REPORT OF THE DETROIT MEETING OF THE INSTITUTE OF MATHEMATICAL STATISTICS

The seventy-second meeting of the Institute of Mathematical Statistics, a Central Regional Meeting, was held at the Hotels Sheraton-Cadillac and Statler, Detroit, Michigan, on September 7–9, 1956. The meeting was in conjunction with meetings of the American Statistical Association, the American Sociological Society, the Econometric Society, the Biometric Society, the Federation of Financial Analysts Societies, the Society for the Study of Social Problems, and the Rural Sociological Society.

A Special Invited Paper, *Randomization and Industrial Experimentation*, was presented by Dr. W. J. Youden, National Bureau of Standards.

The following members of the Institute attended the Detroit meeting:

Om P. Aggerwal, Wm. R. Allen, R. L. Anderson, Theo. W. Anderson, Jr., Virgil L. Anderson, Wm. B. Anderson, Kenneth J. Arnold, Wm. Dowell Batten, Z. W. Birnbaum, Chester I. Bliss, Colin Ross Blyth, Helen Bozivich, Ralph Allan Bradley, Alva Esmond Brandt, Glenn W. Brier, Harold F. Bright, Irwin D. S. Bross, Byron Wm. Brown, Robert W. Burgess, Irving W. Burr, Elizabeth Dean Bushell, Joseph M. Cameron, Mavis B. Carroll, Victor Chew, Williard H. Clatworthy, Alonzo C. Cohen, Samuel E. Cohen, Wm. Stokes Connor, Louis J. Cote, Dudley J. Cowden, Gertrude M. Cox, Cecil C. Craig, Joseph F. Daly, Herbert T. David, Besse B. Day, Claude DeCourval, Daniel B. DeLury, Francis R. Del Priore, Lucile Derrick, Stuart C. Dodd, James L. Dorby, Acheson J. Duncan, Chas. W. Dunnett, Paul S. Dwyer, Marjorie Easterbrook, Churchill Eisenhart, Benjamin Epstein, Chas. F. Federspiel, Wm. Brooke Fetters, Lester R. Frankel, Spencer M. Free, Jr., Fred Frishman, Donald A. Gardiner, Norman R. Garner, Seymour Geisser, Dorothy Morrow Gilford, Leo A. Goodman, Samuel W. Greenhouse, Joseph A. Greenwood, Lee Gunlogson, Paul Gunther, Keet W. Halbert, Max Halperin, Albert N. Halter, Morris H. Hansen, Boyd Harshbarger, H. Leon Harter, Herman O. Hartley, Wm. C. Healy, Jr., F. M. Hemphill, Leon H. Herbach, Irene Hess, Clifford G. Hildreth, Robt. G. Hoffman, Robert Hooke, Wm. H. Horton, Daniel G. Horvitz, Harold Hotelling, Earl E. Houseman, Hendrik Houthakker, Cyril C. Hoyt, Paul E. Irick, J. Edward Jackson, Palmer O. Johnson, Howard L. Jones, Lawrence F. Jones, Hyman B. Kaitz, Edward L. Kaplan, Marvin Kastenbaum, Leo Katz, Harriet J. Kelley, Lester S. Kellogg, Oscar Kempthorne, Robt. W. Kennard, George H. Kennedy, Allyn W. Kimball, Arnold J. King, Edward P. King, Calvin J. Kirchen, Leslie Kish, Carl F. Kossack, Robt. M. Kozelka, Clyde Y. Kramer, Wm. H. Kruskal, T. T. Kwo, Donald E. Lamphiear, James F. Lanahan, Andre G. Laurent, Alfred Lieberman, Morris M. Lightstone, Rensis Likert, Benjamin Lipstein, Geo. F. Lunger, Albert Madansky, G. L. Marcus, Eli S. Marks, Robt. H. Matthias, Paul Meier, Dale M. Mesner, Irwin Miller, Albert Mindlin, Joseph E. Morton, Jack Moshman, Hugo Muench, Mervin E. Muller, John Neter, Monroe L. Norden, Horace W. Norton, James A. Norton, Edwin G. Olds, Ingram Olkin, Paul S. Olmstead, Thos. M. Oneson, Bernard Ostle, Donald B. Owen, Wm. R. Pabst, Nancy S. Parker, John F. Pauls, Kan-Chen Peng, Eugene W. Pike, James H. Powell, John W. Pratt, Bruce P. Price, Donald L. Richter, David Rubenstein, Daniel E. Sands, F. E. Satterthwaite, Edward Sax, Marvin A. Schneiderman, Norman C. Severo, Richard H. Shaw, Walt R. Simmons, Morris Skibinsky, H. Fairfield Smith, Paul N. Somerville, Frederick F. Stephan, John N. Stewart, Fred L. Strodtbeck, Seiji Sugihara, Zenon Szatrowski, Daniel Teichroew, James G. C. Templeton, Benjamin J. Tepping, Milton E. Terry, Donovan J. Thompson, Wm. A. Thompson, Geo. Wm. Thomson, Leo J. Tick, Chia Kuei Tsao, John W. Tukey, Malcolm E. Turner, Elizabeth Vaughan, Joseph Waksberg, Louis Weitter, Alfred G. Whitney, John M. Wiesen, Gregory P. Williams, R. Lowell Wine, Gerald Winston, Wm. W. Wolman, Max A. Woodbury, Wm. J. Youden, Marvin Zelen, John A. Zoellner.

