Nonparametric Statistics FOR THE BEHAVIORAL SCIENCES

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been highly selective in the techniques presented or have not included the tables of significance values which are used in the application of the various tests. Therefore I have felt that a text on the nonparametric methods would be a desirable addition to the literature formed by the sources mentioned.

In this book I have presented the tests according to the research design for which each is suited. In discussing each test, I have attempted to indicate its "function," i.e., to indicate the sort of data to which it is applicable, to convey some notion of the rationale or proof underlying the test, to explain its computation, to give examples of its application in behavioral scientific research, and to compare the test to its parametric equivalent, if any, and to any nonparametric tests of similar function.

The reader may be surprised at the amount of space given to examples of the use of these tests, and even astonished at the repetitiousness which these examples introduce. I may justify this allocation of space by pointing out that (a) the examples help to teach the computation of the test, (b) the examples illustrate the application of the test to research problems in the behavioral sciences, and (c) the use of the same six steps in every hypothesis test demonstrates that identical logic underlies each of the many statistical techniques, a fact which is not well understood by many researchers.

Since I have tried to present all the raw data for each of the examples, I was not able to draw these from a catholic group of sources. Research publications typically do not present raw data, and therefore I was compelled to draw upon a rather parochial group of sources for most examples —those sources from which raw data were readily available. The reader will understand that this is an apology for the frequency with which I have presented in the examples my own research and that of my immediate colleagues. Sometimes I have not found appropriate data to illustrate the use of a test and therefore have "concocted" data for the purpose.

In writing this book, I have become acutely aware of the important influence which various teachers and colleagues have exercised upon my thinking. Professor Quinn McNemar gave me fundamental training in statistical inference and first introduced me to the importance of the assumptions underlying various statistical tests. Professor Lincoln Moses has enriched my understanding of statistics, and it was he who first interested me in the literature of nonparametric statistics. My study with Professor George Polya yielded exciting insights in probability theory. Professors Kenneth J. Arrow, Albert H. Bowker, Douglas H. Lawrence, and the late J. C. C. McKinsey have each contributed significantly to my understanding of statistics and experimental design. My comprehension of measurement theory was deepened by my research

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collaboration with Professors Donald Davidson and Patrick Suppes.

This book has benefited enormously from the stimulating and detailed suggestions and criticisms which Professors James B. Bartoo, Quinn McNemar, and Lincoln Moses gave me after each had read the manuscript. I am greatly indebted to each of them for their valuable gifts of time and knowledge. I am also grateful to Professors John F. Hall and Robert E. Stover, who encouraged my undertaking to write this book and who contributed helpful critical comments on some of the chapters. Of course, none of these persons is in any way responsible for the faults which remain; these are entirely my responsibility, and I should be grateful if any readers who detect errors and obscurities would call my attention to them.

Much of the usefulness of this book is due to the generosity of the many authors and publishers who have kindly permitted me to adapt or reproduce tables and other material originally presented by them. I have mentioned each source where the materials appear, and I also wish to mention here my gratitude to Donovan Auble, Irvin L. Child, Frieda Swed Cohn, Churchill Eisenhart, D. J. Finney, Milton Friedman, Leo A. Goodman, M. G. Kendall, William Kruskal, Joseph Lev, Henry B. Mann, Frank J. Massey, Jr., Edwin G. Olds, George W. Snedecor, Helen M. Walker, W. Allen Wallis, John E. Walsh, John W. M. Whiting, D. R. Whitney, and Frank Wilcoxon, and to the Institute of Mathematical Statistics, the American Statistical Association, Biometrika, the American Psychological Association, Iowa State College Press, Yale University Press, the Institute of Educational Research at Indiana University, the American Cyanamid Company, Charles Griffin & Co., Ltd., John Wiley & Sons, Inc., and Henry Holt and Company, Inc. I am indebted to Professor Sir Ronald A. Fisher, Cambridge, to Dr. Frank Yates, Rothamsted, and to Messrs. Oliver and Boyd, Ltd., Edinburgh, for permission to reprint Tables No. III and IV from their book Statistical Tables for Biological, Agricultural, and Medical Research.

My greatest personal indebtedness is to my wife, Dr. Alberta Engvall Siegel, without whose help this book could not have been written. She has worked closely with me in every phase of its planning and writing. I know it has benefited not only from her knowledge of the behavioral sciences but also from her careful editing, which has greatly enhanced any expository merits the book may have.

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