Statistical Laboratory

established 1933

Annual Report

July 1, 1994 to June 30, 1995

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Contents

THE STATISTICAL LABORATORY
Iowa State University
1994-95 Annual Report

Personnel

On July 1, 1994, Dean Isaacson began his third term as director of the Statistical Laboratory, head of the Department of Statistics in the College of Liberal Arts and Sciences, and head of the Statistics Department of the Iowa Agriculture and Home Economics Experiment Station. His current contract runs through June 1998.

Hal S. Stern joined the faculty in July as associate professor, with tenure. He holds M.S. and Ph.D. degrees in statistics from Stanford University and had been a member of the Department of Statistics at Harvard University since 1987, becoming associate professor in 1991.

Bill Meeker was on faculty improvement leave during the fall 1994 semester. He spent four weeks in September and October as a visiting professor with the Department of Statistics and Actuarial Science and the Institute for Improvement in Quality and Productivity at the University of Waterloo, Waterloo, Ontario, Canada. He also spent four weeks in November and December as a visiting professor at Louisiana State University, Baton Rouge. The purpose of the leave was to complete some research projects and to continue writing a book (joint with Luis Escobar at LSU). The book, Statistical Methods for Reliability Data, is expected to be published by John Wiley and Sons in 1997.

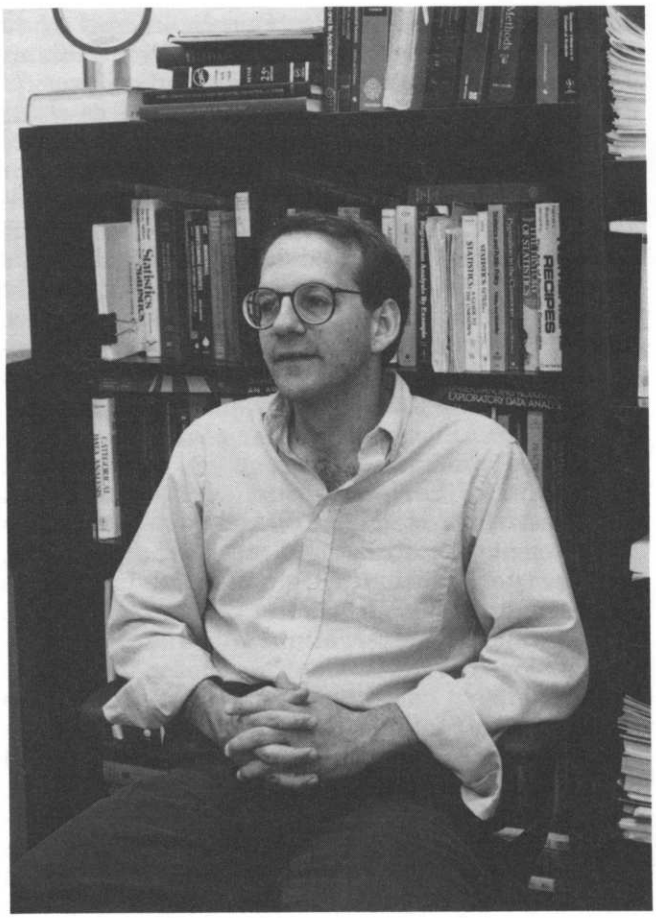
Soumendra Lahiri was on faculty improvement leave in the Department of Statistics, Stanford University, California, fall semester 1994 to conduct research on resampling methods.

The Survey Section of the Statistical Laboratory lost two members to cancer during the year. Harold Baker died on December 17, 1994; he had been an assistant professor since 1965. Sue Verkade died on June 22, 1995; she had been a data technician since 1980. See pp. 51-52 for memorial statements.

Yoshiko Isogawa, visiting associate professor, returned to her position as associate professor, Department of Management Science, Kobe University of Commerce, Kobe, Japan, in August 1994. She had been working mainly with Professors Fuller and Amemiya in research on measurement error models.

Phil Iversen, temporary assistant professor for spring semester and summer term 1994, accepted a position as senior statistician, Division of Statistical and Mathematical Sciences, Lilly Corporate Center, Indianapolis, Indiana, beginning September 12, 1994.

Prof. Shomei Tsukibayashi of Aichi University, Japan, visited the Department of Statistics on September 10-11, 1994, to consult with H. A. David on order statistics.



Hal Stern, a 1994 addition to the statistics faculty, formerly at Harvard, is coauthor of a book on Bayesian data analysis, scheduled for July 1995 publication. His research interests include paired comparisons and ranking and statistics in sports.

Five visitors came for short stays in connection with spatial statistics research supported by a grant from the Environmental Protection Agency: Profs. John Kent, Department of Statistics, University of Leeds, UK; Linda Young, Department of Biometry, University of Nebraska-Lincoln; Scott Urquhart, Department of Statistics, Oregon State University; Antony Unwin, Institut fur Mathematik, University of Augsburg, Germany; and Graham Wills, AT&T Bell Laboratories, Naperville, Illinois. All gave seminars here (see pp. 50-51).

Neil J. A. Sloane, Mathematical Sciences Research Department, AT&T Bell Laboratories, Murray Hill, New Jersey, visited the departments of Statistics and Mathematics on May 1-5, 1995, to give two seminars and conduct research with John Stufken.

Ahmed Youssef has been here since April 1994 as a visiting research scientist through the Iowa State University Channeling Program. He is a doctoral student from the Department of Applied Statistics and Econometrics, Institute of Statistical Studies, Cairo University, Egypt, and plans to remain at ISU for two years working on his dissertation.

Toni Genalo resigned from the Survey Section effective May 31, 1995. She accepted a position at the Survey Research Center, University of California-Berkeley, beginning in June. The Survey Section

hosted a farewell coffee for Genalo on May 31 in recognition of her years of service. Andrew Williams joined the Statistical Laboratory as survey projects manager in April 1995. He had worked as study director at Westat Inc., Rockville, Maryland, since 1987. Before that he had been a statistics instructor at the University of South Florida, assistant manager for data collection at the U. S. Bureau of the Census, Tampa, Florida, and study manager at Comsis Corporation, Silver Spring, Maryland, for shorter periods. Williams received his B.S. (honors) degree in psychology at the University of North East London, England, in 1983, and the M.A. degree in human sciences at Hood College, Maryland, in 1991.

Sam Wieand accepted a position as director of biostatistics for the National Surgical Adjuvant Breast and Bowel Project (NSABP) and professor in the Department of Biostatistics, School of Public Health, University of Pittsburgh, beginning May 1, 1995. He had been director of the Cancer Center Statistics at Mayo Clinic, Rochester, Minnesota, and group statistician for the North Central Cancer Treatment Group. Wieand has served as collaborator with the Department of Statistics, Iowa State University, since February 1988 and will continue in this role until doctoral research he is supervising here is completed. He had been on the statistics faculty at the University of Pittsburgh for approximately ten years before joining Mayo Clinic in 1985. Two Iowa State students will have completed Ph.D. dissertations under the direction of Dr. Wieand.

Derrick K. Rollins, Sr., received a National Science Foundation Presidential Faculty Fellows Award on September 29, 1994. The award recognizes both research and teaching and is given annually to 30 faculty members in the nation, 15 in engineering disciplines and 15 in the social sciences. The award includes a grant for $100,000 per year for five years from NSF. Rollins plans to use these funds to support research work, to buy more equipment and workstations for use by students in chemical engineering and statistics, and to write a statistics textbook for chemical engineering students.

Derrick Rollins has been appointed to chair the interdisciplinary Afro-American Studies Program effective October 1994. He was also named as an honorary member of the Golden Key National Honor Society at Iowa State University during the fall.

Dean Isaacson was elected a fellow of the American Statistical Association in 1994. He was cited for "outstanding administrative leadership of a major Department of Statistics; and for important contributions to the theory of stochastic processes."

W. Robert Stephenson received the James Huntington Ellis Award for Excellence in Undergraduate Introductory Teaching at the 1995 spring convocation at Iowa State University. The $1,000 award recognizes faculty members who, in teaching an introductory course, demonstrate creativity in improving the quality of course offerings, excite interest and involvement in courses without compromising scholarship, and enhance student performance in future courses. Stephenson was cited for his development of the Principles of Statistics course into a modern introduction to statistical ideas. "Thousands of Iowa State undergraduates have benefited from his enthusiasm, creative teaching methods and effective supervision of this course."

Sam Wieand (left) confers with his doctoral student Birol Emir on new developments in Emir's dissertation preparation. Research by the two men has already resulted in a joint paper for which Emir received a Biometric Society (ENAR) Student Travel Award. Wieand until recently was based at the Mayo Clinic, Rochester, Minnesota. He has been a collaborator with the Department of Statistics since February 1988. On this occasion, he is commuting from a new position at the University of Pittsburgh.

Looking toward next year: Three open positions were announced in late 1994, and candidates were interviewed. The results are that the following appointments will be made: Jean-Didier Opsomer will be joining the Survey Section as assistant professor. He received the M.S. degree in management engineering at Katholieke Universiteit Leuven, Belgium, in 1986, the M.B.A. degree in finance at the University of Chicago in 1987, and M.S. and Ph.D. degrees in operations research at Cornell University, in 1994 and 1995, respectively. Linda Brant Collins will be added to the undergraduate teaching faculty as assistant professor. She received a B.S. degree in mathematics at the University of Texas at San Antonio in 1991 and completed work for a Ph.D. degree in statistics at the University of Chicago in the summer of 1995. Yannis G. Bilias will have a joint appointment as assistant professor in statistics and economics. He completed an M.A. degree in economic theory and policy at the Economic University of Athens, Greece, in 1989, and a Ph.D. degree in econometrics at the University of Illinois Urbana-Champaign in 1995. Bilias has four years' experience as an econometric computing consultant at Illinois.

Three faculty members will be on faculty improvement leave for part or all of the 1995-96 year. Krishna Athreya will be gone for the full academic year. He will spend most of that time as a visiting professor at the Jawaharlal Nehru Centre for Advanced Scientific Research, Indian Institute of Science, Bangalore, India. He will also be visiting the Indian Statistical Institute, Bangalore, Calcutta, and Delhi, and the University of Melbourne, Australia, to

do collaborative research. Peter Sherman will be visiting the Australian Defence Science & Technology Organization during summer 1995 and will be on faculty improvement leave fall semester to conduct research at the Cooperative Research Centre for Robust and Adaptive Systems, (CR)²ASys, whose partners include the Australian National University, Australian defence agencies, and industry. Fred Lorenz will be at the University of North Carolina-Chapel Hill fall semester. He will work with Glen H. Elder, Jr., and Ken Bollen, Department of Sociology, on modeling change in people's lives over time.

Alicia Carriquiry has been promoted to associate professor of statistics with tenure. Derrick K. Rollins has been promoted to associate professor of statistics and chemical engineering, with tenure.

Statistical Laboratory Staff--Fiscal Year 1994-95 under the administrative direction of:

Martin C. Jischke, Ph.D.--president
John J. Kozak, Ph.D.--provost
Patricia B. Swan, Ph.D.--vice provost for research and advanced studies; dean of the Graduate College
Elizabeth Hoffman, Ph.D.--dean, College of Liberal Arts and Sciences; director, Liberal Arts and Sciences Research Institute
David G. Topel, Ph.D.--dean, College of Agriculture; director, Iowa Agriculture and Home Economics Experiment Station
Dean L. Isaacson, Ph.D.--director, Statistical Laboratory; head, Department of Statistics; head, Statistics Department, Iowa Agriculture and Home Economics Experiment Station

Professors
Yasuo Amemiya
Krishna B. Athreya, joint appointment with Department of Mathematics
Theodore B. Bailey
C. Philip Cox, professor emeritus
David F. Cox, University Professor
Noel A. C. Cressie, Distinguished Professor in Liberal Arts and Sciences
Herbert A. David, Distinguished Professor in Liberal Arts and Sciences
Herbert T. David, University Professor, joint appointment with Department of Industrial and Manufacturing Systems Engineering
Wayne A. Fuller, Distinguished Professor in Liberal Arts and Sciences; faculty status also in Department of Economics
Richard A. Groeneveld
David A. Harville
Roy D. Hickman, professor emeritus
Paul N. Hinz, faculty status also in Department of Forestry
Donald K. Hotchkiss, professor emeritus
David V. Huntsberger, professor emeritus
Dean L. Isaacson
Oscar Kempthorne, emeritus Distinguished Professor in Liberal Arts and Sciences
William J. Kennedy
Kenneth J. Koehler
Frederick O. Lorenz, joint appointment with Department of Sociology
William Q. Meeker, Jr.
Edward Pollak, joint appointment with Department of Genetics
Mack C. Shelley II, joint appointment with Department of Political Science
Robert F. Strahan, joint appointment with Department of Psychology
Norman V. Strand, professor emeritus
Stephen B. Vardeman, joint appointment with Department of Industrial and Manufacturing Systems Engineering
H. Samuel Wieand, Mayo Clinic collaborator
Leroy Wolins, professor emeritus

Associate Professors
Soumendra N. Lahiri
Mervyn G. Marasinghe
Carl W. Roberts, joint appointment with Department of Sociology
Peter Sherman, joint appointment with Department of Aerospace Engineering and Engineering Mechanics
W. Robert Stephenson
Hal Stern
John Stufken
Shaskikala Sukhatme

Assistant Professors
Harold D. Baker
F. Jay Breidt
Alicia Carriquiry
Dianne Cook
Mark Kaiser
Sarah Nusser
Derrick Rollins, joint appointment with Department of Chemical Engineering

Temporary Assistant Professor
Philip W. Iversen

Resident Collaborator
Dean Thompson, USDA Soil Conservation Service

Visiting Research Scholar
Ahmed Youssef

Graduate Assistants

The status of graduate students often changes. Students holding appointments as graduate teaching or research assistants in statistics for part or all of the year are listed here. Cooperative internships are listed on p. 46.

Pamela Abbitt (Shell scholar)
Kevin Ackley (Providian Bancorp scholar)
W. Jeremy Aldworth (Shell scholar)
Gregg Althen
Anthony Baiching An
Peter Anderson
Gregorio Atúncar
Barbara Dombroski Barnet
Lee Barton
Rebecca Benner

Carter Ann Blakeley (Vera David fellow)
Marek Brabec
G. Gordon Brown
Dana Bruden
Aidan Cardella
Cong Chen
Huaichin Chen
Jianlin Cheng
Rohit Deo
Mark Dietrich
Kevin Dodd
Tom Dubinin
Birol Emir
Michael Eraas
Solidad Fernandez
Jun-ichiro Fukuchi
Angelita Nason Garth
Juan Jose Goyeneche (Fulbright/LASPAU scholar)
Jason Gunnink
Richard N. Hardy
Kari Ann Henry
Hsin-Cheng Huang
Shiaau-Er Huarng
Yoon-Sook Jeon
Amy Rath Johanson
Angela M. Jones (Procter & Gamble scholar)
Philip G. Jones
Kari Jovaag
Shin-Soo Kang
Jae-Kwang Kim
Sara Kind
Thomas Kirchoff
Matthias Klapper
Seoung-Gon Ko
Jennifer Kohn (Eli Lilly scholar)
Shonda Kuiper
Chiang-Sheng Johnson Lee
Jaehyung Lee
Ding-Hwa Dean Lei
Beth Lencowski
Nicholas Lewin
Rong Li
Chien-Hua Jonathan Liao
Win-Chin Lin
Chih-Yao Craig Liu
Feng Lu
Maritza Melèndez-Cuero
Amy Jo Meyer
Peter Morse
Sol Mumey
Savas Papadopoulos
Brandon Paris (Eli Lilly scholar)
Francis Jave Pascual
Mark Peters
Abdul Wajid Rana
Deanne Reber (Shell scholar)
Anindya Roy (Fryer scholar)
Leroy Rushing
Abigail Sage
Christopher Scheib
Pamela Schmidt (Shell scholar)
Angela Schneider
Heidi Shierholz (Shell scholar)
Tae-Sung Shin
James D. Smith IV (Dow Chemical scholar)
Richard Sullivan
Catherine Sunde
Ling-Ling Claire Tsao
Jennifer Walker
Melanie Wall (Providian Bancorp scholar)
Ouhong Wang
Lisa Wicklund
Jeffrey Wieland
Christopher Wikle (Shell fellow)
Kevin Wright (Shell scholar)
Jill Yoder (Providian Bancorp scholar)
Zugeng Zheng
Weiye Zhu

Supported Graduate Students

Abdulelah Al-Nafisa--Institute of Public Administration, Kingdom of Saudi Arabia
Andim O. Balce--Pamukkale University, Turkey
Shawn Bates--Department of Human Development and Family Studies, ISU
Kristine Bendixen--Department of Chemical Engineering, ISU
Bassirou Chitou--USAID-ATLAS/AFGRAD
Sriram Devanathan--Department of Chemical Engineering, ISU
Donald J. Dougherty--Center for Continuous Quality Improvement, ISU Research Park
Michael Elling--Iowa Transportation Center
Dennis Field--Iowa Quality Coalition
Birgit T. Flatau (DAAD scholar)--Dortmund University
King-Chong Iris Fung--Department of Economics, ISU
Elizabeth Goldberg (GSFAP scholar)--Rural Health Research Center, ISU
Chad Hart--Department of Economics, ISU
Lun-Xiong He--Department of Electrical Engineering and Computer Engineering, ISU, and Ames Laboratory, U.S. Department of Energy
Nan-Jung Hsu--U.S. Department of Agriculture
Mu-Yeh Huang--College of Engineering, ISU
Wynandin Imawan--STAID-IU-Indonesia
Alejandro Islas-Camargo--CONACyT-Mexico
Shuen-Lin Jeng--Center for Nondestructive Evaluation, IPRT, Ames Laboratory, U.S. Department of Energy
Sock-Cheng Koh--National University of Singapore
Koji Kondo--Department of Economics, ISU
Yoon-Dong Lee--Social and Behavioral Research Center for Rural Health, ISU
Michael Lieber--Family and Consumer Sciences Research Institute, ISU
Nicholas Lewin--Department of Ecology and Evolutionary Biology, ISU
Henning Lustig (DAAD scholar)--Dortmund University
Marcia Macedo--CNPq/CAPES and Kellogg Foundation
James Majure--GIS Support and Research Facility, ISU
Lucky Wes Mokgatlhe--University of Botswana
Bryan Nelson--Research Institute for Studies in Education, ISU
Elizabeth Paterno--Department of Economics, ISU
Laknath Peiris (Fulbright scholar)--University of Peradeniya, Sri Lanka
Xiao-ming Qi--Department of Forestry, ISU
Melissa Reyes--Department of Psychology, ISU
Pradipta Sarkar--Center for Nondestructive Evaluation, IPRT, Ames Laboratory, U.S. Department of Energy
Wendelin Schnedler (DAAD scholar)--Dortmund University
Chungyeol Shin--Rural Health Centers, ISU
Jürgen Symanzik (DAAD scholar)--Dortmund University and Geographical Information Systems Support and Research Facility, ISU
Delfino Vargas-Chanes--CONACyT-Mexico
Anand Vidyashankar--Department of Mathematics, ISU
Michael Wallendorf--Department of Entomology, ISU, and USDA
You Wang--Department of Mathematics, ISU
Susan White--Department of Agronomy, ISU
Lie-Ling Wu--College of Veterinary Medicine, ISU
Ming Xu--Ames Laboratory, U.S. Department of Energy
Ilker Yalçin--Department of Psychology, ISU

Self-Supporting Graduate Students

Xiao-Hong Cao
Ashraf El-Houbi

Peter Hanson
Gibog Hong
Je Yeong Jeong
Hea-Lim Jung
Kyu-Nam Jung
Dae-Lyong Kim
Sun-hee Kwon
Kye-Don Lee
Huei Grace Liu Ho
Jean Pelkey
Daniel Rose
Chi-Hong Tseng
Xilin Wu

Professional and Scientific Staff

Dianne G. Anderson, research associate, Survey Section
Richard Dorsch, systems analyst, Survey Section
Mary Genalo, survey projects coordinator, Survey Section
Masoud Kazemi,research associate, Survey Section
Todd Krueger, statistical systems analyst, Survey Section, starting January 17, 1995
Edith Landin, administrative specialist.
Anita Hinkeldey McVey, research associate, Survey Section
Bud Meador, supervisor, Statistical Data Processing Services
Deborah Reed-Margetan, programmer-analyst, Survey Section
Janet L. Schultz, programmer, Survey Section
Kathleen Shelley, supervisor, Statistical Numerical Analysis Services
Melissa J. Swanson, programmer, Survey Section
Harvey Terpstra, data systems manager, Survey Section
Douglas L. Tschopp, programmer, Survey Section
Jauvanta Walker, communication specialist
Andrew Williams, program coordinator (survey projects manager), Survey Section, beginning April 17, 1995

General Office Staff

Rose Ann Anderson, secretary
Norma Elwick, secretary
Janice Franklin, account specialist
Brenda Hewitt, clerk typist
Jeanette La Grange, clerk typist
Denise Riker, secretary
Sharon Shepard, clerk typist
Darlene Wicks, clerk typist

Survey Section Staff

Archana Arkanath, research assistant
Glenda Ashley, key entry operator
Kathryn Bottorff, field interviewer
Jean Carey, field interviewer
Carolyn A. Cockayne, clerk
Kathryn Goodwin, field interviewer
Vimlesh Gupta, key entry operator
Nancy Heathman, account clerk
Marlys Huff, field interviewer
Marcia Luze, field interviewer
Kathie Reinertson, data technician
Jasmine Seagrave, data technician
Judy Shafer, clerk typist
Sandie Smith, secretary
Susan E. Verkade, data technician
Karon White, key entry operator

Consulting and Cooperative Research

Statistical consulting and research services are provided to other parts of the university and to local, state, and federal agencies as time and funds permit. Some of this work is supported by contracts and grants.

Agriculture and Home Economics Experiment Station

The Iowa Agriculture and Home Economics Experiment Station supports collaborative research and statistical consulting services for many staff members and graduate students in the biological, agricultural, and health sciences. The core statistical staff in these areas consists of T. B. Bailey, D. F. Cox, Paul Hinz, Mark Kaiser, Kenneth J. Koehler, and Hal Stern, who were assisted this year by graduate students Claire Tsao, Kari Jovaag, Mike Wallendorf, Mark Brabec, Mike Lieber, Li-Ling Wu, Nan-Jung Hsu, and Birol Emir.

Mark Kaiser and Claire Tsao consulted with researchers in the Department of Animal Ecology on a study concerned with the survival and growth rates of wild turkey polts fitted with several types of radio transmitters. This project is one of several that involve fitting hierarchical models to repeated measures data, in this instance growth curves.

Tsao helped with the analysis of data from a study on air quality in animal housing units. Animal ammonia production was simulated by releasing CO_2 from two locations in the floor of an unoccupied unit. Concentrations of CO_2 were measured by 48 probes located at four heights at each of 12 floor positions. Data were collected when ventilation fans were at low and high speeds and when the floor space had obstructions to simulate the presence of animals and when there were no obstructions. A split plot analysis was used where height and floor positions were split plot factors and ventilation and floor obstruction were whole plot factors.

Kari Jovaag analyzed data from a study of storage methods on quality of frozen chicken. A split-split plot design was used with packaging methods being the whole plot, storage time being the split plot, and serving method being the split-split plot. Variables analyzed came from a taste panel evaluation of tenderness, juiciness, and flavor and from gas chromotography measures of concentrations of several lipid fractions.

Data from an experiment to determine if a virus affected cell growth rate in pig intestines were analyzed by Mike Wallendorf. The number of nucleolar organizing regions was counted in each of 15 cells from each of three intestine regions of challenged and unchallenged pigs. Measurements were made at each of five times after challenge. A split plot analysis was used with challenge and time as whole plot factors and intestine region as the split plot factor.

Data from a five-year capture-recapture study of frogs in the Czech Republic were analyzed by Mark Brabec. The Jolly-Seber model was used in the analysis to estimate rates of mortality and emigration.

Mike Lieber analyzed data from a questionnaire on the drinking habits of 200 students from wine tasting classes at Chico State University. The purpose of the study was to learn if drinking habits of students or their parents are useful in predicting their use of wine. Two-way tables, chi square tests, t-tests, and logistic regression were used in the analysis.

Mark Kaiser and Lie-Ling Wu began work in cooperation with researchers at the College of Veterinary Medicine to develop appropriate nonlinear response models with random effects to describe respiratory compliance in pigs. This study involves the comparison of pigs challenged with a viral infection to unchallenged (control) pigs.

Wu analyzed data from a study to determine if a vitamin E supplement helps pigs resist two types of bacteria infection, streptococcus and salmonella. Response variables such as temperature, antibody titer, white blood counts, and tbar plasma were used to measure treatment effects. A split plot analysis of variance was used in which treatment groups were the whole plot factor and time was the split plot factor.

Nan-Jung Hsu assisted in a study of the shedding pattern of *E. coli* bacteria in cattle rumen. The bacteria was inocculated into adult cattle, calves, and previously inocculated calves. A split plot analysis of variance was used with age groups being the whole plot factor and time being the split plot factor.

Paul Hinz assisted in designing an experiment to optimize lactic acid production in a batch fermentation process. The fermentation vessels use support structures that supply nutrition for the bacteria and are made from oat hulls, blood albumin, salt, red blood cells, and yeast. A one-half replication of a 2^5 design was recommended for this experiment.

Birol Emir analyzed corn yield data from crop rotation experiments from two Iowa locations. Nashua had 16 years of data from six rotations and Kanawha had 10 years of data from seven rotations. All rotations use four levels of nitrogen fertilizer as a split plot factor on the corn plots. The major conclusions are that corn following soybeans or hay has higher yield than second or third year corn and that the yield of second and third year corn is less than first year corn at high levels of nitrogen.

Ted Bailey was a research collaborator with ISU researchers in a study comparing the molecular structures and physical properties of mung-bean starch and tapioca starch. The experiment included three treatment factors: pH, reaction time, and reaction temperature. A split plot design, with two replications, was chosen as the experimental design. Temperatures were randomly allocated to whole plots, and pH-reaction time treatments were split plot treatments. Molecular structure and physical properties of mung-bean starch were then simulated by using a mixture of chemically modified tapioca starch and high-amylose maize starch to make noodles.

Center for Agricultural and Rural Development

Alicia Carriquiry continued collaborating with colleagues in the Food and Nutrition and the Natural Resources Divisions of CARD. In the Natural Resources Division, she was involved in the 1995 Farm Bill analysis, through her work on design of simulation experiments and soil sampling experiments. She also collaborated with Bruce Babcock in economics and Hal Stern in statistics on the development of statistical methodology to improve farmers' decisions regarding fertilizer application rates. In the Food and Nutrition Division, Carriquiry continued with her work on estimating the distribution of usual intakes of nutrients. (See p. 13.)

Statistical Computing Section

The Statistical Computing Section provides statistical computer programming and data processing support for research projects conducted both on- and off-campus. Its members develop software for special applications; design and install databases for general use; maintain general-purpose software systems; supervise maintenance of hardware and software used by faculty, students, and staff in statistics; and consult on problems related to scientific applications of digital computers. Teaching and research activities for the section in 1994-95 were led by William J. Kennedy and Mervyn Marasinghe (see p. 43).

Computer use by faculty, graduate students, and staff in the Statistical Laboratory and Department of Statistics continued to increase during the past year, as it has for the past several years. Many new pieces of electronic equipment, such as workstations, PCs, printers, scanners, etc., were added to the equipment inventory. The amount of computer-related equipment, and software used by such equipment, is now enormous compared to that available only a few years ago. The section's workload in intradepartmental consulting and maintenance service support has increased accordingly. Despite this increase in departmental service, many external sponsored projects were handled during the year. These are described in the following paragraphs.

Darlene Wicks, Statistical Computing Service clerk typist, is one of the first to try new versions of software for technical word processing. Here she is shown with part of her growing collection of miniature pigs, sharing an expression of life from the family farm.

The graduate students who worked closely with Kathy Shelley included Dean Lei, Shawn Bates, Deanne Reber, and Pete Anderson. Four of the main projects were ongoing from the previous year and included Iowa Farmland Ownership Patterns, the Child Welfare Research Training Project, Ruan Leasing Inc. truck maintenance cost estimation, and development of the ISYS Inc. EpiStation Software for medical data analysis. Two new projects included graphical representation of bird migration patterns and analysis of surgery techniques for patients at the Iowa Vein Center.

Dean Lei worked with Ann Schultz, project director for the Iowa Farmland Ownership Survey, to produce tables for the final report that was presented to the State Legislature by Schultz and Prof. Neil Harl. Lei also worked with Dr. Olivencia from the Iowa Vein Center to help analyze data relative to the question of which surgery procedures should be used with various types of patients.

Shawn Bates concluded his assistantship working for Karen Linnan, director of the Iowa Child Welfare Research Training Project. This year he worked mostly on transferring the PC-entered data to the ISU mainframe where he wrote programs in SPSS for data analyses.

