THE ANNALS
of
STATISTICS

AN OFFICIAL JOURNAL OF THE
INSTITUTE OF MATHEMATICAL STATISTICS

Vol. 20, No. 2—June 1992

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

EDITORIAL POLICY

The main purpose of *The Annals of Statistics, The Annals of Probability* and *The Annals of Applied Probability* is to publish significant contributions to the theory of statistics and probability and their applications. The emphasis is on importance and interest; formal novelty and mathematical correctness alone are not sufficient for publication. Especially appropriate are authoritative expository papers and surveys of areas in vigorous development. Because statistics is an evolving discipline, the Editors of *The Annals of Statistics* take a broad view of its domain and welcome papers in interface areas. Contributors to *The Annals of Statistics* should review the editorial in the January 1980 issue. All papers are refereed.

ADDITIONAL GUIDELINES FOR PREPARING PAPERS FOR THE ANNALS OF STATISTICS

1. The introduction and/or abstract should contain a statement pertaining to the statistical importance of the paper. Sometimes this is clear when reference is made to previous work. Statistical importance, not mathematical complexity for its own sake, is the prime criterion for publication.

2. The introduction should be thorough and contain clear yet nontechnical descriptions of the important results. Furthermore, the introduction should give a clear indication of where in the paper the main results and conclusions are to be found.

3. In papers where the formulation is general and mathematically abstract, when appropriate, the author should provide a short development of a special case, an example, or an illustration of the results. If possible, the special case or example should be in the introduction or shortly thereafter.

4. The manuscript should be proofread thoroughly before being submitted. Manuscripts with many typographical errors will cause unnecessary delays and may require resubmission.

IMS CORPORATE MEMBERS

THE AEROSPACE CORPORATION
Los Angeles, California

AT & T BELL LABORATORIES
Murray Hill, New Jersey

BELL COMMUNICATIONS RESEARCH
Morristown, New Jersey

GENERAL MOTORS CORPORATION
Research Laboratories
Warren, Michigan

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

SPRINGER-VERLAG NEW YORK INCORPORATED
New York, New York

IMS INSTITUTIONAL MEMBERS

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

FLORIDA STATE UNIVERSITY
Dept of Statistics
Tallahassee, Florida

HARVARD UNIVERSITY
Cabot Science Library
Cambridge, Massachusetts

GEORGE WASHINGTON UNIVERSITY
Dept of Statistics
Washington, DC

HARVARD UNIVERSITY
Dept of Biostatistics
Boston, Massachusetts

HARVARD UNIVERSITY
Dept of Statistics
Cambridge, Massachusetts

INDIANA UNIVERSITY
Dept of Mathematics
Bloomington, Indiana

INSTITUTO MEXICANO
  DEL PETROLEO
Mexico, DF, Mexico

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

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

SCOTT AIR FORCE BASE
Air Weather Service Technical Library
Scott AFB, Illinois

SIMON FRASER UNIVERSITY
Dept of Mathematics and Statistics
Burnaby, British Columbia, Canada

SOUTHERN ILLINOIS UNIVERSITY
Dept of Mathematics and Statistics
Edwardsville, Illinois

STANFORD UNIVERSITY
Dept of Statistics
Stanford, California

SYRACUSE UNIVERSITY
Dept of Mathematics
Syracuse, New York

TEMPLE UNIVERSITY
Dept of Mathematics
Philadelphia, Pennsylvania

TEXAS TECH UNIVERSITY
Dept of Mathematics
Lubbock, Texas

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

UNIVERSITY OF ARIZONA
Dept of Mathematics
Tucson, Arizona

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
Dept of Statistics
Berkeley, California

UNIVERSITY OF CALIFORNIA
Div of Statistics
Davis, California

UNIVERSITY OF CALIFORNIA
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 MICHIGAN
Dept of Statistics
Ann Arbor, Michigan

UNIVERSITY OF MINNESOTA
School of Statistics
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 PENNSYLVANIA
Dept of Statistics
Philadelphia, Pennsylvania

UNIVERSITY OF SOUTH CAROLINA
Dept of Statistics
Columbia, South Carolina

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

UNIVERSITY OF TEXAS AT AUSTIN
Dept of Mathematics
Austin, 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

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 Manuscripts. 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. Four 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 selfcontained.

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 1980 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*-1980. 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 handwritten 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^{b_c} and a_{b_c}, 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 " ... Keifer (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*.

Addresses. The permanent address of each author should be typed following the references.

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 galleys.

 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 Redactory, Science Typographers, Inc., 15 Industrial Boulevard, Medford, NY 11763.

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.