

30. On a Problem in Abelian Groups and the Construction of Fractionally Replicated Designs, R. C. BOSE, University of North Carolina AND R. C. BURTON, National Bureau of Standards.

Consider an Abelian group of order s^n , generated by n letters A_1, A_2, \dots, A_n , with the relations $A_1^s = A_2^s = \dots = A_n^s = I$, where I is the identity and s is a prime. If $G = A_1^{x_1} A_2^{x_2} \dots A_n^{x_n}$ is any element of the group, then the number of non-zero exponents x_i may be called the length of G . Given an integer $r < n$, the problem is to find a subgroup of order s^r , generated by r independent elements $G_i = A_1^{x_{i1}} A_2^{x_{i2}} \dots A_n^{x_{in}}$ such that the minimum length of the elements in the subgroup (except the length of the unit element) is greater than or equal to k . Consider the finite projective space $PG(r-1, s)$. To any point $x = (x_1, x_2, \dots, x_r)$ of this space, assign a non-negative integer m , which may be considered the measure of x , in such a way that the total measure for the space is n . To a point of measure m associate m different letters chosen out of A_1, A_2, \dots, A_n , each of these letters being assigned to one and only one point. Let $G_i = A_1^{x_{i1}} A_2^{x_{i2}} \dots A_n^{x_{in}}$ where x_{ij} is the i th coordinate of the point to which A_j is associated. It is proved that the length of the element $G_1^{x_1} G_2^{x_2} \dots G_r^{x_r}$ is the measure of the set of points not lying on the linear space $\lambda_1 x_1 + \lambda_2 x_2 + \dots + \lambda_r x_r = 0$. For example let $n = 10, r = 4, s = 3$. We can find exactly 10 points on an unruled quadric in $PG(3, 3)$. If we take the corresponding subgroup as the fundamental identity for generating a $\frac{1}{3^4}$ fraction in a factorial design with 10 factors, then all the aliases of a main effect will have five or more factors, and all the aliases of two factor interaction will have four or more factors. (Received January 21, 1957.)

NEWS AND NOTICES

Readers are invited to submit to the Secretary of the Institute news items of interest

Personal Items

Professor Felix Bernstein, the founder and director Emeritus of the Institute of Mathematical Statistics, University of Goettingen, Germany, died December 3, 1956 in Zuerich, Switzerland. Professor Bernstein was also a member of the International Statistics Institute, a fellow of the Royal Statistics Society, a fellow of the AAAS, and was professor of biometrics, New York University from 1936-1945. In 1950 he was American Fulbright professor at the Institute of Statistics, Rome, Italy.

Dr. Robert M. Blumenthal has been appointed to an instructorship at the University of Washington.

Glenn L. Burrows has been appointed Staff Statistician at the Knolls Atomic Power Laboratory, Schenectady, New York.

Victor Chew resigned on February 1, 1957 from the position of Assistant Professor of Statistics, University of Florida, to become Asst. Statistician at Institute of Statistics at Raleigh, North Carolina, and do work towards a Ph.D. in experimental statistics.

Professor Kai Lai Chung, on leave from Syracuse University, is a Visiting Professor at the University of Chicago during 1956-57.

George E. Ferris is now with the Statistics Department of General Foods' Corporation in Hoboken, New Jersey.

Alfred E. Garratt is now Assistant Professor of Statistics at Virginia Polytechnic Institute.

Ferdinand Lemus, formerly with the Experimental Design and Statistical Analysis Group of Westinghouse Electric Corp., East Pittsburgh, Pa., is now employed as a Statistical Engineer with the Avon Lake Experimental Station, B. F. Goodrich Chemical Company, Avon Lake, Ohio.

Gisiro Maruyama has been appointed Professor at Kyusyu University, Faculty of Science, Fukuoka, Japan.

W. Jay Merrill, Jr., received his Ph.D. from Ohio State University in December, 1956.

Robert Mirsky, who for the past six years has been with the Cornell Aeronautical Laboratory, has joined the General Electric Company as an operations research analyst in their Engineering Operation at 3198 Chestnut Street, Philadelphia, Pa.

Dr. Mervin E. Muller is on leave of absence from the Scientific Computing Center, International Business Machines Corp., New York, in order to accept a position as Research Associate in Mathematics, Department of Mathematics, Princeton University.

A. Carl Nelson, Jr., formerly an instructor in mathematics at the University of Delaware, Newark, Delaware, is now a statistician for Westinghouse Atomic Power Division, Pittsburgh, Pa.

Joseph S. Rhodes has been appointed manager of operations research of Atlas Powder Company, a new post in its Economic Evaluation Department.

Ronald W. Shephard has been appointed a professor in the Engineering Department, University of California, Berkeley, California.

George W. Snedecor has gone to North Carolina State College as a visiting professor in the Institute of Statistics, stationed with the Department of Experimental Statistics from January until September 1957. He is engaged in consulting and teaching statistical methods.

