Statistical Laboratory

established 1933

Annual Report

July 1, 1996 to June 30, 1997

$$\sigma^2 \quad \mu \quad \Omega \quad \chi^2 \quad \Sigma \quad \beta$$

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Contents

THE STATISTICAL LABORATORY
Iowa State University
1996-97 Annual Report

Personnel

Yuhong Yang joined the faculty as an assistant professor in October 1996. He received a Ph.D. in statistics at Yale University in 1996. His research interests include nonparametric function estimation, model selection, adaptive procedures, and estimation under dependence.

Alicia Carriquiry was on faculty improvement leave from August 16, 1996 to May 15, 1997. Within this period she was a visiting professor in the Department of Statistics, Pontificia Universidad Católica de Chile, in Santiago, Chile, fall 1996, and in the Institute of Statistics and Decision Sciences, Duke University, Durham, North Carolina, in March and April 1997.

Linda Brant Collins resigned as assistant professor effective December 31, 1996, in order to accept a position in the Division of Mathematics and Statistics, University of Texas at San Antonio.

Sandie Smith was promoted to secretary III on July 12, 1996, and serves as the administrative assistant for the Survey Section. Anita Hinkeldey McVey resigned from the section in September and took a position with Pioneer Hi-bred International as a statistician. Dianne Anderson was promoted to assistant survey projects manager, overseeing survey projects as well as supervising data entry operations, on October 29, 1996. Allison Tyler accepted a position in the Survey Section as a program assistant in December. She had previously worked as an hourly employee supporting survey operations. Linda Anderson joined the Survey Section in April 1997 as a statistical research associate. She has an M.S. degree in biometry from the University of Illinois at Urbana-Champagne, and will assist with USDA cooperative research.

Jung Hyun Park was here as a visiting scholar in the Department of Statistics from August 1, 1996, through July 31, 1997. He is an associate professor in the Department of Computer Science and Statistics at Kwan-Dong University in Korea. Dr. Park conducted research in the area of stochastic processes and collaborated with Soumendra Lahiri. Park also collaborated with Kenneth Koehler on applications of stochastic processes in the analysis of survival data.

Dr. Andrew Lawson, University of Abertay Dundee, Scotland, came on October 2 for a month to work with Noel Cressie on an Office of Naval Research grant project. Several other visitors came during the year to consult with Cressie and others in connection with EPA and ONR grants or to discuss spatio-tem-
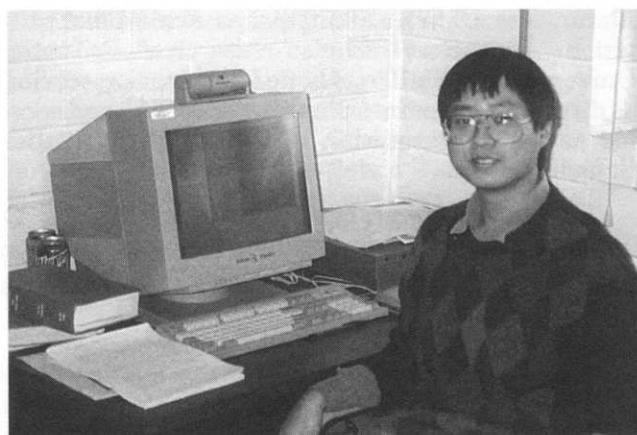
Yuhong Yang joined the statistics center in October 1996 after completing his doctorate at Yale. Earlier degrees are from the University of Science and Technology of China and the University of Illinois at Urbana/Champaign.

poral prediction: Prof. L. Mark Berliner, Geophysical Statistics Project, National Center for Atmospheric Research, and Department of Statistics, Ohio State University, October 6-8, 1996; Prof. Masaharu Tanemura, Institute of Statistical Mathematics, Tokyo, Japan, November 18-December 7; and Olaf Berke, Department of Statistics, University of Dortmund, Germany, January 29-February 12, 1997. Seminars given by Berliner and Tanemura are described on p. 50. Also Dr. Murari Singh, ICARDA, Aleppo, Syria, visited Cressie on April 30-May 2 to discuss spatial methods in agriculture.

After completing work for their doctorates here, Melissa Lopez Reyes and Jürgen Symanzik accepted temporary appointments for spring semester as instructor and postdoctoral fellow/instructor, respectively.

Derrick Rollins received the Anna Pate Mentoring Award for 1995-96 given by the ISU Program for Women in Science and Engineering on September 26, 1996. He also received a mentor award from the American Association for the Advancement of Science at its annual meeting in Seattle, Washington, in February 1997. The AAAS Mentor Awards honor individuals who during their careers demonstrate extraordinary leadership to increase participation in science and engineering by underrepresented groups, specifically women of all racial and ethnic groups; African American, American Indian and Hispanic men; and people with disabilities.

Bill Meeker received the Frank Wilcoxon Prize for the best practical application paper in *Technometrics* in 1995. Presentation was made by the chair of the Chemical Process Industries of the American Society of Quality Control at the Fall Technical Conference in Scottsdale, Arizona, on October 21, 1996.

Jay Breidt received the LAS Award for Early Excellence in Research/Artistic Creativity, given by the College of Liberal Arts and Sciences at Iowa State on May 7, 1997. At the same convocation, alumnus Martin Wilk (M.S. 6/53, Ph.D. 6/55) received an

Alumni Association Distinguished Achievement Citation. His career includes research at Princeton University and Bell Telephone Laboratories, serving as director of corporate planning at AT&T, and serving as Chief Statistician of Canada, in Statistics Canada.

Five searches were conducted during the year, to fill positions vacated by Strahan, Harville, and Collins, to fill a new position in environmental statistics, and to add a position in survey sampling. Two of these will be continued next year.

David F. Cox, University Professor, and his wife, Martha, were feted at a retirement coffee in May in the Oscar Kempthorne Reading Room.

David Cox retired effective May 15 and has been named University Professor Emeritus.

Looking toward next year: The Department of Statistics will celebrate the 50th anniversary of its founding, which was effective July 1, 1947. A special conference, Statistics for Correlated Data, is scheduled for October 1997.

Mark Kaiser and Sarah Nusser have been promoted to associate professor with tenure. Hal Stern and John Stufken have been promoted to full professor.

New faculty include Michael Daniels (for a new position in environmental statistics), William Duckworth (for undergraduate statistics, a position formerly held by Linda Collins), and Huaiqing Wu (for general theory, a position formerly held by David Harville).

Carl Roberts will be on faculty improvement leave for the 1997-98 fiscal year to do collaborative research with Prof. Roel Popping at the University of Groningen, the Netherlands.

As an experiment, the most recent Annual Report is being included in material accessible from the Department of Statistics' home-page on World Wide Web, as well as being printed in hard copy. Darlene Wicks has scanned text and photos for the electronic version. Contact http://www.public.iastate.edu/~stat/statindx.html and click on *Annual Report*.

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Statistical Laboratory Staff--Fiscal Year 1996-97 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; faculty status also in Ecology and Evolutionary Biology Program

Herbert A. David, emeritus 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, University Professor

David A. Harville, professor emeritus

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., Distinguished Professor in Liberal Arts and Sciences

Edward Pollak, joint appointment with Department of Genetics

Mack C. Shelley II, joint appointment with Department of Political Science

W. Robert Stephenson

Robert F. Strahan, professor emeritus

Stephen B. Vardeman, joint appointment with Department of Industrial and Manufacturing Systems Engineering

Leroy Wolins, professor emeritus

Associate Professors
F. Jay Breidt
Alicia Carriquiry
Soumendra N. Lahiri
Mervyn G. Marasinghe
Carl W. Roberts, joint appointment with Department of Sociology
Derrick K. Rollins, joint appointment with Department of Chemical Engineering
Peter Sherman, joint appointment with Department of Aerospace Engineering and Engineering Mechanics
Hal Stern
John Stufken
Shaskikala Sukhatme

Assistant Professors
Yannis G. Bilias
Linda Brant Collins
Dianne Cook
Mark Kaiser
Sarah Nusser
Jean-Didier Opsomer
Yuhong Yang

Temporary Instructor
Melissa L. Lopez Reyes

Postdoctoral Research Associate and Temporary Instructor
Jürgen Symanzik

Resident Collaborator
Robert Dayton, USDA NRCS
Tom O'Connor, USDA NRCS
Dean Thompson--director of NRCS Inventory and Analysis Institute, USDA NRCS
Herb Wilson, USDA NRCS

Visiting Research Scholar or Visiting Scientist
Park Jung Hyun
Andrew Lawson

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.

Pamela Abbitt
W. Jeremy Aldworth
Kari Henry Azevedo
Xiao-Hong Cao
Ian Carlson
Victor Chan
Cong Chen
Pinliang Patrick Chen
Jianlin Cheng
Bassirou Chitou
William F. Christensen (Shell scholar)
Dean DeCock (Procter and Gamble scholar)
Zachariah Dietz (Providian scholar)

Kevin Dodd
Dominic Dousa (Miller fellow and Dow scholar)
Thomas Dubinin
Jens Eickhoff
Michael Elling
Michael Eraas
Soledad Fernández
Allison Florance
King-Chong Iris Fung
John Gabrosek
Juan Jose Goyeneche (Fulbright/LASPAU fellow)
Matt Haubrich (Providian scholar)

Jennifer Heldt Hellrung (Shell scholar)
Paul Hendrickson (Shell scholar and Snedecor fellow)
Nan-Jung Hsu
Hsin-Cheng Huang
Shiaau-Er Huarng
Yoon-Sook Jeon
Angela M. Jones
Philip G. Jones (Fryer scholar)
Kari Jovaag
Jae-Kwang Kim
Koji Kondo
Shonda Roelfs Kuiper
Sun Hee Kwon
Chiang-Sheng Johnson Lee
Jaehyung Lee
Nicholas Lewin
Win-Chin Lin
Yi-Te Lin
Huei Grace Liu Ho
Xiao Hu Liu
Amy Jo Meyer (Vera David fellow)
Barbara Mock
Peter Morse (Shell scholar)
Laura Nalbarte-Migliaro
Andrew Nordine
Daniel Nordman (Procter and Gamble scholar and Miller fellow)

Ann Otte Schmidt
Brandon Paris
Jean Pelkey
Kara Perritt
Charles T. Peterson
Sylvia Rabstein (DAAD scholar)
Deanne Reber (Shell scholar)
Janelle Rhorer
Anindya Roy
Ken J. Ryan
Abigail Sage
Adam Sales (Shell scholar)
Florian Schirm (DAAD scholar)
Tae-Sung Shin
Haiyan Shu
Sandip Sinharay (Providian scholar)
Heather Smith
James D. Smith IV
Richard B. Sullivan
Ling-Ling Claire Tsao
Jun-Yuan Wang
Xue Wang
James H. Wright, Jr. (Lilly scholar)
Kevin Wright
Jill Yoder
Lei Zhang
Zugeng Zheng
Jun Zhu (Fryer scholar)

Supported Graduate Students
Kevin Ackley--Center for Family Research in Rural Mental Health, ISU
Abdulelah F. Al-Nafisa--Kingdom of Saudi Arabia
Hans Martin Axelson--Jan Wallander and Tom Hedelius Foundation for Social Science Research, Sweden
Andim Balce--Pamukkale University, Turkey
Barbara Dombroski Barnet--College of Education, ISU
Rebecca Benner--College of Business, ISU
Marek Brabec--College of Veterinary Medicine
Kok-Leong Chiang--National University of Singapore
Sriram Devanathan--Department of Chemical Engineering, ISU
Martina Erdbruegge (DAAD scholar)--Dortmund University
Yaling Fan--Department of Aerospace Engineering and Engineering Mechanics, ISU
Gerhard Helleman (DAAD scholar)--Dortmund University
Shuen-Lin Jeng--Center for Nondestructive Evaluation, ISU
Sock-Cheng Koh--National University of Singapore
Soon Seng Lau--Department of Aerospace Engineering and Engineering Mechanics, ISU

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Yoon-Dong Lee--Center for Family Research in Rural Mental Health, ISU

Márcia Macêdo--CNPq/CAPES Brazil and Kellogg Foundation

Inna Megretskaia--College of Family and Consumer Sciences, ISU

Toshitsugu Otake--Department of Economics, ISU

Sebastian Paris-Scholz (DAAD scholar)--Dortmund University

Francis G. Pascual--College of Engineering, ISU

Elizabeth Paterno--Department of Economics, ISU

B. Laknath Peiris--Center for Family Research in Rural Mental Health, ISU

Luiz Peternelli--CNPq/CAPES Brazil and Universidade Federal de Viçosa

Elizabeth Pierce--College of Family and Consumer Sciences, ISU

Xiaoming Qi--Department of Forestry, ISU

Nerilson Santos--CAPES/CNPq, Government of Brazil and Federal University of Viçosa

Pradipta Sarkar--Center for Nondestructive Evaluation, ISU

Michael Schuckers--Department of Aeronautical Engineering and Engineering Mechanics, ISU

Birdal Senoglu--Government of Turkey

Fangqiu Sun--Department of Economics, ISU

Melanie Wall--Center for Family Research in Rural Mental Health, ISU

Yanrong Wang--Department of Economics, ISU

Yufeng Wang--Department of Zoology and Genetics, ISU

Lie-Ling Wu--College of Veterinary Medicine, ISU

Jing Xue--Department of Economics, ISU

Tariq Yeslam Yahya--PIET/USAID

Jing Zhang--Department of Forestry, ISU

Sanyi Zhao--Department of Electrical and Computer Engineering, ISU

Self-Supporting Graduate Students

Anthony Baiching An
Jin Young Byun
Sau Kum Lydia Chan
Zhongshan Chen
Hwei Chun Chou
Young Hun Han
Chin-Liang Hung
Alejandro Islas-Camargo
Hee-Koung Joeng
Thomas J. Kirchoff
Eun-Kyung Lee
Song Li
Yunfeng Li
Chiou-Ping Liu
Shiping Liu
Sharon Osborn
Mingue Park
Yu-Ping Jade Tien
Xuchun Wang
Chi-Hung Wu
Yihong Xiao
Ling-Yu Cynthia Yang
Zhaohui Zhu

Professional and Scientific Staff

Maria Alvarado, systems support specialist, Survey Section, until November 30, 1996

Dianne G. Anderson, program coordinator, Survey Section

Linda Anderson, systems analyst, Survey Section, starting April 1, 1997

Richard Dorsch, systems analyst, Survey Section

Masoud Kazemi, systems analyst, Survey Section

Todd J. Krueger, systems analyst, Survey Section

Edith Landin, administrative specialist

Janice Larson, program assistant, Survey Section, starting fulltime July 1, 1996

Anita Hinkeldey McVey, analyst/programmer, Survey Section, until September 20, 1996

Deborah Reed-Margetan, systems analyst, Survey Section

Janet L. Schultz, analyst/programmer, Survey Section

Kathleen Shelley, supervisor, Statistical Numerical Analysis Services

Melissa J. Swanson, analyst/programmer, Survey Section

Harvey Terpstra, data systems manager, Survey Section

Douglas L. Tschopp, analyst/programmer, Survey Section

Allison Tyler, program assistant, Survey Section, starting December 15, 1996

Jauvanta Walker, communication specialist

Andrew Williams, program coordinator (survey projects manager), Survey Section

Gail Yarger, research associate, Survey Section, starting May 17, 1997

General Office Staff

Rose Ann Anderson, secretary
Norma Elwick, secretary
Brenda Hewitt, clerk typist
Jeanette La Grange, clerk typist
Denise Riker, secretary
Sharon Shepard, clerk typist
Marlene Tjernagel, account clerk
Darlene Wicks, clerk typist, Statistical Computing Section

Survey Section Staff

Glenda Ashley, key entry operator
Pubali Banerjee, research assistant, until December 15, 1996
Kathryn Bottorff, field interviewer, until May 30, 1997
Linda Claussen, secretary
Kathryn Goodwin, field interviewer
Vimlesh Gupta, key entry operator
Nancy Heathman, account specialist
Marlys Huff, field interviewer, until May 30, 1997
Marcia Luze, field interviewer
Kathie Reinertson, data technician
Jasmine Seagrave, data technician
Judy Shafer, clerk typist
Sandie Smith, secretary, Survey Section
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 Marek Brabec, Dominic Dousa, Kari Henry Azevedo, Kari Jovaag, Beth Pierce, Haiyan Shu, Claire Tsao, Jimmy Wright, Jun Zhu, Paul Hendrickson, Ken Ryan, and Jing Zhang.

Jun Zhu analyzed data from the Department of Entomology, on how the Western Equine Encephalitis virus affects the survival of mosquitoes. Each of two virus titers was assigned to 100 mosquitoes with an additional 100 control mosquitoes. A proportional hazards model was used to analyze the data. The result showed that the high titer dramatically increased the mosquito mortality, while no difference could be detected between the low titer and the control.

Jimmy Wright analyzed data from a corn-soybean rotation experiment that used three levels of phosphorous and three levels of potassium in a randomized complete block design. Eighteen years of data were used in the analysis. An analysis of variance that included years as a split plot factor was used to analyze the effect of phosphorous and potassium on crop yield.

Dominic Dousa and Wright analyzed data from a study that examined the effect of exposing cut carnations to norbornadiene. A total of four experiments, each using a randomized complete block design, were conducted in which the ethylene production of flowers exposed to a constant level of norbornadiene for 0, 2, 4, 6, 8, 10, and 12 days was conducted. After data from the individual experiments were analyzed, treatment means from each experiment were used as data for a combined analysis in which the experiments

Claire Tsao and Kari Jovaag, two of the graduate students in the statistics AES consulting group, discuss a consulting problem.

were regarded as blocks in a randomized block analysis. While there were large differences among the experiments, the combined analysis showed a significant decreasing, linear trend between the number of days exposed to norbornadiene and average ethylene production.

The long term effect of five sulfur treatments on crop yield was investigated at five Iowa locations using experiments in which corn and soybeans were planted in alternate years from 1977 to 1990. Three locations used a latin square and two locations used a randomized complete block design. Beth Pierce and Paul Hinz analyzed the year effects at single locations as a split plot factor and used an unweighted means analysis to combined data from all the locations. There was no evidence that sulfur benefited the yield of either corn or soybeans.

An experiment at each of three locations was used, with 15 bacteria strains, to test sensitivity of two drugs. Each location used a randomized complete block design with two replications. Haiyan Shu analyzed data from each location separately and then combined the data into one analysis by using treatment means from each location as data for an analysis in which locations were regarded as blocks in a randomized block analysis.

Marek Brabec analyzed water quality data from the Veterinary Diagnostic Laboratory consisting of measurements of concentrations of various chemical compounds in well water. Because of the presence of concentrations below the limit of detection, maximum likelihood was used to fit several models for left censored data. Variables free of censoring were used for regressions on several explanatory characteristics, such as well water properties. Factor analysis was used to describe relationships among chemical compounds.

Claire Tsao consulted on a project to study how the growth of soil micro-organisms differed when the bases of poplar trees were uncovered or covered with

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plastic. Two poplar varieties were used, and the soil was sampled at two depths. Each soil sample was evaluated at four dilutions. A split split plot analysis of variance was recommended with treatment and variety as whole plot factors, soil depth as the split plot factor, and dilution as the split split plot factor.

Kari Henry Azevedo consulted on a wide range of projects. Research topics included toxins and their relation to liver cancer, studies comparing beliefs and practices of preschool and elementary teachers, assortment planning in merchandising, classroom-based social interaction interventions, improvement of testing procedures for iron isotopes, and comparison of success for businesses in small towns with community involvement. The types of analysis involved included factor analysis, cluster analysis, and logistic regression.

Kari Jovaag analyzed data collected from a project designed to learn how panicle type, position on panicle, harvest date, and other observational factors affect the germination of seed from foxtail grass. An analysis of variance was used to identify those factors that had the most influence on the germination of embryos, caryopses, and seeds.

Kenneth Koehler consulted with several animal ecologists on the design of studies for examining the impact of various environmental factors on bird species abundance, nest predation, and nesting success. Statistical methods were developed for applying Poisson and logistic regression models to split plot designs and studies with nested factors.

Koehler worked with a graduate student, Jing Zhang, to develop neural networks for predicting dew formation from information on temperature, wind speed, and relative humidity. He is currently working with another graduate student, Ken Ryan, in developing a database that will be used to compare the accuracy of weather information obtained from a model fit to satellite data with corresponding information obtained from ground stations at various locations in the midwest. This is part of a larger project on site-specific weather data simulation being carried out by a team of researchers headed by Mark Gleason, Department of Plant Pathology.

Koehler consulted with researchers in the Department of Food Science and Nutrition on the design of several studies. One study will examine the potential of isoflavonoids from soy protein to prevent certain symptoms experienced by women in menopausal transition. Another study will examine the effect on growth of low weight infants that can be achieved by providing parents with nutritional guidance through regular visits with highly trained nurses. A third study will examine the role of dietary energy restriction in cell signaling and inhibition of skin tumor formation.

▓ 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 1996-97 were led by William J. Kennedy and Mervyn Marasinghe (see p. 44).

Due to the rapidly expanding and changing computer hardware inventory in the statistics center, and the retirement of Bud Meador, the Statistical Computing Section has reorganized to shift more of its focus from programming and data processing operations to providing departmental hardware support and statistical software consulting support. The organization now has Kathy Shelley as internal operations supervisor, and a staff of four graduate research assistants.

The graduate assistants who worked with Shelley during the 1996-97 year included Deanne Reber, Shaau-Er Huarng, Lei Zhang, Tae-Sung Shin, and Chuck Peterson. The major software development applications included the State Forest Nursery Tree Order System, the Ruan Truck Leasing statistical modeling and cost estimation project, and EpiSTATION software development. Especially toward the end of the year, departmental service work took priority with the arrival of much new equipment for laboratories and individual offices.

New features were added to the State Forest Nursery Tree Order System. The orders for seedlings are taken over the phone and are entered directly on networked PCs. Enhancements included the ability to recall all customer information for people who ordered during the previous year, with the screen information automatically entered, an on-line list of locations for Spring seedling pick-ups, and initial inventory querying to be able to see which seedlings have been sold out.

Deanne Reber has been in charge of software development for the Ruan Truck Leasing project for the past three years. Reber continued to work with Kenneth Koehler in updating the maintenance cost database, and developing new graphs and software. Koehler developed improved algorithms for predicting future costs and labor requirements for maintaining leased trucks. Reber incorporated Koehler's statistical modeling enhancements into the overall package, which included graphical and tabular maintenance cost estimation reports and on-line table look-up estimates that are used in the Ruan repair terminal sites located nationwide. Chuck Peterson came at the end of the year to work with Reber to take over the software management.

EpiSTATION is a data management and statistical analysis software package for medical claims data. Work on EpiSTATION ended in February. The product, which was developed by Kathy Shelley, Pete Anderson from ISYS Inc., and Tom Bubolz from Dartmouth University Medical School, is being beta-tested and prepared for the final marketable version. This was a three year project written in SAS/Frame

with statistical and graphical procedures providing the user with quickly obtained analyses on very large datasets. Its focus was the ability to obtain statistical information on zipcode-based small areas--similar to GIS modeling, while also providing SAS' linear modeling capabilities for those small areas.

World Wide Web departmental page support has increased dramatically, and this section has implemented many of the content changes on the pages. Darlene Wicks has done the majority of the changes with faculty/staff page updates, scanning and installing the Statistical Laboratory Annual Report and recent newsletters, and enhancing our departmental 50th Anniversary Web pages. Lei Zhang provided help organizing the seminar Web page and doing the beginning pages that will comprise a department computing help page. Both Wicks and Zhang used HTML coding. Zhang also explored using a PC-based Web page tool, Hot Dog Professional. Shanshan Cui was hired as a graduate assistant from the College of Design to develop Web frames that have provided visual enhancements to the departmental pages.

With the arrival of 22 new DEC Alpha workstations for the public laboratory in room 322 and the arrival of six new Pentium PCs in the fall, work quickly shifted to hardware and software setup and support. The new machines created a domino effect of replacing the oldest equipment with the newly purchased equipment. There was little software installation for the Alpha workstations because software is provided through the university-wide Project Vincent™ networked software. The PCs required more setup time because software was transferred from the older Windows 3.x machines to the newer Windows 95 machines with initially mixed, but eventual, success. Shiaau-Er Huarng used our portable tape backup unit on the older PCs. She also installed new network software, including Netscape and Windows versions of Telnet and FTP, on the older PCs once their RAM memory was upgraded.
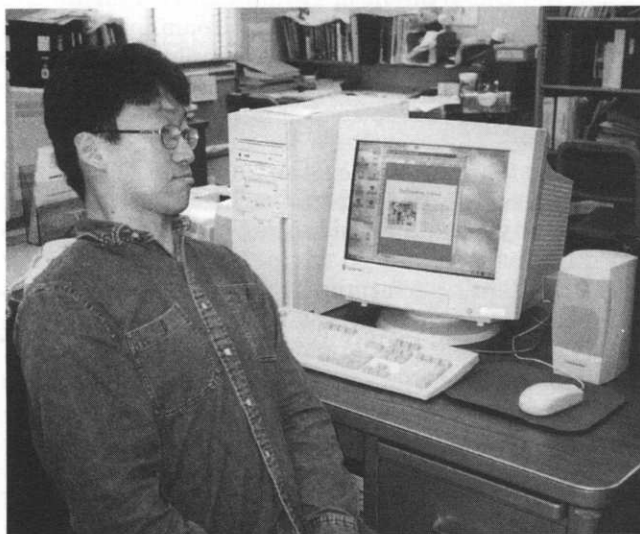
Tae-Sung Shin listens to a client regarding hardware and software setup and support for the department. This work has included setup of new ethernet Postscript printers and installation of virus protection software.

Tae-Sung Shin has installed and maintained the on-line workstation CIS data query system for statistical research. Users are able to find titles to statistical journal articles by submitting subject keywords, title, or author information. Shin also has set up the new ethernet Postscript printers in our department, which provide much faster output for graphics and finished research documents. He also has done substantial work on the Statistical Computing Section's Web pages and has installed virus protection software on all departmental PCs.

The section provides university-wide support for use of the SAS statistical software package in PCs. This is one of the most heavily used software packages on campus. The section maintains a university site license for Windows SAS. For an annual fee, section personnel will install the SAS software at the user's office and provide on-site support for any problems related to the software. Shiaau-Er Huarng did most of the on-site installations for the section.

▨ 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, study design, and execution of sample surveys and censuses. Section staff engage in all operational areas 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 human subjects survey projects and staff, with support from Dianne Anderson, Janice Larson, and Allison Tyler. Jean Opsomer, Sarah Nusser, Jay Breidt, and Wayne Fuller assist with sample design and selection for projects and in consulting with clients.

The Survey Section collaborated with the Iowa Department of Public Health (IADPH) on two studies this year. The first study, conducted for the IADPH and the Centers for Disease Control and Prevention, was a case-control study of individuals who took part in a pilot program called the 5 + 5 Program, designed to encourage residents to consume at least five servings of fruits and vegetables a day and to exercise for at least 20 minutes five times a week. Section staff designed the study, sample, and questionnaire with a faculty member from the College of Education. Approximately 240 individuals who participated in the 5 + 5 Program (cases) and a random sample of 270 Ames area residents (controls) were interviewed to determine the effects of this community-based program. The Survey Section collected and coded the data.

The staff also cooperated with the IADPH and faculty from the College of Family and Consumer Sciences on a study to investigate the opinions and experiences of individuals enrolled in the state's Medicaid program, both before and after the introduction of an HMO-style management plan. A stratified sample was selected consisting of 570 recipients

who sought substance abuse care under the new HMO plan, and 285 recipients who received care for non-substance abuse reasons. Section staff were responsible for sample design, questionnaire design, data collection, coding, data processing, and weighting.

The staff cooperated with the Iowa Workforce Development (IWD, formerly the Iowa Department of Employment Services) to select establishments to participate in the 1996 survey of Iowa wage rates. The Survey Section selected a stratified sample of firms to obtain wage information for over 400 occupations in substate regions. The IWD conducts the mail survey and processes data. The Survey Section was asked to conduct a telephone nonresponse followup survey to obtain wage information from 1,000 firms that failed to respond to the mail study. Survey Section staff drew a sample of nonresponding establishments with allocation targeted toward obtaining data from underrepresented job categories. Section staff were responsible for sampling, data collection, coding, and initial data processing for the nonresponse study. Data from respondents in the mail study and the telephone nonresponse study were combined by the IWD. Section staff were responsible for weight calculations, and for generating statewide and regional mean wage rates and entry level wages for individual occupations and for groups of occupations. The statistical summaries are included in a report produced by the IWD.

