Statistical Laboratory

established 1933

Annual Report

July 1, 1992 to June 30, 1993

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Contents

THE STATISTICAL LABORATORY
Iowa State University
1992-93 Annual Report

The Stat Lab at 60

The ten years since the 50th anniversary of the Statistical Laboratory have seen a number of changes and transitions. After the euphoria of the 50th anniversary conference, there was a period of economic belt-tightening in the State of Iowa, related to the agricultural sector recession/depression. There was also a period of changing leadership throughout the university administration, accompanied by a rethinking of missions and goals by the three Regents universities.

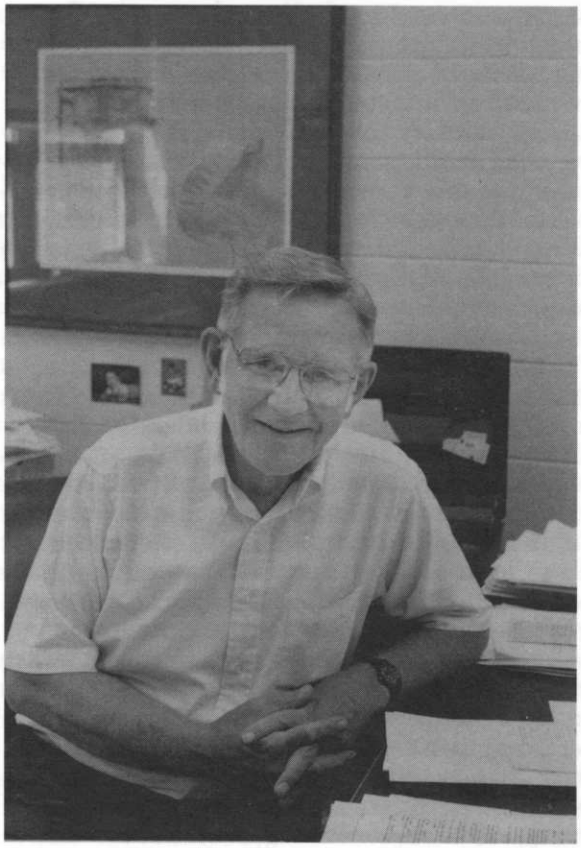
H. A. David stepped down as director and head of the statistics center at ISU in 1984 after twelve years' service in that position. Dean Isaacson assumed administrative duties on a temporary basis, then agreed in 1986 to continue as director and head for another four, then four more, years.

The ten years since the 50th anniversary have brought increased international professional interaction through conferences, lectures, and workshops. A German-U.S. graduate student exchange program with Dortmund University will enter its fourth year next August. Eleven Dortmund students have studied at ISU, and two ISU students have gone to Dortmund. Within the last three years, faculty have given talks and lectures in Australia, Belgium, Canada, Chile, China, Colombia, Costa Rica, Egypt, Finland, France, Germany, Hong Kong, Hungary, India, Israel, Italy, Malaysia, Mexico, the Netherlands, Portugal, Russia, Scotland, Singapore, Spain, Switzerland, Taiwan, Uruguay, and Venezuela.

The Statistical Laboratory Preprint Series was initiated to help faculty and students disseminate their results more quickly than refereed journals would allow. A major conference was held here in 1989--From Observation to Inference, in honor of Oscar Kempthorne.

The past ten years have seen some retirements, resignations, and a death: Philip Cox, Roy Hickman, Don Hotchkiss, Oscar Kempthorne, and Leroy Wolins retired, although all have maintained ties with the Stat Lab; Tom Bubolz, J. Jeffery Goebel, Glen Meeden and Jerry Sacks took other positions; Vince Sposito died in October 1991.

Visiting faculty and several temporary or nontenured faculty came and went: George Battese, Franz Hering, J. K. Ghosh, Byron Jones, Peter Jones, Balvant Kale, J. Tiago de Oliveira, Shian-Koong Perng, Christopher Skinner, Yasuyuki Toyooka, Ishay Weissman, Shie-Shien Winston Yang, Emmanual Yashchin, Fetih Yildirim, Chen Zhao-Guo, John Eltinge, Stephen Haslett, Ronaldo Iachan, Paul McGovern, Mark Reiser, and Debapraya Sengupta.



Roy Hickman chose early retirement in 1991 after 25 years in the Statistical Laboratory, including 20 years as administrative head of Survey Section operations. He agreed to continue supervision of the Survey Section on a temporary basis until a replacement was found--and then to stay a little longer to enable a smooth transistion. A retirement banquet was held on October 22, 1992, and a reception at the Memorial Union, the following day in his honor. He has been named professor emeritus.

Two alums were invited to return to take faculty positions: Alicia Carriquiry and Sarah Nusser. Other faculty have been added: F. Jay Breidt, Noel Cressie, Mark Kaiser, Soumendra Lahiri, Carl Roberts, Derrick Rollins, Peter Sherman, and John Stufken.

The faculty continue to represent a broad base of academic experience in their research interests, links with other subject matter areas, and statistical applications. Ties with engineering and, to a lesser degree, the physical sciences have increased. A cooperative arrangement between Mayo Clinic and the Department of Statistics was reestablished. Faculty diversity has also increased in other ways. In 1983 we had one woman faculty member; we now have three, and a fourth is coming in August 1993. Through other appointments, multicultural and minority students have gained new professional role models. Family and previous professional ties to other nations have stimulated interaction with colleagues in Uruguay, India, Australia, and the Netherlands.

The impact of computers has become ubiquitous. It has changed the nature of statistical consulting,

research, and teaching on campus and the routine exchange of information locally and off campus.

Graduate enrollment has grown, although minimum requirements for admission were raised. Support from industry through scholarship and fellowship money and internships has allowed enrichment of some graduate appointments and provided practical experience to both graduate and undergraduate students. The number of undergraduate majors in statistics has held relatively steady. On the other hand, the number of nonmajors required to take statistics courses as part of their programs has risen.

The net result of the strategic rethinking of missions and goals, a departmental self-study, an external review, and university leadership changes has been positive and continuing. As one of the strongest academic areas at Iowa State, statistics has received firm administrative backing and, within the limits of available funds, efforts to strengthen outreach to other subject matter areas through joint appointments and curricular changes have been encouraged.

Alumni and friends have responded generously to annual fund drives. This support has allowed us to maintain a number of projects, including the Annual Report, despite new expenses such as those associated with increased use of computers. Cash awards have been given to graduate assistants who excel in teaching, research, consulting, or statistical computing. Endowed fellowships and scholarships have also been established through the efforts of alumni and friends (see pp. 45 and 50). In sum, the continued support for our statistical program from both local and off campus individuals and agencies allows us to face the future with optimism.

Both the Iowa STAT-ers and the undergraduate Statistics Club come up with ideas for embellishing tee-shirts and sweat shirts. The Statistics Club developed the design shown here to celebrate four favorite teachers and persuaded them to put on their images: L to R, Richard Groeneveld, William Q. Meeker, W. Robert Stephenson, and Mervyn Marasinghe.

Personnel

In August 1992, Carl Roberts returned from faculty improvement leave spent at the University of Leiden in the Netherlands. Mervyn Marasinghe continued on faculty improvement leave at the School of Statistics, University of Minnesota, through December. His work focused on data analysis and graphical methods.

Jerome Sacks resigned as USDA-ARS resident collaborator effective September 20 to join the Cooperative Studies Program, Hines VA Hospital, Hines, Illinois. Hines is one of four statistical Coordinating Centers providing design, data management, statistical analysis, and administrative support to the program, which is a division of the U.S. Department of Veterans Affairs Medical Research Service.

Mack Shelley, who holds a joint appointment as professor in the departments of Statistics and Political Science, became vice chair of Political Science in January 1993.

Shashikala Sukhatme went to Case Western Reserve University for the months of June and July 1993. As visiting professor in the Department of Epidemiology and Biostatistics, she taught a course in Sampling Theory and Methods.

Emeritus professors took an active part in the teaching, research, consulting, and administrative functions of the statistical center. After Jerome Sacks' departure, C. P. Cox served as a consultant to supervise graduate assistants supported by the Agricultural Research Service, USDA, primarily to provide statistical services to the National Animal Disease Center. Donald Hotchkiss returned to teach Stat 401 in Des Moines in the fall and here on campus in the spring. Roy Hickman filled in for him during a prescheduled vacation break and also consulted with Sarah Nusser on Survey Section operations from time to time. O. Kempthorne continued to do research, revise a textbook, and give papers.

Short-term visitors during the year included three alumni who had completed doctorates in statistics at Iowa State. Eiichiro Ed Funo, associate professor, Department of Economics, Kanto Gakuin University, Yokohama, Japan, returned for a visit in mid-September and presented a seminar. Sastry Pantula, associate professor, Department of Statistics, North Carolina State University, was here from October 1 to November 16, 1992, to work with Wayne Fuller on time series research. Luis Escobar, Department of Experimental Statistics, Louisiana State University, came for the week of June 14, 1993, to collaborate with William Q. Meeker on research in the area of analysis of reliability data.

Do-Seok Chang came in December 1992 for a more extended stay, through January 1994, as visiting scholar sponsored by Iowa State University's Exchange Visitor Program. He is associate professor and chair of the Department of Statistics and Computer Science, Dongduck Women's University, Seoul, Korea, and a director of the Business Administration Institute there. He has support from the Korea Ministry of Education and his university and is engaged in research on Bayesian inference for switching point and on regression. Chang first joined the faculty of Dongduck Women's University in 1979 and received his Ph.D. in statistics at Korea University in 1990. He is author, with Byung-ji Chang, of *Introductory Statistics* (9th edition, 1991).

Kim-Anh Do, lecturer in statistics, Faculty of Information Sciences and Engineering, University of Canberra, Australia, came in mid-June 1993 as visiting research scholar, for a month. She and Ken Koehler worked on improving numerical and computational efficiency of bootstrap procedures for interval estimation in proportional hazards survival models.

Samuel Wieand was inducted as a fellow of the American Statistical Association at the annual meeting in August 1992. He was cited for innovative and influential applications of statistics to medical science, for research and consulting contributions, and for scientific leadership.

Dean Isaacson received the 1992 Governor's Iowa Quality Recognition Award in the category Individual/Public Sector (Education/Government). The award was presented by Governor Terry Branstad on October 13, 1992, in Des Moines during the Iowa Excellence Forum. Isaacson has served on the board of the Iowa Quality Coalition, representing the Regents institutions, for several years. He has also supervised the graduate students in statistics at ISU supported by the coalition.

At the university's 1993 Spring Convocation and Awards Ceremony, Noel Cressie was named Distinguished Professor in Liberal Arts and Sciences. The title honors faculty members in a given college as having attained the highest academic achievement. David F. Cox and Herbert T. David were named as University Professors. That title, conferred for the first time this year, recognizes senior faculty members who have had a significant impact on their departments and the university.

The award citations included the following remarks: "Noel A. C. Cressie... has published more than 85 refereed journal articles and two books. According to a colleague, his book *Statistics for Spatial Data* (Wiley, 1991) 'is a monumental synthesis of the field which will stand as the standard work for a decade'... Dr. Cressie is widely sought as a consultant and panel member by national agencies... He not only creates new statistical methods but uses them to address real world problems. Dr. Cressie is also a very effective teacher. He has taught courses from the 100 to 600 level and is an illustrious example of a professor whose teaching is strengthened by an active research and consulting program."

"During his 34 years at Iowa State University, Dr. David Cox has excelled as a researcher, teacher, and consultant. Though his sections of Stat 401 and 402 [each] enroll more than 100 graduate students, he has an impact on individuals... Dr. Cox works as a statistical consultant for researchers throughout Iowa State. In the words of a colleague, 'He is the hidden co-author of literally hundreds of scientific papers published by his former students and by colleagues.'"

"Herbert T. David has unselfishly given his time, energy and ideas to Iowa State University for 35 years. He has directed the dissertations of 52 Ph.D. students... has collaborated with colleagues throughout Iowa State and often contributed the key idea that resulted in a breakthrough. He served as a mentor to many junior faculty members before it was fashionable to do so... His broad knowledge of scientific fields makes him especially effective in solving engineering problems."

Stephen Vardeman was selected to receive a College of Liberal Arts and Sciences Teaching Excellence Award in May 1993. He has also been elected an ordinary member of the International Statistical Institute. His book *Statistics for Engineering Problem Solving* will be published by PWS Publishing in November 1993.

Oscar Kempthorne was invited to visit Greece in June 1993 to receive an Honorary Doctor of Philosophy degree from the University of Ioannina. This is the first honorary degree given by the university. The candidate was presented by his former student, Takis Papaioannou (Ph.D. 5/70), professor of probability and statistics, Department of Mathematics, at Ioannina. Kempthorne first visited Greece in 1946, as a British member of the Allied technical mission sent to monitor voting in the Greek elections.

Looking toward next year: Dianne Cook will join the faculty as assistant professor in the Statistical Laboratory and the Department of Statistics. She has completed M.S. and Ph.D. degrees at Rutgers University (Ph.D. 5/93) and has research interests in statistical computing and dynamic graphics. Earlier studies were in Australia, at the University of New England, N.S.W. Before coming to the U.S., she taught secondary mathematics in Australia and held research positions at Australian National University. Yasuo Amemiya has been promoted to full professor. Peter Sherman has been awarded tenure and promotion to associate professor. Shashikala Sukhatme will be at Case Western Reserve University as visiting professor in the Department of Epidemiology and Biostatistics summer and fall 1993. Soumendra Lahiri will visit Australia and work with Peter Hall during spring semester 1994.

Statistical Laboratory Staff--Fiscal Year 1992-93 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

David C. Glenn-Lewin, Ph.D.--interim dean, College of Liberal Arts and Sciences; interim 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

Krishna B. Athreya, joint appointment with Department of Mathematics

Theodore B. Bailey

C. Philip Cox, professor emeritus

David F. Cox, University Professor

Noel A. C. Cressie, Distinguished Professor in Liberal Arts and Sciences

Herbert A. David, Distinguished Professor in Liberal Arts and Sciences

Herbert T. David, University Professor, joint appointment with Department of Industrial and Manufacturing Systems Engineering

Wayne A. Fuller, Distinguished Professor in Liberal Arts and Sciences; faculty status also in Department of Economics

Richard A. Groeneveld

David A. Harville

Roy D. Hickman, professor emeritus

Paul N. Hinz, faculty status also in Department of Forestry

Donald K. Hotchkiss, professor emeritus

David V. Huntsberger, professor emeritus

Dean L. Isaacson

Oscar Kempthorne, emeritus Distinguished Professor in Liberal Arts and Sciences

William J. Kennedy

Kenneth J. Koehler

William Q. Meeker, Jr.

Edward Pollak, joint appointment with Department of Genetics

Jerome M. Sacks, USDA collaborator

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

Robert F. Strahan, joint appointment with Department of Psychology

Norman V. Strand, professor emeritus

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

H. Samuel Wieand, Mayo Clinic collaborator

Leroy Wolins, professor emeritus

In June, Oscar Kempthorne went to Greece to receive an honorary doctorate from the University of Ioannina. From L to R: Maria Papaioannou, Valda and Oscar Kempthorne, and Takis Papaioannou (Ph.D. statistics, ISU, 1970), a former student of Kempthorne's, who is professor in the chair of probability and statistics at the University of Ioannina.

Associate Professors

Yasuo Amemiya

Frederick O. Lorenz, joint appointment with Department of Sociology

Mervyn G. Marasinghe

Carl W. Roberts, joint appointment with Department of Sociology

W. Robert Stephenson

John Stufken

Shaskikala Sukhatme

Assistant Professors

Harold D. Baker

F. Jay Breidt

Alicia Carriquiry, joint appointment with Center for Agricultural and Rural Development

Mark Kaiser

Soumendra N. Lahiri

Sarah Nusser

Derrick Rollins, joint appointment with Department of Chemical Engineering

Peter Sherman, joint appointment with Department of Aerospace Engineering and Engineering Mechanics

Resident Collaborator

Dean Thompson, USDA Soil Conservation Service

Visiting Research Scholars

Do-Seok Chang

Kim-Ahn Do

Sastry Pantula

Graduate Assistants

The status of graduate students often changes. Students holding appointments as graduate teaching or research assistants in statistics for part or all of the year are listed here. Cooperative internships are listed on p. 48.

Gregg Althen (Dow scholar)
Anthony Baiching An
Gregorio Atúncar
Lori Becker
Rebecca Benner (Corning scholar)
Marek Brabec
Sherry Bushaw
Ann Russey Cannon (Shell fellow)
Abderrahmane Chakak
Marie Coffin
Joseph H. R. Croos
Bradley Davidson
Rohit Deo
Carola Deppe (DAAD scholar)
Mark Dietrich
Kevin Dodd
Barbara Dombroski
Gerri M. Dunnigan
Michael Elling (Shell scholar)
Jun-ichiro Fukuchi
Matthew Gerdis (Corning scholar)
Carolyn Goebel
Jason Gunnink
David W. Hall
Peter Hanson
Michael Hartfield
Jeffrey Helterbrand (Shell fellow)
Hsin-Cheng Huang
Mu-Yeh Huang
Molly Isbell
Philip W. Iversen
Cheryl Johnson
Philip G. Jones
Shin-Soo Kang
Sara Kind
Rachel Kintzinger
Thomas Kirchoff
Scott Klabacha
Seoung-Gon Ko
Lynn Konecne
Tillman Krahnke
Chinh Kreisberg
Shonda Roelfs Kuiper
Reiner Kurzhals
Kye-Don Lee
Ding-Hwa Dean Lei
Klaus Lemke
Kelli Leonard (Shell scholar)
Charles Lerch
Yang Li
Chih-Yao Craig Liu
Thomas Loughin (Shell fellow)
Steven Mattics
Anita Hinkeldey McVey
MaritzaMelèndez-Cuero
Peter Morse
Sol T. Mumey
Hamid Reza Navvabpour
Bryan Olin
Savas Papadopoulos
Daniel J. Parks
Francis Pascual
Jean Pelkey
Mark Peters
Sara Peterson (Vera David fellow)
Abdul Wajid Rana
Sellem Remadi
Daniel Rose
Leroy Rushing
Todd Sanger
Rebekah Clark Santiago
Pradipta Sarkar
Michelle Sawyer
Stephanie Johnson Schaller
Silke Schmidt (DAAD scholar)
Jürgen Schroeder
Tae-Sung Shin
Greg Stenback (Shell scholar)
Andrine Swensen (Corning scholar)
Jürgen Symanzik
Margot Tollefson
Brigitta Voss (DAAD scholar)
Hui Wang
Ouhong Wang
Christopher Wikle
Ibrahim Yansaneh
Zugeng Zheng
Weiye Zhu
Alan Zimmermann

Supported Graduate Students

Abdoulaye Adam—USAID-Niger and U.S. Department of Agriculture
Aidan Cardella—U.S. Department of Agriculture
Bassirou Chitou—USAID-ATLAS/AFGRAD
Donald J. Dougherty—ISU Research Park
Birol Emir—Government of Turkey
Dennis Field—Iowa Quality Coalition
Christian Garrigoux—Center for Nondestructive Evaluation, IPRT, Ames Laboratory, U.S. Department of Energy
Hui-Lin Hu—College of Veterinary Medicine, ISU
Wynandin Imawan—STAID-IU-Indonesia
Alejandro Islas-Camargo—CONACyT-Mexico
Kari Jovaag (Corning scholar)—Soil Tilth Laboratory, ISU
Brian Kluge—Admissions Office, ISU
Jaehyung Lee (Fryer scholar)—Center for Family Research and Rural Mental Health, ISU
James Majure—GIS Support and Research Facility, ISU
David G. McDonald—National Center for Atmospheric Research (in absentia)
Timothy Ogamba—Graduate College, ISU
Gerald Parise—Department of Economics, ISU
Elizabeth Paterno—Department of Economics, ISU
Sellem Remadi—U.S. Department of Agriculture
Jason Rupe—Department of Industrial and Manufacturing Systems Engineering, ISU
Chungyeol Shin—Department of Horticulture, ISU
David Siev—U.S. Department of Agriculture
Kai-One Sriplung—Center for Agricultural and Rural Development, ISU
Hiroshi Takahashi—Global Pig Farms, Inc., Japan
Dilek Tali—Central Bank of the Republic of Turkey
Elizabeth Uken (Eli Lilly scholar)—Department of Geological and Atmospheric Science, ISU
Delfino Vargas-Chanes—CONACyT-Mexico
Anand Vidyashankar—Department of Mathematics, ISU
Michael Wallendorf—Department of Entomology, ISU
Lie-Ling Wu—College of Veterinary Medicine, ISU
Ilker Yalçin—Hacettepe University, Turkey
Seongmo Yoo—Social & Behavioral Research Center for Rural Health, ISU
Jincheol Yu--Korean Army

Self-Supporting Graduate Students

Mahmood Ahmad
Peter Anderson
Yudiantri Asdi
Christine Ashman
Todd Borchert
George G. Brown, Jr.
Shu-Tien Chen
Hyen-Hyee Cho
Jihwan Cho
Michael Cummings (in absentia)
Todd Defor
Joan Qiong Dong
Ashraf El-Houbi
Marjorie Green
Shawkat Hassan
Nan-Jung Hsu
Hui-Yi Huang
Shuen-Lin Jeng
Yoon-Sook Jeon
Je Yeong Jeong
Hyun-Hee Joo
Dae-Lyong Kim
Sahmyeong Kim
Young Jae Li
Win-Chin Lin
Stella Chueck-Wah Luk
Soheila Naeini
Sang-Heon Oh
Margarita Paterno
Muhamad Sabran
Angela Schneider
Richard Sullivan
Tsing-Feng Tsai
Chi-Hong Tseng
Enid Van Valkenburg
Daniel Walczak
Steve Wilmarth
Ibrahim Yansaneh
Namkyu Yu

Professional and Scientific Staff

Dianne G. Anderson, research associate, Survey Section
Richard Dorsch, programming consultant, Survey Section
Mary Genalo, survey projects coordinator, Survey Section
Masoud Kazemi, research associate, Survey Section
Edith Landin, administrative assistant
Marie Loughin, research associate, Survey Section
Anita Hinkeldey McVey, research associate, Survey Section (beginning 10/26/92)
Bud Meador, supervisor, Statistical Data Processing Services
Deborah Reed-Margetan, programmer-analyst, Survey Section
Janet L. Schultz, programmer, Survey Section
Kathleen Shelley, supervisor, Statistical Numerical Analysis Services
Melissa J. Swanson, programmer, Survey Section
Harvey Terpstra, data systems manager, Survey Section
Douglas L. Tschopp, programmer, Survey Section
Jauvanta Walker, information specialist

General Office Staff

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

Survey Section Staff

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

Consulting and Cooperative Research

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

Agriculture and Home Economics Experiment Station

The Iowa Agriculture and Home Economics Experiment Station supports collaborative research and statistical consulting services for many faculty 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, and Kenneth J. Koehler, who were assisted this year by graduate students Tom Loughin, Lynn Konecne, Andrine Swensen, Lie-Ling Wu, and Marek Brabec.

The diversity of the work done in the Agriculture and Home Economics Experiment Station shows in projects that used the consulting services this year. One project dealt with the effects of mixing bowl material and beater type on the characteristics of angel cakes. Another project studied the biodegradability of plastics used as mulching materials in the production of melons and other vegetable crops in Iowa. Consultants also assisted in designing projects on new, water conserving irrigation methods for vegetable crops and sustainable methods of biological control of insect damage to corn.

Paul Hinz assisted with the design of two experiments in the Horticulture Department. One experiment studied the genetic variability of growth rate and drought tolerance of sugar and black maple seedlings. Recommendations were made on how to choose the seed sources and the number of seedlings from each seed source. The other experiment used a split-plot design to study salt build-up and growth rate of potted chrysanthemums when watered from the bottom versus from the top. Bottom watering was achieved by immersing pots in a fertilizer solution on custom built greenhouse benches. The same solution was used for the top watered pots, which were placed on the same bench but protected from the immersing solution. Three concentrations of the fertilizer solution were used as the whole-plot factor. The whole plots were arranged in blocks to account for an anticipated temperature gradient across the greenhouse bay.

Hinz and Lynn Konecne analyzed bacteria counts from a study of two methods of disposing of dead birds from poultry farms. The methods studied were the usual practice of stacking birds outside in a refuse pile and a composting method. A sampling plan had to be developed to obtain material for testing. Marek Brabec aided in the planning and analysis of a series of experiments to study how temperature, time of temperature exposure, and concentration of an antibacterial compound affect counts of harmful bacteria on a meat product. The initial design was a two-level factorial with center points. The method of steepest ascent was used to help decide treatment levels for subsequent experiments.

Ted Bailey consulted on a project in the ISU Meat Export Research Center. This dealt with the effects of adding three selected nonmeat ingredients, individually and in combination, to ground pork products. Bailey developed the treatment design and the experimental design. The experiment contained three replications of 10 treatments in a randomized complete block design. The 10 treatments included a three-factor factorial and two control treatments.

Bailey also consulted with researchers in entomology on a heritability study of a specific developmental trait in seven laboratory face fly strains. The nature of inheritance of diapause was studied using hybrids and backcrosses. The objectives of the study were to investigate the genetic mechanism of diapause and to explain the variation of diapause incidence among face fly laboratory populations. A genetic analysis estimated the mode of inheritance, the minimum number of diapause-associated genes, and heritability.

Mark Kaiser assisted researchers in molecular biology in calculation of probabilities for nucleotide sequences in DNA strands. The objective was to compute the expected number of short sequences of 6 to 8 particular nucleotides in longer strands of about 5,000 nucleotides under a model of random assortment. Kaiser also continued work on limnological sampling problems and time series modeling of water chemistry measurements in lakes and streams.

Andrine Swensen and Tom Loughin worked on a project to study the relationship between degree of landscape fragmentation and avian species richness. They are developing a modification of capture-recapture methods to apply to the problem. Lie-Ling Wu recommended a split plot design to study therapies for tendon damage of horses. Ten horses with damaged tendons were randomly selected to be exercised, and one randomly selected leg on each horse was surgically treated. Percent of damaged area was measured once a week for eight weeks. No important effect of exercise or surgery was found.

Rachel Kintzinger, Sara Peterson, Paul Hinz, and hosts Jim Lux and Ken Pecinovsky from the ISU Department of Agronomy traveled to the McNay farm, near Derby, Iowa, to see a field experiment for methods of controlling weeds. A split plot design was used, with three types of tillage and three levels of herbicide being the whole and split plot treatments respectively. Three crops, corn, oats/alfalfa, and soybeans, were planted in strips in each split plot and rotated annually. The experiment was in its fifth year, and the objective was to determine the long term effects of the treatments and rotation on weed counts. The data from this experiment, and from another similar experiment that used fertilizer instead of tillage, were used by Kintzinger and Peterson for their creative components. Jeff Hofer (M.S. 5/90) used data from the first two years of these same experiments to study how the treatments affected the mix of weed species.

Dave Cox, Paul Hinz, and hosts Carl Mize and Paul Ovrom from the ISU Department of Forestry traveled to the state forest nursery near Ames to consult on sampling problems encountered in field experiments with red oak seedlings.

