematics  
Bloomington, Indiana

INSTITUTE FOR DEFENSE ANALYSIS  
Center for Communications Research  
La Jolla, California

IOWA STATE UNIVERSITY  
Dept of Stat and Statistical Lab  
Ames, Iowa

JOHNS HOPKINS UNIVERSITY  
Depts of Biostatistics  
and Mathematical Sciences  
Baltimore, Maryland

KANSAS STATE UNIVERSITY  
Dept of Statistics  
Manhattan, Kansas

MARA INSTITUTE OF TECHNOLOGY  
Selangor, Malaysia

MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
Dept of Mathematics  
Cambridge, Massachusetts

MEDICAL COLLEGE OF WISCONSIN  
Biostatistics Division  
Milwaukee, Wisconsin

MCGILL UNIVERSITY  
Dept of Mathematics and Statistics  
Montreal, Quebec, Canada

MEMORIAL SLOAN-KETTERING CANCER CENTER  
Biostatistics Service  
New York, New York

MIAMI UNIVERSITY LIBRARY  
Oxford, Ohio

MICHIGAN STATE UNIVERSITY  
Dept of Statistics and Probability  
East Lansing, Michigan

NATIONAL SECURITY AGENCY  
Fort George G. Meade, Maryland

NEW MEXICO STATE UNIVERSITY  
Dept of Mathematical Sciences  
Las Cruces, New Mexico

NORTH CAROLINA STATE UNIVERSITY  
Dept of Statistics  
Raleigh, North Carolina

NORTH DAKOTA STATE UNIVERSITY LIBRARY  
Fargo, North Dakota

NORTHERN ILLINOIS UNIVERSITY  
Div of Statistics  
DeKalb, Illinois

OHIO STATE UNIVERSITY  
Dept of Statistics  
Columbus, Ohio

OREGON STATE UNIVERSITY  
Dept of Statistics  
Corvallis, Oregon

PENNSYLVANIA STATE UNIVERSITY  
Dept of Statistics  
University Park, Pennsylvania

PRINCETON UNIVERSITY LIBRARY  
Princeton, New Jersey

PURDUE UNIVERSITY LIBRARY  
West Lafayette, Indiana

QUEEN'S UNIVERSITY  
Dept of Mathematics and Statistics  
Kingston, Ontario, Canada

RICE UNIVERSITY LIBRARY  
Houston, Texas

THE ROCKEFELLER UNIVERSITY LIBRARY  
New York, New York

STANFORD UNIVERSITY  
Dept of Statistics  
Stanford, California

SOUTHERN ILLINOIS UNIVERSITY  
Dept of Mathematics and Statistics  
Edwardsville, Illinois