A case-control study of birth defects, funded by the Centers for Disease Control, examined pregnancy and genetic histories of mothers of children born in Iowa with specific multiple birth defects. The Survey Section conducted telephone interviews with approximately 160 mothers, half of whom had children recently diagnosed with defects. This survey is part of an ongoing multiyear project, in conjunction with researchers at the University of Iowa College of Medicine.

The biennial Ames School Census was conducted in the fall of 1996. Approximately 25 interviewers were employed to visit each residence in Ames to collect census information on children under seven in Ames. The Survey Section was responsible for all data collection, coding, and data processing tasks. The data are used to help the Ames Board of Education and local schools plan for future staffing and resource needs.

Two telephone studies were conducted for campus organizations. The Survey Section conducted a readership survey for the *Iowa State Daily*. Stratified samples of 240 faculty/staff and 230 students were selected to be interviewed. This project was designed to collect information on newspaper readership patterns and consumer habits of members of the university community. A survey concerning ISU Telecommunications voice-based services was also conducted. A mail questionnaire was sent to approximately 750 students, and a telephone followup of a sample of 210 nonresponding students was then conducted.

A study was conducted for the North Central Association of Colleges and Schools, an educational accrediting association. The chief executive officers from 900 member institutions and a sample of approximately 300 consultant-evaluators were sent a questionnaire designed in collaboration with Survey Section staff. The questionnaire covered issues including satisfaction with the current accreditation procedures and administration.

Two mail studies were conducted for the ISU administration. The President's Office commissioned a study to determine the extent to which faculty, staff, and merit employees took part in professional development opportunities. A mail-out questionnaire was designed by the Survey Section in conjunction with the President's Committee on Professional Development Surveys. A stratified sample of 3,290 faculty, P&S, and merit staff was selected by section staff for participation in the survey. Results are being used to investigate future needs for professional development on campus.

The ISU Office of Institutional Research continued its collaboration with the Survey Section to conduct the biennial Faculty Activity Hours Survey. Two hundred forty faculty were randomly selected and asked to report the number of hours worked on professional activities during each day of the previous week. Survey Section staff were responsible for sample design, data collection, data processing, and production of weighted estimates of the average number of hours worked per week by faculty. The report for the Faculty Activity Hours Survey is submitted to the Board of Regents.

Survey Section staff also provided advice and consultation for many members of the university community, including the College of Business for assistance with a study of leadership traits, ISU Extension for the development of a large study that will investigate the effects of welfare reform in 1997-1998, the Department of Human Development and Family Studies for a study of classroom intervention techniques, the Department of Agronomy for a questionnaire to measure high school student and guidance counselor perceptions of agronomy as a career, the College of Agriculture for a project on organic waste at slaughter houses, the College of Family and Consumer Sciences for a study of financial behavior, the Faculty Senate Presidential Review Committee for questionnaire design advice on a study to review the President's performance, the Center for Transportation Research for study design advice for a study of trucking technology, the Department of Agricultural and Biosystems Engineering for sample and questionnaire design advice for a survey of responses to carbon monoxide incidents by fire departments, the College of Design for a project on potential use of the Iowa Communications Network among faculty, a consulting group working on the ISU Housing Master Plan for a study to determine future housing needs, and the Department of Family and Consumer Sciences for a project to investigate social capital in rural and mid-sized towns.

In addition, Survey Section staff provided advice and consultation to the American Society of Farm Management and Rural Appraisers on methods for crop yield surveys, ISU Extension to study how extension staff are expanding international aspects of their work, the Business and Finance Office on a customer satisfaction survey, and the Human Development and Consumer Sciences Department on survey methods for longitudinal household studies in Poland.

▓ 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.

Herbert T. David, Peter Sherman, Derrick Rollins, and Stephen Vardeman provided assistance on engineering research projects. For example, Sherman has consulted with a General Motors engineer enrolled in the M.S. program on a problem in vehicle dynamics.

In the 1996-97 year, Francis Pascual served as statistics research consultant for the College of Engineering, providing online statistical consulting for engineering departments. He received several questions on different topics in statistical analysis. For example, a researcher in mechanical engineering inquired about estimating measurement and sampling errors in his data collection. Assistance was given to a faculty member of the Department of Chemical Engineering in the analysis of different data sets on gas-promoted oil agglomeration processes. This was a continuation of work started in the previous year. H. T. David and Pascual consulted on designing experiments for subsequent research and analyzing the data from these experiments. Pascual also consulted with professors in the Department of Aerospace Engineering and Engineering Mechanics on two projects and with graduate students in civil and construction engineering, materials science and engineering, and mechanical engineering.

▓ Social and Behavioral Sciences and Humanities

Mack Shelley consulted with Iowa State University faculty and students from the departments of Industrial Education and Technology, Human Development and Family Studies, Professional Studies in Education, Community and Regional Planning, Health and Human Performance, Sociology, Curriculum and Instruction, Statistics, Forestry, Journalism and Mass Communication, and Economics, and from the ISU Residence Halls system. He also served as a consultant to the Iowa Department of Education and the Iowa Department of Public Health.

A special project involved providing advice to the law firm of Marcus and Thompson, P.C. (Fairfield,

Iowa), and providing expert witness testimony regarding the role of "third" political parties in the political history of the United States, for the federal district court case *Natural Law Party v. IPTV,* heard in the Southern District of Iowa, September-October 1996.

Analysis of data from a study of Iowa companies' needs for assistance by ISU in their pursuit of international business opportunities, in collaboration with the International Agriculture Programs office in the College of Agriculture, funded by a grant from the Council on International Programs, led to publication of "International Needs Assessment of Iowa Businesses: The Implications for Iowa State University's 1995 ©2000 Strategic Plan: Report on the Results of a Survey," by David Acker, August Ralston, Steffen Schmidt, and Mack Shelley, in December 1996 for ISU's Council on International Programs.

The consulting projects undertaken by Shelley at ISU addressed an attitude rating scale to select employees who display the potential to become effective in-house trainers in small- and middle-sized manufacturing companies; the adjustment by international students to a university in the United States; the relationship between personal possessions brought from home and adjustment to university life at Iowa State by dormitory housing residents; correlates of student dormitory residents' satisfaction with the performance of their residence hall assistants; factors affecting the darkening of lithographic reproductions; the effect of the presence of law enforcement personnel on the incidence of traffic violations by bicycle riders; college students' perceptions of faculty roles in diversity and multiculturalism; the attitudes of Korean nurses toward child abuse; the effects of race and athlete/nonathlete status on the incidence of eating disorders among female high school students; perceptions of the suitability of different types of vocational-technical education programs in community colleges in the United States; high school dropout rates and social capital influence in Missouri school districts; comparing adoptive and nonadoptive families; the effects of classroom teacher, parenting practices, and preschoolers' responses to peers' distress in daycare; parents' utilization of neonatal hospital services following discharge; and attitudes, motivations, and experiences of foster parents in Iowa.

Other consulting projects concerned the effect of a treatment on pre-service mathematics teachers' attitudes about arithmetic and computers; preschool science education; ethnic differences in attitudes toward family behavior; gambling frequency, expenses, and scope in Iowa; educational and career choices among the mathematically precocious; properties of three varieties of four-year-old hybrid poplar kraft pulp; male-female differences in estate planning; perceptions among college students of Koreans portrayed on television in the United States; economic distress in Poland since the end of socialism; different perceptions of ability to solve technological

problems among students at Iowa State University, the University of Missouri, and Central Missouri State University, comparing technology and humanities majors; life circumstances for adoptive children; the effects of mothers working split shifts, staying at home, and working full-time during the day on the mothers and their children; perceptions of sexual behavior and the sexual activities of students taking a course in human sexual development at Iowa State; prelim performance by doctoral students in the ISU Department of Statistics; food and beverage production in the U.S. over a 34-year period; racial prejudice among university students regarding African Americans and Chinese Americans; and estimating a model of human capital formation.

During the year Frederick O. Lorenz also continued to do consulting with social and behavioral science graduate students.

▓ Other Consulting/Cooperation

Noel Cressie advised a master's student in economics on how to summarize spatial dependence in maps. The use of Geary's contiguity ratio was suggested, allowing weekly maps to be summarized as a time series of the contiguity ratio. Advice was given to a master's student in physics on how to summarize measured gamma radiation, believed to have come from active galactic nuclei ("black holes"). He consulted with a Ph.D. student in agricultural and biosystems engineering on how to analyze coulter-profile data. After appropriate summarization of the profiles, an analysis of variance would detect any differences due to coulters.

Cressie advised USDA scientists in the Soil Tilth Laboratory on spatial design for use of satellite remote-sensing data to detect nitrogen stress, water stress, weed detection, and plant health.

He also consulted with the Ministry of Science and Technology, Government of India, on developing GIS-based technologies for local-level development planning, specifically the use of spatial statistics in a GIS environment.

Mark Kaiser developed a Bayesian hierarchical model to monitor changes in water chemistry variables over time in a given lake or reservoir. This model was applied with good results to a municipal water supply reservoir in Colorado and to analysis of a 30-year record of water quality measurements in Lake Washington. Both projects were undertaken jointly with John R. Jones of the School of Natural Resources, University of Missouri.

Hal Stern continued his collaboration with researchers at the ISU Center for Transportation Research and Evaluation, concerning an evaluation of the impact of electronic clearance at truck weigh stations on U.S. Interstate Highway 75. Studies are being carried out to estimate the amount of fuel and time saved by trucks permitted to bypass weigh stations. In addition, a simulation model of weigh station traffic is being developed to estimate benefits of electronic clearance at other locations.

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), and the College of Liberal Arts and Sciences (LAS). Several other colleges provide research support through graduate assistantships for statistics students; these students consult with researchers within the colleges.
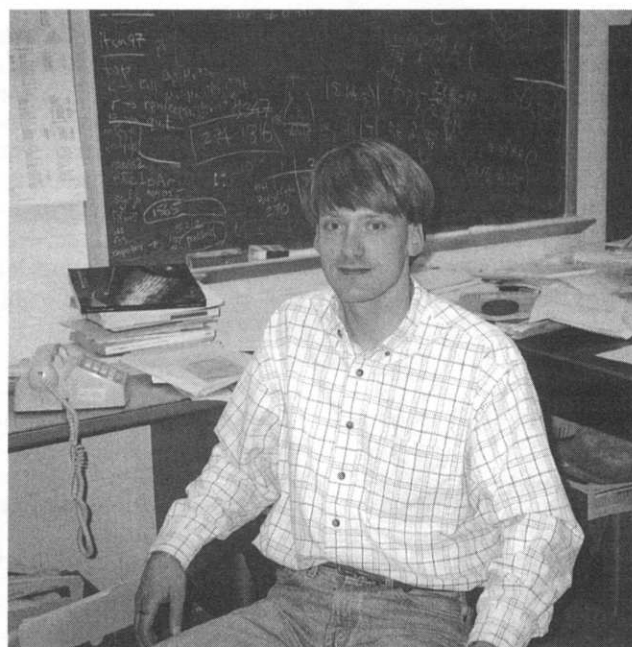
Jay Breidt received an award for early excellence in research from the College of Liberal Arts and Sciences. His research deals with time series and survey sampling.

▓ Natural Resources Inventory

The Survey Section continued its research in survey methodologies for natural resource surveys under a cooperative agreement with the National Resources Conservation Service (NRCS), U.S. Department of Agriculture. This work is directed by Sarah Nusser. On-site USDA collaborators include Bob Dayton, Tom O'Connor, Dean Thompson, and Herb Wilson. Jay Breidt, Wayne Fuller, Nusser, and Jean-Didier Opsomer were the ISU faculty working

on the agreement. They were responsible for sample design, statistical estimation procedures, and other statistical and survey methods research associated with the project. Richard Dorsch was in charge of data processing and database management, assisted by Linda Anderson, Glenda Ashley, Vimlesh Gupta, Masoud Kazemi, Todd Krueger, Kathie Reinertson, Jan Seagrave, and Melissa Swanson. Other staff members working on this project during the year were Pubali Banerjee, Kevin Dodd, Jens Eichkoff, Jae-Kwang Kim, Amy Meyer, Junyuan Wang, Gail Yarger, 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 to study changes in resource conditions over the ten-year period. This year, effort was devoted to preparing for 1997 NRI data collection. The 1997 sample consists of the entire sample used during the 1992 NRI. 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 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 sample units includes information on soil characteristics, land use, soil erosion, vegetative cover, and ecological variables such as habitat diversity. The 1997 NRI data will be collected primarily by remote sensing via aerial photography with a minimum of on-site field visits.

A new computer-assisted survey information collection (CASIC) system was developed to support 1997 data collection. The system consists of hand-held computers (Newton MessagePads) used by NRCS data gatherers to collect data via a computer-assisted survey instrument (CASI), which connects via modem or Internet to a central database service at ISU to exchange survey data and other information. The CASI and communication software for connecting to the database service was cooperatively developed by Survey Section staff, on-site USDA collaborators, and Aristar, Inc.

The NRI database service was designed by ISU Computation Center and Survey Section staff. Redundancies and separation of computing tasks were incorporated into the system design to promote robustness in the event of component failures. The NRI database accessed by the hand-held computers was developed in the ORACLE relational database environment. The database contains historical as well as the current year's survey information. Log-in IDs and passwords were implemented to maintain system security, and transaction logs of system processes were developed to monitor system usage and to investigate problems in system operation. A World Wide Web (WWW) interface was created to monitor survey progress and to review data collected by

NRCS staff. Survey Section staff engaged in testing of the software required to link the database, the data servers, and the PDAs into an efficient data collection and processing system. Development work involved several different programming environments including UNIX, Apple/Newton, IBM PC, and the WWW.

In addition to research in CASIC systems, research projects were conducted to develop statistical methodology in preparation for the 1997 NRI. Opsomer and Eickhoff extended an algorithm for generating pseudo points for the NRI surveys by incorporating spatial location information in the selection of donor points. Pseudo points are imputed from real NRI point data to reflect changes in land use that occur in PSU or county level data but that are not reflected in existing points. By using donor points that are located closer to the pseudo points, the bias in the NRI estimators was shown to be reduced. Fuller and Dorsch worked with Glenn Lawson of the NRCS National Resources Inventory and Analysis Institute on developing procedures for the use of GIS information in the 1997 NRI. Lawson has assembled data and developed programs to extract geographic data on federal lands, large water bodies, and large streams that will become part of the 1997 NRI database. This information is used in imputing pseudo points and calculating weights for NRI points.

Editing and preliminary analyses of data from the special 1996 NRI study were completed during the year. This study was conducted outside the normal five-year rotation of the regular NRI and was commissioned to investigate the effect of the 1996 Farm Bill and high commodity prices on cropping patterns, land management, and cultural practices. The 1996 study is a sample of about 4,000 PSUs from the regular NRI. Both 1996 levels and 1995-1996 changes were estimated using regression weighting procedures, and variances were estimated using linearization techniques. Future analyses will include incorporation of data from operator interviews conducted by the National Agricultural Statistics Service (NASS) on a subsample of the points in the selected PSUs.

As part of the special 1996 NRI study, Opsomer and Meyer developed a model to predict soil erosion losses from agricultural lands. The model uses four years of cropping history, location, and other land use information to estimate the cropping factor (C), the most rapidly changing element in the Universal Soil Loss Equation (USLE) index. In on-going research, the model is being extended to predict wind erosion losses.

Preparations were also initiated for a 1997 special NRI study, which is to be conducted in addition to data collection for the full national 1997 NRI sample. The 1997 special study will involve intensive data collection from aerial photography on a subsample of about 6,000 PSUs from the full 1997 NRI, including the 4,000 PSUs from the 1996 study. Changes in land management and cropping patterns from 1996 to 1997 will be studied using these data.

Jean Opsomer continued his work from the previous year on the Alaska NRI, collaborating with

NRCS staff in organizing the data of previous NRIs and planning for the 1997 NRI.

Fuller and Breidt were involved in the design of a pilot inventory of rangeland conditions on public lands administered by the Bureau of Land Management (BLM). Such an inventory is mandated by Congress. The pilot study, conducted by BLM personnel on federal lands in Colorado, is intended to determine the economic and logistic feasibility of adopting an NRI-type sampling protocol on BLM lands nationwide. Fuller and Breidt met with BLM scientists in Denver on March 6-7 to discuss design issues, and met in Grand Junction on April 9-11 to field-test the measurement protocols. Data collection will continue through fall 1997.

Nusser and Opsomer collaborated with the NRCS Watershed Sciences Institute and Soil Quality Institute to develop sampling designs for watershed studies in North and South Carolina. The purpose of the surveys is to assess watershed health in relation to land use, agricultural practices, and riparian buffer capacity. Opsomer and Nusser developed sampling designs for components of the study. This project relies heavily on the use of Geographical Information System (GIS) tools for delineating the watershed strata, the sampling frame of drainage areas, as well as the data collection. Survey Section and Natural Resources Inventory and Analysis Institute staff developed a CASIC system that directly interfaces with global positioning system (GPS) receivers to assist in data collection.

A project was initiated in cooperation with Natural Resources Inventory and Analysis and Iowa CRCS staff to apply NRI sampling and data collection protocols in gathering data for local planning purposes. The 1992 NRI sample in Johnson County, Iowa, will be used to collect data. The study objectives also include assessment of the accuracy of digital sample location information and use of NRI data as ground truth information in developing land use maps. Fuller directed research on the use of replication methods for variance estimation for two-phase samples. The objective of the research is to produce a procedure in which the end user works only with the second-phase sample. It is planned to use the method for subsamples of the NRI, such as the special 1996 NRI study. It is also desired that the procedure produce the correct estimated variances for items in the second-phase sample that are observed on the first-phase sample. Kim assisted in this research.

Fuller also conducted research on possible designs for the NRI should the program migrate to a design based on large annual surveys. Designs that are combinations of a pure panel observed every year and samples observed for shorter periods of time are being considered.

F. Jay Breidt and Alicia Carriquiry conducted research on sampling methods for environmental policy assessment. The Natural Resources Inventory (NRI) points are taken as the sampling frame for drawing a subsample of points on which to run computer fate and transport models that simulate, for example, the leaching of chemicals to the ground-

water, or the amount of topsoil lost to erosion under different policy scenarios. Martin Axelson collaborated in this research.

Nusser, Wang, and William R. Clark (ISU Animal Ecology) collaborated on a project to combine Iowa Department of Natural Resources pheasant survey data with NRI data. The research focused on developing statistical methods to assess the impact of the Conservation Reserve Program on pheasant populations in Iowa.

Soils Databases

An ongoing part of the NRCS cooperative work is the storage, maintenance, and software development for the national soil survey 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 Deborah Reed-Margetan, Jane Schultz, Douglas Tschopp, and Jan Seagrave. The data entry staff included Glenda Ashley and Vimlesh Gupta.

Several main databases make up the system of soils data. The national map unit interpretations (MUIR) database consists of basic soil property and interpretation information for each map unit component in NRCS detailed soil surveys. The official soil series description (OSD) database contains a textual description of soil series. The soil series classification (SC) database contains the official soil classification for soil series. The soil interpretations (SIR) database consists of basic soil property and interpretation information for all soil series in the nation.

These soils databases are used by the NRCS to record and retrieve much of the basic information collected in their soil survey work and in their work to classify and correlate soil series. NRCS uses these databases to provide data for NRCS state and county office computer systems and to produce tables that are published in NRCS soil survey reports. 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, the Center for Agricultural and Rural Development, and the Soil Quality Institute have used the data.

During the year, the transition of most soils database activities from the ISU mainframe computer to a Unix computer environment was completed. The SC and OSD databases were implemented on a Sun computer located in the ISU Computation Center. Both WWW and non-WWW interfaces were developed for query and retrieval from these databases. The national MUIR database is maintained in an Oracle database on Project Vincent™. This national MUIR database has now become the main database of soil property and interpretations data elements

used for national queries and for data dissemination. The SIR database was continued on the mainframe for limited use by those needing to finish specific soil survey projects. It will soon be discontinued.

World Wide Web (WWW) access to the NRCS soils information and databases has seen continued development this year. Work was completed on enhanced access to the OSD data, which included capabilities to query for soil series with selected classification, location, and date attributes. Query and report capabilities for the SC database were also developed, as were various enhancements to the MUIR access capabilities. In addition to the database access, the WWW pages provide various information about the NRCS Soil Survey Division (www.statlab.iastate.edu/soils/soildiv). This NRCS information includes the following publications: *National Soil Survey Handbook, Keys to Soil Taxonomy,* and revised chapters for the *Soil Taxonomy* manual.

Another major project was the continued development and refinement of a program to calculate the NRCS soil rating for plant growth (SRPG) index. This index is designed for use in comparing the relative productivity of soils nationwide. The index is used in the USDA Conservation Reserve Program (CRP) sign-up to help determine eligibility and amount of payment. The SRPG calculation is based on a complex set of interrelationships between soil, landscape, and climate factors. Throughout the year, many refinements were made to the calculation as states reviewed results in detail. The national MUIR database is used in these calculations.

The next generation of NRCS map unit soil property and interpretations database is being called the National Soil Information System (NASIS). Working with the NRCS NASIS developers, the soil database project staff along with staff from the ISU Computation Center participated in testing of a centralized database server for NASIS. Plans call for having a centralized, national NASIS Informix database server at ISU with a large number of remote clients scattered around the country running the NASIS user software. Because initial testing showed significant performance problems, efforts are being made to redesign NRCS software. Further testing is planned.

The ongoing tasks of system maintenance, hotline support for NRCS remote users, and data distribution were also part of this year's activities.

Soil Survey Updates

Research to develop statistical methods for soil survey updates was continued in association with NRCS National Soil Survey Center staff in Lincoln, Nebraska, Iowa NRCS, and faculty and students in the departments of Agronomy and Statistics. At Iowa State, Pam Abbitt, Jay Breidt, Bennie Clark (Agronomy), Tom Fenton (Agronomy), Wayne Fuller, Sarah Nusser, Sandip Sinharay, and Zugeng Zheng participated in the project. Statistical Laboratory staff

included Glenda Ashley, Vimlesh Gupta, Todd Krueger, and Jan Seagrave. NRCS staff included Ellis Benham, Louis Beockman, Dennis Lytle, Gary Medlyn, and Tom Reedy.

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 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 and geographically linked data.

A multi-phase sampling plan using Markov chain point selection is being field-tested in a three-year pilot project in Crawford and Woodbury counties, Iowa, as part of the Soil Survey Update for MLRA 107. 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 over those obtained previously with purposive samples. 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.

A computer-assisted survey instrument was created using methodologies developed as part of the 1997 National Resources Inventory preparation. In addition, preliminary analysis products for the soil survey report were developed by ISU and NRCS staff to guide statistical research objectives.

Abbitt, Breidt, and Nusser are studying regression estimation procedures for summarizing distributional characteristics of soil map units in a multi-phase sampling context. These techniques are being applied to data collected in the MLRA 107 soil survey updates. Special features of the data include truncated distributions, for which nonlinear predictors are appropriate.

Time Series and Survey Sampling

Joint research in time series, survey design, and measurement error models is supported by the U.S. Bureau of the Census, the National Agricultural Statistics Service, and, through AES Project 3294, the Iowa Agriculture and Home Economics Experiment Station. Federal agencies' support in the 1996-97 year came through Cooperative Agreement No. 43-3AEU-3-80088. Wayne Fuller is principal investigator. Other personnel working on the project include Anindya Roy, Pradipta Sarkar, Jae-Kwang Kim, Cong Chen, Juan Jose Goyeneche, and Zugeng Zheng.

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Investigation of modifications of existing estimators for multivariate autoregressive processes in which a root is close to one was conducted by Roy and Fuller. A procedure that modifies the coefficients on the basis of the test for a unit root has been studied using Monte Carlo methods. In those studies the modification has smaller mean square error than ordinary least squares for processes with a root close to one.

Anindya Roy developed an approximation to the maximum likelihood procedure that is relatively easy to compute for processes with a root near one. The computational procedure can be iterated to obtain the maximum likelihood estimator. The performance of the maximum likelihood estimator and the approximation are similar, and both are superior to ordinary least squares for processes with large roots.

Roy also worked with Prof. Barry Falk, Department of Economics, on applications of estimators for autoregressive processes with a root near one.

Pradipta Sarkar studied estimation for autoregressive processes with errors that are not normally distributed. He developed a procedure that uses the residuals from a least squares regression to estimate the unknown density of the errors, where the approximation is a spline. The estimated error distribution is then used to construct an improved estimator of the autoregressive coefficients. The procedure outperforms ordinary least squares for many nonnormal distributions and is only moderately inferior to ordinary least squares when the errors are normal. The estimated error distribution can be used to construct confidence intervals for prediction. In Monte Carlo simulations the procedure produced confidence intervals with coverage probabilities close to the nominal probabilities.

Jae-Kwang Kim has initiated work on variance estimation for samples with imputed values. Research is concentrating on jackknife estimation for hot deck imputation. He also worked on replication variance estimation procedures for two-phase samples.

Wayne Fuller conducted research on small area estimation, in cooperation with Cary Isaki, Michael Ikeda, and Julie Tsay of the Census Bureau. A quadratic programming procedure was developed for the estimation of household characteristics given external estimates of the number of individuals in different categories, and household information from the census. Variance estimators that recognize the error in the estimated number of individuals were developed. Juan Jose Goyeneche and Zugeng Zheng applied the estimators of variance to data from the 1995 Census Test.

▨ Dietary Intake Estimation

Development of methods for estimating the usual intake distributions of nutrients and foods continued in 1996. Alicia Carriquiry, Sarah Nusser, Wayne Fuller (Statistics), and Helen Jensen (Center for Agricultural and Rural Development), in cooperation with Patricia Guenther (Agricultural Research Service (ARS)) completed the work on a long-term cooperative agreement between Iowa State University and ARS that ended in September. Research assistants working on this project included Kevin Dodd, Juan Jose Goyeneche, and Cong Chen. Todd Krueger, from the Survey Section, did most of the programming work related to software development for the project.

During the last year of the agreement, methods for computing the correlation between dietary intakes observed on consecutive days, for estimating the usual intake distributions of ratios of dietary components (such as the percent of calories consumed from fat), and for estimating the usual intake distributions of foods, were extended in various ways. Research also emphasized issues of implementation of the statistical procedures that were developed. Nusser, Fuller, and Guenther published a manuscript that describes a method for estimating the usual intake distributions of foods when the probability of consuming a food item and the amount of the item consumed are independent. Carriquiry, Fuller, and Chen proposed an approach to relax the independence assumption. Carriquiry, Goyeneche, and Fuller developed a method for estimating bivariate usual intake distributions, that in turn permit the estimation of the usual intake distributions of ratios of dietary components. Two software packages, SIDE and C-SIDE, written in SAS-IML and C, respectively, were completed and tested, and are now available for purchase by the general public.

Carriquiry continued her research on methods to assess the dietary status of populations. In cooperation with George Beaton (University of Toronto), she proposed an estimator for the proportion of the population who are at risk of a dietary deficiency for a dietary component. Carriquiry and Beaton were invited to present their findings at a workshop organized by the Center for Human Nutrition of Johns Hopkins University in October.

Carriquiry, Fuller, and Dodd cooperated with the Food and Nutrition Board of the National Academy of Sciences in the production of the report entitled "Dietary Reference Intakes." The report presents the newly developed dietary guidelines as a revision of the former Recommended Daily Allowances (RDAs) for calcium, phosphorus, magnesium, fluoride, and vitamin D. The Iowa State University group continues cooperating with the board as reports related to other dietary components are under development.

Carriquiry and Nusser initiated cooperation with Dr. Jacqueline Wright, from the National Center for Health Statistics (NCHS), Centers for Disease Control, U.S. Department of Health and Human Services. Under this new one-year agreement, data collected in the National Health and Nutrient Examination Survey III (NHANES III) on dietary intakes and blood biochemical indicators were analyzed using the statistical methods developed at Iowa State University for estimating usual intake distributions. Kevin Dodd and Juan Jose Goyeneche collaborated on this project.

Spatial Statistics

Basic research in spatial statistics is supported by a grant, *Inference for Spatial Stochastic Processes,* from the Office of Naval Research. Noel Cressie is principal investigator, working on detection of unusual patterns in locational data that are considered to be a realization of a spatial point process. The Navy is interested in implementing these methods to detect minefields in the presence of background clutter. Dr. Andrew Lawson, University of Abertay Dundee, visited the department for a month in October, and worked with Cressie on a fully Bayesian hierarchical modeling approach. One conference paper has been written and a journal article is in preparation. Research with Dr. Linda Collins, University of Texas, San Antonio, continues into local indicators of spatial association (LISAs) for detection of unusual points in a point pattern. A journal article is in preparation.

This grant has also supported Hsin-Cheng Huang in his graduate work. His research assistantship concentrated on the use of multi-resolution methods to detect signals or images in the presence of additive white noise.

