

MODERN STATISTICS
Methods and Applications



**PROCEEDINGS OF
SYMPOSIA IN
APPLIED MATHEMATICS**

VOLUME XXIII

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IN APPLIED MATHEMATICS
Volume XXIII**

**MODERN STATISTICS:
METHODS AND APPLICATIONS**

**AMERICAN MATHEMATICAL SOCIETY
PROVIDENCE, RHODE ISLAND
1980**

LECTURE NOTES PREPARED FOR THE
AMERICAN MATHEMATICAL SOCIETY SHORT COURSE

**MODERN STATISTICS:
METHODS AND APPLICATIONS**

HELD IN SAN ANTONIO, TEXAS
JANUARY 7–8, 1980

EDITED BY
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The AMS Short Course Series is sponsored by the Society's Committee on Employment and Educational Policy (CEEP). The Series is under the direction of the Short Course Advisory Subcommittee of CEEP.

Library of Congress Cataloging in Publication Data

American Mathematical Society Short Course on Modern Statistics: Methods and Applications, San Antonio, 1980.

Modern statistics, methods and applications.

(Proceedings of symposia in applied mathematics; v. 23)

“Lecture notes prepared for the American Mathematical Society Short Course [on] Modern Statistics: Methods and Applications, held in San Antonio, Texas, January 7–8, 1980.”

Includes bibliographies.

1. Mathematical statistics—Congresses. I. Hogg, Robert V. II. American Mathematical Society. III. Title. IV. Series.

QA276.A1A45 1980

001.4'22

80-16093

ISBN 0-8218-0023-χ

1980 *Mathematics Subject Classification*. Primary 62D05, 68G10, 62G05, 62M10, 62F35.

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PREFACE

This volume contains the lecture notes prepared by the speakers for the American Mathematical Society Short Course on *Modern Statistics: Methods and Applications* given in San Antonio, Texas, on January 7–8, 1980.

We were very pleased with the substantial attendance at the course. The skills of the lecturers and the enthusiasm of the participants encouraged the AMS Committee on Short Courses to request that these notes be published. We are indebted to our colleagues for this support and the AMS office for the cooperation in publishing these proceedings.

Of course, the choice of topics from a field as large as Statistics is a difficult one. However, I did want to avoid any substantial overlap with the highly successful short course on statistics held three years earlier in St. Louis, January, 1977. Therefore it seemed very natural to begin with one important topic that is sometimes overlooked in an introductory course, particularly one in mathematical statistics. Yet this topic is one through which the general public most often hears about statistics, namely, survey sampling. Wayne Fuller spoke on “Samples and Surveys”, noting the operations necessary in conducting a survey of a human population. In his article, he explains the construction of a probability sample design and the corresponding optimal estimators.

The more general problem of the design and analysis of an experiment was covered by Peter John in his “Analysis of Variance”. These techniques have, for years, been extremely important in applications and have also motivated a large amount of statistical research. It is clear that even in an elementary design the experimenter must understand the importance of randomization.

Nonparametric statistical methods have played a major role in modern statistics. Two coordinated talks on that subject were given by Ronald Randles and Thomas Hettmansperger. Randles introduced distribution-free rank tests, such as one by Wilcoxon, and some of their good asymptotic properties. Hettmansperger then explained how these rank tests could be used to obtain point and interval estimates for various parameters, including the regression situation. These resulting

R -estimates are very robust because they are not highly sensitive to reasonable deviations from the underlying assumptions.

The important topic of regression was continued by considering isotonic regression and time series. F. T. Wright showed how to use the method of maximum likelihood to estimate ordered parameters. Then Douglas Martin considered a time sequence of data. After presenting a collection of interesting examples, he discussed appropriate models and their estimates, including robust ones.

While it is impossible to cover all of Statistics in six articles, these and their references should prove useful to those who wish to learn something of the natures of modern statistics. In that regard, I must also call your attention to *Studies in Statistics* that I had the opportunity to edit for Volume 19 of *Studies in Mathematics* under the sponsorship of the Mathematical Association of America. I hope that this present volume, along with that one, will provide the interested reader a good introduction to modern statistical methods.

Robert V. Hogg
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March, 1980