Deanne Reber worked on a variety of projects that included departmental projects in addition to refining a graphical representation of bird migration for a professor of wildlife ecology. She also worked on all phases of data management, cost estimation, graphics, and PC software development for Ruan Leasing Inc. Kenneth Koehler developed the statistical model for this application and continually provided advisory support for this project (see p. 9).

Pete Anderson and Kathy Shelley worked as a team to improve the user interface and add new features to the ISYS Inc. EpiStation Software Package. This package is a highly interactive, icon driven application that allows medical researchers to quickly explore what-if hypotheses concerning the geographic distribution of selected populations of patients. The program has been converted to SAS Institute's new object-oriented FRAME software. It is projected to be released as a beta version product in early September.

Departmental and university-wide support was provided by installing and fine tuning an X-Windows software program, by providing statistical package support as on-line Project Vincent™ consultants, and by representing the Department of Statistics at the Project Vincent Work-group Administrator meetings. Reber was successful in installing Micro-X on departmental PCs. This program allows PC users who do not have their own workstations, to log into another workstation and display the X-windows on their PC screens. She also began to explore PPP, which will allow people to run X-Windows from their home PCs via a high speed modem. SAS, S-Plus, and SPSS questions are answered by Statistical Computing Section personnel via Project Vincent's on-line consulting facility. This serves as additional support to the section's help room.

The graduate students who worked closely with Bud Meador included Jeff Wieland, Huaichin Chen, Shiaau-Er Huarng, and Chiang-Sheng Johnson Lee. The group supervised by Meador handled three major continuing projects, in addition to impromptu or reactive-type work coming from the help room and departmental staff. The State Forest Nursery, Iowa Corn Yield Tests, and Plant Breeder Projects are the big three.

Jeff Wieland worked on the nursery project during the first half of the year. Huaichin Chen and Shiaau-Er Huarng came into the section at mid-year to continue software maintenance and implement new features as needed for the nursery's LAN operation. Chen and Kathy Shelley's section handled problems relating to dBASE software and Huarng worked primarily on Fortran-based software.

Huaichin Chen handled a primitive programming problem when the nursery put a new model barcode scanner into use. The barcode reader was coupled to a PC via the rs232 communication port, and the PC's monitor and keyboard were used to control the reprogramming effort.

Shiaau-Er Huarng worked on a sampling-without-replacement problem in botany. A specified number of plants per treatment group were sampled from a database, and further computations were made to reduce each sample to an observation. The research worker used these data to prepare graphs to show the effect of changing the sample size from small samples to the point where all plants were included in the sample.

Johnson Lee worked almost exclusively on the Iowa Corn Yield Test Reports and two programs for plant breeders, the Books and Labels program and an analysis of variance/covariance program. This may be the last time the university's mainframe research computer is used on most of the processing. A PC running WIN/SAS is expected to handle everything

except the printing for the yield test work in the future.

Another program commonly used by plant breeders to prepare planting plans, field books, gummed labels, and barcode labels was reprogrammed from Fortran to SAS by Bud Meador. The program generates plans for rectangular lattice, square lattice, and randomized complete block designs. New features of the Books and Labels program add flexibility in the manner in which plans are generated and in how information is printed on the field book and on the four label types. Default lattice plans are computed according to constraints described in Patterson and Williams (*Biometrika* 63:83-93) as programmed by the late S. G. Carmer, professor of biometry, University of Illinois, Urbana-Champaign, Illinois. Alternative lattice plans can be substituted for default plans.

Survey Section

The Survey Section of the Statistical Laboratory provides consultation and direct operational assistance to research workers both on- and off-campus in sample design and the planning and execution of sample surveys and censuses. Section staff engage in all areas pertaining to the operational conduct of surveys. Faculty also conduct research and teach courses in the areas of sampling, survey design, and statistical methods. Sarah Nusser serves as administrative director of the section. Andrew Williams oversees survey projects and staff, with support from Dianne Anderson and Jan Larson.

Four health-related studies are being conducted in collaboration with researchers at the University of Iowa. Three thousand veterans who served at the time of the Persian Gulf War are being interviewed by telephone to collect information on their physical and mental health, and on the health of children born to the veterans since the war. The sample consists of four groups, each containing 750 veterans who were on active duty between August 1990 and July 1991. The groups are defined by whether or not the veteran was present in the Persian Gulf during the war and whether the veteran was a member of the regular military or of the National Guard or Reserves. Section staff helped develop the questionnaire and conducted a pilot test of the instrument. Survey Section staff will be responsible for conducting main study interviews. Additionally, five percent of completed interviews receive a reliability interview.

The final year of data collection was completed on a four-year project related to specific language impairment in five and six year-old children. This year, 449 mothers of cases and controls were interviewed by telephone after University of Iowa staff conducted screening and diagnostic speech and hearing tests with the children. Staff were responsible for interviewing, coding, and processing the data.

A collaborative study is being conducted, sponsored by the National Institute on Aging and the National Cancer Institute, to examine co-morbid conditions in older cancer patients. Survey Section staff designed the questionnaire and field forms and conducted the training for the five participating states. Personal interviews are being administered in Iowa during 1995 and 1996 to 300 recently diagnosed cancer victims 55 years of age or older.

A case-control study of multiple birth defects, funded by the Centers for Disease Control, will examine pregnancy and genetic histories of mothers of children born in Iowa with specific multiple birth defects. Survey Section staff will conduct interviews by telephone with 300 mothers of children recently diagnosed with these defects.

Mothers of children born in California with multiple birth defects are also being interviewed by Survey Section staff, who are working in cooperation with the California March of Dimes to conduct the Centers for Disease Control study in California. Approximately 250 mothers will be interviewed in 1995-1996 using a questionnaire similar to that used in the Iowa study.

A health-related study for the Mayo Clinic's Division of Health Sciences Research is in its third and final year. The study is designed to measure the impact of an intervention program that encourages physicians to institute a cancer screening reminder system with their female patients. Survey Section staff conducted post-intervention interviews by telephone with 876 women in 13 Minnesota counties regarding the recency of breast exams, pap smears, and mammograms. Staff were responsible for designing and implementing sample selection procedures, and will be responsible for calculating weights for the study.

Two state government projects were conducted this year. The Survey Section worked with Iowa Public Television and the Iowa Department of Education to conduct a mail survey of primary and secondary school teachers regarding their use of television in the classroom. Twelve hundred teachers were selected to participate in the study, of which 511 returned questionnaires. Section staff were responsible for selecting the sample, calculating weights, analyzing the data, and writing a report.

Section staff also cooperated with the Iowa Department of Employment Services (DES) to select establishments to participate in the 1995 survey of Iowa wage rates. The Survey Section is responsible for selecting a stratified sample of firms to obtain wage information on over 400 occupations. The DES conducts the mail study and processes the data. Survey Section personnel will then calculate sampling weights and estimate mean statewide wage rates and entry level wages for individual occupations and groups of occupations, as well as other distributional parameters. The statistical summaries are included in a report produced by the DES.

A number of surveys were conducted for Iowa State University faculty and administrators this past year. Planning for a pilot study to be conducted in July and August 1995 was begun. The survey will be used to estimate the proportion of U.S. households

with at least one member who owns or actively manages a family-owned business. Section staff assisted with questionnaire development and were responsible for sample design using random digit dialing techniques. Approximately 1,300 households are to be contacted and interviewed. Section staff will calculate sampling weights and analyze the data in preparation for the full study, to be conducted in 1996. A faculty member of the Department of Human Development and Family Studies organized the study, which was conducted for a multi-university Agricultural Experiment Station research consortium.

A researcher in the Office for International Students and Scholars worked with section staff to design and conduct an investigation of factors leading to the success of college and university study-abroad programs throughout the U.S. Staff provided advice on questionnaire design and mail survey procedures, and were responsible for entering, processing, and analyzing the data.

The university Computation Advisory Committee worked with Survey Section staff to conduct a study of instructional computer use on campus. Six hundred twenty-three students and 744 faculty were interviewed by telephone to determine which computation facilities and services they used, how computers were incorporated in the classroom, and their opinions on various options for improving instructional computing on campus. Section staff were responsible for sample design, questionnaire development, interviewing, weight calculation, data analysis, and report writing. The results will help guide expenditures by the Computation Advisory Committee.

A study of hours per week spent on university work by faculty was conducted for Institutional Research as requested by the Board of Regents. Two hundred nine faculty returned surveys that were mailed to approximately ten faculty during each of 24 weeks. Section personnel were responsible for designing the survey instrument, entering the data, analyzing the data, and writing a report.

Survey Section staff provided survey advice, sample design, and/or analyses to members of the Institutional Research Office for a survey of student satisfaction; the Office of Orientation and Retention Programs for a survey of nonreturning students; the ISU Foundation for studies of international alumni, of women's philanthropic attitudes, and of volunteers; and the Affirmative Action Office for a survey of sexual harassment on campus.

The Ames School Census was conducted in the fall of 1994 to determine the number of children living in Ames who have not yet started school. Interviewers contacted each household in Ames to enumerate preschool children.

Industry and Engineering Sciences

The Statistical Laboratory, the Engineering Research Institute, and joint faculty appointments with three departments in the College of Engineering support statistical consultation with engineering and physical science faculty and graduate students. Consulting with industry is offered by individual faculty members and graduate students.

Kenneth Koehler, Dan Parks, Kathleen Shelley, and Deanne Reber continued to update and develop truck maintenance models for predicting costs and associated labor hours. This work is supported through a contract from the RUAN Transportation Corporation, Des Moines, Iowa.

Bill Meeker has continued his work with engineers at Ford Motor Company to develop computer software for life data analysis and for the analysis of accelerated life test data and degradation data. In November 1994, he participated in a Ford-internal conference on the connections between robust design and reliability.

Meeker visited the General Electric Research and Development Center, Schenectady, New York, for three days in July 1994. While there he consulted with GE engineers and statisticians on prediction of the number of failures in product populations, the planning of reliability studies, and the development of software for reliability data analysis. In related work, he was involved in helping to plan an accelerated life test for electronic components to be used in a new generation of communications satellites.

W. Robert Stephenson consulted with Cenex/Land O Lakes in Fort Dodge, Iowa, on a problem involving sampling and quality assurance for grains used in livestock feed.

Aidan Cardella and Stephen Vardeman worked on a problem for AlliedSignal Aerospace. They compared the statistical properties of a particular company continuous inspection scheme to those of single sampling plans specified in Mil-Std 2175 when applied to a stable product stream.

A graduate student, Mu-Yeh Huang, was supported by the Engineering Research Institute to provide consulting services to faculty and graduate students in the College of Engineering. Faculty members Herbert T. David, Peter Sherman, and Derrick Rollins assisted her with the engineering research projects.

Peter Sherman consulted with students and faculty in mechanical engineering in the area of stochastic processes associated with highspeed turbomachinery.

Rollins served as a consultant to the Engineering Service and Technology unit of the 3M Company, St. Paul, Minnesota, during the year. Projects dealt with include an interdisciplinary project on statistical methods to enhance artificial neural networks and contractual research on improving powder mixture homogeneity.

Social and Behavioral Sciences and Humanities

Frederick Lorenz continued to consult with faculty and graduate students in the social and behavorial sciences on a variety of design and analysis issues.

Carl Roberts' consulting activities include the supervision of quantitative analyses performed for dissertations and theses plus ad hoc consulting on research by students and faculty in the social sciences. Roberts is commonly consulted both within and outside the university on methodological topics related to text analysis.

Mack Shelley consulted with faculty and students from the departments of Sociology; Human Development and Family Studies; Industrial Education and Technology; Hotel, Restaurant, and Institution Management; Curriculum and Instruction; Animal Ecology; Professional Studies in Education; Statistics; Agricultural Education and Studies; and Political Science. He also served as a faculty research associate in the Gerontology program at Iowa State University and as a consultant to the Department of Human Rights in the Iowa Bureau of Weatherization.

Shelley's consulting projects addressed aspects of study design and data analysis, particularly applications of linear models and structural equations methods, mostly to survey data. Areas of applications included studies of managerial style, preschool teaching methods, comparing structured and unstructured methods for evaluating graphic designs projects, clinical dieticians' daily professional activities, household spending patterns and repeat-use budget planning identified from the Consumer Expenditure Survey, before-after evaluation of the impact of a course teaching students about international education, an experimental design to study the determinants of teaching effectiveness among preschool instructors, a survey of animal care, a study of the consequences of abuse by mothers and fathers on their children's likelihood of becoming sex offenders in later life, multivariate analysis of data from the General Social Survey relating personal happiness to voting choice in the 1992 presidential election, a survey related to an industrial training program, a field-experimental study of fish populations in Iowa streams, an experiment to evaluate the effect of a treatment program designed to increase compliance with court-ordered child-support payments among noncustodial fathers, the diffusion of technological innovations among firms, two studies of family behavioral patterns, a survey of home production versus out-of-home production, and a study of teenage mothers. Methods employed in these investigations included LISREL models, logistic regression, time series, discriminant analysis, and related techniques.

Special projects that Mack Shelley consulted on included work with a quality insurance specialist at the Iowa Department of Human Services on sampling procedures required to determine whether providers satisfy agency requirements for service delivery; a study conducted by the Iowa Department of Human Rights, Bureau of Weatherization, on the analysis of survey data evaluating the effects of consumer education programs on the weatherization of homes in Iowa; and development of multivariate statistical models for analyzing student retention in the ISU College of Engineering.

Statistical consulting was provided by Robert Strahan to graduate students and faculty in the areas of psychology, child development, education, professional studies, and engineering. Specific topics for which statistical guidance was given involved a simulation study of traffic light timing in Ames, comparison of Taiwanese and American teaching attitudes, and confirmatory factor analysis of a personality measure of social desirability responding.

Other Consulting/Cooperation

Noel Cressie carried out consulting for the Office of Hydrology, National Weather Service, on the problem of estimating snow water equivalent during the winter and spring months in the western USA. Geostatistical methods were developed with Steven Carroll, Arizona State University. This work led to an article in *Environmentrics* (see abstract, p. 28) and another article to appear in *Water Resources Bulletin*. Graduate student Hsin-Cheng Huang worked on the spatio-temporal prediction of snow water equivalent for his creative component; a paper on this work is to appear in *Computational Statistics and Data Analysis*.

Noel Cressie also consulted on problems in spatial statistics with researchers in the Northern Plains Area Wind Erosion Research Unit, USDA Agricultural Research Service; Texas Instruments; and the Department of Geography, University of Auckland, New Zealand. He consulted on problems in environmental statistics with researchers in the National Institute of Statistical Sciences and the National Soil Tilth Laboratory, Ames, Iowa.

David Harville spent three days consulting with Prof. William Sanders and with other members of the University of Tennessee Value-Added Research and Assessment Center. The center is developing and implementing methods for the evaluation of teachers, schools, and school systems. These methods are based to a considerable extent on mixed-effects linear models.

Kenneth Koehler participated in a review of a pilot program for providing services for at risk high school and middle school children and their families. This program is administered through the Iowa Department of Education.

Koehler consulted with doctors at the Iowa Health Center on a study of the costs and benefits of replacing potentially defective pacemakers. In a second study, he developed a classification model for aiding in the detection of a certain heart defect in children.

Hal Stern consulted with the Iowa Transportation Center at Iowa State University in an evaluation of the advantages of a newly-developed electronic weigh-station clearance system designed for U.S. Interstate Highway 75. Stern helped design two pilot studies and assisted in the evaluation of the data from the pilot studies. The next step of the project is a two-year evaluation of the electronic clearance system.

Current Research

Research projects supported by outside grants or contracts are listed first in this section. Some of these projects reflect a continuing series of contractual agreements between sections within the Statistical Laboratory and federal or state agencies. Individual research is also summarized.

Within the university, research funds are provided by the budgets of the Statistical Laboratory, the Iowa Agriculture and Home Economics Experiment Station (AHEES), the College of Liberal Arts and Sciences (LAS), and the Engineering Research Institute.

Natural Resource Inventories

The Survey Section continued cooperative research with the Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture. This joint activity is directed by Sarah Nusser. Dean Thompson serves as resident NRCS collaborator.

Richard Dorsch was in charge of NRI data processing activities, assisted by Anita McVey, Kathie Reinertson, Melissa Swanson, Sue Verkade, and Glenda Ashley. Wayne Fuller, Jay Breidt, and Harold Baker were responsible for research and operational aspects of sample design and estimation. Other staff members working on inventory projects during the year were Hsin-Cheng Huang, Todd Krueger, Ouhong Wang, and Zugeng Zheng.

The NRCS conducts a National Resources Inventory (NRI) of the country's soil and water-related resources every five years. The 1982, 1987, and 1992 inventories have been used to create a longitudinal database for study of changes in resource conditions during a ten-year period.

The national sample for 1992 was a stratified cluster sample of approximately 300,000 primary sampling units (PSUs), with approximately 800,000 points selected within the PSUs. Most of the PSUs were observed in the 1982 NRI, and about one third of the PSUs were observed in the 1987 NRI. Stratification of the sample recognizes the geographic boundaries of counties, Major Land Resource Areas, and Water Resource Council Hydrologic Units. Data collected on PSUs include information on soil characteristics, land use, soil erosion, vegetative cover, and ecological variables such as habitat diversity. The 1992 NRI data were collected primarily by remote sensing via aerial photography with a minimum of on-site field visits. The final 1992 NRI database and associated soils database were released for 49 states and the Carribbean in July 1994. Release of data for Alaska is planned for 1996. The 1992 NRI database contains approximately one million 1,000-character records.

Much of the year was devoted to completing the data processing and estimation for special studies associated with the 1992 NRI. Data for the range subsample, which was selected to study range condition and trend, were sent to NRCS and their collaborators at Texas A&M for further analysis. Conservation tillage subsample data were also edited and sent to NRCS for review. Work continued on processing a supplemental sample for Kansas designed to provide county-level inferences. Statistical Laboratory staff worked with Alaska NRCS to edit the Alaska NRI data, collected for the first time for the entire state during the 1992 inventory.

A special 1995 NRI Erosion Update Study was designed to provide 1995 estimates of water and wind erosion on crop lands, with particular emphasis on highly erodible lands and the influence of conservation practices on erosion levels. A subsample of the 1992 sample for which 1982, 1987, and 1992 data were available, was selected in a sample of counties of 38 randomly selected states. The sample was designed to avoid overlap with a concurrent Conservation Technical Assistance and Watershed Evaluation Study also using a subsample of the NRI sample. Data collection forms for the Erosion Update Study, and associated instructions, were constructed for field observation of field residue levels following crop planting in the spring and summer of 1995.

A sample was also selected to study Natural Resources Districts in eastern Nebraska.

Planning was initiated for the 1997 NRI. Statistical Laboratory and NRCS staff gathered in Fort Collins, Colorado, to discuss features of the data entry software to be used during the 1997 NRI. Work began on design of a database and associated server system for electronic transmission of selected sample data. Research was conducted on the feasibility of using personal digital assistants (handheld pen-based computers) as data collection and transmission devices.

Soil Survey Methods

This year, a new research project designed to apply statistical methods to soil survey updates was initiated by staff associated with the NRCS National Soil Survey Center in Lincoln, Nebraska, and the Iowa NRCS in cooperation with faculty and students in the Departments of Agronomy and Statistics. At Iowa State, Pam Abbitt, Jay Breidt, Cong Chen, Tom Fenton (Agronomy), Wayne Fuller, and Sarah Nusser participated in the project. NRCS staff include Louis Boeckman, Bennie Clark, and Craig Ditzler.

The National Cooperative Soil Survey, a program in which the NRCS collaborates with a state agency, is responsible for constructing soil maps detailing the location of soil series throughout the U.S. For each county, reports are generated that contain maps plus

a description of the characteristics for each soil map unit (SMU) within the county. These maps are periodically updated by the NRCS to provide current information on the range of values for particle composition, depth of horizons, and other related attributes. Soil scientists and other natural resource scientists have recently become interested in obtaining more detailed statistical descriptions of the distribution of SMU characteristics.

Data on SMU characteristics have been collected using a number of different procedures, including purposive point and transect sampling. Measurements are taken at points, and the maximum and minimum values observed for a particular characteristic of the soil determine the range of values for this characteristic. The midpoint of this interval is defined to be a "representative value." It is difficult to construct statistically valid estimates of the characteristics of SMU's using the current data collection procedures. When purposive sampling techniques are used, unbiased estimates of the mean, variance, and other distributional parameters (e.g. percentiles) cannot be calculated.

A multi-phase sampling plan using Markov chain point selection has been proposed for collecting data during soil survey updates. The phases correspond to increasingly intensive data collection, and are designed to balance the burden of field work against the need for information to make meaningful statistical estimates. Data gathered under this sampling plan will provide improved estimates of central tendency and spread.

This design will also permit estimation of distributional parameters such as percentiles and will provide higher quality information for researchers who wish to model phenomena using soil properties.

The design is being field-tested in a three-year pilot project in Crawford and Woodbury counties as part of the Soil Survey Update for MLRA 107. Research is being conducted on the properties of the design and estimators for distributional parameters.

Soils Databases

Another ongoing part of the NRCS cooperative work is the storage and maintenance of, and software development for, the national soil interpretations databases. These databases are stored at Iowa State University as an important part of the NRCS cooperative soil survey program for the United States. Harvey Terpstra directed this work, assisted by Douglas Tschopp, Jan Seagrave, Janet Schultz, Deborah Reed-Margetan, and Masoud Kazemi. The data entry staff included Glenda Ashley and Vimlesh Gupta.

Several main databases make up the system of soils data. The soil interpretations database consists of basic soil property and interpretation information for all soil series in the nation. It currently contains over 40,000 records. The soil map unit database consists of information identifying each map unit in NRCS soil surveys. It currently contains nearly 275,000 map units from approximately 3,000 survey areas. The official soil series description database contains a textual description of 17,000 soil series. The soil series classification database contains the official soil classification for over 19,000 soil series.

These soils databases are used by the NRCS to record and retrieve much of the basic information collected in their soil survey work. A primary use is to provide data for NRCS state office computer systems. State offices, in turn, provide data to county NRCS office computer systems, where an automated system of providing soil data to NRCS clients is being used. Another primary NRCS use of these data is the production of tables that are published in NRCS soil survey reports. The Statistical Laboratory staff receive numerous requests to furnish data from the soils databases to help answer various soils-related questions. Nationally, the soils databases are used to help meet the requirements of congressional farm legislation and are distributed to researchers in government, university, and private sectors. At Iowa State University, researchers at the Soil Tilth Laboratory and at CARD have used the data.

A major new effort this year was the development of World Wide Web (WWW) access to some of the soils data. This work was the first step in a long-range plan to provide easy, electronic access to NRCS soils data on the Internet under an umbrella called the National Soil Data Access Facility (NSDAF). During the 1994-1995 year, a WWW server was established in the Survey Section, and the national hydric soils list and the Official Soil Series Description database were made available for WWW access. Further development in this area will continue in the coming year.

Throughout 1994-95, planning has been underway for moving the NRCS soils database work off the ISU mainframe computer and onto the Project Vincent™ Unix workstation environment. This transition planning, done in conjunction with ISU Computation Center staff, has involved discussions of the necessary Unix workstation equipment, the databases that must be transitioned from the mainframe, and the type of access needed to data on the Unix system. The transition will require substantial effort.

Other system development included finishing the NRCS field office computer system (FOCS) software package for soils reports, bringing the soils database plants file up to date with the official NRCS plants database, and developing a program to generate soil rating for plant growth (SRPG) index values for use in comparing the relative productivity of soils nationwide. This SPRG index will be used to determine payment values in the next USDA Conservation Reserve Program (CRP) sign-up. Refinement of the SRPG criteria will continue. The ongoing tasks of system maintenance and hotline support for NRCS remote users of our system were also part of this year's efforts.

Measurement and Sampling Error

Joint research in measurement error models, time series, and survey design is supported by the U.S. Bureau of the Census, the National Agricultural Statistics Service, and, through AES Project 2699, the Iowa Agriculture and Home Economics Experiment Station. Federal agencies' support was through Cooperative Agreement No. 43-3AEU-3-80088.

Wayne Fuller is principal investigator. Other personnel working on the project include Jay Breidt, Rohit Deo, Anindya Roy, Anthony An, and Jae-Kwang Kim.

Breidt, Fuller, and graduate student Tony An have continued work on regression weighting in the context of multiple phases of sampling. Regression weighting procedures are used to combine information collected at the various phases into well-behaved estimators. These estimation procedures have been applied to some natural resource inventories conducted by the United States Forest Service in Alaska, in which the multiple phases of sampling consist of satellite imagery, high and low altitude photography, and ground visits.

Methods of multiple phase estimation have been applied by An in the context of the Survey of Income and Program Participation (SIPP), a large longitudinal study conducted by the Census Bureau. In SIPP, respondents are interviewed several times. Information from those that responded on the first interview but not on subsequent interviews and information from the Current Population Survey are available for use in estimation at later stages of the study. Nonresponse adjustment procedures that utilize estimators of the response probabilities were studied, where response probabilities were estimated as a function of observable characteristics using logistic regression. The estimated probabilities can be incorporated into the estimation as weights in a Horvitz-Thompson regression estimator. Alternative regression estimation procedures were compared using the SIPP data. The results suggest that the use of estimated probabilities can produce estimators with smaller biases than those of adjustment procedures that use only the original selection probabilities.

Methods of sampling and of small area estimation that are being considered as possibilities for the Population Census of 2000 were studied by Wayne Fuller. Stratification procedures, ratio estimators based upon a classification of families, the use of controls based on auxiliary information, imputation, and variance estimation, were investigated. This research is conducted in close cooperation with Cary Isaki and Julie Tsay of the U.S. Bureau of the Census.

Tests for cointegration in vector time series were studied by Rohit Deo and Fuller. A test for cointegration similar to the likelihood ratio test but based on alternative estimators of the process parameters was considered. The asymptotic distribution of the test statistics was derived and the performance of the test was evaluated via Monte Carlo studies. The new test procedure provides a definite improvement in power relative to the likelihood ratio test for cointegration.

Deo obtained results on parameter estimation for long memory time series, where long memory time series are those whose covariance functions decay hyperbolically to zero. It was shown that if an observed series is the sum of a long memory Gaussian signal and noise, where the noise is an independent identically distributed zero mean sequence, then the parameter estimators obtained by maximizing the Gaussian likelihood are asymptotically normal. The ordinary least squares estimators of the regression model parameters with polynomial trends as regressors and long memory errors were shown to be asymptotically normal. A similar result was established for a weighted least squares estimator, which is known to be asymptotically efficient in the case of polynomial trend regressors. The asymptotic distribution of the periodogram of a long memory time series evaluated at a fixed Fourier frequency was also derived. An approximate maximum likelihood estimator was proposed for the parameters of a class of long memory time series and was proved to be asymptotically normally distributed.

Dietary Intake Estimation

Work on several aspects of dietary intake estimation was continued this year. Collaborators in this work are Wayne Fuller, Alicia Carriquiry, Sarah Nusser, Kevin Dodd, Juan Goyeneche, Soledad Fernandez, Zugeng Zheng, and Helen Jensen (Center for Agricultural and Rural Development). While the problem of estimating the distributions of usual intakes of nutrients has been almost completed, several important aspects of the problem were addressed.

Estimation of the day-to-day correlation among intakes when dietary data are collected over consecutive years was one of the problems on which Carriquiry worked. In collaboration with Fuller, Dodd, Goyeneche, and Jensen, she developed a two-stage estimator for the day-to-day correlation coefficients, that produces smooth estimates with smaller variances than the usual direct estimates. Results are presented in a technical report entitled "Estimated correlations among days for the combined 1989-91 CSFII."

In addition, Carriquiry initiated research on the problem of estimating usual intake distributions for ratios of dietary components, a problem that arises whenever interest is on quantities such as the percent of calories ingested from fat. This work was done in collaboration with Fuller, Dodd, Goyeneche, and Phillip Kott (USDA/ARS).

Nusser, Fuller, and Zheng worked on the problem of estimating usual intake distributions of foods. Data on food consumption have attributes that are different than those present in nutrient consumption data. One such characteristic is the presence of a large proportion of zero intakes, corresponding to those individuals that either are nonconsumers of the food, or did not consume the food on the day they were interviewed. Thus, estimation of the distribu-

tions of usual food consumption involves estimating the joint distribution of probability of consumption and amount of the food consumed. Results from this research were presented in a manuscript entitled "Estimating usual dietary intake distributions: Adjusting for measurement error and nonnormality in 24-hour food intake data."

As the Food and Nutrition Board, Institute of Medicine, National Academy of Sciences, gears up to undertake major revisions of the recommended dietary allowances and of dietary population recommendations next year, researchers at Iowa State have been called on to contribute to the project. Carriquiry was invited to participate in an advisory panel that will commence meeting next year.