Jennifer Davidson, associate professor in the Department of Electrical Engineering and Computer Engineering, ISU, is co-principal investigator, working on automatic target recognition. With Cressie, and her graduate student Xia Hua, she is investigating the use of partially ordered Markov models, maximum likelihood estimation, and genetic algorithms to infer both objects and textures from image data.

Spatio-Temporal Analysis in Environmental Statistics

A cooperative agreement, *Spatial Statistics Research Applied to Ecological Resource Monitoring Programs,* between the U.S. Environmental Protection Agency and ISU, has allowed considerable progress to be made in environmental statistics research. Noel Cressie is principal investigator, and Dianne Cook, Mark Kaiser, and Soumendra Lahiri are co-principal investigators. Five statistics graduate students are supported by the grant: Jeremy Aldworth, John Gabrosek, Jaehyung Lee, Yoon-Dong Lee, and Jürgen Symanzik. In December, Symanzik converted to a postdoctoral fellowship to continue work with Cook and Cressie on an XGobi, ArcView™ link, and to extend the link to the statistical package Xplore. Jürgen Symanzik visited Humboldt University, Berlin, Germany, January 6-17, 1997, in connection with this project. The visit was the basis for an invited talk at the Interface '97 in Houston, Texas, in May. Cook and Symanzik have also been investigating the potential of virtual reality for exploring spatial environmental data.

In May, Jaehyung Lee converted to a postdoctoral fellowship to continue work with Kaiser and Cressie on developing models and inference for new spatial Markov random fields.
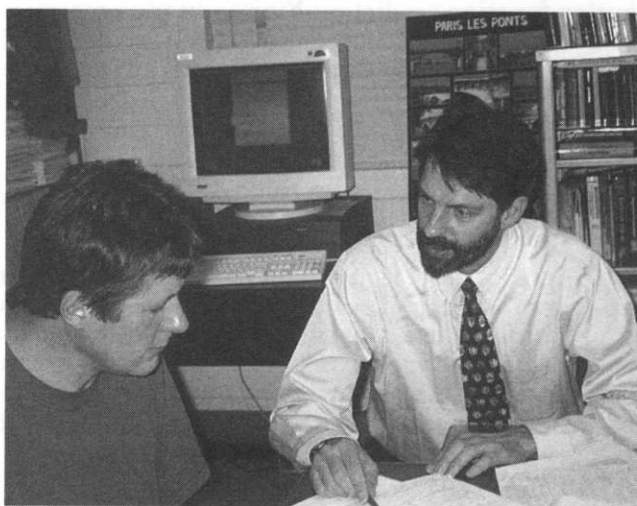
Jeremy Aldworth confers on the development of his doctoral research project in geostatistical and spatial prediction with his major professor, Noel Cressie.

The work by Kaiser and Cressie has focused on the construction and analysis of conditionally specified statistical models. Conditionally specified models are formulated by assigning to each random variable on a finite lattice a distribution written as conditional on observed values for all other variables. Spatial neighborhoods then lead to a Markov property, reducing the complexity of the conditional specifications. A conditionally specified Winsorized Poisson model has been used to estimate the strength of spatial dependence on counts of organism abundance, and a spatial beta-binomial mixture model is being developed to analyze damage to trees in the northeastern United States.

Noel Cressie has been working with his former student Christopher Wikle, a postdoctoral fellow at the National Center for Atmospheric Research (NCAR), on spatio-temporal statistical modeling of environmental data. Using an empirical Bayes approach, they have developed a space-time Kalman filtering method that allows process prediction at arbitrary location and time. In joint work with Mark Berliner of NCAR and the Ohio State University, they have extended their ideas to a fully hierarchical Bayesian space-time model.

Soumendra Lahiri's work has been concerned with developing central limit theorems for weighted sums of observations obtained by discrete sampling of a spatial process. The results apply to different types of stochastic as well as nonrandom spatial sampling designs. Asymptotic frameworks adopted for investigation include the pure increasing domain case and a mixed increasing domain case. For the latter, infilling of any bounded subregion of the sampling region is allowed. Other asymptotic results, these with Yoon-Dong Lee, have been obtained for generalized least squares estimators of spatial variogram parameters.

Lahiri also continued research on resampling methods for the empirical spatial cumulative distri-

bution function predictor. Finite sample properties of a subsampling method have been investigated through an extensive simulation study. The results reveal some interesting connections between the strength of dependence of the underlying spatial process and the choice of the subsampling parameters. This work was done jointly with Noel Cressie, Mark Kaiser, and Nan-Jung Hsu.

The EPA-ISU cooperative agreement has been extended for a fourth year. Mark Kaiser will lead an effort that will use Markov random fields to model and predict particulate matter and ozone in urban environments. The department's new faculty member in environmental statistics, Mike Daniels, will join the group as a co-principal investigator.

▓ Target Tracking

Alicia Carriquiry (while on faculty improvement leave) and Jay Breidt, with Wolfgang Kliemann and Dragan Mirković (both in the ISU Department of Mathematics), and Amarjit Budhiraha (Brown University) continued work on a three-year project on multi-target tracking, with funding from the Office of Naval Research. Research on the problem of forming validation regions or "gates" for new sensor measurements obtained when tracking targets in clutter was considered. Target dynamics and measurement characteristics are modeled with possible non-Gaussianities or nonlinearities, so that some degree of approximation is usually required in the computation of predictive densities for future measurements. An algorithm for construction of highest posterior density gates via simulation from the filtering density approximation was proposed and evaluated. Graduate student Ling-Yu Yang studied these procedures in the context of extended Kalman filtering.

Research assistant Nan-Jung Hsu worked with Breidt on developing methods of estimation and smoothing techniques for hierarchical long-memory models and semi-Markov models.

▓ Center for Agricultural and Rural Development

Jean Opsomer's current research involves extensions of nonparametric regression theory into several areas. As part of an on-going agricultural policy research project at the Center for Agricultural and Rural Development (CARD), a statistical model is used for nitrogen runoff from agricultural lands in the Midwest and Northern Plains regions of the U.S. The model, jointly developed by Opsomer with David Ruppert (Cornell University), Matt P. Wand (Harvard University), Ulla Holst and O. Hossjer (University of Lund, Sweden), is a novel combination of parametric and nonparametric regression techniques and provides an improved fit to the data compared to a previous model that only used parametric techniques and ignored the correlation and heteroskedasticity in the data. Much of the data used by the
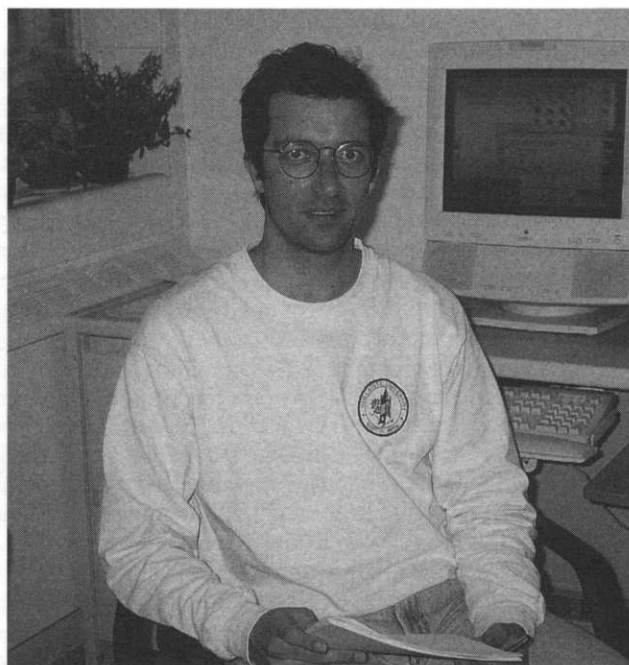
Jean Opsomer came to Iowa State as assistant professor in 1995 and works with both the Survey Section and CARD on research projects.

metamodel is provided by the 1992 National Resources Inventory.

Other methodological research funded by CARD generalizes Opsomer's previous work on bivariate additive models to models of arbitrary dimension (*Statistical Laboratory Preprint Series 96-12*). Opsomer also continued the work started last year on local polynomial regression when the errors exhibit short-range dependence. He collaborated with David Ruppert on developing the theory and a working algorithm for the semiparametric additive model, in which some terms are parametric while some others are left unspecified (*Preprint Series 97-20*).

▓ Missing Data in Structural Equation Models

Hal Stern and graduate student Yoon-Sook Jeon, supported by an ISU research grant, are working on statistical methods to fit structural equation models when observations are missing or incomplete. Researchers at the Rural Health Research Centers at ISU have provided an example in which only 350 out of 451 data records are complete. Our research program includes using likelihood-based methods to draw inferences about model parameters, and imputation methods to obtain complete data sets that can be used by a variety of researchers.

▓ Mixed Effects Models

Alicia Carriquiry continued working on issues related to mixed models. F. Jay Breidt and Carriquiry conducted research on the estimation of genetic

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trends of populations undergoing selection, by formulating a mixed model in which the random effects vector representing genotypes follows a local linear trend model. Soledad Fernández participates in this research. Work with Guido del Pino and Guillermo Marshall (Pontificia Universidad Catolica de Chile) is ongoing.

Probability Theory and Mathematical Statistics

Soumendra Lahiri visited the Indian Statistical Institute, Calcutta, India, on July 2-29, 1996 and May 26-June 6, 1997 to collaborate on research projects.

Design of Experiments

John Stufken, supported by an NSF grant, conducted research on various topics in design of experiments. Theory and application of orthogonal arrays remained a topic of primary interest, which resulted in new papers and the near completion of a book on this topic, the latter co-authored with S. Hedayat and N. J. A. Sloane. Other topics on which progress was made, also resulting in new papers, included crossover designs, trend-free and nearly trend-free designs, and polygonal designs.

Statistical Methods for Correlated Survival Data

Kenneth Koehler and Shin-Soo Kang completed work on a modification of the Greenwood formula for the variance of the product-moment estimator of a survivor function when some event times are correlated in the sense that more than one event time is observed for some subjects. Koehler continues to work on statistical methods for interval censored data involving cohorts of correlated response times and nonhomogeneous inspection schedules across cohorts.

Modeling Panel Data

Frederick Lorenz's research interests continue to be with modeling panel data and conducting experiments in surveys. He continued research, as a coinvestigator, on modeling multiple wave, multiple informant family data through the Iowa State University Center for Family Research in Rural Mental Health. He also continued research for the center on the effects of stressful life events on psychological distress and physical health. These projects are funded by the National Institutes of Mental Health.

Precision Farming

"Precision farming" is the use of field-specific data such as topography, soil characteristics, and yield levels to make management decisions on hybrid choices, seeding rates, chemical applications, etc. Jay Breidt and Bruce Babcock (ISU Department of Economics and CARD) have been investigating the economic and statistical implications of the use of imprecise data in making "optimal" agricultural decisions. Breidt and Babcock are co-principal investigators with PI Keith Whigham, ISU Agronomy, and others on the project "On-Farm Site-Specific Crop Management for Iowa," funded by the Iowa Soybean Promotion Board. Cong Chen, a research assistant working on this project, has studied a spatial autoregressive model for describing the relationship between crop yields and soil characteristics.

Statistical Process Control and Gross Error Detection

Derrick Rollins continued as principal investigator on projects funded by the National Science Foundation and the National Aeronautics and Space Administration. Statistics graduate students working with him during the 1996-1997 year, with support from Rollins' Presidential Faculty Fellows Award and/or project grant funds, include Shonda Roelfs Kuiper, Jean Pelkey, Xiao-Hong Cao, Jennifer Heldt, and Jun Zhu.

Drowsy Driver Identification

Current research by Peter Sherman involves identifying correlations between time series related to steering wheel motion and lane position, as a function of frequency. Kalman filtering is a primary tool for this study.

Periodic Random Process Research

A weakly periodic random process is one whose second order statistics are periodic. In many real world applications the period varies with time. Peter Sherman's research has concentrated on accommodation of this variation in order to retain useful information. It is often the case that periodic processes are a mixture of regular and deterministic components. This mixture can introduce ambiguities in spectral analysis. Sherman's research is also concerned with resolving these ambiguities. The research is supported by a grant from the Division of Statistical Signal Processing, Air Forces Office of Scientific Research.

Reliability and Nondestructive Evaluation

Bill Meeker continued as thrust coordinator for the statistical component of the National Institute of Standards and Technology/ISU Center for Nondestructive Evaluation Program for Integrated Design, NDE, and Manufacturing Sciences. Working with him has been Pradipta Sarkar.

Since 1993, Bill Meeker has continued to work as a participant providing statistical expertise and inte-

gration for the FAA-supported project, "Engine Titanium Consortium," involving a team of researchers from Iowa State University, Allied Signal Propulsion Engines, General Electric Aircraft Engines, and Pratt & Whitney. The consortium is working to respond to recommendations made by the FAA Titanium Rotating Parts Review Team for improvements in inspection of engine titanium. Both Meeker and Shuen-Lin Jeng are members of the Probability of Detection (POD) Working Group.

▣ Other Research

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

Theory and Methods

Yasuo Amemiya conducted research in multivariate analysis. For nonlinear system monitoring, estimation of the instrument bias and the true values was investigated, and a testing procedure for system anomaly was proposed. For latent variable analysis, a two-stage modeling technique and graphical methods were introduced to deal with nonlinear structure in data. A model fitting procedure was suggested for the random coefficient analysis of panel data with measurement errors.

Recent research by Yuhong Yang concerns adaptive function estimation and regression with dependent errors. An interesting question on adaptive estimation is, given a collection of estimation strategies designed under different assumptions, can we construct a single estimator that shares advantages of all these strategies in terms of statistical risk? A positive answer is provided using a connection between function estimation and information theory. Then it is shown that minimax-rate adaptive estimators exist for a general collection of function classes. Model selection is demonstrated as a practical means to obtain adaptivity. For nonparametric regression with general dependent errors under random design, separate roles of function class and dependence in determination of minimax rates of convergence are identified. The finding that dependence affects rates of convergence only through a simple parametric problem is rather surprising.

Kenneth Koehler is working with Marek Brabec in the development of statistical procedures for analyzing data from convolution models with left censoring. These procedures have important applications in the analysis of concentrations of substances in soil, water, or tissue samples. In such situations, the measuring process may add random variation to the measured concentration beyond the variation of the actual concentrations across samples. Left censoring of measurements arises from detection limits of the measuring process. The procedures being developed use bias corrections for parameter estimates obtained from simplified likelihoods to obtain consistent estimates with respect to the true likelihood.

This approach provides feasible numerical procedures with relatively little loss in efficiency.

Scorings of 0 and 1, for "failure" and success, respectively, have been used by Philip Cox in the comparison of two proportions. A linear model and the associated analysis of variance were used to compare five "χ^2-like" test statistics for such situations. One finding was that, *caeteris paribus,* the standard, Pearson "χ^2-statistic" is necessarily less powerful than at least one of the alternative statistics. A numerical example shows that differences of the order of 5 percent between the magnitudes of alternative test statistics can occur.

Hal Stern and Noel Cressie worked on developing Bayesian statistical methods for estimating disease incidence maps. The estimation of maps is complicated by the fact that, while we are interested in good estimates for all small areas, we are especially interested in accurate estimates for regions with high and low disease incidence rates. Conditionally-specified Gaussian autoregressive models are used to allow for spatial association of disease rates. Part of the research program concerns developing loss functions that emphasize high and low rate regions.

Another part of the research involves construction of spatial aggregation models that account for heterogeneity of both geography and demography.

In collaboration with Hal Stern, Alicia Carriquiry continued research on a Bayesian method for assessing the value of soil tests in making fertilizer application decisions. Research concentrated on developing methods for estimating the parameters in a hierarchical changepoint model that represents the response of crops to increasing amounts of fertilizer application.

Jay Breidt continued research on stochastic volatility models, including developing methods of estimation for hierarchical long-memory versions of stochastic volatility with graduate student Nan-Jung Hsu, and techniques for fitting continuous-time models from discrete-time data with graduate student Junyuan Wang.

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 1996-1997 academic year he continued doing research on theory for partially selfing populations. Joint work with Dr. Muhamad Sabran, a former student, was completed on the calculation of the probability of ultimate survival of a combination of alleles at two loci that are favorable together but have no selective advantage by themselves. It was assumed that one such combination is initially present in a single heterozygote in a large population. It was found that the survival probability is a decreasing function of the recombination fraction and, for the most part, an increasing function of the probability of self-fertilization.

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Edward Pollak also derived an expression for the effective size of a large age-structured population when there is partial selfing. This was found to be the same as for a population with discrete generations having the same mean and variance of the number of successful gametes produced during a lifetime and the same number of individuals entering the population per generation. The generation interval is the mean, among copies of an allele A in genotypes of newborn offspring, of ages of parents when the inbreeding coefficient has attained its equilibrium value.

Social Science Applications

Mack Shelley currently is pursuing research applications of statistical methods, including logistic regression, structural equation models, and other linear models methods, to studies in a variety of social science contexts. These include studies of differences of preschoolers' play behavior and peer interaction in classroom and playground settings; an ad-hoc indexing approach to a cohort study of undergraduate student persistence and retention, identifying students at risk of attrition; implications for faculty and administrators of a college student retention study; a structural equations approach using merged cross-generational data to evaluate the quality of adult child/aging parent relationships; a cohort model for policy and planning goals for educational administration and undergraduate retention; the impact of parents' number and monetary practices on their kindergartners' number concepts, monetary concepts, and monetary skills; parenting attitudes, foster parenting attitudes, and motivations of adoptive and nonadoptive foster parent trainees; and college students' attitudes toward gay fathers and lesbian mothers.

Current grants activity includes an investigation of injury trauma in traffic accidents through the ISU interdepartmental gerontology program, evaluation of a "5-a-day" nutrition program through the Division of Substance Abuse and Health Promotion of the Iowa Department of Public Health, and a study of homelessness in Iowa through the Iowa Department of Education.

Shelley is co-editor (with Uday Desai and Matthew Holden) of a symposium on The Politics of Policy, forthcoming in the *Policy Studies Journal*.

Carl Roberts, while on faculty improvement leave, received a small grant from the University of Groningen, the Netherlands, for a study of national policy discourse in the Russian and East European press.

Professional Activities

Offices and Committee Work

At the joint annual statistical meetings, Herbert T. David chaired the Committee on the W. J. Youden Award in Interlaboratory Testing.

Alicia Carriquiry continued to serve as a member of the Executive Committee of the American Statistical Association Biometric Section (Proceedings editor), and was appointed program chair for the section; her responsibility was to plan the invited and contributed program for the section in the joint statistical meetings to be held in Anaheim in August 1997. She was president of the ASA Iowa Chapter for 1996-1997. She also served on the Regional Advisory Board of the Eastern North American Region of the International Biometric Society.

Wayne Fuller has been a member of the ASA Blue Ribbon Panel on the Census, which has studied the appropriateness of using statistical methods, and sampling in particular, as part of the 2000 census. He attended a meeting of the ASA Survey Research Methods Group on the Technical Aspects of the SIPP, held at the Bureau of the Census, Suitland, Maryland, on September 16-17. He attended a meeting of the National Research Council Panel on Estimates of Poverty for Small Geographic Areas, held in Washington, D.C., on October 11-12.

Fuller served on the American Statistical Association Strategic Planning Committee, attending a meeting in Washington, D.C., on October 19.

Wayne Fuller served on the Panel on Small Area Estimates of Poverty for the Committee on National Statistics and attended a meeting in Washington, D.C., on December 6-7.

Effective January 1, 1997, Noel Cressie became chair-elect of the ASA Section on Statistics and the Environment. Stephen Vardeman began a three-year term as ASA Council of Sections Representative (1997-1999).

W. Robert Stephenson was appointed as the Council of Sections representative to the ASA Committee on Nominations for 1996-98.

Stephen Vardeman attended meetings of the American Statistical Association's Committee on Nominations in Chicago, Illinois, in August and in Alexandria, Virginia, October 13-14, 1996. Hal Stern served on the 1997 IMS Nominating Committee and was appointed to the ASA Committee on Publications for three years (1997-1999).

Noel Cressie was a member of the scientific program committee for the first European Conference on Geostatistics for Environmental Applica-

tions, Lisbon, Portugal, in 1996, and the Bernoulli Society's scientific program committee in 1996-97 for the 51st International Statistical Institute Session, Istanbul, Turkey. He is a member of the Science Advisory Board for the Third International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences, Quebec City, Canada, May 1997-1998. Cressie also has served on the Advisory Committee for the National Science Foundation Geophysical Statistics Project at the National Center for Atmospheric Research since 1995.

Alicia Carriquiry was appointed as program chair for the International Society for Bayesian Analysis (ISBA) for 1997. She was a member of the organizing committee of the 4th Carnegie Mellon University Bayesian Case Studies Workshop, scheduled for September 1997.

Frederick O. Lorenz has been chair of Western Regional Project W-183, Improvement of Rural and Agricultural Sample Survey Methods. The project was renewed for five years, with the first meeting of the renewed project being held on January 23-25, 1997.

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

Yasuo Amemiya (chair), Alicia Carriquiry, Paul Hinz, and Ken Koehler were members of the organizing committee for the conference, Statistics for Correlated Data, scheduled for October 1997 to mark the 50th anniversary of the Department of Statistics at Iowa State University.

▓ Short Courses, Workshops, and Paper Sessions

Dianne Cook chaired the workshop on Dynamic Statistical Graphics, presented at Macquarie University, Sydney, Australia, on July 6, 1996 in conjunction with Interface '96.

For the joint statistical meetings in Chicago, August 4-8, Soumendra Lahiri organized an invited paper session, Empirical Likelihoods and Resampling Methods, for the 1996 IMS annual meeting. On August 5, Bob Stephenson led discussion at a roundtable on Distance Education in Statistics, while Linda Collins led discussion for a roundtable on Computer Demonstrations in Introductory Statistics Lectures: Experiences and Examples. On August 6, Alicia Carriquiry chaired a session on Bayesian Biostatistics I, Wayne Fuller chaired one on Cointegration and Unit Roots, and Yasuo Amemiya chaired one on Long Memory Processes, Models, and Predictions. On August 7, Jürgen Symanzik led discussion at a roundtable on How Can Virtual Reality Be Useful in Statistics?, Linda Collins chaired a session on Issues of Fairness and Inclusion in Teaching Statistics, while Kenneth J. Koehler chaired a session on Methods and Case Studies in Econometrics II.

Hal Stern was one of three instructors for a one-day short course, Bayesian Data Analysis, presented on August 5 in conjunction with the joint statistical meetings.

Peter Sherman offered a short course for industry, Basic Rules of Vibration Testing, jointly with Kenneth McConnell (ISU Department of Aeronautical Engineering and Engineering Mechanics), in Bloomingdale, Illinois, on October 28-29, 1996.

William Q. Meeker and Luis A. Escobar (Louisiana State University) presented a three-day short course, Statistical Methods for Reliability Data, at the Indian Statistical Institute, Bangalore, India, January 1-5, 1997, and at the National Cheng-Kung University, Tainan, Taiwan, January 8-10.

Noel Cressie presented a six-hour short course on Spatial Statistics at Séminaire de Printemps, Universités Suisses Romands, Villars, Switzerland, March 3-4, 1997.

Paul Hinz gave a workshop on Applied Multivariate Analysis to staff at the USEPA Laboratory, Duluth, Minnesota, March 12-14, 1997. On June 19-21, he attended the National Science Foundation Chautauqua Short Course on The Ecology of the Klamath Mountains Bioregion, held at Southern Oregon State University.

▓ Editorial Activities

William J. Kennedy completed a three-year term as editor of the *Journal of Computational and Graphical Statistics* in 1997.

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

Hal Stern continued to serve as a senior associate editor of *Chance* magazine, published by the American Statistical Association. He has been named column editor for a new column on sports and statistics.

Noel Cressie continued as an associate editor of the *Journal of Statistical Planning and Inference* and as an editorial board member of *Chemometrics and Intelligent Laboratory Systems*. He was appointed to the Advisory Board of the Wiley Book Series in Probability and Statistics in December 1996.

K. B. Athreya continued to be an associate editor of *Statistics & Probability Letters* and the *Journal of Statistical Planning and Inference*.

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

Dianne Cook continued on the editorial board for the *Journal of Statistical Software,* (http://www.stat.ucla.edu/journals/jss/). She became an associate editor for *The American Statistician* in November 1996.

Bill Meeker continued as an associate editor of the *International Statistical Review*.

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

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

Sarah Nusser was publications officer, Biometrics Section, American Statistical Association, for calendar year 1996.

Stephen Vardeman became an associate editor of *The American Statistician* in 1996.

▨ Other Activities

Mervyn Marasinghe completed a seven-week visiting senior lecturer appointment in the Department of Statistics and Computer Science, University of Colombo, Sri Lanka, on July 26, 1996. He taught a summer course to fourth-year undergraduates in statistics and engaged in collaborative research there with Dr.Nimal Wickremasinghe, a graduate of Iowa State.

For the second time in three years, an Iowa State graduate student team won the College Bowl competition sponsored by Mu Sigma Rho and the ASA Section on Statistical Education. Team members were Pam Abbitt, Kevin Dodd, Anindya Roy, and Pradipta Sarkar.

Kenneth Koehler participated in the June 1997 reading and scoring of the College Board's Advanced Placement Examination in Statistics. The AP program gives capable high school students an opportunity to take rigorous college-level courses at their high school and, based on their performance on the national examination, to receive credit and/or advanced placement when they enter college. This was the first year that an AP program was offered in statistics, and 7500 students submitted examinations.

▨ Papers Presented, Lectures, and Seminars

At the Sydney International Statistical Congress (SISC-96), held on July 7-12, 1996 in Sydney, Australia, and combining the 13th biennial Australian Statistical Conference and Interface '96--the 28th Symposium on the Interface: Graph—Image Vision:

COOK, Dianne: "Escape from Pillai Trace?";

Symanzik, Jürgen: "Implementation issues of variogram cloud plots and spatially lagged scatterplots in the linked ArcView 2.1 and XGobi environment";

Symanzik, Jürgen, Dianne COOK, B. D. Kohlmeyer, U. Lechner, and C. Cruz-Neira: "Dynamic statistical graphics in the CAVE virtual reality environment."

At the 36th Annual Workshop of the National Association for Welfare Research and Statistics, San Francisco, California, July 7-10, 1996:

SHELLEY, MACK C. II, and Paula W. Dail: "Models for estimating the number and characteristics of the sheltered homeless";

Dail, Paula W., and Mack C. SHELLEY II: "Descriptive characteristics and demographic trends of the sheltered homeless."

At the 1996 joint statistical meetings of the American Statistical Association, International Biometrics Society (ENAR and WNAR), Institute of Mathematical Statistics, and Statistical Society of Canada, in Chicago, Illinois, August 4-8:
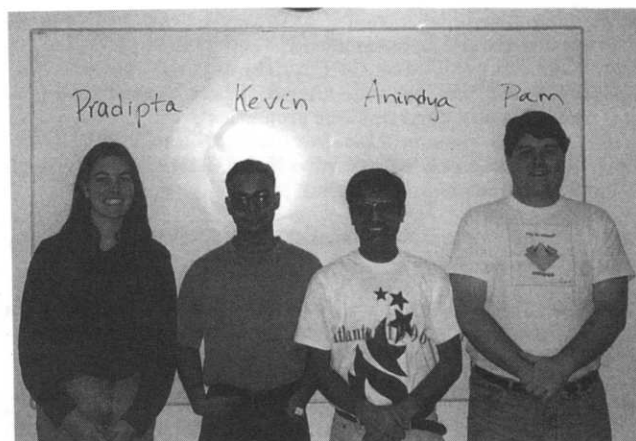
The winning team from the College Bowl competition sponsored by Mu Sigma Rho and the ASA Section on Statistical Education pose in scrambled order under their names. From L to R are Pam Abbitt, Anindya Roy, Pradipta Sarkar, and Kevin Dodd.