The program of the Detroit meeting follows:

FRIDAY, SEPTEMBER 7, 1956

10:00 a.m. Covariance Analysis, I. Cosponsored with the American Statistical Association and the Biometric Society.

Chairman: A. W. KIMBALL, Oak Ridge National Laboratory.
Papers: *Elements of Covariance*, D. B. DeLURY, Ontario Research Foundation
    Interpretations of Regressions in Analysis of Covariance, H. FAIRFIELD SMITH,
    North Carolina State College.
Discussion: OSCAR KEMPTHORNE, Iowa State College.

1:00 p.m. Contributed Papers.

Chairman: JAMES LANAHAN, University of Detroit.
Papers: 1. *Some Results on the Distribution of the Peaks of a Gaussian Process*, IRWIN
    MILLER AND JOHN E. FREUND, Virginia Polytechnic Institute.
  2. *Unbiased Estimation of the Normal Distribution Function. (Preliminary report)*,
    WILLIAM C. HEALY, JR., Ethyl Corporation Research Laboratories, Ferndale,
    Michigan.
  3. *Unbiased Estimation of Correlation Coefficients*, INGRAM OLKIN AND JOHN W.
    PRATT, University of Chicago. (By title)
  4. *On a Multivariate Tchebycheff Inequality. (Preliminary report)*, INGRAM OLKIN
    AND JOHN W. PRATT, University of Chicago. (By title)
  5. *A Continuous Time Treatment of the Waiting-time in a Queueing System Having
    Poisson Arrivals, a General Distribution of Service-time, and a Single Service
    Unit. (Preliminary report)*, VACLAV EDVARD BENEŠ, Bell Telephone Labora-
    tories, Murray Hill, New Jersey. (By title)
  6. *Some Results on the Analysis of Random Signals by Means of a Cut-counting
    Process*, IRWIN MILLER AND JOHN E. FREUND, Virginia Polytechnic Institute.
    (By title)
  7. *A New Class of Partially Balanced Incomplete Block Designs*, DALE M. MESNER,
    Purdue University and Michigan State University.
  8. *Generalization of Thompson's Distribution*, ANDRE G. LAURENT, Michigan State
    University.
  9. *Some Results for Inverting Patterned Matrices*, A. E. SARHAN AND B. G. GREEN-
    BERG, University of North Carolina. (By title)
  10. *On the Solution of the Functional Equation of Farrell's Market*, A. CHARNES AND
    O. P. AGGARWAL, Purdue University. (By title)

2:00 p.m. Covariance Analysis, II. Cosponsored with the American Statistical Association and the Biometric Society.

Chairman: GERTRUDE M. COX, North Carolina State College.
Papers: *Covariance Analysis with Unequal Subclass Numbers*, WALTER T. FEDERER, Cornell
    University.
    The Analysis of Covariance for Incomplete Block Designs, MARVIN ZELEN, Na-
    tional Bureau of Standards.
    *Group Comparisons and Analysis of Variance and Covariance in Cluster Sam-
    pling*, H. O. HARTLEY, Iowa State College.
Discussion: JOHN W. TUKEY, Princeton University.

4:00 p.m. Applications of Electronic Computers in Statistics. Cosponsored with the American Statistical Association and the Biometric Society.

Chairman: M. A. WOODBURY, New York University.
Papers: *Experiences with SEAC*, J. M. CAMERON, National Bureau of Standards.
    How to Control the Digital Computer, R. W. HAMMING, Bell Telephone Laboratories.
    Sampling Experiments, D. TEICHROEW, National Cash Register Company.
Discussion: ZENON SZATROWSKI, International Business Machines Corporation, New York.

8:00 p.m. Theoretical Aspects of Sample Surveys. Cosponsored with the American Statistical Association.

Chairman: HOWARD L. JONES, Illinois Bell Telephone Company.
Papers: *Estimation of Variances and Composite Estimation Procedures*, JOSEPH WAKSBERG,
    Bureau of the Census.
    Unsolved Problems in the Statistics of Survey Sampling, LESLIE KISH, University of
    Michigan.
    Unbiased Ratio Estimators and Their Variances, LEO GOODMAN, University of
    Chicago, AND H. O. HARTLEY, Iowa State College.
Discussion: D. HORVITZ, North Carolina State College. ALLEN ROSS, State University of
    New York.

SATURDAY, SEPTEMBER 8, 1956

9:00 a.m. Critical Problems in New Quantitative Techniques. Cosponsored with the American Statistical Association and the American Sociological Society.

Chairman: LEO A. GOODMAN, University of Chicago.
Papers: *Stochastic Models and their Applications to Social Phenomena*, JERZY NEYMAN, University of California, AND WILLIAM KRUSKAL, University of California and
    University of Chicago.
    Measurement and Sampling in Social Research, FREDERICK F. STEPHAN, Princeton
    University.
Discussion: PAUL F. LAZARSFELD, Columbia University.

11:00 a.m. Special Invited Paper.