Kenneth J. Koehler and Tom Loughin continued work on a model to predict duration of dew events on plant leaves from information available from local weather stations. Koehler collaborated with entomologists on modeling the effects of temperature on the development rates of bean leaf beetle larva. He also collaborated with botanists on modeling the reestablishment of various plant species in a controlled study of wet areas that were drained and reflooded.

Center for Agricultural and Rural Development

As part of her joint appointment, Alicia Carriquiry consulted, or engaged in joint research, on a number of projects in the Center for Agricultural and Rural Development (CARD) at ISU. For example, she continued work under a cooperative agreement with the U.S. Environmental Protection Agency (USEPA) on the impact of agricultural policy on environmental pollution. She started a joint research project with Agriculture Canada to make an agro-ecological economic assessment of agricultural policy and soil degradation in western Canada.

Carriquiry, Noel Cressie, and James Majure initiated work on a national pilot project in Erath County, Texas, on livestock pollution. This project is partially funded through a cooperative agreement with USEPA.

Between January 24 and February 6, 1993, Alicia Carriquiry traveled to Vilnius, Lithuania, Riga, Latvia, and Copenhagen, Denmark, with Helen Jensen of the experiment station agricultural economics department and CARD. This travel was funded through a grant from the Office of International Cooperation and Development, USDA. The purpose of the trip was to initiate international collaboration on the design and analysis of household expenditure surveys in the former Soviet republics and assess the impact of economic reforms on low-income households.

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, and consult on problems related to scientific applications of digital computers. Teaching and research activities for the section in 1992-93 were led by William J. Kennedy and Mervyn Marasinghe (see pp. 16 and 43).

The seemingly unending constriction of available funding further reduced the section's size during the past year. Today the section has fewer research assistants, funded by the university, than at any time since 1963. Nevertheless, the section's staff continue to provide strong support for statistical computing both inside and outside the statistics center.

Consulting and programming support was again this year handled by two groups supervised by Bud Meador and Kathy Shelley. Two large projects received support from both groups. They are the Iowa Corn Yield Tests and the State Forest Nursery project.

Students supervised by Bud Meador were Klaus Lemke, Matthew Gerdis, Mark Peters, Sara Kind, and Sherry Bushaw. Kind will replace Bushaw next year in taking control of the Iowa Corn Yield Tests project. The scope of this project is such that at least one person is fully occupied at all times.

Matt Gerdis devoted most of his time to the State Forest Nursery project of the Iowa Department of Natural Resources. The Statistical Computing Section has been involved with this dynamic project for over 10 years. A huge data base is now in place, which permits an analysis and tracking of the tree development from seed to seedling to final distribution.

Gerdis also provided some assistance with a project with still greater longevity--the Iowa Crop Processes project, which has been a part of the section's activity for over 20 years.

Mark Peters and Klaus Lemke handled the distribution of PC/SAS 6.04 on campus, via a portable computer. Peters installed the beta version of Windows/SAS on one of the section's 386 PCs. He also worked, with the group supervised by Kathy Shelley, on the Iowa Heart Center project mentioned below.

Kathy Shelley, Dan Parks, and Dean Lei worked on a variety of projects that included applications in the fields of medicine, child welfare, transportation, farmland ownership, and quality control issues for tree seedling production. The service contribution of this group was mainly involved with support of the Project Vincent™ workstation network.

Dean Lei developed three large data entry systems for the Iowa Heart Center, dealing with angioplasty surgery, renal arterial surgery, and equipment reliability for nuclear data analysis. This involved programming in the dBASE language, which ensured accurate data entry while offering data input menus for ease of use. Four years of surgery data were entered at the Iowa Heart Center for the angioplasty project, and Lei worked with Kenneth J. Koehler in the analysis of these data for the doctors.

Dan Parks spent most of the year working on the child welfare project. He made a major programming breakthrough by rewriting an overly complicated SAS* program into an easily understood shorter version.

Kathy Shelley worked with Harold Baker and Ann Schultz on analyzing survey data to characterize farm land ownership in Iowa. This study has been mandated by the Iowa Legislature to occur on a five-year basis.

Parks, Shelley, and Mark Peters worked on an inventory tracking system for equipment used by fire stations throughout Iowa. This system is now administered by the State Forest Nursery. An interactive graphical data analysis system was also developed to track the relationship between soil chemical content and the percent of saleable seedlings by tree species. David Cox helped the statistical computing group look at issues in tree seedling survival by species. Other work by Shelley, with Kenneth Koehler, is described on p. 11.

Some of the highlights of Project Vincent™ support involved helping the statistics faculty and support staff become versant in the use of electronic mail. Each professor now has keyboard access, thus reducing the amount of paper in departmental communications. The speed of communications has continually increased. Peters successfully installed an ethernet card that allowed extremely fast data transfer capabilities between the PC and Project Vincent™ workstations. This card will most likely become the prototype for further communication upgrades in the department. Xterminal software was also beta-tested; this could allow the secretaries to display workstation windows on their PCs, enabling them to experiment with the La-Tex technical word processing system. The Statistical Computing Section continued to serve as on-line consultants for statistical software questions submitted through electronic mail. This represents an increasing trend in software consulting, where face-to-face help is replaced by electronic communication.

Survey Section

The Survey Section of the Statistical Laboratory provides consultation and direct operational assistance to research workers both on- and off-campus in sample design and the planning and execution of sample surveys and censuses. Section staff engage in all areas pertaining to the operational conduct of surveys. Professional staff members also conduct research and teach courses in the areas of sampling, survey design, and statistical methods. Sarah M. Nusser serves as administrative director of the section.

Several multi-year projects were completed this year. A follow-up study of couples' dietary habits, equity in the relationship, and general nutrition was conducted. This project involved reinterviewing 154

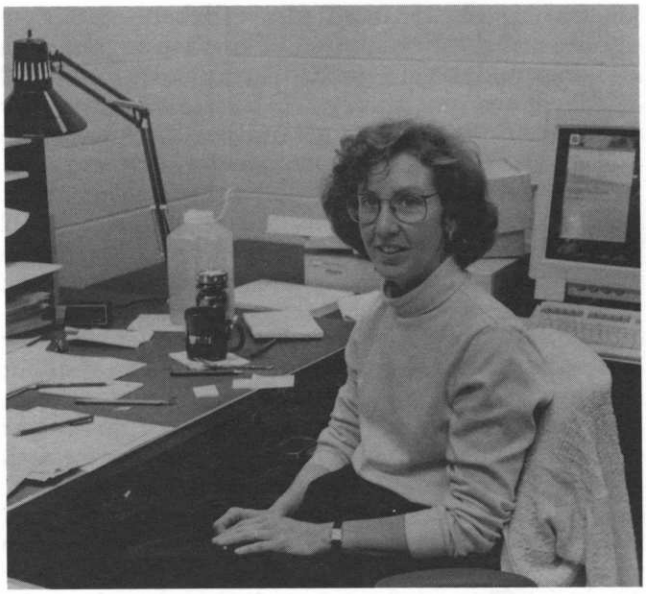
of the couples originally interviewed in 1979 and 57 new sample couples. Researchers in the departments of Sociology and Food Science and Nutrition are coordinating this project to measure attitudes, perceptions, and practices related to diet and nutrition and how this might change over time with couples.

Another follow-up study to investigate farm safety practices was conducted for Fred Lorenz and colleagues in the departments of Finance and Agricultural Engineering. Section staff interviewed 516 farmers by telephone regarding their practices, awareness, and concerns about farm hazards. This year, 476 of the first-phase respondents were interviewed for postintervention study after a university media campaign designed to heighten awareness to farm hazards was conducted throughout Iowa. The principal investigators hope to analyze the two waves of data to measure the impact of the information provided during the media campaign.

Three studies of health-related issues continue. The fourth year of a case/control study of the epidemiology of cranio-facial anomalies involved data collection by telephone with mothers regarding their health, pregnancy, and genetic histories. The study is being conducted for researchers at the University of Iowa. Year two of a case/control project studying specific language impairment in 5 and 6 year-old children has been completed. Section staff are collecting, coding, and processing the data for University of Iowa researchers, who are studying the origins of language impairment in an effort to identify prevention methods. A three-year project coordinated by an investigator at the Mayo Clinic Health Sciences Research Division is concerned with cancer screening for women. The clinic is encouraging physicians to use a cancer screening reminder system with their female patients in southeastern Minnesota. Survey Section staff designed the 15-county sample, collected the preintervention data with 1,020 women by telephone this year, and will conduct postintervention interviews after the system has been in place for one year. The research is designed to measure the influence of intervention programs on women's frequency and recency of breast exams, pap smears, and mammograms.

A longitudinal view of farmland ownership, the changes in ownership patterns, and methods of transferring land with specific interest in corporate farms was the focus of a study completed for researchers in the Department of Economics. This year's project is one in a series of studies on that topic, which began in 1945. Telephone interviews were conducted with 950 Iowa agricultural land owners. Section personnel designed and selected an area sample using county auditors' records, conducted all interviews, and processed the data.

Two projects were completed for the Ames Community School District. The first, a census of all preschoolers in the Ames district, is conducted by the Survey Section every two years. The second was a telephone project involving 300 voters in a recent school bond vote. The school board hopes to use the data from this study to assess the reasons for the defeat of a 22 million dollar bond issue so that it might restructure the request next year. Section staff conducted all work related to the study and provided the school board with results.



Sarah Nusser has taken over administrative responsibilities for the Survey Section. She received her Ph.D. in statistics here in 1990 and returned to ISU in May 1992 after working as statistician in the Miami Valley Laboratories of the Procter & Gamble Company.

The Iowa Consortium for Substance Abuse Prevention is participating in a multi-state study of substance abuse, prevention, and treatment needs. The Survey Section is collaborating on the project with researchers from Iowa State University, the University of Northern Iowa, the University of Iowa, and the Iowa Department of Health. Section staff designed the sample, assisted in questionnaire development, and are conducting telephone interviews with 900 adult Iowans to assess prevalence of substance abuse and treatment needs for adult Iowans.

Administrators of the University Child Care Services at ISU requested that a study be done to assess the interest in and need for a university-based child care center. The section designed the sample and conducted telephone interviews with 1,200 students, faculty, and staff. The section was also responsible for data processing and analysis.

A sample of households was selected in Waterloo, Iowa, for researchers in ISU's Department of Sociology. The sample was selected from areas thought to have a relatively high proportion of African-American households to study their perceptions of the economic impact of the farm crisis on African-Americans in Iowa.

A study of the climate for diversity at Iowa State is being developed and will involve collecting data by mail from approximately 4,000 faculty, staff, and students. The project is being conducted by the University Steering Committee on Diversity to evaluate the acceptance of minorities within the academic environment.

Survey Section staff also collaborated with a member of the Department of English to provide a detailed analysis of a gender equity study conducted earlier in the year among ISU faculty. The analyses focus on determining university-wide patterns in tenure and promotion by gender.

Section staff worked with the Iowa Department of Employment (DES) to design a sample for the 1992 Iowa Wage Survey, which is conducted to provide wage and salary information for the State of Iowa. The sample of employers (reporting units) was designed to contain a reasonable number of units for each of roughly 425 occupations of interest. Mail-out surveys were collected from selected units by DES, and data were provided to section staff for weight estimation. Staff produced a set of statistics for each eligible occupation for inclusion in the DES report.

Numerous researchers within the university used the consulting services of the section for sample design, questionnaire design, coding, data entry or analysis. This year's projects included work on the following: an assessment of the landscape golf curriculum; an evaluation of the services provided by the Office for International Student Services; a study of agroforestry systems in the Midwest; an evaluation of students' use and abuse of credit cards; a research project measuring secondary teachers' views about incorporating cultural diversity into their curricula; the assessment of funding for college unions; an assessment of the impact of pesticides on fruit and vegetable crops grown in Iowa; a study of motor carriers' loads, trips, and pricing; a student evaluation of the core courses for freshman engineering students; a student assessment of student advisors for the College of Liberal Arts and Sciences; a study measuring the effectiveness of the Small Business Development Center; a nationwide survey of administrators of two-year and four-year institutions of higher learning; and a sampling of records relating to agricultural loans to operators of small farms in Kenya.

Researchers outside the university also received help, on projects dealing with barriers to health care for rural Iowans, pseudo-rabies disease among swine herds in Iowa, the use of hair restraints in hospital cafeterias, a study of Iowa high school students concerning attitudes and behavior with respect to drug and alcohol usage, a self-assessment survey of its membership by a national agricultural organization, an evaluation of supervisors in the Iowa Department of Transportation, and a grocery store intervention study to promote increased consumption of fresh fruits and vegetables.

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, Stephen B. Vardeman, Peter Sherman, Derrick Rollins, and Mu-Yeh Huang provided assistance on engineering research projects during the 1992-93 year. For instance, Peter Sherman and Mu-Yeh Huang consulted with a researcher in aeronautical engineering to develop a correlation technique for describing random land profiles. Sherman consulted with researchers in mechanical engineering on processing pressure time series data from a high-speed rotary compressor to determine the strength of pressure pulsations at the blade passing frequency and its harmonics. (Also see Other Research, p. 17.) In joint investigation with researchers in atmospheric sciences, he applied recently developed algorithms for detecting sinusoids to upper atmosphere wind data. This resulted in discovery of a periodic long-term trend, previously thought to be quasi periodic.

Kenneth Koehler and Kathy Shelley continued to update and develop databases and models to predict maintenance costs and labor needs for the Ruan Transportation Company. This is part of Ruan's overall effort to improve quality and productivity.

Derrick Rollins was a faculty intern for seven weeks in July and August 1992 at the 3M Corporation, St. Paul, Minnesota, working with staff assigned to the Polymer Processing Research and Development Laboratory, Engineering Service and Technology Department.

William Q. Meeker, Jr., continued to serve as a consultant to the AT&T Bell Laboratories Quality Technology Center, Holmdel, New Jersey; the General Electric Corporate Research and Development Center Statistics Program, Schenectady, New York; and Ford Motor Company, Livonia, Michigan, during summers 1992 and 1993.

Michelle Sawyer and W. Robert Stephenson worked on a quality improvement project for DeeZee, Inc., Ankeny, Iowa. The project involved a nut and bolt packaging process. Statistical design and analysis of experiments were used to investigate the process and to choose process settings to improve throughput.

Stephenson met with researchers at the National Institute for Research in Inorganic Materials, Tsukuba, Japan, in May. The researchers are interested in using statistically designed experiments to investigate thin film deposition on ceramic substrates.

Dennis Field, as a representative of the Iowa Quality Coalition, made assessment visits to Vantec, Inc., a plastic injection molding firm in Webster City, Iowa, and to a division of Dunham-Bush located in Marshalltown, Iowa. The Dunham-Bush division manufactures HVAC equipment, such as heating pump packages, steam specialties, centrifugal pumps, and custom OEM pumps.

Field also provided consulting support to faculty in the Department of Business Administration, Grandview College, regarding statistical sampling and analysis, and in the ISU Department of Industrial Engineering and Manufacturing Systems, regarding the derivation of, and relationship between, several statistical distributions.

Social Sciences and Humanities

Frederick Lorenz continues to serve as director of statistical services and data management in the ISU Center for Family Research in Rural Mental Health, and he continues to work with sociology colleagues Rand Conger, Ron Simons, and Les Whitbeck on longitudinal studies of 450 rural Iowa families and 200 single parent families. During the past year, they wrote two grant proposals designed to continue existing work with these families and to extend the panels as the adolescents from the panels graduate from high school and enter into college, military service, or the general labor force. This work is supported by grants from the National Institutes of Mental Health and the National Institute on Drug Abuse.

Lorenz is also working with sociology colleague Joe Hraba on a project relating stress associated with political and economic change to distress and family relations in the Czech Republic.

Carl Roberts continues to aid students in selecting and performing quantitative analyses for their dissertations and theses. He also acts as an *ad hoc* consultant for faculty research. Recent consulting activity has regarded research on sustainable agriculture, on democratic imagery in the U.S. news media, on the influence of television content on high school students' political awareness, and other topics. Consulting activity outside the university has been primarily in the area of text analysis.

Mack Shelley consulted with faculty and students from the departments of Sociology, Human Development and Family Studies, Professional Studies in Education, Community and Regional Planning, Political Science, Industrial Education and Technology, Agricultural Education and Studies, Psychology, Family and Consumer Sciences Education and Studies, Textiles and Clothing, and the College of Education Student Services.

Consultation addressed aspects of research design and data analysis of the following: a national survey regarding the consequences of self-supervision, mother-care, and nonrelative-care for children aged 7-11; studies investigating structural effects on budgetary expenditures for research, and on the distribution of full-time equivalent personnel, related to the extensive funding of research in molecular biotechnology at ISU; data from Scotland, Canada, Japan, and the United States addressing the causes and consequences of personal bankruptcies; national survey data dealing with the quality of life of divorced mothers and their dependent children; institutional and student performance data pertaining to students participating in eight college and university Upward Bound programs preparing first-generation post-secondary students.

Advice was given concerning survey data addressing the emergence of social competency in low-income children participating in Head Start and other nursery school programs; survey data from Oaxaca, Mexico, pertaining to satisfaction with housing and public services; an Iowa survey of citizen involvement in and satisfaction with local civic and personal activities; a survey on the abuse of elderly residents of Iowa nursing homes by facility staff; a survey of Total Quality Management practices in Iowa companies; and a survey of perceptions regarding the effectiveness of agricultural education graduate programs among international students participating in such programs in the United States.

Mack Shelley also advised on the use of correspondence analysis to evaluate data from a survey of media effects on respondents' perceptions of environmental hazards; a study of family dysfunction; a survey dealing with school psychology; a study of the role of women in the Sudan; a survey of the impact of family structure and attitudes toward learning on academic performance among high school students in Iowa; a survey of consumer satisfaction with home knitting machines; a survey dealing with students from the fifth to twelfth grades in an Iowa College Bound program; survey data dealing with elderly recipients of personal and home caregiving; a survey of the relationships among social perceptions, self-perceptions, and academic success for nontraditional and traditional-age students on a comprehensive community college campus; the use of structural equation methods in a study of custodial and noncustodial parents; and intensive survey data on the role of religion in modern life.

Other Consulting/Cooperation

Following the departure of resident collaborator Jerome Sacks, C. Philip Cox assisted graduate students Aidan Cardella and Weiye Zhu in their consulting on the design and analysis of experiments with scientists at the National Animal Disease Center (NADC). Research assistants Stephanie Schaller and Zhu had provided similar consultative assistance under Sacks' supervision during summer 1992. Hui-Lin Hu began consulting on NADC projects in June 1993.

Noel Cressie consulted with researchers in climatology and in environmental science on the prediction of snow-water equivalent. He also consulted with the Center for Agricultural and Rural Development (CARD) on statistical aspects of a study of the contamination of surface water by agricultural waste.

Kenneth Koehler and Kathy Shelley continued to collaborate with the staff at the Iowa Heart Center in Des Moines on the design and analysis of studies of effective treatment of coronary and renal diseases. This work involves the development of data bases and analysis of the resulting data for several heart and angioplasty studies. Shelley continued development of data entry programs and supervised the database management and basic analyses (see p. 8).

Alicia Carriquiry cooperated with economists in the Law and Economics Consulting Group, San Francisco, California, on the problem of estimating stock price volatilities. The models used are stochastic volatility models such as those proposed by Andrew Harvey. The emphasis in this ongoing project is on applications, and one of the objectives is to make inferences about traders' behaviors.

Current Research

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

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

National Resource Inventories and Soils Databases

The Survey Section continued cooperative research with the Soil Conservation Service (SCS), U.S. Department of Agriculture. Directed by Sarah M. Nusser, this joint activity has been an important part of the work of the Statistical Laboratory since 1956. Dean Thompson serves as resident SCS collaborator.

The SCS conducts a National Resources Inventory (NRI) of the country's soil and water-related resources every five years. During the past year, the Survey Section was heavily involved with the 1992 NRI. The 1992 inventory, together with the 1982 and 1987 inventories, will be used to create a longitudinal database for study of changes in resource conditions during the last ten years. The national sample for 1992 is a sample of approximately 300,000 primary sampling units (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.

Two types of data are associated with the 1992 National Resources Inventory. County base data provide total acreages for each county in the U.S. for categories such as land area, water area, federal land, roads, and railroads. Data collected on PSUs include information on soil characteristics, land use, and soil erosion. During the past year, state SCS staff recorded 1992 data values and verified and updated data collected in 1982 and 1987. The 1992 NRI data were collected primarily by remote sensing via aerial photography with a minimum of on-site field visits.

Nearly all of the 1992 county base and PSU data were transmitted to the Survey Section this year. County base data were key entered and edited. PSU data were downloaded, and the process of editing the data and merging the field data with pertinent soils data was initiated. During the next year, editing and estimation will be completed.

Much of the past year's effort was devoted to developing imputation and estimation methods for the 1992 NRI data. Wayne Fuller and Jay Breidt directed research and software implementation. Imputation procedures were developed for application to PSUs that were not sampled in 1987 and to PSUs that were not observed prior to 1992. Estimation methods were developed to incorporate acreage information from county base data, from a special urban study being conducted by SCS, and from administrative records on Conservation Reserve Program participation.

Several special samples were also designed and selected during the year in collaboration with Jeff Goebel, the SCS Resource Inventory Development National Leader, Washington, D.C. A sample was selected to provide additional data regarding agricultural activity in northern Wisconsin for administering state level SCS programs. Two samples were selected for New York state. More intensive NRI samples were selected for upstate New York and for New York City's watershed. In addition, a standard NRI sample was selected for the District of Columbia to be included in the 1992 NRI.

The SCS is cooperating with the National Agricultural Statistical Service (NASS) and the Economic Research Service (ERS), USDA, in the third year of a study to assess the economic and environmental impact of government policies aimed at reducing agricultural sources of ground water contamination. Samples in study areas in the Mississippi Embayment, the Southern High Plains (Texas and New Mexico), Southern Arizona, and the San Joaquin-Tulane basins in California were selected for completion in 1993-1994. Survey Section staff designed and selected subsamples of the 1992 NRI sample. The selected PSUs will be used to identify a sample of about 1,000 farm operators within each study area. Operators will be interviewed by NASS interviewers regarding their farming practices and chemical use. The ERS will investigate the interrelationships of farming activities, ground water quality, soil properties, and farm operators' decision-making processes. In addition, the Survey Section estimated weights for the 1991-1992 and 1992-1993 study years and provided that information to the ERS.

The SCS is cooperating with the U.S. Forest Service in a project to study ownership of forest acres throughout the U.S. A sample was designed by Wayne Fuller and Harold Baker based on 1992 NRI sample PSUs that contain forestland. The Forest Service will identify the owners of land at selected points within sample PSUs and mail out a questionnaire. Next year Survey Section staff will provide weights for this study. Results will be used to help implement federal programs to improve management of private forestlands.

Richard Dorsch is in charge of NRI data processing activities, assisted by Anita McVey, Marie Loughin, Kathie Reinertson, Melissa Swanson, and Sue

Verkade. Wayne Fuller directs the work on sample design and estimation, assisted by Harold Baker and Jay Breidt. Other staff members working on inventory projects during the year were Ouhong Wang, Savas Papadopoulos, Margot Tollefson, Hsin-Cheng Huang, Kelli Leonard, and Hui Wang.

Soils

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

Four main databases make up the system of soils data. The soil interpretations database consists of basic soil property and interpretation information for all soil series in the nation. It currently contains over 35,000 records. The soil map unit database consists of information identifying each map unit in SCS soil surveys. It currently contains nearly 275,000 map units from approximately 3,000 survey areas. The official soil series description database contains a textual description of 15,000 soil series. The soil series classification database contains the official soil classification for over 16,000 soil series.

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

System development undertaken this year includes programming a model to determine permissible erosion factors from basic soil properties, establishing a file to store the national range site identification information, developing the programs needed to match soils information with 1992 NRI data point records, completing major changes to the hydric soils program module that is part of the SCS state software system, implementing a program to generate interpretation ratings for map unit specific data, and making numerous maintenance changes to our existing system of data and software. Also undertaken was the testing of the soils databases in the Project Vincent environment stored in the Oracle relational database management system. The purpose is to test the feasibility of storing these large databases in the Unix workstation environment.

Measurement and Sampling Error

Joint research in measurement error models, time series, and survey design is supported by the U.S. Bureau of the Census and, through AES Project 2699, by the Iowa Agriculture and Home Economics Experiment Station. The bureau's support for the 1992-1993 year came through Joint Statistical Agreement J.S.A. 91-21. Wayne Fuller is principal investigator. Other personnel working on the project include Jay Breidt, Rohit Deo, Hui Wang, Hsin Cheng Huang, and Anthony An. Sastry Pantula of North Carolina State University also visited the Statistical Laboratory and participated in the research on time series.

Research continued on methods of estimation for repeated surveys. Several estimators of the labor force components, number of employed and number of unemployed, were compared for the Current Population Survey. Methods of estimation based upon regression weights that permit the use of optimal weights for the number employed and for the number unemployed were developed. This procedure was shown to be more efficient than the present procedure for the number of employed.

Estimators of the mean for samples selected from skewed distributions were studied. Included in the investigation were estimators that are functions of preliminary tests, and estimators based upon the Weibull likelihood. The model-based procedures are applied only to the large observations. The mean of the population is then estimated by the weighted average of the simple mean of the small observations and the model-based estimated mean of the large observations. The preliminary test procedures display good mean square error properties, generally superior to the likelihood procedures. The likelihood-based procedures are generally less biased than the preliminary test procedures.

Estimation procedures appropriate for small areas were studied in cooperation with Census Bureau personnel. Relatively simple procedures applicable to areas where no sample units are observed were developed. Also, methods of estimating the variances of small area estimators were derived.

Research was conducted on testing and estimation procedures for autoregressive processes with unit roots. A Monte Carlo study of the univariate process compared a test for a unit root based on the unconditional likelihood, a test based on a weighted symmetric least squares procedure, and a test based on the ordinary least squares estimator. The likelihood and weighted symmetric tests are more powerful against the stationary alternative for the autoregressive model with an intercept. The ordinary least squares procedure is the most powerful for the model with no intercept. The ordinary least squares and

symmetric least squares were compared for the vector process, and similar results were obtained.

Dietary Intake Estimation

The U.S. Department of Agriculture has conducted periodic dietary intake surveys since 1936. Information collected from these surveys is used to make policy decisions, design food assistance programs (such as Food Stamps and Women and their Infant Children, WIC), and, in general, gain knowledge about the dietary status of the U.S. population or various subpopulations.

Typically, food intake data are collected from a sample of individuals for several days. Food intakes are then transformed into their nutrient equivalents via extensive conversion tables developed by the USDA. It is generally agreed that a relevant measure of the dietary status of an individual is the individual's usual intake of a nutrient, where usual intake is defined as the long-run average intake of that nutrient. Unfortunately, it is impractical to measure an individual's usual intake directly, since it would require a very large number of observations for each individual in the sample. At present, no more than 3 or 4 days of intake data are available for each individual in most national-scale surveys.

To assess the dietary status of a population, it is necessary to estimate the distribution of usual intakes in the population. Several characteristics of dietary intake data need to be taken into account. Intake data are typically nonnormal, and there is large intraindividual variance in intakes relative to the between individual variance. Further, intraindividual variation is heterogeneous and, if food intake data are collected on consecutive days, then intakes are autocorrelated.