AMEMIYA, Yasuo, and Elizabeth M. S. Paterno: "Random effect and random coefficient analysis with errors-in-variables";

Axelson, H. Martin, F. J. BREIDT, and Alicia L. CARRIQUIRY: "Two-phase regression estimation for policy analysis using computer simulation experiments";

BREIDT, F. Jay, and Alicia L. CARRIQUIRY: "Bayesian estimation of genetic trends";

Cardella, Aidan Thomas (General Electric Co.), and Stephen B. VARDEMAN: "Performance comparison of lot-by-lot and continuous acceptance sampling plans";

Coffin, Marie (Clemson University), and Shashikala SUKHATME: "Measurement errors in Receiver Operating Characteristic studies";

CRESSIE, Noel: discussant for session on Statistical Assessment of Environmental Monitoring in the United States;

CRESSIE, Noel, and Christopher K. Wikle (National Center for Atmospheric Research): "Spatially descriptive, temporally dynamic models for predicting meteorological and climatological processes";

Dodd, Kevin W., Alicia L. CARRIQUIRY, and Wayne A. FULLER: "Replicate weighting methods for quantile variance estimation";

Garth, Angelita D. (Applied Research Consultants), and Derrick K. ROLLINS: "Evaluation of model discrimination techniques in artificial neural networks";

GROENEVELD, Richard A.: "A class of quantile measures for kurtosis";

HINZ, Paul N.: discussant for invited paper session on Linear Models with Multiple Experiments, Section on Statistical Consulting;

Hsu, Nan-Jung, and F. J. BREIDT: "Bayesian approach to long memory stochastic volatility models";

Huang, Hsin-Cheng, and Noel CRESSIE: "Asymptotic properties of maximum likelihood estimators for partially ordered Markov models";

Ko, Seoung-Gon Ko, Vincent S. Shu, and Herbert T. DAVID: "Approximately optimal flexible two-stage plans for binary responses";

KOEHLER, Kenneth J., and Thomas J. Kirchoff: "Nonparametric estimation of maintenance cost and labor hour curves";

Koh, Sock-Cheng, and **Yasuo AMEMIYA:** "An algorithm for heteroscedastic factor analysis";

LAHIRI, S. N.: "On jackknife-after-bootstrap method for dependent data and its asymptotic properties";

Lee, Yoon-Dong, and **Soumendra N. LAHIRI:** "Bootstrap estimation in sequential sampling";

Lin, Lawrence K., and **W. Robert STEPHENSON:** "Viral assay validation";

LORENZ, Frederick O., and Vern D. Ryan: "Experiments in community surveys: Comparing results of mail and telephone surveys";

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

MARASINGHE, Mervyn, and **Tae-Sung Shin:** "Tools for teaching regression concepts using dynamic graphics" (Poster Session);

MEEKER, William Q.: "Using graphics and simulation to teach statistics/concepts";

NUSSER, Sarah: "Personal digit assistants to collect survey data";

OPSOMER, Jean D.: "Estimating an unknown function by local polynomial regression when the errors are correlated";

Pelkey, Jean E.: "Nonlinear errors-in-variables analysis for monitoring a chemical process";

Roy, Anindya, and **Wayne A. FULLER:** "Estimator for the first order vector autoregressive process";

Sarkar, Pradipta, and **Wayne A. FULLER:** "Confidence intervals for predictions for autoregressive processes";

SHELLEY, Mack C. II, and Steven G. Koven: "Attitude formation, religion, and the mass public: Choice and change in the cultural dimensions of American politics";

Shin, Chungyeol, and **Yasuo AMEMIYA:** "Two-stage structural equation modeling using factor score estimates";

STERN, Hal S.: discussant for technical session on Real-world Applications of Statistics in Sports;

Symanzik, Jürgen: "How can virtual reality be useful in statistics?";

Tsay, Julie H., **Wayne A. FULLER,** and Cary T. Isaki: "A block based nonresponse followup survey design";

VARDEMAN, Stephen B.: Panelist for Special Contributed Session Panel on Effectively Teaching Statistics in Industry and Academia Education for Engineers;

Vidyashankar, Anand N. (STATcomp Inc.): "Analogue of Joffe's martingale for multitype branching random walk and related limit results";

Wall, Melanie: "Methods for detecting and modeling nonlinear structure in multivariate data".

At the Rural Sociological Society meetings in Des Moines, Iowa, August 15-18:

LORENZ, Frederick O., and Joseph Hraba: "Re-creating inequality: The consequences of privatization on working men in the Czech Republic";

LORENZ, Frederick O., and Vern D. Ryan: "Factor invariance in survey experiments."

At the Second International Workshop on TLS and Errors-in-Variables Modeling, Louvain, Belgium, August 21-24:

AMEMIYA, Yasuo: "Generalizations of the TLS approach in the errors-in-variables problems";

FULLER, Wayne A.: "Estimated true values for errors-in-variables models."

At the Confronting an American Disgrace: The Systemic Causes of Homelessness Conference, Indiana University at South Bend, September 19-21:

Dail, Paula W., and **Mack C. SHELLEY:** "A rural state's perspective on the systemic causes of homelessness";

Dail, Paula W., and **Mack C. SHELLEY:** "Family and social correlates of homelessness."

At the Midwest Sociological Society Annual Meeting, Des Moines, Iowa, April 4-6, 1997:

SHELLEY, Mack C. II: "Back to the future: Contemporary public policy in social control," (invited participant in roundtable discussion);

Mercier, Joyce, and **Mack SHELLEY:** "Policy implications related to well-being of the oldest-old compared to the younger-old";

Mercier, Joyce, and **Mack SHELLEY:** "Access to health care among three cohorts of older Americans residing in a rural state."

At the joint spring meetings of the Iowa Chapters of the American Statistical Association and the Mathematics Association of America in Ames, Iowa, April 11-12, 1997:

Aldworth, Jeremy, and **Noel CRESSIE:** "A comparison of spatial cumulative distribution function (SCDF) predictors of a spatial process sampled with measurement error";

Boulaevskaia, Vera: "Predicting nocturnal sky cover in Iowa";

Chen, Cong, and **Jay BREIDT:** "A spatial autoregressive model in precision agriculture";

Eickhoff, Jens, and **Jean OPSOMER:** "Pseudo point generation for NRI data";

Goyeneche, Juan Jose, Alicia L. CARRIQUIRY, and **Wayne A. FULLER:** "Estimating bivariate usual intake distributions";

Jeng, Shuen-Lin, and **William Q. MEEKER:** "Comparisons of approximate Weibull distribution confidence intervals for type I censored data";

Kim, Jae Kwang Kim, and **Wayne A. FULLER:** "Use of estimating functions for estimating finite population parameters";

Lau, Soon, and **Peter J. SHERMAN:** "Asymptotic statistical properties of the autoregressive spectral estimator for random processes with mixed spectrum";

Meyer, Amy J., and **Jean OPSOMER:** "A regression model for predicting erosion in the United States";

Paterno, Elizabeth Martha S.: "Likelihood-based estimation for the random effect model with measurement error";

Roy, Anindya, and **Wayne A. FULLER:** "A likelihood based estimator for the first order vector autoregressive process";

Sarkar, Pradipta, William Q. MEEKER, R. Bruce Thompson, and Timothy A. Gray: "Probability of detection modeling for ultrasonic testing";

Smith, Heather J.: "Is there evenhandedness in the Mississippi delta?";

Wang, Junyuan: "Analyzing ecological trends with multiple natural resource databases";

YANG, Yuhong: "Adaptive function estimation."

At other locations:

AMEMIYA, Yasuo: "Statistical latent variable analysis for multivariate data exploration and modeling," seminar, IBM Thomas Watson Research Center, Yorktown Heights, New York, October 21, 1996.

ATHREYA, Krishna B.: "Transformation of measures on Markov chains with applications," Department of Mathematics, Indian Institute of Technology, Bombay, July 1, 1996.

"The vacillating mathematician, fractals, and Markov chains," Department of Mathematics and Statistics, University of Guelph, Ontario, Canada, August 2.

"Theoretical issues in Markov chain Monte Carlo," colloquium, Department of Statistics, University of Toronto, September 12.

"Random iteration, fractals, and limit points of Markov chains," at the First NIU Symposium on Statistics, Northern Illinois University, DeKalb, September 28.

"Random iteration, fractals, and Markov chains," colloquium, Department of Mathematics, Iowa State University, October 22, 1996.

"Random iteration, balanced sampling, fractals, and all that," colloquium, Department of Statistics, Florida State University, February 13, 1997.

BREIDT, F. Jay: "A threshold autoregressive stochastic volatility model," at the Workshop on Recent Developments in Time Series and Chaos, Canberra, Australia, July 6, 1996.

"Some results in stochastic volatility modeling: Nonlinearity, extremes, and long memory," seminar, Department of Statistics and Operations Research, New York University, November 15.

"Bayesian analysis of fractionally integrated ARMA with additive noise," by **Nan-Jung Hsu** and Breidt, seminar, Department of Statistics, University of Connecticut, April 16, 1997; also seminar, Department of Mathematics, New Jersey Institute of Technology, April 18.

"Highest density gates for target tracking," by Breidt and **Alicia L. CARRIQUIRY,** at the Office of Naval Research Workshop on Tracking, Dahlgren, Virginia, May 15.

CARRIQUIRY, Alicia: "Mixed models with dynamic random effects," by Carriquiry and **F. Jay BREIDT,** at III Congreso Latinoamericano de Sociedades de Estadistica (CLATSE), Santiago, Chile, October 9, 1996.

"Methodological issues in defining dietary recommendations," at the Defining Dietary Recommendations Workshop, Center for Human Nutrition and Biostatistics Department, Johns Hopkins University, October 24.

"Improved maximum likelihood for stochastic volatility estimation," by Carriquiry and **F. Jay BREIDT,** seminar, Department of Statistics, Pontificia Universidad Catolica de Chile, Santiago, November 20.

"Bayesian decision-making," at the African-U.S. Educational and Research Workshop on Bayesian Analysis, Cape Town, South Africa, December 16, 1996.

"Bayesian estimation of genetic trend," at the 4th World Meeting of the International Society for Bayesian Analysis, Cape Town, South Africa, December 19.

"Analysis of dietary intake data," by Carriquiry and **F. Jay BREIDT,** seminar, Institute of Statistics and Decision Sciences, Duke University, April 27, 1997.

COOK, Dianne: "Exploring associations among Mid-Atlantic stream indicators using dynamic multivariate graphics and geographic mapping in a highly immersive virtual reality environment," by Cook, C. Cruz-Neira, B. D. Kohlmeyer, U. Lechner, **N. Lewin,** L. Nelson, A. Olsen, S. Pierson, and **J. Symanzik,** at EMAP, Albany, New York, in April 1997; also at Interface '97, Houston, Texas, on May 17.

CRESSIE, Noel: "Partially ordered Markov models (POMMs) as spatial statistical models," at the Sydney International Statistical Congress, Sydney, Australia, July 8, 1996.

"Spatio-temporal statistical modeling using a GIS," at the Symposium on Statistics and the Sciences, Halifax, Nova Scotia, Canada, August 15.

"Spatial statistical analysis and its consequences for spatial sampling," by Cressie and **Jeremy Aldworth,** at the Fifth International Geostatistics Congress, in Wollongong, Australia, September 24; also chair of the session on Geostatistical Theory.

"GIS, spatial statistical graphics, and forest health," at the New South Wales Branch of the Statistical Society of Australia, Sydney, Australia, September 26, and at the Fall Meeting of the Twin Cities Chapter, American Statistical Association, in St. Paul, Minnesota, October 8.

"Spatial statistical models for lattice data," at the Conference on Modelling Longitudinal and Spatially Correlated Data, in Nantucket, Massachusetts, on October 17.

"Spatio-temporal statistical modeling," at the annual meetings of the American Society of Agronomy, Indianapois, Indiana, November 5.

"GIS, spatial statistical graphics, and forest health," Distinguished Lecture, Computer and Information Technology Institute, Rice University, and "Partially ordered Markov models (POMMs) as spatial statistical models," seminar for the Department of Statistics, Rice University, November 6.

"Space-time dynamic models with applications to climatology," also "Spatial lattice models contructed from conditional distributions" by Cressie and **Mark KAISER,** at the annual meeting of the Netherlands Society for Statistics, Lunteren, Netherlands, November 11 and 12.

Invited discussant in the session, Making Statistical Sense of Earth Observations from Satellites, at the International Association for Statistical Computing World Conference, Pasadena, California, February 19, 1997.

"Making statistical sense of earth observations from satellites—the future," Colloquium for the DataLab, Jet Propulsion Laboratory, Pasadena, California, February 20.

"Models and inference for clustering of locations of mines and mine-like objects," by Cressie and **Andrew LAWSON,** at Aerosense '97, a Conference on Mines and Mine-like Targets, in Orlando, Florida, April 23.

"Bayesian inference for extremes in disease incidence rates at aggregated and point levels," by Cressie and **Hal STERN,** at the Workshop on Spatial Epidemiology, Vancouver, British Columbia, Canada, May 17.

"Statistical inference on a triangular grid: The method of subsampling," at the Harris Seminar on Discrete Global Grids, Corvallis, Oregon, May 19.

DAVID, H. A.: "The paired t-test under artificial pairing," by David and **Jason L. Gunnink,** at the 18th International Biometric Conference, Amsterdam, the Netherlands, July 4, 1996.

FULLER, Wayne A.: "Estimation of the dietary usual intake distribution," seminar at the University of Munich, Munich, Germany, August 19, 1996.

"Estimators for autoregressive processes with a root near one," "Estimation of the dietary usual intake distribution," and "Adjustments for nonresponse in longitudinal surveys," H. O.

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Hartley Memorial Lectures, Department of Statistics, Texas A&M University, on October 14, 16, and 17.

"Nonsampling errors and survey estimation," closing keynote address at the Nonsampling Errors Symposium sponsored by Statistics Canada, in Ottawa, Canada, November 15, 1996.

GROENEVELD, Richard A.: "Measures of the skewness and kurtosis of a probability distribution," seminar presented to the Division of Mathematical Sciences, Thomas Watson Research Laboratory, IBM, Yorktown Heights, New York, on May 23, 1997.

HINZ, Paul N.: "Graduate study in statistics" and "A short history of experimental design," lectures at Luther College, April 22, 1997.

ISAACSON, Dean L.: "The view from Iowa State," in a session on The View from Several Departments, at the 11th Annual Department Chairs Colloquium, Preserving Strength While Meeting Challenges, held by the National Research Council Board on Mathematical Sciences in Washington, D.C., October 11, 1996.

"Statistics partnerships among academe, industry and government," at the Winter '97 meeting, Twin Cities Area Chapter, American Statistical Association, March 18, 1997.

"Partnering with departments on campus," at the SPAIG (Statistics Partnerships among Academe, Industry, and Government) Conference held in Raleigh, North Carolina, May 29-June 1.

KAISER, Mark: organizer and discussant for invited paper session, The Impact of Generalized Linear Models in the Agricultural and Ecological Sciences, for the Spring Meeting of the International Biometric Society, Eastern North American Region, Memphis, Tennessee, held on March 23-26, 1997.

"Effects of aggregation on chlorophyll-phosphorus relations," by J. R. Jones, M. F. Knowlton, and Kaiser, at the 30th meeting of the Korean Society of Limnology, Pusan, Korea, in May.

LAHIRI, Soumendra N.: "Resampling methods under long range dependence," at the National Science Foundation Symposium on the Bootstrap and Econometrics, Berkeley, California, August 1, 1996.

"Prediction of spatial cumulative distribution functions and prediction bands based on a subsampling method," at the Environmental Statistics and Earth Sciences Conference, Brno, Czech Republic, August 21.

"On empirical choice of the optimal block size for block bootstrap methods," seminar, Department of Statistics, Northern Illinois University, April 25, 1997.

"On empirical choice of the optimal block size for block bootstrap methods," at the 1997 International Symposium on Contemporary Multivariate Analysis and Its Applications, Hong Kong, May 21.

LORENZ, Frederick O.: "Modeling growth and decline with Structural Equation Models," at the Workshop on Structural Equation Modeling, Population Center, Pennsylvania State University-State College, June 30, 1997.

MARASINGHE, Mervyn: "An extension of Tukey's single degree of freedom test for three-way nonadditivity," seminar, Department of Statistics and Computer Science, University of Colombo, Sri Lanka, July 15, 1996.

MEEKER, William Q.: "Tools for the rapid development of high-reliability products," seminar, at the General Electric Corporate Research and Development Center, Schenectady, New York, July 24, 1996.

"Methodology for estimating nondestructive evaluation capability," by Meeker, R. Bruce Thompson, Chien-Ping Chiou,

and Shuen-Lin Jeng, at the Quantitative Nondestructive Evaluation Conference, Brunswick, Maine, July 29.

"Accelerated degradation tests: Modeling and analysis," by Meeker, L. A. Escobar, and C. J. Lu, at the Conference on Probabilistic Mechanics and Structural Reliability, sponsored by the American Society of Civil Engineers, in Worcester, Massachusetts, August 8; also presented at the International Conference on Statistics in Quality and Reliability, Cochin, India, December 29.

"Software for life data analysis," at the Fall Technical Conference sponsored by the ASQC Chemical Process Industries and Statistics divisions and the ASA section on Physical Sciences and Engineering, Scottsdale, Arizona, October 24.

"An overview of statistical methods for reliability data," by Meeker and L. A. Escobar, at the Indian Statistical Institute, Dehli, India, January 6, 1997.

"Statistical prediction based on censored life data," by Luis A. Escobar and Meeker, at Academia Sinica, Taipei, Taiwan, January 11.

"Statistical tools for the rapid development and evaluation of high-reliability products," by Meeker and M. Hamada, at the Statistical Society of Ottawa Conference on Reliability and Quality, Ottawa, Ontario, Canada, February 12.

"Statistical methods for probabilistic design," by Luis A. Escobar and Meeker, at the Workshop on Response and Reliability of Stochastic Dynamical Systems, University of Notre Dame, May 23.

"Accelerated tests: Promises and problems," by Meeker, Luis A. Escobar, and C. Joseph Lu, at the General Electric Corporate Research and Development Center, Schenectady, New York, June 4.

NUSSER, Sarah: "Conducting surveys with personal digital assistants," at the 1996 International Conference on Computer-Assisted Survey Information Collection, December 14 in San Antonio, Texas.

"Statistical methods for soil survey updates," seminar, Department of Statistics, North Carolina State University, April 1997.

OPSOMER, Jean: "Estimating an unknown function by local linear regression when the errors are correlated" and "The impact of agricultural practices on nitrogen runoff in the Midwest and Northern Plains," seminars, Department of Statistics and Environmental Statistics Workshop, Cornell University, September 25 and 26, 1996.

"Nonparametric regression for correlated data using local polynomial regression," at the Conference on Modelling Longitudinal and Spatially Correlated Data, Nantucket, Massachusetts, October 17.

"Estimating an unknown function by local linear regression when the errors are correlated," seminar, Department of Statistics and Actuarial Sciences, University of Iowa, December 5.

"Estimating a function by local linear regression when the errors are correlated," poster presentation at the Workshop on the Art of Nonparametric Statistics: Methodologies and Applications, in Louvain-la-Neuve, Belgium, February 20, 1997.

"An application of universal kriging with nonparametric variance function estimation," seminar, National Center for Atmospheric Research, Boulder, Colorado, June 18.

POLLAK, Edward: "A way to calculate the effective population size," at the 18th International Biometric Conference, Amsterdam, the Netherlands, July 4, 1996.

"The effective size of an age-structured population that reproduces partially by selfing," at the annual meeting of the

American Society of Naturalists, the Society of Systematic Biologists, and the Society for the Study of Evolution, Boulder, Colorado, June 16, 1997.

ROBERTS, Carl: "A generic semantic grammar for quantitative text analysis: Applications to East and West Berlin radio news content from 1979," at the American Sociological Association meeting, held in New York City, New York, August 16-21, 1996.

"Democracy as reflected in newspapers in east-central Europe," by Roel Popping and Roberts, at the Conference on Transformation Processes in Eastern Europe, held in Amsterdam, the Netherlands, March 6-7, 1997.

"Do words matter: And other questions that only text analysis can answer," seminar, Department of Sociology, Iowa State University, April 17.

SHELLEY, Kathy: "SAS/GRAPH blues? FRAME to the rescue!" at the SAS Users Group International 22nd Annual Conference, San Diego, California, March 18, 1997.

SHELLEY, Mack C.: "The antecedents and consequences of rural homelessness," by Paula W. Dail and Shelley, at the 59th Annual Meeting of the Rural Sociological Society, held in Des Moines, Iowa, August 15-18, 1996.

Discussant on panel, "The politics of policy," at the annual meeting of the American Political Science Association, held in San Francisco, California, August 28-September 1.

"The politics and practice of public policy: Homelessness and public policy," by Shelley and Paula W. Dail, at the 1996 Annual Meeting of the Illinois Sociological Association, held in St. Charles, Illinois, October 10-11, 1996.

"Political implications of declining trends in homelessness," by Paula W. Dail and Shelley, at the National Council on Family Relations Annual Conference, held in Kansas City, Missouri, November 7-10.

"Implications of policy related to the well-being of the oldest-old," by Joyce M. Mercier and Shelley, at the 49th Annual Scientific Meeting of the Gerontological Society of America, held in Washington, D.C., November 17-21.

"Age as a predictor of injury severity in head-on highway vehicular collisions," by Cletus R. Mercier, Shelley, Julie Rimkus, and Joyce M. Mercier, at the 1997 Annual Transportation Research Board Meetings, Washington, DC, January 13, 1997.

"International educational needs of Iowa agribusiness," by Joe Dale, David Acker, August Ralston, Steffen Schmidt, and Shelley, at the 13th Annual Conference of the Association for International Agricultural and Extension Education, held in Arlington, Virginia, April 3-5. (This presentation was granted the Outstanding Graduate Student Paper Presentation Award.)

SHERMAN, Peter: "An investigation of sensor and preprocessing factors on statistics related to steering wheel motion," by M. Brekke, Sherman, and M. Elling, at the 1996 Society of Automotive Engineers International Truck and Bus Meeting and Exposition, Detroit, Michigan, held on October 14-16, 1996.

"A frequency domain investigation of the planet gear inner race corrosion spalling in a helicopter gear train," at the Office of Naval Research, Washington, D.C., March 7, 1997.

"Signal processing issues concerning nominally periodic processes with applications to rotating machinery," at the U.S./Australian Workshop on Defense Signal Processing, held at Victor Harbor, South Australia, on June 25-27.

"Signal processing research related to rotating machinery," at the Symposium on Advances in Signal Processes, held by the Cooperative Research Center for Sensor Signal and Information Processing, Adelaide, South Australia, on June 30-July 1, 1997.

STERN, Hal S.: "Probability and statistics in the real world," seminar, Young Investigator Series, Office of Precollegiate Programs for Talented and Gifted, Iowa State University, October 26, 1996.

"Finite mixtures of linear regression models," seminar, John M. Olin School of Business, Washington University, St. Louis, March 18, 1997.

"Inference for extremes in epidemiology," seminar, Department of Statistics, Carnegie-Mellon University, March 19.

STUFKEN, John: "Design of experiments in the presence of trends," at the First NIU Symposium on Statistical Science, DeKalb, Illinois, September 27, 1996.

"Orthogonal arrays: Selected results and some open problems," three-hour presentation jointly sponsored by the departments of Mathematics and Statistics at Tamkang University, Taipei, Taiwan, December 31; also two-hour presentation at the Institute of Statistical Science, Academia Sinica, Taipei, January 7, 1997.

"The continuing saga of crossover designs--the last 10 years," by S. Hedayat and Stufken, at the 20th Annual Midwest Biopharmaceutical Statistics Workshop, Muncie, Indiana, May 20.

SUKHATME, Shashikala: "The effect of observer's bias in the Receiver Operating Characteristic studies," at the XVIII International Biometric Conference, Amsterdam, the Netherlands, held July 1-5, 1996.

"Measurement errors in Receiver Operating Characteristic studies," seminar, Department of Statistics, Dortmund University, Dortmund, Germany, July 9.

"Receiver Operating Characteristic studies and measurement errors: An application of kernel density-estimation," joint seminar, Department of Biostatistics and Department of Statistics and Actuarial Sciences, University of Iowa, September 26; also joint seminar, Department of Biostatistics and Department of Statistics, University of Minnesota, Minneapolis, October 10.

"Estimating P(Y > X) when measurements are subject to error," seminar, Department of Mathematics, Statistics, and Computer Science, Marquette University, November 7.

"Estimation of reliability--using data with measurement errors," at the International Conference on Stochastic and Numerical Modelling and Applications, at Bhubaneswar, India, sponsored by the Indian Statistical Institute and Utkal University, January 6-8, 1997.

"Distribution of ranks of truncated data, randomly censored data, and exact powers of two-sample rank tests," at the International Conference on Combinatorial Methods and Applications to Probability and Statistics, McMaster University, Hamilton, Canada, June 25, 1997.

Symanzik, Jürgen: "Dynamic statistical graphics in highly immersive environments," at the Dynamic Statistical Graphics Workshop, Sydney, Australia, July 7, 1996.

"Spatial data analysis in the linked ArcView 2.1 and XGobi environment," workshop, and "The linked ArcView 2.1 and XGobi environment--GIS, dynamic statistical graphics, and spatial data," seminar, both in the GIS Seminar Series, the University of Michigan, Ann Arbor, November 12.

"The linked ArcView 2.1 and XGobi environment--GIS, dynamic statistical graphics, and spatial data," seminar, Center for Computational Statistics, George Mason University, November 14, and contributed talk by Symanzik, **J. J. Majure**, and **Dianne COOK**, at the Fourth ACM Workshop on Advances in Geographic Information Systems, Rockville, Maryland, November 16.

"Dynamic statistical graphics in the C2 virtual reality environment (in German)," seminar, Fachbereich Statistik, Universität Dortmund, Dortmund, Germany, December 17, 1996; seminar, Wirtschaftswissenschaftliche Fakultät, Institut für

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Statistik und Ökonometrie, Humboldt Universität zu Berlin, Germany, January 8, 1997.

"Dynamic graphics in a GIS: A bidirectional link between ArcView 2.1 and XGobi--an update," at the Second World Conference of the International Association for Statistical Computing, Pasadena, California, February 20, 1997.

"Spatial data analysis in the dynamically linked ArcView/XGobi/XploRe environment," at Interface '97 (29th Symposium on the Interface: Computing Science and Statistics), Houston, Texas, May 17, 1997.

YANG, Yuhong: "Adaptive density estimation," seminar, Department of Statistics, University of Missouri-Columbia, November 8, 1996.

▨ Other Meetings

Alicia Carriquiry attended the Third International Conference on Forensic Statistics, in Edinburgh, Scotland, June 30-July 3, 1996, and the Second World Congress of Nonlinear Analysts, in Athens, Greece, July 10-15.

F. Jay Breidt attended the Sydney International Statistical Congress held in Sydney, Australia, on July 8-12, 1996.

Paul Hinz attended the North Central Region-170 Meeting of Experiment Station Statisticians, held at Purdue University July 10-12, 1996.

Wayne Fuller, Kevin Dodd, and Todd Krueger attended a workshop on usual dietary intakes at the Agricultural Research Service, Washington, D.C., on July 15-16, 1996. They presented research results and described software for the estimation of usual intake distributions to personnel from ARS and from other agencies.

Edith Landin continued to serve as secretary of the Ames chapter of Professional Secretaries International for the 1996-1997 year. She attended the Professional Secretaries International (PSI) Annual International Convention in Des Moines, Iowa, July 21-25, 1996, and assisted the host chapter on the seminar committee and the trips and tours committee.

Yoon-Dong Lee attended the NSF Symposium on the Bootstrap and Econometrics, held in Berkeley, California, July 30-August 6, 1996.

Xiao-Hong Cao, Dianne Cook, Allison Florance, Shiau-Er Huarng, Chin-liang Hung, Dean Isaacson, Shuen-Lin Jeng, William J. Kennedy, Jae-Kwang Kim, Chiang-Sheng Lee, Jaehyung Lee, Savas Papadopoulos, John Stufken, Yu-ping Tien, Lie-Ling Wu, Yihong Xiao, Ling-yu Yang, Jing Zhang, and Zugeng Zheng attended the joint statistical meetings in Chicago, Illinois, August 4-8.

Dean Isaacson attended a National Science Foundation-sponsored planning meeting for a SPAIG (Statistics Partnerships among Academe, Industry, and Government) Conference. The planning meeting was held in Gatlinburg, Tennessee, August 23-24, 1996.

Junyuan Wang went to the joint spring meetings of the Iowa Chapters of the American Statistical Association and the Mathematics Association of America in Ames, Iowa, April 11-12, 1997.

Hal Stern attended a meeting at Harvard University, May 6, 1997, in honor of the retirement of Prof. Herman Chernoff.

William Q. Meeker attended the Spring Research Conference on Statistics in Industry and Technology sponsored by the ASA section on Physical and Engineering Sciences and the Institute of Mathematical Statistics, in New Brunswick, New Jersey, June 2-3, 1997.

Dean Isaacson attended the Education Fair at eight General Motors locations in Michigan, Indiana, and Ohio on June 2-6. W. Robert Stephenson presented material on the ISU graduate program in statistics and videotape delay courses at two educational fairs at General Motors Technical Education Program sites in Ramos Arizpe and Toluca, Mexico, on June 22-28.

Yuhong Yang attended the Workshop on Longitudinal Data Analysis held at the University of Missouri-Columbia on June 10-14.