Spatial Statistics

Research is supported on two different grants. *Spatial Stochastic Processes with Image Algebra* is jointly funded by the Office of Naval Research and the National Science Foundation. Noel Cressie is principal investigator, and Jennifer Davidson, assistant professor in the Department of Electrical Engineering and Computer Engineering, ISU, is co-principal investigator. For the problem of texture analysis, they have developed a special class of Markov random fields called partially-ordered Markov models (POMMs). This class has great computational advantages and is remarkably flexible in spite of the directional aspect of its definition. Indeed Cressie and a graduate student supported on this grant, Craig Liu, have demonstrated probabilistic equivalence between certain symmetric Ising models and binary POMMs. The Office of Naval Research has extended the grant for a further three years to develop spatial statistical methods for detecting small objects and groups of objects in the presence of background clutter.

Spatial Statistics Research Applied to Ecological Resource Monitoring Programs is a three-year cooperative agreement funded by the Environmental Protection Agency. Noel Cressie is principal investigator, and Dianne Cook, Mark Kaiser, Soumendra Lahiri, and James Majure (manager of the Geographic Information System Support and Research Facility at Iowa State) are co-principal investigators. Four statistics graduate students are supported on the grant: Jeremy Aldworth, Philip Jones, Jaehyung Lee, and Jürgen Symanzik.

Cook, Majure, Jones, and Symanzik are looking at interactive and dynamic graphics for high-dimensional spatial data linked directly to a geographic information system. Cressie, Kaiser, and Lahiri are looking at statistical inference methods for these statistical summaries. The spatial cumulative distribution function of a given region is one summary that has been considered in detail. Majure, Cook, Cressie, Kaiser, Lahiri, and Symanzik presented an invited paper on their results at Interface '95 in June in Pittsburgh, Pennsylvania. Videos displaying the graphics work have been produced with the assistance of the ISU Media Production Unit.

Dianne Cook interrupts experimentation with computer graphic displays for a photo session. Cook, a native Australian, joined the statistics faculty in 1993 and has research interests in statistical computing and dynamic graphics.

In connection with collaborative research on the Environmental Monitoring and Assessment Program supported by an EPA grant, Cook visited the Department of Statistics, Oregon State University, and EMAP at EPA Corvallis, Oregon, September 28-October 5, 1994, and May 30-June 8, 1995.

Cressie is working on statistical problems in aggregation and disaggregation and, with Aldworth, on the use of geostatistics in sampling from continuous ecological resources. Kaiser is working with Lee on spatial mixture distributions, and Lahiri is working on infill asymptotics that involve taking more and more samples within a finite region.

Mercury Contamination in Minnesota Sportfish

Mark Kaiser, Jay Breidt, and Sarah Nusser continued work on a statistical analysis of the Minnesota Fish Contaminant Monitoring Program, assisted by graduate students Dana Bruden, Rong Li, and Heidi Shierholz. Nusser, Breidt, and Shierholz focused efforts on the development of a probability-based sampling plan for this program. A basic objective of the design is to improve the scientific basis on which the State of Minnesota issues health consumption advisories for sportfish. The sample design will take advantage of existing survey efforts while including lakes not currently targeted by fisheries surveys. Kaiser has been responsible for analysis of existing data. Major concerns are identification of temporal or spatial trends in the approximately 20 years of records, and estimating relations between mercury concentration and size of individual fish. The entire project is being conducted in cooperation with the Minnesota Departments of Natural Resources and Public Health and the state Pollution Control Agency.

Probability Theory and Mathematical Statistics

During the 1994-95 fiscal year, Krishna Athreya continued his research on branching processes and Markov chains. This work was partially supported by a grant from the National Science Foundation. The research was focused on the following areas: (i) large deviation aspects of convergence in multitype supercritical branching processes, (ii) growth of tree derivations in context-free grammar in computer science, (iii) laws of large numbers and large deviations for branching Markov chains and processes in positive recurrent, null recurrent, and transient cases, (iv) the LLogL theorem for measure-valued branching processes using the Lyons, Pemantle, and Perès method, (v) statistical inference for Harris recurrent Markov chains, (vi) Markov chain Monte Carlo, and (vii) resampling methods for sample extremes of stationary sequences.

Statistical Methods for Correlated Survival Data

Kenneth Koehler and Shin-Soo Kang developed a simple modification to the Greenwood formula for the variance of estimated survival probabilities that provides accurate results for life table analysis of data consisting of groups of correlated responses. This method was used to analyze survival times for angioplasty procedures where more than one procedure is performed on some patients.

Modeling Panel Data

Frederick Lorenz continues to do research and consulting with social and behavioral scientists in the Center for Family Research in Rural Mental Health. The research focuses on modeling panel data relating stressful life events and chronic conditions to psychological distress in rural families.

Lorenz is co-principal investigator on a study of the effects of rapid social transformation on the physical health and psychological well-being of a panel of 700 Czech households. This study is supported by a three-year grant from the National Institute of Mental Health.

Jaehyung Lee works with Lorenz and K. A. S. Wickrama, Rural Health Research Centers, to manage large data sets. Chungyeol Shin works with another faculty member in the Rural Health Research Centers, Richard Spoth, on Project Family, a large-scale study of families with children at risk for drug problems.

Reliability and Nondestructive Evaluation

Bill Meeker and Pradipta Sarkar have been working on the NIST-funded project "Program for Integrated Design, NDE, and the Manufacturing Sciences" being conducted by the ISU Center for Nondestructive Evaluation. Previous work in this project developed Bayes' decision theory methods for planning in-service inspections of critical components. In recent work Sarkar and Meeker are applying similar methods to help determine schedules and procedures for doing on-line NDE inspection of manufactured parts as part of a process monitoring effort.

Bill Meeker and Shuen-Lin Jeng are members of the Probability of Detection Working Group of the FAA-sponsored Engine Titanium Consortium project. The project is being coordinated by scientists at the ISU/FAA Center for Aviation Systems Reliability. This project has team members from General Electric, Pratt & Whitney, Allied Signal, and Iowa State University. The goal of the project is to develop and evaluate better ultrasonic inspection methods for finding potentially dangerous flaws in titanium to be used in components of jet engines. Meeker is a member of the Probability of Detection (POD) Working Group. In the past year, details of the POD methodology have been developed by this group. A large experiment was designed and conducted on flat-bottom hole synthetic flaws in titanium. The results of this experiment have been used to explore the effect that potentially important experimental and flaw factors have on NDE signal strength. The results of the experiment were used to fit statistical models and to improve physical models for NDE inspection. Combining the physical and statistical models will allow adequate prediction of POD over a wider range of new inspection conditions.

Statistical Process Control and Gross Error Detection

Five areas in chemical engineering are targeted by Derrick K. Rollins for research in the five-year period covered by his NSF Presidential Faculty Fellows Award: industrial data reconciliation and gross error detection, statistical modeling and sensor validation in space life support systems, statistical methods to enhance neural networks, improvement of powder mixture homogeneity, and statistical process control. Rollins is principal investigator on projects funded by the National Science Foundation, the National Aeronautics and Space Administration, and the 3M Corporation. Statistics graduate students working with him during the 1994-1995 year include Shonda Roelfs Kuiper, Jean Pelkey, Jennifer Walker, Angelita Nason-Garth, Maritza Melèndez, James Stallman-Smith, and Kristine Bendixen.

In the areas of data reconciliation and gross error detection, major progress is being made in the development of methods and their implementation into industrial processes.

Secondly, statistical techniques are being developed that validate and improve measured variables in space closed-loop life support systems (CLLSS). This work presents a major challenge because of the required accuracies and the low concentrations of

chemical species. Hence, Rollins and his group are developing a working algorithm (i.e., a computer program) to validate sensor measurements for the initial phase of modeling CLLSS.

Artificial neural networks (ANN) have received considerable attention in recent years in many scientific and human behavioral disciplines. Rollins and his group are using NSF funding to (1) increase understanding of the strengths and weaknesses of ANN as they apply to chemical processes; (2) increase theoretical understanding of ANN as they relate to model development in order to evaluate them against current statistical model building techniques; (3) determine the best modeling approach for a given application--statistical or ANN; and (4) investigate the development of statistical procedures to cross-validate ANN models. Specific applications will include modeling and controlling the product moisture content in industrial grain dryers.

Also Rollins' group are accelerating their research program to improve powder mixture homogeneity by (1) improving the ability to determine if mixtures are significantly segregated; (2) increasing understanding of mixing phenomena; (3) improving the ability to diagnose inhomogeneity; and (4) transferring theoretical and empirical knowledge to the manufacturing processes in the form of operating guidelines and process and equipment improvements.

Finally, one aspect of the group's research is centered on ways to combine statistical and physical process knowledge to improve their ability to extract important information from high dimensional process data and to use it to better control chemical processes from both supervisory and automatic modes.

Peter Sherman holds a bamboo didgeridoo, a transportable musical keepsake from travels to Australia. Sherman came here in 1991 and has been an associate professor in statistics and aeronautical engineering since 1993.

Drowsy Driver Identification

Peter Sherman continued work on development of an automative driver impairment identification system. Support from the ISU College of Liberal Arts and Sciences and the Midwest Transportation Center was provided for Mike Elling, a Ph.D. student in statistics. Research by Sherman and three other students (two in computer engineering and one in electrical engineering) on automotive lane tracking was completed with support from the Midwest Transportation Center joint with Rockwell International.

Stochastic Processes and Statistical Signal Processing for Quasi-periodic Systems

A three-year grant from the Air Forces Office of Scientific Research is supporting research by Peter Sherman and two graduate students (an M.S. student in electrical engineering and a Ph.D. student in statistics and aeronautical engineering and engineering mechanics) in the area of quasi-periodic systems. Primary applications include condition monitoring of rotating machinery.

Other Research

Support for the work below was largely funded by the Statistical Laboratory, the College of Liberal Arts and Sciences, and the Agriculture and Home Economics Experiment Station at Iowa State University.

Theory and Methods

Yasuo Amemiya conducted research in various areas of multivariate analysis. Research on nonlinear factor analysis has continued. Statistical tools for modeling scale scores in social and behavioral sciences were investigated. With Ilker Yalçin, the approximate conditional likelihood method for fitting an additive nonlinear factor analysis model was developed. The small-sigma asymptotic results for the estimator of the model parameter and for the model fit test statistic were derived. With Melanie Wall, a simple method for testing nonlinearity in linear factor analysis was proposed, and the graphical exploration of nonlinearity in multivariate data was studied.

For the problem of random coefficient analysis for repeated measures, several practical tools were developed. With Chungyeol Shin, new algorithms for computing the maximum likelihood and REML estimates for the univariate and multivariate random coefficient models were developed. The new algorithms are supported by theoretical justification, and do not have the parameter space boundary problems associated with the existing algorithms. Also, test procedures were studied for testing hypotheses concerning the random coefficients.

Another research topic was the development of asymptotically robust procedures for analyzing

longitudinal data using latent variable models. With Savas Papadopoulos, a pseudo-independence method was suggested as a practical procedure. The procedure is simple to implement and was shown to be asymptotically robust with minimal loss of efficiency.

Additional research topics included the multiple-relationship nonlinear errors-in-variables analysis. With Jean Pelkey, the asymptotic comparison of the maximum likelihood estimator and the bias-adjusted estimator was conducted under the assumptions corresponding to engineering applications.

Alicia Carriquiry, in collaboration with Wolfgang Kliemann, Department of Mathematics, continued with her work on exploration of posterior distributions that arise in mixed linear models. The objective of this work is to locate modes in high dimensional posterior distributions, and assess the relative mass associated with each mode. This information can then be used to improve the performance of numerical methods such as the Expectation-Maximization (EM) algorithm and Markov chain Monte Carlo (MCMC) procedures.

Alicia Carriquiry, Jay Breidt, and Wayne Fuller initiated research on estimation of parameters in stochastic volatility models. They proposed an adaptive transformation that improves the performance of the usual quasi-maximum likelihood estimator and that solves the inlier problem. Their procedure has been included as an option in the software "Structural Time Series Analysis, Modeling and Prediction" (STAMP) that is produced by the London School of Economics.

Shashikala Sukhatme and Marie Coffin of Clemson University continued investigation of effect of measurement errors, in the data, used for evaluating "performance indices" associated with receiver operating characteristic curves. The results will be useful for models in clinical experiments as well as lifetime models in reliability. Sukhatme and C. H. Lin studied exact powers of the Wilcoxon test and the logrank test when the data are randomly censored.

Investigation of the relative efficiency of several statistics measuring skewness was completed by Richard Groeneveld. A paper summarizing these results will appear in the Festschrift for H. A. David, to be presented to him in November 1995.

Design of Experiments

John Stufken continued his research activities in design of experiments. Topics on which he worked include optimal crossover designs, existence and construction of difference schemes of strength t and their use to construct orthogonal arrays, bounds for the number of runs in mixed orthogonal arrays, sampling designs to control second-order inclusion probabilities, and algorithms to find trend-free or nearly trend-free versions of a given block design. He also continued work, jointly with A. Hedayat from the University of Illinois at Chicago and N. J. A. Sloane from AT&T Bell Laboratories, on a book manuscript on orthogonal arrays and their applications.

Mathematical and Statistical Genetics

Project 3201 of the Iowa Agriculture and Home Economics Experiment Station supports research by Edward Pollak on mathematical and statistical genetics. In the 1994-1995 academic year he generalized results obtained during the previous period. Thus, the effective population size was derived for a finite population of polyploids that reproduces partly by selfing and partly by random mating. The expressions obtained allow for any offspring distribution and, if there are hexaploids, any probability of double reduction. Previously he had considered only tetraploids. In addition, work was continued on effects of selection for viability on the change in the frequency of a favorable allele if there is reproduction partly by selfing and partly by a regular system of inbreeding. It was assumed, as before, that there are only two alleles, but the study was generalized to incorporate any level of dominance.

Pollak also obtained numerical values for probabilities of survival, in a large population reproducing partly by selfing, of a favorable mutant allele in tetraploids and a favorable two-locus allele combination in diploids.

Dynamic Graphics

Dianne Cook conducted research on dynamic graphics methods for analyzing multivariate data. In particular this focused on user controls for displaying projections of high-dimensional data, and methods applicable to spatial data with multiple measurements made at each spatial location.

Biostatistics and Agronometry

Kenneth Koehler and Marek Brabec continued to cooperate with faculty in plant pathology and agronomy/meteorology on models for predicting dew formation and duration, using 40 years of hourly weather data from the Des Moines airport. They are studying models to predict nighttime cloud cover from more easily obtained information such as temperature and relative humidity. The goal is to improve a dew prediction model so that it can be used to accurately forecast outbreaks of plant diseases that are driven by wetness duration and temperature.

Kenneth Koehler also consulted with ecologists on the analysis of the effects of various habitat factors on nest predation rates for various bird species, and on the analysis of the effects of the level of fragmentations of habitat by water on the relative abundance of bird species along the Mississippi River.

Mark Kaiser continued to work with Dr. David Siev of the USDA Veterinary Biologics Field Operations office (a former graduate student, MS 1993) on comparison of nonparallel enzyme-linked immunoassay curves and estimation of time-dependent tolerance distributions in short-term toxicity tests.

Engineering Statistics

Herbert T. David has been involved in two research projects in the Department of Industrial and

Manufacturing Systems Engineering, in the area of stochastic networks. The first of these, funded by a grant to graduate student Scott Singleton, aims at improving currently available formulations and analysis of criticality for the stochastic directed graphs of stochastic project scheduling models. The second project concerns the analysis of certain partly deterministic queueing networks representing certain production lines, that heretofore have been analyzed using Markovian or entirely deterministic formulations.

Social Science Applications

Mack Shelley currently is pursuing research applications of structural equations models and time series methods. He applied these techniques to patterns of intergenerational interaction between adult children and their parents, legislative elections, implications of the impact of state economic development funding on academia, the contributions of religious commitment and social relationships to self-esteem among older women, the effects of age and gender as predictors of injury severity in vehicular collisions, and education policy. In addition to this research, a book on contemporary issues in United States public policy is under preparation, for release in 1996.

Beth Lencowski and Lisa Wicklund worked on problems in text analysis with guidance from Carl Roberts. Lencowski's creative component for the M.S. degree in statistics concerns a semantic text analysis of East and West German news coverage of the Sandinista Revolution and the Chinese invasion of Vietnam; Wicklund's creative component concerns a semantic text analysis of female and male speech on U.S. prime time television.

Frederick Lorenz is an investigator on a regional experiment station project, "Improvement in Rural and Agricultural Sample Survey Methods (W-183)." The study represents an effort on the part of researchers active in collecting and analyzing survey data to examine the conditions under which survey responses are vulnerable to the context in which the questions are asked.

Robert Strahan participated in contract research on the driving capabilities of elderly persons. A second study was undertaken in which 30 elderly drivers and 30 control group younger drivers came to the ISU campus for one half day's activities. As in the initial study, these subjects took a battery of psychological and demographic tests, performed some perceptual/cognitive tasks, then were rated for their driving performance on a closed-course route. The aim, as before, was to determine a regression equation or variable profile to aid in determining which elderly drivers might safely continue to drive and to suggest prophylactic measures to help those at greater risk.

Other research by Strahan dealt with the characteristics of measures of statistical effect size (alternatives to proportion of accounted-for variance), and personality assessment.

Professional Activities

Offices and Committee Work

Wayne Fuller was elected to the Council of the International Statistical Institute for the period 1995-1999.

Herbert T. David served as chair of the ASA Committee on the W. J. Youden Award Committee on Interlaboratory Testing for 1994-95. He completed a five-year term on the ASA/NSF/NIST Fellowship Review Board.

W. Robert Stephenson served as representative to the Council of Sections for the Section on Statistical Education of the American Statistical Association. He is also a member of the nominating committee for the Council of Sections.

Stephen Vardeman began a two-year term on the ASA Nominations Committee.

Dean Isaacson served as chair-elect for the Institutional Representatives and Academic Department Chairs during the year.

Frederick Lorenz served on the development committee for the Rural Sociological Society.

Kathleen Shelley was on the Executive Planning Committee for the 1994 Midwest SAS Users Group Conference, held in Omaha, Nebraska, September 25-27. She edited the conference proceedings with assistance from Darlene Wicks.

Derrick Rollins served on the Academic Advisory Board for the University of Kansas Chemical Engineering Department. He also served on the advisory board for the Electronic Encyclopedia of Statistics Examples and Exercises software program developed by statisticians at Ohio State University.

He began a three-year term on the CACHE (Computer Aids for Chemical Engineering) Statistics Committee in 1994.

Mack Shelley served as elected president of the Iowa State University chapter of the American Association of University Professors.

Edith Landon continued as president of the Iowa Division of PSI (Professional Secretaries International). Jauvanta Walker was president of the Des Moines Branch of the National League of American Pen Women, Inc.

Short Courses, Workshops, and Paper Sessions

Dianne Cook was an invited participant in the Workshop on New Directions in Curve Estimation, at the Centre for Mathematics and Its Applications,

Australian National University, June-July 1994. Subsequently she visited Australian National University in July, the Institute for Statistics and Econometrics, Humboldt University in Berlin, Germany, in August, and AT&T Bell Labs in November.

Noel A. C. Cressie and Isobel Clark (Geostokos Limited) gave a two-day short course, Spatial Statistics for Environmental and Earth Sciences Data, on August 13-14, 1994, for Continuing Education of the American Statistical Association, in connection with the joint statistical meetings 1994. On August 15, Stephen Vardeman was a panelist for the NSF-sponsored Writing Workshop for New Researchers.

At the joint statistical meetings William J. Kennedy organized and chaired an invited paper session, Self-validating Numerical Methods in Statistical Computing. Stephen Vardeman organized and chaired the *Technometrics* invited paper session. Mervyn Marasinghe chaired a contributed paper session entitled Inference Based on the Bootstrap, on August 16, while Alicia Carriquiry chaired a contributed paper session entitled Random Effects and Mixed Models, on August 18 during the joint statistical meetings. Krishna B. Athreya chaired the presentation of Presidents' awards for COPSS on August 18.

Wayne Fuller chaired meetings of the Statistics Canada Advisory Committee on Statistical Methods held in Ottawa, Ontario, October 3-4, 1994, and May 1-2, 1995.

Paul Hinz presented a workshop of experimental design, data analysis, and data interpretation to the NCR-22 Committee on Small Fruits and Viticulture on November 2, 1994, at Iowa State University's Scheman Continuing Education Center.

Noel Cressie presented four lectures on "Spatial Statistics" at the Department of Environmental Science and Engineering, New University of Lisbon, in Portugal on November 17-18.

Carl Roberts gave an all-day workshop, with Roel Popping, on Content and Text Analysis at the Social Science Information Technology Conference (sponsored by the Interuniversity Expertise Centre ProGAMMA), held in Amsterdam, the Netherlands, December 7-9.

Bill Meeker gave a short course, with Luis A. Escobar, on Planning Reliability Studies, in Guanajuato, Mexico, January 16-21, 1995, sponsored by the Centro de Investicion en Matematicas.

Peter Sherman chaired a session for the 13th International Modal Analysis Conference held in Nashville, Tennessee, February 15-18, 1995.

Wayne Fuller participated in an American Agricultural Economics Association Survey and Data Task Force that met in Washington, D.C., March 9-10.

Peter Sherman participated in a workshop on Modelling of Structures and Mechanical Systems held at the Technion Institute of Technology, Haifa, Israel, May 8-10, 1995.

Wayne Fuller was one of four instructors (with Jon Rao, Graham Kalton, and Wes Schaible) in a short course, Small Area Estimation, sponsored by the Joint Program in Survey Methodology, University of Maryland and the Washington Statistical Society, held in Washington, D.C., May 22-23.

For Interface '95: Statistics and Manufacturing, the 27th Symposium on the Interface: Computing Science and Statistics, held in Pittsburgh, Pennsylvania, June 21-24, Noel Cressie organized and chaired a session on Spatial Statistics for Environmental Data; William Kennedy organized the *Journal of Computational and Graphical Statistics* Invited Papers session, which was chaired by Mervyn Marasinghe.

Noel Cressie taught a one-quarter course, Stat 882, Spatial Statistics, as visiting professor in the Department of Statistics, Ohio State University, March 28-June 8, while continuing half-time duties at Iowa State.

David Cox was selected as a participant in the 1995 National Science Foundation's Chautauqua Short Courses for College Teachers, in Memphis, Tennessee; he attended a course June 1-3 on Statistics: An Indispensable Tool for Decision-making in the Modern World.

Alicia Carriquiry was a member of the organizing committee for the V Colombian International Statistics Symposium: Statistics in Agriculture and the Environment, held in Santa Marta, Colombia, June 6-12, 1995. During the symposium she presented a short course, Applied Bayesian Analysis: Hierarchical Models, Numerical Methods, and Applications in Agriculture.

Editorial Activities

Stephen Vardeman continued as editor of *Technometrics* and as an ex officio member of its Management Committee. He also continued to serve on the ASA Publications Committee. Sharon Shepard served as editorial assistant for *Technometrics.*

William Kennedy is editor of the *Journal of Computational and Graphical Statistics* for the term 1995-97. The journal is a joint publication of the American Statistical Association, the Institute of Mathematical Statistics, and Interface Foundation of North America.

Yasuo Amemiya became an associate editor for the *Journal of Business and Economic Statistics* starting January 1995, and an associate editor for *Statistics and Probability Letters* starting May 1995.

K. B. Athreya continues to be an associate editor of *Statistics & Probability Letters.*

Alicia Carriquiry continued as an associate editor of *Revista Colombiana de Estadística* (Bogotá, Colombia).

Dianne Cook became an associate editor, for graphical and computational articles, for the *Journal of Educational and Behavioural Statistics* starting in July 1994.

Noel Cressie is an associate editor of the *Journal of Statistical Planning and Inference* and is an editorial board member of *Chemometrics and Intelligent Laboratory Systems.*

Kenneth Koehler is an associate editor for *The American Statistician.*

Frederick O. Lorenz is an associate editor of *Rural Sociology*.

William Q. Meeker continued to serve on the ASA Journals Management Committee and as chair of the *Technometrics* management committee.

Mack Shelley is co-editor of the *Policy Studies Journal*.

Hal Stern continues to serve as a co-editor of *Chance*, an American Statistical Association publication.

W. Robert Stephenson continued as an associate editor of *Technometrics* and served on the editorial boards for the *Journal of Statistics Education* and *STATS: The Magazine for Students of Statistics*.

John Stufken is an associate editor of *Communications in Statistics* and of the *Journal of Statistical Planning and Inference*.

In addition, many of the faculty serve as reviewers for various journals.

Other Activities

Derrick Rollins took part in Higher Ground and LEAD, new programs at ISU for freshman minority students, in August and September; he gave talks to minority student athletes and the ISU football team in October and was keynote banquet speaker to high school students attending the Best of Iowa Future Scholars Conference for minority students, at ISU on March 31, 1995. He presented a chemical engineering experimental demonstration for second graders at M. L. King, Jr., School in Des Moines, Iowa, January 9.

Dianne Cook participated in making a 15-minute historical video on statistical graphics that is to be part of the American Statistical Association Statistical Graphics Section Video Lending Library. Planning sessions were held in Seattle, Washington, May 28-30, and in Pittsburgh, Pennsylvania, June 21, and production is scheduled for August 1995 at Iowa State University.

In June 1995 Bill Meeker visited the University of Waterloo, Waterloo, Ontario, Canada, to serve as an external examiner for a Ph.D. thesis written in the Department of Statistics and Actuarial Science at the University of Waterloo.

Papers Presented, Lectures, and Seminars

At the 1994 Rural Sociological Society meetings in Portland, Oregon, August 11-14:

LORENZ, Frederick O., B. Magruder, and K. A. S. Wickrama: "Life stress and health in rural men and women: Trajectories of change";

LORENZ, Frederick O., J. Saltiel, and D. Hoyt: "Question order and fair play: Evidence of even handedness in rural surveys."

At the 1994 joint statistical meetings of the American Statistical Association, the Biometric Society (ENAR and WNAR), and the Institute of Mathematical Statistics, Toronto, Canada, August 13-18:

AMEMIYA, Yasuo: "On nonlinear random coefficient analysis";

An, Anthony B., F. Jay BREIDT, and **Wayne A. FULLER:** "Regression weighting methods for SIPP data";

Arnold, Barry C., and **Richard A. GROENEVELD:** "Measuring skewness with respect to the mode";

Carroll, Steven S., and **Noel CRESSIE:** "Incorporating geographic attributes into the covariance-distance function used in spatial modeling of snow water equivalent";

CRESSIE, Noel, and **Jeffrey D. Helterbrand** (Lilly Research Laboratories): "Hidden Markov models in image analysis with an application to closed object boundary identification";

DAVID, H. A.: "First (?) occurrence of common terms in mathematical statistics," poster session;

Deo, Rohit, and **Wayne A. FULLER:** "Symmetric tests for cointegration";

Escobar, Luis A., and **William Q. MEEKER, Jr.:** "Teaching about approximate confidence regions based on maximum likelihood estimation," poster paper;

Jung, Sin-Ho, **Sam WIEAND,** and Stephen Cha: "A statistic for comparing two correlated markers which are prognostic for time to an event";

KAISER, Mark S.: "Regression mixed over the unit interval";

Ko, Seoung-gon, Vincent S. Shu, and **Herbert T. DAVID:** "Efficient two-stage clinical trials with flexible second stage";

KOEHLER, Kenneth J.: discussant, Special Contributed Papers Session on Generalized Linear Models with Overdispersion";

KOEHLER, Kenneth J., Thomas M. Loughin (Kansas State University), and **Jürgen Symanzik:** "PHRUN: Software for bootstrap analysis of proportional hazards models," poster paper;

Lei, Ding-Hwa, and **Stephen B. VARDEMAN:** "LRT method of constructing a two-sided acceptance region for variables acceptance sampling and its comparison with other methods";

Leonard, Kelli A., Anthony B. An, Sarah M. NUSSER, and **F. Jay BREIDT:** "Approximating the variance of the survey regression estimator using poststratification";

McVey, Anita, F. Jay BREIDT, and **Wayne A. FULLER:** "Two phase estimation by imputation";

MARASINGHE, Mervyn G., William Q. MEEKER, Jr., Dianne COOK, and **Tae-sung Shin:** "Using graphics and simulation to teach statistical concepts";

NUSSER, Sarah M.: "Estimating usual intake distributions for 24-hour food intake data containing many zero intakes";

Papadopoulos, Savas, and **Yasuo AMEMIYA:** "Asymptotic robustness for the structural equation analysis of several populations";

POLLAK, Edward: "On the response to selection when there is partial inbreeding";

SHELLEY, Mack C. II: "Parliamentary bi-elections and government stability in the United Kingdom and the United States: A transfer function approach";

STERN, Hal: "Some difficulties in logistic and probit regression";

STEPHENSON, W. Robert: panelist on "The future of Mu Sigma Rho";

STEPHENSON, W. Robert: discussion leader, "Trial and tribulations of large lecture statistics: How do we get students involved?"--roundtable luncheon session;

Wang, Ouhong: "Application of numerical interval analysis to obtain self-validating results in statistical applications."

At the U.S. Environmental Protection Agency/National Institute of Statistical Sciences Workshop on Spatial Sampling for the Environment, Chapel Hill, North Carolina, September 21-22, 1994:

BREIDT, F. Jay, and **Wayne A. FULLER:** "The National Resources Inventory: Current methods and future issues";

CRESSIE, Noel: "Spatial sampling designs--description, examples, questions."