One objective of the present five-year cooperative research agreement between the Human Nutrition Information Service (HNIS) of the U.S. Department of Agriculture and the Center for Agricultural and Rural Development (CARD) at Iowa State University is to develop a statistical procedure for estimating usual intake distributions. Those in the Statistical Laboratory Survey Group working under this cooperative agreement are Wayne A. Fuller, Alicia L. Carriquiry, Sarah M. Nusser, Kevin W. Dodd, Stephanie Schaller, David Hall, and Steven Mattics.

The procedure for estimating usual intake distributions consists of several steps. First, nutrient intake data are adjusted for survey related effects, such as interview method (personal or telephone), and weekday versus weekend effects. The adjustment used is a ratio, rather than the usual linear adjustment, to ensure that adjusted intakes are positive. A power transformation is then applied to the adjusted intakes to make them as normal as possible. The best power is estimated via a semiparametric approach. Power transformed data are then mapped all the way into normality by applying a nonparametric transformation similar to the method of fitting cubic splines. A measurement error model in normal space is used to obtain estimates of individual usual intakes. The measurement error model assumptions allow for the presence of heterogeneity of intraindividual variances. Finally, an estimate of the usual intake distribution in the original scale is obtained by applying standard statistical techniques to the distribution of usual intakes in the normal scale.

Estimates of percentiles of the estimated usual intake distribution, and their standard errors, can also be obtained from this procedure. Further, software to carry out these calculations has been developed, and is currently undergoing beta testing in several locations in the United States and Canada. Simulation studies to compare the performances of the ISU method for estimating usual intake distributions and other methods have been started, and will continue during the next year.

Some preliminary results were shared by Sarah Nusser and Helen Jensen (CARD) with French food consumption researchers on November 4, 1992, at a meeting held in the USDA Human Nutrition Information Service, Washington, D.C.

Frontier Estimation and Efficiency Analysis

Alicia Carriquiry started working on efficiency analysis of the Ukrainian agricultural sector, with Helen Jensen and Aziz Bouzaher from the experiment station's agricultural economics department and CARD. The work is funded from a grant from the National Council on East European and Soviet Relations. Farm-level input/output data for the period 1986-1991 were obtained by Carriquiry, Bouzaher, and Jensen during a 1991 visit to the Ukraine.

Spatial Statistics

The Office of Naval Research, the National Science Foundation, and the National Security Agency are supporting joint research on spatial statistics with image algebra by Noel Cressie and Jennifer L. Davidson, Department of Electrical Engineering and Computer Engineering. Students supported on this research are Jeffrey Helterbrand, Craig Liu, and Gregory Stenback.

Cressie continued work with the university's GIS Support and Research Facility to develop spatial statistical modules for a geographical information system. This work is supported in part by the National Science Foundation and the Center for Agricultural and Rural Development (CARD).

In addition, Cressie worked on a variety of other projects involving spatial statistics. He is principal investigator on a project supported through CARD to investigate spatial statistical modeling of water and air quality in Erath County, Texas. He is principal investigator on an Ames Laboratory project, Change of Support Spatial Statistics. In March, Cressie engaged in joint research with M. Thornett and R. Milne at the University of Western Australia on nonlinear spatial prediction.

Sampling Strategies for DOE Waste Site Mapping

Herbert T. David and graduate student Seongmo Yoo continued work on developing spatial sampling strategies for waste site mapping. The intent is to systematically prescribe which, and how many, sites are to be tested. The research is supported by the Ames Laboratory, under contract with the U.S. Department of Energy, and has led to joint efforts with Rockwell International.

Statistical Modeling

Mark Kaiser has continued to work on the development of models to relate animal population size to habitat characteristics. The work has been partially funded by the U.S. Fish and Wildlife Service, Anchorage, Alaska. Current models incorporate the ecological concept of optimal ranges of habitat characteristics into nonlinear models mixed over a distribution on (0,1).

Mathematical Modeling of Dendritic Growth

With support from a grant from the National Institutes of Health, Alicia Carriquiry continued research on mathematical modeling of dendritic growth, working with Wolfgang Kliemann, Department of Mathematics, and Etsuro Uemura, Department of Veterinary Anatomy. Others working on the grant project were statistics graduate students Reiner Kurzhals and Jürgen Schroeder.

Mixed-Effects Linear Models

David Harville continued his research on the Bayesian approach to mixed-model inference and prediction. The focus was on computational techniques for locating the mode(s) of the posterior distribution of the random effects. Alan Zimmermann participated in this project as a research assistant. The project has been supported in part by a grant from the National Security Agency.

Probability Theory and Mathematical Statistics

Krishna B. Athreya continued his work on large deviation rates for single and multiple supercritical branching processes. Along with his student A. Vidyashankar, he extended these results to branching random walks and processes in random environments. Work was also continued on the convergence rates for the Markov chain method in Gibbs sampling and other Monte Carlo procedures. In July 1992 Athreya did collaborative research with the faculty of the Institute of Statistics and the Institute of Mathematics, Academia Sinica, Taipei, Taiwan. From mid-May 1993 to mid-July he engaged in collaborative research with faculty at the Indian Statistical Institute. Part of the summer work was supported by a grant from the National Science Foundation. For an M.S. creative component under Athreya, Junichiro Fukuchi investigated the consistency of bootstrap for extremes of i.i.d. random variables.

Soumendra Lahiri continued research on resampling methods. This work was supported by a National Science Foundation grant. In the context of bootstrapping observations with long-range dependence, an interesting phenomenon is observed. Recently Künsch (1989) and Liu and Singh (1992) independently introduced a resampling scheme, called the moving block bootstrap (MBB), for dealing with dependence in the data. For weakly dependent observations, the MBB does outperform the conventional large sample approximations, just as the iid resampling scheme of Efron (1979) does for independent observations. However, when the observations exhibit a very strong form of dependence, Lahiri has shown that even the MBB, in its standard form, fails to provide a valid approximation. Furthermore, with appropriate modification, the MBB captures the limit distribution for normalized sums, say T_n, only when T_n is asymptotically normal. An intuitive explanation for this comes from the observation that, for nonnormal limits of T_n, joining *independent* blocks under the MBB destroys strong dependence of the underlying data and results in a slower growth rate for the variance of the bootstrap sample mean compared to the rate for the variance of the original sample mean.

Statistical Methods for Survival Data

A grant from the National Cancer Institute supports the development of statistical methods for analyzing survival time and life event history times from data that contain correlated responses. Kenneth J. Koehler is principal investigator for the three-year grant project. Koehler and Tom Loughin have developed effective bootstrap procedures for estimation and confidence interval construction in both univariate and multivariate proportional hazards models. Jürgen Symanzik assisted in the development of a computer program that is available at no cost.

Sarah Nusser continued to work on multivariate survival analysis methods with Koehler and Symanzik. The procedures are appropriate for grouped observations with a common censoring scheme. A robust variance estimator was developed and software development was initiated to make the procedures easier to implement.

Double Sampling Plans

Herbert T. David, Vincent Shu of Abbott Laboratories, and graduate student Seoung-Gon Ko continued work on developing double sampling plans for use in clinical trials. These are a class of optimal double sampling plans that have both frequentist and Bayesian interpretations. The research is being

expanded to cover comparison of two treatments with each other, as well as with a control. Ko's assistantship was funded by Abbott Laboratories.

Reliability and Nondestructive Evaluation

William Q. Meeker, Jr., coordinates the statistics staff's part of the National Institute of Standards and Technology (NIST) Program for Integrated Design, Nondestructive Evaluation (NDE), and Manufacturing Sciences. During the 1992-93 year, Meeker and Christian Garrigoux continued their research on models and methods for degradation failure and on how to use such models in the planning of in-service NDE inspections. Meeker and Bryan Olin have written a review paper describing many of the important applications of statistics in the area of NDE. They have also written a separate paper that focuses on the application of designed experiments that can be used to assess and improve NDE measurement capability.

Statistical Process Control

Derrick Rollins' research interests concern gross error detection and process control. During the 1992-93 year, he continued research on data reconciliation and gross error detection. An unrestricted grant from Shell Development Company is partially funding this work and supported undergraduate and high school students' involvement. A grant from the 3M Corporation is supporting research on improving powder mixture homogeneity by Rollins and several undergraduate students in chemical engineering.

Another 3M grant is supporting an interdisciplinary project on statistical methods to enhance neural networks; Rollins is working with statistics graduate assistant Jean Pelkey and members of the Department of Mechanical Engineering. He is also engaged in research on adaptive control for improved drying, under a grant from Grain Processing, Incorporated, Muscatine, Iowa.

Other Research

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

Theory and Methods

Yasuo Amemiya conducted research on topics in multivariate analysis. A class of general nonlinear factor analysis models was developed, and associated identification and estimation problems were investigated. Various estimators of the true values were compared for the nonlinear functional relationship problem. For the nonlinear repeated measure model with random parameters, a test for randomness and a model fitting procedure were developed for situations with a relatively small number of repeated measures.

Research by C. Philip Cox on simple estimations of the quasi-parametric elements and the variance components in mixed, three-stage, hierarchal models has continued. Previously reported results have been extended for application to some investigations having one or more fixed elements in the first stage and unequal numbers of random elements in the second and third stages.

H. A. David has completed joint research with H. N. Nagaraja on a selection statistic. He has also reviewed and extended results on the concomitants of extreme order statistics.

More recently, David has been preparing a list of terms commonly used in mathematical statistics, together with their apparent first occurrence in print. For example, "variance" was coined by R. A. Fisher in his famous 1918 paper on the correlation between relatives; "standard deviation" goes back to the first major paper by Karl Pearson in 1894.

Richard Groeneveld and William Q. Meeker, together with Barry C. Arnold and Robert J. Beaver of the University of California at Riverside, continued research into the estimation of the parameters of the truncated marginal of a truncated bivariate normal distribution.

Mark Kaiser and a graduate student, David Siev, have worked on extensions of link function estimation in generalized linear models for binomial and multinomial response data. These models might find use in survival problems involving several dose levels of a toxicant and observations grouped into time intervals.

John Stufken continued to work on orthogonal arrays. His efforts have primarily focused on existence questions and construction methods of orthogonal arrays. With Bryan Olin he has also been working on orthogonal blocking for mixture experiments and on mixture designs under the presence of linear trends.

Shashikala Sukhatme and her graduate student Marie Coffin are investigating problems due to measurement errors in data used for Receiver Operating Characteristic (ROC) Studies of clinical diagnostic tests. An ROC curve of a diagnostic test is the plot of the true positive probability versus the false positive probability associated with the test. Because of the variability among the observers and/or the equipment they use, it is almost impossible to collect observations without error. Sukhatme and Coffin are doing research on nonparametric and parametric methods of estimating biases in the estimators of "performance index" of an ROC curve.

Statistical Computing

William J. Kennedy and Ouhong Wang extended research in self-validating computation of probabilities to multivariate distributions and supercomputing. The MASPAR MP1 and MP2 machines, located on campus, were used to support this work. The architecture of these machines is SIMD, which is one

that is not often considered by researchers in statistical computing. Initially, the multivariate normal and t distributions are under consideration.

Work continued on the ULTRIX version of PC CARP. Extensions to allow more variables, and a new user interface, were designed. The intent is to include also the capability to handle auxiliary variables. This is, however, a major extension of the program and will require large amounts of time and effort.

Mervyn Marasinghe's work during his faculty improvement leave focused on data analysis and graphical methods. He collaborated with several researchers in the Applied Statistics Department, University of Minnesota. Phil Iversen and Marasinghe are continuing research on dynamic graphics for experimental design.

Biostatistics and Agronometry

Some of the collaborative research conducted by members of the statistics department of the Iowa Agriculture and Home Economics Experiment Station (AHEES) has already been described (pp. 6-7 and 12-13). Other work is described below.

Project 2588 of the Iowa Agriculture and Home Economics Experiment Station supports research by Edward Pollak on mathematical and statistical genetics. In the 1992-93 academic year he studied the deterministic theory for effects of selection in a large population that reproduces partly by the mating of full-sibs and partly by random mating. He found that if there is selection for viability between zygote formation and adulthood the frequency of an allele changes in two steps within a generation. The first of these results from survival probabilities that differ among the different genotypes. The second occurs because mates are more likely to share a favorable allele than if there is complete random mating. This induces a positive correlation between the frequencies of the favorable allele in the mates, which is reflected in a second change in the population frequency of the allele. This second change does not occur with complete random mating.

Pollak also began research on theory to describe how it is possible for a mitochondrial allele carried by immigrants to become established in a population, even though this does not occur for autosomal genes carried by these individuals.

Engineering Statistics

Peter Sherman spent six weeks during summer 1992 in Australia conducting research on stochastic processes with researchers at the Australian National University, Canberra, and the Defence Science and Technology Organization, Adelaide. Specifically, they investigated the influence of period uncertainty in extraction of time-varying spectral information from cyclostationary processes, as well as methods for accommodating it.

Sherman conducted research with personnel in the Department of Engineering Fundamentals and Multidisciplinary Design in a study to determine whether elderly drivers can be partially characterized by lane position statistics. Results will be presented at an international conference on automotive technologies to be held in Aachen, Germany. Sherman is also conducting sponsored research with personnel at Ford Motor Company to develop a drowsy driver identification system for use at the Ford Proving Grounds.

With individuals in the Department of Mechanical Engineering, Sherman is conducting research to describe the stochastic structure of pressure signals from a high-speed rotary compressor.

Social Science Applications

Sarah Nusser, Toni Genalo, and Fred Lorenz are investigating the effect of question and response category ordering on the reliability of responses in a statewide survey of substance use and the need for substance abuse treatment in adult Iowans. It is expected that results will contribute to a coordinated effort under the USDA AES Western Regional Project W-183, to broaden the conditions under which questionnaire experiments are conducted. One aim of this AES project is to aggregate observed response patterns in relation to questionnaire design so that general patterns across populations and survey topics can be detected. Lorenz serves as secretary of the regional project. During the annual W-183 meeting held in Tucson, Arizona, January 29-30, he made an informal presentation of the results on an "even-handedness" experiment.

When Carl Roberts left the Netherlands in August 1992 to return to ISU at the end of his faculty improvement leave, he had begun collaboration with a Dutch colleague, Roel Popping, Institute of Social Science Information Technology, University of Groningen, on a comparative study on recent ideological developments in Eastern Europe. This work is continuing. In cooperation with an ISU faculty member in computer science and Popping, Roberts is seeking support for the development of an interactive English language parsing system for text analysis and other applications.

Mack Shelley is currently pursuing research on many topics, including issue dimensions of the "cultural war;" the relationship between age and vehicular injuries; the effects of liquid laundry starch on terbufos residues, thermal insulation, and permeability of cotton work fabrics; interaction of adult children with their parents; economic development and the farm economy; effects of economic development funding on the public university; the changing fiscal structure of academia; the changing nature of university personnel and their research; legislative elections; multivariate time series analysis and congressional behavior; coordination barriers between universities and industry; public opinion polls in the 1992 presidential election; and the impact of health and social support on institutionalization of older family members. Also, preparation for a book on contemporary American public policy is underway with two colleagues.

Professional Activities

Wayne Fuller continued as vice president of the American Statistical Association (ASA) and attended meetings of the board of directors on August 8-9 in Boston, Massachusetts, and on December 3-5 and April 15-17 in Washington, D.C., and a meeting of the Budget and Planning Committee on October 21 and June 22, in Washington, D.C.

H. A. David is continuing as an ex officio member of the Committee on ASA Archives and Historical Materials. Herbert T. David is on the advisory panel for the ASA/NSF/NIST seminar research Fellowship Program for 1991-1993 and attended a panel meeting in Washington, D.C., in March 1993.

W. Robert Stephenson is currently serving as president of the Iowa Chapter of the American Statistical Association. He is chair of the ASA Continuing Education Advisory Committee. He is a 1993 nominee for the position of Publications Officer, ASA Section on Quality and Productivity (term to begin Jan. 1, 1994) and a 1993 nominee for the position of vice chair (1994-96) of the ASA Council of Sections. The spring meeting of the Iowa Chapter was held in conjunction with the visit of James Durbin to Iowa State University on May 5, 1993, as B. V. Sukhatme lecturer (see p. 49).

Kenneth J. Koehler received a Service Recognition Award from the American Statistical Association Council of Chapters in August 1992. F. Jay Breidt is currently the Iowa Chapter representative to the council.

Noel Cressie continued to serve as a member of the ASA Review Committee for the Environmental Protection Agency's Ecological Monitoring and Assessment Program. In 1992 he chaired the Committee on Fellows, Statistical Graphics Section, ASA. He also served on the Publications Committee and the Committee on Symposia and Conferences for the ASA Section for Statistics and the Environment.

H. A. David is concluding a four-year term on the Executive Committee of Sigma Xi, ISU Chapter, by serving as president for 1993-1994.

Dean Isaacson continued to serve on the board of directors of the Iowa Quality Coalition.

Mack Shelley continued to serve as the Iowa State University official representative to the Inter-University Consortium for Political and Social Research, through January 1993. He was elected vice president of the Iowa State Chapter of the American Association of University Professors.

In 1993 Edith Landin served as secretary of the Iowa Division, Professional Secretaries International, for two months to fill out an uncompleted term, then was elected president-elect in June.

Wayne Fuller chaired meetings of the Advisory Committee on Statistical Methods of Statistics Canada, in Ottawa, Canada, November 5 and 6 and attended another Advisory Committee meeting there on April 26-27.

On July 20-24, 1992, Alicia Carriquiry gave a series of five lectures, "Prediction from components of variance models," at the XI Winter School on Probability and Statistics, held by the Universidad Católica de Chile and CIENES, in Santiago, Chile.

William Q. Meeker attended the 1992 Gordon Research Conference on Statistics in Chemistry and Chemical Engineering, in New Hampton, New Hampshire, July 26-31, serving as a backup speaker and past chair of the conference.

Samuel Wieand taught a one-week course entitled Analysis of Clinical Trials as part of the International Graduate Summer Session in Epidemiology at the University of Michigan, on July 27-31.

Stephen Vardeman was one of four workshop leaders for an NSF-sponsored writing workshop for young researchers offered during the joint statistical meetings in Boston August 9-13. William Q. Meeker, along with his co-author Gerry Hahn, presented a short course, Statistical Intervals: A Guide for Practitioners and Professionals, on August 9. Kenneth J. Koehler chaired a session on Categorical Data Analysis.

During the Boston meetings an ISU reunion dinner was held. Over 60 alumni from the undergraduate and graduate programs in statistics at Iowa State joined current faculty, students, and guests at the MIT Faculty Club on Monday evening, August 10. During the time before dinner, attendees competed against each other in a contest to meet as many graduates from a given time period as possible. Yasuo Amemiya (Ph.D. 12/82), Jeanne Devin (M.S. 12/81), Sarah Nusser (Ph.D. 8/90), Douglas Splitstone (M.S. 8/67), James Mellon (M.S. 5/68), and David Dickey (Ph.D. 8/76) won souvenir sweatshirts. There was at least one other winner, but we cannot figure out who it was. If you were the other winner, let us know. The views of the Charles River and the sunset added to an enjoyable atmosphere during dinner. After dinner, there was a short program featuring Dean Isaacson, Robert Arnold (Ph.D. 8/84), and W. Robert Stephenson. The Department of Statistics would like to thank all those attending. Special thanks go to Arnold for taking care of local arrangements.

Krishna Athreya spent two weeks in July 1992 at the Academia Sinica, Taipei, at the invitation of its Institute of Statistics and its Institute of Mathematics.

Noel Cressie gave a two-day short course, Statistics for Spatial Data, at the Army Research Office's 38th Conference on Experimental Design, in Santa Monica, California, October 26-27.

Mark Kaiser chaired a session on Statistical Analysis at the 1992 Annual Meeting of the Society of Environmental Toxicology and Chemistry, in

Cincinnati, Ohio, November 11.

Carl Roberts chaired a session on Text Analysis during the Social Science Information Technology Conference in Amsterdam, the Netherlands, December 4.

William Q. Meeker and Gerry Hahn presented a tutorial on Statistical Intervals at the American Society for Quality Control Conference on Applied Statistics, in Atlantic City, New Jersey, on December 14.

Paul Hinz presented the continuing education course, Computer Applications of Multivariate Statistics for Fisheries Biologists, on January 6-8, 1993, at Eastern Illinois University. This course, with 32 participants, was sponsored by the Illinois Chapter of the American Fisheries Society.

In addition to regular invited talks, two faculty members gave special named lectures during the year. Wayne Fuller presented the Morris Hansen Memorial Lecture to the Washington (D.C.) Statistical Society in November 1992. David Harville spent March 10-12, 1993, on the Cornell University campus as the first recipient of the Shayle R. and Helen M. Searle Visiting Lectureship in Statistics and Biometry. This lectureship was recently established as a lasting tribute to Helen Searle.

Noel Cressie presented four invited lectures on "Spatial Prediction" in an honors course, Probability 4S1, at the University of Western Australia on March 15-19, 1993.

Alicia Carriquiry was invited to attend the workshop entitled Inflation in Latin America, organized by the Institute on Policy Reform, in Washington, D.C., March 10-14.

She presented two guest lectures, "Bayesian econometrics," for the doctoral-level econometrics course in the Department of Agricultural Economics, University of California-Berkeley, May 5-10. Also she presented six invited talks at the Statistics Symposium organized by the National University of Colombia, Department of Mathematics and Statistics, in Bogata, June 7-11: a series of five entitled "Mixed models and BLUP," and one entitled "Modern methods for prediction in mixed models: Bayesian approaches."

Dennis Field assisted, as a member of the planning committee, in setting up and hosting the Fourth Annual Iowa Conference on Manufacturing, held at Iowa State University May 5-6.

Wayne Fuller chaired a session, Weighting and Estimation I, June 29, for the International Conference on Establishment Surveys, held in Buffalo, New York.

Editorial Activities

Stephen Vardeman, editor-elect of *Technometrics,* became editor beginning on January 1, 1993. Sharon Shepard is serving as editorial assistant. William Q. Meeker, Jr., continued as chair of the *Technometrics* Management Committee; Vardeman, as ex officio member.

W. Robert Stephenson is an associate editor of *Technometrics* and an editorial board member of *Stats,* the Magazine for Students of Statistics. He is also an editorial board member of the *Journal of Statistics Education.*

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

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

Edward Pollak was an associate editor of *Biometrics* until his four-year term ended in February 1993. He continues to serve on the editorial board of *Mathematical Biosciences.*

William Q. Meeker (chair) and W. Robert Stephenson are on the IMS Standing Committee on Selected Tables in Mathematical Statistics. Meeker is co-editor of *Selected Tables in Mathematical Statistics.* He is also a member of the ASA Journals Management Committee.

Mack Shelley continued to serve as a member of the board of editors for the *Policy Studies Journal,* and as associate editor. He was elected co-editor, to begin June 1993.

Papers Presented, Lectures, and Seminars

At the 1992 joint statistical meetings of the American Statistical Association, the Biometric Society (ENAR and WNAR), and the Institute of Mathematical Statistics, Boston, Massachusetts, August 9-13:

Adam, Abdoulaye, and **Wayne A. FULLER:** "Covariance estimators for the Current Population Survey";

AMEMIYA, Yasuo: "On a random-parameter nonlinear regression model for panel data";

Andersen, Jeff (McLain Corporation), and **W. Robert STEPHENSON:** "The Box-Cox transformation and individual/moving range charts";

BREIDT, F. Jay: "Variance estimation in the frequency domain for seasonally adjusted time series";

CARRIQUIRY, Alicia: "Exact computation of posterior modes in mixed linear models";

Croos, Joseph, and **Wayne A. FULLER:** "Robust estimation for the simple measurement error model";

DAVID, H. A.: "N. L. Johnson's contributions to distribution theory, inference, and actuarial statistics--pre-Chapel Hill era";

Escobar, L. A., and **William Q. MEEKER:** "Planning accelerated life tests with two or more experimental factors";

Helterbrand, Jeffrey, and **Noel A. C. CRESSIE:** "Object recognition using principal curves for multivariate gray-scale imagery";

ISAACSON, Dean L.: "TQM within a university/Statistics Department";

ISAACSON, Dean L., Joe Padgett, and David Hanson: panel discussants on "Problems encountered by statistics programs and how the committee might help," session sponsored by the Committee on ASA Institutional Members and Academic Department Chairs;

KOEHLER, Kenneth J.: "A goodness-of-fit test for P-P probability plots";

LAHIRI, Soumendra Nath: "Bootstrapping Studentized M-estimators of a multiple linear regression parameter";

LOUGHIN, Marie, Wayne A. FULLER, and **Harold BAKER:** "Regression weighting for the 1987-1988 Nationwide Food Consumption Survey";

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

POLLAK, Edward, and **Muhamad Sabran:** "Fixation probabilities under partial selfing";

SUKHATME, Shashikala: "Distribution of ranks in a two-sample problem with right censored data";

WIEAND, S., J. Su, P. Murtaugh, and S. Cha: "Definitions and estimators of sensitivity and specificity for repeated markers";

Tollefson, Margot, and **Wayne A. FULLER:** "Variance estimation for samples with random imputation";

Yansaneh, Ibrahim, and **Wayne A. FULLER:** "Alternative estimators for the Current Population Survey";

Zimmermann, Alan G., and **David A. HARVILLE:** "Posterior distribution of the fixed and random effects in a mixed-effects linear model."

At the annual meeting of the American Sociological Association, Pittsburgh, Pennsylvania, August 20-24, 1992:

Nauta, André, and **Carl W. ROBERTS:** "The secularization of charity: Trends in U.S. religious affiliation, 1964-1986";

ROBERTS, Carl W., and Ya-Chun Wang: "Mannheim's elusive generation unit: Implications from trends in attitudes concerning blacks and women, 1970-1988."

In the Symposium on Environmental Statistics, Assessment and Forecasting, at the annual meeting of the American Chemical Society, Washington, D.C., August 25-26:

CRESSIE, Noel A. C.: "Spatial chemostatistics";

DAVID, H. T., and **Seongmo Yoo:** "Where next? Adaptive measurement site selection for area remediation."

At the joint annual meetings of the American Society of Agronomy, the Crop Science Society of America, and the Soil Science Society of America, Minneapolis, Minnesota, November 1-6:

Carlson, I. T., W. C. Young III, and **T. B. BAILEY:** "Breeding orchardgrass for increased seed yield in Oregon";

Swan, J. B., R. L. Higgs, N. C. Wollenhaupt, and **T. B. BAILEY:** "Surface residue and in-row treatment effects on long-term no-tillage continuous corn."

At the Second IMS International Symposium on Probability and Its Applications, Bloomington, Indiana, March 20-21, 1993:

ATHREYA, Krishna B.: "Inference for heavy tailed distributions";

LAHIRI, Soumendra Nath: "On asymptotic expansions for normalized sums of random vectors under dependence";

Vidyashankar, Anand: "Large deviation for multitype branching processes."

At the spring meeting of the Biometric Society (ENAR), Biometrics Section of the American Statistical Association, and the Institute of Mathematical Statistics, Philadelphia, Pennsylvania, March 21-24:

KOEHLER, Kenneth J.: "Some methods for multivariate survival analysis";

NUSSER, Sarah M.: "Estimating usual food intake distributions."