Dan Teichroew has been transferred by the National Cash Register Company to its Electronics Division in Hawthorne, California, to form a Business Systems Analysis Section in the Product Development Department.

Dr. Alan E. Treloar is currently on leave from the University of Minnesota and serving as Director of Research for the American Hospital Association in Chicago.

Frank H. Trinkl has joined The Ramo-Wooldridge Corporation as a Member of the Technical Staff, of the Computer Systems Division.

William H. Williams has been chosen to receive The George W. Snedecor Award in Statistics for 1957, by vote of the graduate faculty in statistics at Iowa State College. The award is given annually to the person judged to be most outstanding among those students at the college working toward a Ph.D. or joint Ph.D. in statistics who are expected to graduate within a specific time interval; it consists of a year's membership in the Institute of Mathematical Statistics together with a subscription to its *Annals*.

Mrs. Pearl A. Van Natta has, since September 25, 1956, been employed by The Denver Research Institute, Division of Physics, as a Research Mathematician.

Use of High Speed Computers by IMS Members*

A questionnaire was mailed to all members of the IMS in 1956 to determine the present status of the use of high speed computers by the membership and to ascertain the kind of information desired regarding these machines. Only 263 members answered the questionnaire: 119 from colleges and universities, 90 from industry and private consulting and 54 from government. As a result of the interest in having sessions on these computers at meetings of the IMS, sessions were cosponsored at both the Seattle and Detroit meetings in 1956, one session was held at the Washington, D. C. meeting in 1957 and sessions are being planned for the Atlantic City meeting. The members seemed to be about equally divided as to topics for papers at these meetings.

Eighty-seven per cent (87 %) of those replying favored an expository article on the subject for the Annals. The content of such an article should emphasize a glossary of terms useful to statisticians, description of major machines and how they differ and examples of the use of the machines for statistical purposes. Only 53 % favored a regular section on computing and 23 % opposed such a section, 24 % being indifferent. Information regarding these machines can be obtained from other journals, but many of the members were unfamiliar with either the Association for Computing Machinery (54 % of those replying) and Mathematical Tables and other Aids to Computation (40 % of those replying). Of those replying, only 55 % had used these computers; of those who had used the computers, 56 % had done some programming.

Of those who had used a high speed computer, 20 % had used it for empirical sampling; 24 % for Monte Carlo; 36 % for data reduction; 36 % for table preparation; 54 % for mathematical problems; and, 62 % for data analysis. Forty-eight per cent (48 %) had used it for analysis of variance or regression and correlation analysis. Other types of analysis mentioned were matrix inversion or multiplication, computation of means and standard deviations, time series and spectral analysis, multivariate analysis including discriminant functions, factor analysis, contingency tables and χ^2 , linear programming and inventory control, solution of equations, numerical integration, solutions of econometric models, tests of significance, distribution theory, complicated confidence limits, differential and integral equations, fitting frequency curves, Boolean algebraic equations, actuarial formulas, non-linear equations, acceptance-rejection methods, stress analysis, maxima of functions and control charts. The committee was impressed by the infrequent use of these machines for solving problems in mathematical statistics and econometrics.

* Prepared by R. L. Anderson, Chairman of IMS Committee on High Speed Machines.

University of Michigan Program in Mathematical Statistics and Probability

The University of Michigan provides training in mathematical statistics and probability, (a) leading to the master's degree, (b) leading to the doctorate. Courses in mathematical statistics and probability are conducted by staff members (including H. C. Carver, A. B. Clarke, A. H. Copeland, C. C. Craig, D. A. Darling, P. S. Dwyer, J. G. Wendel, Oscar Wesler). Teaching fellowships and assistantships are also available. Applications for these should be sent to Professor T. H. Hildebrandt of the Department of Mathematics. Additional information may be obtained by writing Professor C. C. Craig or Professor P. S. Dwyer of the Department of Mathematics.

Summer Statistical Seminar

A two-week summer statistical seminar will be held at the Endicott House in Dedham, Massachusetts, beginning July 29, 1957. The first week will be devoted to the general topic of time series with emphasis on turbulence, aeronautics, ship motion, and communication, under the chairmanship of Leo Tick of New York University.

The program for the second week will include business applications, reliability, and data reduction topics, as part of the general discussion of the impact of computers on statistical problems. Dr. Max Woodbury is chairman of this program.

Further information can be obtained from Dr. M. E. Terry, Bell Telephone Laboratories, Murray Hill, New Jersey, or the secretary, Dr. Geoffrey Beall, Gillette Safety Razor Company, Boston, Massachusetts.

University of Chicago Department of Statistics

The department of statistics at the University of Chicago, known since its organization in 1949 as the Committee on Statistics, is now called the Department of Statistics. The name was changed from Committee to Department in order to avoid confusion about the nature and status of the organization. Leonard J. Savage, who has been Acting Chairman of the Department this year, has accepted a regular appointment as Chairman beginning March 1, 1957. He succeeds W. Allen Wallis, who now is Dean of the School of Business though he continues as a member of this Department. Other members of the Statistics faculty are K. A. Brownlee, Kai Lai Chung, Sudhish G. Ghurye, Leo A. Goodman, William Kruskal, John W. Pratt, Harry V. Roberts, and David L. Wallace.