To further a Dress Down Friday custom at the office, statistics support staff have worn special shirts with a logo based on the Annual Report cover design. Shown from L to R, in front, are Norma Elwick, Jauvanta Walker, and Jeanette La Grange; in the middle row are Darlene Wicks, Edith Landin, Brenda Hewitt, and Rose Ann Anderson; in the back row are Sharon Shepard, Denise Riker, and Marlene Tjernagel.

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PUBLICATIONS

In the Statistical Laboratory preprint series, 18 titles (#96-17 to 96-34) were added during the last half of 1996 and 10 more (#97-1 to 97-10) in the first half of 1997. 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 January 1998.

▨ Books

Jagers, Peter, and **Krishna B. ATHREYA**, editors. *Classical and Modern Branching Processes.* [Proceedings of the June 1994 IMA Workshop on Classical and Modern Branching Processes.] Institute for Mathematics and its Applications (IMA) Series, Vol. 84. New York: Springer-Verlag. November 1996.

HARVILLE, D. A. (IBM Thomas J. Watson Research Center). *Matrix Algebra from a Statistician's Perspective.* New York: Springer. 1997. 648 pp.

ROBERTS, Carl W., editor. *Text Analysis for the Social Sciences: Methods for Drawing Statistical Inferences from Texts and Transcripts.* Hillsdale, New Jersey: Lawrence Erlbaum Associates. January 1997. 316 pp.

The book is an ecumenical collection of writings on text analysis that contain international and cross-disciplinary applications not only of the most recent semantic and network text analysis methods but also of the more traditional thematic method of text analysis. In fact, it is originally with this volume that these two "relational" approaches to text analysis are defined and contrasted with more traditional, "thematic" text analysis methods. The book's emphasis is on application, and it provides guidance regarding the sorts of inferences that each method affords, as well as up-to-date descriptions of the human and technological resources required to apply the methods. Its purpose is to serve as a resource for making quantitative text analysis methods more accessible to social science researchers.

Schmidt, Steffen W., **Mack C. SHELLEY II,** and Barbara A. Bardes. *American Government and Politics Today, 1997-1998 Edition.* Belmont, California: West/Wadsworth. 1997. xxxvi + 724 pp. + G-13 + I-26.

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 1996 elections in the United States, as well as "logging on" segments providing students with instructions about how to access Internet/World Wide Web sites for research and information-gathering purposes. 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.

▨ Published Research Papers

AMEMIYA, Yasuo. Generalization of the TLS approach in the errors-in-variables problem. Pp. 77-86 in *Recent Advances in Total Least Squares Techniques and Errors-in-Variables Modeling,* edited by Sabine Van Huffel. SIAM. 1997.

The total least squares (TLS) method is an appropriate estimation procedure for the errors-in-variables model with a single linear relationship and with the error covariance matrix either known or known up to a multiple. This type of the errors-in-variables model can be extended in a number of ways keeping the applicability of the basic TLS approach in some form. The extensions considered here include models with a nonlinear relationship, with multiple relationships, and with an unknown error covariance matrix. Proper estimation procedures for the extended models can be considered as generalizations of the basic TLS methods.

For the models with a known error covariance matrix and with either a nonlinear relationship or multiple linear relationships, the estimation procedures are discussed from the TLS point of view. For the factor analysis model with multiple linear relationships and an unknown diagonal error covariance matrix, it is described how a proper estimation method can be carried out using an iterated version of the weighted TLS method with iteratively estimated weights. Also, the nonlinear factor analysis problem, an area of current statistical research interest, is discussed. An estimation procedure that can be considered as a generalization of the TLS method is presented for the nonlinear factor analysis model with multiple nonlinear relationships and an unknown diagonal error covariance matrix.

AMEMIYA, Yasuo, and **Ilker Yalçin.** Model fitting procedures for nonlinear factor analysis using the errors-in-variables parameterization. Pp. 195-210 in *Latent Variable Modeling and Applications to Causality,* edited by Maia Berkane. Springer Lecture Notes in Statistics. New York: Springer-Verlag New York, Inc. 1997.

Traditional factor analysis and structural equation modeling use models that are linear in latent variables. Here, a general parametric nonlinear

factor analysis model is introduced. The identification problem for the model is discussed, and the errors-in-variables parameterization is proposed as a solution. Two general procedures for fitting the model are described. Tests for the goodness of fit of the model are also proposed. The usefulness and comparison of the model fitting procedures are studied based on a simulation.

ATHREYA, K. B., and **A. Vidyashankar.** Large deviation rates for branching processes, super-critical and critical cases. Pp. 20-34 in *Proceedings of the IMA Workshop on Classical and Modern Branching Processes,* edited by Peter Jagers and Krishna B. Athreya. New York: Springer-Verlag. 1996.

In this paper, probabilities of large deviation rates of the averages of multitype branching processes for the supercritical and critical cases conditioned on nonextinction are shown to decay at geometric rates by using the convergence of iterates of the associated generating functions.

ATHREYA, K. B. The vacillating mathematician-- a stochastic version, I. *Resonance* (Journal of Science Education, Indian Academy of Sciences) 2:1 (1997) 16-24.

In this paper and the following one, the problem of a vacillating mathematician walking on the unit interval is used to introduce the idea of random iteration and Markov chains and their limit behavior.

ATHREYA, K. B. The vacillating mathematician-- a stochastic version, II. *Resonance* (Journal of Science Education, Indian Academy of Sciences) 2:2 (1997) 34-40.

Dugba, P. N., C. J. Bern, I. Rukunudin, M. K. Misra, and **T. B. BAILEY.** Preservative effects of iprodione on shelled corn. *Transactions of the American Society of Agricultural Engineers* 39:5 (1996) 1751-1756.

Laboratory tests were conducted to determine preservative effects of iprodione (Rovral®) fungicide on shelled corn. One-kilogram corn samples were held at 20°C, and 18.0, 22.5, and 23.5% moisture while being aerated at 0.45 m³/min-Mg (0.4 cfm/bu). Time required for the samples to lose 0.5% of original dry matter was used as the criterion of preservative effectiveness. Application of 20 ppm of iprodione extended this time 21% for 18% moisture corn and 13% for 22.5% corn. Effectiveness of iprodione increases with application rate up to 100 ppm where storage time is extended about 25%. A higher application rate had little added effect. The 3.29 mL/kg (3 oz/bu) fungicide solution rate is more effective than the 5.48 mL/kg (5 oz/bu) rate. Non-uniform application of iprodione did not decrease preservative effectiveness if the same total quantity of fungicide was applied.

Damaged kernel totals after storage tests were higher for 22.5% moisture samples, compared to 13% moisture samples, but were not affected by iprodione treatment.

Singh, S. K., L. A. Johnson, L. M. Pollak, S. R. Fox, and **T. B. BAILEY.** Comparison of laboratory and pilot-plant corn wet-milling procedures. *Cereal Chemistry* 74:1 (1997) 40-48.

One waxy and three regular yellow dent corn hybrids were wet milled by using two scales of laboratory procedures (modified 100-g and 1-kg) and a pilot-plant procedure (10-kg). The modified 100-g and 1-kg laboratory procedures gave similar yields of wet-milling fractions. Starch yields and recoveries were significantly lower for the pilot-plant procedure, whereas gluten and fiber yields were greater because of their high contents of unrecovered starch. Protein contents of the starches obtained by all three procedures were within commercially acceptable limits (<0.50% db for normal dent corn and <0.30% for waxy corn). Rankings for starch yields and starch recoveries for the four hybrids, having very different physical and compositional properties, were the same for all three procedures. The harder the grain, the lower the yield and recovery of starch. Least significant differences ($P < 0.05$) for starch yield were 0.8% for the modified 100-g procedure, 1.2% for the 1-kg procedure, and 2.0% for the pilot-plant procedure.

BILIAS, Yannis G., Minggao Gu, and Zhiliang Ying. Towards a general asymptotic theory for the Cox model with staggered entry. *The Annals of Statistics* 25:2 (1997) 662-682.

A general asymptotic theory is established for the two-parameter Cox score process with staggered entry data. It extends in several directions the existing theory developed by Sellke and Siegmund, Slud, and Gu and Lai. An essential tool employed here is a modern empirical process theory, as elucidated in a recent monograph by Pollard.

BREIDT, F. Jay, and **Alicia L. CARRIQUIRY.** "Improved quasi-maximum likelihood for stochastic volatility models." Pp. 228-247 in *Modeling and Prediction: Honoring Seymour Geisser,* edited by J. Lee, C. Johnson, and A. Zellner. New York: Springer-Verlag. 1996.

Jacquier, Polson, and Rossi (1994, *Journal of Business and Economic Statistics)* have proposed a Bayesian hierarchical model and Markov chain Monte Carlo methodology for parameter estimation and smoothing in a stochastic volatility model, where the logarithm of the conditional variance follows an autoregressive process. In sampling experiments, their estimators perform particularly well relative to a quasi-maximum likelihood approach, in which the nonlinear stochastic volatility model is linearized via a logarithmic transformation and the resulting linear state-space model is treated as Gaussian. In this paper, we explore a simple modification to the treatment of inlier observations that reduces the excess

kurtosis in the distribution of the observation disturbances and improves the performance of the quasi-maximum likelihood procedure. The method we propose can be carried out with commercial software.

BREIDT, F. Jay, Anita McVey, and **Wayne A. FULLER.** Two-phase estimation by imputation. *Journal of the Indian Society of Agricultural Statistics* 49:Golden Jubilee Number 1996-97 (1997) 79-90.

In the National Resources Inventory conducted by the U.S. Natural Resources Conservation Service in cooperation with Iowa State University, data are collected at two levels. The primary sampling unit is an area segment of land, often 160 acres in size. The secondary sampling unit is a point. Some data, such as urban and built-up area, are collected on the segment. Detailed data are collected at the points. In the 1992 inventory, the segment data were used to impute point data for land uses occurring in the segment but not observed at a point in that segment. The goal was to create a tabulation data set of sampled and imputed points, which would contain the information in the segment data. The imputation procedure is described and small area estimates constructed with the imputed data are compared with two-phase estimates using segment data as the first phase estimates. Analysis of data collected in Missouri indicates that the imputation procedure produces far fewer small area estimates of no change in urban acres than the standard two-phase estimation procedure. Tests of equivalence for the two procedures indicate that the imputation procedure is generally unbiased.

Babcock, Bruce A., **Alicia L. CARRIQUIRY,** and **Hal S. STERN.** Evaluation of soil test information in agricultural decision-making. *Applied Statistics* 45:4 (1996) 447-461.

The value of soil test information in planning application levels of fertilizer is determined by using agricultural field plot data to estimate the corn production function, to construct plausible prior distributions of nitrate levels, and to determine the sampling distribution of soil test results. These quantities are used to determine the posterior distribution of soil nitrate concentrations given the results of a soil test. Optimal decisions concerning application levels of fertilizer are made with respect to this posterior distribution. Average reductions in fertilizer application rates range from 15% to 41%, depending on the form of prior information that is available. These reductions are achieved by increasing the variability of application rates over time. Disregarding the uncertainty that remains after soil testing significantly overstates the expected benefits of soil testing.

Guenther, Patricia M., Phillip S. Kott, and **Alicia L. CARRIQUIRY.** Development of an approach for estimating usual nutrient intake distributions at the population level. *Journal of Nutrition* 127:6 (1997) 1106-1112.

Assessment of the dietary intake of a population must consider the large within-person variation in daily intakes. A 1986 report by the National Academy of Sciences (NAS) marked an important milestone in the history of this issue. Since that time, USDA has been working cooperatively with statisticians at Iowa State University (ISU), who have further developed the measurement error model approach proposed by NAS. The method developed by the ISU statisticians can be used to estimate usual dietary intake distributions for a population. It is based on the assumption that an individual can more accurately recall and describe the foods eaten yesterday than foods eaten at an earlier time. The method requires as few as two independent days of nutrient intake information or three consecutive days for at least a subsample of the individuals. The method developed at ISU is described conceptually and applied to data collected in the 1989-91 USDA Continuing Survey of Food Intakes by individuals to estimate the proportion of men and women age 20 years and older having "usual" (long-run average) intakes below 30% of energy from fat, below the 1989 Recommended Dietary Allowances for vitamin A and folate, and above 1000 μg for folate.

Jensen, Helen, P. G. Lakshminarayan, Aziz Bouzaher, **Alicia CARRIQUIRY,** Stanley R. Johnson, and Peter Sabluk. A stochastic frontier analysis of technical efficiency of Ukrainian crop and livestock enterprises and implications for reform. *Ukrainian Economic Review* 2:3 (1996) 4-22.

Agricultural firms in Ukraine faced a system of incentive structures determined by two important factors, production objectives and a system of standards, both set by the central planner. Data from Ukrainian farms indicate that these policies resulted in productivity that often varied considerably.

An analysis of farm data for the period 1986 to 1991 indicate that overall, for both the crop and livestock sectors, production in state and collective farms was at relatively constant returns of scales, and labor's share of total cost was relatively constant, except for the smallest firms. Based on analysis of technical efficiencies, major inefficiencies in agricultural production seem to be present.

This study suggests that public farms are not technically as efficient as has been concluded on the basis of previous aggregated studies. Although technical efficiency in production exists for a few farms, production of many farms is highly inefficient. Ukraine has the opportunity to increase production in the agricultural sector through improved technology. The productivity of labor seems especially low in the production of most crops. This, of course, will place greater demands for improvements on the trade and distribution channels for agricultural outputs.

COOK, Dianne, James J. Majure (GIS Support and Research Facility, Iowa State University), **Jürgen Symanzik,** and **Noel CRESSIE.** Dynamic graphics in a GIS: Exploring and analyzing multivariate spatial data using linked software. *Computational Statistics: Special Issue on Computer Aided Analyses of Spatial Data* 11:4 (1996) 467-480.

Interactive and dynamic graphical methods provide powerful tools to interface a data analyst with data. For multivariate data, interactive techniques such as linked brushing and identification allow an analyst to query the data, isolate or mask subsets, and examine dependencies between many variables. Dynamic techniques such as the grand tour give the analyst a sense of the overall shape (clusters or nonlinearities) of the data. This paper reports on research into interactive and dynamic graphical methods applied to spatial data made available through a link between two software packages: ArcView 2.1™ (a Geographic Information System), and XGobi (a dynamic graphics program for exploratory multivariate data analysis).

COOK, Dianne, Jürgen Symanzik, James J. Majure (Miner and Miner, Greeley, Colorado), and **Noel CRESSIE.** Dynamic graphics in a GIS: More examples using linked software. *Computers and Geosciences: Special Issue on Exploratory Cartographic Visualization* 23:4 (1997) 371-385. www.elsevier.nl/locate/cgvis.

This paper, which is a continuation of an earlier one with the same main title, describes the linking of two software packages to provide exploratory dynamic graphical tools directly from within a geographic information system (GIS). The GIS we have used is ArcView™ 2.1, which is a widely used package for examining maps and images. XGobi is the dynamic graphics package that is publicly available and also widely used for exploring multivariate data. Examples of the different types of plots and interactions are given in the paper in both image and video format.

CRESSIE, Noel. Comment on "Trends in ozone exposure in Harris County, Texas," by R. J. Carroll, R. Chen, T. H. Li, H. J. Newton, H. Schmiediche, N. Wang, and E. I. George. *Journal of the American Statistical Association* 92:2 (1997) 411-413.

CRESSIE, Noel. Jackknifing in the presence of inhomogeneity. *Technometrics* 39:1 (1997) 45-51.

Under the classical assumption that data are a random sample from a distribution with cumulative distribution function F, the jackknife generally yields bias reduction, an (asymptotically) pivotal statistic, and a variance estimator for an estimator of an unknown parameter θ (F). In this article, the classical assumption is relaxed to allow for inhomogeneous subpopulations. The jackknife is seen to account for these inhomogeneities automatically and, so, is valid in a class of problems much larger than that for which it was originally intended. Data from experiments to determine the acceleration of gravity at Washington, D.C., are analyzed. A family of weighted-mean estimators is considered, and recommendations are made regarding which estimators yield both valid and efficient jackknife-based inferences.

CRESSIE, Noel. Weighted jackknife variance estimation for functions of rates and proportions. Pp. 343-352 in *Research Developments in Probability and Statistics,* edited by E. Brunner and M. Denker. Utrecht, The Netherlands: VSP International Science Publishers. 1996.

Jackknifing is a straightforward way of obtaining variance estimators for functions of sample means. In the case where one is dealing with functions of weighted sample means, the unweighted jackknife variance estimator tends to be overoptimistic (i.e., too small). In this article, a weighted jackknife variance estimator is suggested that corrects for this negative bias, and it is applied to the important problem of estimating rates and proportions.

CRESSIE, Noel, and **Jeremy Aldworth.** Spatial statistical analysis and its consequences for spatial sampling. Pp. 126-137 in *Geostatistics Wollongong '96, Volume 1,* edited by E.Y. Baafi and N. A. Schofield. Dordrecht, The Netherlands: Kluwer Academic Publishers. 1997.

Spatial sampling of continuous resources does not always fit very well into the traditional theories of survey sampling, which are predicated on assuming a finite population of units to be sampled. A geostatistical model of the underlying phenomenon gives a powerful way of predicting unknown parts of the population. Even when the observable process is contaminated with measurement error, there is a straightforward way to filter it out by appropriately modifying the kriging equations. These methods of spatial analysis assume the locations of data are somehow deterministically chosen; however, in many instances they are obtained from a (spatial) sampling design. The design typically has a component of randomization present to ensure against a biased sample and to provide a mechanism for computing means and variances of, say, estimated population totals. Under circumstances where both local and nonlinear predictions are needed, it is demonstrated that appropriate geostatistical analyses perform extremely well, even when the designs are randomization-based. Randomization has a role to play in controlling bias but, having chosen the sampling locations, this paper shows why (and how) spatial-proximity information should be used.

CRESSIE, Noel, and **Andrew B. LAWSON** (University of Abertay Dundee, Dundee, UK). Models

and inference for clustering of locations of mines and mine-like objects. Pp. 519-530 in *Detection and Remediation Technologies for Mines and Mine-like Targets II,* edited by A. C. Dubey and R. L. Barnard. Society of Photo-Optical Instrumentation Engineers (SPIE) Proceedings, Volume 3079. Bellingham, Washington: SPIE. 1997.

Mines and mine-like objects are distributed throughout an area of interest. Remote sensing of the area from an aircraft yields image data that represent the superposition of electromagnetic emissions from the mines and mine-like objects. In this article we build a hierarchical statistical model for the reconstruction of mine locations given a point pattern of the superposition of mines and mine-like objects. It is shown how inference on the mine locations can be obtained using Markov chain Monte Carlo methods.

CRESSIE, Noel, and James J. Majure (Miner and Miner, Consulting Engineers, Fort Collins, Colorado). Spatio-temporal statistical modeling of livestock waste in streams. *Journal of Agricultural, Biological, and Environmental Statistics* 2:1 (1997) 24-47.

Livestock agriculture (e.g., dairy, beef, pork, poultry) in the United States is tending rapidly toward operations where a large number of animals are concentrated in a relatively small area. The economies of scale are counterbalanced by the dangers of pollution from inadequate treatment of animal waste. Traditional methods of treatment involve lagoon retention and subsequent spreading on fields, but the sheer volume of production seems to be outstripping these and other technologies. Surface-water runoff finds its way into streams and rivers, ultimately polluting all downstream segments of the watershed. The topic of this paper is spatio-temporal statistical modeling of (log) nitrate concentration in the upper North Bosque watershed, which is a region of concentrated dairy operations. A model is fitted from daily data collected over a period of 15 months at 17 stream monitoring sites throughout the watershed. Optimal predictions of unknown nitrate concentration at all stream locations at any given time are obtained, along with a measure of their variability.

CRESSIE, N., and J. J. Majure (Miner and Miner, Consulting Engineers). Non-point-source pollution of surface waters over a watershed. Pp. 201-224 in *Statistics for the Environment 3: Pollution Assessment and Control,* edited by V. Barnett and K. Feridun Turkman. Chichester: John Wiley & Sons Ltd. 1997.

Environmental studies are often observational and are to be contrasted with controlled, designed studies that use blocking, randomization, and replication in an attempt to determine causative factors. When analyzing data from environmental studies, the statistical scientist often employs techniques such as post-stratification and regression. In this article, we illustrate the power of a Geographic Information System (GIS) in providing the means to carry out these techniques at the highest possible spatial resolution. A spatio-temporal statistical model is built for surface-water chemistry in the streams in and around Erath County, Texas, a region of concentrated dairy operations.

CRESSIE, Noel, Anthony Olsen, and Dianne COOK. Massive data sets: Problems and possibilities, with application to environmental monitoring. Pp. 115-119 in *Massive Data Sets: Proceedings of a Workshop.* Washington, D.C. 1996.

Massive data sets are not unlike small to large data sets in at least one respect, namely it is essential to know their context before one starts an analysis. That context will almost certainly dictate the types of analyses attempted. However, the sheer size of a massive data set may challenge and, ultimately, defeat a statistical methodology that was designed for smaller data sets. This paper discusses the resulting problems and possibilities generally and, more specifically, considers applications to environmental monitoring data.

Carroll, Steven S., and Noel CRESSIE. Reply to Discussion by David C. Garen on "A comparison of geostatistical methodologies used to estimate snow water equivalent," by Steven S. Carroll and N. Cressie. *Journal of the American Water Resources Association* 33 (1997) 221-222.

Carroll, Steven S., and Noel CRESSIE. Spatial modeling of snow water equivalent using covariances estimated from spatial and geomorphic attributes. *Journal of Hydrology* 190 (1997) 42-59.

As the demand for water in the United States rapidly approaches the total available water supply, it is essential that water resources be accurately monitored. Consequently, 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. To obtain accurate predictions and forecasts, it is necessary, periodically throughout the snow season, to estimate the snow water equivalent in river basins throughout the United States. The estimates are obtained using a geostatistical model and snow course, SNOTEL, and airborne snow data. In this research, we develop a positive-definite spatial covariance function that allows researchers to incorporate geomorphic site attributes when snow water equivalent estimates are obtained. We illustrate our methodology using snow course and SNOTEL data collected in the North Fork Clearwater River basin. Our results indicate that by incorporating elevation into the covariance model used for the North Fork Clearwater River basin we are able to improve substantially the accuracy of the snow water equivalent estimates.

Morgan, Peter B., and **Noel CRESSIE.** A comparison of the cost-efficiencies of the sequential, group-sequential, and variable-sample-size-sequential probability ratio tests. *Scandinavian Journal of Statistics* 24 (1987) 181-200.

Wald and Wolfowitz (1948) have shown that the Sequential Probability Test (SPRT) for deciding between two simple hypotheses is, under very restrictive conditions, optimal in three attractive senses. First, it can be a Bayes-optimal rule. Second, of all level-α tests having the same power, the test with the smallest joint-expected number of observations is the SPRT, where this expectation is taken jointly with respect to both data and prior over the two hypotheses. Third, the level-α test needing the fewest conditional-expected number of observations is the SPRT, where this expectation is now taken with respect to the data conditional on either hypothesis being true. Principal among the strong restrictions is that sampling can proceed only in a one-at-a-time manner. In this paper, we relax some of the conditions and show that there are sequential procedures that strictly dominate the SPRT in all three senses. We conclude that the third type of optimality occurs rarely and that decision-makers are better served by looking for sequential procedures that possess the first two types of optimality. By relaxing the one-at-a-time sampling restriction, we obtain optimal (in the first two senses) variable-sample-size-sequential probability ratio tests.

DAVID, H. A. Some applications of concomitants of order statistics. *Journal of the Indian Society of Agricultural Statistics* 49:Golden Jubilee Number 1996-97 (1997) 91-98.

DAVID, H. A., and N. Balakrishnan. Product moments of order statistics and the variance of a lightly trimmed mean. *Statistics & Probability Letters* 29 (1996) 85-87.

In this note a relation for product moments of order statistics is interpreted, extended, and applied to give a convenient formula for the variance of a lightly trimmed mean.

DAVID, H. A., and **Jason L. Gunnink** (Providian Bancorp., San Francisco, CA). The paired t test under artificial pairing. *The American Statistician* 51:1 (1997) 9-12.

Suppose that in the situation of a paired t test natural pairing, such as the use of twins, is not possible. Reduction in variability is then often achieved artificially, for example by pairing animals of similar birth weight. This article points out that, unless such pairing is ineffective, the usual assumptions underlying the paired t test are violated. Nevertheless, simulation indicates that, with randomization in the allocation of treatments, the standard procedure gives good results. Our bivariate normal model provides the factor by which the length of the confidence interval for the mean treatment difference is reduced as a result of the pairing. Another form of pairing sometimes used is shown to be incorrect. Nonparametric analogs are also briefly considered.

DAVID, Herbert A. (Letter to the Editor) A general representation of equally correlated variates. *Journal of the American Statistical Association* 91:436 (1996) 1756.

Field, Dennis (Iowa State University), and **William Q. MEEKER.** Optimizing product design based on time to failure distributions. *Quality and Reliability Engineering International* 12 (1996) 429-438.

Analysis of experimental data is often a problem facing design and manufacturing engineers. Many experiments are run for the express purpose of making a decision between manufacturing process or material alternatives. Statisticians recommend replication in experimental design; however, methods of analyzing experimental data, as presented in a majority of engineering curricula, generally review only the most basic situations (checking for a statistically significant difference between the means or variances of two samples, for example). If means and variances change with time, group comparisons may require more sophisticated analyses. This paper presents one method that takes into account shifts in group means and variances over time. Resistance temperature sensor drift data generated from six different design configurations are used as an illustration. This procedure takes into account all drift path information from multiple sensors in multiple groups.

Helterbrand, Jeffrey D. (Lilly Research Laboratories), and **Noel CRESSIE.** Object identification using Markov random field segmentation models at multiple resolutions of a rectangular lattice. Pp. 159-173 in *Modelling Longitudinal and Spatially Correlated Data: Methods, Applications, and Future Directions,* edited by T. Gregoire *et al.* Springer Lecture Notes in Statistics, No. 122. New York: Springer. 1997.

One of the most powerful uses for Markov random fields is in the area of image analysis, where the (noisy) image is observed on a rectangular lattice. In Bayesian approaches, Markov chain Monte Carlo (McMC) algorithms are usually suggested as a means to obtain a maximum *a posteriori* (MAP) prediction. The particular problem we consider here is that of contextual image segmentation. In practice, approximations to theoretically optimal McMC algorithms are necessary but these algorithms tend to restrict movement through the space of potential segmentations. In this paper, efficient multi-resolution techniques are used to obtain a good initial labeling and to allow more movement through the label configuration space. Examples of both natural images and synthetic images are presented.

Mallarino, A. P., E. S. Oyarzabal, and **P. N. HINZ.** Multivariate analysis as a tool for interpreting relationships between site variables and crop yields. Pp. 151-158 in *Precision Agriculture: Proceedings of the 3rd International Conference on Precision Agriculture,* edited by P. C. Roberts *et al.* 1997.

Precision farming technologies allow for collection of large amounts of data from producers' fields. This research used factor analysis to study relationships among many site variables and corn yields. Correlated variables were grouped into soil fertility, weed control, and conditions for early growth factors. Their importance in explaining the yield variability differed greatly among fields.

Oyarzabal, E. S., A. P. Mallarino, and **P. N. HINZ.** Using precision farming technologies for improving applied on-farm research. Pp. 379-387 in *Precision Agriculture: Proceedings of the 3rd International Conference on Precision Agriculture,* edited by P. C. Roberts *et al.* 1997.

This research demonstrates the use of data generated with precision farming technologies for comparing management practices on farmers' fields. Corn yield variability, treatment effects, and relationships between yields and several site variables were analyzed at various scales. Yield responses to the treatments are reported for two cornfields and for different areas within each field.

Huang, Mu-Yeh (Chung-Yu Junior College of Business Administration, Taiwan), **Stephen B. VARDEMAN,** and Douglas W. McBeth. Developmental test programs for one-shot systems: Two-state reliability and binary developmental tests results. *IEEE Transactions on Reliability* 45:3 (1996) 379-385.

Jones, Philip G., and **Dianne COOK.** "Multivariate Q-Q plots based on quantile contours." *Computing Science and Statistics* 27 (1996) 269-273.

A common graphical method for comparing one-dimensional distributions is the Q-Q plot. We consider the construction of Q-Q plots for multivariate distributions, based on matching points along estimated contours ("quantile contours") of cumulative distribution functions (*cdf's*). The multivariate Q-Q plot can be explored using tour methods; several examples are given for bivariate data.

KAISER, M. S., and D. Siev. Comparison of nonparallel immunoassay curves resulting from mixtures of competing antigens. *Statistics in Medicine* 16:10 (1997) 1151-1166.