At the Temple University-National Institute of Standards and Technology (NIST) Conference on Extreme Value Theory and Its Applications, May 2-7, 1993, in Gaithersburg, Maryland:

ATHREYA, K. B., and **J. Fukuchi:** "Bootstrapping extremes of i.i.d. random variables";

DAVID, H. A.: "Concomitants of extreme order statistics."

At other locations:

AMEMIYA, Yasuo: "Estimation for a nonlinear structural equation model," at the Seventh International Conference on Multivariate Analysis, Barcelona Meeting, Barcelona, Spain, September 22, 1992.

ATHREYA, Krishna B.: "Conditional distributions and joined distributions" and "Markov chain methods in Monte Carlo," at the Institute of Mathematics and the Institute of Statistics, Academia Sinica, Taipei, Taiwan, July 9 and 13, 1992.

"Large deviation results for branching processes," seminar, Department of Statistics, University of Chicago, May 10, 1993.

BAILEY, Theodore B.: "Effect of high water table conditions on corn growth," by N. Ahmad, R. S. Kanwar, T. C. Kaspar, and Bailey, at the annual meeting of the American Society of Agricultural Engineers, Albuquerque, New Mexico, June 1991.

"An evaluation of hemostatic parameters following hypertonic saline combined with colloids for resuscitation of dogs with hypovolemia," by D. L. Zoran, A. E. Jergens, D. H. Riesdesel, S. D. Martin, and Bailey, at the annual meetings of the American College of Internal Medicine, San Diego, May 1992.

BREIDT, F. Jay: "Introduction to survey sampling," at the Pioneer Hi-Bred International Market Research Retreat, Fort Myers, Florida, March 1, 1993.

"Markov chain designs for one-per-stratum sampling," at the Institute of Mathematical Statistics/Biometric Society (WNAR) Western Regional Meeting, Laramie, Wyoming, June 28.

CARRIQUIRY, Alicia: "Methods of estimating usual intake distributions," by Carriquiry, Helen Jensen, **Wayne FULLER,** and P. Guenther, at the First International Conference on Dietary Assessment Methods, Minneapolis, Minnesota, September 20, 1992.

"Approximate Bayesian inference in mixed models," at the XX Annual Meeting of the Chilean Statistical Society, Antofagasta, Chile, November 12.

"Exact computation of posterior modes," at the NSF-NBER Workshop of the Americas on Recent Advances in Bayesian Statistics and Econometrics, Caracas, Venezuela, December 10.

"Estimation of usual intake distributions," at the Consensus on Dietary Assessment Methods Workshop organized by the U.S. Department of Health and Human Services, Richmond, Virginia, February 23, 1993.

"Bayesian prediction from components of variance models," seminar, Department of Statistics, Carnegie-Mellon University, March 17.

"Bayesian approaches to components of variance models: A review," seminar, Department of Statistics, Purdue University, April 15.

COX, C. Philip: "Simple estimations of the variance components and the fixed and random effects in mixed, three stage, hierarchal models," at the Fifth Annual Kansas State University Conference on Applied Statistics in Agriculture, Manhattan, Kansas, April 26.

COX, David F.: "Differing mealiness in potato cultivars," by Diane R. McComber, Harry T. Horner, and Cox, at the 84th annual meeting and exposition of the American Home Economics Association, held in Corvallis, Oregon, June 26-30, 1993.

CRESSIE, Noel A. C.: "Geostatistical analysis of environmental

and ecological data," at the Fourth International Environmetrics Conference, Helsinki, Finland, August 18; also discussant, session on Large-Scale Environmental Monitoring Methods, August 20.

"Aggregation in geostatistical problems," at the Fourth International Geostatistics Congress, Troia, Portugal, September 15; also chair of the session, Theory of Geostatistics.

Presenter and discussant at U.S. Environmental Protection Agency Workshop on the EMAP Program, Research Triangle Park, North Carolina, September 28.

"Spatial statistics and GIS," two lectures in the experimental course AE 515x, Geographic Information Systems, for the Department of Agricultural and Biosystems Engineering, Iowa State University, October 9 and 13.

"Random sets and point processes," at the Office of Naval Research Workshop on Planar Point Processes and Minefield Detection, held in Washington, D.C., December 17-18.

"Nonlinear spatial prediction of missing data," in Communications and Signal Processing Seminar Series, Department of Electrical and Computer Engineering, Iowa State University, February 5, 1993.

"Visualizing spatial dependence in multivariate spatial data," by Cressie and **J. J. Majure**, at the NCGIA Workshop on Exploratory Spatial Data Analysis and GIS, February 26, in Santa Barbara, California.

"Spatial statistics for environmental and ecological data," at a meeting of the Georgia Chapter of the American Statistical Association, Atlanta, Georgia, February 23, and at a meeting of the Western Australian Branch of the Statistical Society of Australia, Perth, Western Australia, March 17.

"Characterizing spatial dependence through the variogram," seminar, Department of Mathematics, Edith Cowan University, Western Australia, March 18.

"Spatial prediction in a multivariate setting," seminar, Department of Mathematics, University of Western Australia, March 19.

"Constrained spatial prediction," seminar, Department of Biometry and Statistics, State University of New York at Albany, and Statistics Center, Cornell University, April 27 and 28, respectively; also seminar, Biostatistics Division, University of Minnesota, Minneapolis, and Department of Statistics, North Dakota State University, May 25 and 27, respectively.

"Spatial statistics for environmental and ecological data," seminar, Biometrics Unit, Cornell University, April 29.

DAVID, H. A.: "Concomitants of order statistics: Review and recent developments," at the 11th Australian Statistical Conference, Perth, July 7, 1992.

"Some properties of order-statistics filters," seminar, Australian Graduate School of Management, University of New South Wales, Sydney, Australia, July 15.

"Ranking from paired comparisons," at the 1993 annual meeting of the Statistical Society of Canada, Wolfville, Nova Scotia, June 7.

DAVID, Herbert T.: "The best of both worlds: Integrating statistical and deterministic approaches to area remediation," by David and **Seongmo Yoo,** at the 1933 International High-Level Radioactive Waste Management Conference held by the American Society of Civil Engineers, Las Vegas, Nevada, April 30.

FULLER, Wayne A.: "Estimators for longitudinal surveys with application to the U.S. Current Population Survey," at the Statistics Canada Symposium 92: Design and Analysis of Longitudinal Surveys, Ottawa, Canada, November 4, 1992.

"Estimation in the presence of measurement error," Morris Hansen Memorial Lecture, to the Washington Statistical Society, Washington, D.C., November 17.

"Alternative estimators for autoregressive processes," seminar, Department of Statistics, North Carolina State University, February 25, 1993.

HARVILLE, David A.: "Computational aspects of likelihood-based inference for variance components," seminar, Biometrics Unit, Cornell University, March 10.

"Mean squared error of estimation or prediction under a general linear model," seminar, Biometrics Unit and Department of Animal Science, Cornell University, March 12.

HINZ, Paul N.: "Graduate study in statistics" and "Interpretation of multiple regression when the independent variables are correlated," lectures, Department of Mathematics, Luther College, November 13, 1992.

"Interpreting significance levels," Applied Statistics seminar, College of Agriculture, University of Idaho, April 6.

KEMPTHORNE, Oscar: "Heritability: Uses and abuses," April 22, 1993, at the Conference on Racism: Its Scientific Justification and Educational Consequences, sponsored by the University of Illinois School Improvement Project and members of three academic departments to recognize the occasion of Jerry Hirsch's retirement, Urbana, Illinois.

"Observation and inference," at the University of Ioannina, Ioannina, Greece, May 17.

"Planning, randomization, and randomization analysis of experiments," at the 2nd network meeting of the Caribbean, Central American, Colombian, and Venezuelan Network, held at the Centro Agronomico Tropical de Investigacion y Enseñanza (CATIE), Turrialba, Costa Rica, June 30.

LAHIRI, Soumendra Nath: "On the second order properties of the moving block bootstrap for studentized M-estimators in multiple linear regression models," at the 4th International Meeting of Statistics in the Basque Country, held in San Sebastian, Spain, August 3-7, 1992.

"On asymptotic expansions," two talks, Statistics and Mathematics Division, Indian Statistical Institute, Calcutta, December 18 and 21.

"On bootstrapping the sample mean of lattice random variables," Indian Statistical Institute, Calcutta, December 28.

LORENZ, Frederick O.: "Differential schematic bias in observational data: The effect of physical attractiveness," by B. Magruder, Lorenz, and J. Melby, at the meeting of the Midwest Sociological Society, Kansas City, Kansas, April 14, 1992.

"Coercive family processes and individual adjustment," by R. D. Conger, G. H. Elder, Jr., Lorenz, R. L. Simons, and L. B. Whitbeck, at the May 1992 meeting of the Society for Life History Research, Philadelphia, Pennsylvania.

"Husbands, wives, and the family economy: Differential influences on family process," by R. D. Conger, X. Ge, and Lorenz, at the meeting of the American Sociological Association, Pittsburgh, Pennsylvania, August 18.

"The effects of economic conditions on the mental health of rural husbands and wives," by Lorenz, Rand D. Conger, Ruth Montague, and K. A. S. Wickrama, at the Rural Sociological Society meetings in College Station, Pennsylvania, August 19.

"The effects of negative life events on the well-being of prospering and struggling husbands and wives," by Lorenz and Brian Magruder, at the annual meeting of the National Council on Family Relations, Orlando, Florida, November 8.

"Age, gender, and differential change in stress and depressive symptoms during adolescence," by X. Ge and Lorenz, at the biennial meeting of the Society for Research in Child Development, New Orleans, Louisiana, March 23, 1993.

MARASINGHE, Mervyn: "An interactive window-based environment for experimental design," by M. Nys and Marasinghe, at the 10th Symposium on Computational Statistics, COMPSTAT 92, held in Neuchâtel, Switzerland, by the International Association for Statistical Computing, August 1992.

MEEKER, William Q.: "Recent and future research on practical methods for accelerated testing," based on joint work with Luis Escobar, and "An accelerated life test model based on reliability kinetics," based on joint work with Mike Lu Valle, at the University of Hong Kong, Department of Statistics, on December 29.

"Assessing influence in regression analysis with censored data," based on joint work with Luis Escobar, at the National University of Singapore, Department of Mathematics, January 3, 1993.

"Some business and industrial applications of statistics," University of Malaya, Kuala Lumpur, Malaysia, January 6.

"Recent and future research on practical methods for accelerated tests," based on joint work with Luis Escobar, at the Quality through Engineering Design Conference, Bangalore, India, January 13--a conference sponsored jointly by the Indian Statistical Institute, the National Institute of Standards and Technology, and the Union of Japanese Scientists and Engineers.

"Planning accelerated life tests with two or more experimental factors," seminars based on joint work with Luis Escobar, for the Department of Statistics, Oakland University, and Department of Statistics, University of Waterloo, Ontario, Canada, on February 8 and 10, respectively.

"A degradation reliability model for planning in-service nondestructive tests," by **Christian Garrigoux** (Ames Laboratory, U.S. Department of Energy) and Meeker, at the Industrial Statistics Workshop on Reliability and Experimental Design, May 26, University of Waterloo.

NUSSER, Sarah M.: "Survival analysis for correlated data," seminar, Department of Statistics, Pennsylvania State University, November 12, 1992.

ROBERTS, Carl W.: "Linguistic content analysis," at the Social Science Information Technology Conference, Amsterdam, the Netherlands, December 4.

ROLLINS, Derrick K.: "Catalyst dilution as a means of obtaining precise kinetic data," by O. A. Sofekun, Rollins, and L. K. Doraiswamy, at the annual AIChE conference, Miami, Florida, November 2, 1992.

"Important uses of statistics in chemical engineering," seminar, Department of Chemical Engineering, Iowa State University, April 15, 1993.

"An evaluation of statistical approaches to assess mix segregation," by Rollins, D. L. Faust, and D. L. Jabas, on May 6 at the 1993 Powders and Bulk Solids Conference and Exhibition, sponsored by Reed Exhibition Companies and held in Chicago, Illinois.

SHELLEY, Kathleen: "Creating interactive user windows without SAS/AF," at the 1992 Midwest SAS Users Group Conference, Kansas City, Missouri, October 1.

SHELLEY, Mack C. II: "Evaluations of leadership and voter choice in the 1988 presidential election: A structural-equations analysis," by Stephen J. Stambough and Shelley, presented at the annual meeting of the American Political Science Association, Chicago, Illinois, September 3-6.

"Interaction patterns of aging parents and their adult children," by J. M. Mercier, Shelley, and Shi Jiuan Wu, presented at the 45th Annual Scientific Meeting of the Gerontological Society of America, Washington, D.C., in November.

Invited presentation (untitled) at the Iowa Council for the Social Studies 1992 Fall Workshops and Conference, on effects of the mass media on political opinions and voting behavior, October 5, 1992, in Ames, Iowa.

SHERMAN, Peter J.: "Searching for periodicities and more," seminar, Department of Systems Engineering, Australia National University, Canberra, Australia, July 22, 1992, and The Australian Defence Science and Technology Organization, Adelaide, Australia, August 5.

"Identification of periodically excited systems," by K. N. Lou, Sherman, and D. E. Lyon, at the 3rd International Symposium on Signal Processing and Its Applications, Gold Coast, Queensland, Australia, August 18.

"A data fusion system for identification of impaired proving ground drivers," at the U.S. Automotive Proving Grounds Safety Committee Meeting, San Angelo, Texas, September 10.

"FRF estimation under non-zero initial conditions," by Kenneth G. McConnell and Sherman, at the 11th International Modal Analysis Conference, held in Kissimmee, Florida, February 5, 1993.

"On AR representations for cyclo-stationary processes," at the IEEE International Conference on Acoustics, Speech, and Signal Processing, Minneapolis, Minnesota, April 27.

"On sensitivity of statistics of cyclostationary processes with respect to period uncertainty," at the Central Section Meeting of the American Mathematical Society, De Kalb, Illinois, May 22.

STEPHENSON, W. Robert: "TQM and instruction," to the College of Business, September 28, 1992; the Department of Industrial Education and Technology, October 3; and the College of Education, October 22, all at Iowa State University; also to representatives of Texas Instruments, at ISU, February 26, 1993.

"Statistical consulting with industry," seminar, Department of Statistics, University of Hong Kong, Hong Kong, June 2.

STUFKEN, John: "Orthogonal arrays: Construction and existence," seminar, Department of Mathematics, Computer Science, and Statistics, University of Illinois at Chicago, March 24.

"Construction of orthogonal arrays," at the Conference on Design of Experiments: Optimality, Construction, and Applications, Mathematical Research Institute Oberwolfach, Germany, held May 2-8.

SUKHATME, Shashikala: "Small sample properties of two-sample rank tests with truncated populations," lecture, Department of Statistics and Actuarial Sciences, University of Iowa, October 8, 1992.

"Exact powers of two-sample rank tests," at the 80th meeting of the Indian Science Congress Association, Goa, India, on January 5, 1993.

"Stratification of ROC studies," lecture, Department of Biostatistics, University of Minnesota, May 18.

WIEAND, Samuel: "Stopping when the experimental regimen does not appear to help," by Wieand, G. Schroeder, and J. O'Fallon, at an Early Stopping Rules Workshop in Cambridge, England, April 15.

Other Meetings

Ted Bailey and Paul Hinz attended the NCR-170 meetings, Research Advances in Applied Agricultural Statistics, in Lincoln, Nebraska, July 9-10, 1992.

Noel Cressie was an invited workshop participant in the Workshop on Environmental Studies, Institute for Mathematics and Its Applications, Minneapolis, Minnesota, July 20-23.

In addition to the faculty and students presenting papers, Sarah Nusser, Gerri Dunnigan, Hamid Navvabpour, Eric Novak, Ann Russey, and Ilker Yalçin attended the joint statistical meetings in Boston August 9-13, 1992.

Krishna Athreya and his students Anand Vidyashankar, Jun-ichiro Fukuchi, and Gregorio Atúncar attended the 14th Midwest Probability Colloquium at Northwestern University in October.

Noel Cressie was an invited participant in the Planning Meeting for Livestock and the Environment: A National Pilot Project, Tarleton State University, Stephenville, Texas, October 14-16.

Sherry Bushaw attended the joint national meeting of the Operations Research Society of America and the Institute of Management Science held in San Francisco, California, in November.

Soumendra Lahiri attended the J.B.S. Haldane Centenary International Conference, Indian Statistical Institute, Calcutta, December 15-19.

Frederick Lorenz attended the American Statistical Association Mid-winter Conference on Family and Children: Research Finding, Data Needs, and Survey Issues, in Fort Lauderdale, Florida, January 2-6, 1993.

Ted Bailey attended meetings of the North Central Regional Technical Committee-21 and the Gordon Research Conference on Quantitative Genetics and Biotechnology held in Ventura, California on February 13-14 and February 15-19, respectively.

On behalf of the Iowa Quality Coalition, Dennis Field participated in the Executive Education Program at the North Iowa Area Community College on February 24.

Gregorio Atúncar and Jun-ichiro Fukuchi attended the 2nd IMS International Symposium on Probability and Its Applications, in Bloomington, Indiana, March 20-21. (Also see papers presented above by Athreya and Vidyashankar.)

Kenneth J. Koehler attended an ASA short course on Nonlinear Mixed Effects Models for Clustered Data, on March 21 in conjunction with the spring meeting of the Biometric Society (ENAR), ASA Biometrics Section, and the Institute of Mathematical Statistics, Philadelphia, Pennsylvania.

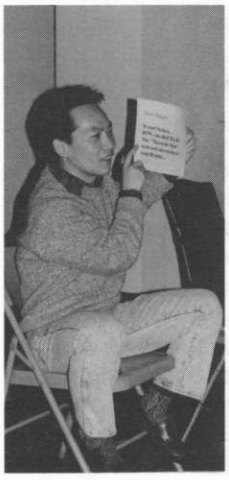
Alicia Carriquiry attended a conference on Conservation of Great Plains Ecosystems: Current Science, Future Options, held in Kansas City, Kansas, April 7-9, and cosponsored by CARD, USEPA Region VII, the Western Governors' Association, and the U.S. Fish and Wildlife Service.

David Cox, C. P. Cox (see paper above), Paul Hinz, Tom Kirchoff, Lynn Konecne, and Andrine Swensen attended the Fifth Annual Kansas State University Conference on Applied Statistics in Agriculture held in Manhattan, Kansas, April 26-27.

Sarah Nusser, Toni Genalo, and Dianne Anderson attended the International (Survey) Field Directors and Field Technologies Conference in Chicago, May 15-19. Genalo was program co-chair for the conference and co-chaired a session on Small-Shop Problem Solving.

William Q. Meeker attended the conference on Making Statistics More Effective in Schools of Business, at the University of Minnesota, June 10-12.

On June 16, Sarah Nusser, W. Robert Stephenson, and Ann Russey Cannon participated in a Quantitative Literacy Workshop for area statisticians and secondary school teachers, held at Grinnell College.



One of the highlights of the year is the Winter Party, hosted by Iowa STAT-ers. This event showcases musical, literary, and dramatic talents, and good food shared by statistics graduate students, faculty, staff, and spouses. Shown above, from L to R: Tony An presenting Deep Thoughts on Schubert's *Nocturne*; refreshment samplers Carola Deppe, Betsy Uken, Ann Cannon, Michelle Sawyer, and Becky Benner; and appreciative audience Peter Morse, Molly Isbell, and Steven Mattics.

PUBLICATIONS

In the Statistical Laboratory preprint series, 23 titles (#92-12 to 92-34) were added during the last half of 1992 and 4 more (#93-1 to 93-4) in the first half of 1993. 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 fall 1993.

Books

Schmidt, Steffen W., **Mack C. SHELLEY II,** and Barbara A. Bardes. *American Government and Politics Today,* 1993-94 edition. St. Paul: West Publishing Company. 1993. xi + 731 pp.

This is the latest edition of a widely used introductory textbook in political science. The current update features extensive coverage of opinion polling and voting behavior associated with the 1992 national elections in the United States. Major supplements include software to facilitate student data analysis, a booklet focused on the 1992 elections, a companion reader, a booklet analyzing the break-up of the Soviet Union, a handbook of selected United States Supreme Court cases, and an appendix on conducting research in political science.

Schmidt, Steffen W., and Mack C. SHELLEY II, editors. *Readings in American Government and Politics Today.* St. Paul: West Publishing Company. 1993. xii + 275 pp.

This reader accompanies the textbook, *American Government and Politics Today,* 1993-94 edition. Each chapter presents at least two reprinted articles keyed to material in the text.

Published Research

ATHREYA, K. B. On measures of non-degeneracy. *Journal of Applied Probability* 29:3 (1992) 733-739.

If ϕ is a convex function and X is a random variable, then $E\phi(X) - \phi(EX))$ is always nonnegative and zero if ϕ is linear in the support of X. It is shown that this quantity is additive only if ϕ is quadratic.

ATHREYA, K. B., and **C. D. Fuh** (Academia Sinica, Taipei) Bootstrapping Markov chains. Pp. 49-64 in *Exploring the Bootstrap,* edited by R. LePage and L. Billard. New York: John Wiley & Sons, Inc. 1992.

This paper gives a survey of recent results on bootstrapping Markov chains. The results include those of (i) Prakasa Rao and Kulperger on finite state irreducible chains, (ii) Athreya and Fuh on countable state space positive recurrent irreducible aperiodic chains, (iii) Dutta and McCormick on the second-order accuracy in the finite state space case. Some open problems are also indicated.

ATHREYA, K. B., and **C. D. Fuh.** Bootstrapping Markov chains: Countable case. *Journal of Statistical Planning and Inference* 33 (1992) 311-331.

Let X be an irreducible Markov chain with a countable state space S and transition probability matrix P. Let P_n be the maximum likelihood estimate of P based on the first n observations. This paper bootstraps the distribution of P_n and establishes its consistency.

ATHREYA, K. B., and **A. Vidyashankar.** Large deviation results for branching processes. Pp. 7-12 in *Stochastic Processes--A Festschrift in Honour of Gopinath Kallianpur,* edited by Stamatis Cambanis, Jayanta K. Ghosh, Rajeeva L. Karandikar, and Pranab K. Sen. New York: Springer-Verlag. 1993.

Let Z_n be a supercritical simple branching process with a finite offspring mean m and zero extinction probability. Then $Z_{n+1} Z_n^{-1}$ converges to m with probability one. This note deals with the large deviation aspects of this convergence and shows that under exponential moment hypothesis the rate is geometric. Extensions to the multitype case are stated without proof. Some open problems are indicated.

ATHREYA, Krishna, and Ananda B. Weerasinghe. Reflecting Ito processes in a stochastic control problem. *Mathematics of Operations Research* 17:3 (1992) 740-750.

For Ito processes on the line reflecting at 0, the problem of maximizing the probability that the local time at 0 does not exceed y before the process hits a level a starting at x is solved under some conditions on the instantaneous mean and standard deviations.

Ahmad, N., R. S. Kanwar, T. C. Kaspar, and **T. B. BAILEY.** Effect of soil surface submergence and a water table on vegetative growth and nutrient uptake of corn. *Transactions of the American Society of Agricultural Engineers* 35:4 (1992) 1173-1178.

Effects of excessive-water stress on corn vegetative growth and nutrient uptake were investigated in

environmentally controlled growth chambers. Two excessive-water treatments (soil surface submergence and water table at 15-cm depth) and four excessive-water stress levels (equivalent to 90, 180, 270, and 360 cm-day of stress as defined by SEW_{30} concept) were imposed at 21 days after emergence. Data on plant growth parameters (i.e, height, leaf area, dry matter, and shoot uptake of N, P, and K) were compared for both water-table conditions. Corn plants were significantly larger when a water table was imposed at the 15-cm depth than when the surface was submerged at all excessive-water stress levels. Plant nutrient uptake also was greater when a water table was maintained at 15 cm below the surface than when the surface was submerged. Nutrient uptake decreased significantly with increasing stress level for the submerged-surface treatment, but the trend was not consistent for the water-table treatment.

Summers, William L., Juan Jaramillo, and **Theodore BAILEY.** Microspore developmental stage and anther length influence the induction of tomato anther callus. *HortScience* 27:7 (1992) 838-840.

This research was concerned with an experiment on anther tissue culture. The objectives were to estimate the effects of (1) anther development stage on callus production and growth, (2) flower bud length or anther length as a predictor of the number of anthers that form callus and the mean diameter of calli produced, and (3) the time of bud harvest (morning or afternoon) on the number and diameter of calli produced. Culture dishes were distributed at random in a growth chamber using a split-plot design with time of bud harvest as main plots. Within main plots, plates representing three tomato cultivars, five developmental stages, six harvest dates, and two replications were distributed at random. Data were tested by analysis of variance techniques.

Zoran, Debra L., Albert E. Jergens, Dean H. Riedesel, Gary S. Johnson, **Theodore B. BAILEY,** and Stephen D. Martin. Evaluation of hemostatic analytes after use of hypertonic saline solution combined with colloids for resuscitation of dogs with hypovolemia. *American Journal of Veterinary Research* 53:10 (1992) 1791-1796.

The effects of hypertonic saline solution (HTSS) combined with colloids on hemostatic analytes were studied in dogs. The analytes evaluated included platelet counts, one-stage prothrombin time, activated partial thromboplastin time, von Willebrand's factor antigen (vWf:Ag), and buccal mucosa bleeding times. The dogs were anesthetized, and jugular phlebotomy was used to induce hypovolemia (mean arterial blood pressure = 50 mm of Hg). Treatment dogs (n = 12) were resuscitated by infusion (6 ml/kg of body weight) of 1 of 3 solutions: HTSS combined with 6% dextran 70, 6% hetastarch, or 10% pentastarch. The control dogs (n = 3) were autotransfused.

All treatment dogs responded rapidly and dramatically to resuscitation with hypertonic solutions. All coagulation variables evaluated, with the exception of vWf:Ag, remained within reference ranges over the 24-hour period. The vWf:Ag values were not statistically different than values from control dogs, and actual values were only slightly lower than reference ranges. Significant ($P \leq 0.04$) differences were detected for one-stage prothrombin time, but did not exceed reference ranges. The results of this study suggested that small volume HTSS/colloid solutions do not cause significant alterations in hemostatic analytes and should be considered for initial treatment of hypovolemic or hemorrhagic shock.

BREIDT, F. Jay, and Richard A. Davis. Time-reversibility, identifiability, and independence of innovations for stationary time series. *Journal of Time Series Analysis* 13:5 (1992) 377-390.

Weiss (1975) has shown that for causal ARMA models with independent and identically distributed (iid) noise, time-reversibility is essentially unique to Gaussian processes. This result extends to quite general linear processes, and the extension can be used to deduce that a non-Gaussian fractionally integrated ARMA process has at most one representation as a moving average of iid random variables with finite variance. In the proof of this uniqueness result, we use a time-reversibility argument to show that the innovations sequence (one-step prediction residuals) of an ARMA process driven by iid non-Gaussian noise is typically not independent, a result of interest in deconvolution problems. Further, we consider the case of an ARMA process to which independent noise is added. Using a time-reversibility argument, we show that the innovations of the ARMA with added independent noise are independent if and only if both the driving noise of the process and the added noise are Gaussian.