Assistance for Travel to International Congress of Mathematicians

Funds will be made available by the National Science Foundation, aided by grants from industry, to provide travel assistance for a limited number of mathematicians attending the International Congress of Mathematicians in Edinburgh, August 14–21, 1958. Grants will be made on the basis of lists prepared by the various mathematical societies. Anyone who wishes to apply through the Institute of Mathematical Statistics should notify its Secretary (see inside front cover for address) not later than October 1, giving the following information. (1) His address; (2) a statement whether he intends to present a paper and if so, whether this is by invitation; if possible the subject or title of the paper should be given; (3) a description of other travel funds, if any, available to him. The applicant should *also* write directly to the National Science Foundation, Washington 25, D. C., requesting an application form for foreign travel grants, and should return the completed form to the National Science Foundation.

DOCTORAL DISSERTATIONS IN STATISTICS, 1956

Listed below are the doctorates conferred during the year 1956 in the United States and Canada for which the dissertations were written on topics in statistics or related fields. The university, major subject, and the title of the dissertation are given in each case. Readers are invited to notify the Editor of any omissions from this list.

John L. Bagg, Michigan State University, major in mathematical statistics, "A Probability Model for Theory of Organization of Groups with Multi-valued Relations between Persons."

Anatole Beck, Yale, major in mathematics, "On the Random Ergodic Theorem."

Robert Blumenthal, Cornell, major in probability, "An Extended Markov Property."

R. V. S. Chacon, Syracuse, major in mathematics, "Some Theorems on Continuous Parameter Markov Chains."

Richard Garth Cornell, Virginia Polytechnic Institute, major in statistics, "A New Estimation Procedure for Linear Combinations of Exponentials."

Arthur P. Dempster, Princeton, major in statistics, "The Two-Sample Multivariate Problem in the Degenerate Case."

B. J. Derwort, St. Louis, major in statistics, "An Extension of the Theory of Cumulative Frequency Functions."

Olive Jean Dunn, California (Los Angeles), major in statistics, "Estimation Problems for Dependent Regression."

Sylvain Ehrenfeld, Columbia, major in mathematical statistics, "Complete Class Theorems in Design of Experiments; Part I: Complete Class Theorems

in Experimental Design; Part II: On the Efficiency of Experimental Design."

Alvin Vincent Fend, Illinois, major in statistics, "Unbiased Estimation and Admissibility and the Treatment of Ties in the Sign Test."

Thomas Shelburne Ferguson, California (Berkeley), major in statistics, Part I: "On the Existence of Linear Regression in Linear Structural Relations;" Part II: "A Method of Generating Best Asymptotically Normal Estimates with Application to the Estimation of Bacterial Densities."

Aubyn Freed, Illinois, major in mathematics, "On the Ergodic Theorem in Dynamical Systems with Variant Measure."

Donald A. Gardiner, North Carolina State College, major in statistics, "Some Third Order Rotatable Designs."

Donald P. Gaver, Princeton, major in probability, "Some Results in the Theory of Queues."

David G. Gosslee, North Carolina State College, major in statistics, "The Level of Significance and Power of the Unweighted Means' Test."

Shanti Swarup Gupta, North Carolina, major in statistics, "On a Decision Rule for a Problem in Ranking Means."

Bertram W. Haines, Johns Hopkins, major in biostatistics, "Some Procedures of Selecting Records for Retirement."

Lester LaVerne Helms, Purdue, major in mathematical statistics, "Convergence Properties of Martingales Indexed by Directed Sets."

G. Ronald Herd, Iowa State College, major in statistics, "Estimation of the Parameters of a Population from a Multi-Censored Sample."

William Gerow Howe, North Carolina, major in statistics, "Some Contributions to Factor Analysis."

Milton V. Johns, Columbia, major in mathematical statistics, "Contributions to the Theory of Empirical Bayes Procedures in Statistics."

Eugene Arthur Johnson, Minnesota, major in biostatistics, "On the Problems of Errors Associated with Linear Regression."

Marvin A. Kastenbaum, North Carolina State College, major in statistics, "Analysis of Frequency Data in Multiway Contingency Tables."

Therese M. Kelleher, North Carolina State College, major in statistics, "Analysis and Interpretation of Variation in Inbred Lines and F_1 Crosses in Corn."

A. R. Khalil, North Carolina State College, major in statistics, "Joint Interpretation of Heterosis and Genetic Variance in Two Corn Varieties and Their Crosses."

Orval M. Klose, Washington, major in statistics, "Topics in Distribution-Free Statistics."

Clyde Young Kramer, Virginia Polytechnic Institute, major in statistics, "Factorial Treatments in Incomplete Block Designs."