SOUTHERN METHODIST UNIVERSITY  
Dept of Science  
Dallas, Texas

SYRACUSE UNIVERSITY  
Dept of Mathematics  
Syracuse, New York

TECHNISCHE UNIVERSITÄT  
Inst für Math Stochastik  
Braunschweig, Germany

**TEXAS TECH UNIVERSITY**  
 Dept of Mathematics  
 Lubbock, Texas

**UNIVERSITÄT KARLSRUHE**  
 Inst für Math Stochastik  
 Karlsruhe, Germany

**UNIVERSITÄTSBIBLIOTHEK DORTMUND**  
 Bereichsbibliothek Statistik  
 Dortmund, Germany

**UNIVERSITY OF ALBERTA**  
 Dept of Statistics  
 and Applied Probability  
 Edmonton, Alberta, Canada

**UNIVERSITY OF ARIZONA**  
 Dept of Mathematics  
 Tucson, Arizona

**UNIVERSITY OF BATH**  
 Library  
 Bath, United Kingdom

**UNIVERSITY OF BRISTOL**  
 Queen's Library  
 Bristol, United Kingdom

**UNIVERSITY OF BRITISH COLUMBIA**  
 Dept of Statistics  
 Vancouver, British Columbia, Canada

**UNIVERSITY OF CALGARY**  
 Dept of Mathematics and Statistics  
 Calgary, Alberta, Canada

**UNIVERSITY OF CALIFORNIA, BERKELEY**  
 Dept of Statistics  
 Berkeley, California

**UNIVERSITY OF CALIFORNIA, DAVIS**  
 Div of Statistics  
 Davis, California

**UNIVERSITY OF CALIFORNIA, IRVINE**  
 Main Library  
 Irvine, California

**UNIVERSITY OF CONNECTICUT**  
 Dept of Statistics  
 Storrs, Connecticut

**UNIVERSITY OF FLORIDA**  
 Dept of Statistics  
 Gainesville, Florida

**UNIVERSITY OF GEORGIA**  
 Dept of Statistics  
 Athens, Georgia

**UNIVERSITY OF ILLINOIS**  
 Dept of Statistics  
 Champaign, Illinois

**UNIVERSITY OF ILLINOIS AT CHICAGO**  
 Dept of Math, Stat and Comp Sci  
 Chicago, Illinois

**UNIVERSITY OF IOWA**  
 Dept of Statistics and Actuarial Sci  
 Iowa City, Iowa

**UNIVERSITY OF MARYLAND**  
 Dept of Mathematics  
 College Park, Maryland

**UNIVERSITY OF MASSACHUSETTS**  
 Dept of Mathematics and Statistics  
 Amherst, Massachusetts

**UNIVERSITY OF MINNESOTA**  
 School of Statistics  
 Minneapolis, Minnesota

**UNIVERSITY OF MINNESOTA**  
 Library  
 Minneapolis, Minnesota

**UNIVERSITY OF MISSOURI**  
 Ellis Library  
 Columbia, Missouri

**UNIVERSITY OF MONTREAL**  
 Dept of Mathematics  
 Montreal, Quebec, Canada

**UNIVERSITY OF NEBRASKA**  
 Dept of Mathematics and Statistics  
 Lincoln, Nebraska

**UNIVERSITY OF NEW BRUNSWICK LIBRARY**  
 Fredericton, New Brunswick, Canada

**UNIVERSITY OF NEW MEXICO**  
 Dept of Mathematics and Statistics  
 Albuquerque, New Mexico

**UNIVERSITY OF NORTH CAROLINA**  
 Dept of Statistics  
 Chapel Hill, North Carolina

**UNIVERSITY OF OREGON**  
 Dept of Mathematics  
 Eugene, Oregon

**UNIVERSITY OF OTTAWA**  
 Dept of Mathematics  
 Ottawa, Ontario, Canada

**UNIVERSITY OF PENNSYLVANIA**  
 Dept of Statistics  
 Philadelphia, Pennsylvania

**UNIVERSITY OF THE PHILIPPINES AT**  
 LOS BAÑOS  
 Library  
 Laguna, Philippines

**UNIVERSITY OF PITTSBURGH**  
 Mathematics Library  
 Pittsburgh, Pennsylvania

**UNIVERSITY OF SOUTH CAROLINA**  
 Dept of Statistics  
 Columbia, South Carolina

**STOCKHOLM UNIVERSITY**  
 Inst of Actuarial Math and Math Stat  
 Stockholm, Sweden

**UNIVERSITY OF TEXAS AT AUSTIN**  
 Dept of Mathematics  
 Austin, Texas

**UNIVERSITY OF TEXAS AT DALLAS**  
 Program in Mathematical Sciences  
 Richardson, Texas

**UNIVERSITY OF VICTORIA**  
 Dept of Mathematics  
 Victoria, British Columbia, Canada

**UNIVERSITY OF VIRGINIA**  
 Dept of Mathematics  
 Charlottesville, Virginia

**UNIVERSITY OF WASHINGTON**  
 Dept of Statistics  
 Seattle, Washington

**UNIVERSITY OF WATERLOO**  
 Dept of Statistics and Actuarial Sci  
 Waterloo, Ontario, Canada

**US DEPT OF AGRICULTURE**  
 Forest Service  
 New Orleans, Louisiana

**US DEPT OF THE AIR FORCE**  
 Air Weather Service Technical Library  
 Scott AFB, Illinois

**VIRGINIA COMMONWEALTH UNIVERSITY**  
 Dept of Mathematical Sciences  
 Richmond, Virginia

**VIRGINIA POLYTECHNIC INSTITUTE**  
 AND STATE UNIVERSITY  
 Dept of Statistics  
 Blacksburg, Virginia

**WAKE FOREST UNIVERSITY**  
 Z. Smith Reynolds Library  
 Winston-Salem, North Carolina

**WAYNE STATE UNIVERSITY**  
 Dept of Mathematics  
 Detroit, Michigan

**YORK UNIVERSITY**  
 Dept of Mathematics  
 Downsview, Ontario, Canada

# THE ANNALS OF STATISTICS

## INSTRUCTIONS FOR AUTHORS

**Submission of Papers.** Papers to be submitted for publication should be sent to the Editor of the *Annals of Statistics*. (For current address, see the latest issue of the *Annals*.) **Four copies** should be submitted on paper that will take ink corrections. The manuscript will *not* normally be returned to the author; when expressly requested by the author, one copy of the manuscript will be returned. All manuscripts should be accompanied by a cover letter.