At the annual American Institute of Chemical Engineers Conference, held in San Francisco, California, November 13-18, 1994:

ROLLINS, D. K., A. Nason, J. Pelkey, J. M. Liang, and S. Penny: "Model discrimination in artificial neural networks with applications to grain drying";

ROLLINS, D. K., M. Melèndez, Y. Cheng, and F. F. Jamin: "The importance of power in gross error detection."

At the 27th International Symposium on Automotive Technology and Automation: A Dedicated Conference on Advanced Transport Telematics/IVHS, Aachen, Germany, October 31-November 4, 1994:

Elling, Michael, and **Peter SHERMAN:** "Evaluation of steering wheel measures for drowsy drivers";

Brekke, Monty, and **Peter SHERMAN:** "A critical evaluation of factors associated with steering wheel data when used for identifying driver drowsiness";

Gabrielsen, Knut, and **Peter SHERMAN:** "Drowsy drivers, steering data, and random processes."

At the 1995 ASA Winter Conference, Interface between Statistical Science and Other Scientific Disciplines, held in Raleigh, North Carolina, January 5-8:

Papadopoulos, Savas, and **Yasuo AMEMIYA:** "Structural equation analysis of nonnormal multivariate panel data";

Shin, Chungyeol: "On the multivariate random coefficient model";

Yalçin, Ilker, and **Yasuo AMEMIYA:** "Additive nonlinear factor analysis."

At the International Biometric Society/ENAR spring meeting, joint with the Institute of Mathematical Statistics and sections of the American Statistical Association, Birmingham, Alabama, March 26-29, 1995:

CRESSIE, Noel: "Spatial sampling of the environment";

Emir, Birol, Sam WIEAND, John Q. Su, and Steve Cha: "Analysis of repeated markers used to predict progression of cancer";

Majumdar, Dibyen, and **John STUFKEN:** "Trend-free and nearly trend-free block designs," as part of an invited session co-organized by Majumdar and Stufken.

At the Midwest Sociological Society annual meeting, in Chicago, Illinois, April 6-8, 1995:

Mercier, Joyce McDonough, and **Mack C. SHELLEY II:** "Interaction of adult children with their parents: Health, proximity, and siblings";

Mercier, Cletus R., Julie B. Rimkus, **Mack C. SHELLEY II,** and Joyce M. Mercier: "Age as a predictor of injury severity in head-on vehicular collisions."

At the Institute of Mathematical Statistics Central Regional Meeting, Iowa City, Iowa, May 14-17, 1995:

DAVID, H. A., and **Jason L. Gunnink:** "The paired t-test under artificial pairing";

VARDEMAN, Stephen B.: "Independent student projects in undergraduate engineering statistics and statistical quality control courses."

At the R. C. Bose Memorial Conference, Colorado State University, Fort Collins, Colorado, June 7-11, 1995:

Hedayat, A., and **John STUFKEN:** "Sampling designs to control selection probabilities of contiguous units";

Hedayat, A., **John STUFKEN,** and G. Su: "On difference schemes and orthogonal arrays of strength t."

At the Second Spring Research Conference on Statistics in Industry and Technology, held at Waterloo, Ontario, Canada, June 12-14, 1995, under joint sponsorship of the American Statistical Association Section on Physical and Engineering Sciences and the Institute of Mathematical Statistics:

Liu, Craig, and **Herbert T. DAVID:** "Minmax fitting of manufactured parts and random covering circles";

Lu, C. Joseph (National Cheng-Kung University, Republic of China): "Model selection in degradation analysis";

MEEKER, William Q., and Michael Hamada: "Statistical tools for the rapid development and evaluation of high-reliability products."

At Interface '95: Statistics and Manufacturing with Subthemes in Environmental Statistics, Graphics, and Imaging (the 27th Symposium on the Interface: Computing Science and Statistics), held in Pittsburgh, Pennsylvania, June 21-24, 1995:

COOK, Dianne, Andreas Buja, Javier Cabrera, and Catherine Hurley: "Grand tour and projection pursuit";

Jones, Philip G., and **Dianne COOK:** "Comparing CDF estimates with a correlation tour";

Majure, James J., Dianne COOK, Noel CRESSIE, Mark S. KAISER, Soumendra N. LAHIRI, and **Jürgen Symanzik:** "Spatial CDF estimation and visualization with applications to forest health monitoring";

Symanzik, Jürgen, James J. Majure, and **Dianne COOK:** "Dynamic graphics in a GIS: A bidirectional link between ArcView 2.0 and XGobi."

At other locations:

AMEMIYA, Yasuo: "Fitting a nonlinear factor analysis model," seminar at the Statistics Center, Cornell University, March 15, 1995.

"Nonlinear multivariate analysis using latent variable modeling," Statistics Day Seminar organized by the Committee on Statistics, Arizona State University, March 23.

"Multivariate model fitting using nonlinear factor analysis," seminar at the Department of Statistics, University of Wisconsin, Madison, April 19.

ATHREYA, Krishna B.: "Large deviations for branching Markov chains," colloquium talk at the T.I.F.R. Centre, Indian

Institute of Science, Bangalore, India, January 5, 1995.

"Markov chain Monte Carlo," colloquium talk, Indian Statistical Institute, Bangalore, January 7.

BREIDT, F. Jay: "Modeling long memory stochastic volatility," NBER/NSF Time Series Seminar, Fort Collins, Colorado, October 1, 1994.

CARRIQUIRY, Alicia: "Improved quasi-maximum likelihood estimation of stochastic volatility models," seminar, Department of Economics, Iowa State University, November 10, 1994.

"Robust QML for stochastic volatility," by **F. Jay BREIDT** and Carriquiry, at the International NSF-NBER Conference on Forecasting, Prediction and Modeling in Statistics and Econometrics, in Hsinchu, Taiwan, December 12, 1994.

"A comparison of methods for estimating usual intake distribution," poster paper by Carriquiry, **Hsin-Cheng Huang, Kevin Dodd,** and **Wayne A. FULLER,** at the Second International Conference on Dietary Assessment Methods, in Boston, Massachusetts, January 24, 1995.

"Estimation of usual intake distributions of nutrients and foods, by Carriquiry and **Sarah NUSSER,** seminar, Department of Statistics, Harvard University, January 25.

"Improved quasi-maximum likelihood for stochastical volatility," by Carriquiry and **F. Jay BREIDT,** at the 19th Annual Conference of the German Classification Society, Basel, Switzerland, March 9.

"Exploring stationary surfaces for Markov chain Monte Carlo," seminar, Department of Statistics, University of Washington, May 15.

"ISU method and software for estimating distributions of usual nutrient intake," by Carriquiry, **Wayne FULLER, Sarah NUSSER,** and **Kevin Dodd,** and "Estimation of usual intake distributions of ratios of dietary components," by Carriquiry, **Wayne FULLER, Kevin Dodd, Juan Goyeneche,** and Phillip Kott, seminars for the USDA Agricultural Research Service, Hyattsville, Maryland, May 31.

COOK, Dianne: "Tours into data analysis," at the 12th Australian Statistical Society Conference, Melbourne, Australia, July 1994.

"Some dynamic graphics for spatial data (with multiple attributes) in a GIS," by Cook, **Noel CRESSIE, James Majure,** and **Jürgen Symanzik,** at the 11th Compstat Symposium, Vienna, Austria, in August.

"Exploring multidimensional data with the grand tour and projection pursuit," seminar, Department of Statistics, University of Augsburg, Augsburg, Germany, in August; also Department of Econometrics and Statistics, Humboldt University, Berlin, Germany, in August; and Department of Statistics, Oregon State University, in October.

"Tours into data analysis," at the spring meeting of the International Biometric Society (ENAR), Birmingham, Alabama, in March 1995.

CRESSIE, Noel: "Spatial hierarchical models," by Cressie and **Mark S. KAISER,** at the National Science Foundation Regional Conference on Bayesian Methods in Finite Population Sampling Theory and Application, Storrs, Connecticut, July 10, 1994.

"Spatio-temporal prediction of livestock waste in streams," by Cressie and **James J. Majure,** at the Fifth International Environmetrics Conference in Burlington, Ontario, Canada, August 12.

"Spatial statistics for environmental and ecological data," seminar for Interdisciplinary Statistics Program, Syracuse University, October 17.

"Texture analysis using partially ordered Markov models," by J. L. Davidson, A. Talukder, and Cressie, at the First IEEE International Conference on Image Processing, Austin, Texas, November 14.

"Identification of mine-like targets using Markov random field boundary models," by Cressie, J. L. Davidson, and X. Hua, at the Office of Naval Research Workshop on Planar Point Processes for Minefield Detection, Panama City, Florida, December 1.

"A comparison of geostatistical techniques used to estimate snow water equivalent," by S. S. Carroll and Cressie, at the Symposium on Geotechnical and Environmental Applications, Phoenix, Arizona, January 26, 1995.

"Spatial statistics for environmental and ecological data," seminar for the Department of Decision and Information Systems, Arizona State University, January 27.

"Spatial statistical analysis with partially ordered Markov models," at the Mathematische Stochastik meeting, Oberwolfach, Germany, March 8.

"Change of support and the modifiable areal unit problem," at the 91st annual meeting of the Association of American Geographers, Chicago, Illinois, March 17; also panelist in the session on Methodological and Measurement Issues in the Geographic Sciences, March 16.

"Image analysis with partially ordered Markov models," seminar, at the Department of Statistics, Ohio State University, April 11.

"Mine boundary detection using Markov random field models," by Xia Hua, Jennifer Davidson, and Cressie, at the SPIE International Symposium on Aerospace/Defense Sensing and Control and Dual-Use Photonics, Orlando, Florida, April 20.

"Spatial statistics for environmental and ecological data," at the annual meeting of the Columbus Chapter, American Statistical Association, May 9.

FULLER, Wayne A.: "Alternative tests for unit root models," at the 1994 Australian meeting of the Econometric Society, Armidale, Australia, July 15, 1994.

"Regression weighting for nonresponse," by Fuller and **S. M. NUSSER,** at the Conference on Imputation and Weighting in Surveys, at the University of Southampton, England, April 5, 1995.

"Weighting for survey samples," at the 1995 Summer Research Conference in Statistics, Melbourne Beach, Florida, June 13, 1995.

HARVILLE, David A.: "Mixed-model methodology: Frequentist and Bayesian perspectives," seminar, IBM Thomas J. Watson Research Center, Yorktown Heights, New York, June 19, 1995.

HINZ, Paul: "Graduate studies in statistics" and "Interpreting significance levels," two lectures for the Department of Mathematics, Luther College, November 11.

"Data presentation in plant science journals," guest lecture in the course Hort 529, Department of Horticulture, Iowa State University, February 9, 1995.

"Precision of genetic parameter estimates in plant breeding research," at the Biometric Society (WNAR)/Institute of Mathematical Statistics meetings, Palo Alto, California, June 28.

ISAACSON, Dean: "Strong ergodicity for nonhomogeneous

Markov chains," colloquium, Department of Statistics and Actuarial Science, University of Iowa, October 7, 1994.

"Undergraduate program in statistics at Iowa State: Past, present, and future," at the annual meeting of the American Public Health Association, Washington, D.C., November 1.

KAISER, Mark S.: "Construction of hierarchical generalized linear models," by Kaiser, **Noel CRESSIE,** and **Jaehyung Lee,** at the Institute of Mathematical Statistics Special Topics Conference: Topics in Generalized Linear Models, Gainesville, Florida, October 1, 1994.

"Variability in nutrients and algal biomass in a Midwestern lake," by J. R. Jones, Kaiser, and B. D. Perkins, at a meeting of the North American Lake Management Society, in Orlando, Florida, October 28.

"The application of hierarchical statistical models in veterinary studies," seminar, Department of Veterinary Physiology, Iowa State University, November 7.

KOEHLER, Kenneth J.: "Analysis of correlated survival data," seminar, Mayo Clinic, Rochester, Minnesota, July 12, 1994.

"An introduction to SAS/INSIGHT," by Koehler and **Kathleen SHELLEY,** at the Iowa SAS Users Group Meeting, Ames, Iowa, February 16, 1995.

LORENZ, Frederick O.: "Physical health and psychological distress in the Czech Republic: Comparative responses to changing economic conditions," by Lorenz, Joseph Hraba, Gang Lee, and Zdenka Pechacova, at the American Sociological Society meetings, Los Angeles, California, August 9, 1994.

Discussant for section, Social Learning Theory and Deviant Behavior in Context, at the American Society of Criminology meetings, Miami, Florida, November 10, 1994.

"The effects of economic conditions on psychological distress in Czech families," seminar presented to the faculty of economics and psychology, Czech Agricultural University, Prague, November 21.

"Using experiments in mass class surveys in teaching sociology," at the Midwest Sociological Society meetings, Chicago, Illinois, April 7, 1995.

MEEKER, William Q.: "Statistical prediction based on censored life data," by Luis A. Escobar and Meeker, at the General Electric Corporate Research and Development Center, Schenectady, New York, July 27, 1994; also at the Department of Statistics and Actuarial Science, University of Waterloo, September 22; at the Department of Mathematics, University of Western Illinois, September 29; and at the Departmento de Matematicas, Instituto y de Estudios Superiores, Monterrey, Mexico, January 12, 1995.

"Some business and industrial applications of statistics," seminar, Department of Mathematics, Western Illinois University, September 30.

"An accelerated life test model based on reliability kinetics," by Meeker and M. J. LuValle, seminar, Department of Experimental Statistics, Louisiana State University, December 5, 1994.

"Methodology for estimating nondestructive evaluation capability," by Meeker, R. B. Thompson, Chien-Ping Chiou, and **Shuen-Lin Jeng,** at the FAA-Sponsored Engine Titanium Consortium Open Forum, Phoenix, Arizona, February 2, 1995.

NUSSER, Sarah: "Conducting high quality survey research," seminar at the Mayo Clinic, Rochester, Minnesota, October 24, 1994.

"Estimating usual food intake distributions," at the Second International Conference on Dietary Assessment Methods, held at the Harvard School of Public Health, Boston, Massachusetts, January 23, 1995.

"Estimating usual dietary intake distributions: Adjusting for measurement error and normality in 24-hour food intake data," by Nusser, P. Guenther, and **W. A. FULLER,** at the International Conference on Survey Measurement and Process Quality, in Bristol, England, April 3, 1995; also seminar for the National Cancer Institute, Bethesda, Maryland, May 10, the Agricultural Research Service, Hyattsville, Maryland, June 1, and Procter and Gamble, Cincinnati, Ohio, June 9.

ROBERTS, Carl: "Die Politik der Säkularisierung (The politics of secularization," seminar at the University of Leipzig, Germany, December 12, 1994.

"Verstehen and the quantification of language," seminar at the University of Munich, Germany, December 13.

ROLLINS, Derrick K.: "Statistically modeling industrial process data," at the 3M-University Process Modeling and Control Meeting, Tartan Park, Minnesota, July 14, 1994.

"Lessons in process modelling and control: Simple is often better," by Rollins and J. M. Liang, at the AIChE Iowa Section meeting, Marshalltown, Iowa, October 7.

"Overcoming," keynote speech at the 1994 Initiation Banquet for Omega Chi Epsilon, the chemical engineering honor society, at ISU, October 26.

"Racism: The double whammy," for an ISU senior seminar course, ChE 401, December 1.

"Simple and accurate semi-empirical modeling of process variables for nonlinear dynamic processes," seminar for the Department of Electrical and Computer Engineering, Iowa State University, February 3, 1995.

"No more excuses," keynote speech at the spring semester meeting of the ISU chapter of the National Society of Black Engineers, February 27.

"Statistical modeling of the thermoregulatory system and sensor validation in life support systems, NASA Ames Research Seminar, Mountain View, California, March 10.

"Accurate simplistic modeling of nonlinear dynamic processes," seminar, Department of Aerospace Engineering, Iowa State University, March 28; seminar, Department of Chemical and Petroleum Engineering, University of Kansas, April 19; seminar, Department of Statistics, Georgia Institute of Technology, May 15; and seminar, Department of Statistics, Ohio State University, May 23.

"To whom much has been given much is required," keynote speech at the annual ISU Scholarship Recognition Dinner, April 11.

"No more excuses--*carpe diem* (seize the moment)," keynote speech at the University of Las Vegas' Minority Engineering Annual Awards Banquet, April 29.

"Fitting statistics into the chemical engineering curriculum," at the annual meeting of the American Society of Engineering Education, held in Anaheim, California, June 25-28, 1995.

SHELLEY, Kathleen: "Black and white is how it should be--but shades of gray are the colors I see," at the 1994 Midwest SAS Users Group Conference, Omaha, Nebraska, September 26.

SHELLEY, Mack C. II: "Farm show participants' perceptions of chemically resistant gloves," by J. Stone, S. Padgitt, W. Winter-

steen, and Shelley, at the XII International Congress of Agricultural Medicine and Rural Health, held in Stockholm, Sweden, July 11, 1994.

"Of time and government stability: By-elections and signal processing," at the annual meeting of the Midwest Political Science Association, held in Chicago, Illinois, April 7, 1995.

SHERMAN, Peter: "Blade-to-blade variability of the pressure asssociated with an axial compressor," by Sherman, Rachel Dudley, and Mitchell Suarez, at Turbo-Expo '95, the International Gas Turbine and Aeroengine Congress and Exposition, held in Houston, Texas, June 5-8, 1995.

STEPHENSON, W. R.: "TQM in instruction," for the College of Veterinary Medicine, Iowa State University, September 29, 1994.

"Introductory statistics: Does it compute?"--at a meeting of the Iowa Mathematical Association of Two Year Colleges, Waldorf, Iowa, October 14.

Invited presentation at a plenary session, Highly Effective Statistics Programs: Three Case Studies, for the colloquium for college and university mathematics department chairs sponsored by the Board on Mathematical Sciences of the National Research Council, Arlington, Virginia, October 29.

"Quality improvement: What's STAT got to do with it?"--for students in industrial education and technology at Iowa State University, November 9.

"Continuous improvement in the classroom," for Faculty/Staff Development Day at Des Moines Area Community College, January 11, 1995.

STERN, Hal: "Prediction on a different playing field: Rating methods for professional football," Animal Breeding and Genetics Seminar, Iowa State University, September 14, 1994.

"Data analysis using finite mixture models," seminar, Department of Biostatistics, School of Public Health, University of Minnesota, October 13.

"Who's #1: Probability and statistics in sports," seminar, Department of Mathematics and Computer Science, Grinnell College, November 10.

"Finite mixtures of linear regression models," seminar, Department of Statistics, University of Iowa, April 20, 1995; also seminar, Department of Statistics, University of Chicago, May 22.

SUKHATME, Shashikala: "Receiver Operating Characteristic studies and measurement errors," at the 17th International Biometric Conference, Hamilton, Ontario, Canada, held August 8-12.

"Exact powers of the Wilcoxon test and the logrank test under random censoring," by Sukhatme and **C. H. Lin** (Ming Chuan College), at the International Research Workshop on Analysis of Censored Data sponsored by the National Science Foundation (USA) and University Grants Commission (India), held at Pune, India, December 28, 1994-January 1, 1995.

"Using Receiver Operating Characteristic curves in data analysis," seminar, Department of Statistics, Shivaji University, Kolhapur, India, January 3, 1995.

"Some problems in ROC studies," seminar, Department of Statistics and Mathematics, Wright State University, May 17.

Wikle, Chris: "A new method for identifying periodic components in climate data," seminar, Department of Geological and Atmospheric Sciences, November 15, 1994.

Other Meetings

Ted Bailey and Paul Hinz attended the 1994 NCR-170 meeting in Madison, Wisconsin, July 6-8.

Kenneth J. Koehler (see seminar given), Rebecca Benner, Tom Dubinin, Ling Ling Claire Tsao visited the Mayo Clinic, Rochester, Minnesota, July 11-12 to discuss possible research opportunities with statisticians there.

William Q. Meeker attended meetings of the Engine Titanium Consortium held at the General Electric-Evendale Facility, Evendale, Ohio, July 12-13, 1994, and February 28-March 1, 1995; at General Electric Corporate Research and Development, Schenectady, New York, November 7-8, 1994; and in Ames, Iowa, June 20-21, 1995.

Jay Breidt, Richard Dorsch, Anita McVey, and Sarah Nusser attended the 1992 National Resources Inventory Environmental and Resource Assessment Symposium, Washington, D.C., July 19-20.

Edith Landin attended the Professional Secretaries International Annual International Convention in Orlando, Florida, July 23-28, and acted as delegate for the Iowa Division.

Alicia Carriquiry attended the Second World Meeting of the International Society for Bayesian Analysis, in Toronto, August 13.

Besides those mentioned earlier, William J. Kennedy, Hsin-Chen Huang, and Ahmed Youssef attended the annual meeting of the American Statistical Association in Toronto August 14-18.

Mack C. Shelley II attended the annual meeting of the American Political Science Association, New York City, September 1-4.

Jay Breidt (as indicated above), Rohit Deo, and Nan-Jung Hsu attended the NBER/National Science Foundation Time Series Seminar in Fort Collins, Colorado, September 30-October 1.

Masoud Kazemi, Deborah Reed-Margetan, and Harvey Terpstra attended the 1994 National Soil Information System Workshop, in Fort Worth, Texas, October 17-21.

Toni Genalo and Anita McVey attended a class on the use of CASES, a software system used to conduct computer assisted surveys, held at the Survey Research Center, University of California-Berkeley, October 24-28.

Herbert T. David attended a mini-symposium on developing efficient strategies for breast cancer screening, held at the Medical College of Wisconsin, Milwaukee, Wisconsin, in November.

Alicia Carriquiry attended the Washington, D.C., forum on Meeting the Challenge: Health, Safety, and Food for America, organized by the Executive Office of the President, Office of Science and Technology Policy, and by the National Academy of Sciences, November 21-22.

Jay Breidt, Mark Kaiser, Sarah Nusser, Dana Bruden, Rong Li, and Heidi Shierholz attended a meeting in Albert Lea, Minnesota, on the Minnesota Lakes Project on January 4.

Pradipta Sarkar attended the 1995 ASA Winter Conference, Interface between Statistical Science

and Other Scientific Disciplines, Raleigh, North Carolina, January 5-8, and took part in its College Bowl.

Jay Breidt and Wayne Fuller attended the 1995 Allied Social Science Associations Winter Meetings in Washington, D.C., January 6-8.

Fred Lorenz attended the annual meeting of Western Regional Project W-183 January 26-29, 1995, in Tucson, Arizona, to discuss experiments and plan papers for professional meetings and submittal to professional journals.

David Cox, Paul Hinz, Kari Jovaag, Tom Kirchoff, Claire Tsao, Mike Wallendorf, and Lie-Ling Wu attended the 7th Annual Applied Statistics in Agriculture Conference in Manhattan, Kansas, April 24-25.

Ted Bailey attended a meeting of geneticists held at the University of Minnesota, St. Paul, April 28-29.

Noel Cressie and Dean Isaacson attended the Institute of Mathematical Statistics Central Regional Meeting, Iowa City, Iowa, May 14-17, in addition to individuals presenting papers there.

Andrew Williams took part in the Annual Conference of the American Association of Public Opinion Researchers, Fort Lauderdale, Florida, May 17-21.

Jay Breidt attended the Small Area Estimation Short Course sponsored by the Joint Program in Survey Methodology and presented in Washington, D.C., May 22-23.

David Cox attended a Workshop for Analysis of Data from Target Animal Safety Studies, in Rockville, Maryland, May 25-29.

Karl Henry (left) and Deanne Reber confer about computer applications. Reber is a research assistant in the Statistical Computing Service, while Henry is a teaching assistant in Stat 104.

PUBLICATIONS

In the Statistical Laboratory preprint series, 22 titles (#94-17 to 94-38) were added during the last half of 1994 and 14 more (#95-1 to 95-14) in the first half of 1995. Copies of the most recent set of abstracts are available on request. Any preprint may be requested by number directly from the author. A new set of preprint abstracts will be released in the fall of 1995.

BOOKS

Schmidt, Steffen W., **Mack C. SHELLEY II,** and Barbara A. Bardes. *American Government and Politics Today,* 1995-96 edition. St. Paul: West Publishing Company. 1995. xlix + 748 pp. + G-15 + I-28.

This is the latest edition of a widely-used introductory textbook in political science. The current edition features extensive coverage of opinion polling and voting behavior associated with the 1994 elections in the United States. Major supplements include a software package applying statistical procedures and display graphics to data sets keyed to the subject matter of each chapter, a companion reader, and an appendix on conducting research in political science.

Stanford, John L., and **Stephen B. VARDEMAN,** editors. *Statistical Methods for Physical Science.* Methods of Experimental Physics series, Vol. 28. San Diego: Academic Press, Inc. 1994. xix + 542 pp.

This book consists of 17 chapters contributed by statisticians and physicists, aimed at providing a point of entry into the statistical literature for physical science researchers. The book is organized into four sections providing introductions to (i) probability modeling, (ii) basic inference, (iii) inference from time series and spatial data, and (iv) methods dependent upon modern computing tools. Every chapter includes extensive references and almost all are carried by important physical science examples.

Published Research

AMEMIYA, Yasuo. On multivariate mixed model analysis. Pp. 83-95 in *Multivariate Analysis and Its Applications,* edited by T. W. Anderson, K. T. Fang, and Ingram Olkin. IMS Lecture Notes-Monograph Series, Vol. 24. 1994.

A general multivariate mixed effect linear model is introduced. Special cases of the model include the multivariate nested error covariance component regression and the random coefficient repeated measure model. Discussion is given on modeling the random effect structure and its effect on statistical inference. A procedure for testing a certain class of hypotheses concerning the random effect structure is developed. The procedure is based on a statistic in a readily computable form, facilitating the use at the model building stage.

ATHREYA, K. B. Large deviations for branching processes--I, single type case. *The Annals of Applied Probability* 4:3 (1994) 779-790.

For single type supercritical branching process with no extinction, large deviation results for an estimator of the population mean are derived.

ATHREYA, K. B. Continuous time gambling problems. Pp. 289-295 in *Doeblin and Modern Probability: Proceedings of the Doeblin Conference "50 Years After Doeblin: Development in the Theory of Markov Chains, Markov Processes, and Sums of Random Variables,"* edited by Harry Cohn. American Mathematical Society Contemporary Mathematics Series Vol. 149. Providence, RI: American Mathematical Society. 1993.

A brief survey of problems involving optimization of hitting probabilities and expected hitting times for Ito processes on $[0,\infty)$ is given. These parallel discrete time gambling problems studied by Dubins and Savage.

ATHREYA, K. B., and **A. N. Vidyashankar.** Large deviations for branching processes--II, the multitype case. *The Annals of Applied Statistics.* 5:2 (1995) 566-576.

The large deviation results of Athreya for the single type case are extended to the multitype case.

Jergens, Albert E., Dean H. Riedesel, Philip A. Ries, Kristina G. Miles, and **Theodore B. BAILEY.** Cardiopulmonary responses in healthy dogs during endoscopic examination of the gastrointestinal tract. *American Journal of Veterinary Research* 56:2 (1995) 215-220.

The purpose of the study reported here was to evaluate the presence and magnitude of cardiopulmonary alterations in 12 healthy dogs during endoscopy of the stomach and small intestine. A randomized-block experimental design, with each week as a block, was used. Within each block one dog from each of three size groups was randomly selected and repeatedly evaluated during the experimental period. Each animal was observed at four consecutive 15-minute periods--preendoscopy, gastroscopy, enteroscopy, and postendoscopy intervals--in which physiologic variables were continually measured. Although cardiopulmonary changes among the three size groups were detected ($P < 0.05$), the changes observed were often small and of little clinical significance.

Kim, Y., E. S. Krafsur, **T. B. BAILEY,** and Suling Zao. Mode of inheritance of face fly diapause and its correlation with other developmental traits. *Ecological Entomology* 20 (1995) 359-366.

Adult face flies, *Musca autumnalis* De Geer, respond to short photoperiods by entering diapause. Diapause responses to different photoperiods at a mean temperature of 17°C were found to vary among seven laboratory strains, 'old' strains losing much of their diapause responses. To analyze the nature of diapause inheritance, hybrids and their back-crosses were made between the two strains that showed the greatest difference in diapause introduction at 10:14 h (L:D), and 17°C. Responses of hybrids to the short photoperiod were intermediate to those of their parents. Joint scaling tests showed that diapause did not fit an additive model and the lack of fit was attributed to incomplete dominance. No cytoplasmic effect was detected, but diapause was partially sex linked. Diapause heritabilities were 47% and 30% in the broad and narrow senses, respectively. Estimates of the minimum number of diapause genes suggested a small number. Developmental rates of egg to adult, ovarian follicle growth, and pterin accumulation were inversely correlated with diapause propensities, suggesting pleiotropy or linkage.

BREIDT, F. Jay, Richard A. Davis, and William T. M. Dunsmuir. Improved bootstrap prediction intervals for autoregressions. *Journal of Time Series Analysis* 16:2 (1995) 177-200.