Thomas E. Kurtz, Princeton, major in statistics, "An Extension of a Multiple Comparisons Procedure."

E. J. Lytle, Jr., Florida, major in statistics, "The Determination of Some Distributions for Which the Mid-range is an Efficient Estimator of the Mean."

John Hans MacKay, North Carolina, major in statistics, "On the Efficiency of Certain Tests for 2×2 Tables."

Thomas A. Magness, California (Los Angeles), major in statistics, "The Use of Cumulants in the Theory and Applications of Stochastic Processes."

Carl E. Marshall, Iowa State College, major in statistics, "Cost Control of Sample Surveys by Two-Step Designs."

Samuel T. Mayo, Minnesota, major in educational psychology, "Some Designs for the Collection of and Methods for the Analysis of Enumerative Data, with Special Applications to the Follow-up of Education Graduates."

F. S. McFeely, Virginia Polytechnic Institute, major in statistics, "Decision Procedures for the Comparison of Exponential and Geometric Populations."

Dale M. Mesner, Michigan State University, major in mathematical statistics, "An Investigation of Certain Combinatorial Properties of Partially Balanced Incomplete Block Experimental Designs and Association Schemes, with a Detailed Study of Designs of Latin Square and Related Types."

Irwin Miller, Virginia Polytechnic Institute, major in statistics, "Tests of Hypotheses Involving Desirability Relations and Some Distribution Theory Connected with Gaussian Processes."

Sujit Kumar Mitra, North Carolina, major in statistics, "Contributions to the Statistical Analysis of Categorical Data."

Gilbert I. Paul, North Carolina State College, major in statistics, "A Method of Estimating Epistatic Variance in Random Mating Populations."

W. E. Perrault, St. Louis, major in statistics, "Contribution-free Population Comparisons."

John Winsor Pratt, Stanford, major in statistics, "Some Results in the Decision Theory of One-Parameter Multivariate Polya Type Distributions."

Ronald Pyke, Washington, major in statistics, "On One-Sided Distribution-Free Statistics."

Roy Radner, Chicago, major in statistics, "Team Decision Problems."

Mushfequr Rahman, McGill, major in mathematics, "A statistical Problem in the Geometry of Numbers (Star-shaped Domains of Quadratic and Hexagonal Symmetry)."

W. L. Roach, Jr., Oregon, major in statistics, "The Application of the Exponential Distribution to a Truncated Stochastic Process."

Joan Raup Rosenblatt, North Carolina, major in statistics, "On a Class of Non-parametric Tests."

Anadi Ranjan Roy, Stanford, major in statistics, "On Chi Square Statistics with Variable Intervals."

Thomas Solon Russell, Virginia Polytechnic Institute, major in statistics, "Estimation of Individual Variations in an Unreplicated Two-Way Classification."

Jagdish Sharan Rustagi, Stanford, major in statistics, "On Minimizing and Maximizing a Certain Integral with Statistical Applications."

Jerome Sacks, Cornell, major in statistics, "Asymptotic Distribution of Stochastic Approximation Procedures."

Sam Cundiff Saunders, Washington, major in statistics, "Sequential and Randomized Distribution-Free Tolerance Limits."

Daniel E. W. Schumann, Virginia Polytechnic Institute, major in statistics, "The Comparison of the Sensitivities of Experiments Using Different Scales of Measurement."

Arthur Shapiro, California (Berkeley), major in statistics, "Some Conditions for the Existence of Similar Regions."

Robert Tynes Smith III, George Washington, major in mathematical statistics, "A Stochastic Model for Economic Time Series."

Andrew Sterrett, Pittsburgh, major in statistics, "An Efficient Method for the Detection of Defective Members of Large Populations."

Hale Caterson Sweeny, Virginia Polytechnic Institute, major in statistics, "Some Results on Experimental Designs When the Usual Assumptions are Invalid."

Maurice M. Tatsuoka, Harvard, major in educational measurements, "Joint Probability of Membership and Success in a Group: An Index which Combines the Information from Discriminant and Regression Analyses as Applied to the Guidance Problem."

James G. C. Templeton, Princeton, major in statistics, "A Test for Detecting Single Cell Disturbances in Contingency Tables."

Aram Thomasian, California (Berkeley), major in statistics, "On the Magnitude of the Sum of Error Probabilities."

Hale F. Trotter, Princeton, major in probability, "Convergence of Semi-Groups of Operators."

Donald Robert Truax, Stanford, major in statistics, "Multi-Decision Problems for the Multivariate Exponential Family."

Henry Tucker, North Carolina State College, major in statistics, "Sampling for Agricultural Price Statistics."

Irving Weiss, Stanford, major in statistics, "Limiting Distributions in Some Occupancy Problems."

Oscar Wesler, Stanford, major in statistics, "A Modified Minimax Principle."

John Wesley Wilkinson, North Carolina, major in statistics, "Analysis of Paired Comparison Designs with Incomplete Repetitions."