Chairman: WILLIAM KRUSKAL, University of Chicago.
Address: *Randomization and Industrial Experimentation*, W. J. YOUDEN, National Bureau
    of Standards.

2:00 p.m. Invited Papers on Mathematical Statistics, I.

Chairman: LEO A. GOODMAN, University of Chicago.
Papers: *The Use of Sample Spacing in Tests of Fit*, LIONEL WEISS, University of Virginia
    and University of Oregon.
    A Generalization of Internal Regression for the Fitting of Some Non-linear Models,
    R. WHITE AND O. KEMPTHORNE, Iowa State College.
    On the Relative Position of the Mean and Order Statistics, H. T. DAVID, University
    of Chicago and Iowa State College.

SUNDAY, SEPTEMBER 9, 1956

10:00 a.m. Applications of Stochastic Processes. Cosponsored with the American Statistical Association and the Biometric Society.

Chairman: OSCAR KEMPTHORNE, Iowa State College.

Papers: *The After-History of Pulmonary Tuberculosis, A Stochastic Model*, DAVID W. ALLING Herman W. Biggs Memorial Hospital.

The Application of Stochastic Processes to the Kinetics of Enzyme Action, ANTHONY F. BARTHOLOMAY, Harvard School of Public Health and Harvard University Medical School.

2:00 p.m. Wishart Memorial Session. Cosponsored with the American Statistical Association and the Biometric Society.

Chairman: GERTRUDE COX, North Carolina State College.

Address: *Contributions of John Wishart to Statistics*, HAROLD HOTELLING, University of North Carolina.

4:00 p.m. Invited Papers on Mathematical Standards, II.

Chairman: LOUIS J. COTE, Syracuse University.

Papers: *Decision Theory for Polya Type Distributions*, JOHN PRATT, University of Chicago.

Bayes Two-stage Decision Rules, MORRIS SKIBINSKY, Purdue University.

The Chairman of the Program Committee for the meeting was Stanley Isaacson Des Moines, Iowa. The Assistant Secretary for the meeting was James Lanahan, University of Detroit.

WILLIAM KRUSKAL
Associate Secretary

REPORT OF THE SEATTLE MEETING OF THE INSTITUTE

The seventy-first meeting of the Institute of Mathematical Statistics and the nineteenth annual meeting was held at the University of Washington, Seattle, Washington on August 21–24, 1956 in conjunction with the national annual meeting of the Biometric Society, the American Mathematical Society, the Mathematical Association of America, and the Econometric Society. A number of the sessions were joint (and are so designated) with these organizations. All meetings were held on the University of Washington campus. The following 134 members of the Institute attended: '

I. J. Abrams, M. S. Ahmed, H. L. Alder, Stephen Allen, C. B. Allendoerfer, A. G. Anderson, F. C. Andrews, K. J. Arnold, R. E. Barlow, C. B. Bell, Z. W. Birnbaum, David Blackwell, J. R. Blum, R. C. Bose, A. H. Bowker, J. V. Breakwell, H. D. Brunk, K. A. Bush, L. D. Calvin, D. G. Chapman, Herman Chernoff, W. S. Connor, D. R. Cox, J. H. Curtiss, Ivonne Cuttle, D. A. Darling, W. J. Dixon, P. J. Doyle, J. A. Dudman, Churchill Eisenhart, Benjamin Epstein, H. P. Evans, T. S. Ferguson, Martin Fox, J. S. Frame, R. S. Gardner, D. W. Gaylor, H. M. Gehman, Dorothy Morrow Gilford, W. A. Golomski, F. A. Graybill,

Geoffrey Gregory, John Gurland, Donald Guthrie, Bernard Harris, T. E. Harris, L. L. Helms, P. G. Hoel, R. V. Hogg, Harold Hotelling, A. S. Householder, M. Iqbal, Walter Jacobs, John L. Jaech, P. W. M. John, H. L. Jones, Samuel Karlin, E. S. Keeping, O. M. Klose, C. F. Kossack, C. H. Kraft, William Kruskal, G. M. Kuznets, R. B. Leipnik, Jerome C. R. Li, G. J. Lieberman, S. P. Lloyd, A. T. Lonseth, F. W. Lott, R. C. McCarty, W. G. Madow, Frank Massey, N. U. Mayall, P. L. Meyer, D. F. Mills, Alex Mood, R. A. Moore, Lincoln Moses, Stanley W. Nash, J. Neyman, G. E. Nicholson, Jr., D. B. Owen, Mohan Pavate, M. P. Peisakoff, R. S. Pinkham, G. B. Price, Ronald Pyke, Howard Raiffa, P. H. Randolph, R. R. Read, G. J. Resnikoff, D. L. Richter, Gerald Rogers, S. N. Roy. Herman Rubin, R. C. Schneider, Lorraine Schwartz, Elizabeth L. Scott, Franklin Sheehan, M. M. Siddiqui, W. L. Smith, G. P. Steck, Charles Stein, Rothwell Stephens, A. D. Stewart, R. F. Tate, W. F. Taylor, Henry Teicher, E. A. Thomas, G. B. Thomas, Jr., F. H. Tingey, F. H. Trinkl, D. R. Truax, J. R. Vatnsdal, Elizabeth Vaughan, R. E. Walpole, J. E. Walsh, L. H. Wegner, J. G. Wendel, Oscar Wesler, Kathleen White, Zivia S. Wurtele, R. K. Zeigler.