We consider bootstrap construction and calibration of prediction intervals for nonGaussian autoregressions. In particular, we address the question of prediction conditioned on the last p observations of the process, for which we offer an exact simulation technique and an approximate bootstrap approach. In simulations for a variety of first-order autoregressions, we compare various nonparametric prediction intervals and find that calibration gives reasonably narrow prediction intervals with the lowest coverage probability mean squared error among the methods used.

BREIDT, F. Jay. Markov chain designs for one-per-stratum sampling. *Survey Methodology* 21:1 (1995) 63-70.

Classical results in finite population sampling tell us that systematic sampling is the most efficient equal-probability one-per-stratum design for certain kinds of autocorrelated superpopulations, but stratified simple random sampling may be much better than systematic sampling if the superpopulation is a trend with uncorrelated errors. What if the superpopulation consists of a trend plus autocorre-

lated errors? Intuitively, some sort of "compromise" between the two designs might be better than either. Such compromise designs are constructed in this paper and are shown to be examples of Markov chain designs, a wide class of methods for one-per-stratum selection from a finite population. These designs include as special cases systematic sampling, balanced systematic sampling, and stratified simple random sampling with one sampling unit per stratum. First- and second-order inclusion probabilities are derived for Markov chain designs, yielding the Horvitz-Thompson estimator and its variance. Efficiency of the Horvitz-Thompson estimator is evaluated using superpopulation models. Numerical examples show that new designs considered here can be more efficient than standard designs for superpopulations consisting of trend plus autocorrelated errors. An example of the implementation of Markov chain designs for the 1992 National Resources Inventory in Alaska is given.

Cannon, Ann (Cornell College), and **Noel CRESSIE.** Temporal analogues to spatial K functions. *Biometrical Journal* 37:3 (1995) 351-373.

In this article, the spatial statistic known as the K function is adapted for temporal processes and patterns. The (optimal) K-function estimator is used in a testing procedure to determine whether behavior patterns of exposed rats versus control rats are different. Specifically, the temporal analogue to the K function is given and an approximately optimal estimator is developed. Next, a testing procedure, to determine whether a group of point patterns is generated from complete temporal randomness, is given. Finally, a testing procedure, to compare pairwise two groups of point patterns to each other, is given. The testing procedures are illustrated with rat-behavior data from both a control-control experiment and an exposed-control experiment, where in the latter case a difference in behavior is known to exist.

Johnson, S. R., A. Bouzaher, **A. L. CARRIQUIRY,** H. H. Jensen, and P. G. Lakshminarayan. Production efficiency and agricultural reform in Ukraine. With discussion. *American Journal of Agricultural Economics* 76:4 (1994) 629-635.

In this paper, we present the results from an analysis in which efficient production frontiers were estimated from farm-level data in the Ukraine. Data included information on almost 400 production and input variables for approximately 11,000 state and collective farms, for the period 1986-1992. A fully parametric, stochastic frontier model was used, where firm-level technical efficiency was allowed to vary over time. Model parameters were estimated via maximum likelihood, and results obtained included estimates for technical efficiency of each firm in each time period, and for the mean technical efficiency over all farms in a time period.

Uemura, Etsuro, **Alicia CARRIQUIRY,** Wolfgang Kliemann, and Jeffrey Goodwin. Mathematical modeling of dendritic growth in vitro. *Brain Research* 671:3 (1995) 187-194.

The dendritic branching pattern of cultured hippocampal neurons was analyzed to obtain mathematical parameters that fit the time-dependent growth of dendrites under limited extrinsic influence. Cultured neurons were stained with a nontoxic carbocyanine dye (diO) and pyramidal-shaped neurons that were physically separated from one another were analyzed at post-plating days 1, 2, 3, 4, 6, and 7. The geometric branching pattern of the dendrites was analyzed using a mathematical model that incorporates random effects in the form of a Galton-Watson branching process where splitting of one branch is statistically independent of the splitting of all other branches, and deterministic effects in the form of a parameter that measures the extent to which dense patterns (clusters) or sparse patterns (elongated trees) are formed. The model parameters were estimated via the method of maximum likelihood. The data suggest that in vitro basal dendrites tend to form elongated trees with fewer secondary bifurcations. This trend is quantified, and it depends on the culture conditions in which the neurons are grown. The quantitative assessment of various influences on dendritic growth patterns is discussed.

COOK, Dianne, Noel CRESSIE, James Majure, and **Jürgen Symanzik.** Some dynamic graphics for spatial data (with multiple attributes) in a GIS. Pp. 105-119 in *Compstat '94: Proceedings in Computational Statistics,* edited by R. Dutter and W. Grossmann. Heidelberg: Physica-Verlag. 1994.

This paper discusses some multivariate exploratory spatial data analysis tools for detecting spatial dependence. The ideas explored are related to canonical correlation analysis and the graphical tools are related to the dynamic method called the grand tour. The work is implemented with a link between a Geographic Information System, ARC/INFO™, and software for exploring multivariate data, XGobi.

Swayne, Deborah F., **Dianne COOK,** and Andreas Buja. User's manual for XGobi, a dynamic graphics program for data analysis implemented in the X Window System (Release 3). *Technical Memorandum SR-3219,* Bellcore, Morristown, New Jersey. 1994. iv + 39 pp.

XGobi brings contemporary dynamic graphics for statistics to the workstation environment. Dynamic graphical methods offer a data analyst the power of motion, high interaction, and rapid response for discovering and understanding higher-dimensional relationships among variables. For example, XGobi has provided insights within Bellcore to software engineers analyzing data on switch memory allocation and to market researchers studying telephone usage data.

XGobi's plots are all variants of the scatterplot. These scatterplots can be single-variable strip plots or scatterplots of two variables or of pairs of linear combinations of three or more variables. The plots can be set in motion: three-variable rotation or higher dimensional rotation known as the grand tour. In addition, a method called the projection pursuit guided tour is provided for directing the tour toward interesting views of the data. The scatterplots can be transformed and manipulated in many ways. Groups of points can be distinguished with a method called brushing or identified with labels, either in one window at a time or using two or more linked windows. A plot can be moved and reshaped, and variables can be transformed interactively. An online help system is available that contains most of the information in this manual. XGobi is implemented in the X Window System™, so it is widely portable. XGobi is designed to be used as a complement to existing analytical tools. For example, one can use XGobi and the S data analysis environment simultaneously, making it possible to use each program's unique functions on the same data.

CRESSIE, Noel. Models for spatial processes. Chapter 4 (pp. 93-124) in *Statistical Methods for Physical Science,* edited by John L. Stanford and Stephen B. Vardeman. San Diego: Academic Press. 1994.

Statistical models for spatial processes are presented for an audience made up largely of physicists. The three principal types considered are geostatistical models, Markov random fields on spatial lattices, and point processes.

CRESSIE, Noel, and **Jonathan Biele** (IMECC, Campinas, Brazil). A sample-size optimal Bayesian procedure for sequential pharmaceutical trials. *Biometrics* 50:3 (1994) 700-711.

Consider a pharmaceutical trial where the consequences of different decisions are expressed on a financial scale. The efficacy of the new drug under consideration has a prior distribution obtained from the underlying biological process, animal experiments, clinical experience, and so forth. Berry and Ho (*Biometrics* 44, 219-227) show how these components are used to establish an optimal (Bayes) sequential testing procedure, assuming a known constant sample size at each decision point. We show in this article how it is also possible to optimize further, with respect to the sample-size rule. This last component of the design, which is missing from most sequential procedures, has the potential to yield considerably larger expected net gains (equivalently, considerably smaller Bayes risks).

Carroll, Steven S., Gerald N. Day, **Noel CRESSIE,** and Thomas R. Carroll. Spatial modelling of snow water equivalent using airborne and ground-based snow data. *Environmetrics* 6 (1995) 127-139.

The National Weather Service maintains a set of conceptual, continuous, hydrologic simulation models used to generate extended streamflow predictions, water supply outlooks and flood forecasts. A vital component of the hydrologic simulation models is a snow accumulation and ablation model that uses observed temperature and precipitation data to simulate snow cover conditions. The simulated model states are updated throughout the snow season using snow water equivalent estimates obtained from airborne and ground-based snow water equivalent data. The National Weather Service has developed a spatial model to obtain integrated snow water equivalent estimates for updating the snow model; however, it is designed to incorporate only ground-based data. In this research, we describe the spatial model and show how to modify it to include data of two different supports (the airborne and ground-based data) so that more precise integrated snow water equivalent estimates can be obtained. The results are illustrated on snow data collected in the Upper Colorado River basin.

Davidson, Jennifer, Ashit Talukder, and **Noel CRESSIE.** Texture analysis using partially ordered Markov models. *Proceedings, ICIP-94 [International Conference on Image Processing]* 3 (1994) 402-406. Los Alamitos, California: IEEE Computer Society Press.

Texture is a phenomenon in image data that continues to receive wide-spread interest due to its broad range of applications, including remotely sensed data, medical imaging, and military applications, to name a few. This paper focuses on but one of several ways to model textures, namely, the class of stochastic texture models. We introduce a new spatial stochastic model called a *partially ordered Markov model,* or POMM. We show how POMMs are a generalization of a class of models called *Markov mesh models,* or MMMs, that allow an explicit closed form for the joint probability, just as do MMMs. While POMMs are a type of Markov random field model (MRF), the general MRFs do not have such an explicit closed form for the joint probability. We present results on texture synthesis and texture classification, introducing a very fast one-pass texture synthesis algorithm, and show that parameter estimation of natural textures can give quite satisfactory results.

Hua, Xia, Jennifer Davidson, and **Noel CRESSIE.** Mine boundary detection using Markov random field models. Pp. 626-636 in *Detection Technologies for Mines and Minelike Targets,* edited by Abinash C. Dubey, Ivan Cindrich, James M. Ralston, and Kelly Rigano. SPIE (Society of Photo-Optical Instrumentation Engineers) Proceedings Series Vol. 2496. 1995.

Detection of objects in images in an automated fashion is necessary for many applications, including automated target recognition. In this paper, we

present results of boundary detection using Markov random fields. Once the boundaries of regions are detected, object recognition can be conducted to classify the regions within the boundaries. Thus, an approach that gives good boundary detection is very important in many automated target recognition systems. Our algorithm for boundary detection combines a Bayesian approach with a histogram specification technique to locate edges of objects that have a closed-loop boundary. The boundary image is modeled by a Markov random field. The method is relatively insensitive to the input parameters required by the user and provides a fairly robust automated detection procedure that produces an image with closed one-pixel-wide boundaries. We apply our method to mine data with very good results.

DAVID, H. A. Concomitants of extreme order statistics. Pp. 211-224 in *Extreme Value Theory and Applications,* edited by J. Galambos, J. Lechner, and E. Simiu. Dordrecht, The Netherlands: Kluwer Academic Publishers. 1994.

Suppose the independent pairs of variates (X_i, Y_i), i = 1,...,n, are ordered by the X_i. Then the Y-variate paired with the r^{th} order statistic $X_{r:n}$ is called the concomitant of $X_{r:n}$ and denoted by $Y_{[r:n]}$. This paper treats the asymptotic distribution theory of concomitants when r or n–r remains fixed as $n \to \infty$. The special case of a linear regression linking X and Y is examined in detail and a theorem of Galambos (1978) is generalized. Results on the joint distribution of concomitants of extremes are reviewed and some applications are indicated.

DAVID, H. A. First (?) occurrence of common terms in mathematical statistics. *The American Statistician* 49:2 (1995) 121-133.

A list of over 300 terms commonly used in mathematical statistics is presented with their apparent first occurrence in print. Some of the more interesting problems encountered in preparing the list are described.

FULLER, Wayne A. Comment on "Issues and options in the provision of small area data," by M. P. Singh, J. Gambino, and H. Mantel. *Survey Methodology* 20:1 (1994) 15-17.

FULLER, Wayne A. Estimation in the presence of measurement error (with discussion). *International Statistical Review* 63:2 (1995) 121-147.

The importance of measurement error for parameter estimation and for the design of statistical studies, particularly sample surveys, is examined. Beginning with a brief review of Hansen's contributions, the discussion concentrates on estimation problems in which measurement error leads to bias in the usual estimators. Distribution functions and regression equations are discussed, and the implications for the design of surveys are presented.

FULLER, Wayne A., Marie M. Loughin, and **Harold D. BAKER.** Regression weighting in the presence of nonresponse with application to the 1987-1988 Nationwide Food Consumption Survey. *Survey Methodology* 20:1 (1994) 75-85.

A regression weight generation procedure is applied to the 1987-1988 Nationwide Food Consumption Survey of the U.S. Department of Agriculture. Regression estimation was used because of the large nonresponse in the survey. The regression weights are generalized least squares weights modified so that all weights are positive and so that large weights are smaller than the least squares weights. It is demonstrated that the regression estimator has the potential for large reductions in mean square error relative to the simple direct estimator in the presence of nonresponse.

Pantula, Sastry G., Graciela Gonzalez-Farias, and **Wayne A. FULLER.** A comparison of unit-root test criteria. *Journal of Business & Economic Statistics* 12:4 (1994) 449-459.

During the past 15 years, the ordinary least squares estimator and the corresponding pivotal statistic have been widely used for testing the unit-root hypothesis in autoregressive processes. Recently, several new criteria, based on maximum likelihood estimators and weighted symmetric estimators, have been proposed. In this article, we describe several different test criteria. Results from a Monte Carlo study that compares the power of the different criteria indicate that the new tests are more powerful against the stationary alternative. Of the procedures studied, the weighted symmetric estimator and the unconditional maximum likelihood estimator provide the most powerful tests against the stationary alternative. As an illustration, the weekly series of one-month treasury-bill rates is analyzed.

Park, Heon Jin, and **Wayne A. FULLER.** Alternative estimators and unit root tests for the autoregressive process. *Journal of Time Series Analysis* 16:4 (1995) 415-429.

Several estimators for the second-order autoregressive process and the associated tests for a unit root are compared. Monte Carlo results are reported for the ordinary least squares estimator, the simple symmetric least squares estimator, and the weighted symmetric least squares estimator. The weighted symmetric least squares estimator of the autoregressive parameters generally has smaller mean square error than that of the ordinary least squares estimator, particularly when one root is close to one in absolute value. For the second-order model with known zero intercept, the one-sided ordinary least squares test for a unit root is more powerful than the symmetric tests. For the model with an estimated intercept, the one-sided weighted symmetric least squares test is the most powerful test.

Garrigoux, Christian G. (Instituto Tecnologico y de Estudios Superiores de Monterrey, Mexico), and **William Q. MEEKER.** A reliability model for planning in-service inspections for components subject to degradation failure. *Pakistan Journal of Statistics,* Series A, 10:1 (1994) 79-98.

This paper develops a probabilistic model for the reliability of components with life-extending in-service nondestructive inspections. Unit-to-unit variability in reliability with no inspections is described by a random effects model with several parameters considered random, e.g., parameters defining the initial level of degradation, the observed level of degradation at inspections, and the degradation law parameters. In-service inspections are scheduled to control the hazard function or other functions of the failure time density. Besides the time to failure density and the hazard function, we provide expressions for reliability figures of merit like the approximate cost per unit of service time. In-service inspections are scheduled dynamically on the basis of the Bayesian updating of the failure time density in order to meet specific reliability or costs criteria. Several important models are derived as special cases of the main model.

Garrigoux, Christian G. (Instituto Tecnologico y de Estudios Superiores de Monterrey), and **William Q. MEEKER.** Assessing the effect of in-service inspections on the reliability of degrading components. Pp. 59-78 in *Recent Advances in Life-Testing and Reliability: A Volume in Honor of Alonzo Clifford Cohen, Jr.,* edited by N. Balakrishnan. Boca Raton: CRC Press. 1995.

This paper combines a reliability model and an inspection model to provide a means of planning in-service inspections. Inspections are planned so as to keep the hazard function for the component below a specified threshold. Although our degradation model is more general, the example involves fatigue failure with a random effects model to describe unit-to-unit differences in degradation and reliability. The random effects in this example are initial crack size and two Paris law crack-growth parameters. Although the inspection model is again more general, our example uses, as is common in the airline industry, given periodic inspection opportunities and a probability of detection (POD) function. The POD is often given as a simple function of crack size.

Arnold, Barry C., and **Richard A. GROENEVELD.** Measuring skewness with respect to the mode. *The American Statistician* 49:1 (1995) 34-38.

There are several measures employed to quantify the degree of skewness of a distribution. These have been based on the expectations or medians of the distributions considered. In 1964, van Zwet showed that all the standardized odd central moments of order 3 or higher maintained the convex or c-ordering of distributions that he introduced. This ordering has been widely accepted as appropriate for ordering two distributions in relation to skewness. More recently, measures based on the medians have been shown to honor the convex ordering. The measure of skewness $(\mu - M)/\sigma$ where μ, σ, and M are, respectively, the expectation, standard deviation, and mode of the distribution was initially proposed by Karl Pearson. It unfortunately does not maintain the convex ordering. Here we introduce a measure based on the mode of a distribution that maintains the c-ordering. For many classes of right-skewed distributions, it is easily computed as a function of the shape parameter of the family and the distribution function of the distribution. The measure γ_M satisfies $-1 \leq \gamma_M \leq 1$, with 1(-1) indicating extreme right (left) skewness. As γ_M can be found explicitly in the gamma, log-logistic, lognormal, and Weibull cases, and its influence function suggests appropriate properties as a skewness measure, it may be considered as an attractive competitor to other measures based on the mean or median.

Grondona, Martin O. (Instituto de Clima y Agua, Buenos Aires), and Noel CRESSIE. Residuals based estimators of the covariogram. *Statistics* 26 (1995) 209-218.

Assuming a polynomial trend with second-order stationary errors, expressions for the expectation of various covariogram estimators are derived. The goal of this article is to compare the estimator based on ordinary-least-squares residuals, with the estimator based on recursive residuals.

Helterbrand, Jeffrey D. (Lilly Research Laboratories), **Noel CRESSIE,** and Jennifer L. Davidson. A statistical approach to identifying closed object boundaries in images. *Advances in Applied Probability* 26:4 (1994) 831-854.

In this research, we present statistical theory, and an algorithm, to identify one-pixel-wide closed object boundaries in gray-scale images. Closed-boundary identification is an important problem because boundaries of objects are major features in images. In spite of this, most statistical approaches to image restoration and texture identification place inappropriate stationary model assumptions on the image domain. One way to characterize the structural components present in images is to identify one-pixel-wide closed boundaries that delineate objects. By defining a prior probability model on the space of one-pixel-wide closed boundary configurations and appropriately specifying transition probability functions on this space, a Markov chain Monte Carlo algorithm is constructed that theoretically converges to a statistically optimal closed boundary estimate. Moreover, this approach ensures that any approximation to the statistically optimal boundary estimate will have the necessary property of closure.

Killeen, Timothy J., and **Paul N. HINZ.** Grasses of the Precambrian Shield region in eastern low-

land Bolivia. I. Habitat preferences. *Journal of Tropical Ecology* 8 (1992) 389-407.

The habitat distribution and relative abundance of 113 species of Gramineae were documented by relevés in 82 stands near Concepción, Santa Cruz, Bolivia. A factor analysis was used to compare the floristic similarity of stands situated in semideciduous forest, cerradão, cerrado, campo rupestre, valley-side campo, pantanal complex or on granite outcrops. Individual grass species usually had a preferred habitat and occurred with decreasing abundance in stands judged to be transitional by physiognomic, edaphic, and floristic criteria. Stands situated in cerrado vegetation were most similar to one another in grass species composition.

Killeen, Timothy J., and **Paul N. HINZ.** Grasses of the Precambrian Shield region in eastern lowland Bolivia. II. Life-form and C_3-C_4 photosynthetic types. *Journal of Tropical Ecology* 8 (1992) 409-433.

A life-form classification from Neotropical Gramineae is proposed for 113 native species from eastern lowland Bolivia. A factor analysis was performed on a correlation matrix of 51 vegetative attributes to identify 'character suites,' which were then used as the basis for the classification. The principal types are arboreal, liana, shrub-like, forb-like, bunch grass with basal foliage, bunch grass with basal and caulescent foliage, caespitose annuals, elongate rhizomes, turf grass, stoloniferous, and decumbent (the last category is further divided into subgroups: -perennial, -indefinite, -floating aquatic, and -vine-like).

The distribution and relative abundance of three major photosynthetic categories were compared with life-form and habitat preference. Comparisons of the relative abundance of the various life-forms in a broad range of habitat types provide a descriptive assessment of the adaptive value of these characteristics.

Monda, D. P., D. L. Galat, S. E. Finger, and **M. S. KAISER.** Acute toxicity of ammonia (NH_3-N) in sewage effluent to *Chironomus riparius:* II. Using a generalized linear model. *Archives of Environmental Contamination and Toxicology* 28 (1995) 385-390.

Toxicity of un-ionized ammonia (NH_3-N) to the midge, *Chironomus riparius,* was compared using laboratory culture (well) water and sewage effluent (≈0.4 mg/L NH_3N) in two 96-h, static-renewal toxicity experiments. A generalized linear model was used for data analysis. For the first and second experiments, respectively, LC_{50} values were 9.4 mg/L (Test 1A) and 6.6 mg/L (Test 2A) for ammonia in well water, and 7.8 mg/L (Test 1B) and 4.1 mg/L (Test 2B) for ammonia in sewage effluent. Slopes of dose-response curves for Tests 1A and 2A were equal, but mortality occurred at lower NH_3-N concentrations in Test 2A (unequal intercepts). Response of *C. riparius* to NH_3 in effluent was not consistent; dose-response curves for tests 1B and 2B differed in slope and intercept. Nevertheless, *C. riparius* was more sensitive to ammonia in effluent than in well water in both experiments, indicating a synergistic effect of ammonia in sewage effluent. These results demonstrate the advantages of analyzing the organism's entire range of response, as opposed to generating LC_{50} values, which represent only one point on the dose-response curve.

KOEHLER, Kenneth J. A bootstrap analysis of temperature effects on bean leaf beetle egg hatch times. Pp. 215-229 in *Applied Statistics in Agriculture*--Proceedings of the 1994 Kansas State University Conference on Applied Statistics in Agriculture. 1995.

Limited failure population (LFP) models with Weibull hatch time distributions are used to estimate parameters of the hatch time distribution and the proportion of viable eggs at several temperatures. These estimates are used in the subsequent weighted least squares estimation of curves for predicting the proportion of viable eggs and the inverse median of the hatch time distribution as functions of temperature. Bootstrap procedures are used to estimate variances that properly account for within cohort correlations. The importance of replicating experiments for different temperature levels is illustrated.

Anderson-Hsieh, Janet, Timothy Riney, and **Kenneth KOEHLER.** Connected speech modifications in the English of Japanese ESL learners. *Issues and Developments in English and Applied Linguistics* 7 (1994) 31-52.

After a review of literature on connected speech modifications in English, this paper reports on a study of the connected speech modifications that five intermediate-proficiency and five high-proficiency Japanese ESL learners used in sentence reading and spontaneous speech tasks, and compares their performance to that of five native speakers of American English. The report concludes that language proficiency, native language, and style shifting are important factors affecting Japanese ESL learners' connected speech.

de Swart, Evalyne O. A. M., Arnold G. van der Valk, **Kenneth J. KOEHLER,** and A. Barendregt. Experimental evaluation of realized niche models for predicting responses of plant species to a change in environmental conditions. *Journal of Vegetation Science* 5 (1994) 541-552.

We estimated, using logistic regression techniques for elevation and species data collected in 1980, the realized niches of the four dominant species in an experimental marsh complex located in the Delta Marsh, Manitoba, Canada. These models were then used to predict the probability of occurrence of

these species in selected elevation ranges when water levels were raised in 1985. Failure of the niche model to provide adqquate predictions after 1985 shows that emergent species are unable to relocate at higher elevations when water levels are raised, as the theory suggests. Emergent species either (1) died out because they could not survive permanent flooding, (2) stayed where they were because they were unable to move upslope through clonal growth, or (3) became more widespread in areas dominated formerly by other species.

Detilleux, Johann C., **Kenneth J. KOEHLER**, A. E. Freeman, Marcus E. Kehrli, Jr., and David H. Kelley. Immunological parameters of periparturient Holstein cattle: Genetic variation. *Journal of Dairy Science* 77:9 (1994) 2640-2650.

The genetic variability of blood neutrophil functions, lymphocyte blastogenic responses to mitogens, serum Ig concentrations, and serum complement and conglutinin activities was investigated from 35 d prepartum to 35 d postpartum for 137 Holstein cows. Periparturient cows experience an immunosuppression of various immunologic parameters at calving. Heritability estimates obtained before, during, and after the episodes of immunosuppression reveal significant genetic variability. This suggests that immune profiles could be used for the selection of cattle with improved innate immune response without adverse effects on milk productivity.

Gleason, M. L., S. E. Taylor, **T. M. Loughin** (Kansas State University), and **K. J. KOEHLER**. Development and validation of an empirical model to estimate the duration of dew periods. *Plant Disease* 78:10 (1994) 1011-1016.

An empirical model to estimate the occurrence and duration of dew periods was developed using hourly data for relative humidity, air temperature, and wind speed from June to September 1990 for Ames, Iowa. After using a nonparametric classification procedure called CART to eliminate periods in which dew occurrence was unlikely, stepwise linear discriminant (SLD) analysis was performed with categories of measured dew (0 = no dew, 1 = dew) as the dependent variable. The resulting CART/SLD model was validated by using hourly data from 13 weather stations in Iowa, Kansas, Nebraska, and Illinois during April through October 1992. This model can be used to provide dew-period estimates for disease-warning systems that are driven by wetness duration and temperature.

Morel, Jorge G., and **Kenneth J. KOEHLER.** A one-step Gauss-Newton estimator for modelling categorical data with extraneous variation. *Applied Statistics* 44:2 (1995) 187-200.

We establish asymptotic normal properties of a one-step Gauss-Newton estimator of the parameters of any sufficiently smooth function that links the expectation of each observed vector of counts to a finite set of covariates, when the data exhibit either overdispersion or underdispersion. Various patterns of extraneous variation are accommodated by simultaneously adjusting different components of variation. Applications to logistic regression models for multicategory responses with extramultinomial variation are explicitly considered.

LAHIRI, Soumendra N. Two term Edgeworth expansion and bootstrap approximation for multivariate studentized M-estimators. *Sankhyā, A* 56:Pt. 2 (1994) 201-226.

This paper gives two-term Edgeworth expansions for normalized M-estimators under very mild conditions. With an appropriate choice of the studentizing matrix, it obtains Berry-Esseen theorems and two-term Edgeworth expansions for studentized multivariate estimators. Furthermore, it is shown that the bootstrap approximation is second order correct in the studentized case.

Conger, Rand D., Xiaojia Ge, Glen H. Elder, Jr., **Frederick O. LORENZ,** and Ronald L. Simons. Economic stress, coercive family process, and developmental problems of adolescents. *Child Development,* special issue on Children and Poverty, 65 (1994) 541-561.

We propose a model of family conflict and coercion that links economic stress in family life to adolescent symptoms of internalizing and externalizing emotions and behaviors. The 180 boys and 198 girls in the study were living in intact families in the rural Midwest, an area characterized by economic decline and uncertainty. Theoretical constructs in the model were measured using both trained observer and family member reports. These adolescents and their parents were interviewed each year for 3 years during the seventh, eighth, and ninth grades. Our theoretical model proposes that economic pressure experienced by parents increases parental dysphoria and marital conflict as well as conflicts between parents and children over money. High levels of spousal irritability, coupled with coercive exchanges over money matters, were expected to be associated with greater hostility in general by parents toward their children. These hostile/coercive exchanges were expected to increase the likelihood of adolescent emotional and bahavioral problems. Overall, results were consistent with the proposed model. Moreover, the hypothesized processes applied equally well to the behavior of mothers and fathers, as well as sons and daughters.

Ge, Xiaojia, Rand D. Conger, **Frederick O. LORENZ,** and Ronald L. Simons. Parents' stressful life events and adolescent depressed mood. *Journal of Health and Social Behavior* 35:1 (1994) 28-44.

This study of 451 families examines a mediational model of the relationship between the stressful life events experienced by parents and adolescent depressed mood. This model overcomes two limitations

in previous research on the relationship between parents' stressful events and adolescent depressed mood by (1) examining a mediating process involving parental mood and parenting behavior, and (2) using multiple informants to assess the theoretical constructs. Findings indicate that stressful life events experienced by parents are first related to parents' depressed mood which operates to disrupt skillful parenting practices. The disrupted parenting practices in turn place adolescents at increased risk for developing depressive symptoms. The results show that inclusion of these mediating processes represents a significant improvement over the bivariate model and that the hypothesized mediational model generalizes to four parent-adolescent dyads: fathers and sons, fathers and daughters, mothers and sons, and mothers and daughters. Moreover, parents' stressful life events are related directly to adolescent boys' depressed mood only when parents' reports are included in both theoretical constructs. When parents' reports are removed as an indicator for the adolescent depressed mood construct, the effect of parental stress on adolescent depressed mood are largely accounted for by stress-related parental depressed mood and harsh/inconsistent parenting.