Relative potency is a measure that has been used for many years to summarize the comparison of dose-response curves in parallel line bioassays. When response curves for two preparations are not parallel the traditional definition of relative potency no longer applies. We review the concept of relative potency and show that, in some situations, it can be given meaning for nonparallel curves as the ratio of biological activity in full strength assay preparations. Under an assumption that nonparallel curves result from the competition of mixtures of antigens for receptor binding sites, estimation of relative potency for nonparallel curves can be accomplished. We show that estimation of models for both parallel curve and response attenuation situations may be accomplished within the framework of generalized linear models. This estimation depends on the ability to deal with nonlinear parameters appearing in the link function, and an iterative algorithm depending on direct parameter updates is outlined. The topics discussed are illustrated with the analysis of data from two immunoassays conducted with veterinary vaccines. The models developed here depend in an essential way on the assumption of response attenuation by competing antigens. Our methods may not be appropriate for nonparallel curves caused by other phenomena.

KAISER, M. S. Maximum likelihood estimation of link function parameters. *Computational Statistics and Data Analysis* 24 (1997) 79-87.

LAHIRI, S. N. Variance stabilizing transformations, studentization, and the bootstrap. *Journal of Statistical Planning and Inference* 61 (1997) 105-123.

This paper compares higher order asymptotic properties of confidence intervals based on studentization and variance stabilizing transformations. Expansions for the coverage probabilities and lengths of (two-sided) confidence intervals with normal critical points are obtained. The comparison is carried out further for bootstrap confidence intervals based on the pivotal quantities derived from these methods. The results are illustrated with two examples involving (i) a location-scale model and (ii) one-parameter exponential family of distributions. Furthermore, generalizations to the case where the asymptotic variance of the estimator sequence of interest depends on nuisance parameters are also given. It follows from these results that neither of the methods outperforms the other in *all* situations, and hence the expansions given here can be used effectively to determine the better method in a specific application.

Karabulut, I., and **S. N. LAHIRI.** Two-term Edgeworth expansion for M-estimators of a linear regression parameter without Cramèr-type conditions and an application to the bootstrap. *Journal of the Australian Mathematical Society, Series A* 62 (1997) 361-370.

A two-term Edgeworth expansion for the distribution of an M-estimator of a simple linear regression parameter is obtained without assuming any Cramèr-type conditions. As an application, it is shown that a certain modification of the naive bootstrap procedure is second order correct even when the error variables

have a lattice distribution. This is in marked contrast with the results of Singh on the sample mean of independent and identically distributed random variables.

LAWSON, Andrew B. (University of Abertay Dundee, Scotland). Markov Chain Monte Carlo methods for spatial cluster processes. *Computing Science and Statistics* 27 (1996) 314-319.

The analysis of clustering in spatial point patterns involves testing for the presence of clustering: estimating parameters such as the cluster variance; locating the 'centres' of the clusters: and grouping the observed data points into clusters. We formulate this as a problem about inference for point processes, both for the parameters of the stochastic model and for the realisation of the model. We use Markov Chain Monte Carlo (MCMC) methods to explore the posterior joint distribution of the cluster centre locations, the cluster membership grouping, and the model parameters. This paper is a report on partly joint work with Adrian Baddeley (University of Western Australia) and Marie-Colette van Lieshout (University of Warwick).

LORENZ, Frederick O., R. L. Simons, R. D. Conger, G. H. Elder, Jr., C. Johnson, and W. Chao. Married and divorced mothers' stressful life events and distress: Tracing change across time. *Journal of Marriage and the Family* 59 (1997) 219-232.

Hraba, Joseph, **Frederick O. LORENZ,** G. Lee, and Z. Pechacova. Gender and well-being in the Czech Republic. *Sex Roles* 34 (1996) 517-533.

Hraba, Joseph, **Frederick O. LORENZ,** G. Lee, and Z. Pechacová. Gender differences in health: Evidence from the Czech Republic. *Social Science and Medicine* 43:10 (1996) 1443-1451.

Hraba, Joseph, **Frederick LORENZ,** Gang Lee, and Zdenka Pechacová. Transformace ekonomiky, nerovnost pozice a distres v Ceské Republice. *Zem d lská Ekonomika* 42:5 (1996) 197-2204.

Hraba, Joseph, **Frederick O. LORENZ,** Zdenka Pechacová, and Wan-Ning Bao. Comorbidity in the Czech Republic: A preliminary study. *Zem d lská Ekonomika* 43 (1997) 1-13.

Hraba, J., Z. Pechacova, **Frederick O. LORENZ,** and Wan-Ning Bao. Subjektivni posouzeni dusevniho zdravi populace CR. *Vyzkume studie* 17:4 (1996) 109-125.

Pechacová, Zdenka, Joseph Hraba, Jin Hradecký, and **Frederick LORENZ.** Economic change and change in well-being in the Czech Republic: The differences between rural and urban genders. *Scientia Agriculturae Bohemica* 27:1 (1996) 57-73.

Pechacová, Zdenka, Joseph Hraba, and **Frederick LORENZ.** Transformace v Ceské Republice: vek, ekonomické stres a deprese. *Ceskoslovenská Psychologie* 40 (1996) 185-196.

Wickrama, K. A. S., **Frederick O. LORENZ,** and R. D. Conger. Parental support and adolescent physical health status: A latent growth-curve analysis. *Journal of Health and Social Behavior* 38 (1997) 149-163.

Wickrama, K. A. S., **Frederick O. LORENZ,** R. D. Conger, L. Matthews, and G. H. Elder, Jr. Marital quality and physical illness: A latent growth curve analysis. *Journal of Marriage and the Family* 59 (1997) 143-155.

Loughin, Thomas M. (Kansas State University), and **Kenneth J. KOEHLER.** Bootstrapping regression parameters in multivariate survival analysis. *Lifetime Data Analysis* 3:2 (1997) 157-177.

Bootstrap methods are proposed for estimating sampling distributions and associated statistics for regression parameters in multivariate survival data. We use an *Independence Working Model* (IWM) approach, fitting margins independently, to obtain consistent estimates of the parameters in the marginal models. Resampling procedures, however, are applied to an appropriate *joint* distribution to estimate covariance matrices, make bias corrections, and construct confidence intervals. The proposed methods allow for fixed or random explanatory variables, the latter case using extensions of existing resampling schemes (Loughin, 1995), and they permit the possibility of random censoring. An application is shown for the viral positivity time data previously analyzed by Wei, Lin, and Weissfeld (1989). A simulation study of small-sample properties shows that the proposed bootstrap procedures provide substantial improvements in variance estimation over the robust variance estimator commonly used with the IWM.

Lu, Chi-Hsien Joseph (National Cheng-Kung University, Taiwan), **W. Q. MEEKER,** and L. A. Escobar. A comparison of degradation and failure-time analysis methods for estimating a time-to-failure distribution. *Statistica Sinica* 6 (1996) 531-546.

Degradation analysis can be used to assess reliability when few or even no failures are expected in a life test. In this paper, we use a simple but useful degradation model to compare degradation analysis and traditional failure-time analysis in terms of asymptotic efficiency. The comparisons consider a range of practical testing situations and provide insight into the trade-offs between these two methods of estimating the quantile of the time-to-failure distribution. We investigate the effects that the number of inspections, the amount of measurement

error, and the quantile of interest have on the asymptotic variances of the quantile estimators. Although measurement error can induce some loss of precision in degradation analysis, our comparisons show that, except in extreme cases, degradation analysis provides more precision than traditional failure-time analysis.

Majure, James J. (GIS Support and Research Facility, Iowa State University), **Dianne COOK, Noel CRESSIE, Mark S. KAISER, Soumendra N. LAHIRI,** and **Jürgen Symanzik.** Spatial CDF estimation and visualization with applications to forest health monitoring. *Computing Science and Statistics* 27 (1996) 93-101.

This paper discusses the estimation and visualization of spatial cumulative distribution functions (CDFs) with extensions to bivariate and higher dimensional CDFs. The use of CDFs is an important part of the USEPA Environmental Monitoring and Assessment Program's (EMAP) work in assessing and monitoring the state of the nation's environmental resources. The resources in a given region can be classified broadly into nominal, marginal, or subnominal states. These can be obtained from the spatial CDF which, in its entirety, offers the greatest flexibility for investigation of spatial and temporal trends. The emphasis in this paper is on the computational and graphical techniques implemented in an interactive environment. The environment supports computation and visualization of CDFs over several spatial regions and features interaction between and linking of elements in the CDF plot and the map view. The work involves communication of data between a geographic information system (GIS), ArcView 2.0™, and a program for dynamic graphics, XGobi (Swayne et al., 1991).

Majure, James J. (Geographic Information System Support and Research Facility, Iowa State University), and **Noel CRESSIE.** Dynamic graphics for exploring spatial dependence in multivariate spatial data. *Geographical Systems* 4:2 (1997) 131-158.

Through exploratory spatial data analysis of geostatistical data, one looks to identify (spatial) outliers and pockets of nonstationarity; spatial trend; and spatial dependence inherent in the data set. In this paper, we propose a dynamic graphical environment for the exploration of spatial data with emphasis on the characterization of spatial dependence. The identity of individual data points has been maintained in the graphics. This allows extreme or outlying points to be identified and investigated further; and, in contrast to more aggregated graphical summaries, it allows interesting patterns to be explored that might otherwise be obscured. Traditional spatial-dependence plots are enhanced with dynamic graphical tools. Both univariate and multivariate spatial data are considered and a bivariate spatial data set, from a study of surface-water contamination, is used to illustrate the graphical tools.

Majure, James J., Noel CRESSIE, Dianne COOK, and **Jürgen Symanzik.** GIS, spatial statistical graphics, and forest health. Pp. 1-00 in *Proceedings of Third International Conference / Workshop on Integrating GIS and Environmental Modeling,* Santa Fe, New Mexico, January 21-26, 1996. Santa Barbara, California: National Center for Geographic Information and Analysis. 1996. Available on CD and at URL, http://www.ncgia.ucsb.edu/conf/SANTA_FE_CD_ROM/main.html.

This paper discusses the use of a geographic information system (GIS), Arcview 2.1, linked with a dynamic graphics program, XGobi, in the statistical analysis of spatial data. Spatial cumulative distribution functions (SCDFs), spatially lagged scatter plots, and variogram cloud plots can be displayed in XGobi using the link. In each type of plot, the connection to the spatial sampling location is maintained and user interaction can take place in either application.

The link is used to predict and analyze SCDFs of forest-crown health in the northeastern United States. The SCDFs are predicted from field data collected as part of the U.S. Environmental Protection Agency's (USEPA) Environmental Monitoring and Assessment Program (EMAP). The field data are augmented with concomitant geographic information, including Landsat Thematic Mapper images, digital elevation models, and population information, which are used to improve the SCDF prediction.

MARASINGHE, Mervyn G., William G. MEEKER, Dianne COOK, and **Tae-sung Shin.** Using graphics and simulation to teach statistical concepts. *The American Statistician* 50:4 (1996) 342-351.

The value to students of *active* learning has been recognized. This has led to the wide use of assignments in statistical methods courses where students use statistical software and computing equipment to analyze data. These assignments enable most students to master the *mechanics* of data analysis. The amount of experience that a student can get with such assignments is, however, limited. A sizable proportion of students have difficulty grasping some of the many *concepts* that are introduced in these courses. Nevertheless, these concepts are important for effective modeling and data analysis, and instructors should focus on them. By using current computing technology, it is possible to supplement standard data analysis assignments and algebraic derivations and have students become actively involved in the learning of important statistical concepts. The learning experience can be enhanced by giving students additional statistical "experiences" by using combinations of carefully designed and implemented multiple simulations and dynamic graphics to illustrate key ideas. In this article we describe and illustrate several instructional modules and corresponding software that have been designed to assist instructors in teaching introductory statistics courses.

NUSSER, S. M., A. L. CARRIQUIRY, K. W. Dodd,
and **W. A. FULLER.** A semiparametric transformation approach to estimating usual daily intake distributions. *Journal of the American Statistical Association* 91:436 (1996) 1440-1449.

The distribution of usual intakes of dietary components is important to individuals formulating food policy and to persons designing nutrition education programs. The usual intake of a dietary component for a person is the long-run average of daily intakes of that component for that person. Because it is impossible to directly observe usual intake for an individual, it is necessary to develop an estimator of the distribution of usual intakes based on a sample of individuals with a small number of daily observations on a subsample of the individuals. Daily intake data for individuals are nonnegative and often very skewed. Also, there is large day-to-day variation relative to the individual-to-individual variation, and the within-individual variance is correlated with the individual means.

We suggest a methodology for estimating usual intake distributions that allows for varying degrees of departure from normality and recognizes the measurement error associated with one-day dietary intakes. The estimation method contains four steps. First, the original data are standardized by adjusting for nuisance effects, such as day-of-week and interview sequence. Second, the daily intake data are transformed to normality using a combination of power and grafted polynomial transformations. Third, using a normal components-of-variance model, the distribution of usual intakes is constructed for the transformed data. Finally, a transformation of the normal usual intake distribution to the original scale is defined. The approach is applied to data from the 1985 Continuing Survey of Food Intakes by Individuals and works well for a set of dietary components that are consumed nearly daily and exhibit varying distributional shapes.

NUSSER, S. M., W. A. FULLER, and P. M. Guenther. Estimating usual dietary intake distributions: adjusting for measurement error and nonnormality in 24-hour food intake data. Pp. 689-709 in *Survey Measurement and Process Quality,* edited by L. Lyberg, P. Biemer, M. Collins, E. DeLeeuw, C. Dippo, N. Schwartz, and D. Trewin. New York: John Wiley & Sons. 1997.

OPSOMER, Jean D., and David Ruppert. Fitting a bivariate additive model by local polynomial regression. *The Annals of Statistics* 25:1 (1997) 186-211.

This paper provides the first explicit bias and variance expressions for the bivariate additive model, a popular nonparametric regression technique. It shows that the order of the bias and variance are asymptotically the same for additive models as for univariate nonparametric regression.

OPSOMER, J. D. Nonparametric regression in the presence of correlated errors. Pp. 339-348 in *Modelling Longitudinal and Spatially Correlated Data: Methods, Applications, and Future Directions,* edited by T. G. Gregoire, D. R. Brillinger, P. J. Diggle, E. Russek-Cohen, W. G. Warren, and R. D. Wolfinger. New York: Springer. 1997.

This paper extends the Direct Plug-In (DPI) bandwidth selection method of Ruppert, Sheather, and Wand (*Journal of the American Statistical Association,* 1995) to the case of correlated errors.

Pascual, Francis G., and **William Q. MEEKER.** Regression analysis of fatigue data with runouts based on a model with nonconstant standard deviation and a fatigue limit parameter. *Journal of Testing and Evaluation* 25 (1997) 292-301.

The fatigue-limit model studied here contains an unknown fatigue limit parameter. Under this model, specimens tested below this fatigue-limit level of stress will never fail. The model also allows the standard deviation of fatigue life to be a function of stress. Researchers can use this model to describe the standard deviation and stress dependence in fatigue data. To illustrate its application, we use maximum likelihood methods to fit the model to fatigue data on a nickel base superalloy. Modern statistical methods based on likelihood ratio provide confidence intervals for the fatigue limit parameter. We also study the effect that test length has on estimation by analyzing simulated data sets based on this model. Through this simulation study, we gain insight into practical test lengths for future fatigue experiments.

POLLAK, E. On the calculation of the effective population size by a method based on the theory of branching processes. *Journal of the Indian Society of Agricultural Statistics* 49:Golden Jubilee Number 1996-97 (1997) 47-66.

The effective population size N_e of a large population with discrete generations can be calculated from a T-type branching process, in which each type has at least one copy of an allele A in its genotype. With neutral alleles, the branching process is positively regular with a first moment matrix M that has a dominant eigenvalue 1 and corresponding left and right eigenvectors $p' = (p_1,...,p_T)$ and $v = (v_1,...,v_T)'$ which satisfy the equations $\Sigma_i\, p_i\, v_i = 1$ and $\Sigma_i\, p_i = 1$. In this paper it is shown that if Y_{ij} is the number of offspring of type j of a parent of type i, then $\Sigma_i p_i \mathrm{Var}(\Sigma_j Y_{ij} v_j)$ is proportional to $K/2N_e$, where K is the number of copies of a gene among fertilized eggs. Examples of the calculation of N_e in this way are then given for random mating dioecious populations and populations that reproduce partly by selfing or full-sib mating. A generalization of the theory that applies to age-structured random mating populations is also discussed. Finally, it is shown that N_e/K

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is proportional to an approximate expression that has recently been obtained for the probability of the long-term survival of A when it is initially present in one individual with a single copy of this allele in its genotype.

POLLAK, Edward, and **Muhamad Sabran** (Balai Penelitian Tanaman Pangan Lahan Rawa, Jalan Karet-Loktabat, Banjarbaru, Indonesia). On the theory of partially inbreeding finite populations. IV. The effective population size for polyploids reproducing by partial selfing. *Mathematical Biosciences* 135:1 (1996) 69-84.

Consider a population of size N in which there is reproduction by selfing with probability β and by random mating with probability $1 - \beta$. In each cell of any individual, homologous chromosomes appear 2n times, with n among them having been contributed by each parent. Wright [*Proceedings of the National Academy of Sciences* 24 (1938) 372] showed that if $\beta = 0$, there is no double reduction in gamete formation, and a Poisson offspring distribution, the probability of nonidentity by descent of two random copies of a gene in an individual of generation $t + 1$ is approximately $1 - 1/(2nN)$ times as large as it is in generation t if N is large. This result will be generalized to populations with any $\beta \geq 0$ and any offspring distribution. If $n = 2$ or 3, a result will be obtained that also holds for any probability of double reduction.

ROBERTS, Carl. Introduction. Pp. 1-8 in *Text Analysis for the Social Sciences: Methods for Drawing Statistical Inferences from Texts and Transcripts,* edited by Carl W. Roberts. Hillsdale, New Jersey: Lawrence Erlbaum Associates. 1997.

ROBERTS, Carl. Semantic text analysis: On the structure of linguistic ambiguity in ordinary discourse. Pp. 55-77 in *Text Analysis for the Social Sciences: Methods for Drawing Statistical Inferences from Texts and Transcripts,* edited by Carl W. Roberts. Hillsdale, New Jersey: Lawrence Erlbaum Associates. 1997.

ROBERTS, Carl. A theoretical map for selecting among text analysis methods. Pp. 275-283 in *Text Analysis for the Social Sciences: Methods for Drawing Statistical Inferences from Texts and Transcripts,* edited by Carl W. Roberts. Hillsdale, New Jersey: Lawrence Erlbaum Associates. 1997.

ROBERTS, Carl W., and Roel Popping. Themes, syntax, and other necessary steps in the network analysis of texts: A research paper. *Social Science Information* 35:4 (1996) 657-665.

Recent approaches to the qualitative analysis of texts afford visual depictions of words as networks. Yet network characteristics can also be quantified, enabling one to draw probabilistic inferences about a population of texts from a sample of texts-encoded-as-networks. This chapter describes three types of ambiguity (and related methodological problems) that arise during three necessary steps in the quantification of texts as networks: idiomatic ambiguity (in the identification of themes [or nodes]), illocutionary ambiguity (in the identification of syntactic links [or arcs]), and relevance ambiguity (in the identification of network characteristics). As one moves from theme to syntax to network, not only does one add complexity to one's conclusions, but one also adds complexity to the encoding process as distinct types of linguistic ambiguity must be resolved. The added complexity of network encoding will be unnecessary for most research questions--questions that might better be addressed via thematic or semantic text analysis. The chapter concludes with an annotated listing of text analysis software for thematic, semantic, and network text analysis.

Roel Popping and **Carl W. ROBERTS.** Network approaches in text analysis. Pp. 381-389 in *Classification and Knowledge Organization: Proceedings of the 20th Annual Conference of the Gesellschaft für Klassifikation e. V. University of Freiburg, March 6-8, 1996,* edited by Ruedinger Klar and Otto Opitz. Heidelberg: Springer. 1997.

In the last decade a broad spectrum of text analysis methods has been developed. One class of these involves the building of network-depictions of texts. At present there are four primary approaches within this class: network evaluation, map analysis, knowledge graphing, and functional depiction. The first two of these approaches are quantitative text analysis methods, in that they were developed to yield statistical inferences about text populations. The latter two approaches are qualitative, in that they offer methods whereby texts can be "simplified," not into a concise statistical model, but into a generalized graphic representation. This paper provides brief introductions to the four methods, as well as to computer programs developed for each.

Mercier, Joyce M., **Mack C. SHELLEY II,** and Edward A. Powers. Religious commitment and social relationships: Their relative contribution to self-esteem of Catholic sisters in later life. *Journal of Women and Aging* 8:3/4 (1996) 91-111. Also published on pp. 91-111 in *Relationships between Women in Later Life,* edited by Karen A. Roberto. 1996.

In this paper we examine religious commitment and social relationships of Catholic sisters and the relative contributions of these and other variables to their self-esteem in later life. Using a sample of 377 Catholic sisters with an average age of 63.5 years, we conducted a series of hierarchical regression analyses to examine the relative contributions of blocks of socio-demographic variables, religious commitment variables, personal relationship variables, and psychological variables to self-esteem. In the overall

model, the extent to which relationships were rewarding, perceptions of themselves as women, coping strategies, and perceived self-control were significant and thus predictive of the self-esteem of Catholic sisters.

Mercier, Joyce McDonough, and **Mack C. SHELLEY II.** Access to health care among three cohorts of older Americans residing in a rural state. *Policy Studies Journal* 25:1 (1997) 140-156.

Three cohorts of older Americans are examined to determine how they perceive the likelihood of being able to access health care in the future. A modified Andersen (1968) model provides the framework for the study. A representative sample of 2,404 noninstitutionalized midwestern older persons separated into three age cohorts (60-69, 70-79, and 80+) was used. Predisposing, enabling, and need factors were examined by logistic regression. Significant differences were found between age cohorts, with the perceptions of the oldest-old and the youngest-old appearing to be markedly more sensitive than those of the middle-old. Need factors of health and the respondents' perceptions of help they needed with instrumental activities of daily living, and enabling factors of community size and the barrier imposed by lack of transportation, combined to explain the perceptions of the oldest-old. For the youngest-old, the significant variables were bills, gender, barriers imposed by inadequate insurance, lack of transportation, and a perception that physicians charged more than allowed by Medicare. Recommendations are made for health care policy with respect to different age cohorts among the elderly, their families, and the rurality of the population.

Lyon, Donald E., and **Peter J. SHERMAN.** Application of the multichannel minimum variance spectra for analysis of harmonic random fields. *IEES Transactions on Signal Processing* 44:9 (1996) 2311-2318.

This paper considers the recovery of a multichannel harmonic signal field corrupted by a possibly unknown homogeneous noise field. An approach is presented using the convergence-based spectra developed by Foias *et al.* in the random process setting. This technique has the advantage of discerning between the point and narrowband noise spectrum based on the monotonically decreasing convergence properties of a sequence of minimum variance (MV) spectra. For the proposed technique, the random field is reduced to a sequence of random processes using a set of condensing functions. An additional advantage of the proposed technique is that these condensing functions can be used to reflect *a priori* information and, hence, improve the effective signal-to-noise ratio. This technique uses information from all dimensions. Traditional techniques would separately apply a spectral algorithm to each dimension of the random field and thereby lose joint information from other dimensions.

Shin, Chungyeol, and **Yasuo AMEMIYA.** Algorithms for the likelihood-based estimation of the random coefficient model. *Statistics & Probability Letters* 32 (1997) 189-199.

The existing algorithms for fitting the random coefficient models tend to have difficulties associated with the covariance matrix parameter space. New ML and REML algorithms are developed, explicitly addressing the parameter space problem. Theoretical justification and numerical results are presented.

STEPHENSON, Bob. Ask Dr. STATS. *Stats* No. 17 (1996) 26-27.

STEPHENSON, Bob. Ask Dr. STATS. *Stats* No. 18 (1997) 26-27.

STEPHENSON, Bob. Ask Dr. STATS. *Stats* No. 19 (1997) 27-28.

Cross, J. S., S. Komatsu, J. Tanaka, M. Mieno, Y. Suetsugu, J. Sakaguchi, Y. Moriyoshi, and **W. R. STEPHENSON.** Hydrogen plasma transport and deposition of films from a solid boron source. *Journal of Materials Science* 32 (1997) 3277-3282.

Thin boron films were produced on Si substrates from a solid boron source and a hydrogen plasma. The plasma was generated using a 13.56 MHz generator and films were deposited with a forward radio frequency (RF) power of 2.0 kW. At pressures from 0.931-2.26×10^2 Pa under high hydrogen concentrations a capacitively coupled plasma (CCP) was observed whereas at low hydrogen concentrations an inductively coupled plasma (ICP) was observed. The films were predominantly deposited with an ICP but in one case a film was deposited using a CCP discharge. The deposited films consisted primarily of boron, but they also contained oxygen and silicon. The films were amorphous at 225 and 350 °C, but revealed X-ray diffractions at 475 °C. It was concluded that the hydrogen concentration, RF plasma power and surface temperature as well as the plasma-boron source interactions strongly influence the film thickness and composition.

STERN, Hal S. Neural networks in applied statistics. *Technometrics* 38:3 (1996) 205-214 and 220 (Reply to discussion).

Artificial neural networks are computer algorithms or computer programs derived in part from attempts to model the activity of nerve cells. The relevance of neural network models for the applied statistician is considered using a time series prediction problem as an example. The multilayer feedforward neural network uses a nonlinear function of the predictors to obtain predictions for future time series values. We illustrate the considerations involved in specifying a neural network model and evaluate the accuracy of neural network models relative to the

accuracy obtained using other computer intensive, non-model-based techniques.

Gelman, Andrew, Xiao-Li Meng, and **Hal S. STERN.** Posterior predictive assessment of model fitness via realized discrepancies. *Statistica Sinica* 6:4 (1996) 733-759, 796-804.

This paper describes Bayesian counterparts of the classical tests for goodness of fit and demonstrates their use in judging the fit of a single Bayesian model to the observed data. The Bayesian formulation facilitates the construction and calculation of a meaningful reference distribution, the posterior predictive distribution, not only for any (classical) statistic, but also for any parameter-dependent "statistic" or discrepancy variable. The computation required for posterior predictive model assessment is a straightforward byproduct of the posterior simulation used for the original Bayesian analysis. We illustrate with three applied examples.

Morduch, Jonathan J., and **Hal S. STERN.** Using mixture models to detect sex bias in health outcomes in Bangladesh. *Journal of Econometrics* 77:1 (1997) 259-276.

Many interesting economic hypotheses entail differences in behaviors of groups within a population, but analyses of pooled samples shed only partial light on underlying segmentations. Finite mixture models are considered as an alternative to methods based on pooling. Robustness checks using t-regressions and a Bayesian analogue to the likelihood ratio test for model evaluation are developed. The methodology is used to investigate pro-son bias in child health outcomes in Bangladesh. While regression analysis on the entire sample appears to wash out evidence of bias, the mixture models reveal systematic girl-boy differences in health outcomes.

STUFKEN, J. Optimal crossover designs. Pp. 63-90 in *Handbook of Statistics 13: Design and Analysis of Experiments,* edited by S. Ghosh and C. R. Rao. Amsterdam: Elsevier. 1996.

Selected results concerning optimal design choices are discussed in the context of crossover designs. Optimal designs and tools to obtain optimal designs are presented for different statistical models.

Hedayat, A., E. Seiden, and **J. STUFKEN.** On the maximal number of factors and the enumeration of 3-symbol orthogonal arrays of strength 3 and index 2. *Journal of Statistical Planning and Inference* 58 (Special issue in honor of Paul Erdös) (1997) 43-63.

It is shown that an orthogonal array for three symbols, of strength 3 and of index 2, can accommodate no more than five factors. It is also shown that there are exactly four nonisomorphic arrays with five factors.

Hedayat, A. S., **J. STUFKEN,** and G. Su. On difference schemes and orthogonal arrays of strength t. *Journal of Statistical Planning and Inference* 56 (Special issue on orthogonal arrays and affine designs) (1996) 307-324.

Difference schemes form a useful tool for the construction of orthogonal arrays of strength 2. We study a generalization of these schemes, difference schemes of strength t, which are useful for the construction and representation of orthogonal arrays of strength t. We study the existence of difference schemes of strength t, methods for their construction, and methods to construct orthogonal arrays of strength t from these schemes.

See, K., S. Y. Song, and **J. STUFKEN.** On a class of partially balanced incomplete block designs with applications in survey sampling. *Communications in Statistics--Theory and Methods* 26 (1997) 1-13.

We revisit the existence and construction problems of balanced sampling plans excluding contiguous units, a class of designs introduced and studied by Hedayat, Rao, and Stufken [*Journal of Statistical Planning and Inference* 19 (1988) 159-170]. A link between these designs and a class of partially balanced incomplete block designs is established, and a Fisher-type inequality is shown to hold. Special attention is given to those designs that attain equality in this Fisher-type inequality. Some new designs are obtained by construction.