The program of the meeting was as follows:

TUESDAY, AUGUST 21, 1956

10:00 a.m. Invited Papers I.

Place: Room 320, Physics Hall
Chairman: A. M. Mood, General Analysis Corporation
> 1. *The Asymptotic Attainment of Bayes Risk*, DAVID BLACKWELL, University of California, Berkeley.
> 2. *Some Problems in Asymptotic Theory*, LUCIEN LE CAM, University of California, Berkeley.

11:30 a.m. Special Invited Address.

Place: Room 320, Physics Hall
Chairman: WILLIAM KRUSKAL, University of California, Berkeley
> *Asymptotic Theory of Kolmogorov, Smirnov, and von Mises Type Statistics*, DONALD A. DARLING, University of Michigan.

2:00 p.m. American Mathematical Society Colloquium Lecture.

Place: Health Sciences Auditorium
Speaker: SALOMON BOCHNER, Princeton University
Title: *Harmonic Analysis and Probability*.

3:00 p.m. Applications to Physical Sciences.

Place: Room 320, Physics Hall
Chairman: HAROLD HOTELLING, University of North Carolina, Chapel Hill
> 1. *Problem of Rotation of Galaxies of Different Types—Statistical Aspects*, N. U. MAYALL, Lick Observatory.
> 2. *Internal Motions in Gaseous Masses of Cosmical Dimensions*, GUIDO MUNCH and O. C. WILSON, Mount Wilson and Mount Palomar Observatories, and California Institute of Technology.
> 3. *Review of Certain Astronomical Problems and Their Statistical Treatments*, J. NEYMAN and ELIZABETH L. SCOTT, University of California, Berkeley.
> 4. *Use of the rth Brightest Star in a Galaxy as a Distance Indicator*, MANDAKINI SANE, University of California, Berkeley.
> 5. *Distribution of the Number of Droplets in Unit Lengths of a Track of a Cosmic*

Ray Particle in a Cloud Chamber, ROBERT READ, University of California, Berkeley.

6. *Effect of Expansion of the Universe on the Serial Correlation of Counts of Images of Galaxies in Regularly Spaced Squares—A Simplified Model*, MARTIN FOX, University of California, Berkeley.

WEDNESDAY, AUGUST 22, 1956

9:00 a.m. Invited Papers II.

Place: Room 320, Physics Hall
Chairman: MRS. BERNICE BROWN, The RAND Corporation
        1. *Confidence Regions for Dependent Regression*, PAUL G. HOEL, University of California, Los Angeles.
        2. *Functional Relationships with All Variables Subject to Error*, JOHN GURLAND, Iowa State College.

9:00 a.m. Statistical Problems in Medicine and Biology. (Joint with the Biometric Society)

Place: Room 334, Physics Hall
Chairman: W. TAYLOR, School of Aviation Medicine, Randolph Air Force Base
        1. *Some Nonparametric Techniques*, L. MOSES, Stanford University, Stanford.
        2. *An Investigation of the Log Transformation of Growth Data*, W. BECKER, University of California, Berkeley, and Western Washington Experimental Station, Puyallup.
        3. *Reaction Rates in Geometrically Constrained Enzyme Systems*, D. JENDEN, Naval Medical Research Institute, Bethesda, and University of California at Los Angeles.

10:30 a.m. Invited Papers III.

Place: Room 320, Physics Hall
Chairman: BENJAMIN EPSTEIN, Wayne University and Stanford University
        1. *Law of Small Numbers*, WILLIAM KRUSKAL, University of California, Berkeley.
        2. *Optimal Multivariate Tests*, CHARLES STEIN, Stanford University.
        3. *What Judgments are Sufficient for Statistics?* I. J. GOOD, Cheltenham, England.

1:30 p.m. Biometric Society Special Invited Address.

Place: Room 320, Physics Hall
Chairman: J. NEYMAN, University of California, Berkeley
        Models and General Mathematical Principles in Biology and Sociology, N. RASHEVSKY, University of Chicago.

1:45 p.m. Mathematical Problems in Incomplete Block Designs.

Place: Room 334, Physics Hall
Chairman: BURTON W. JONES, University of Colorado
        1. *Recent Advances in Partially Balanced Designs*, R. C. BOSE, University of North Carolina, Chapel Hill.
        2. *Symmetrical Balanced Designs*, H. J. RYSER, Ohio State University.
        Discussant: W. J. CONNOR, National Bureau of Standards.

8:00 p.m. Council Meeting.

Place: Room 320, Physics Hall

THURSDAY, AUGUST 23, 1956

9:00 a.m. Prediction Problems. (Joint with Biometric Society)

Place: Room 320, Physics Hall
Chairman: DAVID BLACKWELL, University of California, Berkeley
        1. *New Light on the Multiple Correlation Coefficient*, HAROLD HOTELLING, University of North Carolina, Chapel Hill.
        2. *Optimal Estimates of Multiple Criteria with Restrictions on the Covariance Matrix of Estimated Criteria*, PAUL HORST, University of Washington.
        3. *Procedural Considerations in Forecasting Populations*, V. A. MILLER, University of Washington.