**Preparation of Manuscript.** Manuscripts should be typewritten, entirely double-spaced, including references, with wide margins at sides, top and bottom. All copies must be completely legible. When technical reports are submitted, all extraneous sheets and covers must be removed. Typists should check an issue of the *Annals* for style.

**Submission of Reference Papers.** Two copies of unpublished or not easily available papers cited in the manuscript should be submitted with the manuscript.

**Title.** The title should be descriptive and as concise as is feasible, i.e., it should indicate the topic of the paper as clearly as possible, but every word in it should be pertinent.

**Abbreviated Title.** An abbreviated title to be used as a running head is also required. This should normally not exceed 35 characters. For example, an article with the title "The Curvature of a Statistical Model, with Applications to Large-Sample Likelihood Methods," could have the running head, "Curvature of Statistical Model" or possibly "Asymptotics of Likelihood Methods," depending on the emphasis to be conveyed.

**Affiliation.** Indicate your present institutional affiliation as you would like it to appear.

**Summary.** Each manuscript is required to contain a summary, clearly separated from the rest of the paper, which will be printed immediately after the title. Its main purpose is to inform the reader quickly of the nature and results of the paper; it may also be used as an aid in retrieving information. The length of a summary will clearly depend on the length and difficulty of the paper, but in general it should not exceed 150 words. Formulas should be used as sparingly as possible within the summary. The summary should not make reference to results or formulas in the body of the paper—it should be self-contained.

**Footnotes.** Footnotes should not be used, except as described under Title Page Footnotes below. Such information should be included within the text.

**Title Page Footnotes.** Included as a footnote on page 1 should be the headings:

AMS 1991 subject classifications. Primary—;  
secondary—.

Key words and phrases.

The classification numbers representing the primary and secondary subjects of the article may be found with instructions for its use in the *Mathematical Reviews Annual Subject Index-1991*. The key words and phrases should describe the subject matter of the article; generally they should be taken from the body of the paper.

Acknowledgment of support. Grants and contracts should also be included in this footnote.

**Identification of Symbols.** Manuscripts for publication should be clearly prepared to insure that all symbols are properly identified. Distinguish between "oh" and "zero," "ell" and "one," "epsilon" and "element of," "summation" and "capital sigma," etc. Indicate also when special type is required (Greek, German, script, boldface, etc.); unless indicated otherwise, formula letters will be set in italics. Acronyms should be introduced sparingly. Any hand-written symbols should be clearly identified.

**Figures and Tables.** Figures, charts, and diagrams should be prepared in a form suitable for photographic reproduction and should be professionally drawn twice the size they are to be printed. (These need not be submitted until the paper has been accepted for publication.) The printer does not improve upon the quality of the figures submitted. Tables should be typed on separate pages with accompanying footnotes immediately below the table.

**Formulas.** Fractions *in the text* are preferably written with the solidus or negative exponent; thus,  $(a + b)/(c + d)$  is preferred to  $\frac{a+b}{c+d}$ , and  $(2\pi)^{-1}$  or  $1/2(\pi)$  to  $\frac{1}{2\pi}$ . Also,  $a^{b(c)}$  and  $a_{b(c)}$  are preferred to  $a^{bc}$  and  $a_{bc}$ , respectively. Complicated exponentials should be represented with the symbol exp. A fractional exponent is preferable to a radical sign.

**References.** References should be typed double-spaced and should follow the style:

Kiefer, J. C. (1976). Admissibility of conditional confidence procedures. *Ann. Statist.* 4 836–865.

In textual material; the format "... Kiefer (1976) ..." should be used. Multiple references can be distinguished as "... Kiefer (1976a) ...". Abbreviations for journals should be taken from a current index issue of *Mathematical Reviews*.

**Copyright, Page Charges and Offprints.** Page charges are \$45 per printed page. Payment of some or all of the estimated page charges associated with articles is strongly encouraged. The editorial review of articles and administration of page charges are completely separate activities. Manuscripts are reviewed and accepted prior to determining whether page charges will be paid.

Corresponding authors receive 25 gratis offprints. Offprints of discussion articles include the main article(s), discussion(s) and rejoinder(s) as a package. Corresponding authors of main articles receive 25 gratis offprints; corresponding discussants receive 10 gratis offprints. Additional offprints may be purchased by using the IMS Offprint Purchase Order Form accompanying the galley.

Copyright transfer, page charges and offprints are the responsibility of the IMS Business Manager.

**Galley Proofs.** The corresponding author will ordinarily receive galley proofs. Corrected galley proofs should be sent to AOS Redatory, Technical Typesetting Inc., 1510 Caton Center Drive, Suite E, Baltimore, MD 21227.

**Correspondence.** All correspondence with the editor must refer to the manuscript number of the paper. This number will be on the card sent to the author acknowledging receipt of the article.