Myron Johnson Willis, Purdue, major in mathematical statistics, "Exponential Regression."

J. W. Woll, Jr., Princeton, major in mathematics, "Homogeneous Stochastic Processes."

New Members

The following persons have been elected to membership in the Institute

November 8, 1956 to February 5, 1957

Bacon, Dr. Ralph H., Ph.D. (New York Univ.), Physicist, General Precision Lab., Pleasantville, New York.

- Brooks, W. Douglas**, M.Ed. (Harvard), Research Psychologist, Educational Research Corporation, 10 Craigie St., Cambridge, Mass., *131 Broadway, Arlington, Massachusetts.*
- Camacho Dias, Antonio**, Diplomado en Estadísticos (Escuela de Estadísticas, Madrid), Técnico de la Comisión Nacional de Productividad y Colaborador del Instituto de Investigaciones Estadísticas, Velazquez 47, Madrid, Spain, *Escosure 5, Madrid, Spain.*
- Crowson, Henry L.**, M.S. (Univ. of Florida), Graduate Assistant, Univ. of Florida, *P. O. Box 3013 Univ. Station, Gainesville, Florida.*
- D'Andrea Du Bois, N. S. Jr.**, M.S. (Howard Univ.), Grad. Student, Univ. of California, Statistical Department, *1407 Hearst St., Berkeley 2, California.*
- Draper, Norman R.**, B.A. (Cambridge, England), Grad. Asst., Statistics Dept., Univ. of North Carolina, Chapel Hill, N. C.
- Dunlap, Paul R.**, M.Ed. (Penn. State Univ.), Sr. Reliability Analyst, RAD-Avco Mfg. Corp., 20 So. Union St., Lawrence, Mass., *3 Kingfisher Road, Tewksbury, Massachusetts.*
- Farrell, Roger H.**, M.S. (Univ. of Chicago), Research Asst. Digital Computer Laboratory, University of Illinois, Urbana, Illinois, *1022 W. Daniel St., Champaign, Illinois.*
- Fleisher, Harold**, Ph.D. (Case Inst. of Tech.), Mgr., Research Communications, International Business Machines Corp., *P. O. Box 390, Poughkeepsie, New York.*
- Fricke, Theresa A.**, M.S. (Purdue Univ.), Statistician, B. F. Goodrich Chemical Company, Experimental Station, Avon Lake, Ohio, *1484½ E. St., Lorain, Ohio.*
- Gillis, Sister Catherine Josephine**, A.M. (Boston Univ.), Asst. Prof. Dept. of Mathematics, Emmanuel College, 400 The Fenway, Boston 15, Mass.
- Good, I. J.**, Ph.D. (Cambridge Univ.), Sen. Principal Scientific Officer, Royal Naval Scientific Service, Government Communications Hdqts., Priors Road, Cheltenham, England, *25 Scott House, Princess Elizabeth Way, Cheltenham, England.*
- Haley, Lawrence B.**, M.S. (Alabama Polytechnic Inst.), Mathematical Statistician, Army Ballistic Missile Agency, Huntsville, Alabama, *1704 La Grande, Huntsville, Alabama.*
- Holmes, D. S.**, M.S. (Purdue Univ.), Quality Control Engineer, General Electric Co., Bldg. 36, 1 River Road, Schenectady 5, New York.
- Jaynes, Lt. William E.**, Ph.D. (Ohio State Univ.), Res. Psychologist (MSC), Psychology Dept. Army Medical Research Laboratory, Fort Knox, Kentucky.
- Jones, N. F.**, LL.B. (New York Univ.), Asso. Actuary, The Prudential Ins. Co. of America, Planning and Development Dept., P.O. Drawer 594, Newark 1, N. J.
- Kudo, Akio**, M.Sc. (Tokyo Univ.), Asst., Mathematical Inst., Faculty of Science, Kyushu Univ., Fukuoka, Japan.
- Lingappaiah, G. S.**, M.Sc. (Mysore Univ., India), Senior Lecturer in Stat. (India); Res. Asst. (Stanford Univ.); Dept. of Stat., University of Madras, Madras 5, India; Dept. of Stat., Stanford Univ., Stanford, Calif., *P.O. Box 617, Stanford, California.*
- Marshall, Albert W.**, (member designated by Univ. of Washington), Lab. of Stat. Research, Dept. of Mathematics, Univ. of Washington, Seattle 5, Washington.
- Moriarity, John J.**, (member designated by Purdue Univ.), Statistical Lab. Purdue Univ., Lafayette, Indiana.
- Ockelmann, Erich**, Abteilungsleiter für Marktforschung (Handlungsvollmacht), Carl Gabler, Werbegesellschaft mbH., München 2, Karlsplatz 13, Germany, *Furstenriederstrasse 100/III, München 42, Germany.*
- Quade, Dana E.**, (member designated by Univ. of N. C.), Dept. of Statistics, Univ. of N. C., Chapel Hill, N. C.
- Reich, Edgar**, Ph.D. (Univ. of California, Los Angeles), Asst. Professor Math., University of Minnesota, Institute of Technology, Minneapolis 14, Minn.
- Seguchi, Tsunetami**, M.Sc. (Kyushu Univ.), Res. Worker, Mathematical Institute, Faculty of Science, Kyushu Univ., Fukuoka, Japan.
- Stevens, Martin**, B.S. (Temple Univ.), Reliability Engineer, General Elec. Co. (MOSD), 3198 Chestnut Street, Philadelphia 4, Pa., *1744 Hawthorne Ave., Havertown, Pa.*
- Temming, Dr. Heinz**, doctor rerum naturalium (Univ. Berlin), Technical director, Peter Temming Aktiengesellschaft, Glückstadt near Hamburg, Germany.