10:00 a.m. Inventory Policy and Dynamic Programming. (Joint with Econometric Society)

Place: Room 314, Physics Hall
Chairman: GEORGE DANTZIG, The RAND Corporation
        1. *A Note on the Optimal Character of the* (s, S) *Policy in the Inventory Problem*, JACK ABRAMS, University of California, Berkeley.
        2. *Optimal Sequential Search Problems*, SELMER JOHNSON, The RAND Corporation.
        3. *Ordering Policy for Poisson Determined Supply and Demand*, S. ALLEN and G. FEENEY, Stanford Research Institute.
        4. *The Min-Max Solution of a One-stage Inventory Problem* (20 minutes), HERBERT SCARF, The RAND Corporation.

11:00 a.m. Invited Papers IV.

Place: Room 334, Physics Hall
Chairman: W. J. DIXON, University of California, Los Angeles
        1. *The Sequential Item Selection Problem in Classification Studies—The Case of Dichotomous Variables*, HOWARD RAIFFA, Center for Advanced Study in the Behavioral Sciences.
        2. *On the Use of Concomitant Variables in the Selection of an Experimental Design*, D. R. COX, University of Cambridge and University of North Carolina, Chapel Hill.

2:00 p.m. Invited Papers V.

Place: Room 320, Physics Hall
Chairman: D. R. Cox, University of Cambridge and University of North Carolina, Chapel Hill
        1. *Transient Queue Phenomena*, WALTER L. SMITH, University of North Carolina, Chapel Hill.
        2. *Some Queueing Statistics*, EDGAR REICH, The RAND Corporation and University of Minnesota.
        3. *Some Models of Birth and Death Processes—Linear Growth and Queueing Problems*, SAMUEL KARLIN, Stanford University, and JAMES McGREGOR, California Institute of Technology.

4:00 p.m. Contributed Papers I.

Place: Room 320, Physics Hall
Chairman: C. H. KRAFT, University of California, Berkeley

1. *Efficient Small Sample Nonparametric Median Tests with Bounded Significance Levels*, JOHN E. WALSH, Lockheed Aircraft Corporation.
2. *Bayes Approach to Control of Fraction Defective*, JOHN V. BREAKWELL, North American Aviation, Inc.
3. *The Distribution of the Extreme Mahalanobis' Distance from Sample Mean (Preliminary Report)*, YVONNE G. M. G. (MRS. P. M.) CUTTLE, University of British Columbia, (introduced by S. W. Nash).
4. *On the Moments of Order Statistics from a Normal Population*, R. C. BOSE and SHANTI S. GUPTA, University of North Carolina, Chapel Hill.
5. *A Comparison of the Power Curves of Some Double Sample Tests*, DONALD B. OWEN, Sandia Corporation.
6. *On Some Nonparametric C-sample Tests*, FRED C. ANDREWS, University of Nebraska.
7. *An Asymptotically Distribution-free Multiple Comparison Method with Application to the Problem of r Rankings of m Objects*, IRENE ROSENTHAL and THOMAS S. FERGUSON, University of California, Berkeley.
8. *Some Asymptotic Results on Wald's Approximate Classification Statistic*, M. IQBAL, University of North Carolina, Chapel Hill.
9. *On the Studentized Largest and Smallest Chi-squared*; K. V. RAMACHANDRAN, University of Baroda, India. (By Title)
10. *On the Distribution of Ranks and of Certain Rank Order Statistics*, PROFESSOR MEYER DWASS, Northwestern University and Stanford University. (By Title)
11. *Contributions to Distribution-free Population Comparisons*, WILLIAM E. PERRAULT and WALDO A. VEZEAU, St. Louis University. (By Title)
12. *Validity of Approximate Normality Values for $\mu \pm k\sigma$ Areas of Practical Type Continuous Populations*, JOHN E. WALSH, Lockheed Aircraft Corporation. (By Title)
13. *Maximum Likelihood Estimation of Restricted Parameters (Preliminary Report)*, H. D. BRUNK, University of Missouri. (By Title)
14. *Confidence Intervals for the Number of Cells in a Multinomial Population with Equal Cell Probabilities*, BERNARD HARRIS, Stanford University and Department of Defense. (By Title)

4:00 p.m. Contributed Papers II. (Joint with American Mathematical Society)

Place: Room 131, Bagley Hall
Chairman: I. J. GOOD, Cheltenham, England

1. *The Quadratic Birth Process*, PETER W. M. JOHN, University of New Mexico.
2. *On a Uniqueness Property not Enjoyed by the Normal Distribution*, GEORGE P. STECK, Sandia Corporation.
3. *Moment Generating Functions of Quadratic Forms in Serially Correlated Normal Variables*, R. B. LEIPNIK, University of Washington.
4. *Solution of a Ranking Problem from Paired Comparisons*, L. R. FORD, JR., The RAND Corporation.
5. *Coincidence Probabilities (Preliminary Report)*, SAMUEL KARLIN, Stanford University, and J. L. McGREGOR, California Institute of Technology.
6. *A Mean Martingale Convergence Theorem*, L. L. HELMS, Convair.