Sloane, N. J. A., and **J. STUFKEN.** A linear programming bound for orthogonal arrays with mixed levels. *Journal of Statistical Planning and Inference* 56 (Special issue on orthogonal arrays and affine designs) (1996) 295-305.

It is shown how the Delsarte theory can be used to obtain a linear programming bound for orthogonal arrays with mixed levels. Even for strength 2 this improves on the Rao bound in a large number of cases. The results point to several interesting sets of parameters for which the existence of the arrays is at present undecided.

Symanzik, Jürgen, James J. Majure, and **Dianne COOK.** Dynamic graphics in a GIS: A bidirectional link between ArcView 2.0 and XGobi. *Computing Science and Statistics* 27 (1996) 299-303.

In Symanzik *et al.* (1994) we have presented a link between a Geographic Information System (GIS), ARC/INFO™, and an interactive dynamic graphics program, XGobi. So far, that link was only unidirectional and allowed the transfer of data from ARC/INFO into XGobi, but not vice versa.

Meanwhile, ESRI, the publisher of ARC/INFO, has released ArcView 2.0™, a package based on ARC/INFO. ArcView 2.0 allows calls to external proce-

dures via Remote Procedure Calls (RPCs) and it also enables external programs to invoke ArcView 2.0 functions using RPCs. These features enable us to provide a bidirectional link between ArcView 2.0 and XGobi. Our link now combines the dynamic, interactive strengths of XGobi for visualizing high dimensional data with the map handling tools of ArcView 2.0, specifically to explore spatial data.

This paper presents information about the technical realization of the link as well as it addresses substantial questions such as security and concurrency issues.

VARDEMAN, Stephen B. Independent student projects in undergraduate engineering statistics and quality control courses. *Communications in Statistics* 25:11 (1996) 2633-2646.

Wang, Morgan C. (University of Central Florida), and **William J. KENNEDY.** Numerical methods for use in preparing high-quality statistical tables. Pp. 333-342 in *Statistics of Quality,* edited by Subir Ghosh, William R. Schucany, and William B. Smith. New York: Marcel Dekker, Inc. 1997.

Software and Videos

COOK, Dianne. Some graphics for multivariate methods. Video (contact: dicook@iastate.edu). 1996.

Lechner, U., Dianne COOK, Jürgen Symanzik, B. D. Kohlmeyer, and C. Cruz-Neira. Interaction tools for dynamic statistical graphics in a highly immersive environment. Video (contact: dicook@iastate.edu). 1996.

Swayne, D., Dianne COOK, and A. Buja. XGobi: software for exploratory graphical analysis of high-dimensional data using scatterplot manipulation. *[9/Oct/90][12/Dec/90][25/Sep/91][23/ Oct/91][25/Mar/92][22/Mar/93][11/Jan/94] [1/Nov/94] [Sep/95] [Sep/96 beta] Available publicly by anonymous ftp from* lib.stat.cmu.edu, and www.research.att.com/~andreas/xgobi/index. html.

Dodd, Kevin W. A technical guide to C-SIDE software for intake distribution estimation. *Dietary Assessment Research Series Report 9.* CARD Publications 96-TR 32. Ames, Iowa: Iowa State University. 1996.

Majure, J. J., Jürgen Symanzik, and **Dianne COOK.** ArcView 2.1--XGobi link: Software connecting a GIS with dynamic statistical graphics program for multivariate data. *[Mar/96] Available publicly at* www.gis.iastate.edu/XGobi-AV2/homepage.html. 1996.

Symanzik, Jürgen, Dianne COOK, B. D. Kohlmeyer, U. Lechner, and C. Cruz-Neira. Dynamic statistical graphics in a highly immersive environment. Video (contact: dicook@iastate.edu). 1996.

Book Reviews, Etcetera

CRESSIE, Noel. Review of *Introduction to Disjunctive Kriging and Nonlinear Geostatistics,* by J. Rivoirard. *SIAM Review* 39:2 (1997) 337-340.

KOEHLER, Kenneth. *A Guide to Chi-Squared Testing.* Priscilla E. Greenwood and Mikhail S. Nikulin. New York: Wiley, 1996. xii + 280 pp. $39.95. Reviewed in *Journal of the American Statistical Association* 92:438 (1997) 793-794.
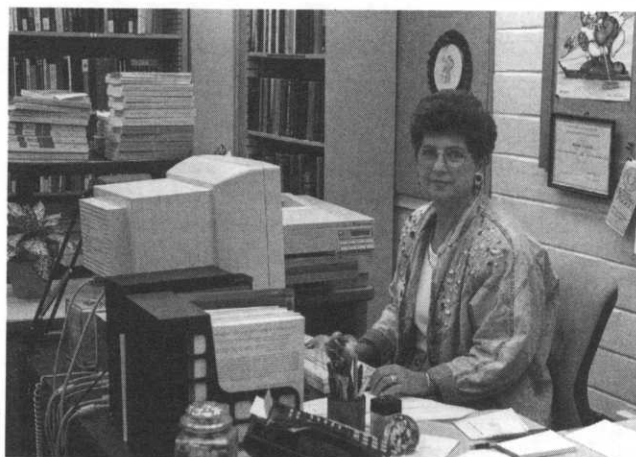
Norma Elwick, Reading Room secretary and supervisor, provides support services for the experiment station statistics consulting group. She also maintains the Reading Room permanent collection, updates the Statlab Preprint Series, checks books and journals in and out, and sees that periodicals and theses are bound.

Thesis Abstracts

An, Anthony B. Regression estimation for finite population means in the presence of nonresponse. Ph.D. thesis, Iowa State University Library. August 1996.

Nonresponse is one source of error in the analysis for survey sampling data. When the respondents and nonrespondents are different, nonresponse introduces bias into the estimation for a population characteristic of a finite population. Regression estimation can be used to reduce the bias from nonresponse by using auxiliary variables.

We investigate the consistency of regression estimators and of Horvitz-Thompson estimators with adjustment for nonresponse probabilities for stratified cluster sampling designs. The consistency of the regression estimator adjusted by the estimated response probabilities is established. Regression estimators and associated weighting procedures are applied to the data from the Survey of Income and Program Participation (SIPP). A model for the response probabilities is estimated for the SIPP.

Benson, Jeremy Todd. Television advertising's effect on the demand for different types of fresh beef: A Gibbs sampling approach. M.S. thesis, Iowa State University Library. August 1996.

This research investigates whether television advertising has been successful in increasing the demand for different types of fresh beef products. The data used in this study were obtained from a marketing research experiment done in Grand Junction, Colorado, from 1985 to 1987. A previous analysis of these data may have masked advertising's effects on consumption via aggregation of all beef products, and did not provide a unified treatment of the two key statistical aspects of the data set: its panel structure and a truncated distribution for the dependent variable. The present study investigates advertising's effects on demand for three types of fresh beef products: steaks, roasts, and ground beef; the study uses a Bayesian analysis of a random effects Tobit model suitable for a limited dependent variable/panel data application.

Cao, Xiaohong. Statistical methods to obtain accurate estimates of measured process variables for redundant sensor measurements. M.S. thesis, Iowa State University Library. May 1997.

The main objective of this research is to develop, use, and then evaluate statistical methods to obtain accurate estimates of measured process variables for redundant sensor measurements where the sensors may be biased, so that these methods can be used in industrial applications. Accurate process data is necessary in order to achieve optimal operations, and therefore it is important to estimate the true process values. The advantages of these statistical techniques are that they are not computationally intensive and can accurately estimate true values of process variables.

In a simulation study the performance of the two proposed techniques was compared where the level of significance (α-level), the size of the bias, and sample size were varied.

In this research, we used these statistical techniques on data provided by researchers at the NASA Ames Research Laboratory. The results are presented for these techniques.

Kirchoff, Thomas James. Statistical analysis of maintenance growth curves. Ph.D. thesis, Iowa State University Library. December 1996.

Annual data on labor hours incurred for maintaining individual trucks in a large fleet are available from a truck leasing firm. Using cumulative mileage as a measure of time, data for a single truck can be effectively viewed as a sample from a growth curve taken at irregular inspection times. The goal is to predict labor hours for a subsequent year. Three methods are considered.

1. A linear interpolation method: Linear interpolation is used to fit an empirical labor hour curve.

This approach has the advantages of being easy to program, and it does not require the entire history of the life of each truck.

2. Locally weighted regression (loess): The loess function contained in S-plus is used to estimate the overall mean labor hour curve. Selection of the neighborhood parameter in the presence of heteroscedastic errors is achieved by a modification of the M-Plot. Bootstrap methods are used to estimate standard errors.

3. A longitudinal analysis using a mixed model: Mixed models, with an overall mean curve for all the units (fixed effects) and an individual curve for each unit (random effects) are considered.

Relative advantages and disadvantages of the three methods are discussed. Methods are compared using data from prior years to predict 1994 results.

Lee, Jaehyung. Specification of dependence structures and simulation-based estimation for conditionally specified statistical models. Ph.D. thesis, Iowa State University Library. May 1997.

Conditionally specified statistical models are frequently constructed from conditional one-parameter exponential family distributions. One way to formulate such a model is to specify the dependence structure among random variables through the use of a Markov random field. A necessary form for conditional one-parameter exponential family densities is given under general conditions of multiway dependence.

A strategy is proposed for maximum likelihood estimation of parameters appearing in the joint distribution of a set of random variables modeled through the specification of all the conditional probability density or mass functions. This strategy relies on maximization of a sequence of Monte Carlo approximations to the log likelihood function. The fundamental issue addressed in our strategy is formulation of an importance sampling distribution as a product of marginal functions, where those marginals are chosen in a way that reflects the influence of dependence on the first two moments of the actual statistical model under consideration. This is extended to mixture models in which the mixing distributions are identified up to the normalizing constants by the specification of full conditional probability density or mass functions. Large sample theory for the resulting estimates from the proposed strategy is provided under the condition of the continuity of negpotential function over a compact set.

Otte Schmidt, Anne Catherine. Osteoporosis risk assessment: Questionnaire data analysis and risk model. M.S. thesis, Iowa State University Library. May 1997.

The development of a questionnaire for obtaining information on potential risk factors for osteoporosis is reviewed. This questionnaire obtains information

from both physicians and individual patients. Data from a pilot study are analyzed and estimates of relative risk are presented for various factors, including use of oral contraceptives, removal of ovaries, height, use of calcium supplements, and alcohol intake. Suggestions are given for improving both the questionnaire and how it is administered. A sampling plan for a larger national survey is presented.

Papadopoulos, Savas. Structural equation and factor analyses for several populations and longitudinal data. Ph.D. thesis, Iowa State University Library. August 1996.

This dissertation considers the use of latent variable modeling in multipopulation studies and longitudinal studies. Possibly correlated populations and unbalanced longitudinal data are considered. For nonnormal samples, practical statistical procedures are developed using the existing computer packages designed for normally distributed observations and independent populations or occasions. Model formulations and parameterizations are found, so that the results from the statistical analysis make sense, and so that the analysis produces correct inferences for parameters and model fit. The dissertation consists of three papers.

In the first paper, a general latent variable model with mean and covariance structures is considered for multipopulation studies. A model formulation that allows meaningful interpretation is suggested. The parameters are estimated by the maximum normal likelihood estimation method. The asymptotic properties of the estimates are derived under assumptions covering most types of nonnormal data. It is shown that the limiting distribution of the estimators for the important parameters is common for normal and nonnormal data, and for independent and correlated populations. A simulation study is also presented.

In the second paper, the analysis using the model with augmented-moment structure is discussed. A certain part of the limiting covariance matrix of the proposed estimator is common under four different sets of assumptions. Thus, the correct standard errors can be computed under an incorrect but simpler set of assumptions. A simulation study compares the finite-sample and asymptotic standard errors.

The third paper proposes a new method for analyzing unbalanced longitudinal data using factor analysis. Difficulties and disadvantages of the full-likelihood method and time series modeling approach are explained. The proposed method uses a reduced form of the likelihood, does not assume restrictive time series structure, and can be readily implemented. The new method is shown to produce valid and useful asymptotic results for models with nonnormal factors and errors and without any specified correlation structure over time. The efficiency loss of the method relative to the full-likelihood method, when the latter can be carried out, is shown to be negligible.

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Peiris, Laknath Baminihennadege. Prediction of progress from selection on nonnuclear genes. M.S. thesis, Iowa State University Library. August 1996.

Evidence of cytoplasmic effects on quantitative traits has been observed in plants and animals for a long time. These effects are due to DNA in chloroplasts and mitochondria, which are maternally inherited. Photosynthesis and respiration are physiological processes that are responsible for quantitative traits and are controlled by both nuclear and cytoplasmic genes and their interactions. Beavis *et al.* (1987) developed a model for maternal inheritance of the cytoplasmic genome and Mendelian inheritance of the nuclear genome and utilized the model to derive genetic variances and covariances for a random mating population. They investigated reciprocal mating designs to estimate variance components for nuclear and cytoplasmic effects and their interactions and reported that the cytoplasmic variance component is confounded with the additive-cytoplasmic interaction component, and the additive-cytoplasmic interaction component is confounded with that for the dominance-cytoplasmic interaction.

Considering cytoplasmic genes to be the only source of extranuclear effects, we developed a statistical model for cytoplasmic effects and nuclear-cytoplasmic interactions in addition to nuclear effects. The model was then utilized to derive the connection between the response to selection and the selection differential, considering both nuclear and cytoplasmic genes. Further, we showed how to modify reciprocal mating designs in order to estimate variance components for all nuclear and cytoplasmic effects and their interactions. Knowledge of cytoplasmic inheritance can be used to increase the response to selection of plants and animals.

Jean Elizabeth Pelkey. Nonlinear measurement error analysis for system monitoring. Ph.D. thesis, Iowa State University Library. May 1997.

In many physical and biological systems, underlying variables satisfy restrictions, but some or all of the variables are measured with error. The restrictions are often nonlinear in variables and may contain unknown parameters. Some of the restrictions may fail to hold at certain time points due to some system anomaly. While a good estimate of the measurement error covariance matrix is often available, systematic measurement biases may be present due to calibration or human errors. Statistical analysis of such systems is considered using a nonlinear errors-in-variables approach.

The case considered first deals with a system in a stable condition, where the restrictions do not contain any unknown parameters, and measurement error biases have been corrected. For estimating the true underlying values of the variables, the maximum likelihood estimator is shown to have a sizable bias due to the nonlinearity of the restric-

tions. An alternative estimator is proposed modifying the restrictions for the nonlinearity. Small-error asymptotic theory is used to show that the bias-adjusted estimator has smaller bias and smaller mean squared error than the maximum likelihood estimator up to a certain order of approximation. For checking the possible violation of some restrictions, the Wald, Lagrange multiplier, and likelihood ratio tests are introduced and compared based on the asymptotic theory and a simulation study.

For the full-scale system that is sufficiently dynamic, statistical inferences for the unknown parameters in the restrictions and possible systematic measurement biases are investigated. If the restrictions are linear in variables, the systematic measurement biases are non-estimable. However, the measurement biases can be estimated if the restrictions are sufficiently nonlinear, even with unknown parameters. A condition for the measurement bias estimability and test procedures for the systematic measurement biases are presented. For estimating the restriction parameters and measurement biases, an estimator adjusting for the nonlinearity bias is proposed based on an idea slightly different from the one used for the simple case. Testing for the possible violation of some restriction at some time point is also discussed.

Smith, James Dennis, IV. Modeling the human body's thermoregulatory response to exercise using statistical and engineering techniques. M.S. thesis, Iowa State University Library. December 1996.

Symanzik, Jürgen. Timed data flow diagrams. Ph.D. thesis, Iowa State University Library. December 1996.

Traditional Data Flow Diagrams (DFD's) are the cornerstone of the software development methodology known as "Structured Analysis," and they are probably the most widely used specification technique in industry today. DFD's are popular because of their graphical representation and their hierarchical structure. Thus, they are well-suited for users with nontechnical backgrounds and are commonly used to depict the static structure of information flow in a system. Numerous attempts to formalize DFD's have appeared in the technical literature. We focus on the Formalized Data Flow Diagrams (FDFD's) developed by Coleman, Wahls, Baker, and Leavens.

This dissertation analyzes and extends FDFD's with respect to their usefulness in specifying the qualitative and quantitative properties of real systems. Prior to this dissertation, there existed no well-founded knowledge about the computational power of FDFD's nor any formal model in FDFD's of the timing behavior of real systems.

The dissertation is organized as a collection of five independent papers. Briefly, the main results of each paper are as follows: (i) Reduced FDFD's are Turing equivalent. (ii) Stores, persistent flows, tests for empty flows, and infinite domains are not essential for FDFD's. (iii) Subclasses of FDFD's are equivalent to known subclasses of FIFO Petri Nets, immediately furnishing the decidability results for subclasses of FIFO Petri Nets to the corresponding subclasses of FDFD's. (iv) A general stochastic model of time for FDFD's (called Timed Data Flow Diagrams--TDFD's) is defined, allowing not only a description of the relative likelihoods of various execution times, but also descriptions of the possible joint firing behavior of transitions. (v) An aggregation principle can be used for an efficient stochastic analysis of periodic TDFD's with Markovian transition times.

The results in this dissertation provide a firm theoretical foundation for further advances in Computer Science and Statistics, leading to practical and expressive tools for the specification and analysis of real systems.

Wikle, Christopher Kim. Spatio-temporal statistical models with applications to atmospheric processes. Ph.D. thesis, Iowa State University Library. August 1996.

The dissertation is organized into paper format. The first provides an overview of spatio-temporal statistical methods in the atmospheric sciences. This is followed by three studies: On the semiannual variation in the Northern Hemisphere extratropical height field; Seasonal variation of lower stratospheric mixed Rossby-gravity waves over the tropical Pacific; and A spatially descriptive, temporally dynamic statistical model with applications to atmospheric processes. The last study advances spatio-temporal statistical methodology through the development of a space-time Kalman filter, which is used to predict monthly precipitation throughout the data-sparse South China Sea region.

After classes and office hours end, statistics graduate students still like to get together. Enjoying the Superbowl game on TV are, L to R in front, Mike Schuckers, Jean Pelkey, visiting scholar Victoria Chen, and Melanie Wall; in back, L to R, are John Gabrosek, Ian Carlson, Peter Morse, and Barbara Mock.

Department of Statistics

◻ Course Offerings

Undergraduate statistical computing courses were reorganized this year. The new courses are numbered 479 and 480. Stat 479 is given in the fall semester. It concentrates on package software usage. The 480 course is given in the spring semester. It deals with methods and algorithms in statistical computing, and includes elements of statistical graphics.

Professors Kaiser and Koehler offered a new course, VCS 652X, Analytic Methods in Production Medicine, as part of a new master's degree in swine production medicine offered by the Department of Veterinary Clinical Sciences in the College of Veterinary Medicine. This course provides an overview of the concepts of randomness, probability distributions, random variables, estimation, confidence intervals, tests of hypotheses, and measures of relative risk. Applications of these concepts are included in the discussion of the design and analysis of animal health and production studies.

Hal Stern, W. Robert Stephenson, and Soumendra Lahiri offered instruction as part of the General Motors Technical Education Program. Course lectures were videotaped and tapes were sent to a number of General Motors instructional sites. Four students have made excellent progress in the General Motors Master of Statistics Program.

Jürgen Symanzik taught a short course, Introduction to S and S-Plus, before the start of spring semester, for graduate students in statistics at ISU.

Course offerings with primary catalog listing in statistics, and instructors for the 1996-97 academic year and the 1997 summer session, are listed below and electronically on our website http://www.iastate.edu/stat/general/annual_report/department. 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.

◻ 1996-97 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 Dubinin Eraas Otte-Schmid	H. Smith Stephenson
104	Introduction to Statistics	3	F,S,SS Christensen Henry A. Jones Kuiper Lopez Reyes	Nordman Pollak Sales Yoder
105	Introduction to Statistics for Engineers	3	F,S Isaacson Sukhatme	J. Wright
201	Applied Regression Analysis for Business	2	F V. Chan Fung	Morse
227	Introduction to Business Statistics	5	F,S,SS Benner Bilias Dietz Elling	Gabrosek Mock Rhorer
231	Probability and Statistical Inference for Engineers	4	F,S Morse	Rollins
305	Engineering Statistics	3	F,S Dousa Lahiri Sukhatme	Symanzik Yang
328	Applied Business Statistics	3	F,S Gabrosek Groeneveld	Meeker
333	Probability and Statistics for Electrical and Computer Engineers	3	F,S Chan P. Jones	Sherman
341	Introduction to Theory of Probability and Statistics	3	F,S Groeneveld	Pollak
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 Barnet Collins D. Cox Kennedy	Lorenz Nusser Roberts Schucker Shelley
402	Statistical Design and the Analysis of Experiments	3	F,S Bailey D. Cox	Koehler Lopez Reyes
403	Nonparametric Statistical Methods	2	F	Groeneveld
404	Statistics for the Social Sciences	3	F	Lorenz
407	Methods of Multivariate Analysis	2	F	Cook
421	Survey Sampling Techniques	3	S	Opsomer
447	Statistical Theory for Research Workers	4	S,SS H. T. David	Yang

No.	Course	Cr.	Sem.	Instructor
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	S,SS	Bailey Nusser Stephenson
493	Workshop in Statistics	1	S	Bailey
495	Applied Statistics for Industry I	3	F	Stephenson
496	Applied Statistics for Industry II	3	S	Stephenson

Courses Primarily for Graduate Students, Major or Minor

No.	Course	Cr.	Sem.	Instructor
500	Statististical Methods	4	F	Hinz
501	Multivariate Statistical Methods	3	S	Cook
511	Theory and Application of Linear Models	3	S	Stufken
512	Design of Experiments	3	F	Stufken
515x	Theory of Nonlinear Models	3	F	Kaiser
521	Theory of Sample Surveys I	3	S	Opsomer
531	Quality Control and Engineering Statistics	3	S	Vardeman
538	Econometric Statistics	3	F	Fuller
539	Game Theory	3	F	H. T. David
542	Theory of Probability and Statistics	3	F	Stern
543	Theory of Probability and Statistics	3	S	Lahiri
544	Bayesian Statistics	3	S	Stern
546	Theory of Nonparametric and Asymptotic Methods	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	Kennedy/ Marasinghe
580	Statistical Computing	3	F	Kennedy
581	Computational Methods in Statistics	3	SS	Marasinghe
590 A	Special Topics: Theory	4	S	Sherman

No.	Course	Cr.	Sem.	Instructor
590 B	Special Topics: Methods	Var	F,S,SS	Cook Shelley Stern
590 D	Special Topics: Design of Surveys	1	SS	Nusser
599	Creative Component	Var	F,S,SS	Amemiya Breidt Carriquiry Cook Hinz Kaiser Koehler Lahiri Lorenz Meeker Nusser Opsomer Pollak Shelley Sherman Stephenson Stern Vardeman

Courses for Graduate Students, Major or Minor

No.	Course	Cr.	Sem.	Instructor
601	Advanced Statistical Methods	3	S	Kaiser
606	Spatial Statistics	3	S	Cressie
621	Advanced Theory of Survey Sampling	3	S	Breidt
642	Advanced Probability Theory	3	S	Athreya
643	Theory of Estimation and Testing of Hypotheses	3	F	Vardeman
647	Multivariate Analysis	2-3	F	Amemiya
699	Research	Var	F,S,SS	Amemiya Breidt Carriquiry Collins Cook Cressie H. T. David Fuller Kaiser Kennedy Koehler Lahiri Lorenz Marasinghe Meeker Nusser Rollins Shelley Sherman Stephenson Stern Stufken Vardeman
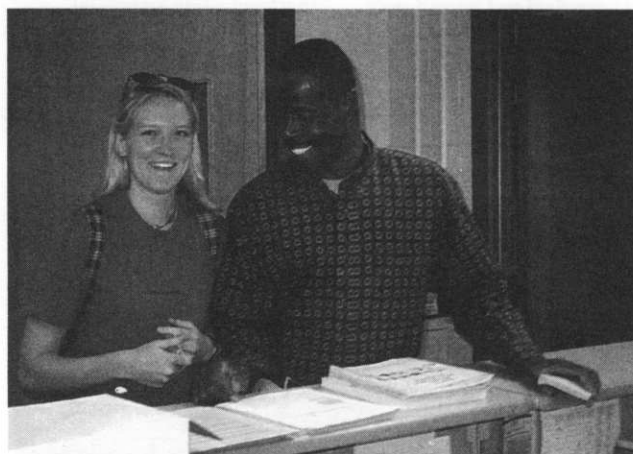
Teaching assistants Sylvia Rabstein and Bassirou Chitou meet in the main office. Rabstein is one of five DAAD scholars from Dortmund University, Germany, at ISU for the 1996-97 academic year. Chitou, from Cotonou, Benin, has been here since 1992 for doctoral studies with support from an ATLAS/AFGRAD fellowship.

▣ Continuing Education

Kenneth Koehler was one of four instructors for a new continuing education course on Sensory Evaluation of Foods given on May 21 and 22, 1997, at Iowa State. This course was sponsored by the Center for Crops Utilization Research and the Department of Food Science and Human Nutrition. The course provides a background in sensory physiology and selected methods used in sensory evaluation research, including difference testing, scaling techniques, and statistical analysis of sensory data.

▣ Graduate Students

Seven Ph.D. degrees and 26 M.S. degrees were granted in the Department of Statistics during the fiscal year. All but five of the masters' degrees were conferred on a nonthesis basis, with candidates completing creative components based on independent study. Abstracts of Ph.D. dissertations and master's theses appear on pp. 40-43.

The Vera David Graduate Fellowship in Statistics was awarded to Amy Meyer for the 1996-97 year. Two graduate students were chosen to receive the Holly and Beth Fryer Scholarship Award for the 1996-97 year: Jun Zhu and Phil Jones.

The Department of Statistics was selected to receive two four-year Miller Graduate Fellowships, each with an annual stipend of $5,000 starting in 1996, to attract outstanding graduate students. These are funded by earnings from the Miller Endowment Trust. The ISU College of Agriculture is funding a similar fellowship for the Department of Statistics, to be known as the George W. Snedecor Graduate Fellowship, providing the same level of support and starting in 1996. First-year recipients of the three fellowships are Dominic Dousa, Daniel Nordman, and Paul Hendrickson.

At the joint statistical meetings in Chicago, Illinois, on August 6, the 1996 Gertrude M. Cox Scholarship in Statistics Award was presented to Pamela

Dominic Dousa (L) and Dan Nordman (R), the first two Miller fellows from statistics.

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Abbitt in recognition of her academic excellence and future promise.

Teaching Excellence Awards were presented to John Gabrosek in December 1996 and to Barbara Mock in 1997. Research Excellence Awards were presented to Christopher Wikle in summer 1996 and to Jürgen Symanzik in December 1996. The Department of Statistics presented the Dan Mowrey Consulting Excellence Award to Elizabeth Pierce and Haiyan Shu, and the Vincent Sposito Statistical Computing Award to Deanne Reber, in May 1997.

Three statistics graduate students, Cong Chen, Yanrong Wang, and Jun Zhu, were accepted into the Honor Society of Phi Kappa Phi on March 23, 1997. Wang is working on a concurrent degree in economics.

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

Jeremy Todd Benson (economics and statistics, Summer 1996; John R. Schroeter and F. Jay Breidt) is an actuary with Cornhusker Casualty Company, Omaha, Nebraska, primarily pricing auto insurances for businesses.

Dana Lynne Bruden (Summer 1996; Mark Kaiser) is employed as a statistician by the State of Alaska.

Xiaohong Cao (Spring 1997; Derrick Rollins) is an analyst/SAS programmer at Abbott Laboratories, Abbott Park, Illinois.

*Thomas Michael Dubinin (Fall 1996; Kenneth J. Koehler).

Jens Christian Eickhoff (Spring 1997; Jean Opsomer) is finishing studies in Germany toward a Diploma in Statistics at Dortmund University.

*Juan José Goyeneche (Fall 1996; Alicia Carriquiry).

Alejandro Islas-Camargo (Fall 1996; Alicia Carriquiry) is a graduate assistant in the Department of Economics, University of New Mexico, working toward a doctorate in economics since January 1996.

Angela M. H. Jones (Summer 1996; Hal Stern) continued studies toward a doctorate in statistics through December 1996, then moved to Kansas City, Missouri, where she now works as a biostatistician in Saint-Luke's Perinatal Center.

*Sock-Cheng Koh (Summer 1996; Yasuo Amemiya).

Chiang-Sheng Johnson Lee (Fall 1996; Stephen B. Vardeman) is continuing studies toward a doctorate in the Department of Industrial and Manufacturing Systems Engineering, at Iowa State.