- Thionet, Pierre**, Professeur agrégé de l'Université (Paris), Administrateur à l'Institut National de la Statistique et des Etudes Economiques, à Paris, Prete au Ministere des Finances, Service des Etudes Economiques et Financieres, 36 rue de Dunkerque, Paris (X^e) France.
- Washio, Yasutoshi**, M.Sc. (Kyushu Univ.), Asst., Mathematical Inst., Faculty of Science, Kyushu Univ., Fukuoka, Japan.
- Weckwerth, Vernon E.**, B.S. (Univ. of Minnesota), Inst. and Res. Fellow, Student, Univ. of Minnesota, Minneapolis 14, Minn., 1612 Huron St., St. Paul 13, Minnesota.
- Wheeler, T/Sgt. R. E.**, U. S. Air Force, AF17261790, Hq. Sq. Sec., Hq. AAC, Box 409, APO 942, Seattle, Washington.
- Wijsman, Robert A.**, Ph.D. (Univ. of Calif., Berkeley), Acting Asst. Prof., Statistics Department, University of California, Berkeley, California.
- Yarborough, (Miss) Leone**, B.S. (Oklahoma A. and M. College), Student, Statistical Laboratory, Oklahoma A. and M. College, Stillwater, Oklahoma.

REPORT OF THE WASHINGTON, D. C. MEETING OF THE INSTITUTE OF MATHEMATICAL STATISTICS

The 1957 Eastern Regional Meeting, seventy-second meeting of the Institute of Mathematical Statistics, was held in Washington, D. C., on March 7-9, 1957, in conjunction with the Biometric Society (Eastern North American Region).

The following 145 members of the Institute registered for the meeting:

R. L. Anderson, T. W. Anderson, James B. Bartoo, Joseph Berkson, Julius R. Blum, R. C. Bose, G. E. P. Box, R. A. Bradley, A. E. Brandt, Ben Buchbinder, Bradley Bucher, Glenn L. Burrows, John A. Carpenter, Mavis B. Carroll, Richard L. Carter, Victor Chew, K. L. Chung, Joseph L. Ciminera, Willard H. Clatworthy, A. C. Cohen, Jr., Ted Colton, Wm. I. Commins, W. S. Connor, Jerome Cornfield, E. L. Cox, Gertrude Cox, Elliot Cramer, Jonas M. Dalton, Willis Davis, Reed Dawson, Besse B. Day, Francis R. DelPriore, Earl L. Diamond, Acheson J. Duncan, David B. Duncan, Arthur M. Dutton, Churchill Eisenhart, Henry Ellner, Benjamin Epstein, William B. Fellers, Clarence Fine, Spencer M. Free, John E. Freund, Fred Frishman, Donald A. Gardiner, A. E. Garratt, John J. Gart, Seymour Geisser, Dorothy M. Gilford, R. Gnanadesikan, Mina H. Gourary, Franklin A. Graybill, B. G. Greenberg, Samuel W. Greenhouse, Joseph A. Greenwood, T. N. E. Greville, Shanti S. Gupta, John Gurland, J. S. Hagan, Max Halperin, Bernard Harris, Boyd Harshbarger, Wassily Hoeffding, W. H. Horton, Harold Hotelling, Wm. G. Howard, David C. Hurst, Frederick V. Hurst, Jr., T. A. Jeeves, G. Kallianpur, Leo Katz, Mortimer B. Keats, George H. Kennedy, A. W. Kimball, Carl F. Kossack, Charles Kraft, Clyde Y. Kramer, Morton Kupperman, Lonnie Lasman, Fred C. Leone, Alfred Lieberman, Gilbert Lieberman, Julius Lieblein, Ardie Lubin, Eugene Lukacs, J. A. McFadden, G. T. McLoughlin, Clifford J. Maloney, Arthur S. Marthens, Paul Meier, William Mendenhall, Dale M. Mesner, Herbert A. Meyer, Donald F. Morrison, Jack Moshman, Mervin Muller, Mary G. Natrella, George Nicholson, Gottfried E. Noether, Junjiro Ogawa, Carl R. Ohman, Ingram Olkin, K. M. Patwary, John F. Pauls, B. E. Phillips, Lila Knudsen Randolph, Wyman Richardson, Donald L. Richter, David Rosenblatt, Harry M. Rosenblatt, Joan R. Rosenblatt, M. Rosenblatt, S. N. Roy, Jagdish S. Rustagi, Rose Sachs, William H. Sammons, Daniel E. Sands, Marvin Schneiderman, Norman Severo, Oliver A. Shaw, Walt R. Simmons, Rosedith Sitgreaves, Morris Skibinsky, Romuald Slimak, Jean F. Smolak, Milton Sobel, Paul N. Somerville, Fannie A. Stinson, H. C. Sweeny, Zen Szatrowski, Robert J. Taylor, Henry Teicher,