BREIDT, F. Jay, Richard A. Davis, and William Dunsmuir. On backcasting in linear time series models. Pp. 25-40 in *New Directions in Time Series Analysis, Part I,* edited by D. Brillinger, P. Caines, J. Geweke, E. Parzan, M. Rosenblatt, and M. Taqqu--The IMA Volumes in Mathematics and Its Applications, Vol. 45. New York: Springer-Verlag. 1992.

This paper examines the role of backcasting in linear time series models. Backcasting had its genesis in Gaussian estimation as a means of getting a better approximation to the quadratic form in the likelihood. Though this approximation has been largely superseded by exact likelihood calculation, backcasting is sometimes a useful alternative, as it is for certain long-memory processes. We review these results and consider the performance and usefulness of backcasting in non-Gaussian likelihood approximation. Finally, we discuss the use of backcasting in a new method of bootstrapping autoregressions, and

investigate the dependence structure of the residuals from backcasting.

Bouzaher, Aziz, David Archer, Richard Cabe, **Alicia CARRIQUIRY,** and Jason F. Shogren. Effects of environmental policy on trade-offs in agrichemical management. *Journal of Environmental Management* 36:1 (1992) 69-80.

This paper presents a novel approach for generating information for regulatory and policy analysis, based on farmers' adoption of weed control technology. A systems approach and a simulation model, WISH, are used to generate cost and risk information on 221 weed control strategies. Empirical results are summarized into "efficient frontiers." Environmental policies simulated are various bans on agri-chemicals. Of particular interest are the predicted shifts in risk and cost and associated substitutions under policies of banning atrazine, all triazines, and broadcast application technology.

Bouzaher, Aziz, P. G. Lakshminarayan, Richard Cabe, **Alicia CARRIQUIRY,** Philip W. Gassman, and Jason F. Shogren. Metamodels and nonpoint pollution policy in agriculture. *Water Resources Research* 29:6 (1993) 1579-1587.

Complex mathematical simulation models are generally used for quantitative measurement of the fate of agricultural chemicals in soil. But it is less efficient to use them directly for regional water quality assessments because of the large number of simulations required to cover the entire region and because the entire set of simulation runs must be repeated for each new policy. To make regional water quality impact assessment on a timely basis, a simplified technique called metamodeling is suggested. A metamodel summarizes the input-output relationships in a complex simulation model designed to mimic actual processes such as groundwater leaching. Metamodels are constructed and validated to predict groundwater and surface water concentrations of major corn and sorghum herbicides in the Corn Belt and Lake States regions of the United States. The usefulness of metamodeling in the evaluation of agricultural nonpoint pollution policies is illustrated using an integrated environmental economic modeling system.

Fink, Deborah, and **Alicia CARRIQUIRY.** Having babies or not: Household composition and fertility in rural Iowa and Nebraska, 1900-1910. *Great Plains Quarterly* 12:3 (1992) 157-168.

This study addresses the lives of rural women, using quantitative methods and census data along with historical narratives to explore the dynamics of childbirth decisions made within rural homes at the turn of the century. Comparing the birth patterns of a rural county in eastern Nebraska with those of a rural county in eastern Iowa, we find that on Nebraska farms the degree of social and geographic isolation of individual couples was significantly correlated with the number of children that women bore. Household composition mattered on the Nebraska frontier in a way that it did not in rural Iowa at the time. Frontier Nebraska women's high levels of fertility can be understood, in part, in terms of their relative isolation.

COX, C. Philip, and Jeff B. Meeker. A simple alternative to the standard statistical model for the analysis of field experiments with Latin square designs. Pp. 125-139 in *Applied Statistics in Agriculture*--Proceedings of the 1992 Kansas State University Conference on Applied Statistics in Agriculture. 1993.

Data are presented to suggest that the regular row, column, treatment additive structural model used to analyze Latin square experiments is not necessarily veridical for field experiments wherein non-Cartesian edaphic, background variability components can occur to contaminate the residual mean square. Using only a simple criterion for term selection it is shown, and exemplified, that representation of the background by a more general polynomial can, by separating out row × column interaction terms, substantially reduce bias in the residual mean square. A note on medieval cultivation practices and experimental design is appended.

CRESSIE, Noel. Aggregation in geostatistical problems. Pp. 25-36 in *Geostatistics Troia '92,* Vol. 1, edited by Amilcar Soares. Dordrecht: Kluwer Academic Publishers. 1993.

A random process $Z(\bullet)$ defined on point support has quite different characteristics to those of aggregations of $Z(\bullet)$. For example, $Z(\mathbf{s})$ has larger variance than $Z(B) \equiv \int_B Z(\mathbf{u})d\mathbf{u}/\int_B d\mathbf{u}$, where $\mathbf{s}$ is a point chosen at random within the block B; B is often referred to as the support of Z(B). Suppose that a resource $Z(\bullet)$ is sampled, yielding data $\mathbf{Z} \equiv (Z(\mathbf{s}_1),...,Z(\mathbf{s}_n))'$. However, the resource is extracted in blocks $B_1,...,B_N$. Let B denote a generic block and suppose that it is desired to predict g(Z(B)) based on the data $\mathbf{Z}$. The conditional expectation, $E\{g(Z(B)) \mid \mathbf{Z}\}$, minimizes the mean-squared prediction error, but it is impossible to estimate it without making over-utopian parametric assumptions. Current approaches to the problem require knowledge of "block-to-block" and "block-to-sample" parameters that cannot be estimated from the data. This paper proposes alternatively to make the kriging predictor more variable; the result is an optimal predictor for g(Z(B)) that is unbiased for a Gaussian process and approximately unbiased for a non-Gaussian process and sufficiently smooth g.

CRESSIE, Noel. Regional mapping of incidence rates using spatial Bayesian models. *Medical Care* 31:5 (1993) YS60-YS65.

This study takes a statistical-modeling point of view to the assessment of health care services and

procedures. The emphasis is on small-area prediction of incidence rates from spatially contiguous regions, although suitable modifications can also give doctor-level predictions. The main idea is to recognize the individuality of each region through a spatial Bayesian model for incidence rates. A noise component, because of location error and measurement error, is filtered out using empirical Bayes methods. The resulting smoothed predictors of incidence rates provide an accurate picture of the health care service or procedure under investigation.

CRESSIE, Noel, and **Soumendra Nath LAHIRI.** The asymptotic distribution of REML estimators. *Journal of Multivariate Analysis* 45:2 (1993) 217-233.

In this paper it is shown that, under appropriate regularity conditions, restricted maximum likelihood (REML) estimators are asymptotically Gaussian with zero mean and variance matrix equal to the inverse of the restricted information matrix. We verify the regularity conditions for variance-components models and apply our results to such models. An important application of variance components is to census undercount. A simulation is carried out to verify REML's properties for a typical census undercount model.

CRESSIE, Noel, and Subhash Lele. New models for Markov random fields. *Journal of Applied Probability* 29:4 (1992) 877-884.

The Hammersley-Clifford theorem gives the form that the joint probability density (or mass) function of a Markov random field must take. Its exponent must be a sum of functions of variables, where each function in the summand involves only those variables whose sites form a clique. From a statistical modeling point of view, it is important to establish the converse result, namely, to give the conditional probability specifications that yield a Markov random field. Besag (1974) addressed this question by developing a one-parameter exponential family of conditional probability models. In this article, we develop new models for Markov random fields by establishing sufficient conditions for the conditional probability specifications to yield a Markov random field.

DAVID, H. A. Ranking and selection from paired-comparison data. Pp. 3-24 in *The Frontiers of Modern Statistical Inference Procedures, Vol. II,* edited by Eve Bofinger, Edward J. Dudewicz, Gwenda J. Lewis, and Kerrie Mengersen--American Series in Mathematical and Management Sciences. Columbus: American Sciences Press, Inc. 1992.

Subset selection and indifference zone approaches to the selection of the best object in a balanced paired-comparison experiment are reviewed. Weak and strong curtailment are introduced in this context. It is shown that the probability of correctly selecting the best object is the same under strong curtailment as for the completed experiment if the Bradley-Terry preference model holds. For unbalanced paired-comparison data, with at most one comparison per pair, it is proposed to rank the objects on the basis of the following scoring system expressed in the language of tournaments: The score of a player A is the total number of (a) wins of players defeated by A minus losses of players to whom A lost, plus (b) A's wins minus A's losses. A tied match counts as half a win plus half a loss. More general experiments can be treated similarly.

DAVID, H. A. Concomitants of order statistics: Review and recent developments. Pp. 507-518 in *Multiple Comparisons, Selection, and Applications in Biometry,* edited by F. M. Hoppe. New York: Marcel Dekker. 1993.

Let (X_i,Y_i), i = 1,...,n, be independent pairs of variates. If $X_{r:n}$ denotes the r^{th} ordered X-variate, then the Y-variate paired with $X_{r:n}$ is termed the *concomitant of the r^{th} order statistic* and denoted by $Y_{[r:n]}$. After a review of basic results, an outline will be given of progress since 1982 in both the theory and the application of concomitants. These developments, due to various authors, include (a) selection through an associated variable; (b) estimation of the correlation coefficient for sensitive data; (c) concomitants of extreme order statistics; (d) dependence structure of concomitants.

DAVID, H. A., and **D. M. Andrews** (Wittenberg University). Nonparametric methods of ranking from paired comparisons. Pp. 20-36 in *Probability Models and Statistical Analyses for Ranking Data,* Lecture Notes in Statistics, Vol. 80, edited by M. A. Fligner and J. S. Verducci. New York: Springer-Verlag. 1993.

Ranking by row-sum scores in the case of balanced paired-comparison experiments was generalized to unbalanced experiments in David. Statistical properties of the proposed scores and associated tests of significance are developed in Andrews and David (*JASA,* 1990), where extensions to unbalanced ranked data are also treated. A brief account of this work is given and a possible generalization is introduced and examined. The simple methods here advanced make no assumptions on the pairwise preference probabilities. A secondary aim of this paper is to provide a critical review of competing methods also involving no such assumptions as well as of related methods requiring only mild assumptions. Many of the procedures discussed are illustrated on a worked example.

DAVID, H. A., and **Jingyu Liu.** Further aspects of the comparison of two groups of ranked objects by matching in pairs. Pp. 38-49 in *Stochastic Inequalities:* IMS Lecture Notes, Vol. 22, edited by M. Shaked and Y. L. Tong. 1993.

Suppose $\Gamma_X = (X'_{(1)},...,X'_{(n)})$ and $\Gamma_Y = (Y'_{(1)},...,Y'_{(n)})$

are two groups of stochastically ordered random variates, representing, say, the increasing strengths of the members of two chess teams. Let $\pi = (\pi_1,...,\pi_n)$ be a permutation of (1,...,n). Then the statistic $S(\pi) = \sum_{i=1}^{n} I(Y'_{(i)} > X'_{(\pi_i)})$ measures the superiority of Γ_Y over Γ_X in matchings under π, where $I(y > x)$ is an indicator function. The dependence of $ES(\pi) = \sum_{i=1}^{n} P(Y'_{(i)} > X'_{(\pi_i)})$ on π, especially when $\pi = (1,...,n)$, and when π is randomly given, has been studied in Liu and David (1993) under two different models. After a review of the main results of that paper, some new optimality results are developed. In addition, a threshold model is used to treat tied comparisons.

Zakaria, R. S., **H. T. DAVID,** and Way Kuo. A counter-intuitive aspect of component importance in linear consecutive-k-out-of-n systems. *IIE Transactions--Industrial Engineering Research and Development* 24:5 (1992) 147-156.

Nagaraj, N. K., and **W. A. FULLER**. Least squares estimation of the linear model with autoregressive errors. Pp. 215-225 in *New Directions in Time Series Analysis, Part I,* edited by D. Brillinger et al. The IMA Volumes in Mathematics and Its Applications, Vol. 45. New York: Springer-Verlag. 1992.

A Monte Carlo study of the least squares estimator of the regression model with autocorrelated errors is presented. The model contains a stationary explanatory variable and a random walk explanatory variable. The error model is a first order autoregressive model and the unit root case is included in the simulations. The limiting distribution of the regression pivotals for the basic model are normal, while the statistics for the autoregressive coefficient have a distribution that depends on the true parameter. The agreement between the Monte Carlo results and the asymptotic theory depends upon the autoregressive coefficient and on the nature of the explanatory variable.

Gotway, Carol A. (University of Nebraska-Lincoln), and **Noel CRESSIE.** Improved multivariate prediction under a general linear model. *Journal of Multivariate Analysis* 45:1 (1993) 56-72.

Under the assumption of a general linear model with known covariance matrix, several linear and nonlinear predictors are presented and their properties are discussed. When simultaneous multiple prediction is involved, a total-sum-of-squared-errors loss function for comparing predictors is used. Based on a fundamental relationship between prediction and estimation, a very general class of predictors is developed. This gives rise to predictors with uniformly smaller risk than that of the classical best linear unbiased (i.e., universal kriging) predictor.

Arnold, Barry C., and **Richard A. GROENEVELD.** Skewness and kurtosis orderings: An introduction. Pp. 17-24 in *Stochastic Inequalities,* IMS Lecture Notes-Monograph Series, Vol. 22. 1993.

Competing skewness orderings are surveyed. It is argued that those based on natural skewness functionals are preferable to those related to convex orderings. Analogous kurtosis orderings are also discussed. Here the role of convex and Lorenz orderings appears more natural.

HARVILLE, David A., and **Alicia L. CARRIQUIRY.** Classical and Bayesian prediction as applied to an unbalanced mixed linear model. *Biometrics* 48:4 (1992) 987-1003.

Unbalanced mixed linear models that contain a single set of random effects are frequently employed in animal breeding applications, in small-area estimation, and in the analysis of comparative experiments. The problem considered is that of the point or interval prediction of the value of a linear combination of the fixed and random effects or the value of a future data point. A common approach is "empirical BLUP (best linear unbiased prediction)," in which an estimate of the variance ratio is regarded as the true value. Empirical BLUP is satisfactory--or can be made satisfactory by introducing appropriate modifications--unless the estimate of the variance ratio is imprecise and is close to zero, in which case more sensible point and interval predictions can be obtained by adopting a Bayesian approach. Two animal breeding examples are used to illustrate the similarities and differences between the Bayesian and empirical BLUP approaches.

HARVILLE, David A., and **Daniel R. Jeske** (AT&T Bell Laboratories). Mean squared error of estimation or prediction under a general linear model. *Journal of the American Statistical Association* 87:419 (1992) 724-731.

The problem considered is that of predicting a linear combination of the fixed and random effects of a mixed-effects linear model. More generally, the problem considered is that of predicting an unobservable random variable from a set of observable random variables. The best linear-unbiased predictor depends on parameters that generally are unknown. Various exact or approximate expressions are given for the mean squared error (MSE) of the predictor obtained by replacing the unknown parameters with estimates. Several estimators of the MSE are investigated.

Chanvillard, Gilles, **J. Peter JONES** (University of Sherbrooke, Quebec, Canada), and Pierre-Claude Aitcin. Evaluation of the statistical significance of a regression and selection of the best regression using the coefficient of determination R^2. *Cement, Concrete, and Aggregates* 15:1 (1993) 31-38.

The statistical methods currently used to analyze experimental data are analyzed. The difficulties and

errors that can be encountered are described and how to avoid them is explained. Two simple equations based on the coefficient of determination are used to analyze data. These equations take advantage of the coefficient of determination available on most calculators.

Anderson-Hsieh, Janet, Ruth Johnson, and **Kenneth KOEHLER.** The relationship between native speaker judgments of nonnative pronunciation and deviance in segmentals, prosody, and syllable structure. *Language Learning* 42:4 (1992) 592-595.

This study investigated the relationship between experienced SPEAK Test raters' judgments of nonnative pronunciation and actual deviance in segmentals, prosody, and syllable structure. Sixty reading passage speech samples from SPEAK Test tapes of speakers from 11 language groups were rated impressionistically on pronunciation and later analyzed for deviance in segmentals, prosody, and syllable structure. The deviance found in each area of pronunciation was then correlated with the pronunciation ratings using Pearson correlations and multiple regression. An analysis of the 60 speakers showed that, whereas deviance in segmentals, prosody, and syllable structure all showed a significant influence on the pronunciation ratings, the prosodic variable proved to have the strongest effect. When separate analyses were done on two language subgroups within the sample, prosody was always found to be significantly related to the global ratings, whereas this was not always true for the other variables investigated.

Berger, P. J., A. C. Cubas, **K. J. KOEHLER,** and M. H.Healey. Factors affecting dystocia and early calf mortality in Angus cows and heifers. *Journal of Animal Science* 70:6 (1992) 1775-1786.

Calving performance records (965,417) from purebred American Angus herds throughout the United States were used to study dystocia and early calf mortality during the period from 1972 to 1985. A sample of 53 herds (83,467) was used to establish reasonable limits on the expected frequency of dystocia and mortality within and among herds that have good reproductive management programs and to verify the frequencies of scores in other herds reporting calving performance information. Logistic regression models for complex samples were used to quantify the effects of age of dam and birth weight of calf on dystocia and perinatal mortality.

Gan, F. F., and **K. J. KOEHLER.** A goodness-of-fit test based on P-P probability plots. *Journal of Quality Technology* 24:2 (1992) 96-102.

A quantitative measure of linearity of a P-P probability plot is the square of the correlation coefficient of points on the plot. This statistic aids in the assessment of goodness of fit of a hypothesized distribution. A computer program is presented for computing the p value of this statistic when testing the goodness of fit of a normal, a Gumbel, or an exponential distribution. The program can also construct a normal, a Gumbel, or an exponential P-P probability plot.

LAHIRI, S. N. Edgeworth expansions for M-estimators of a regression parameter. *Journal of Multivariate Analysis* 43:1 (1992) 125-132.

This paper gives r^{th} order Edgeworth expansions ($r \geq 3$) for M-estimators of a regression parameter in a simple linear regression model. The regularity conditions used here essentially require the smoothness of some integrals of the score function with respect to the underlying error distribution. As a result, these expansions are valid for robust M-estimators corresponding to nonsmooth score functions.

LAHIRI, S. N. On bootstrapping M-estimators. *Sankhyā*, Series A, 54:Part 2 (1992) 157-170.

Under certain regularity conditions this paper gives an almost sure asymptotic expansion for the distribution of bootstrapped M-estimators in a multivariate setting. Using this expansion the bootstrap approximation to the distribution of standardized M-estimator is shown to be of the order of $o(n^{-1/2})$ almost surely, thereby extending a result of Singh (1981) about the sample mean to M-estimators.

LAHIRI, S. N. On the Bahadur-Ghosh representation of sample quantiles. *Statistics & Probability Letters* 15:2 (1992) 163-168.

It is shown that the differentiability of the underlying distribution function at the population p^{th} quantile, $0 < p < 1$, is equivalent to (i) the Bahadur-Ghosh representation and (ii) the asymptotic normality of the corresponding sample quantile.

LAHIRI, Soumendra Nath. Bootstrapping M-estimators of a multiple linear regression parameter. *The Annals of Statistics* 20:3 (1992) 1548-1570.

Consider a multiple linear regression model $Y_i = x_i' \beta + \epsilon_i$, where the ϵ's are independent random variables with common distribution F and the x_i's are known design vectors. Let $\hat{\beta}_n$ be the M-estimator of β corresponding to a score function ψ. Under some conditions on F, ψ and the x_i's, two-term Edgeworth expansions for the distributions of standardized and studentized $\hat{\beta}_n$ are obtained. Furthermore, it is shown that the bootstrap method is second order correct in the studentized case when the bootstrap samples are drawn from some suitable weighted empirical distribution or from the ordinary empirical distribution of the residuals.

LAHIRI, Soumendra Nath. On bootstrapping the studentized sample mean of lattice variables. *Journal of Multivariate Analysis* 45:2 (1993) 247-256.

The rate of bootstrap approximation for the studentized sample mean of lattice variables is investigated. It is shown, by an example, that this rate is not better than the normal approximation, in general. However, a modified version of the bootstrap procedure is shown to be second-order correct. The proposed procedure smooths the estimator rather than the resampling distribution. Confidence intervals based on this procedure have more accurate coverage probabilities than the usual bootstrap confidence intervals, irrespective of the lattice or nonlattice character of the data.

LAHIRI, Soumendra Nath. Refinements in asymptotic expansions for sums of weakly dependent random vectors. *The Annals of Probability* 21:2 (1993) 791-799.

Let S_n denote the n^{th} normalized partial sum of a sequence of mean zero, weakly dependent random vectors. This paper gives asymptotic expansions for $Ef(S_n)$ under weaker moment conditions than those of Götze and Hipp (1983). It is also shown that an expansion for $Ef(S_n)$ with an error term $o(n^{-(s-2)/2})$ is valid without any Cramér-type condition, if f has partial derivatives of order (s – 1) only. This settles a conjecture of Götze and Hipp in their 1983 paper.

Lin, C. H. (Ming Chuan College, Taipei, Taiwan), and **Shashikala SUKHATME.** On the choice of precedence tests. *Communications in Statistics—Theory and Methods* 21:10 (1992) 2949-2968.

The best precedence test (BPT) is derived for testing the hypothesis that the lifetimes of two types of items on test have the same distribution. The test has maximum power in the class of the Lehmann type of alternatives $F = 1 - (1-G)^{\lambda}$, $\lambda > 1$, where F and G are probability distributions of the lifetimes of two types of items on test. This class includes exponential distributions, the Weibull distribution differing only in scale, and distributions with proportional hazard rates. Exact power of the BPT is compared with other nonparametric and parametric tests. The test may terminate before all the lifetimes of the items on test are recorded. In comparison with competing tests of equal size, the power functions are similar, but a considerable number of items can be saved and the time on test can be reduced by using the BPT.

Liu, Jingyu, and **H. A. DAVID.** Comparing two groups of ranked objects by pairwise matching. *Journal of Statistical Planning and Inference* 35:2 (1993) 157-169.

Suppose $\Gamma_X = (X'_{(1)}, X'_{(2)}, \ldots, X'_{(n)})$ and $\Gamma_Y = (Y'_{(1)}, Y'_{(2)}, \ldots, Y'_{(n)})$ are two groups of stochastically ordered rv's, which can represent, say, the increasing strengths of the members of two chess teams or two tennis teams, etc. Let $\pi = (\pi_1, \pi_2, \ldots, \pi_n)$ be a permutation of (1,2,...,n). Then the statistic $S(\pi) = \Sigma_{i=1}^{n} I(Y'_{(i)} > X'_{(\pi_i)})$ measures the superiority of Γ_Y over Γ_X in matchings under π, where $I(y > x)$ is an indicator function. We study the dependence of $ES(\pi) = \Sigma_{i=1}^{n} P(Y'_{(i)} > X'_{(\pi_i)})$ on π, especially when $\pi = 1,2,\ldots,n)$ and when π is randomly given. A class of special matchings called 'fair matchings' is also discussed. These problems are investigated under two models, termed the order statistics model and the linear preference model.

Livengood, Dennis (now Dennis Field). Quality. *Global View* 3:11 (1992) 4 pp., unnumbered, as *Internet Focus* insert, Vol. 1, No. 7.

In this article, the groundwork is set to help understand current trends in quality efforts, and a few recommendations are made for companies interested in initiating or upgrading their quality programs.

Conger, Rand D., Katherine J. Conger, Glen H. Elder, Jr., **Frederick O. LORENZ,** Ronald Simons, and Les B. Whitbeck. Family economic stress and adjustment of early adolescent girls. *Developmental Psychology* 29:2 (1993) 206-219.

This paper examines a family process model that links economic stress in family life to prosocial and problematic adolescent adjustment. Employing a sample of 220 seventh grade girls living in intact families in the rural midwest, the theoretical constructs in the model were measured using both trained observer and family member reports. Objective economic conditions such as per capita income and unstable work were related to parents' emotional status and behaviors through their perceptions of increased economic pressures such as the inability to pay monthly bills. These pressures led to depression and demoralization for both parents, the result of which was greater marital conflict and disruptions in skillful parenting. Disrupted parenting partially mediated the relationships between the earlier steps in the stress process and adolescent adjustment. The emotions and behaviors of both mothers and fathers were almost equally affected by financial difficulties, and the disruptions in each parent's childrearing behaviors had adverse consequences for adolescent development.

Conger, Rand D., **Frederick O. LORENZ,** Glen H. Elder, Jr., Ronald L. Simons, and Xiaojia Ge. Husband and wife differences in response to undesirable life events. *Journal of Health and Social Behavior* 34:1 (1993) 71-88.

Data from 451 married couples living in the rural midwest were used to examine gender differences in reports of exposure and vulnerability to specific types of undesirable life events. Men were more likely than

women to report exposure to, and to be distressed by, work and financial events. Women were more strongly influenced by exposure to negative events within the family but not within their network of friends. Outcomes varied according to the type of emotional distress. Financial stress, for example, increased hostility among men more than among women, but wives were more likely than husbands to report somatic complaints in response to the same stressor. The findings demonstrate the need for future research that more directly investigates the intraindividual and social mechanisms that account for gender differences in a broad range of emotional and behavioral responses to varying types of significant life changes.

Ge, Xiaojia, Rand D. Conger, **Frederick O. LORENZ,** Glen H. Elder, Jr., Ruth B. Montague, and Ronald L. Simons. 1992. Linking family economic hardship to adolescent distress. *Journal of Research on Adolescence* 2:4 (1992) 351-378.

This paper tested a model linking financial difficulties to adolescent psychological problems through the quality of marital and parent-child relationships. Using a sample of 451 rural midwest families, the results show that economic stress has a direct effect on marital quality which, in turn, disrupts or undermines the parent-child relationship. Negative feelings by parents and adolescents about their relationships tend to increase adolescent psychological distress. The model operates similarly across four family dyads: fathers and sons, fathers and daughters, mothers and sons, mothers and daughters.

Mattson, Gary, **Frederick O. LORENZ,** and R. Phillip Twogood. Planning style, citizen participation and decision rules: The distributional patterns of recreational projects in New England from Johnson to Carter. *Journal of Architectural and Planning Research* 10:1 (1993) 59-75.

Planners are frequently given the task of devising "decisional allocation rules" in the form of national standards, but few studies have successfully linked decision rules to impact on service allocation. This paper investigates the distributional patterns of the Land and Water Conservation Fund program over a 12 year period (1965-77) in the six New England states. The general proposition is that certain key factors such as planning style, size of planning staff, and a city's population size and racial composition explain whether or not a community obtains a recreational grant. Using logitistic regression models, we conclude that acquisition of grants was related to planning professionalism and that this did not lead to inequitable distribution of funding, as was commonly claimed.

Melby, Jan N., Rand D. Conger, Katherine J. Conger, and **Frederick O. LORENZ.** Effects of parental behavior on tobacco use by young male adolescents. *Journal of Marriage and the Family* 55:2 (1993) 439-454.

A social-development model of early adolescent tobacco involvement is evaluated in this study of 204 seventh grade boys. Using data from the young adolescents, their parents and siblings, this paper examines the influence of parental childrearing strategies and tobacco use upon tobacco involvement by early adolescents. Even after controlling for the effects of parental and sibling tobacco use, positive relationships were found between hostile/inconsistent parenting and adolescent tobacco use, and negative relationships between nurturant/involved parenting and adolescent tobacco use. The results suggest that parenting behaviors had both direct effects on adolescent tobacco use and indirect effects through the adolescent's association with tobacco-using peers.