Ge, Xiaojia, **Frederick O. LORENZ,** Rand D. Conger, Glen H. Elder, Jr., and Ronald L. Simons. Trajectories of stressful life events and depressive symptoms during adolescence. *Developmental Psychology* 30:4 (1994) 467-484.

This four-year longitudinal study of 191 girls and 185 boys living in intact families in the rural Midwest examines the trajectories of life events and depressive symptoms in adolescence. The trajectories of depressive symptoms differ between boys and girls. Compared with boys, girls experienced a greater number of depressive symptoms after age 13. Changes in uncontrollable events are associated with the increases in girls' but not boys' depressive symptoms. Latent growth curve analyses show that, over four years, (a) depressive symptoms for girls changed according to a curvilinear pattern that is associated with changes in stressful events; (b) the level of depressive symptoms is related to the level of life events for both boys and girls; and (c) change in depressive symptoms is significantly related to change in stressful events only for girls. Girls living with less supportive mothers were more vulnerable to negative life events.

Wickrama, K. A. S., R. D. Conger, and **Frederick O. LORENZ.** Work, marriage, life style, and changes in men's physical health. *Journal of Behavioral Medicine* 18 (1995) 97-111.

Using three waves of data for 320 men living in the rural Midwest, this study tested a model that proposed independent effects of work conditions and marital experiences on change in physical health through health behaviors. The findings support the hypothesized model. Both control over work and positive marital interactions reduced the probability of a risky lifestyle in terms of health related behaviors after controlling for family economic status. Risky lifestyle, in turn, was related to poorer self- and spouse-reported health after controlling for previous health status and family income. The findings underscore the importance of specific work and marital processes for men's physical health.

Nobre, Flavio F., and **Marcia M. A. de Macedo.** Feasibility of contour mapping epidemiological data with missing values. *Statistics in Medicine* 14:5-7 (1995) 605-613.

Data of epidemiologic interest often occur as spatial information during each of several time periods. In most cases data are available from a set of regions or localities that can be viewed as points in a plane. Although contour mapping is useful for displaying these data, the lack of data for all data points in a region may lead to erroneous interpretation. In this paper, simulation is used to investigate the impact of missing data points for contour mapping when two distinct simulated spatial-time distributions for epidemiologic variables are used. A model for the occurrence of malaria in localities randomly distributed in one region is chosen as the prototype for data generation.

MEEKER, William Q., and Luis A. Escobar. Maximum likelihood methods for fitting parametric statistical methods. Chapter 8 (pp. 211-244) in *Statistical Methods for Physical Science,* edited by John L. Stanford and Stephen B. Vardeman. San Diego: Academic Press, Inc. 1994.

The chapter describes and illustrates the use of the versatile method of maximum likelihood for fitting statistical models to data. Applications to problems involving censored and truncated data are indicated. The use of likelihood-based and normal-approximation confidence intervals is compared. Potential pitfalls and methods of avoiding them are also described. Particular applications to problems in physics are used to illustrate the methods.

MEEKER, William Q., and Luis A. Escobar. Teaching about approximate confidence regions based on maximum likelihood estimation. *The American Statistician* 49:1 (1995) 48-53.

Maximum likelihood provides a powerful and extremely general method for making inferences over a wide range of data/model combinations. The likelihood function and likelihood ratios have clear intuitive meanings that make it easy for students to grasp the important concepts. Modern computing technology has made it possible to use these methods over a wide range of practical applications. However, many mathematical statistics text books, particularly those at the senior/masters level, do not give this important topic coverage commensurate with its place in the world of modern applications. Similarly,

in nonlinear estimation problems, standard practice (as reflected by procedures available in the popular commercial statistical packages) has been slow to recognize the advantages of likelihood-based confidence regions/intervals over the commonly used "normal-theory" regions/intervals based on the asymptotic distribution of the "Wald statistic." In this note we outline our approach for presenting, to students, confidence regions/intervals based on ML estimation.

MEEKER, William Q., and Michael Hamada. Statistical tools for the rapid development & evaluation of high-reliability products. *IEEE Transactions on Reliability* R-44 (1995) 187-198.

This paper uses a conceptual degradation-based reliability model to describe the role and need for integration of reliability data sources. These sources include accelerated degradation testing, accelerated life testing (for materials and components), accelerated multifactor robust-design experiments and overstress prototype testing (for subsystems and systems), and the use of field data (especially early-production) to produce a robust, high-reliability product and to provide a process for continuing improvement of reliability of existing and future products. Manufacturers need to develop economical and timely methods of obtaining, at each step of the product design and development process, the information needed to meet overall reliability goals. We emphasize the need for intensive and effective upstream testing of product materials, components, and design concepts.

MEEKER, William Q., and Michael J. LuValle. An accelerated life test model based on reliability kinetics. *Technometrics* 37:2 (1995) 133-146.

Inferences from accelerated life tests typically involve extrapolation in stress. For this reason, it is important to use statistical models that have their basis in the physics and chemistry of the important failure mechanism(s). The standard accelerated failure time regression models (based, for example, on Weibull or lognormal approximations to the failure time distribution at a given stress and linear scaling of time) are adequate for modeling some simple chemical processes that lead to failure. In this article we present the results from a humidity accelerated life test of conductive anodic filament failures on printed circuit boards. Standard accelerated life test models are clearly inadequate for these data. Using an approximate chemical kinetic model of the failure process as a basis, we derive an alternative, more general, class of accelerated life test models. We illustrate the use of likelihood based methods to estimate the model parameters. The new models fit the data better than the traditional accelerated life test models and provide extrapolations that are more consistent with actual field data.

Escobar, Luis A., and **William Q. MEEKER, Jr.** Algorithm AS 292: Fisher information matrix for the extreme value, normal, and logistic distributions and censored data. *Applied Statistics (Journal of the Royal Statistical Society* Series C) 43:3 (1994) 533-540.

This paper presents an algorithm that can be used to compute the Fisher information matrix for censored data from the following location--scale distributions: smallest extreme value (SEV), largest extreme value (LEV), normal, and logistic. Applications for the algorithm include planning studies with responses that may be censored and extend to the related Weibull, lognormal, and loglogistic distributions.

POLLAK, Edward. Some effects of selection when there is partial full-sib mating. *Genetics* 139:1 (1995) 439-444.

If there is selection only for viability between zygote formation and adulthood, the frequency of a particular allele changes between these two stages of life. With complete random mating this is all that happens, but if there is a positive probability that full sibs mate, there is an extra change between adulthood and the appearance of zygotes in the next generation. This occurs because there are then correlated frequencies of the alleles carried by the mates. An expression for the change in the frequency of an allele, which incorporates these two effects, is derived, and the result is found to be consistent with earlier work by the author on the probability of survival of a rare allele in a large population. The result is inconsistent with the usual expression for the change in frequency of an allele when there is partial inbreeding because that expression does not incorporate the second change in frequency within one generation.

Rathbun, Stephen L. (University of Georgia), and **Noel CRESSIE.** A space-time survival point process for a longleaf pine forest in southern Georgia. *Journal of the American Statistical Association* 89:428 (1994) 1164-1174.

A marked spatial point pattern of trees and their diameters is the result of a dynamic biological process that takes place over time as well as space. Such patterns can be modeled as realizations of marked space-time survival point processes, where trees are born at some random location and time and then live, grow, and produce offspring in a random fashion. A model for a marked space-time survival point process is fit to data from a longleaf pine *(Pinus palustris)* forest in southern Georgia. The space-time survival point process is divided into three components: a birth process, a growth process, and a survival process. Each of the component processes is analyzed individually, from which conclusions regarding the dynamic ecological processes can be made. By using this reductionist approach, questions concerning each individual process can be addressed that might not have been answerable otherwise.

ROBERTS, Carl W., and Danny R. Hoyt. Models and trends of log-linear association: Applications to mobility tables for U.S. white males, 1952 to 1984. *Quality & Quantity* 29:1 (1995) 17-37.

Log-linear models afford a wide range of tests regarding specific aspects of the association between two ordinal-level variables with identical attributes. This range is considerably broadened when orthogonal contrasts are used to trace changes in these aspects over time. This paper provides descriptions and graphic illustrations of six common log-linear models' applications to mobility data on U.S. white males. The models are then expanded to examine temporal variations in aspects of the mobility regime captured by the respective models. The analysis shows a significant increase over the period of study in the odds that white males from blue collar backgrounds attain higher occupational statuses. Moreover, the findings indicate that blue collar workers are more likely to be drawn from lower status origins during years of economic prosperity, and from higher status origins at times of economic dearth.

Sofekun, O. A., **D. K. ROLLINS,** and L. K. Doraiswamy. A random particle model for catalyst dilution. *Chemical Engineering Science* 49:160 (1994) 2611-2619.

The effect of mixing catalyst and inert particles on conversion has been studied. It has been shown that the dilution criterion proposed by van den Bleek et al. is not valid for all reaction orders. A new model (random particle model) that stochastically models a reactor consisting of a random mixture of catalyst and inert particles is proposed. Based on this model, dilution equations have been developed to enable an experimenter to estimate a priori the magnitude of the effect of dilution.

Campbell, Sharyn A., Anant P. Godbole, and **Stephanie Schaller** (Blue Cross and Blue Shield of Kansas City). Discriminating between sequences of Bernoulli and Markov-Bernoulli trials. *Communications in Statistics, Theory and Methods* 23:10 (1994) 2787-2814.

Given $p \in (0,1)$ we consider a sequence $\{X_j\}_{j=1}^{n}$ of (0,1)-valued random variables (a) that have an i.i.d. Bernoulli (p) distribution or (b) that evolve according to a stationary ergodic 2-state Markov chain with transition probabilities given by $P(X_{j+1} = 1 \mid X_j = 1) = \alpha$, $P(X_{j+1} = 1 \mid X_j = 0) = \beta$, and with stationary distribution $P(X_j = 1) = p = \beta/(1-\alpha+\beta)$. Lehmann (1986) proved that the conditional run test possesses certain optimality properties if used as a criterion to discriminate between the above two possibilities; we show that the same is true of the unconditional analog of the run test if p is small and n is not excessively large. The rather complicated distribution of R, the total number of runs of successes or failures, is approximated (in the total variation sense) by an appropriately defined Poisson distribution on the odd integers, with the approximation performing well for low values of p--independently of the value of n. The test based on the above approximation is shown to be "almost" consistent. Our procedure is generalized to test the hypothesis of independence against the alternative of second-order Markov dependence; the case of r^{th}-order Markov dependence ($r \geq 3$) can be handled in much the same way.

SHELLEY, Mack C. II. Conservatism. Pp. 528-530 in *The Encyclopedia of the United States Congress,* edited by Donald C. Bacon, Roger H. Davidson, and Morton Keller. New York: Simon and Schuster. 1995.

This invited essay appraises the role of conservative political thought and conservative political movements in the workings of the United States Congress.

SHELLEY, Mack C. II. Conservative coalition. Pp. 530-532 in *The Encyclopedia of the United States Congress,* edited by Donald C. Bacon, Roger H. Davidson, and Morton Keller. New York: Simon and Schuster. 1995.

This invited essay evaluates the emergence in the 1930s of congressional voting behavior linking the interests of Republicans with conservative (mostly southern) Democrats, the issue positions taken by this voting alliance, and recent transformations of this cross-party ideological alliance that now occur substantially less frequently.

Stone, Janis, Steve Padgitt, Wendy Wintersteen, **Mack Shelley,** and Sandra Chisholm. Iowa greenhouse applicators' perceptions and use of personal protective equipment. *Journal of Environmental Health* 57:3 (1994) 16-22.

A mail survey of Iowa greenhouse pesticide applicators was conducted in 1992 to establish benchmark data concerning use of personal protective equipment (PPE), safety attitudes, and experience with pesticide-related illness symptoms before the implementation of the Worker Protection Standard for Agricultural Pesticides. A 72% response rate provided 185 observations revealing that 79% were employees of firms, and the remaining 21% self-employed. Hypotheses of difference in use of PPE between the self-employed and employees of firms were not confirmed except with relation to use of regular work gloves, disposable coveralls, and boots. Applicators' clothing was reported to meet pesticide label requirements. Few applicators reported acute or chronic health effects associated with pesticide use, and no differences were found between the employees and the self-employed. Most (72%) employees decided when to replace their uniforms. This study demonstrated that greenhouse applicators want further information about PPE and need education about its laundering and storage.

Stone, J., S. Padgitt, W. Wintersteen, and **M. SHELLEY.** Farm show participants' perceptions of chemically resistant gloves. *Annals of Agricultural and Environmental Medicine* 1:2 (1994) 230.

The two objectives of this study were to help farm show participants improve their understanding of chemically resistant gloves to minimize pesticide exposure, and to gather their perceptions about neoprene, barrier laminate, and nitrile gloves for changing spray nozzle tips used in pesticide spraying operations. An educational exhibit at a three-day farm show introduced attendees to three types of gloves suitable for use with pesticides. Their hands were measured; then each received neoprene, barrier laminate, and nitrile gloves to change spray nozzle tips. Afterward, they completed a questionnaire giving their perceptions of chemical resistance, grip, fit, ease of donning and doffing, protection, and comfort. No pesticides were used. On the last day the barrier laminate was used as a liner, rather than by itself. On the first day, 602 participants completed the 5-minute activity and survey; on the second day, 526; and on the third day, 395. Each day less than half (40%, 40%, and 35%) were certified agricultural pesticide applicators. Between 11% and 15% used gloves for garden and ornamentals; between 9% and 14%, for pesticides around the house. About 20% never used pesticides, which was curious, given the exhibit's purpose; a few asked about gloves for finishing furniture. Each day, neoprene was most often judged to give the most secure grip. The barrier laminate was judged as most protective more often when used as a liner.

STEPHENSON, Bob. How to choose a graduate program in statistics: The COOL schools. *STATS* no. 12 (1994) 23-26.

Advice is given on how to find the school with a graduate program in statistics that offers the chance of optimal learning.

Bittle, Robert R., **W. Robert STEPHENSON,** and Michael B. Pate. An experimental evaluation of capillary tube-suction line heat exchanger performance with R-152a. *ASHRAE [American Society of Heating, Refrigerating and Air-Conditioning Engineers] Transactions* 1995 101:Pt 1 (1995) #3844, 1-12.

Capillary tube-suction line heat exchanger performance correlations predicting mass flow rate and effective subcooling have been generated for refrigerant R-152a for application to household refrigerators. These prediction correlations were developed from experimental data taken over a range of applicable operating boundary conditions and heat exchanger geometries. Due to the large number of variables that could potentially influence heat exchanger performance, statistical methods were employed in designing the test plan and in reducing the data. For these experiments, the measured mass flow rate ranged between 6.5 and 15.5 lbm/h (2.95 and 7.03 kg/h), and the effective subcooling level ranged between 25°F and 50°F (13.9°C and 27.8°C). A comparison of the R-152a results to experimental data for R-12 was also made.

Bittle, Robert R., **W. Robert STEPHENSON,** and Michael B. Pate. An evaluation of the ASHRAE method for predicting capillary tube-suction line heat exchanger performance. *ASHRAE Transactions* 1995 101:Pt 2 (1995) #3918, 1-9.

The ASHRAE method of predicting capillary tube performance, including the effect of suction line heat exchange, was experimentally evaluated for R-12. Capillary tube-suction line heat exchangers are commonly used in household refrigerator application. For this study, performance test data were taken over a range of operating conditions and heat exchanger geometries applicable to household refrigerators. Measured mass flow rates and calculated effective subcooling values were compared to predictions using the appropriate ASHRAE design charts. Most mass flow rate data points fell within 5% of prediction, and all fell within 10% of prediction. Effective subcooling data were within 3°F (1.7°C) of prediction.

STERN, Hal S. A Brownian motion model for the progress of sports scores. *Journal of the American Statistical Association* 89:427 (1994) 1128-1134.

The difference between the home and visiting teams' scores in a sports contest is modeled as a Brownian motion process with a drift in favor of the home team. This model is used to obtain a simple relationship between the home team's lead (or deficit) at a given time and the probability of victory for the home team. The model provides a good fit to the results of 493 professional basketball games from the 1991-92 National Basketball Association (NBA) season. The model is also applied to the progress of baseball scores, a process that would appear to be too discrete to be adequately modeled by the Brownian motion process. Surprisingly, the Brownian motion model matches previous calculations for baseball reasonably well.

STERN, H. S. Estimating the probabilities of the outcomes of a horse race (alternatives to the Harville formulas). Pp. 225-235 in *Efficiency of Racetrack Betting Markets,* edited by D. B. Hausch, V. S. Y. Lo, and W. T. Ziemba. San Diego, California: Academic Press. 1994.

Studies of the efficiency of the racetrack betting market have concluded that there are systematic biases in the win odds available at the track. However, these biases are insufficient to create profitable strategies using only win bets, except in rare in-

stances. To examine the return of place and show bets, estimates for the probabilities of the outcomes of a race are required. Opportunities for profitable place and show betting exist; however, the Harville formulas often used to estimate the probabilities of race outcomes have certain limitations. A natural family of alternatives to the Harville model is described here. The formulas resulting from the alternative models give up the simplicity of the Harville formulas in return for slightly more accurate estimates.

STERN, H. S., D. Arcus, J. Kagan, D. B. Rubin, and N. Snidman. Statistical choices in infant temperament research. *Behaviormetrika* 21:1(1994) 1-17.

Temperamental characteristics can be conceptualized as either continuous dimensions or qualitative categories. The distinction concerns the underlying temperamental characteristics rather than the measured variables, which can usually be recorded as either continuous or categorical variables. A finite mixture model captures the categorical view, and we apply such a model here to two sets of longitudinal observations of infants and young children. A measure of predictive efficacy is described for comparing the mixture model with competing models, principally a linear regression analysis. The mixture model performs mildly better than the linear regression model with respect to this measure of fit.

Rubin, D. B., and **H. S. STERN.** Testing in latent class models using a posterior predictive check distribution. Pp. 420-438 in *Latent Variables Analysis: Applications for Developmental Research,* edited by A. von Eye and C. C. Clogg. Thousand Oaks, California: Sage Publications. 1994.

Goodness of fit measures and significance tests based on the likelihood ratio statistic are frequently used to choose between competing models in statistical problems. It is well known, however, that such tests for determining the number of classes in a latent class model do not have the usual chi-squared reference distributions. A procedure that uses the posterior predictive distribution of the likelihood ratio statistic as a reference distribution is described for testing in this situation. The posterior predictive distribution of the likelihood ratio statistic for comparing two latent class models is used to estimate the number of qualitatively different groups in a study of infant temperaments.

STRAHAN, R. F., and A. E. Kelly. Showing clients what their profiles mean. *Journal of Counseling and Development* 72 (1994) 329-331.

This article suggests that counselors might profitably investigate new graphic approaches to showing clients what their multivariate profiles mean. An illustration is given in terms of Holland's RIASEC (Realistic, Artistic, Social, Enterprising, Conventional) model of vocational interests.

STUFKEN, John. Combinatorial and statistical aspects of sampling plans to avoid the selection of adjacent units. *Journal of Combinatorics, Information and System Sciences* 18 (1993) 81-92. (Special issue in honor of C. R. Rao.)

We study the existence, construction, and implementation of balanced sampling plans to avoid the selection of adjacent units. A necessary condition for the existence of such plans is given, while iterative and direct methods of construction, using ideas analogous to symmetrically repeated differences, are discussed. A discussion on how those plans can be used to control second-order inclusion probabilities is provided; the paper concludes with methods to implement balanced sampling plans to avoid the selection of adjacent units. The results extend and generalize results in Hedayat, Rao, and Stufken [*Journal of Statistical Planning and Inference* 19 (1988) 159-170] on sampling plans that exclude the selection of contiguous units.

Hedayat, A., **John STUFKEN,** and W. G. Zhang. Virtually balanced incomplete block designs for $V = 22, k = 8$, and $\lambda = 4$. *Journal of Combinatorial Designs* 3:3 (1995) 195-201.

When basic necessary conditions for the existence of a balanced incomplete block design are satisfied, the design may still not exist or it may not be known whether it exists. The parameter set $(V, k, \lambda) = (22, 8, 4)$ is the smallest (in terms of V and b) for which the existence of a balanced incomplete block design is not known. We study some virtualy balanced incomplete block designs for this parameter set. Virtually balanced incomplete block designs are efficient alternatives to balanced incomplete block designs, and offer challenging cominatorial questions.

Kim, Kwanghun, and **John STUFKEN.** On optimal block designs for comparing a standard treatment to test treatments. *Utilitas Mathematica* 47 (1995) 211-224.

We consider the problem of comparing a standard treatment to test treatments in incomplete blocks. We seek designs that maximize the coverage probability $P\{\tau_0 - \tau_i \geq \hat{t}_0 - \hat{t}_i - d, i = 1,...,V\}$, where V is the number of test treatments, d is a positive constant, $\tau_0 - \tau_i$ is the difference in effects between the standard treatment and the i^{th} test treatment, and $\hat{t}_0 - \hat{t}_i$ is the best linear unbiased estimator of $\tau_0 - \tau_i$. Computational results, assuming a multivariate normal distribution for the vector of observations, are presented for $V = 4$, blocks of size 3, and various values of the number of blocks b. Optimal designs are identified within the class of group divisible treatment designs for $b \leq 25$ and are compared to A-optimal designs in the same class of designs.

Symanzik, Jürgen, James Majure, Dianne COOK, and **Noel CRESSIE.** Dynamic graphics in a GIS: A link between ARC/INFO™ and XGobi. *Computing Science and Statistics* 26 (1994) 431-435.

This paper describes a link between a Geographical Information System (GIS), ARC/INFO™, and an interactive dynamic graphics program, XGobi. GISs provide a user with a standard and convenient software for spatial geographical data. In particular, the GIS ARC/INFO is a combination of two systems: ARC maintains the spatial information of map features and provides tools for spatial analyses while INFO maintains the thematic or attribute information associated with the map features. XGobi is an interactive dynamic graphics program for data visualization in the X Window System™. It is designed for the exploration of multivariate data, primarily by manipulating and displaying scatterplots in arbitrary dimensions.

The motivation for the work is to link the dynamic, interactive strengths of XGobi for visualizing high-dimensional data with the exhaustive map handling tools of ARC/INFO, specifically to explore spatial data. This paper presents information about the technical realization of the link between ARC/INFO and XGobi as well as an introductory example of its use.

Wang, Morgan C. (University of Central Florida), and **William J. KENNEDY.** A self-validating numerical method for computation of central and non-central F probabilities and percentiles. *Statistics and Computing* 5 (1995) 155-163.

A self-validating numerical method based on interval analysis for the computation of central and non-central F probabilities and percentiles is reported. The major advantage of this approach is that there are guaranteed error bounds associated with the computed values (or intervals), i.e., the computed values satisfy the user-specified accuracy requirements. The methodology reported in this paper can be adapted to approximate the probabilities and percentiles for other commonly used distribution functions.

Wang, Morgan C. (University of Central Florida), and **William J. KENNEDY.** Self-validating computations of probabilities for selected central and noncentral univariate probability functions. *Journal of the American Statistical Association* 89:427 (1994) 878-887.

Self-validating computation based on interval arithmetic can produce computed values with a guaranteed error bound. Such methods are especially useful whenever the computed results must satisfy given accuracy requirements. This article reports methods for obtaining self-validating results when computing probabilities and percentiles of univariate continuous distributions. Probability functions dealt with explicitly in the article are normal, incomplete gamma, incomplete beta, and noncentral chi-squared.

Book Reviews, Etcetera

Swayne, Deborah F., **Dianne COOK,** and Andreas Buja. XGobi: Software for exploratory graphical analysis of high-dimensional data using scatterplot manipulation [1/Nov94 release]. Available publicly by anonymous ftp from lib.stat.cmu.edu.

CRESSIE, N. *Optimally Sequentially Planned Decision Procedures,* by N. Schmitz (with the assistance of G. Duscha, J. Lubbert, and T. Meyerthole). *Lecture Notes in Statistics,* vol. 79, Springer-Verlag, 1993, xii, 207 pp. Reviewed in *Metrika* 42:2 (1995) 141-143.

STUFKEN, John. *Taguchi Methods: A Hands-On Approach,* by Glen Stuart Peace. Reading, MA: Addison-Wesley, 1992, xxvi + 522 pp. Reviewed in *Technometrics* 36:1 (1994) 121-122.

Theses

Atuncar, Gregorio Saravia. Statistical inference for real-valued Markov chains and some applications. Ph.D. thesis, Iowa State University Library. December 1994.

The purpose of this thesis is to study, by using techniques of regenerative processes, the problem of estimation of the stationary density and the transition density of a real-valued recurrent Markov chain and the sojourn time distribution of semi-Markov processes when the imbedded Markov chain is real-valued and recurrent. We propose kernel estimators for all these problems.

Using the regeneration technique of Athreya and Ney and Nummelin, we are able to significantly reduce the strong hypotheses on the Markov chain such as Doeblin recurrence, stationarity, and mixing that were imposed in all the earlier works.

In this thesis, we assume that the Markov chain satisfies a much weaker condition known as Harris recurrence. Our results hold for any initial distribution, and we assume no mixing.

In the first chapter we present basic definitions and review some known results necessary to our purpose. In the second chapter, by using techniques of regenerative processes, we prove consistency and asymptotic normality for a simple kernel estimator of the stationary density and of the transition density. In the third chapter, the results of chapter 2 are extended to a class of kernels satisfying some conditions. In the fourth chapter we present some results on the estimation of sojourn time distribution for semi-Markov processes. In chapters 2, 3, and 4 we also present some results from a simulation study.

Dunnigan, Gerri Marie. Sampling strategies for an optimal control problem. Ph.D. thesis, Iowa State University Library. August 1994.

Sampling and adjustment strategies for a standard optimal control problem incorporating a nonrandom drift per time period are considered.

The cost associated with an l-period problem in which a fixed nonzero, potentially non-integer sample size is used at each time period and the adjustment made at each time period is the sum of a fixed proportion, α, $0 < \alpha \leq 1$, of the perceived deviation from target and a fixed proportion, β, $0 < \beta \leq 1$, of the nonrandom drift is derived. The optimal sample size to use in the "infinite horizon" case is defined to be the sample size that minimizes the limiting average cost function. The optimal adjustment strategy is defined similarly in terms of the values of α and β that minimize this function.

Dynamic programming is used to determine the potentially non-integer sample sizes and adjustments that will minimize the cost function associated with the l-period problem. The limiting behavior of these sample sizes and adjustments is used to define the optimal sampling and adjustment strategies for the "infinite horizon" case.

The penalty associated with a restriction to integer sample sizes is discussed, and alternative sampling strategies using integer sample sizes are proposed for several cases where the penalty is high.

Jun-ichiro Fukuchi. Bootstrapping extremes of random variables. Ph.D. thesis, Iowa State University Library. December 1994.

Bootstrap, introduced by Efron (1979), is a general method of estimating the distribution G_n of a function $R(\mathbf{X}_n,F)$ of the data $\mathbf{X}_n = \{X_1,X_2,...,X_n\}$ and the underlying distribution F. Bootstrap is said to be consistent if the difference between G_n and the bootstrap distribution of $R(\mathbf{X}_n,F)$ converges to zero in probability (or with probability 1) as the sample size n and resample size m tend to infinity. This thesis studies the consistency of Efron's bootstrap and the moving block bootstrap (MBB) for extremes of both independent and dependent random variables.

After an introduction and a literature review in Chapter 1, the case of independently and identically distributed random variables is studied in Chapter 2. It is shown that Efron's bootstrap is consistent if and only if $mn^{-1} \rightarrow 0$.

In Chapter 3, the case of a stationary sequence of random variables is studied. It is shown that both Efron's bootstrap and the MBB are consistent if $mn^{-1} \rightarrow 0$ and conditions $D(u_n)$ and $D'(u_n)$ of Leadbetter (1974) hold. It is also shown that the MBB is consistent even without $D'(u_n)$, and thus it works for a wider class of stationary processes than Efron's bootstrap does.

In Chapter 4, we propose a method of constructing confidence intervals for the lower endpoint of a cdf by applying the smoothed bootstrap to Weissman's (1981) statistics. The method is extended to the case of the type II censoring. Some Monte Carlo simulation results are included.

Huang, Mu-Yeh. Design of developmental test programs for one-shot systems with two-state reliability. Ph.D. thesis, Iowa State University Library. May 1995.

This dissertation considers efficient developmental testing for one-shot systems (for example, missiles) that are destroyed in testing or first normal use, where there is the possibility of "reliability growth" of the basic system design as a result of redesigns following failed developmental tests. We consider situations where the cost of redesign is negligible and there is a fixed procurement budget covering both system development and purchase, and each developmental test produces either a binary (success-failure) or a continuous outcome. The analysis offered here is intended as an answer to the question "How much testing is enough?" posed by Seglie (1992) in the context of the procurement of military weapons systems. For a particular two-state model of system reliability, dynamic programming is used to identify testing plans/stopping rules that are optimal in the sense of maximizing the expected number of effective systems (of the final design) that can be purchased with the remaining budget when developmental testing is terminated. Several reasonable and easily implemented suboptimal rules are also considered, and their performances are compared to that of the optimal rule for a variety of combinations of model parameters.