Rong Li (Summer 1996; Mark S. Kaiser) joined Norwest Card Services, Des Moines, Iowa; her position involves business statistical modeling.

Shiping Liu (Summer 1996; William Q. Meeker) joined Providian Bancorp (now Providian Financial Corporation) in San Francisco, California.

Anne Catherine Otte Schmidt (Spring 1997; Kenneth J. Koehler) has joined Stratis Health, Bloomington, Minnesota, as project manager.

Brandon Louis Paris (Fall 1996; Stephen B. Vardeman) began working toward a joint Ph.D. in statistics and education at Iowa State, and then accepted a position in the Quality Assurance and Applied Statistics division of Eastman Kodak Company, Rochester, New York, beginning June 30, 1997.

*Laknath B. Peiris (Summer 1996; Edward Pollak).
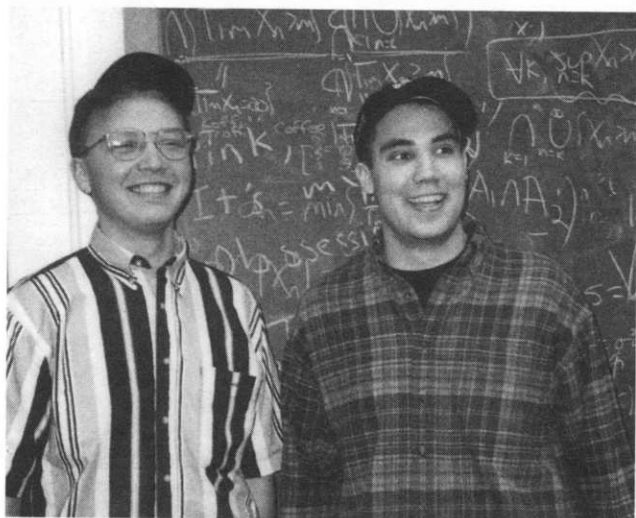
Elizabeth Gail Pierce (Spring 1997; Paul N. Hinz) is a business analyst with Providian Bancorp (now Providian Financial Corporation) in San Francisco.

Xiaoming Qi (Summer 1996; Kenneth J. Koehler) is a graduate assistant in the Department of Forestry, Iowa State University, continuing studies toward a doctorate in forestry economics.

*Deanne Lynne Reber (Fall 1996; Hal Stern).

Abigail Kepner Sage (Spring 1997; William Q. Meeker) is an analyst with AT&T, Somerset, New Jersey.

Pamela Marie Schmidt (Summer 1996; F. Jay Breidt) is a business modeling analyst with Norwest Card Services, West Des Moines, Iowa.

Heather Jeanne Smith (Spring 1997; Frederick O. Lorenz) has joined the marketing science department of Novartis Pharmaceuticals, East Hanover, New Jersey.

James Dennis Smith IV (Fall 1996; Derrick K. Rollins) remained at Iowa State as a teaching assistant in statistics during the spring 1997 semester and then accepted a position as engineering statistician with Corning, Inc., Corning, New York, in the optical-electronic components division.

Richard Bernard Sullivan (Summer 1996; Richard A. Groeneveld) continued graduate study in statistics at Iowa State during the 1996-97 academic year. He will start a Ph.D. program in the College of Education at the University of Iowa in the fall of 1997.

Yu-ping Jade Tien (Spring 1997; Yasuo Amemiya) has returned to Taipei, Taiwan.

Yihong Xiao (Spring 1997; Kenneth J. Koehler) is a research product coordinator for Trans Union, a credit information company, in Chicago, Illinois.

Jing Zhang (Spring 1997; Kenneth J. Koehler), who received concurrent M.S. degrees in statistics and forestry (forest economics and marketing) at Iowa State, is an analyst II for statistical business modeling with Norwest Card Services, West Des Moines, Iowa.

Ph.D. Recipients

Anthony Baiching An (Summer 1996; Wayne A. Fuller) has held a position as senior research statistician with SAS Institute Inc., Cary, North Carolina, since June 1995.

Thomas James Kirchoff (Fall 1996; Kenneth J. Koehler) accepted a position as assistant professor in the Department of Mathematics and Statistics, University of Missouri-Rolla.

Jaehyung Lee (Spring 1997; Mark Kaiser and Noel Cressie) is currently a postdoctoral fellow in the Department of Statistics.

Savas Papadopoulos (Summer 1996; Yasuo Amemiya) is a visiting assistant professor in the Department of Mathematics, Texas A&M University-Kingsville.

Jean Elizabeth Pelkey (Spring 1997; Yasuo Amemiya and Derrick K. Rollins) has taken a position as senior statistician with Intel Corporation, Chandler, Arizona, to work in its Assembly Test Material Operation.

Jürgen Symanzik (statistics and computer science, Fall 1996; Herbert T. David and Albert L. Baker) accepted a postdoctoral position in the Department of Statistics, Iowa State University, to work with Noel Cressie.

Christopher Kim Wikle (statistics and meteorology, Summer 1996; Noel A. C. Cressie and Tsing-Chan Chen) has a two-year appointment as visiting scientist in the Geophysical Statistics Project, National Center for Atmospheric Research, Boulder, Colorado.

M.S. Candidates

Kevin Ackley	Jin Young Byun
Abdulelah Al-Nafisa	Xiao-Hong Cao
Hans Martin Axelson	Ian Carlson

Sau-Kum Lydia Chan	Daniel Nordman
Pinliang Patrick Chen	Sharon Osborn
Zhongshan Chen	Toshitsugu Otake
Kok-Leong Chiang	Anne Otte Schmidt
Hwei-Chun Chou	Sebastian Paris-Scholz
Zachariah Dietz	Kara Perritt
Dominic Dousa	Charles T. Peterson
Jens Eickhoff	Elizabeth Pierce
Michael Elling	Xiaoming Qi
Martina Erdbruegge	Sylvia Rabstein
Yaling Fan	Janelle Rhorer
Soledad Fernández	Ken J. Ryan
Allison Florance	Abigail Sage
King-Chong Iris Fung	Adam Sales
Young Hun Han	Florian Schirm
Matt Haubrich	Birdal Senoglu
Gerhard Helleman	Haiyan Shu
Jennifer Heldt Hellrung	Sandip Sinharay
Paul Hendrickson	Heather Smith
Chin-Liang Hung	Fangqiu Sun
Alejandro Islas-Camargo (in absentia	Yu-Ping Jade Tien
	Jun-Yuan Wang
Hee-Koung Joeng	Xuchun Wang
Soon Seng Lau	Xue Wang
Nicholas Lewin	Yanrong Wang
Song Li	Yufeng Wang
Yunfeng Li	Chi-Hung Wu
Chiou-Ping Liu	Yihong Xiao (in absentia)
Shiping Liu (in absentia)	Jing Xue
Xiao-Hu Liu	Tariq Yeslam Yahya
Márcia Macêdo	Ling-Yu Cynthia Yang
Inna Megretskaia	Jing Zhang
Amy Jo Meyer	Lei Zhang
Barbara Mock	Sanyi Zhao
Laura Nalbarte-Migliaro	Zhaohui Zou
Andrew Nordine	

M.S. Candidates (General Motors)

David M. Hammelef	Timothy J. Lang
Brian T. Kenney	Mary E. Kriz O'Daniel
Vinod Kumar	

Ph.D. Candidates

Pamela Abbitt	Thomas J. Kirchoff
W. Jeremy Aldworth	Sock-Cheng Koh
Kari Henry Azevedo	Koji Kondo (economics and statistics)
Anthony Baiching An (in absentia)	Shonda Roelfs Kuiper
Andim Balce	Sun-Hee Kwon
Barbara Dombroski Barnet (statistics and education)	Chiang-Sheng Johnson Lee
Rebecca Benner	Eun-Kyung Lee Jaehyung Lee
Marek Brabec	Yoon-Dong Lee
Victor Chan	Win-Chin Lin
Cong Chen	Yi-Te Lin
Jianlin Cheng	Huei Grace Liu Ho (statistics and animal science)
Bassirou Chitou	Peter Morse
William F. Christensen	Savas Papadopoulos
Dean DeCock (statistics and industrial engineering)	Brandon Paris (statistics and education)
Sriram Devanathan (chemical engineering and statistics)	Mingue Park
Kevin Dodd	Francis G. Pascual
Thomas Dubinin	Elizabeth Paterno (economics and statistics)
Michael Eraas	B. Laknath Peiris (statistics and plant breeding)
John Gabrosek	Jean Pelkey
Juan Jose Goyeneche	Luiz Peternelli (statistics and plant breeding)
Nan-Jung Hsu	Deanne Reber
Hsin-Cheng Huang	Anindya Roy
Shiaau-Er Huarng	Nerilson Santos
Shuen-Lin Jeng	Pradipta Sarkar
Yoon-Sook Jeon	Michael Schuckers
Angela M. Jones	James D. Smith IV
Philip G. Jones	Tae-Sung Shin
Kari Jovaag	
Jae-Kwang Kim	

Richard B. Sullivan
Jürgen Symanzik (statistics
    and computer science)
Ling-Ling Claire Tsao
Melanie Wall
James H. Wright, Jr.
Kevin Wright

Lie-Ling Wu (statistics and
    ecology and evolutionary
    biology)
Jill Yoder
Zugeng Zheng (statistics and
    industrial engineering)
Jun Zhu

▨ Snedecor Award
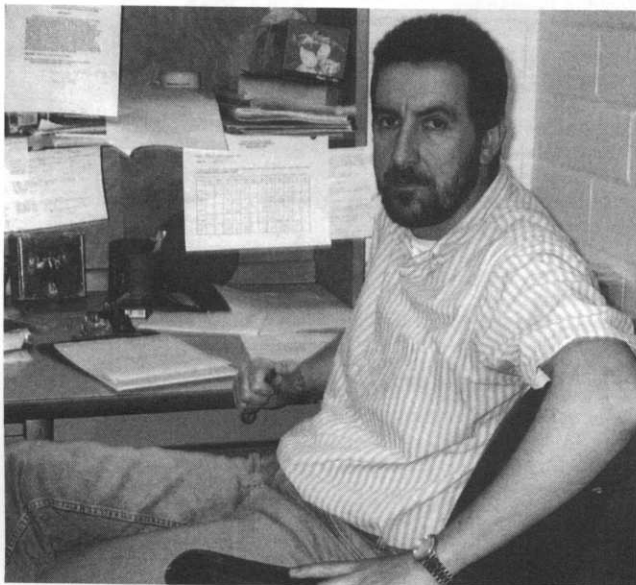
Juan Jose Goyeneche received the 1997 Snedecor Award as the outstanding doctoral student in statistics.

The George W. Snedecor Award, given to an outstanding doctoral student in statistics, went to Juan Jose Goyeneche, who received an M.S. degree in statistics here in December 1996. Earlier degrees (master's degree in statistics and Licenciatura in economics) had been granted by CIENES, in Chile, and the University of the Republic, Uruguay, respectively. Goyeneche had held positions as professor, researcher, and consultant in Uruguay in the University of the Republic and the Ministry of Agriculture since 1980 and came to ISU in 1993 as a Fulbright/LASPAU scholar. He is currently working with Wayne Fuller and Alicia Carriquiry in the Survey Section. His award includes a subscription to the *Journal of the American Statistical Association.*

▨ Iowa STAT-ers

The Iowa STAT-ers club was created in 1979 to encourage professional growth in the field of statistics, and to provide a social outlet for graduate students in the Department of Statistics. Toward this end, the STAT-ers sponsor seminars, run a reading group, plan parties and outdoor activities, and inform students of funding and services provided to graduate students.

The STAT-ers club is recognized as a student organization by the ISU Graduate Student Senate (GSS) and receives a portion of its funding from it. The remaining funds come from members' dues, or from fund-raising activities (like a recent sale of departmental t-shirts, STAT-ers cook books, and STAT-ers calendars).

Officers for the 1996-97 year were Lee Barton, president; Tom Kirchoff, vice president; Kevin Dodd, vice president; Pam Abbitt, treasurer; and Catherine Sunde, secretary. Beth Lencowski was social committee chair and Becky Benner was GSS senator. The social committee organizes several functions to provide opportunities for interaction outside the hallways of Snedecor. Traditional highlights feature the Talent Show (with skits and musical entertainment), the Halloween Party, intramural sports, tennis and golf tournaments, picnics, and a weekly Friday Afternoon Club.

▨ Snedecor Lecture

A. W. F. Edwards, the seventh Snedecor lecturer.

The seventh George W. Snedecor Lecture was given by A. W. F. Edwards, reader in biometry and Fellow of Gonville and Caius College, University of Cambridge, on September 30, 1996. He spoke on "Probability before and after the event in the work of R. A. Fisher." Edwards received B.A., Ph.D. and Sc.D. degrees at Cambridge. A contributor to both genetics and statistics, he is best known to statisticians for his book *Likelihood* (1972, 1992). He was president of the British Region of the International Biometric Society 1992-1994.

The Snedecor Lecture program is a series of occasional lectures that recognize George Snedecor's pioneering contributions to the field of statistics and to the Statistical Laboratory.

▨ Zyskind Memorial Lecture

The 19th George Zyskind Memorial Lecture was given by Peter McCullagh, who spoke on "Residual likelihood, vector spaces, and generalized linear models" on October 21, 1996. He has been a full professor in the Department of Statistics, University of Chicago, since 1985 and department chair since 1992.

McCullagh received his Ph.D. in statistics from Imperial College, London, in 1977. With J. A. Nelder, he is author of *Generalized Linear Models,* now in its

second edition. He is a fellow of the Institute of Mathematical Statistics, the American Association for the Advancement of Science, the Royal Society, and the American Statistical Association. He received the COPSS Presidents' Award in 1990.

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

▓ Sukhatme Memorial Lecture

The B. V. Sukhatme Memorial Lecture was given by Roderick Little, who spoke on "Analysis of longitudinal data with nonrandom drop-outs" on April 21, 1997. Little is professor and chairman, Department of Biostatistics, University of Michigan School of Public Health. He received M.S. and Ph.D. degrees at Imperial College, London University, and is a fellow of the American Statistical Association and past editor of the *Journal of the American Statistical Association*. He is author of numerous articles, various bulletins and scientific reports on the World Fertility Survey, and the book, with Donald B. Rubin, *Statistical Analysis with Missing Data*.

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.

▓ Undergraduate Students

The Department of Statistics and the Statistics Club participate in several programs that recognize scholarship and contributions to the club, department, college, and university. Moneys donated by individuals (including alumni of the undergraduate program in statistics) and/or companies have enabled certain awards. During 1996-97 the following undergraduate statistics majors received scholarships or recognitions:

Ryan J. Lennon, a senior with a minor in mathematics, received the George W. Snedecor Undergraduate Statistics Award for 1997 ($200), recognizing a statistics major who had demonstrated superior academic achievement and scholarship. Gary J. Walters, a junior, was selected to receive the Max Boehm Scholarship in Statistics and the $500 Schillmoeller Family Scholarship for the academic year 1997-98. The Boehm scholarship covers full in-state tuition for the year. These scholarships were presented by the department chair on April 14, 1997.

Marina C. Ashiotou was chosen, on April 11, 1997, to receive the Procter and Gamble Company Scholarship ($1,000) for 1997-98. The purpose of this scholarship is to recognize early academic achievement in the major of statistics. Ashiotou, a sophomore, is a double major in mathematics and statistics. Also, Julie E. Modzelewski, a statistics sophomore, was chosen in April to receive the newly established Scott Kongable/Rockwell Undergraduate Statistics Scholarship ($600) for 1997-98. This scholarship is supported by Kongable (B.S. stat 5/89)

and by matching funds from Rockwell/Collins in Cedar Rapids.

The Statistics Club sponsors an award of $200 that recognizes an undergraduate statistics major who has contributed to the club and the department while demonstrating academic achievement and scholarship. The award for 1997-98 went to Sarah E. Feekes.

At the first Student Scholars and Leaders Recognition Ceremony on April 3, 1997, in C. Y. Stephens Auditorium, Gary J. Walters and Vera Boulaevskaia were recognized as standing in the top two percent of the Liberal Arts and Sciences College junior and senior classes, respectively. Boulaevskaia, who received a B.A. in French and a B.S. in statistics in spring 1997, was also recognized as the highest scholarship graduating senior in both of these majors. Additionally, she and two other students were recognized as the highest scholarship graduating seniors in the College of Liberal Arts and Sciences. David M. Loecke, a senior joint major in mathematics and statistics, was initiated as a member of Phi Beta Kappa on April 27, 1997.

Charlotte M. Schulze-Hewett, who received B.S. degrees in mathematics and statistics, with distinction in spring 1996, was awarded a scholarship by Phi Kappa Phi in March 1997 for her first year of graduate study. She will be a mathematics graduate student at the University of Illinois, Chicago Circle, in the fall of 1997.

Ten students received B.S. degrees in statistics during the period July 1, 1996, to June 30, 1997. Names of the degree recipients follow, with employment or study plans where definite. An asterisk indicates that the student is continuing in the graduate program in statistics at ISU.

Joel Andrew Abrams (Fall 1996; W. Robert Stephenson) continued graduate work at Iowa State University as an undeclared major.

Vera L. Boulaevskaia (Spring 1997, with distinction; Richard A. Groeneveld), who received a concurrent B.A. degree in French with distinction at Iowa State, will attend graduate school in statistics at the University of Minnesota.

Annette Gladys Brommel (Fall 1996; W. Robert Stephenson) has continued employment at Principal Financial Group, Des Moines, Iowa.

Tade Louis Gerischer, Jr. (Fall 1996; W. Robert Stephenson) is a quality assurance analyst at Filtronics Comtek, Salisburg, Maryland.

Kimberlee Coleen Huntrods (Fall 1996; W. Robert Stephenson).

Aaron James Kaufman (Spring 1997, with distinction; W. Robert Stephenson) is engaged in actuarial work with John Deere Inc. Health Care, Davenport, Iowa.

*Ryan John Lennon (Spring 1997, with distinction; Richard A. Groeneveld).

Chad Michael McDermott (Fall 1996; Mark S. Kaiser) is a supervisor at Metz Baking Company, Sioux City, Iowa.

Jeff Dean Meyer (Spring 1997; W. Robert Stephenson) has contin-

ued employment at Principal Financial Group, Ames, Iowa, as senior claims examiner.

Rina L. Patel (Fall 1996; William Q. Meeker) is a statistical programmer with Harris Laboratories, Lincoln, Nebraska.

Jennifer Bloom worked as a summer 1997 statistical intern for Firestone Agricultural Tire Company in Des Moines, Iowa. Vera Boulaevskaia had a statistics internship with the 3M Company in Minneapolis, Minnesota, during the summer before becoming a graduate student at the University of Minnesota. Sarah Feekes was an actuarial intern with the Principal Financial Group in Des Moines, Iowa, during this period. Ryan J. Lennon spent a second summer as a data analyst at the Mayo Clinic before beginning graduate study in statistics at ISU. Gary J. Walters worked over the summer with the Survey Section of the Statistical Laboratory in Snedecor Hall.

▩ Statistics Club

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

The club kicked off the new year with its annual pizza party. In addition to catching up on what members had been doing over the summer, they placed names in nomination for the various offices. Elections were held over the next two weeks with members voting, for the first time, via e-mail (hopefully not more than once). The officers of the club for 1996-97 were as follows: president, Aaron Kaufman; vice president, Sarah Feekes; treasurer, Gary Joe Walters; and secretary, Ryan Lennon.

Just before registration for spring semester started, the club held a meeting to help students decide what courses to take. This meeting offered students new to the statistics major an opportunity to find out from juniors and seniors what courses in the major, support courses, and courses in general were really like.

So what is the hardest course in the undergraduate statistics major? Most students indicated Stat 480: Statistical Applications of Digital Computers was difficult because of the programming involved. Stat 341-342: Introduction to the Theory of Probability and Statistics was a close second. You really do need a solid background in calculus to do well in this sequence. One bit of advice for success in statistics courses: Always, always, always do your homework. Besides statistics, many courses that can be used to meet the Group Requirements were discussed. Thumbs up were given to Theater 106: Introduction to the Performing Arts and Music 102: Introduction to Music Literature. Classical studies courses would be interesting for those who like mythology. Be careful if you sign up for English 335: Film, since you may get a semester of really weird movies. Other courses were discussed, and members got a good idea

of not only the diversity of courses but also the diversity of interests possessed by undergraduate statistics majors.

▩ Seminars

The series of regular weekly seminars offered by the Statistical Laboratory and the Department of Statistics throughout the 1996-97 year was planned by F. Jay Breidt and Krishna Athreya. Noel Cressie coordinated the occasional environmental/ecological statistics seminars. Kevin Wright was chair for the Iowa STAT-er seminar series.

Statistical Laboratory Seminars

Summer 1996

July 23   Graphing statistical results from meta-analytic reviews. Morgan C. Wang, Department of Statistics, University of Central Florida

Fall 1996

September 6   Plans and prospects for 1997. Dean L. Isaacson

16   Recovering joint densities from marginal information. Douglas Miller, Department of Economics, Iowa State University

October 1   Evolutionary tree inference for continuous characters. A. W. F. Edwards, Cambridge University

7   Statistics in numerical weather forecasting. L. Mark Berliner, Geophysical Statistics Project, National Center for Atmospheric Research and Department of Statistics, Ohio State University

14   Bayesian estimation and comparison of multiple change point models. Siddhartha Chib, John M. Olin School of Business, Washington University

21   Inhomogeneous point-process random field models for studying spatial patterns. Katja Ickstadt, Institute of Statistics and Decision Sciences, Duke University

28   Rationality, algorithms, and juridical proof. Ronald J. Allen, John Henry Wigmore Professor, Northwestern University School of Law

November 4   Smoothing: Recent developments and applications. Matt Wand, Australian Graduate School of Management, University of New South Wales, Sydney, Australia

5   Three state survival models with frailty. Handan Wand, Department of Statistics, University of Illinois

6   Optimal design of censored life testing experiments. Ilya Gertsbakh, Ben Gurion University, Beersheva, Israel

11   Writing an electronic statistics textbook. Jan deLeeuw, Department of Statistics, University of California, Los Angeles

21   Statistical analysis of maintenance growth curves. Tom Kirchoff

December 2   Statistical analysis of spatial pattern of nonspherical objects and its application. Masaharu Tanemura, Institute of Statistical Mathematics, Tokyo, Japan

5   (Joint Computer Science and Statistical Laboratory Seminar) Analytical results for formalized and timed data flow diagrams. Jürgen Symanzik

6   A noninformative Bayesian approach to some nonparametric problems. Glen Meeden, School of Statistics, University of Minnesota

December 16   Semiparametric methods for longitudinal data analysis. Naomi Altman, Department of Statistics, Cornell University

Spring 1997

January 27   Predictions of spatial cumulative distribution functions and prediction bands based on a subsampling method. S. N. Lahiri

30   Bayesian CART model search. Hugh Chipman, Graduate School of Business, University of Chicago

February 3   If Fisher had a workstation: Permutation tests of bivariate interchangeability. Michael Ernst, Department of Statistical Science, Southern Methodist University

6   Nonconjugate Bayesian estimation of covariance matrices and its use in hierarchical models. Michael Daniels, Department of Statistics, Carnegie Mellon University

10   Poisson/gamma random field models for spatial statistics: A Bayesian analysis of tree patterns and travel demand. Katja Ickstadt, Institute of Statistics and Decision Sciences, Duke University

12   Adjusting data for measurement error. Jeffrey Bay, Department of Statistics, North Carolina State University

13   Locally adaptive density estimation. Stephan Sain, Department of Statistical Science, Southern Methodist University

17   Bayesian frequency calculations for using normal mixture models (an example with infant temperature data). Michael D. Larsen, Department of Statistics, Stanford University

19   Extended linear modeling and general approximating spaces. Jianhua Huang, Department of Statistics, University of California, Berkeley

21   Bayesian curve fitting, CART and MARS. Bani K. Mallick, Department of Mathematics, Imperial College, London

24   Codes, designs and distance. William Duckworth, Department of Statistics, University of North Carolina-Chapel Hill

25   Genetic analysis of schizotypal personality traits. Michael Miller, Department of Psychiatry, Washington University School of Medicine

March 4   A new generation of a statistical computing environment on the net. Dr. Sigbert Klinke, Institut für Statistik und Ökonometrie, Humboldt Universität, Berlin, Germany

5   Design and estimation in circular measurement error models. Huaiqing Wu, Department of Statistics, University of Michigan

17   Two sample densities ratio models and their applications in binary data analysis. Jing Qin, Department of Mathematics, University of Maryland

17   (Joint with Iowa STAT-ers) The history of statistics at Iowa State. H. A. David

31   Information theory in probability and statistics. Andrew Barron, Department of Statistics, Yale University

April 7   Statistical modeling of count data. A. H. El-Shaarawi, National Water Research Institute and McMaster University

28   High-dimensional data visualization: A framework and case studies of interactive and dynamic graphics. Dianne Cook

May 12   Simulation-based estimation for conditionally specified statistical models. Jaehyung Lee

Summer 1997

June 27   Estimating fatigue curves with the random fatigue-limit model. Francis G. Pascual

Special Lectures and Seminars

September 30   George W. Snedecor Lecture: Probability before and after the event in the work of R. A. Fisher. A. W. F. Edwards, Institute of Public Health, Cambridge University

October 21   George Zyskind Memorial Lecture: Residual likelihood, vector spaces, and generalized linear models. Peter McCullagh, Department of Statistics, University of Chicago

April 21   B. V. Sukhatme Memorial Lecture: Analysis of longitudinal data with nonrandom dropouts. Roderick Little, Department of Biostatistics, University of Michigan School of Public Health

Seminar in Environmental/Ecological Statistics

October 24   Analysis of disease clustering and putative pollution hazards. Andrew B. Lawson, University of Abertay Dundee, Scotland
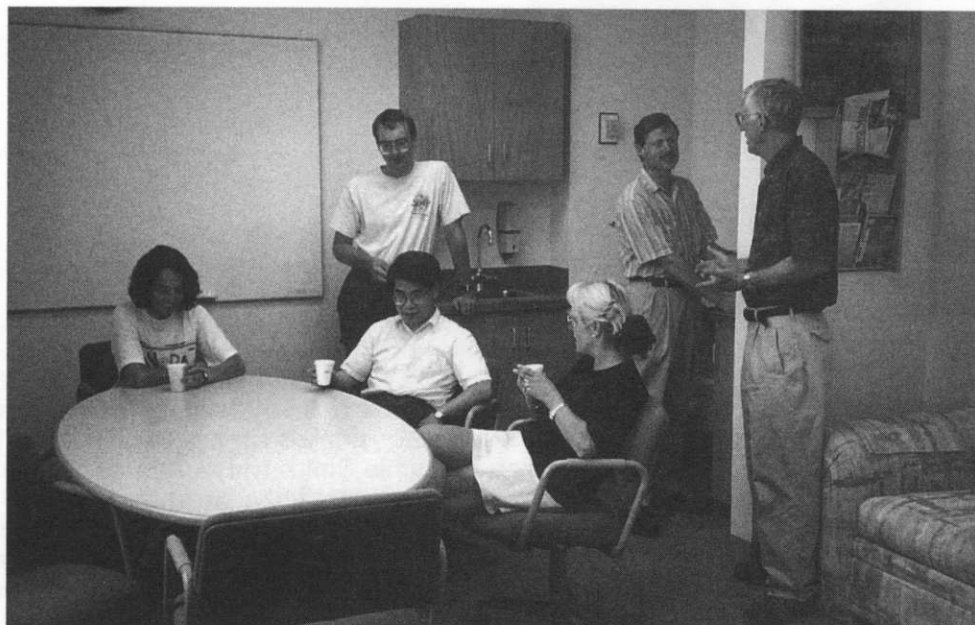
Faculty and students meet in the new lounge before seminar. From L to R are Soledad Fernandez, Kevin Wright (standing), Yasuo Amemiya, Alicia Carriquiry, Ken Koehler, and Dean Isaacson.

Iowa STAT-ers Seminars

September 18   Providian Bancorp. Drew Langewin et al., Providian

25   Summer internship experiences. Becky Benner, Marek Brabec, William Christensen, Barb Mock, Deanne Reber, and Jun Zhu

October 23   Life at Intel. Dwayne Pepper, Intel

November 18   [No formal title] Aidan Cardella and Gerry Hahn, General Electric

20   Neural networks and statistics: A comparison of results. Babatunde J. Ayeni, 3M Company, St. Paul, Minnesota

March 17   (See Statistical Laboratory Seminars above) H. A. David

21   Statistics and Trilogy Corporation. Greg Jarecki, Trilogy Consulting Corporation

26   Discussion of departmental issues. Dean Isaacson

April 14   Statistics and Kodak. Richard Scott, Eastman Kodak Company

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