Simons, Ronald L., **Frederick O. LORENZ,** Rand D. Conger, and Chyi-In Wu. Support from spouse as mediator and moderator of the disruptive influence of economic strain on parenting. *Child Development* 63:5 (1992) 1282-1301.

A model is presented regarding associations between economic strain, support from spouse, and quality of parenting. The model was tested using a sample of 451 two-parent families, each of which included a seventh grader. Parent and adolescent reports, as well as observational ratings, were used as indicators of constructs. Analyses using structural equation modeling indicated that level of spouse support was positively related to supportive parenting, whereas economic strain operated to undermine parental involvement. As posited, economic strain produced its effects through a direct relation with parenting and indirectly through its association with spouse support. These findings held for mothers and fathers, regardless of the gender of the child. Spouse support moderated the impact of economic strain on supportive parenting for mothers but not for fathers. Possible explanations for this gender difference were presented.

Whitbeck, Les B., Danny Hoyt, Ronald L. Simons, Rand D. Conger, Glen H. Elder, Jr., **Frederick O. LORENZ,** and Shirley Huck. 1993. Intergenerational continuity of parental rejection and depressed affect. *Journal of Personality and Social Psychology* 63:6 (1993) 1036-1045.

This study used structural equation modeling to partially replicate the intergenerational model of Elder, Caspi, and Downey (1986) that indicates a cyclical transmission process by which parents' personality traits affect parent-child interactions, which, in turn, increases the propensity for developmental problems among offspring. The results indicated a pattern of intergenerational transmission of depressed mood through parental rejection of offspring. Multiple reporters and multiple indicators strengthen

previous intergenerational findings by reducing some of the method variance biases that have been problematic in prior studies.

Lu, C. Joseph (National Cheng-Kung University, Taiwan), and **William Q. MEEKER.** Using degradation measures to estimate a time-to-failure distribution. *Technometrics* 35:2 (1993) 161-174.

Some life tests result in few or no failures. In such cases, it is difficult to assess reliability with traditional life tests that record only time to failure. For some devices, it is possible to obtain degradation measurements over time, and these measurements may contain useful information about product reliability. Even with little or no censoring, there may be important practical advantages to analyzing degradation data. If failure is defined in terms of a specified level of degradation, a degradation model defines a particular time-to-failure distribution. The purpose of this work is to develop statistical methods for using degradation measures to estimate a time-to-failure distribution for a broad class of degradation models.

MARASINGHE, Mervyn G., and Robert J. Boik. A three-degree of freedom test of additivity in three-way classifications. *Computational Statistics & Data Analysis* 16:1 (1993) 47-61.

This article proposes a new interaction model for nonreplicated three-way classifications. A simulation study is used to show that a three-degree of freedom score test based on the new model compares favorably with existing one-degree of freedom score and likelihood ratio tests of additivity. The tests are illustrated through an analysis of a data set where it is shown how the new model may reveal a specific structure of three-factor interaction. This structure may be exploited to suggest possible explanations for the nonadditivity.

Nys, M., P. Darius, and **M. MARASINGHE.** An interactive window-based environment for experimental design. Pp. 233-238 in *Computational Statistics, Vol. 2*, edited by Yadolah Dodge and Joe Whittaker—Proceedings of the 10th Symposium on Computational Statistics, COMPSTAT, Neuchatel, Switzerland, August 1992. New York: Springer-Verlag. 1992.

Although current statistical packages are convenient and powerful tools for statistical analysis, their usefulness in the planning stage of the experiment is limited. In this paper we describe a system that assists the user in building up a design with many possibilities to examine its properties and change them.

MEEKER, William Q., and Luis A. Escobar. A review of recent research and current issues in accelerated testing. *International Statistical Review* 61:1 (1993) 147-168.

Accelerated tests are used to obtain timely information on the life distribution or performance over time of products. Test units are used more frequently than usual or are subjected to higher than usual levels of stress or stresses like temperature and voltage. Then the results are used to make predictions about product life or performance over time at the more moderate use or design conditions. Changes in technology, the calls for rapid product development, and the need to continuously improve product reliability have put new demands on the applications for these tests. In this paper we briefly review the basic statistical and other ideas behind accelerated testing and give an overview of some current and planned statistical research to improve accelerated test planning and methods.

Hahn, Gerald J., and **William Q. MEEKER.** Assumptions for statistical inference. *The American Statistician* 47:1 (1993) 1-11.

In this article we overview and discuss some of the important practical assumptions underlying statistical inference. What we say, though not new, is stressed insufficiently in teaching statistical methods and applications. We build on the important conceptual difference between enumerative and analytic studies, emphasized by W. Edwards Deming. Our comments, however, go beyond the published views of Deming. We emphasize the assumptions needed for both types of studies and illustrate the concepts with examples.

Mingoti, Sueli A. (Universidade Federal de Minas Gerais, Brazil), and **Glen MEEDEN** (University of Minnesota): Estimating the total number of distinct species using presence and absence data. *Biometrics* 48:3 (1992) 863-875.

Consider the problem of estimating the total number of distinct species in some specified region under investigation. Suppose the region is divided into N disjoint subregions or quadrats of equal size. A sample of size n quadrats is chosen, $n < N$. Within each sampled quadrat the distinct species present are observed and an empirical Bayes estimator of the total number of species in the region is constructed. This estimator is based on a model that is an adaptation for presence and absence data of a model originally due to Fisher. The estimator and a corresponding interval estimator are compared to bootstrap and jackknife estimators.

Jensen, Helen H., **Sarah M. NUSSER,** Howard Riddick, and Laura Sands. A critique of two methods for assessing the nutrient adequacy of diets. *Journal of Nutrition Education* 24:3 (1992) 123-129.

The adequacy of diets can be assessed using several analytical approaches. This paper reviews two methods of assessment: a cutoff method, which estimates the percentage of the population having

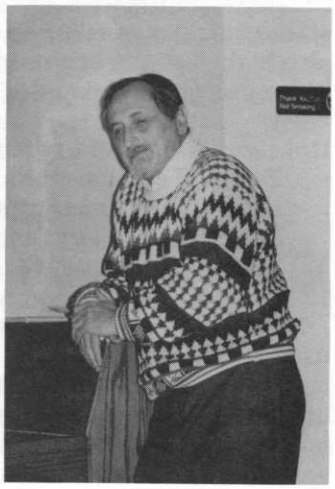
usual intakes below a given value; and a probability method, which assesses the percentage of the population whose usual intakes are below their individual requirements. First, the concept of usual nutrient intakes and the problems associated with estimating usual intake distributions are discussed. Next, the two methods of dietary assessment and their related assumptions are described and compared. The more specific inference of the probability method is shown to rely on its assumptions and data that are currently not available. While the cutoff method is simpler, its use may result in misclassification errors and its estimates are highly influenced by the cutoff standard selected.

POLLAK, Edward, and **Muhamad Sabran:** On the theory of partially inbreeding finite populations. III. Fixation probabilities under partial selfing when heterozygotes are intermediate in viability. *Genetics* 131:4 (1992) 979-985.

In a previous paper by the senior author, an approximation to the probability of survival was given for a mutant, which is originally present in a single heterozygote, in a population that reproduces partly by selfing and partly by random mating. The population was assumed to be very large, but the result obtained is general with regard to the level of dominance in viability. In this paper two errors that were made in that earlier work are corrected. A general approximate expression is then derived for the probability that an allele A is fixed in a partially self fertilizing population of size N, if its initial frequency is p, selection is weak, and heterozygotes with the allele are exactly intermediate in viability compared with genotypes AA and $\bar{A}\bar{A}$. A rigorous proof is given for a special case that is a generalization of the classical binomial sampling model. In this case, but not in general, the approximate fixation probability is independent of the probability of reproduction by selfing. Some implications are discussed.

Remadi, Sellem, and **Yasuo AMEMIYA.** Limiting distribution of roots with differential rates of convergence. *Statistics & Probability Letters* 17:3 (1993) 237-244.

Some general results on the limiting distribution of the roots of $|\mathbf{A}(n)-\lambda\mathbf{B}(n)| = 0$ are given, incorporating differential rates of convergence of $\mathbf{A}(n)$, $\mathbf{B}(n)$,



More Winter Party scenes: clockwise starting with the upper left photo, L to R: violinist Mike Elling; Iowa STAT-ers president Rachel Kintzinger, Reiner Kurzhals, Becky Benner, and Kevin Dodd in a Statistical Wheel of Fortune presentation; Herbert T. David lip-synching to a Marlene Dietrich tape; and Cheryl Johnson, Gregg Althen, and Michelle Sawyer in a skit, It's a Small World After All.

and the roots. The results are applied to the multivariate covariance component problem.

Eltinge, Elizabeth M., and **Carl W. ROBERTS.** Linguistic content analysis: A method to measure science as inquiry in textbooks. *Journal of Research in Science Teaching* 30:1 (1993) 65-83.

A method using linguistic content analysis was developed to assess the degree to which science was portrayed as a process of inquiry within a high school biology textbook series. Linguistic content analysis is a method of encoding textual data by categorizing key words and identifying the relationships among these words. The encoded textual data were analyzed using logistic regression techniques. The measure developed for the study was shown to be highly reliable and valid. In the textbook series studied, the frequency of the portrayal of science as a process of inquiry increased from 1956 to 1965, then showed a pattern of decline in 1977 and 1985. The results further indicate that the frequency of portrayal of science as a process of inquiry was higher in introductory chapters of the textbooks and in chapters dealing with the topic of genetics, and lower in chapters dealing with leaf structure. The frequency of the portrayal of science as a process of inquiry was also higher at the beginning of chapters and at the beginning of paragraphs.

Robison-Cox, James (Montana State University). Tables of order statistics of normal random variables under linear trend. *Communications in Statistics—Theory and Methods* 21:12 (1992) 3497-3520.

Estimators based on order statistics are being used in cases where the random variables being ordered are independent, but not identically distributed. We examine one case, that of independent normal variates with means exhibiting linear trend and unit variance. For samples of size 2 to 10 we compute tables of the expectations, variances, and covariances of the order statistics for trend values from 0 to 3. Applications dealing with quality control and assessment of robustness of estimators to trend are shown.

ROLLINS, Derrick K., Donna L. Faust, and Duane L. Jabas. An evaluation of statistical approaches to assess mix segregation. Pp. 579-588 in *Proceedings of the 1993 Technical Program—Powders and Bulk Solids Conference and Exhibition*. 1993.

Since the mid-fifties, the primary statistical way that engineers and operating personnel have evaluated powders for homogeneity (mixing) has been through mathematical quantities called indexes. Indexes have several fundamental limitations that make them very unattractive as measures of segregation. The major limitation is that if a mixture is unsegregated and sampling variability is important, indexes can be significantly affected. A second major limitation of indexes is that their statistical distributions are not known.

In this work we present an approach for evaluating segregation that does not suffer from the limitations discussed above. In this approach, the expected value of the statistic that measures the degree of segregation is affected *only* by segregation. In addition, the distribution properties of the statistic are known and, thus, one is able to control error levels, determine sample sizes, and make important statistical inferences. These properties are also discussed theoretically, and this statistic is evaluated along with some common indexes in a simulation study.

ROLLINS, Derrick K., and **Shonda D. Roelfs.** Gross error detection when constraints are bilinear. *AIChE Journal* 38:8 (1992) 1295-1298.

This paper is an extension of a new approach, the Unbiased Estimation Technique (UBET) [Rollins, 1990], that identifies and estimates true values of process variables when multiple gross measurement errors exist. In its original development, the UBET only addressed linear constraints (i.e., mass balances). However, products of measured variables (bilinear constraints) exist in energy balance and component mass balances. These constraints are more complex than linear constraints because they do not have normal distributions when the individual variables are normally distributed. In this work we discuss three ways to preserve the features of the UBET when constraints are linear.

ROLLINS, Derrick K., and **Shonda D. Roelfs.** Application of an unbiased estimation technique when constraints are bilinear. Pp. 137-148 in *Proceedings of the 19th Annual National NOBCChE Conference*, New Orleans, April 1992. August 1992.

This paper discusses methods to extend the Unbiased Estimation Technique (UBET) (Rollins, 1990) to bilinear constraints. Bilinear constraints are more complex than linear constraints because they do not have normal distributions when the individual variables are normally distributed. We develop a two-stage technique and a linearization technique to confront this problem. These methods identify and estimate true values of process variables when multiple gross measurement errors exist and also develop: (1) α-level test statistics to identify biased measurements; (2) power functions to control type II errors; (3) unbiased estimates to achieve accuracy; and (4) known distributions and confidence intervals for estimates.

SACKS, Jerome M. (Hines VA Hospital, Hines, Illinois), Randall C. Cutlip, **Amy L. Weaver** (Mayo Clinic, Rochester, Minnesota), and Howard D. Lehmkuhl. Prevalence rate differences based on herdmate comparisons. Pp. 41-47 in *Applied Statistics in Agriculture*—Proceedings of the 1992

Kansas State University Conference on Applied Statistics in Agriculture. 1993.

A nonrandom survey of ovine progressive pneumonia (OPP) seropositive prevalence rates among 16,827 sheep in 29 states in the United States revealed large breed differences, a higher prevalence rate among older sheep, and an unexplainable female rate that was more than three times the male rate. The herdmate comparison procedure, successfully used in evaluating dairy bulls, was adapted to compare the prevalence of a breed to the rate of its herdmates within herds. Likewise, sex and age differences in OPP prevalence were compared within herds that contained animals of both sexes and several ages. Using herdmate comparisons, breed and age differences in OPP prevalence remained but the sex difference disappeared.

Cutlip, Randall C., Howard D. Lehmkuhl, **Jerome M. SACKS**, and **Amy L. Weaver**. Prevalence of antibody to caprine arthritis-encephalitis virus in goats in the United States. *Journal of the American Veterinary Medical Association* 200:6 (1992) 802-805.

Goats from 28 states were tested for antibodies to caprine arthritis-encephalitis virus. Of 3,790 goats, 1,175 (31%) tested positive, and of 196 herds tested, 143 (73%) had one or more seropositive members. This prevalence, based on serum samples from all goats in the participating herds, was lower than most rates reported in other studies. Such studies were based on fewer samples, incomplete sampling of herds, or smaller geographic base. Prevalence was highest in western Pacific and northern plains regions, increased with age to 3 years, was highest among goats on family-owned farms, and was lowest in the Angora breed. Differences in prevalence were not related to gender or size of herd.

Orr, P. H., and **J. M. SACKS.** Chipping responses of stored potatoes after handling. *Transactions of the American Society of Agricultural Engineers* 35:3 (1992) 567-568.

Chip color was measured, after simulated handling, in three chipping potato cultivars—'Norchip,' 'Monona,' and 'Atlantic'—and ND860-2 tubers stored two to eight months at 9° C, 90% RH. ND860 is a germ-plasm of current interest for its cold-chipping ability. Tubers were tumbled in a rubber-lined drum to simulate handling, then chipped, fried, and scored for color, one, two, three, and four days after handling. Chip color did not appear to change due to handling that followed storage of two to eight months.

SHELLEY, Mack C. II, and Steven G. Koven. Interstate migration: A test of competing interpretations. *Policy Studies Journal* 21:2 (1993) 243-261.

This study presents a model of net interstate migration in the United States during the 1970s. Of five composite dimensions derived from an exploratory factor analysis of 20 candidate predictors of interstate migration, the greatest predictive power in an ordinary least squares regression analysis is attained by a set of quality-of-life correlates of migration. Composites of fiscal policy and labor relations variables, more controllable by public decisionmakers, are also significant.

SHERMAN, P. J., L. B. White, and R. R. Bitmead. On AR representations for cyclostationary processes. Pp. 260-263 in *Proceedings of the 1993 IEEE International Conference on Acoustics, Speech, and Signal Processing, Vol. IV: Statistical Signal and Array Processing.* 1993.

This work is concerned with autoregressive types of wide sense cyclostationary processes. The comparative performance of DFT, Wigner-Ville, and autoregressive (AR) methods of estimating the time-periodic spectral density of an AR(2) wide sense cyclostationary process is provided. We then address problems with these methods in the case of uncertainty of the process period. Examples concerning an AR(2) process subjected to period drift and randomness are provided to show that the time-varying spectral estimate converges to a time-invariant one. Results from stochastic differential equations that support this behavior are cited. Finally, the method of extended Kalman filtering is proposed to track a slowly time-varying period.

Lou, K. N., **P. J. SHERMAN,** and D. E. Lyon. Identification of periodically excited systems. Pp. 580-583 in *Proceedings, ISSPA 92, the Third International Symposium on Signal Processing and Its Applications.* 1992.

The problem of identifying a multi-input/single-output linear time-invariant system, where the input contains a mixture of sinusoidal and random processes, is addressed in an example. Two complementary new spectral-based identification approaches are presented, and compared in an example with DFT and AR approaches. Notable improvement over these later methods is obtained, and pitfalls of the later are illustrated.

Lou, K. N., **P. J. SHERMAN,** and D. E. Lyon. System identification and coherence analysis in the presence of a harmonic signal. *Mechanical Systems and Signal Processing* 7:1 (1993) 13-27.

This work is concerned with estimation of transfer function and coherence information associated with periodic systems, such as rotating machinery, that involve random processes having infinite as well as finite energy. We propose new complementary spectral-based approaches for system identification and coherence estimation that anticipate this mixture of processes. Their value is demonstrated in a comparative setting, wherein the limitations of FFT and autoregressive methods are highlighted.

McConnell, Kenneth G., and **Peter J. SHERMAN.** FRF estimation under non-zero initial conditions. *Proceedings of the 11th International Modal Analysis Conference,* held in Kissimmee, Florida. Vol. II, pp. 1021-1025. 1993.

This work addresses the estimation of a system frequency response function (FRF) using the *step relaxation method* (SRM). After a review of the assumptions on which the SRM relies and why they may not be fulfilled, a single degree-of-freedom *(d.o.f.)* system is analyzed in detail to arrive at an expression for the error in the SRM-based FRF estimate that involves system parameters and the observation window size. Simulation results for a cantilevered beam modeled as a two *d.o.f.* system are then presented to demonstrate potential problems with the SRM and how to alleviate them.

Narula, Subhash C., **Vince A. SPOSITO,** and John F. Wellington. Intervals which leave the minimum sum of absolute errors regression unchanged. *Applied Statistics* 42:2 (1993) 369-378.

One of the appealing properties of the minimum sum of absolute errors (MSAE) regression is its resistance to outliers and long-tailed error distributions. Just like the sample median, the MSAE estimators are influenced by all the observations but determined by only a subset of the observations. The MSAE estimates are not altered if the value of the response (or predictor) variable for an observation associated with a non-0 residual is within a certain interval. In this paper we develop procedures to determine such intervals for the simple linear regression model.

Hedayat, A. S., Kewei Pu, and **John STUFKEN.** On the construction of asymmetrical orthogonal arrays. *The Annals of Statistics* 20:4 (1992) 2142-2152.

General techniques for the construction of asymmetrical orthogonal arrays of strength 2 are presented. These are then applied to special cases to obtain new families of such arrays.

Hedayat, A. S., and **J. STUFKEN.** Some mathematical results on incomplete orthogonal arrays. *Sankhyā* 54 (1992) 197-202 (special volume on combinatorial mathematics, dedicated to the memory of Raj Chandra Bose).

Let H with size h be a proper subset of S with s elements. A k×N array based on S is called an incomplete orthogonal array of strength t and index λ based on S and H if the columns of any t×N subarray contain each element from $S^t - H^t\lambda$ times, while those from H^t do not appear at all. Such an array is denoted by IOA (N,k,(S,h),t). New results include: (1) In any such array $k \le (S/h) + t - 1$, regardless of the value of λ; (2) $k \le f(\lambda S^{t-1}, S, t-1) + 1$, where f(N,S,t) denotes the largest value of k for which an OA (N,k,S,t) exists; (3) if $S_1 > S_2$ where S_2 is a prime power and S_1 is a power of S_2, then there exists an IOA $(S^t_1 - S^t_2, S_2+1, (S_1,S_2), t)$; (4) some families of incomplete orthogonal arrays based on orthogonal Latin squares and orthogonal arrays are constructed.

STUFKEN, John, and **Kui-Jang Wang** (Tamkang University, Tamsui, Taiwan). Factorial designs and the theory of trade-off. *Statistics & Probability Letters* 15:5 (1992) 369-372.

We consider a method to construct factorial designs with all factors at two levels and with an information matrix, pertaining to a specified model, that is equal to the information matrix for a given design. The method is based on a relation between this problem and the problem of trade-off in block designs. By exploring this relation, the extensive results on t-trades can be used for the construction of the desired factorial designs. This provides also additional incentive for the continued development of the theory of trade-off.

Vander Wiel, Scott A. (AT&T Bell Laboratories), and **Stephen B. VARDEMAN.** Discussion of "Statistical process monitoring and feedback adjustment—a discussion," by George Box and Tim Kramer. *Technometrics* 34:3 (1992) 278-281.

VARDEMAN, Stephen B. What about the other intervals? *The American Statistician* 46:3 (1992) 193-197.

For a variety of introductory audiences, there are strong practical and pedagogical reasons for the early teaching of statistical interval methods that are often treated as "advanced" topics, if at all. There are also simple, effective ways of making this early introduction. This expository article discusses the elementary teaching of one-sided statistical intervals, prediction intervals, and tolerance intervals for both (one-sample) nonparametric and (general) normal theory contexts.

Kasprzyk, Robert, and **Stephen B. VARDEMAN.** Applied statistical methods and the chemical industry. Chapter 4 (pp. 83-117) in *Riegel's Handbook of Industrial Chemistry, 9th edition,* edited by J. A. Kent. New York: Van Nostrand Reinhold. 1992.

This expository article introduces methods of applied statistics to a target audience of industrial chemists. It includes discussion of some methods of descriptive statistics, control charting and capability assessment, multi-factor experimentation and data analysis, mixture analysis, and nonlinear mechanistic model building. It also touches on the chemical industry implications of the relationships between modern quality philosophy and the discipline of statistics. A fairly extensive bibliography is provided to aid readers in pursuing topics in more depth.

Ver Hoef, Jay M. (Alaska Department of Fish and Game), and **Noel CRESSIE.** Multivariable spatial prediction. *Mathematical Geology* 25:2 (1993) 219-240.

For spatial prediction, it has been usual to predict one variable at a time, with the predictor using data from the same type of variable (kriging) or using additional data from auxiliary variables (cokriging). Optimal predictors can be expressed in terms of covariance functions or variograms. In earth science applications, it is often desirable to predict the joint spatial abundance of variables. A review of cokriging shows that a new cross-variogram allows optimal prediction without any symmetry condition on the covariance function. A bivariate model shows that cokriging with previously used cross-variograms can result in inferior prediction. The simultaneous spatial prediction of several variables, based on the new cross-variogram, is then developed. Multivariable spatial prediction yields the mean-squared prediction error matrix, and so allows the construction of multivariate prediction regions. Relationships between cross-variograms, between single-variable and multivariable spatial prediction, and between generalized least squares estimation and spatial prediction are also given.

Ver Hoef, Jay M., Noel A. C. CRESSIE, and David C. Glenn-Lewin. Spatial models for spatial statistics: Some unification. *Journal of Vegetation Science* 4:4 (1993), 441-452.

A general statistical framework is proposed for comparing linear models of spatial process and pattern. A spatial linear model for nested analysis of variance can be based on either fixed effects or random effects. Greig-Smith (1952) originally used a fixed effects model, but there are examples of random effects models in the soil science literature. Assuming intrinsic stationarity for a linear model, the expectations of a spatial nested ANOVA and two-term local variance (TTLV, Hill 1973) are functions of the variogram, and several examples are given. Paired quadrat variance (PQV, Ludwig and Goodall 1978) is a variogram estimator that can be used to approximate TTLV, and we provide an example from ecological data. Both nested ANOVA and TTLV can be seen as weighted lag–1 variogram estimators that are functions of support, rather than distance. We show that there are two unbiased estimators for the variogram under aggregation, and computer simulation shows that the estimator with smaller variance depends on the process autocorrelation.

Ahlquist, David A., **Harry S. WIEAND,** Charles G. Moertel, et al. Validity of fecal occult blood screening for colorectal neoplasia. *Journal of the American Medical Association* 269:10 (1993) 1262-1267.

To define the sensitivity and specificity of fecal blood as a marker for colorectal neoplasia in the screening setting and to compare yields by Hemoccult and HemoQuant, we studied two high-risk patient groups. In both groups for both fecal blood tests, if specificity was nearly 95%, sensitivity was well under 50%. We concluded that, in the screening setting, fecal blood is a poor marker for colorectal neoplasia.

Book Reviews, Etcetera

Clayton, Murray K., and **Dean L. ISAACSON.** How to apply to graduate school. *Stats* No. 9 (Spring 1993) 19-21.

This article offers advice on what to do, and what not to do, when applying to and preparing for graduate school in statistics.

ROLLINS, Derrick K. *Fundamentals of Industrial Quality Control* (2nd ed.), by Laurence Aft, Milwaukee: ASQC-Quality Press, 1992, xi + 351 pp., $45.95. Reviewed in *Technometrics* 35:2 (May 1993) 232-233.

STEPHENSON, W. Robert. The first (last?) Statistics College Bowl. *Stats* No. 9 (Spring 1993) 22-23 and 27.

The organizer-emcee of the first national college bowl devoted to statistics and probability describes the competition held in conjunction with the 1992 ASA Winter Conference.

Theses

Adam, Abdoulaye. Covariance estimation for characteristics of the Current Population Survey. Ph.D. thesis, Iowa State University Library. August 1992.

In repeated surveys, the usual survey estimator of a characteristic can be represented as the sum of the true value and a measurement error, where the measurement error is due to sampling. If the sampling units stay in the survey for a fixed finite number of periods, then the sequence of sampling errors, $\{u_t\}$, is a moving average. Assuming that the sequence of true values, $\{x_t\}$, is a realization of a time series, the objective of estimating the covariance structure of the series $\{x_t\}$ is considered.

For the Current Population Survey, a components-of-variance model for the sampling error is estimated. Three components of variance are identified. These are a replicate component that is due to variation between primary sampling units, a permanent component associated with rotation groups within primary sampling units, and a transient component associated with rotation groups within primary sampling units. The replicate component and the permanent rotation group effects are assumed to be constant over time. The transient rotation group effect is assumed to be a third order autoregressive

process. Under the 4-8-4 rotation scheme of the Current Population Survey, u_t is a fifteenth order moving average. Given the covariance function of $\{u_t\}$, two estimation procedures of the structure of $\{x_t\}$ are proposed and applied to data from the Current Population Survey. The first procedure is a frequency domain estimation procedure, and the second procedure uses autocovariances.

The limiting distribution of the frequency domain estimator is derived. A Monte Carlo study of the estimator for the first order moving average is conducted. The distributional properties of the estimator and the asymptotic results are in reasonable agreement for samples on the order of 100 observations when the parameter is not close to the boundary.

Chakak, Abderrahmane. Some methods of constructing multivariate distributions. Ph.D. thesis, Iowa State University Library. May 1993.