Kang, Shin-Soo. Life-table analysis for correlated response times. Ph.D. thesis, Iowa State University Library. December 1994.

Survival data consisting of independent groups of correlated response times arise from a variety of situations, such as event times collected from husband and wife pairs, siblings, litter mates, distinct components of a machine, or repeated measurements on each individual subject. In this dissertation, we restrict our attention to the situations where response times within groups are not distinguishable, and the marginal survival distributions are the same for all individuals within any group. Furthermore, the data are interval censored, so exact event times are not observed. Only the number of failures and the number of censored individuals are observed within a finite set of time intervals. We are interested in estimating marginal survival probabilities and their variances and covariances from the observed counts. In this situation, distribution-free methods are developed for the situations involving independent groups of correlated response times. This will be referred to as "life-table analysis for correlated response times."

In Chapter 2, the product limit (PL) and actuarial life-table (AL) estimates of marginal survival probabilities are defined, and a modification of the Greenwood formula is derived for their variances. Large

sample properties of the PL and AL estimates are also examined. In Chapter 3, a nonparametric maximum likelihood estimate is developed under the same assumptions used to derive the PL estimate, and it is used to check the relative efficiency of the PL estimate. Results of a simulation study of small sample properties of the PL estimate, the AL estimate, and the MLE for marginal survival probabilities are reported in Chapter 4. The effects of the strength of correlation between responses, the level of censoring, the number of time intervals, and sample size are examined. Estimates of variances from the Greenwood formula and the modified Greenwood formulas are compared. Differences between the modified and unmodified Greenwood formulas are most greatly affected by the levels of correlation between responses. In Chapter 5, we review tests for the equality of two survival distributions given independent and univariate event times, and develop chi-square tests for testing equality of two survival distributions for the situation involving correlated response times where the entire groups of correlated responses are randomly assigned to treatments. Then, different treatments are applied to different independent sets of subjects. The use of these estimation and testing procedures is illustrated with an analysis of failure times for angioplasty procedures where more than one procedure is performed on some patients.

Ko, Seoung-gon Ko. Optimal flexible two-stage plans. Ph.D. thesis, Iowa State University Library. August 1994.

This research aims to enhance the efficiency of two-stage plans, by allowing second-stage sample size and critical region to depend on first-stage evidence. This aim is implemented by certain optimizations. These optimizations are done under two types of formulation, of which one is related to the group-sequential point of view. By proper choice of type of optimization, the experimenter can, to some extent, pre-determine the behavior of second-stage sample size as a function of first-stage outcome. Both formulations show a modest reduction in overall sampling effort, as compared with matched optimal standard two-stage plans.

When the two types of formulation are merged, there results a methodology capable of easily constructing whole families of approximately optimal binomial plans, based on a single Wiener optimization.

Kuiper, Shonda Roelfs. Gross error detection when constraints are bilinear. M.S. thesis, Iowa State University Library. December 1994.

In his Ph.D. dissertation, D. K. Rollins developed a technique to obtain unbiased estimates for true values of process variables when multiple gross errors are present, called the unbiased estimation technique (UBET). In its original development the UBET only addressed linear constraints. However, bilinear constraints are also common in chemical processes. In this thesis various ways to preserve features of the UBET when constraints are bilinear are discussed.

From a statistics viewpoint the basic problem with bilinear constraints is that the constraint equations appear as sums of products of random variables. These do not have normal distributions when individual measurements are normally distributed. The problem was confronted by using the distribution for the product of two normal random variables. The application of this distribution was examined in terms of test statistics, power functions, and confidence intervals. In addition, the asymptotically normal properties of this distribution were exploited and some of the original methods of the UBET were applied. Furthermore, two other ways to apply normal theory were discussed: (1) linearizing constraints using a Taylor Series expansion and (2) estimating flow variables using mass balances and assuming that these estimates are without error in the energy balance constraints. Thus, under this assumption the energy balance constraints were linear with only the temperatures assumed to be random. In the thesis, the results of these approaches using simulated data were compared.

Majure, James Johnston. A spatio-temporal statistical model of pollutant concentrations in surface waters. M.S. thesis, Iowa State University Library. May 1995.

This thesis describes the construction of a spatio-temporal model to predict the concentrations of nitrates in the surface waters of the Upper North Bosque River watershed. The area is characterized by a large dairy industry that is suspected to be the source of increased nutrient levels in the surface-water system. The general statistical model used to describe the contaminant concentrations is written as:

$$Z(\underline{s},t) = \mu(\underline{s},t) + \delta(\underline{s},t),$$

where $Z(\underline{s},t)$ is the observed contaminant concentration (or perhaps some suitable transformation such as its logarithm) at stream location $\underline{s}$ and time t, $\mu(\underline{s},t)$ is the deterministic large-scale variation, and $\delta(\underline{s},t)$ is the stochastic small-scale variation.

The large-scale term, $\mu(\underline{s},t)$, is modeled as a linear combination of variables that describe the potential sources of the contaminants and the landscape characteristics that affect the transport of contaminants from their source to the watershed. Because the contaminants are in a surface-water system, all variables for a sampling site are calculated within the area that drains to the site, using a geographic information system.

The small-scale term, $\delta(\underline{s},t)$, which is estimated by the residuals of the data from the large-scale term, is assumed to be intrinsically stationary. After a valid variogram model is fit, spatial prediction is

conducted using the theory of best linear unbiased prediction. The predictions are added back to the large-scale variation and consequently are used to predict contaminant concentrations for any point on the stream network at any time. The fitted model was validated using cross-validation techniques.

Rana, Abdul Wajid. Variance estimation in repeated samples of size one. Ph.D. thesis, Iowa State University Library. December 1994.

In this study, the estimation of variance in repeated samples of size one from different populations ordered in time, when the population means are potentially changing, has been explored. Five models covering a variety of circumstances were considered. Method of moments, maximum likelihood, and Bayesian techniques were used to derive estimators. Some estimators robust to unknown changes in population means were identified.

Shin, Chungyeol. On the multivariate random and mixed coefficient analysis. Ph.D. thesis, Iowa State University Library. May 1995.

The random coefficient and mixed effect model analyses are widely used as statistical techniques for repeated-measures design, panel data, and longitudinal studies. The interpretation of the analyses is based either on the traditional fixed-random effects approach or on the empirical Bayes approach. A general multi-response mixed coefficient model and its various special cases are considered in this dissertation.

The existing statistical procedures for some special cases have some shortcomings. First, the estimation of the random coefficient covariance matrix does not take into account the complicated nature of the parameter space. This can be a serious practical problem when the fully random coefficient is assumed but its actual variability is limited, and when the resulting estimate is used for further analysis. An estimated covariance matrix needs to be nonnegative definite, and may possibly be singular of any rank. New maximum likelihood estimation and restricted maximum likelihood estimation algorithms with proper justification and with the parameter space consideration are proposed for various special cases of the general multivariate mixed coefficient model. Alternative non-iterative estimation methods are also proposed and discussed. All the estimation methods developed here produce a nonnegative definite estimated covariance matrix of any rank, and provide some insight into possible structure of the random coefficients.

The second problem in the random or mixed coefficient analysis, which has not been studied satisfactorily, is that of determining coefficients or functions of coefficients to be treated as constant instead of random. For this problem, several new test procedures are introduced and their properties are compared. The idea here is the development of simple and useful test procedures that can be utilized in the model building stage of the analysis.

Vidyashankar, Anand V. Large deviation results for branching processes in fixed and random environments. Ph.D. thesis, Iowa State University Library. August 1994.

The large deviation results proved by Krishna Athreya for the single type case are extended to the multitype case in fixed environments, the single type case in random environments, and branching random walks.

Wang, Ouhong. Application of numerical interval analysis for statistical computing in a massively parallel computing environment. Ph.D. thesis, Iowa State University Library. December 1994.

Interval analysis is a relatively new method of performing scientific computation. It uses intervals as basic computing elements and has a set of arithmetic that is different from the traditional one. The shortcomings of conventional computation that motivate the development of interval analysis are the inaccuracy caused by the finite number systems of computers and the uncertainty of various approximations. Using interval analysis we can manage to have the theoretically true results after each computing step contained in the computed interval. Although the exact location of the true value is not determined (sometimes it is even not possible), we know a pair of guaranteed lower and upper bounds of it. Using various techniques we can shrink the length of the interval and hence obtain highly accurate results.

This dissertation investigates the use of interval analysis in statistical computing. We focus on two major applications: bounding computational errors and global optimization. Bounding computational errors is demonstrated by high dimensional Normal and t probability computations. Both the rounding errors from the finite nature of machine computing and the approximation errors from mathematical approximations are taken into account. We are able to compute high dimensional probabilities to high accuracy, which can not be achieved using traditional methods. For global optimizaton, we use the capability of interval analysis to compute the range of a function over a finite region. This can give us an idea of the variation of the objective function value over that region. Within a finite region, the algorithm can throw away local optima, and if there exist more than one global optima we are able to locate them all. This application is demonstrated by several examples in statistics.

The use of interval analysis is at the expense of running time being large. In order to make it practical to use, we develop all the algorithms on a massively parallel machine. In this way we obtain guaranteed highly accurate results within reasonable running times.

Yalçin, Ilker. Nonlinear factor analysis. Ph.D. thesis, Iowa State University Library. May 1995.

Factor analysis and more general structural equation modeling have been popular statistical tools in social and behavioral sciences, and are useful statistical methods in a wide range of applications. Traditional models in these types of analyses are linear in underlying factors or latent variables. The linear model assumes that the observed variables are linear functions of the underlying factors or latent variables. This assumption may not be valid or realistic in many applications. In behavioral sciences, it is often the case that the linear model fits the data well but with a larger number of factors than expected. In such cases, the subject matter theory usually fails to explain the nature of the unexpected additional factors. Another problem pointed out in application is that the linear model with the maximum allowable number of factors sometimes fails to fit the data. These problems could be due to the existence of nonlinear relationships between observed variables and underlying factors. Models nonlinear in factors may fit the data well and may produce more interpretable results based on the subject matter theory. Nonlinear models can also provide a large class of useful exploratory data analysis tools.

This dissertation consists of two papers. In the first paper, we discuss the additive nonlinear factor analysis model that is nonlinear in underlying factors but linear in parameters. Based on a certain conditional distribution, an estimation procedure for model parameters and a test procedure for checking the model fit are introduced. Asymptotic properties of the estimator and the test procedure are derived using the small- asymptotics. A simulation study is also presented. The second paper deals with the general nonlinear factor analysis model. The identification problem for such a model is discussed. Two model fitting procedures are introduced and described. The usefulness and comparison of the procedures are studied through a Monte Carlo experiment.

Pickup volleyball at Emma McCarthy Lee Park during the Statistics Fall Picnic.

Department of Statistics

Work at the university level to draft a strategic plan for the years 1995-2000 served as a basis for corresponding work at the department level throughout the year. The plan includes strategies and goals for improving teaching, research, and consulting. Current strengths will be maintained and some new initiatives will be pursued. The results should be evident in future editions of this annual report.

Several faculty members have textbooks in statistics near completion or in press: David Harville, a book on matrices; John Stufken, a co-authored book on orthogonal arrays; and Hal Stern, a co-authored book on Bayesian data analysis scheduled for summer 1995 publication. Also in progress are a book by Bill Meeker, with Luis Escobar, and one by Peter Sherman.

Fifty-five General Motors employees enrolled in the first of the new sequenced videotaped courses, Applied Statistics for Industry I, in fall 1994. Forty General Motors employees enrolled in the second course in spring 1995. Seventeen students, from ISU and local industry, took the same courses live on campus from Bob Stephenson. Some of the GM students will pursue M.S. degrees by videotape. They will take Stat 500 and Stat 511 during 1995-96.

The Department of Statistics offers a wide range of introductory courses taken by students throughout Iowa State University. The goal of a project begun in 1993 is to provide those students who have completed one or more of these courses with the knowledge and ability to conduct basic statistical computations and graphical procedures using a uniform microcomputer software package across the campus. This has now been made possible by inclusion of the Minitab® statistical package in the "software suite"--a set of programs required to be installed in ISU microcomputer laboratories' set-up using funds obtained from the university student computer fee. The Department of Statistics has begun using this package on microcomputers to a limited degree during the 1994-1995 academic year.

Students in Stat 227, 231, and 305, who were using Minitab on the VAX system (discontinued on June 1, 1995), moved to microcomputers as soon as the package was installed in all ISU microcomputer labs. Under the current plan, Stat 101 and 104 students will also begin using Minitab in fall 1995.

In fall 1994, the department sought funds from the university student computer fee to replace the VAX terminals in Room 307, Snedecor Hall, with eight networked microcomputers. These machines

will be connected to the local area network of microcomputers installed in the Durham Computation Center. Room 307 will be called the Minitab Consulting Room, with statistics teaching assistants monitoring the facility at regularly scheduled and posted times. The project was funded in spring 1995 from university fees and National Science Foundation funds, and installation of the laboratory has begun.

The NSF project "Developing modern computing and graphics-based methods for teaching important concepts in undergraduate statistics courses" was completed in December 1994. The goal was to design instructional tools for illustrating statistical concepts more effectively in the classroom than is possible using just mathematical arguments or static graphical displays. During the year additional instructional modules and software were developed by William Meeker, Mervyn Marasinghe, Dianne Cook, and Tae-sung Shin.

(Earlier work was presented at the annual meetings of the ASA held in August 1994 in Toronto.)

Jay Breidt offered an experimental course, Stat 551X, Time Series Analysis, fall 1994. The purpose of this course is to introduce students to the theory and methods of statistical time series analysis. Emphasis is on practical modeling and prediction techniques for data collected sequentially in time. The theory of covariance-stationary stochastic processes, which is the mathematical basis for these techniques, is developed. Topics covered include state space models and the Kalman recursions.

The experimental course Stat 581X became a regular alternate summer offering in 1995. The course is taught by Mervyn Marasinghe.

Don Hotchkiss taught Stat 401, Statistical Methods for Research Workers, in Fort Dodge, Iowa, in fall 1994, as part of an M.S. program in veterinary microbiology. Classes were held at Fort Dodge Laboratories.

Stat 601, Advanced Methods, was redesigned and offered by Mark Kaiser in spring 1995. Topics included mixture and hierarchical models, Monte Carlo simulation, and Markov chain Monte Carlo applications. Several guest lectures were given by Noel Cressie and Hal Stern.

The process of refurbishing Snedecor Hall continued. After the graduate students painted the hallways on the first and second floors, the university completed this job by painting the stairwells and the third floor hallways. Plans were made to remodel the statistical center's Main Office on the first floor, with construction to begin in July 1995. Plans were also made to create a lounge in Room 104. This project will be undertaken in fall semester 1995.

Course offerings for the 1994-95 academic year and the 1995 summer session, with primary catalog listing in statistics, are listed below. A few courses with primary listing in mathematics or industrial and manufacturing systems engineering may also be taken for statistics credit at the undergraduate or graduate level.

1994-95 Course Offerings in Statistics

Courses for Undergraduate Students Only

100	Orientation in Statistics and Biometry	R	F	Stephenson
101	Principles of Statistics	4	F,S,SS Barnet Barton Eraas Gunnink	 Johanson A. Jones Kirchoff Stern
104	Introduction to Statistics	3	F,S,SS Barton Dubinin Gunnink Henry	 Pollak Rushing Sukhatme Yoder
105	Introduction to Statistics for Engineers	3	F,S Dubinin Isaacson	 Kennedy
201	Applied Regression Analysis for Business	2	F Morse	 Rushing
227	Introduction to Business Statistics	5	F,S,SS Benner Blakeley	 Scheib Wicklund
231	Probability and Statistical Inference for Engineers	4	F,S Morse	 Rollins
305	Engineering Statistics	3	F,S Althen Amemiya Cardella	 Cheng Pascual Wall
328	Applied Business Statistics	3	F,S Cook Groeneveld	 Kirchoff
333	Probability and Statistics for Electrical and Computer Engineers	3	F,S Athreya Scheble	 Sherman
341	Introduction to Theory of Probability and Statistics	3	F	Groeneveld
342	Introduction to Theory of Probability and Statistics	3	S	Groeneveld

Courses for Graduate Minors and Undergraduates

401	Statistical Methods for Research Workers	4	F,S,SS Bailey D. Cox Hotchkiss Kaiser Kirchoff Koehler Pascual	 Roberts Shelley Stern Stephenson Strahan Wickrama
402	Statistical Design and the Analysis of Experiments	3	F,S D. Cox/ Hinz Stephenson	 Stufken
403	Nonparametric Statistical Methods	2	F	Groeneveld
404	Statistics for the Social Sciences	3	F	Lorenz

407	Methods of Multivariate Analysis	2	F	Carriquiry
421	Survey Sampling Techniques	3	S	Nusser
436	Genetic Statistics for Research Workers	3	S	Bailey
447	Statistical Theory for Research Workers	4	S,SS H. A. David	H. T. David
451	Applied Time Series	3	S	Meeker
480	Statistical Applications of Digital Computers	3	F	Marasinghe
481	Computer Processing of Statistical Data	3	S	Marasinghe
490	Independent Study	Var	F,SS Marasinghe	Stephenson
495x	Applied Statistics for Industry I	3	F	Stephenson
496x	Applied Statistics for Industry II	3	S	Stephenson

Courses Primarily for Graduate Students, Major or Minor

500	Statistical Methods	4	F	Hinz
501	Multivariate Statistical Methods	3	S	Cook
511	Theory and Application of Linear Models	3	S	Harville
512	Design of Experiments	3	F	Stufken
521	Theory of Sample Surveys I	3	S	Breidt
531	Statistics for Quality and Productivity	3	S	Vardeman
534	Ecological Statistics	2	S	Pollak
538	Econometric Statistics	3	F	Fuller
539	Game Theory	3	F	H. T. David
542	Theory of Probability and Statistics	3	F	H. A. David
543	Theory of Probability and Statistics	3	S	Sukhatme
551x	Time Series Analysis	3	F	Breidt
557	Statistical Methods for Counts and Proportions	3	F	Koehler
579	Introduction to Computer Hardware and Software Systems for Statistical Computing	1	F	Marasinghe/ Kennedy
580	Statistical Computing	3	F	Kennedy
581	Computational Methods in Statistics	3	SS	Marasinghe
590 B	Special Topics: Methods	Var	F,S,SS Hinz/Kaiser Kaiser Shelley	Stern Weiand
599	Creative Component	Var	F,S,SS Amemiya Breidt Carriquiry Cook Cressie H. A. David Groeneville Harville Kaiser	Koehler Nusser Pollak Roberts Shelley Stephenson Stern Vardeman

Courses for Graduate Students, Major or Minor

601	Advanced Statistical Methods	3	S	Kaiser
611	Advanced Linear Model Theory	3	F	Harville
612	Advanced Experimental Design	3	S	Stufken
642	Advanced Probability Theory	3	S	Lahiri
643	Theory of Estimation and Testing of Hypotheses	3	F	Cressie
647	Multivariate Analysis	3	F	Amemiya
699	Research	Var	F,S,SS Amemiya Athreya Breidt Carriquiry Cressie H. A. David H. T. David Fuller Harville Kaiser Kennedy Koehler	Lahiri Marasinghe Meeker Pollak Rollins Shelley Sherman Stern Sukhatme Vardeman Wieand

Graduate Students

The graduate students in statistics represent a diversity of backgrounds and come from five continents. In addition to attending classes together, they meet as members of the Iowa STAT-ers (see p. 48).

Eleven Ph.D. degrees and 30 M.S. degrees were granted in the Department of Statistics during the fiscal year. All but two of the masters' degrees were conferred on a nonthesis basis, with these candidates completing creative components based on independent study. Abstracts of Ph.D. dissertations and master's theses appear on pp. 38-42.

The Vera David Graduate Fellowship in Statistics for 1994-95 was awarded to Carter Ann Blakeley. The Holly and Beth Fryer Scholarship Award went to Anindya Roy.

Teaching Excellence Awards were presented to Francis Pascual in summer 1994, to Kari Ann Henry in fall 1994, and to Lee Barton and Lisa Wicklund in spring 1995. A Research Excellence Award was presented to Jun-ichiro Fukuchi in fall 1994. The Department of Statistics presented the Dan Mowrey Consulting Excellence Award to Kari Ann Jovaag and Claire Tsao, and the Vincent Sposito Statistical Computing Award to Kevin Dodd, in May.

Matt Klapper became vice president of the new German Students Association at Iowa State.

Names of graduate degree recipients, with names of major professors, time of graduation, and employment or educational decisions, are given below. An asterisk signifies that the student has chosen to work toward a doctorate in statistics at Iowa State.

M.S. Recipients

Gregg Mateo Althen (Fall 1994; W. Robert Stephenson) joined Eastman Chemical Company, Kingsport, Tennessee, as a statistician.

Lee Joseph Barton (Spring 1995; F. Jay Breidt) accepted a position with Communications Data Services, Inc., Des Moines, Iowa.

Aidan Thomas Cardella (Fall 1994; Stephen Vardeman) held a temporary position as teaching instructor of statistics at Grinnell College in the Department of Mathematics beginning January 23, 1995.

Mark Robert Dietrich (Summer 1994; William Q. Meeker) joined Providian Bancorp (formerly First Deposit National Corporation), San Francisco, California.

Donald Joseph Dougherty (Spring 1995; W. Robert Stephenson) worked as a statistician for the Center for Continuous Quality Improvement in Ames, Iowa, before joining his family's food distribution business.

Ashraf Farouk El-Houbi (Summer 1994; Herbert T. David) is continuing graduate study in statistics at Kansas State University.

Dennis Wayne Field (Spring 1995; William Q. Meeker) is pursuing a Ph.D. in the Department of Industrial Education and Technology at Iowa State University.

Matthew Lee Gerdis (Summer 1994; Mervyn Marasinghe) is a statistician with Intel Corporation, Chandler, Arizona.

Carolyn Ann Goebel (Summer 1994; Frederick O. Lorenz) is an underwriter with Fortis Benefits Insurance Company, Kansas City, Missouri.

Jason Lee Gunnink (Spring 1995; H. A. David) has joined Information Resources Incorporated, Chicago, Illinois, as project manager.

Peter Daniel Hanson (Fall 1994; F. Jay Breidt) accepted a temporary teaching position at Drake University in the Department of Mathematics.

***Nan-Jung Hsu** (Summer 1994; F. Jay Breidt).

***Hsin-Cheng Huang** (Fall 1994; Noel A. C. Cressie).

Wynandin Imawan (Spring 1995; Kenneth J. Koehler) returned to his position in Jakarta, Indonesia, as Chief, Sociometric Analysis Subdivision, Division of Social Analyses, Central Bureau of Statistics.

***Yoon-Sook Jeon** (Summer 1994; Herbert T. David).

Je Yeong Jeong (Fall 1994; Edward Pollak) is continuing studies in San Francisco, California, to become an actuary.

***Dae-Lyong Kim** (Fall 1994; Mark S. Kaiser).

Matthias Klapper (Spring 1995; F. Jay Breidt) returned to Germany.

***Shonda Roelfs Kuiper** (Fall 1994; Derrick K. Rollins).

James J. Majure (Spring 1995; Noel A. C. Cressie) continued as manager of the Geographic Information Systems Support and Research Facility, Iowa State University.

***Sol Timothy Mumey** (Fall 1994; Alicia Carriquiry).

***Francis Garcia Pascual** (Summer 1994; William Q. Meeker).

Mark Lewis Peters (Summer 1994; Stephen B. Vardeman) joined Providian BanCorp (formerly First Deposit National Corporation), San Francisco, California.

Daniel Lynn Rose (Summer 1994; Stephen B. Vardeman) joined Neural Tech in Fairfax, Virginia.

***Tae-Sung Shin** (Fall 1994; Mervyn G. Marasinghe).

Andrine Rosemarie Swensen (Summer 1994; Kenneth J. Koehler) has entered a Ph.D. program in epidemiology at the University of Minnesota.

Chi-Hong Tseng (Fall 1994; Mark Kaiser and F. Jay Breidt) is working on a Ph.D. degree in the Department of Statistics, University of Washington.

Elizabeth Ann Uken (Summer 1994; F. Jay Breidt), now Elizabeth Uken Lindemulder, is a clinical data analyst with Alza Corporation, Palo Alto, California.

***Delfino Vargas-Chanes** (Fall 1994; William Q. Meeker).

Weiye Zhu (Summer 1994; Mark Kaiser) accepted a position with Providian Bancorp (formerly First Deposit National Corporation), San Francisco, California.

Ph.D. Recipients

Gregorio Saravia Atuncar (Fall 1994; Krishna B. Athreya) returned to his position as professor in the Department of Statistics, Federal University of Minas Gerais-Brazil.

Gerri Marie Dunnigan (Summer 1994; Stephen B. Vardeman and Herbert T. David) is assistant professor of mathematics, Department of Mathematics, University of North Dakota.

Jun-ichiro Fukuchi (Fall 1994; Krishna B. Athreya and Soumendra N. Lahiri) is a lecturer in statistics, Department of Economics, Hiroshima University, Hiroshima, Japan.

Mu-Yeh Huang (statistics and industrial engineering, Spring 1995; Stephen B. Vardeman and Douglas W. McBeth) has taken a position as associate professor in the International Trade Department, Chung-Yu Junior College, Keelung, Taiwan.

Shin-Soo Kang (Fall 1994; Kenneth J. Koehler) returned to South Korea and has taken a position as associate professor, Statistics Department, Gawn-Dong University.

Seoung-Gon Ko (Summer 1994; Herbert T. David) returned to Korea to serve in the military as a translator.

Abdul Wajid Rana (Fall 1994; Stephen B. Vardeman) returned to a teaching and research position in the Department of Statistics, Bahauddin Zakariya University, Multan, Punjab, Pakistan.

Chungyeol Shin (Spring 1995; Yasuo Amemiya) accepted a position at the ISU Research Park as postdoctoral research associate in the Center for Family Research in Rural Mental Health starting May 1, 1995.

Anand N. Vidyashankar (statistics and mathematics, Summer 1994; Krishna B. Athreya) is a visiting assistant professor, Department of Mathematical Sciences, University of Illinois-Chicago Circle.

Ouhong Wang (Fall 1994; William J. Kennedy) is a senior statistician with Eli Lilly, Indianapolis, Indiana.

Ilker Yalçin (Spring 1995; Yasuo Amemiya) accepted a position as statistician in the Division of Mental Health at the World Health Organization, Geneva, Switzerland, starting March 1, 1995.