7. *Stochastic Convergence of Semimartingales*, KLAUS KRICKEBERG, University of Wisconsin.
8. *A General Convergence Theorem for Sequences of Stochastic Processes*, E. G. KIMME, Oregon State College. (By Title)
9. *Almost Sure Everywhere Divergence of Random Series*, ARYEH DVORETZKY, Hebrew University, Jerusalem, and Columbia University.

6:00 p.m. Business Meeting.

Place: Room 320, Physics Hall

8:00 p.m. Council Meeting.

Place: Room 320, Physics Hall

FRIDAY, AUGUST 24, 1956

9:00 a.m. Invited Papers VI.

Place: Room 320, Physics Hall
Chairman: LEO KATZ, Michigan State University
1. *Law of Small Numbers*, WILLIAM KRUSKAL, University of California, Berkeley.
2. *Some Non-parametric Tests for Independence*, JULIUS R. BLUM, Indiana University.
3. *Some Non-parametric Generalizations of Analysis of Variance and Multivariate Analysis*, S. N. ROY, University of North Carolina, Chapel Hill.

9:00 a.m. Stochastic Population Problems. (Joint with Biometric Society)

Place: Room 334, Physics Hall
Chairman: DOUGLAS CHAPMAN, University of Washington, Seattle.
1. *A Stochastic Model for the Tunneling and Retunneling of Flour Beetles*, M. AHMED, University of California, Berkeley.
2. *A Stochastic Model for the Number of Beetles on the Surface of Flour*, EARL R. RICH, University of California, Berkeley.

11:00 a.m. Invited Papers VII.

Place: Room 320, Physics Hall
Chairman: DONALD R. TRUAX, California Institute of Technology
1. *The Distributions of Shadows with Applications to Traffic and Counter Problems*, HERMAN CHERNOFF, Stanford University.
2. *Bounds for Stochastic Processes*, Z. W. BIRNBAUM, University of Washington.
3. *Quasi-Martingales and Stochastic Integrals*, HERMAN RUBIN, University of Oregon.

1:30 p.m. Contributed Papers III.

Place: Room 320, Physics Hall
Chairman: M. R. MICKEY, The RAND Corporation
1. *Incomplete Sufficient Statistics and Similar Tests*, ROBERT A. WIJSMAN, University of California, Berkeley, (introduced by David Blackwell).
2. *Multi-decision Problems for the Multivariate Exponential Family*, DONALD R. TRUAX, California Institute of Technology.
3. *Some Distributions Related to D_n+*, Z. W. BIRNBAUM and R. PYKE, University of Washington.

4. *Sequential Distribution-free Tolerance Regions*, SAM C. SAUNDERS, University of Washington.

5. *Idempotent Matrices and Quadratic Forms in the General Linear Hypothesis*, FRANKLIN A. GRAYBILL and GEORGE MARSAGLIA, Oklahoma A. and M. College.

6. *On Infinitely Divisible Random Vectors*, MEYER DWASS, Northwestern and Stanford Universities and HENRY TEICHER, Purdue and Stanford Universities.

7. *Further Contributions to Multivariate Confidence Bounds*, S. N. ROY and R. GNANADESIKAN, University of North Carolina, Chapel Hill.

8. *Contributions to univariate and multivariate components of variance analysis*, S. N. ROY and R. GNANADESIKAN, University of North Carolina, Chapel Hill.

9. *The Linear Hypothesis, Information, and the Analysis of Variance, (Preliminary Report)*, CHESTER H. MCCALL, JR., The George Washington University. (By Title)

10. *A Sequential Multiple Decision Procedure for Selecting the Multinomial Event with the Largest Probability (Preliminary Report)* R. E. BECHHOFER, Cornell University, and M. SOBEL, Bell Telephone Laboratories. (By Title)

11. *On the Existence of Uniformly Efficient Estimates*, R. R. BAHADUR, University of Chicago. (By Title)

12. *Definite Quadratic Forms and Discontinuous Factor*, ANDRÉ G. LAURENT, Michigan State University. (By Title)

13. *A Further Contribution to the Theory of Univariate Sampling on Successive Occasions (Preliminary Report)*, B. D. TIKKIWAL, University of North Carolina and Karnatak University. (By Title)

14. *Invariance, Sequential Decision Functions, and Continuous Time Processes*, J. KIEFER, Cornell University. (By Title)

15. *On the Construction of Fractional Factorial Designs*, ROBERT C. BURTON, National Bureau of Standards, (introduced by W. C. Connor). (By Title)

CHARLES KRAFT
Associate Secretary

MINUTES OF THE ANNUAL BUSINESS MEETING
1956

A business meeting of the Institute of Mathematical Statistics was called to order at 6:00 p.m., August 22, 1956, in Room 320, Physics building, University of Washington, Seattle, by President David Blackwell. Approximately 42 persons were present. A special announcement was made by G. E. Nicholson about the tragic death of John Wishart.

Minutes of the Annual Business Meeting held in New York in December, 1955, were read and approved. Z. W. Birnbaum introduced a resolution which had been recommended by the Council that the Kingston Policy on holding unsegregated meetings be made the permanent policy of the Institute. After considerable discussion this motion was passed.

The reports of the Editor, Treasurer, Secretary, and Program coordinator were presented and approved. It was announced by the Secretary that Dorothy

Morrow Gilford had been appointed by the Council to be Associate Secretary for the Eastern Region to fill Allan Birnbaum's unexpired term.