We present some methods of constructing multivariate distributions when the marginal distributions are assumed known. The method is based on a conditional approach and allows for different associations between different pairs of variables. Some general properties are examined, and this method is illustrated by generalizing the Clayton (1978), Plackett (1965), and Lindley and Singpurwalla (1978) distributions. The method of construction provides a convenient way to simulate random samples from multivariate distributions, and an algorithm is presented. This methodology is used to model litter matched life event data from a teratological study.

An alternative method of constructing multivariate distributions with specific univariate marginal distributions is obtained from solving a Cauchy type partial differential equation whose solutions involve the Bessel function of order zero. Many distributions are shown to be special cases of a family of distributions arising from a certain solution. Some of the properties of this family are derived. New families of bivariate distributions are derived.

Finally, we introduce a randomization technique to extend families of multivariate distributions. This results in bivariate distributions with a symmetric range for possible correlations and an extended variety of shapes.

Croos, Joseph H. R. Robust estimation in measurement error models. Ph.D. thesis, Iowa State University Library. August 1992.

We consider the simple measurement error regression model $y_t = \beta_0 + \beta_1 x_t + q_t$, $(Y_t,X_t) = (y_t,x_t) + (w_t,u_t)$, where $\beta = (\beta_0,\beta_1)$ is the parameter of interest, (Y_t,X_t), $t = 1,2,...,n$, are the observations, (y_t,x_t) are the true vectors, (w_t,u_t) are measurement errors, and q_t is the equation error. We assume that the measurement errors $\mathbf{a}_t = (w_t,u_t)$, $t = 1,2,...,n$, are independent of (q_j,x_j) for all t and j and that q_j is independent of x_t for all t and j. It is also assumed that the covariance matrix of $\mathbf{a}_t$ is known.

Extreme observations have an adverse effect on the usual estimators of the parameters. A class of estimators of β is constructed in which the effect of extreme observations is reduced. Our estimation procedure is based on the robust regression of Y on X and the robust regression of X on Y. The asymptotic joint distribution of the robust estimators of the regression coefficients and error mean squares is obtained when the observations are sampled from a bivariate normal distribution. The robust estimator of β is a smooth function of the estimated regression coefficients and the estimated error mean squares from the two robust regressions. We show that for normal distributions, under certain regularity conditions, our estimator is consistent and normally distributed in the limit. The robust estimation procedure is developed to be robust against a single outlier and then extended to be robust against multiple outliers. A Monte Carlo study is presented to show that our estimator is insensitive to outliers and that the efficiency loss is modest when there is no outlier in the sample.

Garrigoux, Christian. Reliability analysis of components subject to degradation failure with in-service inspections. Ph.D. thesis, Iowa State University Library. December 1992.

Maintaining the reliability of components subject to degradation failures is an important problem. The traditional way to deal with this problem has been to systematically replace parts so that certain reliability, and possibly cost, criteria are satisfied. More recently, new technologies have been developed that allow nondestructive inspections, and replacements may be based now on observations made at these inspections. In a first model, we consider the important case where degradation and failure result from the growth of a crack that has developed within the component of interest, this growth being assumed deterministic.

A probabilistic model is presented for the fatigue reliability of such components subject to periodic nondestructive inspections. Some figures of merit considered include the hazard function, an approximation of the cost per unit of service time, and the mean time between failures. A numerical example is given that focuses on the effect of inspections on the hazard function. This model is then extended in order both to handle the possible stochasticity of different parameters, and to allow the dynamic scheduling of inspections from observations. The model is not restricted to the crack growth type degradation.

Iversen, Philip. Dynamic graphics for experimental design. Ph.D. thesis, Iowa State University Library. May 1993.

When designing an experiment, it is often assumed that the response to be measured can be modelled as a linear function of a vector of parameters plus an error term, $\mathbf{y} = X\beta + \epsilon$. Using this model several properties of the design can be defined in

terms of the matrix X'X, including A-, D-, E-, and G-optimality. In this dissertation we review some common design properties and develop new graphical methods for displaying them using dynamic graphics techniques, including interactive updating, linking, animation, and rotation. The effects of perturbations to the design on these properties are also displayed, and a new graphical search technique for improving designs is introduced. Our results indicate that these graphs can help to verify the stability of standard experimental designs, highlight weaknesses present in nonstandard designs, and suggest possible remedies.

In addition, an adaptation of Cook's method for assessing local influence is developed to examine the effects of local perturbations to the model and to the design on selected design properties. Perturbations are made to case weights, design variables, and added variables not included in the assumed model. The design properties examined are D-optimality and the mean squared error of estimating the response at selected points in the design region. Graphical displays are used to interpret the results.

Kurzhals, Reiner. Statistical and mathematical approach to modeling dendritic growth. M.S. thesis, Iowa State University Library. May 1993.

Characteristics of growth patterns of nerve cells' dendrites include the metric and the geometric structure of neuronal cells. By metric structure we mainly mean the length of a dendrite, the splitting length, and growth velocity. The geometric structure concerns the dendritic bifurcation process involving the complete tree pattern, and some of its particular aspects, for example, the number of terminal and nonterminal branches or the maximal centrifugal order of a tree.

The purpose of this work is to extend a model from an already existing model, which describes the metric structure of the branching process in early brain development utilizing data material observed at Iowa State University. Furthermore, results obtained with the new model will be compared to results gained with the already existing model. The new model should result in more precise estimates for the model parameters and, as a long term implication in the areas of neural networks, in reliable in vitro drug testing methods that will considerably cut testing time and costs.

More specifically, to obtain an extended model from the data available, differential equations are used to describe the variables growth velocity and total length for each order of a branch; the Newton-Raphson algorithm is applied to these equations to get estimates for the proposed model. A gamma function is fitted to the variable splitting length, and goodness-of-fit tests are evaluated for each order to verify this distribution assumption.

Lemke, Klaus Wilhelm. A Bayesian approach to sequential assembly experiments. Ph.D. thesis, Iowa State University Library. December 1992.

Sequential assembly experiments aim at identifying important sources of variability in performance attributable to component parts of an assembly with a few successive assembly tests. A test consists of a single--or multiple--part exchange on an assembly followed by unit reassembly and performance measurement. Two fundamentally different prescriptions for sequential experimentation with assemblies are developed. These are a Bayesian "look-ahead" heuristic and a "swapping" heuristic that is related to a technique currently used by practitioners.

This study investigates and compares the characteristics of the heuristics through computer simulations. The context of this study is a linear random effects model for a three-part assembly with a single important source of variability. In addition, costs of experimental actions and a decision cost regarding the unknown identity of the important source are considered. The problem being addressed is determining whether one heuristic dominates the other in terms of criteria such as the success rate and total cost.

Liu, Jingyu. Comparing two groups of ranked objects by pairwise matching. Ph.D. thesis, Iowa State University Library. August 1992.

Let $\Gamma_X = (X'_{(1)}, X'_{(2)}, \ldots, X'_{(n)})$ and $\Gamma_Y = (Y'_{(1)}, Y'_{(2)}, \ldots, Y'_{(n)})$ be two groups of stochastically increasing rv's, which can represent, say, the increasing strengths of the members of two chess teams or two tennis teams, etc. Let $\pi = (\pi_1, \pi_2, \ldots, \pi_n)$ be a permutation of $(1,2,\ldots,n)$. Then the statistic $S(\pi) = \Sigma_{i=1}^{n} I(Y'_{(i)} X'_{(\pi_i)})$ measures the performance of Γ_Y over Γ_X under the permutation of matching π, where $I(y > x)$ is an indicator function. We are interested in the relationship between π and $ES(\pi) = \Sigma_{i=1}^{n} P(Y'_{(i)} > X'_{(i)})$, especially in comparing $ES(\pi)$ when $\pi = (1,2,\ldots,n)$, corresponding to ordered matching, and when π is randomly given. The $P(Y'_{(i)} > X'_{(i)})$ are of interest in themselves. A class of special matchings called 'fair matchings' is emphasized. We say a matching π is *fair* if $ES(\pi) = n/2$ when $\Gamma_X \sim \Gamma_Y$. *Simple matching* and *symmetric matching,* which are fair under certain conditions, are also defined. These problems are investigated under two models, i.e., the order statistics model and the linear preference model.

In the order statistics model, $X'_{(i)}$ and $Y'_{(i)}$ have the same marginal distributions as $X_{(i)}$ and $Y_{(i)}$, the i^{th} order statistics in two random samples of size n from F(x) and G(x), respectively. In the linear preference model, $X'_{(i)} \sim F(x-\lambda_{(i)})$ and $Y'_{(i)} \sim F(x-\mu_{(i)})$, for $i = 1,2,\ldots,n$, where F(x) is a unimodal distribution function, $\lambda_{(1)} \leq \lambda_{(2)} \leq \ldots \leq \lambda_{(n)}$, and $\mu_{(1)} \leq \mu_{(2)} \leq \ldots \leq \mu_{(n)}$. In both models, the case with ties permitted is also considered.

McVey, Anita Marie Hinkeldey. The effect of number of maize families on the precision of genetic parameters estimates. M.S. thesis, Iowa State University Library. December 1992.

Recent publications on the methods of variability assessment for heritability (H) and selection response

(R) have provided genetic researchers with valuable statistical tools. However, the only evaluation of the validity of these methods has been by use of simulation studies, and it is not known if the assumptions of these studies adequately model actual experimental data. This paper assesses the applicabilities of simulation studies by doing sampling studies on data from a plant breeding experiment on maize (*Zea mays* L.). Our research has shown that applying the confidence interval formula for H to data combined across locations will not give valid results and therefore should not be calculated. The confidence interval formula for H performed well when data from a single location were analyzed. Our research found the confidence interval formula for R to be a valid method of assessing the precision of R regardless of the type of analysis used. Methods for obtaining confidence intervals for average yield are also valid.

The effect of sample size on the precision of the estimates of H and R was also investigated. Although an exact value for the ideal sample size could not be found, it is evident that the use of less than 100 families will result in less than acceptable precision for both H and R. Estimates of H and R are highly unreliable when only 25 to 30 families are used in a study.

Navvabpour, Hamid Reza. Statistical methods for multivariate survival data. Ph.D. thesis, Iowa State University Library. December 1992.

Multivariate survival analysis involves the study of failure times, including the influence of covariates, in the presence of dependence. A general method for constructing multivariate distributions, which allows for a different association parameter for each pair of variables, is used to specify multivariate survivor functions with specific univariate marginal survival functions. A particular form of the multivariate survivor function is applied to data from a toxicological study to make inferences about effects of treatments and other explanatory variables on three development times monitored on each animal in the study. Likelihood based inferences for the regression coefficients, using marginal proportional hazards models, and for the parameters governing the associations are considered for this fully parametric model.

In the presence of associations among survival times, it is usually difficult to identify an appropriate model for a multivariate survival data set. When inferences about marginal parameters are of primary interest, methods that do not require complete specification of the joint survival function can be used. These methods, independent marginal models and a semi-parametric approach using a robust covariance estimator, ignore dependence among survival times and estimate marginal parameters using marginal likelihood functions. These estimation methods are easier to apply than joint parametric methods, but they ignore associations among survival times, and the resulting estimators are generally not efficient.

Remadi, Sellem. On multivariate covariance component problems. Ph.D. thesis, Iowa State University Library. August 1992.

Statistical procedures for making inferences on the variance components in univariate mixed effect models have been developed and extensively used in many fields. Development for multivariate mixed models has been relatively limited. One important issue in the multivariate problem is determining the rank of a covariance component. Knowledge on the rank can be utilized to obtain efficient estimators. That issue on the rank is one of the underlying themes throughout this dissertation. A difficulty in developing asymptotic inference procedures for the general random effect problem is the nonexistence of a single index over which the limit is taken. An eventual goal of this dissertation is to develop approximate inference procedures that can be justifiably used for a wide range of practical sampling configurations.

To develop asymptotic theory, a certain nonstandard result on the limiting distribution of the roots of a determinantal equation is needed. The first paper of this dissertation presents general results on such a limiting distribution. The second paper deals with the rank testing problem. A number of asymptotic and exact procedures are discussed for a large class of multivariate mixed effect models. The third paper discusses asymptotic properties of the covariance component estimators in the multivariate one-way random effect model with possibly incorrect specification of the rank of the between-group component.

Sabran, Muhamad. Survival probabilities of genes or gametic types in partially selfing populations. Ph.D. thesis, Iowa State University Library. August 1992.

Survival probabilities of genes or gametic types and other quantities of genetic interest in various types of finite partially selfing populations under selection were calculated algebraically and numerically for various types of finite partially selfing populations. A finite Markov chain with trinomial transition probabilities was employed to approximate fixation probabilities, cumulative heterozygosity, and cumulative additive variance contributed by a favorable allele, while alleles segregate. This approximation was carried out by expanding the transition probabilities in terms of power series of the selection coefficient.

Multitype branching process theory was used to approximate the survival probabilities of mutant genes in a two-locus diploid population and in an autotetraploid population. An expression for the variance effective size of an autotetraploid population with an arbitrary degree of double reduction was also derived.

In a two-locus diploid population with a specific viability model, it was found that tight linkage of the two loci is necessary for the survival of the mutant

genes and the effect of increasing the rate of selfing is to increase the survival probability. In an autotetraploid population, the survival probability decreases until the rate of selfing rises to a certain level, and then increases.

Sanger, Todd Michael. Estimated generalized least squares estimation for the heterogeneous measurement error model. Ph.D. thesis, Iowa State University Library. December 1992.

The measurement error model of interest is $y_t = \beta_0 + \mathbf{x}_t\beta_1 + q_t$, $\mathbf{Y}_t = y_t + w_t$, $\mathbf{X}_t = \mathbf{x}_t + \mathbf{u}_t$, where $\mathbf{Z}_t = \mathbf{Y}_t, \mathbf{X}_t)$ is the observed p-dimensional vector, $\mathbf{z}_t$ is the equation error, and the measurement errors $\mathbf{a}_t = (w_t, \mathbf{u}_t)$ are distributed with mean zero and known variance Σ_{aatt}. An estimated generalized least squares estimator of the mean and variance of $\mathbf{z}_t$, denoted by μ and Σ_{zz} respectively, is shown to have a limiting normal distribution under mild regularity conditions. An estimator of $\beta' = (\beta_0, \beta'_1)$ based upon the proposed estimator of μ and $\mathbf{Z}_{zz}$ is constructed and shown to have a limiting normal distribution. The variances of the limiting distribution are less than or equal to the corresponding variances for other estimators that have been suggested for the heterogeneous error model. The estimated generalized least squares estimator also displayed smaller mean square error than other estimators in a Monte Carlo study. A program to implement the proposed estimators is developed. The iterated estimated generalized least squares estimators of the measurement error model are investigated. The limit of a modified iteration procedure is shown to be the maximum likelihood estimator for the normal distribution.

Estimated generalized least squares estimation is considered for the general linear model, $\mathbf{Y} = \mathbf{X}\beta + \mathbf{u}$, where the variance of $\mathbf{u}$ is denoted by $\mathbf{V}_{uu}$ and the elements of $\mathbf{X}'\mathbf{V}_{uu}^{-1}\mathbf{X}$ may increase at different rates. Sufficient conditions are given for the estimated generalized least squares estimator to be consistent and asymptotically equivalent to the generalized least squares estimator constructed with known $\mathbf{V}_{uu}$. Consistent estimators of the normalizing matrix are developed, and the asymptotic distribution of a linear combination of the elements of the estimator is considered. The model where $\mathbf{V}_{uu}$ is a function of a fixed, finite number of parameters and the use of ordinary least squares residuals to estimate the parameters of $\mathbf{V}_{uu}$ are examined. Applications of the results to the trend model with first order autoregressive errors and to the measurement error model are given.

Sriplung, Kai-One. Mispricing in the Black-Scholes model: An exploratory analysis. Ph.D. thesis, Iowa State University. May 1993.

The Black-Scholes option pricing model has been highly influential in security trading and in analyses of risk-price relationships, despite the fact that it has been shown to have an apparent unexplainable mispricing bias. This study examines the mispricing exhibited by the Black-Scholes model and shows that it can be explained by the estimation procedures utilized and the measures of volatility. Specifically, a model is constructed to test for the systematic over- or underpricing of the Black-Scholes model. Striking price and time-to-maturity are included in the model. The model also includes an autoregressive error structure.

Recognizing the autocorrelation in the errors improves estimation efficiency and predictability of future option prices. The method of entering implied volatility into the model has a great impact. When only one estimated implied volatility was used to explain the option data, the Black-Scholes model exhibited a bias that was a similar function of striking price for all of the securities studied. When separate estimated implied volatilities for difference option positions were used, the bias as a function of striking price and time-to-maturity varied among securities. Predictions of market option prices based on the model containing striking price, time-to-maturity, and an autoregressive error structure were more accurate than those based on the Black-Scholes model.

Tollefson, Margot Helena. Variance estimation under random imputation. Ph.D. thesis, Iowa State University Library. August 1992.

The properties of the usual estimator of the population mean or total calculated using a sample that includes randomly imputed values are derived. Simple random sampling without replacement, stratified sampling, and a general sampling plan are considered. It is assumed that imputation is done within imputation classes and that the missing values are missing at random within the imputation classes. For stratified sampling and the general sampling scheme, an underlying superpopulation is assumed, where the variables of interest are identically and independently distributed within the imputation classes. Elements within one imputation class are assumed to be independent of elements in other imputation classes. For imputation of a single variable, the set of respondents is replicated as many times as the set fits into the set of missing values and the remaining missing values are filled in by respondents chosen by simple random sampling without replacement from the set of respondents. The donors are assigned to the missing values at random. Three methods of imputation applicable to two variables with missing values are considered. The imputation schemes for two variables are variations on the imputation scheme for a single variable.

For stratified random sampling and the general sampling plan, the expected values of the estimator of the population mean are given conditional on the finite population and unconditional with respect to the superpopulation. The expectation of the usual estimated total, given the finite population, is biased. Under the model, the mean of a simple random

sample with imputed values is an unbiased estimator of the population mean.

Three estimators of the variance of the estimated mean with imputation are given for simple random sampling and stratified sampling. For the general sampling scheme a variance estimator is given and a general form for the estimated covariance between estimators is given for the population totals. It is demonstrated that these estimators are suitable for implementation into survey sampling software.

Results for the general model are applied to an imputation problem posed by the Soil Conservation Service's 1987 National Resources Inventory.

Yansaneh, Ibrahim S. Least squares estimation for repeated surveys. Ph.D. thesis, Iowa State University Library. August 1992.

Least squares estimation for repeated surveys is addressed. Several estimators of current level, change in level, and average level over time are developed. Estimators include the recursive regression estimator, which is the best linear unbiased estimator based on all periods of the survey.

We assume that the basic data consist of elementary estimators of the parameters of interest associated with different rotation groups and that their covariance structure is based on a components of variance model. Under this model, several theoretical results associated with the least squares estimation procedures are derived. In particular, we prove that (1) the recursive regression estimator of [the] current level is optimal in the sense of minimum variance, and (2) the covariance matrix of the recursive least squares estimators converges to a positive definite matrix as the number of periods increases. The effects of revision of previous estimates and time-in-sample effects on alternative estimators are examined. The results are applied to the estimation of selected labor force characteristics for the Current Population Survey.

Yoo, Seongmo. On Pitman domination. Ph.D. thesis, Iowa State University Library. May 1993.

The research (part of which is reported in Yoo and David (1993)) is devoted to constructing classes of estimators *Pitman-dominating,* rather than *Pitman-dominated by,*median-unbiased estimators derived from sufficient statistics. The research emphasizes the geometry of certain nonlinear shrinkage constructions, provides Pitman-dominating classes of estimators for entirely general median-unbiased estimators and certain related statistics, and identifies a key condition for the construction of such dominating classes: the coincidence of the parameter range with the support of the distribution of the dominated statistic. Examples include shrinkage constructions for the scale parameter case, for the noncentral t parameter case, and for the location-scale case.

Simultaneous application of the present approach and other recent approaches places sufficient median-unbiased estimators between dominated and dominating classes, and yields classes of examples of Pitman-intransitive triples of estimators for location and scale families.

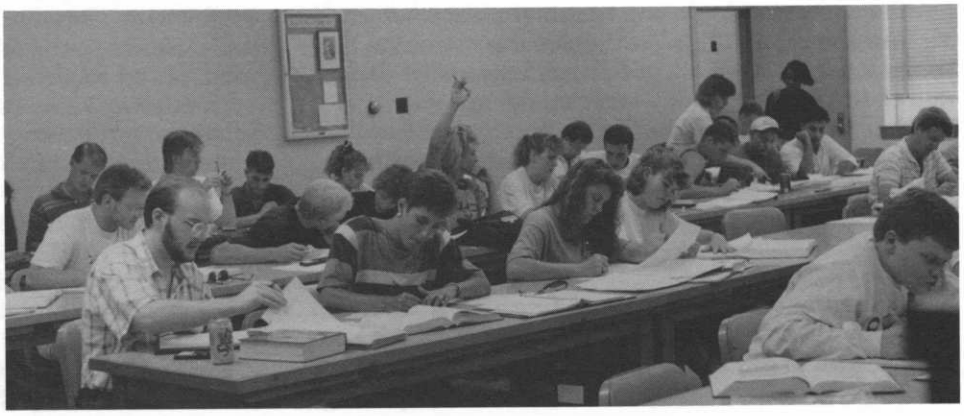
The results pertain as well to a generalization of the PCC that substitutes quite general loss for absolute error.

Yu, Yunn-hwu. Aspects of statistical multiple tolerancing. Ph.D. thesis, Iowa State University Library. August 1992.

This dissertation studies multiple tolerancing problems for multi-featured parts. The minmax point-to-point interference problem studies the ways in which manufacturing tolerances affect the likelihood of meeting composite tolerances, and acceptable fits for mating parts; the least squares point-to-point interference problem studies the ways in which manufacturing tolerances affect Taguchi-type squared-error penalties for failing to meet exact design specifications. A certain extension of extreme value theory is used for the minmax formulation; the least squares formulation involves certain asymptotic aspects of nonlinear least squares.

Only translation (not rotation) adjustment is used in the minmax problem. The minmax interference is approached by upper- and lower-bounding process, with the diameter of a random convex hull involved in the lower-bounding process.

Rotation is considered in addition in the least squares problem, and the distribution of the optimal translation, as well as rotational, adjustment is provided. The roles of pattern size and location are explored.



In the Henry A. Wallace Room, students work on laboratory assignments for Stat 227, Introduction to Business Statistics. Approximately 3,000 students take one of our introductory statistics courses each year.

Department of Statistics

The Department of Statistics offers courses leading to the degrees of Bachelor of Science, Master of Science, and Doctor of Philosophy with major in statistics. These degrees are conferred by the College of Liberal Arts and Sciences and by the Graduate College. A Master of Science degree in operations research is offered jointly with the Department of Industrial and Manufacturing Systems Engineering. Some undergraduates and some Ph.D. candidates choose co-majors in order to add depth in an area of application or the mathematical sciences. M.S. candidates may choose either the thesis or the nonthesis option. The latter requires a written examination and completion of a creative component representing at least two credits of independent work. More information is given in the departmental brochure, "Iowa State University--Graduate Program in Statistics," which is available upon request.

Minor changes in statistics course descriptions were made for the 1993-95 university catalog. Stat 436 was renamed Quantitative Genetics. Stat 554 and 555 (Math 554 and 555) were renamed Introduction to Stochastic Processes and Theory of Stochastic Processes. Three courses were deleted: Stat 405, Applied Econometric Statistics; Stat 522, Theory of Sample Surveys II, and Stat 639, Stochastic and Abstract Programming.

In the area of teaching statistical computing, a significant development is the experimental course Stat 581X that Mervyn Marasinghe is presenting during summer 1993. The course is intended for master's level graduate students who have little background in computer science. Major topics will be applications of matrix computations, optimization methods, stochastic simulation, iterative techniques, and other selected numerical methods in statistical research. Implementation of algorithms rather than their development will be emphasized. It is planned to use FORTRAN, C, and S for the programming exercises. This course is one product of the faculty improvement leave that Marasinghe took during the summer and fall of 1992.

Stat 579, the orientation course for new statistics graduate students was completely redesigned and taught in the fall. The course now deals only with workstations in the Project Vincent™ distributed computing environment. These workstations have allowed faculty and graduate students to expand their opportunities in terms of statistical computing.

Progress continues in strengthening and expanding computational facilities available in the Department of Statistics and the Statistical Laboratory. William Meeker and Mervyn Marasinghe are co-principal investigators for a project "Developing modern computing and graphics-based methods for teaching important concepts in undergraduate statistics courses." Professors Richard Groeneveld, Mark Kaiser, Ken Koehler, Bob Stephenson, and Steve Vardeman as collaborators are also working to support the development of software and teaching materials for the project. This project is funded by a $55,000 grant from the National Science Foundation Instrumentation and Laboratory Improvement Program, with additional cost sharing coming from student computing fees ($26,000 from the University Central Fund and $30,000 from the College of Liberal Arts and Sciences Fund). These resources have been used to buy 23 Project Vincent™ high-performance Unix-based workstations. Twenty-one of the workstations are installed in Snedecor 322 for student use. The other two are being used by two of the faculty members associated with the NSF project.

In the near future, all of our introductory statistics courses will use computers and common statistical software. Toward this end, Dean Isaacson established a university-wide advisory committee last fall to aid in selection of the software package to be used in those courses. The committee is responsible for testing software and making a recommendation that will fit both Mac and DOS environments.

Alicia Carriquiry and Sarah Nusser sponsored Heidi Shierholz (Grinnell College) as a Women in Science 1992 summer intern at Iowa State. Shierholz's work focused on patterns of well water contamination in Iowa. Nusser is sponsoring Min Ye (Yale University) as a 1993 summer intern. Ye is comparing usual daily intake distributions estimated from food frequency- and dietary record-based data.

Steve Vardeman is nearing completion of a modern engineering statistics textbook. The book emphasizes the engineering applications and implications of a variety of statistical methods and intends to show both university students and working engineers how these can help them be more effective engineers. The text uses a minimal amount of formal mathematics, opting instead to emphasize graphical methods of data analysis, statistical intervals, both qualitative and quantitative issues in engineering experimentation (including both fractional factorial and response surface methodologies), and methods of statistical quality monitoring and variance component analysis. A manuscript version of the book has been used as the text for several years in Stat 305, a 3 semester hour course with no statistics prerequisite that provides coverage through standard fractions of 2^p factorials. Vardeman expects the book to be available in the late fall of 1993.

The Department of Statistics is one of the academic areas becoming interested in having TQM practiced, taught, and studied at Iowa State. The university's application for a grant from IBM was

unsuccessful. However, Texas Instruments is forming a partnership with ISU, with the help of two alumni, to explore the possibilities of TQM, and has pledged monetary support for collaborative work.