M.S. Candidates

Pamela Abbitt
Kevin Ackley
Abdulelah Al-Nafisa
Gregg Althen
Peter Anderson
Lee Barton
Shawn Bates
Rebecca Benner
Carter Ann Blakeley
G. Gordon Brown, Jr.
Dana Bruden
Xiao-Hong Cao
Aidan Cardella
Huaichin Chen
Mark Dietrich
Donald Dougherty
Thomas Dubinin
Ashraf El-Houbi
Michael Elling
Soledad Fernandez
Dennis Field
Birgit T. Flatau
King-Chong Iris Fung
Angelita Garth
Juan Jose Goyeneche
Jason Gunnink
Peter Hanson
Richard N. Hardy
Lun Xiong He
Kari Henry
Gibog Hong
Xianfeng Hu
Wynandin Imawan
Alejandro Islas-Camargo
Je Yeong Jeong
Amy Rath Johanson
Angela Jones
Philip Jones
Sarah Kind
Matthias Klapper
Sock-Cheng Koh
Jennifer Kohn
Kye-Don Lee
Beth Lencowski
Nicholas Lewin
Rong Li
Chien-Hua Jonathan Liao
Michael Lieber
Feng Lu
Henning Lustig
Marcia Macedo
James J. Majure
Maritza Melèndez
Amy Jo Meyer
Lucky Wes Mokgathle
Sol Mumey
Joseph Mummert
Bryan Nelson
Brandon Paris
B. Laknath Peiris
Xiao-ming Qi
Deanne Reber
Daniel Rose
Abigail Sage
Christopher Scheib
Pamela Schmidt
Wendelin Schnedler
Angela Schneider
Heidi Shierholz
Tae-Sung Shin
James D. Smith IV
Richard Sullivan
Catherine Sunde
Chi-Hong Tseng
Delfino Vargas-Chanes
Jennifer Walker
Melanie Wall
You Wang
Lisa Wicklund
Jeffrey Wieland
Xilin Wu
Yihong Xiao
Ming Xu
Zugeng Zheng
Weiye Zhu

M.S. Candidates (General Motors)

Edward R. Alef
Diana M. Baran
Leonard A. Brown
Larry E. Cisney
Carilee Cole
Donald J. Couture, Jr.
Kevin A. Diviney
Michael J. Ecarius
David J. Elias
Ellen T. Evans
Eric A. Gonzales
Paul Greskowiak
David M. Hammelef
Brian Kenney
Mary Kriz
Timothy J. Lang
Daniel E. Nicholson
Jonathan L. Rhoades
Timothy Sakshaug
Richard J. Schomaker
Michael Wood

Ph.D. Candidates

Mahmood Ahmad (statistics and industrial education and technology)
W. Jeremy Aldworth
Anthony Baiching An
Gregorio Atuncar
Andim Balce
Barbara Dombroski Barnet
Kristine Bendixen (chemical engineering and statistics)
Marek Brabec
Cong Chen
Jianlin Cheng
Bassirou Chitou
Rohit Deo
Sriram Devanathan (chemical engineering and statistics)
Kevin Dodd
Birol Emir
Michael Eraas
Jun-ichiro Fukuchi
Elizabeth Goldberg (statistics and sociology)
Chad Hart (economics and statistics)
Nan-Jung Hsu
Hsin-Cheng Huang
Mu-Yeh Huang
Shiaau-Er Huarng
Shuen-Lin Jeng
Yoon-Sook Jeon
Kari Jovaag
Hea-lim Jung
Kyu-Nam Jung
Shin-Soo Kang
Dae-Lyong Kim
Jae-Kwang Kim
Thomas Kirchoff
Seoung-Gon Ko
Koji Kondo (economics and statistics)
Shonda Kuiper
Sun-hee Kwon
Chiang-Sheng Johnson Lee
Jaehyung Lee
Yoon-Dong Lee
Ding-Hwa (Dean) Lei
Win-Chin Lin
Chih-Yao Craig Liu
Huei Grace Liu Ho
Peter Morse
Savas Papadopoulus
Francis Pascual
Elizabeth Paterno (economics and statistics)
Jean Pelkey
Abdul Wajid Rana
Melissa Lopez Reyes (psychology and statistics)
Anindya Roy
Leroy Rushing
Pradipta Sarkar
Chungyeol Shin
Juergen Symanzik
Ling-Ling Claire Tsao
Anand Vidyashankar
Michael Wallendorf (statistics and animal ecology)
Ouhong Wang
Susan White (agronomy and statistics)
Christopher Wikle (statistics and meteorology)
Kevin Wright
Lie-Ling Wu
Ilker Yalçin
Jill Yoder

Shawkat Hassan accepted a second term as an intern with Weyerhaeuser as data analyst in Hot Springs, Arkansas through December 1994. Kari Henry was an intern there January-May 1995, and Feng Lu began an internship in June. Peter Anderson was an intern with Blue Cross Blue Shield in Des Moines, Iowa, spring semester 1995. Dan Park was an intern with Ruan Corporation during spring semester. Pam Schmidt was an intern at Mayo Clinic, Rochester, Minnesota, during June and July 1995. Peter Morse went to General Motors for a summer internship. Angela and Philip Jones and Sriram Devanathan went to Providian Bancorp for summer internship positions.

Sol Mumey, before beginning doctoral studies in statistics at ISU, went to Germany for a year, for an eight-week German language program at Goethe Institut, in Bremen, and an academic year exchange program, with a teaching assistantship in the Department of Mathematics, at the University of Augsburg.

Shell Lecture in Industrial Statistics

The second annual Shell Lecture in industrial statistics was given on March 27 by Gerald D. Hahn, manager of the Management Science & Statistics Program, GE Corporate Research & Development Center, Schenectady, New York. He spoke on "The life of an industrial statistician: 1995." The Shell lectures are supported by departmental grants from the Shell Oil Company Foundation.

Hahn is a fellow of the American Statistical Association and of the American Society for Quality

Gerald Hahn, Shell lecturer

Control and is an elected member of the International Statistical Institute. He has published over 100 papers in refereed statistical and engineering journals. He is co-author of *Statistical Models in Engineering* (1967), *Statistical Intervals: A Guide for Practitioners* (1991), and *How to Plan an Accelerated Life Test--Some Practical Guidelines* (1985).

Hahn received degrees of B.B.A. at CUNY City College, M.S. in statistics at Columbia University, M.S. in mathematics at Union College, and Ph.D. in operations research and statistics at Rensselaer Polytechnic Institute. Since 1973 he has headed the corporate group responsible for providing leadership and a central source of competence to all GE components in the development of statistical and management science methods and their application. As a member of this group since 1955, he has developed new methods and contributed to the solution of numerous Company problems in such areas as statistical quality control, process improvement, risk analysis, product life analysis, system error analysis, and the design and analysis of experiments. He has also served, since 1965, as an adjunct professor in Union College's Graduate Studies Division. For his publications and service to the profession, Hahn has won the Brumbaugh Award (3 times), the Shewell Prize (2 times), the Wilcoxen Prize (2 times), and the Youden Award, and in 1992, for his leadership in applied statistics, he was given the William G. Hunter Award of the Statistics Division of the American Society for Quality Control.

Sukhatme Memorial Lecture

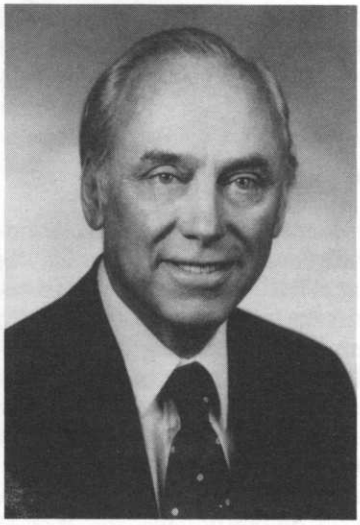
The 12th B. V. Sukhatme Memorial Lecture was presented by Kirk M. Wolter, senior vice president, National Opinion Research Center (NORC), and professor of statistics, University of Chicago, on April 12, 1995. He spoke on "The Consumer Price Index: How to make it better, faster, and cheaper." Wolter received his B.A. degree in mathematics and economics from St. Olaf College and M.S. and Ph.D. degrees in statistics from Iowa State. He joined the U.S. Bureau of the Census as mathematical statistician in 1974 upon completing doctoral studies and served there as chief of the Statistical Research Division until 1988. While with the Census Bureau he also lectured part-time at the George Washington University. He then joined the A. C. Nielsen Company, Northbrook, Illinois, as vice president and in 1994 moved to NORC.

In 1980 Wolter was chosen to receive an Outstanding Young Alumnus Award at Iowa State; two years later he received a Bronze Medal from the U.S. Department of Commerce. He is a member of the International Statistical Institute and a fellow of the American Statistical Association and author of numerous publications, including the 1985 book *Introduction to Variance Estimation.*

The Sukhatme lecture series honors the late B. V. Sukhatme, who was professor of statistics at Iowa State from 1958 to 1979, specializing in survey sampling.

Zyskind Memorial Lecture

The 18th George Zyskind Memorial Lecture was given by T. W. Anderson, professor emeritus in the Departments of Statistics and Economics, Stanford University. He spoke on "Tests of correlation structure in stationary time series" on April 24, 1995.



T. W. Anderson, Zyskind lecturer

Professor Anderson received his Ph.D. from Princeton, spent a year at the Cowles Commission for Research in Economics at the University of Chicago, 21 years at Columbia University, and the years since 1967 at Stanford. He is a recipient of many honors, including being a fellow of the American Statistical Association, the Institute of Mathematical Statistics, the Econometric Society, and the American Association for the Advancement of Science. He was elected a member of the National Academy of Sciences in 1976. Anderson is a prolific author; his writings include two classic books, *An Introduction to Multivariate Statistical Analysis* and *The Statistical Analysis of Time Series.*

The Zyskind lecture series honors the late George Zyskind, professor of statistics at ISU from 1959 to 1974.

Iowa STAT-ers

The Iowa STAT-ers, the Department of Statistics graduate student organization, offers opportunities for athletic, social, and intellectual interaction among members and faculty.

Officers for the 1994-95 year were Lee Barton, president; Kevin Dodd and Tom Kirchoff, co-vice president; Pam Abbitt, treasurer; and Katy Sunde, secretary. Beth Lencowski and Jason Gunnink served on the social committee; Lee Barton attended statistics faculty meetings as the student representative. Jay Breidt was the faculty advisor to the student club.

This year's Reading Group meetings were organized by Matt Gerdis and Andrine Swensen. Gregg Althen and Jean Pelkey served as intramural sports coordinators. Katy Sunde edited the Iowa STAT-er Chatter newsletter. Becky Benner, Tony An, Nicholas Lewin, and Claire Tsao served on the ISU Graduate Student Senate.

Social events during the year included a Pizza Party, a fall picnic, a hayride, the traditional Howard House Halloween Party, the Winter Party where students and faculty display hidden talents, weekly FAC gatherings, and sports tournaments. Members of STAT-ers continued to serve as recycling volunteers for Snedecor Hall for a fourth year, produced a STAT-er birthday calendar, and carried on active sports programs, including flag football, broomball, volley ball, and badminton.

Snedecor and Bancroft Awards

The George W. Snedecor Award to an outstanding doctoral student in statistics went to Hsin-Cheng Huang, who is working with Noel Cressie. He received a certificate, check, and a subscription to *Biometrika*. Huang completed a B.S. degree in mathematics at National Taiwan University and, after military service, was a research assistant in the Institute of Statistical Science, Academia Sinica, in Taipei before coming here in 1992. As indicated on p. 45, he completed the M.S. degree in statistics in 1994. The award honors the founder and first director of the Statistical Laboratory.

The 1995 T. A. Bancroft Award went to Melissa Lopez Reyes, a Ph.D. student co-majoring in psychology and statistics under Veronica Dark and Kenneth J. Koehler. She received a certificate, check, and a subscription to *Psychometrika*. This award, for which doctoral students with declared minors in statistics or joint majors in statistics and another field are eligible, honors Theodore A. Bancroft, director of the Statistical Laboratory and head of the Department of Statistics from 1950 to 1972. Reyes completed a B.Sc. degree, magna cum laude, in mathematics at the University of the Philippines in 1986, then served as an instructor in the Department of Mathematics. She completed the M.Sc. degree there in psychology in 1991 after serving as lecturer and instructor in the Department of Psychology. She began doctoral studies in psychology at Iowa State University in August 1991 and changed to a co-major in 1994.

Undergraduate Students

Several academic recognitions were received by undergraduate statistics majors. Sondra M. Reis (a joint major in statistics and political science) received the Melissa Luton Bradford Scholarship ($2825) from the Kappa Alpha Theta Foundation, Indianapolis, Indiana, for the 1994-95 academic year. Reis was also named as one of the ten members of the 1994 ISU Homecoming Court, on the basis of her academic work, involvement, and personal character. At the Scholarship Recognition Dinner on April 11, 1995, Vera F. Boulaevskaia and Lingcheng Huang were recognized as standing in the top two percent of the junior and senior classes, respectively, in the College of Liberal Arts and Sciences. Yuen Shan Wong was recognized as the highest graduating senior in the Department of Statistics. On April 30, Boulaevskaia was elected to Phi Beta Kappa as a junior in the College of Liberal Arts and Sciences.

In May, Lingcheng Huang and Charlotte M. Schultze were recognized as co-recipients of the George W. Snedecor Undergraduate Statistics Award. Schultze was also named as the first recipient of the Schillmoeller Family Scholarship ($500) for 1995-96. Matthew S. Haubrich received the Statistics Club Award ($200). These awards will be presented in fall 1995.

Two undergraduate statistics majors have been awarded Barry M. Goldwater Scholarships for 1995-96: Vera F. Boulaevskaia (who has a second major in French) and Lingcheng Huang. The scholarships will pay for up to $7,000 each in expenses such as tuition, fees, books, and room and board for the next academic year. About 250 such scholars were named in 1995 in the United States, including four attending colleges or universities in Iowa. Boulaevskaia comes from Los Alamos, New Mexico; Huang, from Iowa City, Iowa.

Richard Groeneveld, faculty coordinator of the undergraduate program in statistics, congratulates Lingcheng Huang (center) and Vera Boulaevskaia on their scholastic achievements, including their winning the prestigious Barry M. Goldwater Scholarships for the 1995-96 academic year.

Daniel P. Ewald was awarded the Statistics Department/Eli Lilly Company Scholarship ($1,000) as the outstanding freshman student planning to major in statistics in fall 1995. He is a 1995 graduate of Ankeny High School in Iowa.

Seven students received B.S. degrees in statistics during the period July 1, 1994, to June 30, 1995. Names of the degree recipients follow, with employment or study plans, where definite.

Philip E. Gose (Spring 1995) is a statistical analyst with National Crop Insurance Services in Overland Park, Kansas.

Jill Lenee Griffith (Spring 1995) accepted a position as a data analyst with Perishable Distributors of Iowa Inc. in Ankeny, Iowa.

Kelly Ryan Iverson (Fall 1994) is an underwriter with the Allied Insurance Group, Des Moines, Iowa.

Sung Kyun Oh (Spring 1995) is continuing as an undergraduate major in mathematics at Iowa State.

Richard Dale Shelton (Spring 1995) is a statistical programmer at ICI Seeds, Slater, Iowa.

Rebecca Jean Swanson (Spring 1995) is a statistical programmer with Harris Laboratories, Lincoln, Nebraska.

Yuen Shan Wong (with distinction, Fall 1994) resides in Americus, Georgia.

During summer 1995 Lingcheng Huang worked at Mayo Clinic, Rochester, Minnesota, as a statistical intern and Nathan D. Pelzer worked as a SAS programmer with ICI Seed Company in Slater, Iowa. In addition, Sondra Reis worked as a statistical intern with Maytag Company in Newton, Iowa; Matt Schwab was a quality assurance intern with Schutt Manufacturing in Litchfield, Illinois; Charlotte Schultze-Hewett was an undergraduate research assistant at Iowa State with Prof. Derrick Rollins (statistics/chemical engineering).

Statistics Club

The purpose of the Statistics Club (STAT CLUB) is to promote interest in statistics among undergraduate students at Iowa State University. Bob Stephenson serves as advisor to the club.

The first order of business this year was to elect new officers. Campaigning was in full swing at the pizza party in early September. As a result, Matt Haubrich was elected president, Becky Swanson was elected vice president, Aaron Kaufman conducted a strong campaign and became treasurer, and Vera Boulaevskaia was elected secretary. At the meeting it was announced that Matt Haubrich and Sondra Reis would share the STAT CLUB Prize for 1994-95. This award is supported by the club and the Department of Statistics. Each student received $150 in recognition of their contributions to the Statistics Club and their academic achievement.

The big event in fall 1994 was a field trip. Seven statistics majors traveled with Bob Stephenson to Cedar Rapids, Iowa, to visit Collins/Rockwell. Scott Kongable (BS stat 1989) was host for the day. The group started out with a tour of the Engineering/Operations main manufacturing facility. Then they heard from Kongable and his colleague, Bill Thomas, about the types of problems they work on and how statistics is used to help solve those problems. Kongable indicated that he did a lot with designed experiments, modeling, sampling plans (how large a sample should be taken), risk analysis, and total quality management. He indicated that analysis of variance, regression, graphical presentation of data, and knowledge of distributions were all very important to the work he does. He mentioned that the most valuable courses for him at Iowa State were Stat 341, 342, 401, 402, 421, and the mathematics support courses. After a break for lunch, STAT CLUB's treat, the group returned for a demonstration of Collins/Rockwell's Global Positioning System (GPS). Everyone was able to use a handheld GPS unit. The unit gives your position, in terms of latitude and longitude. As you move, the readout tells you your speed and change in position. To find your way to a specific location, you can either put in the latitude and longitude of where you wish to go or mark a return position. With a touch of the navigate button the GPS gives you the heading you need to proceed on to get to your destination. If you don't know anything about headings there are flashing arrows that tell you to turn right or left to get on the correct heading. The price, $1,200, is 70% less than other manufacturers' bids primarily because design of experiments and other statistical methods were used in the design and development of the GPS.

In the spring, Hal Stern of the ISU Department of Statistics spoke to the club on Statistics and sports. He emphasized that Statistics, with a capital S, is much different from statistics, with a small s, the latter being summaries of data--points scored, batting averages, etc. The former is the analysis and interpretation of data. Stern discussed the use of Statistics, and Probability, in developing sports strategy, in assessing the chance that a team leading at half-time will eventually win, and ratings and rankings of teams. When it comes to baseball strategy, a statistician named Lindsey analyzed data from the 1959/60 professional baseball season to see how scoring progresses. The data indicated that, on average, a sacrifice bunt to advance a player from first to second when there are no outs is a bad idea. Probability and Statistics can also be used to look at the chance that a team with a lead will eventually win. Stern discussed some models for professional basketball that take into account home court advantage. Some interesting patterns emerge, one of which is that if the visiting team is behind but very close towards the end of the game it has a pretty good chance of coming out the winner. The final part of Stern's talk dealt with ratings and rankings of teams. In particular, he discussed a least squares method to come up with power ratings of college football teams. The method puts a lot of weight on strength of schedule and comes up with some unusual ratings.

The nice thing about the ratings is that the difference between two teams' ratings is interpretable as the point differential if those two teams would play. Following Stern's talk, the STAT CLUB adjourned for sundaes at Hickory Park.

Seminars

The series of regular weekly seminars offered by the Statistical Laboratory and the Department of Statistics throughout the 1994-95 year was planned by William J. Kennedy and David Harville. Tom Kirchoff was chair for the Iowa STAT-er seminar series.

During the fall an environmental/ecological statistics seminar series was offered. This was followed by weekly sessions of a statistical ecology reading/discussion group during spring semester. Nicholas Lewin coordinated the group's activities.

Statistical Laboratory Seminars

Summer 1994

July 6 Splines and kriging for spatial data, with applications to shape analysis. John Kent, Department of Statistics, University of Leeds, United Kingdom

27 Applications of numerical interval analysis to obtain self-validating results in statistical applications. Ouhong Wang

Fall 1994

August 31 Strategic planning for Statistics. Dean L. Isaacson

September 12 Statistical consulting via computer. Roel Popping, Department of Statistics, University of Groningen, the Netherlands

19 Interpreting significance levels. Paul N. Hinz

26 The effective population size for polyploids reproducing by partial selfing. Edward Pollak

October 3 Life-table analysis for correlated response times. Shin Su Kang

6 Construction of asymptotic tests based on estimating equations. Guido E. del Pino, Department of Statistics, U. Catolica de Chile

10 The "power" of latent variable models. Daniel W. Russell, Department of Psychology, Iowa State University

17 Bootstrapping extremes of random variables. Jun-ichiro Fukuchi

24 Hierarchical generalized linear models. Mark S. Kaiser

November 2 Modeling insect distribution and movement: Extensions of Polya's urn model and interacting Markov chains. Linda Young, Department of Biometry, University of Nebraska-Lincoln

7 Statistical inference for real-valued Markov chains and some applications. Gregorio Saravia Atuncar

8 Bayesian modeling and non-randomness in finite populations. Susie Bayarri, Department of Statistics, University of Valencia, Spain

14 Statistical prediction based on censored life data. William Q. Meeker

28 Spatial data visualization. Graham Wills, Data Visualization & Software Research Group, AT&T Bell Laboratories, Indian Hill, Naperville, Illinois

December 5 Nonlinear factor analysis. Ilker Yalçin

Spring 1995

January 23 (Joint Economics and Statistical Laboratory Seminar) Adaptive estimation of cointegrating regressions. Douglas Hodgson, Department of Economics, Yale University

25 (Joint Economics and Statistical Laboratory Seminar) Time series regression with mixtures of integrated processes. Yoosoon Chang, Department of Economics, Yale University

30 Missing data imputation using the multivariate t distribution. Chuanhai Liu, Department of Statistics, Harvard University

February 1 Optimal bandwidth selection for fitting a bivariate additive model by local linear regression. Jean Opsomer, School of Operations Research and Industrial Engineering, Cornell University

2 (Joint Economics and Statistical Laboratory Seminar) Sequented analysis of duration data. Yannis G. Bilias, Department of Economics, University of Illinois-Champaign

6 Plug-in semiparametric estimating equations. Roberto G. Gutierrez, Department of Statistics, Texas A&M University

13 Inter-event distance methods for testing and estimation in the analysis of spatial point processes. Linda Brant Collins, Department of Statistics, The University of Chicago

15 Statistical decision theory for environmental remediation. Lara J. Wolfson, Department of Statistics, Carnegie Mellon University

16 A randomization method for sensitivity analysis in generalized linear models and nonparametric regression. Abhinanda Sarkar, Department of Statistics, Stanford University

20 Bayesian meta-analysis: Use of hierarchical models in 2x2 tales. Scott M. Berry, Department of Statistics, Carnegie Mellon University

27 Priors and models for multivariate stochastic volatility. Nicholas G. Polson, Graduate School of Business, University of Chicago

March 6 Modeling change with panel data. Fred Lorenz

13 Estimation associated with streams: The Mid-Atlantic Highlands assessment (MAHA). N. Scott Urquhart, Department of Statistics, Oregon State University

20 The paired t-test under artificial pairing. Herbert A. David

April 6 Developmental test programs for one-shot systems with two-state reliability. Mu-Yeh Huang

10 (Joint Mathematics-Statistics Colloquium) Vector exceedance measures and processes with deterministic peaks. Ross Leadbetter, Department of Statistics, University of North Carolina-Chapel Hill

13 Statistical analysis of heterogeneous variances in Gaussian linear mixed models. Jean-Louis Foulley, National Institute for Agricultural Research (INRA), Statistical Genetics, Jouy-en-Josas, France

19 The LRT method of constructing a two-sided "variables" acceptance region and its comparison with other methods. Ding-Hwa (Dean) Lei

19 Robust Bayesian design and analysis of clinical trials via prior partitioning. Bradley P. Carlin, Division of Biostatistics, University of Minnesota

20 A score test against one-sided alternatives. Mervyn Silvapulle, Department of Statistics and Actuarial Science, University of Iowa

May 1 Animal breeding applications of Gibbs sampling. Curt Van Tassell, Department of Animal Science, University of Nebraska, Lincoln

3 Gosset: a general purpose program for constructing designs. N. J. A. Sloane, AT&T Bell Laboratories, Murray Hill, New Jersey

Summer 1995

June 19 MANET (Missings Are Now Equally Treated) --interactive graphical tools for datasets with missing values. Antony Unwin, Institute of Mathematics, University of Augsburg

Special Lectures and Seminars

December 8 (Joint Economics/Statistics Seminar) Graphical methods for estimating the size and power of hypothesis tests. Russell Davidson, Department of Economics, Queen's University

March 27 Second Annual Shell Lecture: The life of an industrial statistician: 1995. Gerry Hahn, GE Research & Development Center

April 12 B. V. Sukhatme Memorial Lecture: The Consumer Price Index: How to make it better, faster, and cheaper. Kirk Wolter, National Opinion Research Center and Department of Statistics, University of Chicago

24 George Zyskind Memorial Lecture: Tests of correlation structure in stationary time series. T. W. Anderson, Department of Statistics and Department of Economics, Stanford University

Seminars in Environmental/Ecological Statistics

September 27 The EPA's environmental monitoring and assessment program. Noel Cressie

October 11 Spatial statistics for environmental and ecological data. Noel Cressie

November 1 Evaluating models of the relationship of mean and variance. Linda Young, Department of Biometry, University of Nebraska-Lincoln

November 15 Spatio-temporal prediction of nitrate concentrations in surface waters in the Upper North Bosque River watershed, Texas. James J. Majure, GIS Support and Research Facility, Iowa State University

December 6 Ecological stability and regression mixed over the unit interval. Mark Kaiser

March 14 The anatomy of sampling studies of ecological responses through time. Scott Urquhart, Department of Statistids, Oregon State and EPA

Iowa STAT-ers Seminar

September 16 Student issues and the Strategic Plan of 1994. Dean Isaacson

21 Statistics and First Deposit Corporation. Steven Mattics, First Deposit Corporation, San Francisco, California

28 Utilizing the Career Services Office at ISU. Steven Kravinsky, Career Services, Iowa State University

October 11 Statistics in industry--experiences in consulting at Shell. Joyce Wellman, Shell Development Company

31 Sexual harassment issues. Sharon Drake, Training and Development, Iowa State University

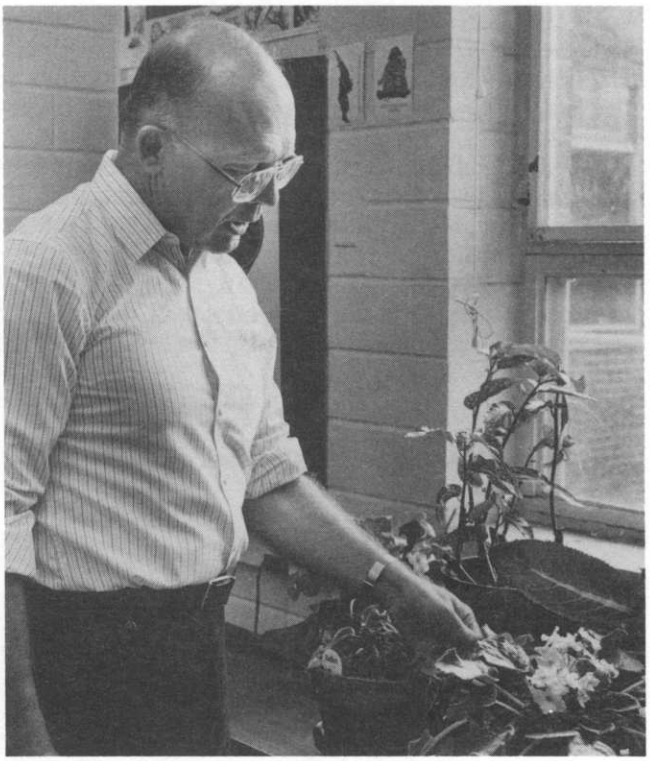
February 17 Movie: A discussion, John Tukey

22 Statistics and Providian Bancorp. Marshall Miller, Providian Bancorp (formerly First Deposit Corporation)

March 31 Statistics and Trilogy Corporation. Greg Jarecki, Trilogy Consulting Corporation, Waukegan, Illinois

IN MEMORIAM

Harold Duwaine Baker, 1933-1994



Harold Baker, assistant professor in the Department of Statistics and a longtime member of the Survey Section of the Statistical Laboratory, died of cancer on December 17, 1994, at Mary Greeley Hospital in Ames. Although seriously ill for more than a year, he was active until a few days before his death. He is survived by his wife Vi, son David, and daughter Susan.

Baker was born in Woolstock, Iowa, on January 27, 1933. He attended Eagle Grove Junior College for two years before being inducted into the U.S. Army in 1953. After a year at Iowa State Teachers College, he transferred to Iowa State College in 1956. He worked for Westinghouse Electric Corporation during summer 1957 and summer 1958 as a junior engineer and a junior statistician, holding a Westinghouse Scholarship in Statistics for studies during the intervening academic year. Baker received the B.S. degree in statistics in March 1958, then continued with graduate work, becoming a graduate assistant in the Survey Section in September, then beginning full-time work in the section in June 1959, working primarily on a U.S. Bureau of the Census project. Baker received the M.S. degree in statistics in August 1963,

his thesis being entitled "The evaluation program for the 1959 Census of Agriculture: A general review of the procedure and a discussion of some of the problems." On July 1, 1965, he was appointed as assistant professor of statistics at Iowa State.

Throughout his career in the Survey Section of the Statistical Laboratory, he participated in the design, field operation, and analysis of sample surveys. Possessing a unique knowledge of Iowa and of the practical aspects of survey sampling, he worked with faculty of all of Iowa's Regent institutions, as well as with faculty from other Midwest universities. He was a member of research groups that cooperated with the U.S. Bureau of the Census and various agencies of the U.S. departments of Agriculture, Labor, and Health and Human Services. No one in the Survey Section has participated in more survey projects.

Harold Baker was a valued coworker capable of adding a lighter tone to technical deliberations. He will be remembered for his contributions to hundreds of survey projects on- and off-campus, his sense of humor, his love of the English language, his interest in world affairs--and the inner strength, dignity, and even temper he displayed during the last year of his life.

Susan E. Verkade, 1947-1995

Susan E. Trexel was born in Jefferson, Iowa, on June 14, 1947 and was a graduate of Ames High School and Iowa State University. She received her master's degree from Bemidji State University in 1971 and taught school in Austin, Minnesota, until 1980. Since then she had worked as a data analyst in the Survey Section of the Statistical Laboratory. She married John G. Verkade in 1982 in Ames.

She was a member of PEO, Alpha Omicron Pi sorority, Phi Kappa Phi honorary, Ames Municipal Band, and the Central Iowa Symphony. She had also played with the ISU Flute Choir and the Austin Symphony, Austin, Minnesota. Sue Verkade died of cancer at Mary Greeley Hospital in Ames on June 22, 1995 at the age of 48. She is survived by her husband, her mother, and one brother, two step-daughters, and a step-son.

Photo Credits

The photos of T. W. Anderson and Gerald Hahn on p. 47 are provided through the courtesy of the guest lecturers. The photo of Susan Verkade was taken by Ed Funo for Iowa STAT-ers. The remaining photos and the layout design are by Jauvanta Walker.

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