M. E. Terry, Malcolm E. Turner, H. Robert van der Vaart, Irving Weiss, Kathleen White, M. B. Wilk, John W. Wilkinson, Evan J. Williams, R. Lowell Wine, Charles W. Wright, W. J. Youden, Samuel Zehl, Marvin Zelen.

The program was as follows:

THURSDAY, MARCH 7, 1957

9:45-10:00 a.m. Welcome from Catholic University

10:00-12:00 noon. Sessions A and B

Session A: Sample Survey Methodology

Chairman: BOYD HARSHBARGER, Virginia Polytechnic Institute

- Papers:
1. *A Sampling Study of Sources of Information for Farm Families in Virginia*, LOWELL WINE, Virginia Polytechnic Institute
 2. *A New Approach to General Purpose Sampling*, CARL KOSSACK, Purdue University
 3. *Recent Experiences with Area Sampling for Agricultural Statistics*, R. E. VICKERY, Agricultural Marketing Service

Session B: Contributed Papers I (I.M.S.)

Chairman: JOAN R. ROSENBLATT, National Bureau of Standards

- Papers:
1. *Synchronization of Trajectory Images of Ballistic Missiles and the Timing Record of the Ground Telemetry Recording System*, HARRY P. HARTKEMEIER, Stanford University (Introduced by Paul R. Rider)
 2. *A Further Contribution to the Theory of Systematic Statistics*, JUNJIRO OGAWA, University of North Carolina
 3. *Multivariate Analysis of Variance*, S. N. ROY, University of North Carolina
 4. *Confidence Bounds Associated with Multivariate Analysis of Variance*, S. N. ROY AND R. GNANADESHIKAN, University of North Carolina.
 5. *On Statistics Independent of a Sufficient Statistic*, EVAN J. WILLIAMS, North Carolina State College
 6. *On a Problem in Abelian Groups and the Construction of Fractionally Repeated Designs*, R. C. BOSE, University of North Carolina AND R. C. BURTON, National Bureau of Standards
 7. *The Variance of Zero-crossing Intervals*, J. A. McFADDEN, U. S. Naval Ordnance Laboratory, (Introduced by Gilbert Lieberman)
 8. *Maximum Likelihood Estimates in a Simple Queue*, A. BRUCE CLARKE, University of Michigan, (By Title)
 9. *The Joint Distribution of a Set of Sufficient Statistics for the Parameters of a Simple Telephone Exchange Model*, VÁCLAV EDVARD BENEŠ, Bell Telephone Laboratories, (By Title)
 10. *An Extension of the Cramér-Rao Inequality*, JOHN J. GART, Virginia Polytechnic Institute, (By Title)
 11. *A Limit Theorem and Bounds for an Optional Stopping Probability*, MORRIS SKIBINSKY, Michigan State University, (By Title)
 12. *On the Mathematical Principles Underlying the Theory of the Chi-square Test*, JUNJIRO OGAWA, University of North Carolina, (By Title)
 13. *A Limit Theorem of Cramér and Its Generalization*, JUNJIRO OGAWA, University of North Carolina, (By Title)
 14. *Some Uses of Quasi-Ranges II*, J. T. CHU AND F. C. LEONE, Case Institute of Technology AND C. W. TOPP, Fenn College, Cleveland, Ohio

1:30-3:00 p.m. Applications of Stochastic Processes

Chairman: RALPH A. BRADLEY, Virginia Polytechnic Institute

- Papers:
1. *Some Estimation Problems in Generalized Harmonic Analysis*, J. E. FREUND AND W. O. ASH, Virginia Polytechnic Institute
 2. *Applications of Stochastic Process Theory to Problems in Aeronautics*, FRANKLIN W. DIEDERICH, National Advisory Committee for Aeronautics, (Langley Field)

3:00-4:00 p.m. Tea and Social Hour**4:00-6:00 p.m. Design of Experiments**

Chairman: D. B. DUNCAN, University of North Carolina

- Papers:
1. *An Industrial Example of Fractional Factorials*, W. H. HORTON, Westinghouse Electric Corp.
 2. *Some Problems in Evolutionary Operation*, G. E. P. BOX, Princeton University
 3. *Factorial Treatments in Group Divisible Incomplete Block Designs*, CLYDE Y. KRAMER, Virginia Polytechnic Institute
 4. *The Structure of Incidence Matrices of Partially Balanced Incomplete Block Designs*, D. M. MESNER, Purdue University Center (Ft. Wayne)