The tellers were instructed to accept ballots from members who had not relayed them by mail.

The President presented his report and turned the chair over to new President Alexander Mood. President Mood extended the thanks of the Institute to the outgoing president for his work for the Institute during the past year.

Lucien LeCam moved that meetings of the Council be open for all members of the Institute to observe and listen. This motion passed.

W. J. Dixon introduced a resolution of thanks to the University of Washington administration and the arrangements committee for the meeting. This was passed.

The tellers announced the election of the following:

President-Elect   L. J. Savage
Members of I.M.S. Council for term 1956–1959:
                      T. W. Anderson
                      M. S. Bartlett
                      J. Berkson
                      Erich Lehmann

The meeting was adjourned at 8:15 p.m.

GEORGE E. NICHOLSON, JR.
Secretary

REPORT OF THE PRESIDENT OF THE INSTITUTE FOR 1956

The affairs of the Institute ran smoothly during 1956.

We have 1649 members as compared with 1505 a year ago. A substantial part of the increase can be attributed to the work of this year's Committee on Individual Memberships, under the chairmanship of Benjamin Epstein. The Council voted special thanks to this committee for an outstanding job.

We expect the Annals to reach a record size of 1225 pages this year, a considerable increase over last year. In spite of this increase, we anticipate that the Institute will, financially, about break even.

The Council has voted to hold a Summer Institute in 1957 on analysis of variance provided we get a grant from the National Science Foundation for this purpose. The organizing committee for the 1957 summer institute, with T. W. Anderson as chairman, is continuing its work.

In addition to the annual meeting at Seattle on August 21–24, with the American Mathematical Society, the Institute held an Eastern Regional meeting in Princeton on April 20–21 and a Central Regional meeting at the University of Chicago on April 27–28. Future meetings already being contemplated are a Central Regional meeting in Detroit on September 7–9, a special meeting in conjunction with the AAAS in New York during the Christmas 1956 holidays,

an Eastern Regional meeting at Catholic University on March 7–9, 1957, the annual 1957 meeting with the American Statistical Association in Atlantic City early in September, 1957, and the annual 1958 meeting with the American Mathematical Society, the time and place of which have not been determined.

Our committee on Professional Standards, under the chairmanship of B. F. Kimball, has prepared a letter, which it plans to send to various personnel officers in state and local governments, concerning appropriate standards for statisticians in government work.

We were happy to be able to invite five distinguished Russian probabilists, Kolmogorov, Hincin, Linnik, Gnedenko, and Prohorov, to attend our Seattle meeting. Unfortunately, because of delays in official machinery, the invitations could not be transmitted until July 2, and none of the Russians was able to come on such short notice. Kolmogorov wrote a most cordial letter, heartily endorsing the desire expressed in our letter to establish a closer contact between scholars of our two countries, and expressing the hope that some Soviet probabilists would be able to attend a later meeting of the Institute of Radio Engineers on information theory at MIT on September 10–12.

It is a pleasure to announce that the Rietz Lecture Committee, with J. Neyman as chairman, has designated J. Wolfowitz as our Rietz lecturer for 1957. He will deliver the lecture at the 1957 annual meeting in Atlantic City.

The Council has unanimously recommended, and the members present at the 1956 membership meeting have unanimously voted, that the Kingston policy be the permanent policy of the Institute. This policy is: "It is the policy of the Institute of Mathematical Statistics that all its meetings shall be held on a completely non-segregated basis. In particular prior to determining the place of a forthcoming meeting, the Secretary of the IMS shall ascertain that meeting halls, eating facilities and housing accommodations adequate for the expected attendance will be available on a non-segregated basis, and that all social events connected with the meetings shall be non-segregated." We have not experienced, and do not anticipate, substantial difficulty in conforming to this policy.

We have reached an agreement with the University of Chicago Press, under which the Institute will cooperate with the Press in publishing, at no cost to the Institute, a series of statistical monographs, which will be available to IMS members at a $\frac{1}{3}$ discount on publication orders. You will be notified when monographs are to appear.

You have already been notified of the arrangement with the University of California Press, under which IMS members may purchase volumes of the *Proceedings of the Third Berkeley Symposium on Probability and Statistics* at a 25 per cent discount.

The Committee on Special Invited Papers, under the chairmanship of William Kruskal, has arranged for the following three Special Invited Papers:

1. W. J. Youden, "Experimental Designs for Industrial Research"; scheduled for Central Regional Meeting, Detroit, September, 1956.
2. D. L. Wallace, on asymptotic approximations to distributions; scheduled for Annual Meeting, Atlantic City, September, 1957.

3. C. Hildreth, on statistical problems in economics; as yet unscheduled.

The 1956 nominating committee consists of Charles Stein, chairman, Joseph Berkson, Kai Lai Chung, John Curtiss, and David Kendall.

L. J. Savage was elected president-elect for 1957, and T. W. Anderson, M. S. Bartlett, J. Berkson, E. L. Lehmann were elected to the Council for 1957–59.

A list of 1956 Institute committees and representatives is included as an appendix to this report. I know that all Institute members join me in expressing gratitude to these members for so generously giving their time to the affairs of the Institute.

