THE ANNALS of MATHEMATICAL STATISTICS

FOUNDED AND EDITED BY H. C. CARVER, 1930-1938 EDITED BY S. S. WILKS, 1938-1949

THE OFFICIAL JOURNAL OF THE INSTITUTE OF MATHEMATICAL STATISTICS

Contents	PAGE
Existence of Consistent Estimates of the Directional Parameter in a Linear Structural Relation between Two Variables. JERZY NEYMAN	
Test Criteria for Hypotheses of Symmetry of a Regression Matrix. UTTAM CHAND	513
Extremal Properties of Extreme Value Distributions. SIGEITI MORIGUTI	523
The Fitting of Polynomials by the Method of Weighted Grouping. P. G. GUEST	537
A Multivariate Gamma-Type Distribution. A. S. Krishnamoorthy and M. Parthasarathy	54 9
A Combinatorial Central Limit Theorem. Wassily Hoeffding	55 8
On Ratios of Certain Algebraic Forms. ROBERT V. Hogg	567
Normal Regression Theory in the Presence of Intra-class Correlation. Max HALPERIN	573
Minimum Variance Estimation without Regularity Assumptions. Douglas G. Chapman and Herbert Robbins	5 81
Notes: A General Concept of Unbiasedness. E. L. LEHMANN	587
One-sided Confidence Contours for Probability Distribution Functions. Z. W. BIRNBAUM AND FRED H. TINGEY	592
On the Estimation of Central Intervals which Contain Assigned Proportions of a Normal Univariate Population. G. E. Albert and Ralph B. Johnson	596
On Dependent Tests of Significance in the Analysis of Variance. A. W. KIMBALL	600
On a Connection between Confidence and Tolerance Intervals. Gott- FRIED E. NOETHER	603
Abstracts of Papers	604
News and Notices	612
Report of the Minneapolis Meeting of the Institute	617
Publications Received	621

Vol. 22, No. 4 — December, 1951

THE ANNALS OF MATHEMATICAL STATISTICS

EDITOR T. W. ANDERSON

R. C. BOSE W. FELLER ASSOCIATE EDITORS
M. A. GIRSHICK
E. L. LEHMANN

ALEXANDER M. MOOD JOHN W. TUKEY

WITH THE COOPERATION OF

M. S. BARTLETT
Z. W. BIRNBAUM
DAVID BLACKWELL
GEORGE W. BROWN
HARALD CRAMÉR
WILLIAM G. COCHRAN
J. F. DALY
J. L. DOOB

T. E. Harris J. L. Hodges, Jr. Wassily Hoeffding Paul G. Hoel Harold Hotelling Howard Levene William G. Madow H. B. Mann FREDERICK MOSTELLER
J. NEYMAN
H. E. ROBBINS
S. N. ROY
L. J. SAVAGE
HENRY SCHEFFÉ
JACOB WOLFOWITZ
MAX A. WOODBURY

Published quarterly by the Institute of Mathematical Statistics in March, June, September and December at Baltimore, Maryland.

INSTITUTE OF MATHEMATICAL STATISTICS

General Office:

Business Administration Building, University of Michigan,

Ann Arbor, Michigan

C. H. Fischer, Secretary-Treasurer

This address should be used for all communications concerning membership, subscriptions, changes of address, back numbers, etc., but *not* for editorial correspondence. Changes in mailing address which are to become effective for a given issue should be reported to the Secretary on or before the 15th of the month preceding the month of that issue.

Editorial Office:

Department of Mathematical Statistics, Columbia University,

New York 27, New York T. W. Anderson, Editor

Manuscripts should be submitted to this address; each manuscript should be typewritten, double-spaced with wide margins, and the original copy should be submitted (preferably with one additional copy). Footnotes should be reduced to a minimum and whenever possible replaced by a bibliography at the end of the paper; formulae in footnotes should be avoided. Figures, charts, and diagrams should be professionally drawn on plain white paper or tracing cloth in black India ink twice the size they are to be printed. Authors are requested to keep in mind typographical difficulties of complicated mathematical formulae.

Authors will ordinarily receive only galley proofs. Fifty reprints without covers will be furnished free. Additional reprints and covers furnished at cost.

Subscription Price:

1951: \$10 per year in Western Hemisphere; \$5 elsewhere; single issues \$3; back numbers \$10 per volume, \$3 per issue.

1952: \$12 per year in U. S. and Canada; \$10 elsewhere.

COMPOSED AND PRINTED AT THE WAVERLY PRESS, Inc., BALTIMORE, MARYLAND, U. S. A.

THE ANNALS OF MATHEMATICAL STATISTICS

EDITOR
T. W. ANDERSON

R. C. BOSE W. FELLER ASSOCIATE EDITORS
M. A. GIRSHICK
E. L. LEHMANN

ALEXANDER M. MOOD JOHN W. TUKEY

WITH THE COOPERATION OF

M. S. BARTLETT
Z. W. BIRNBAUM
DAVID BLACKWELL
GEORGE W. BROWN
HARALD CRAMÉR
WILLIAM G. COCHRAN
J. F. DALY
J. L. DOOB

T. E. Harris J. L. Hodges, Jr. Wassily Hoeffding Paul G. Hoel Harold Hotelling Howard Levene William G. Madow H. B. Mann FREDERICK MOSTELLER
J. NEYMAN
H. E. ROBBINS
S. N. ROY
L. J. SAVAGE
HENRY SCHEFFÉ
JACOB WOLFOWITZ
MAX A. WOODBURY

Published quarterly by the Institute of Mathematical Statistics in March, June, September and December at Baltimore, Maryland.

INSTITUTE OF MATHEMATICAL STATISTICS

General

Office:

Business Administration Building, University of Michigan,

Ann Arbor, Michigan

C. H. Fischer, Secretary-Treasurer

This address should be used for all communications concerning membership, subscriptions, changes of address, back numbers, etc., but *not* for editorial correspondence. Changes in mailing address which are to become effective for a given issue should be reported to the Secretary on or before the 15th of the month preceding the month of that issue.

Editorial Office:

Department of Mathematical Statistics, Columbia University,

New York 27, New York T. W. Anderson, Editor

Manuscripts should be submitted to this address; each manuscript should be typewritten, double-spaced with wide margins, and the original copy should be submitted (preferably with one additional copy). Footnotes should be reduced to a minimum and whenever possible replaced by a bibliography at the end of the paper; formulae in footnotes should be avoided. Figures, charts, and diagrams should be professionally drawn on plain white paper or tracing cloth in black India ink twice the size they are to be printed. Authors are requested to keep in mind typographical difficulties of complicated mathematical formulae.

Authors will ordinarily receive only galley proofs. Fifty reprints without covers will be furnished free. Additional reprints and covers furnished at cost.

Subscription Price:

1951: \$10 per year in Western Hemisphere; \$5 elsewhere; single issues \$3; back numbers \$10 per volume, \$3 per issue.

1952: \$12 per year in U. S. and Canada; \$10 elsewhere.

COMPOSED AND PRINTED AT THE WAVERLY PRESS, INC., BALTIMORE, MARYLAND, U. S. A.