FRIDAY, MARCH 8, 1957**9:00-11:00 a.m. Electronic Computers**

Chairman: JACK MOSHMAN, Council for Economic and Industry Research

- Papers:
1. *The Use of Generalized Subroutines in Statistical Calculation*, ROMUALD SLIMAK, Sperry Rand Corp.
 2. *Some Uses of the I.B.M. 650 in Applied Statistics*, H. L. LUCAS, Princeton University
 3. *The Mutual Troubles of Statisticians and Digital Computers*, FORMAN S. ACTON, Princeton University

Discussant: MILTON E. TERRY, Bell Telephone Laboratories

11:00-12:00 noon. Methodology in Survey of Smoking Habits

Chairman: B. G. GREENBERG, University of North Carolina

- Paper:
1. *An Investigation on Smoking Habits of Individuals*, D. G. HORVITZ, G. T. FORADORI, J. MONROE, J. FLEISCHER, A. L. FINKNER, North Carolina State College

Discussant: JEROME CORNFIELD, National Institutes of Health

2:00-4:00 p.m. Contributed Papers (I.M.S. and Biometric Society)

Chairman: MAX HALPERIN, National Institutes of Health

- Papers:
1. *A Rank Order Test for Trend in Correlated Means*, ARDIE LUBIN, Walter Reed Army Institute of Research, Washington, D. C.
 2. *On the Stochastic Structure of Minkowski-Leontief Systems*, DAVID ROSENBLATT, American University
 3. *The Use of Incomplete Block Designs for Asymmetrical Factorial Arrangements*, MARVIN ZELEN, National Bureau of Standards
 4. *Extension of Some Results Given by Mitra on Statistical Analysis of Categorical Data*, EARL DIAMOND, University of North Carolina
 5. *Testing of Hypotheses on a Mixture of Variates Some of Which are Continuous*

and the Rest Categorical, S. N. ROY AND M. D. MOUSTAFA, University of North Carolina

6. *Generalized Quantal Response in Biological Assay*, JOHN GURLAND, Iowa State College
7. *The Recovery of Intervariety Information*, BRADLEY D. BUCHER, Princeton University
8. *On the Stochastic Structure of Minkowski-Leontief Systems, II*, DAVID ROSENBLATT, American University, (By Title)
9. *On the Stochastic Structure of Minkowski-Leontief Systems, III*, DAVID ROSENBLATT, American University, (By Title)
10. *On Selecting a Subset which Contains All Populations Better Than a Standard*, SHANTI S. GUPTA AND MILTON SOBEL, Bell Telephone Laboratories
11. *On the Relation Between Loss Functions and Significance Levels*, H. R. VAN DER VAART, North Carolina State College

4:00-6:00 p.m. Recent Developments in Statistics and Probability

Chairman: CHURCHILL EISENHART, National Bureau of Standards

- Papers:
1. *Statistical Inference*, JEROME CORNFELD, National Institutes of Health
 2. *The Efficiency of Non-parametric Tests*, GOTTFRIED NOETHER, Boston University
 3. *A Survey of the Theory of Analytic Characteristic Functions*, EUGENE LUKACS, Catholic University
 4. *Tests Concerning the Means of Certain Distributions*, NORMAN SEVERO, National Bureau of Standards

SATURDAY, MARCH 9, 1957

10:00-12:00 noon. Stochastic Problems in Physics (I.M.S.)

Chairman: KAI LAI CHUNG, University of Chicago

- Papers:
1. *Applications of Stochastic Processes to Problems in Chemical Kinetics*, ELLIOT MONTROL, University of Maryland
 2. *Statistical Theory of Cascade Processes*, J. E. MOYAL, Columbia University

DOROTHY MORROW GILFORD
Associate Secretary

PUBLICATIONS RECEIVED

- DIAB, M. A., *The United States Capital Position and the Structure of Its Foreign Trade (Contributions to Economic Analysis)*, North-Holland Publishing Company, Amsterdam, P.O. Box 103, Holland, 1956, viii + 67 pp., \$2.75.
- CLATWORTHY, W. H., *Contributions on Partially Balanced Incomplete Block Designs with Two Associate Classes*, National Bureau of Standards Applied Mathematics Series 47, 70 pages, 7 tables, 45 cents. (Order from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.)
- NARASIMHAM, N. V. A., *A Short Term Planning Model for India (Contributions to Economic Analysis)*, North-Holland Publishing Company, Amsterdam, P.O. Box 103, Holland, 1956, xiii + 93 pp., \$2.75.
- TINBERGEN, J., *Economic Policy: Principles and Design (Contributions to Economic Analysis)*, North-Holland Publishing Company, Amsterdam, P. O. Box 103, Holland, 1956, xxviii + 276 pp., \$7.00.