In closing, I wish to congratulate our nine newly elected Fellows. They are

Allan Birnbaum

D. R. Cox

N. L. Johnson

Samuel Karlin

W. H. Kruskal

Walter L. Smith

Milton Sobel

Erling Sverdrup

E. J. Williams

DAVID BLACKWELL,
President

Appendix. 1956 IMS Committees and Representatives

(The first name is that of the chairman)

Academic Institutional Members: G. J. Lieberman, H. Robbins.

Activities and Development: T. W. Anderson, J. Berkson, A. Bowker, T. E. Harris, W. Kruskal, S. Wilks.

Exchanges: P. Dwyer, T. E. Harris (*ex officio*), G. E. Nicholson, Jr., (*ex officio*).

Fellows: H. Levene, F. Anscombe, M. Bartlett, D. Blackwell, L. Goodman, L. J. Savage.

Finance: M. Spiegelman, A. Bowker, K. J. Arnold.

Individual Membership: B. Epstein, E. Crow, D. Chapman, F. Grubbs, E. Pike.

Non-Academic Institutional Members: Bernice Brown, A. Householder, P. Olmstead, C. C. Hand.

Physical Facilities: Z. W. Birnbaum, Leo Katz, G. E. Nicholson, Jr.

Professional Standards: B. F. Kimball, R. Burgess, C. Eisenhart, G. Harrington, A. House-holder, J. Lev, H. Marshall, R. Patton, J. E. Walsh.

Program Committees:

  Annual: M. Peisakoff. H. Raiffa, H. Levene, M. Rosenblatt, D. G. Chapman, J. Kiefer, B. Harshbarger, L. Katz (*ex officio*).

  Eastern: M. Zelen, R. L. Anderson, R. Bradley, G. Burrows, C. Derman, M. Halperin, L. Weiss, Leo Katz (ex officio).

  Central: S. Isaacson, F. C. Andrews, L. Cote, L. Goodman, J. Gurland, I. Olkin.

  Western: L. Moses, H. Rubin, Z. Birnbaum, B. Brown, M. Sandomire, G. Lieberman, J. Yerushalmy.

Rietz Lecture: J. Neyman, H. Hotelling, W. Feller.

Special Invited Papers: W. Kruskal, R. L. Anderson, K. Arrow, G. Cox, A. T. Craig, H. Hartley, I. Savage, T. E. Harris (*ex officio*).

Mathematical Tables: J. W. Tukey, R. L. Anderson, A. Bowker, E. Cureton, W. Dixon,

C. Dunnett, C. Eisenhart, J. A. Greenwood, H. Hartley, E. Kaplan, W. Kruskal, D. B. Owen, D. Teichroew, Max Woodbury.

Fast Machines: R. L. Anderson, F. S. Acton, K. J. Arnold, A. S. Householder, C. F. Cossack, W. H. Kruskal, W. J. Merrill, H. A. Meyer, J. Moshman, H. W. Norton, G. J. Resnikoff, R. Slimak, Z. Szatrowski, D. Teichroew.

1957 Summer Institute: T. W. Anderson, H. Scheffé, J. W. Tukey, J. Cornfield, O. Kempthorne.

Inviting Russian Probabilists: E. Lukacs, D. Blackwell, J. L. Doob, J. Neyman, H. Robbins.

1956 Nominating Committee: C. Stein, J. Berkson, K. L. Chung, J. Curtiss, D. G. Kendall.

Representatives

American Association for the Advancement of Science: H. Hotelling (through 1957).
Intersociety Committee on Standardization of Nomenclature and Symbols: H. Raiffa.
National Research Council: S. S. Wilks (through 1957).
Policy Committee for Mathematics: J. F. Daly.
Council of Population and Housing Census Users: Paul Meier.

REPORT OF THE SECRETARY FOR 1956

During 1956 the Institute held its 69th through 72nd meetings. A business meeting was held during the 71st (19th Annual) meeting. The Program Committees are to be congratulated on the excellent programs which have been arranged under the immediate direction of M. P. Peisakoff, Stanley Isaacson, and Gottfried E. Noether with the overall guidance of our Program Coordinator, Leo Katz. The Assistant Secretaries, M. R. Wilk, D. L. Wallace, D. G. Chaoman, and J. E. Lanahan are to be congratulated on the physical arrangements, and the Associate Secretaries, Allan Birnbaum, William Kruskal, and C. H. Kraft, on their performance of the duties of the Secretary with respect to the meetings.

GEORGE E. NICHOLSON, JR.
Secretary

INTERIM EDITOR'S REPORT FOR 1956

The volume of material submitted to the *Annals* (in terms of manuscript pages) has shown an upward trend. In the year August 1, 1954–July 31, 1955 it was higher than in any preceding year. In the following year, the one just ending, it was somewhat less, but still higher than any of the previous years. The 1956 *Annals* is accordingly being expanded, the Council having authorized 1225 pages for the year; the increase in size will enable the backlog of accepted papers to be brought below one issue. The Council has also authorized a 1957 volume of 1100 pages.

Thanks are due to many people, other than the regular members of the editorial staff, for generous refereeing assistance and other help. Specific acknowledgment will be made in the final report for the 1956 volume, which will appear in the March, 1957 issue.