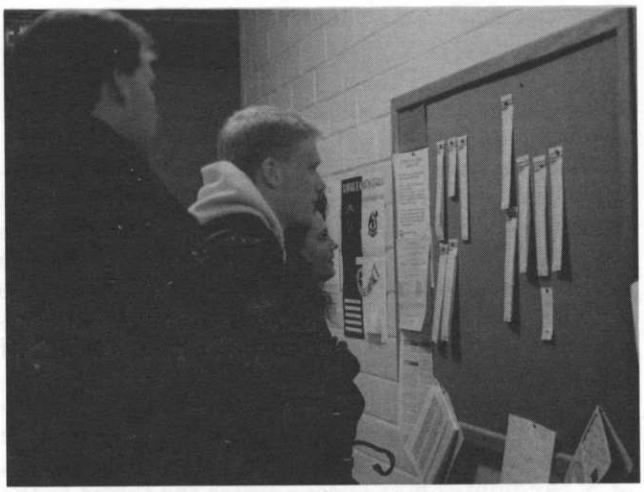
Opportunities to provide education beyond the campus have grown in the past few years. This year Stat 328 was offered by Marie Coffin on Saturdays in Ames for offcampus-based students in the Master of Business Administration program. Twenty students elected to take Stat 401 fall term in Des Moines, Iowa. This course was taught by Don Hotchkiss, emeritus professor. The Department of Statistics is now planning to partner with General Motors to offer a master's degree in statistics for students at General Motors. The first step is the preparation of a course in industrial statistics, by W. Robert Stephenson, to be presented in 1994-95.

Course offerings for the 1992-93 academic year and the 1993 summer session, with primary catalog listing in statistics, are listed below. A few courses with primary listing in mathematics or industrial and manufacturing systems engineering may also be taken for statistics credit at the undergraduate or graduate level.

1992-93 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 Dombroski Dunnigan Kirchoff	Pascual Stephenson
104	Introduction to Statistics	3	F,S,SS Althen Davidson Gunnink Kaiser	Pollak Stufken Sukhatme
105	Introduction to Statistics for Engineers	2	F,S Isaacson	Kuiper
201	Applied Regression Analysis for Business	2	F Coffin	Helterbrand
227	Introduction to Business Statistics	5	F,S,SS Hanson Hartfield Kintzinger	Klabacha Peterson
231	Probability and Statistical Inference for Engineers	4	F,S Morse	Rollins
305	Engineering Statistics	3	F,S,SS Lerch Pelkey	Russey Zimmermann
328	Applied Business Statistics	3	F,S Coffin (off-campus)	Groeneveld Meeker
333	Probability and Statistics for Electrical and Computer Engineers	3	F,S Lahiri	Sherman
341	Introduction to Theory of Probability and Statistics	3	F,S Amemiya	Groeneveld
342	Introduction to Theory of Probability and Statistics	3	S	Groeneveld



Students eagerly wait for the posting of Stat 101 and 341 grade slips at the end of final week.

Courses for Graduate Minors and Undergraduates

401	Statistical Methods for Research Workers	4	F,S,SS Bailey Breidt Coffin D. Cox Hotchkiss Kaiser	Kennedy Lorenz Roberts Shelley Stephenson
402	Statistical Design and the Analysis of Experiments	3	F,S D. Cox/ Hinz Stephen-son	Strahan Stufken
403	Nonparametric Statistical Methods	2	F	Groeneveld
404	Statistics for the Social Sciences	3	F	Lorenz
407	Methods of Multivariate Analysis	2	F	Carriquiry
421	Survey Sampling Techniques	3	S	Baker
436	Genetic Statistics for Research Workers	3	S	Bailey
447	Statistical Theory for Research Workers	4	S,SS H. A. David	H. T. David
451	Applied Time Series	3	S	Meeker
480	Statistical Applications of Digital Computers	3	F	Kennedy
481	Computer Processing of Statistical Data	3	S	Marasinghe
490	Independent Study	Var	S,SS Nusser	Vardeman

Courses Primarily for Graduate Students, Major or Minor

500	Statististical Methods	4	F	Hinz
501	Multivariate Statistical Methods	3	S	Koehler
511	Theory and Application of Linear Models	3	S	Harville
512	Design of Experiments	3	F	Stufken
521	Theory of Sample Surveys I	3	S	Breidt
531	Statistics for Quality and Productivity	3	S	Vardeman
534	Ecological Statistics	2	S	Pollak
538	Econometric Statistics	3	F	Amemiya
539	Game Theory	3	F	H. T. David
542	Theory of Probability and Statistics	3	F	H. A. David
543	Theory of Probability and Statistics	3	S	Lahiri
546	Theory of Nonparametric and Asymptotic Methods	3	S	Sukhatme
557	Statistical Methods for Counts and Proportions	3	F	Koehler
579	Introduction to Computer Hardware and Software Systems for Statistical Computing	1	F	Kennedy
580	Statistical Computing	3	F	Kennedy
581x	Computational Methods in Statistics	3	SS	Marasinghe
590 A	Special Topics: Theory	Var	F,SS D. Cox	Kaiser
590 B	Special Topics: Methods	Var	F,SS Kaiser Strahan	Vardeman
599	Creative Component	Var	F,S,SS Amemiya Breidt Carriquiry Cressie H. A. David H. T. David Hinz Kaiser Kennedy Koehler Lorenz Meeker Nusser Sherman Stephenson Strahan Stufken Vardeman	

Courses for Graduate Students, Major or Minor

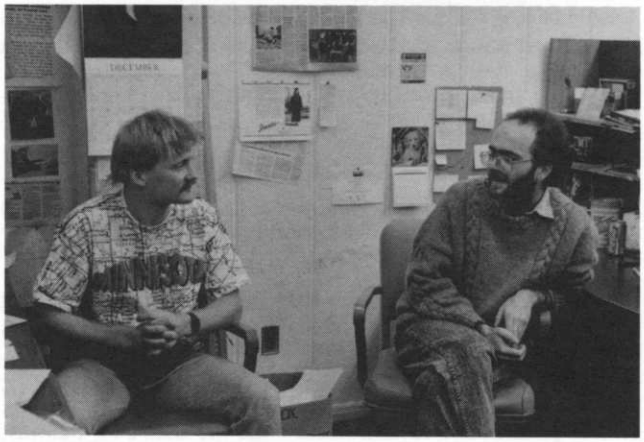
601	Advanced Statistical Methods	3	S	Kaiser
642	Advanced Probability Theory	3	S	Athreya
643	Theory of Estimation and Testing of Hypotheses	3	F	Cressie
647	Multivariate Analysis	3	F	Amemiya
648	Seminar on Theory of Statistics and Probability: Recent Advances in Mathematical Statistics	3	F	Lahiri
699	Research	Var	F,S,SS Amemiya Athreya Carriquiry Cressie H. A. David H. T. David Fuller Harville Kaiser Kennedy Koehler Marasinghe Meeker Rollins Stufken Sukhatme Vardeman	

Graduate Students

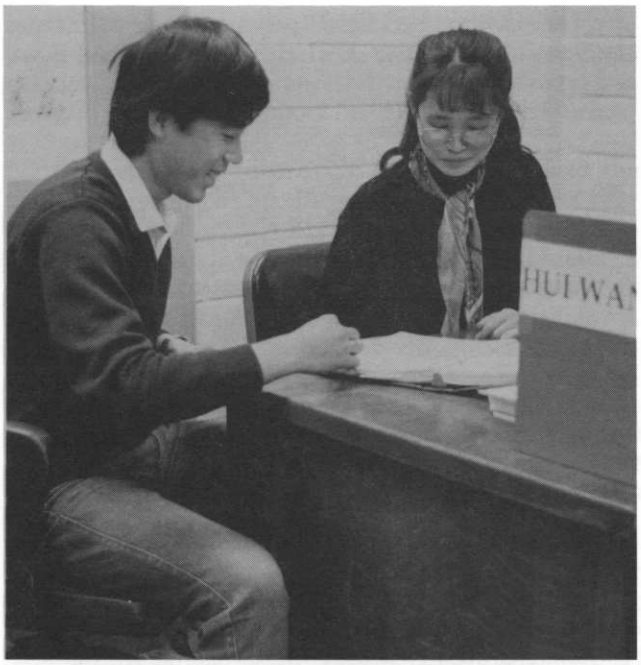
Sixteen Ph.D. degrees and 29 M.S. degrees were granted in the Department of Statistics during the fiscal year. All but two of the masters' degrees were conferred on a nonthesis basis, with candidates completing creative components based on independent study. Abstracts of Ph.D. dissertations and master's theses appear on pp. 37-42.

Sara Peterson was selected as the first recipient of the Vera David Graduate Fellowship in Statistics. The award is designated for a woman who has just completed her first year of graduate studies in statistics at Iowa State. Jaehyung Lee was chosen as the first Ph.D. student to receive an award from the new Holly and Beth Fryer Scholarship Award Fund. Holly Fryer, professor emeritus of statistics at Kansas State (and former director and department head), received the first Ph.D. degree in statistics conferred at Iowa State. Selection occurred during summer 1992 and both awards were announced at the opening Statistical Laboratory seminar in August.

Three Ph.D. students near the end of their programs were awarded $2,500 Shell Oil Company Foundation fellowships in addition to their assistantships for the academic year: Ann Russey Cannon, Jeffrey Helterbrand, and Thomas Loughin.



Tom Loughin, L, and Marek Brabec, R, share an office, as well as statistical consulting responsibilities, while working on their doctorates. Loughin is a Shell Oil Company Foundation fellow this year. Brabec is one of two students awarded the Dan Mowrey Consulting Excellence Award in May.



Ouhong Wang is the first recipient of the Vincent Sposito Statistical Computing Award. Here he talks with Hui Wang, a master's student who is not related to him but shares involvement in National Resource Inventories projects in the Survey Section.

Teaching Excellence Awards were presented to Tom Kirchoff in December and to Rachel Kintzinger and Charles Lerch in May 1993. A Research Excellence Award was given to Seongmo Yoo in May. The Department of Statistics presented the Dan Mowrey Consulting Excellence Award to Marek Brabec and Michael Wallendorf, and the Vincent Sposito Statistical Computing Award to Ouhong Wang in May.

Jeffrey Helterbrand, Hui-Lin Hu, and Jaehyung Lee were initiated into the Honor Society of Phi Kappa Phi on March 23.

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 remain at Iowa State to work toward a doctorate in statistics.

M.S. Recipients

***Mahmood Ahmad** (Summer 1992; John Stufken).

Christine Ann Ashman (Summer 1992; Frederick O. Lorenz) joined Pratt-Whitney in Miami, Florida, as a statistician.

Lori Jean Becker (Summer 1992; W. Robert Stephenson).

Todd Allen Borchert (Summer 1992; David A. Harville) continued to work for Communications Data Services, Des Moines, Iowa, as a marketing database statistician.

Sherry Lisa Bushaw (operations research, Spring 1993; Herbert T. David and John C. Even, Jr.) accepted a position as analyst of performance measurement with the Santa Fe Railway, Schaumburg, Illinois.

Alice Marie Cramer (operations research, Summer 1992; Herbert T. David and Howard Meeks) joined Universal Foods Corporation, Milwaukee, Wisconsin, as a quality improvement specialist.

Ann Renee Dyer (Summer 1992; Stephen B. Vardeman) is a statistical engineer in the Department of Statistics and Quality Engineering, Corning, Inc., Corning, New York.

***Jun-ichiro Fukuchi** (Fall 1992; Krishna Athreya).

Mary Louise Gessner (Summer 1992; William J. Kennedy) accepted a position with Abacus Direct Corporation, Westminster, Colorado, a direct marketing entrepreneurial company.

***Hui-Lin Hu** (Fall 1992; Yasuo Amemiya).

Hui-Yi Huang (Summer 1992; William J. Kennedy) joined Advanced Computer Corporation, Ames, Iowa, as salesman and programmer.

Molly Isbell (Spring 1993; Frederick O. Lorenz) is a statistician/scientist with Radian Corporation, an environmental consulting company, Austin, Texas.

Rachel Evelyn Kintzinger (Spring 1993; Paul N. Hinz) is an SPC analyst with Weyerhaeuser Corporation, Federal Way, Washington.

***Thomas James Kirchoff** (Fall 1992; David F. Cox).

Reiner Michael Kurzhals (Spring 1993; Alicia Carriquiry) is a biostatistician with HOECHST AG Frankfurt/Main Germany.

Fen-Hui Lin (operations research, Summer 1992; Way Kuo and Herbert T. David) is continuing studies toward a doctorate in industrial engineering at Iowa State.

Stella Chueck-Wah Luk (Fall 1992; Kenneth J. Koehler) took a temporary position teaching in the Des Moines Area Community College fall semester 1992; she is now employed as a statistician at Pioneer Hi-Bred International, Johnston, Iowa.

Anita Marie Hinkeldey McVey (Fall 1992; Paul N. Hinz) is working in the Survey Section, Statistical Laboratory, Iowa State University, as research associate.

Christopher Charles Novak (Summer 1992; William Q. Meeker, Jr.) joined the 3M Corporation in St. Paul, Minnesota.

***Savas Papadopoulos** (Summer 1992; Wayne A. Fuller).

Gerald Francis Parise (Summer 1992; Richard A. Groeneveld) is continuing his studies toward a Ph.D. degree in economics at ISU.

***Elizabeth Martha Seminiano Paterno** (Fall 1992; Yasuo Amemiya) is pursuing a joint Ph.D. degree in economics and statistics at ISU.

Sara L. Peterson (Spring 1993; Paul N. Hinz) is a statistical analyst in the Technical Standards Department, Information Resources, Inc., Chicago, Illinois, engaged in marketing research.

Michelle Therese Sawyer (Spring 1993; W. Robert Stephenson) is a data analyst in quality assurance at Mercy and Unity Hospitals, Fridley and Coon Rapids, Minnesota.

Jürgen Schroeder (Spring 1993; Alicia Carriquiry) has joined SIECOR (Siemans and Corning), Neustadt/Coburg, Germany.

Dilek Tali (Summer 1992; William Q. Meeker, Jr.) resumed her position as statistical expert in the Directorate of Financial Statistics, General Directorate of Data Processing, Statistics and Economic Information, Central Bank of the Republic of Turkey, in Ulus, Ankara, Turkey.

Paul Franklin Wenz (Fall 1992; Mervyn Marasinghe) joined Intel Corporation, Chandler, Arizona, as a statistician.

Steven Ray Wilmarth (Fall 1992; Kenneth J. Koehler) held a summer internship in the Statistics Department, Kellogg Company, Battle Creek, Michigan; subsequently he took a position as statistician with Westinghouse Corporation, Richland, Washington.

***Lie-Ling Wu** (Fall 1992; Paul N. Hinz).

Ph.D. Recipients

Abdoulaye Adam (Summer 1992; Wayne A. Fuller) has resumed his position as head of the Statistical Division, Institut

National de la Recherche Agronomique du Niger (INRAN), in Niamey, Niger, West Africa.

Abderrahmane Chakak (Spring 1993; Kenneth J. Koehler) is an assistant professor of statistics, Faculty of Sciences, Université Abdelmalek Essaadi, Tetouan, Morocco.

Joseph H. R. Croos (Summer 1992; Wayne A. Fuller) is working at SAS Institute, Inc., Cary, North Carolina, as a senior research statistician.

Christian Garrigoux (joint Ph.D. in statistics and industrial education and technology, Fall 1992; William Q. Meeker, Jr., and William G. Miller) remained at Iowa State as a postdoctoral research associate with the Center for Nondestructive Evaluation, IPRT, Ames Laboratory of the U.S. Department of Energy, through June 1993, then is returning to a faculty position at the Instituto Technologico y de Estudios Superiores de Monterrey, Mexico.

Philip Wayne Iversen (Spring 1993; Mervyn Marasinghe) has a one-year appointment as senior research associate, Department of Statistics, the University of Newcastle, Newcastle, Australia, through January 1994.

Klaus Wilhelm Lemke (joint Ph.D. in statistics and industrial engineering, Fall 1992; Stephen B. Vardeman).

Jingyu Liu (Summer 1992; H. A. David) has a temporary position in the San Francisco Bay area, California.

Hamid Reza Navvabpour (Fall 1992; Kenneth J. Koehler) is an associate professor in the Department of Statistics, University of Meli, Tehran, Iran.

Sellem Remadi (Summer 1992; Yasuo Amemiya) returned to the École Superieur d'Horticulture, Chott Mariem, Sousse, Tunisia, where he is an associate professor in the Department of Applied Mathematics.

Muhamad Sabran (Summer 1992; Edward Pollak) returned to the Banjarbaru Research Institute for Food Crops (BARIF), Banjarbaru, Indonesia, to continue as statistician.

Todd Michael Sanger (Fall 1992; Wayne A. Fuller) joined Eli Lilly and Company as senior statistician, Statistical and Mathematical Sciences, Lilly Corporate Center, Indianapolis, Indiana.

Kai-One Sriplung (economics and statistics, Spring 1993; Stanley Johnson and Wayne A. Fuller) returned to Bangkok, Thailand.

Margot Helena Tollefson (Summer 1992; Wayne A. Fuller) is working here part time for the Survey Section as a research assistant.

Ibrahim Sorie Yansaneh (Summer 1992; Wayne A. Fuller) accepted a nine-month appointment as research associate, U.S. Bureau of Labor Statistics, Washington, D.C.

Seongmo Yoo (Spring 1993; Herbert T. David) is a research associate at the Electronics and Telecommunications Research Institute in Taejon, Korea.

Yunn-hwu Yu (Summer 1992; Herbert T. David).

M.S. Candidates

Gregg Althen
Peter Anderson
Yudiantri Asdi
Christine Ashman
Lori Becker
Rebecca Benner
Todd Borchert
George G. Brown, Jr.
Sherry Bushaw
Aidan Cardella
Shu-Tien Chen
Hyen-Hyee Cho
Michael Cummings (in absentia)
Bradley Davidson
Todd Defor
Carola Deppe
Mark Dietrich
Joan Qiong Dong
Donald J. Dougherty
Ashraf El-Houbi
Michael Elling
Dennis Field
Matthew Gerdis
Carolyn Goebel
Marjorie Green
Jason Gunnink
David W. Hall
Peter Hanson
Michael Hartfield
Shawkat Hassan
Nan-Jung Hsu
Hsin-Cheng Huang
Hui-Yi Huang
Wynandin Imawan
Molly Isbell
Yoon-Sook Jeon
Je Yeong Jeong
Cheryl Johnson
Philip G. Jones
Hyun-Hee Joo
Kari Jovaag
Dae-Lyong Kim
Sahmyeong Kim
Sara Kind
Rachel Kintzinger
Scott Klabacha
Brian Kluge
Lynn Konecne
Tillman Krahnke
Chinh Kreisberg
Shonda Roelfs Kuiper
Reiner Kurzhals
Kye-Don Lee
Kelli Leonard
Charles Lerch
Li Li
Yang Li
Young Jae Li
Stella Chueck-Wah Luk
James Majure
Steven Mattics
Anita Hinkeldey McVey
Maritza Melèndez-Cuero
Peter Morse
Sol T. Mumey
Soheila Naeini
Timothy Ogamba
Sang-Heon Oh
Gerald Parise
Daniel J. Parks
Francis Pascual
Margarita Paterno
Mark Peters
Sara Peterson
Jason Rupe (operations research)
Rebekah Clark Santiago
Michelle Sawyer
Stephanie Johnson Schaller
Silke Schmidt
Angela Schneider
Jürgen Schroeder
Tae-Sung Shin
David Siev
Richard Sullivan
Andrine Swensen
Dilek Tali
Hsin-Feng Tsai
Chi-Hong Tseng
Elizabeth Uken
Enid Van Valkenburg
Delfino Vargas-Chanes
Anand Vidyashankar
Brigitta Voss
Daniel Walczak
Hui Wang
Christopher Wikle
Steven Wilmarth
Jincheol Yoo
Namkyu Yu
Weiye Zhu

Ph.D. Candidates

Abdoulaye Adam
Mahmood Ahmad
Anthony Baiching An
Gregorio Atúncar
Marek Brabec
Ann Russey Cannon
Abderrahmane Chakak
Bassirou Chitou
Jihwan Cho
Marie Coffin
Joseph H. R. Croos
Rohit Deo
Kevin Dodd
Barbara Dombroski
Gerri M. Dunnigan
Birol Emir
Jun-ichiro Fukuchi
Christian Garrigoux (statistics and industrial education and technology)
Jeffrey Helterbrand
Hui-Lin Hu
Mu-Yeh Huang (statistics and industrial engineering)
Alejandro Islas-Camargo
Philip W. Iversen
Shuen-Lin Jeng
Shin-Soo Kang
Thomas Kirchoff
Seoung-Gon Ko
Jaehyung Lee
Ding-Hwa Lei
Klaus Lemke (statistics and industrial engineering)
Win-Chin Lin
Chih-Yao Craig Liu
Thomas Loughin
David G. McDonald (mostly in absentia) (statistics and meteorology)
Hamid Reza Navvabpour
Bryan Olin
Savas Papadopolous
Elizabeth Paterno (economics and statistics)
Jean Pelkey
Abdul Majid Rana
Sellem Remadi
Daniel Rose
Leroy Rushing
Muhamad Sabran
Todd Sanger
Pradipta Sarkar
Chungyeol Shin
Kai-One Sriplung (economics and statistics)
Greg Stenback
Jürgen Symanzik (statistics and computer science)
Hiroshi Takahashi (animal science and statistics)
Margot Tollefson
Michael Wallendorf
Ouhong Wang
Lie-Ling Wu
Ilker Yalçin
Ibrahim Yansaneh
Seongmo Yoo
Zugeng Zheng
Alan Zimmermann

Mike Hartfield taught introductory and MBA statistics courses for Drake University during fall, spring, and summer terms. Peter Morse completed a

statistics cooperative internship with Weyerhaeuser, Hot Springs, Arkansas, in December 1992. He was succeeded there by Peter Hanson for the spring semester. Greg Althen took a research assistantship position in atmospheric science at Iowa State for summer 1993.

Iowa STAT-ers

The Iowa STAT-ers, the Department of Statistics graduate student organization, offers opportunities for social and intellectual interaction among members and faculty. This active group of 70 students has gained recognition from graduate departments at ISU and from other statistics departments for its activities and its high level of participation.

In the 1992-93 year, STAT-er activities included a bi-weekly seminar series and a reading group. The seminar series, organized by vice presidents Bryan Olin and Tom Kirchoff, featured ISU faculty members, students, and company representatives who spoke to graduate students about various topics in the field of statistics. The Reading Group, coordinated by Dan Parks, met bi-weekly on Wednesday and discussed interesting papers about statistics and mathematics.

Social activities were arranged by Sara Peterson and Jürgen Schroeder. These activities included Friday Afternoon Club (FAC, a weekly social gathering), a beginning-of-the-year pizza party and picnic, a tennis tournament, a fall camping trip to Ledges State Park, a Halloween party, a Winter Party, a barbecue and foreign beer party, and an end-of-the-year pizza party.

Another popular STAT-er activity was intramural sports, organized by Aidan Cardella and Gregg Althen. This year the STAT-ers had teams or individuals participating in sports such as flag football, broomball, three-player basketball, five-player basketball, wallyball*, indoor soccer*, outdoor soccer, 8-ball pool, softball, volleyball, and frisbee.

Fundraisers this year included birthday calendars and a STAT-er cookbook. The calendar featured group photos of each month's birthday students. The cookbook, back from last year by popular demand, included recipes submitted by graduate students, faculty members, and support staff.

Officers for the 1992-93 year were Rachel Kintzinger, president; Bryan Olin and Tom Kirchoff, vice presidents; Chuck Lerch, treasurer; and Molly Isbell, secretary. Sara Peterson and Jürgen Schroeder served on the social committee; Ilker Yalçin was the club's international representative. Jeff Helterbrand attended statistics faculty meetings as the student representative. Alicia Carriquiry was faculty advisor to the student club.

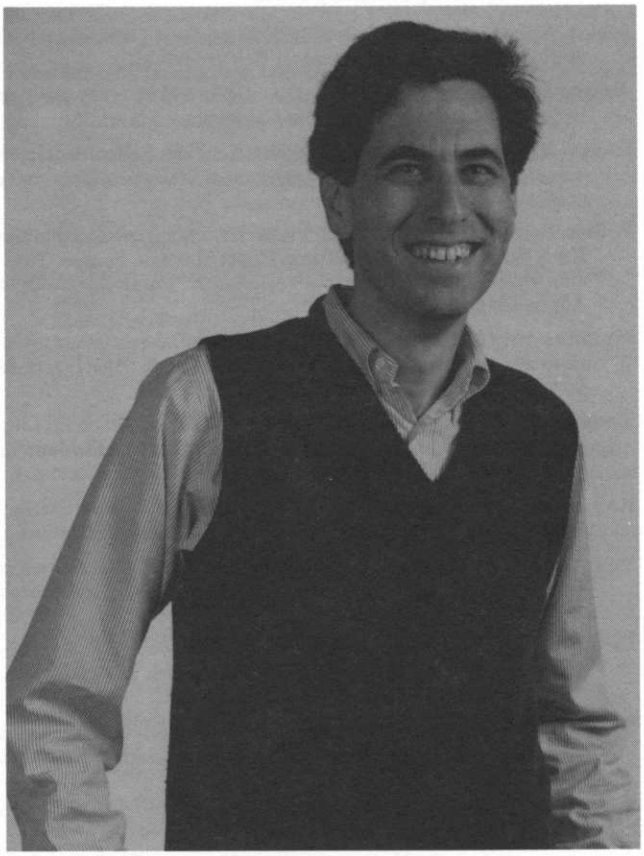
Three Iowa STAT-er members were elected to serve as senators in the all-university Graduate Student Senate: Rachel Kintzinger, Reiner Kurzhals, and Sara Peterson.

* sports in which STAT-ers won the championship

Mu Sigma Rho

Mu Sigma Rho is the national honor society for statistics. Founded in 1968 as an outgrowth of an active undergraduate statistics club at Iowa State University, it has grown to 17 chapters across the United States. Mu Sigma Rho promotes activities designed to help in the statistical and general scholarly development of its members.

This year four undergraduate statistics majors and 16 graduate students, majors and minors in statistics, were recognized for their academic achievement--especially in the field of statistics--by election into the Iowa Alpha Chapter. Faculty members F. Jay Breidt and Peter Sherman were elected for their achievements in the field of statistics. Sanford Weisberg was made an honorary member.



Sanford Weisberg, Mu Sigma Rho lecturer

The 22nd annual Mu Sigma Rho lecture was given by Sanford Weisberg, School of Statistics, University of Minnesota. His talk, entitled "An Introduction to Regression Graphics," was presented to a large audience on April 28. Although graphics hardly need an "introduction," the on-going revolution in computing can lead to a revolution in statistical graphics as well. The seminar presented a mix of theory and applications of statistical graphics. The audience was able to see in action the static and dynamic graphics discussed by Weisberg, who used a laptop computer and a projection system. The seminar demonstrated some new techniques developed using XLISPSTAT.

Professor Weisberg received his A.B. degree in statistics from Berkeley in 1969 and his Ph.D. in statistics from Harvard in 1973. He has been at the University of Minnesota for over 20 years. He is currently chair of the American Statistical Association Statistical Computing Section. Weisberg is the author of many articles and has written text books dealing with regression and regression diagnostics, the last-mentioned being with Dennis Cook.

This year's officers were Thomas Loughin, president; Ilker Yalçin, vice president; and Bryan Olin, secretary-treasurer. W. Robert Stephenson served as advisor to the local chapter. He is also national president of Mu Sigma Rho.

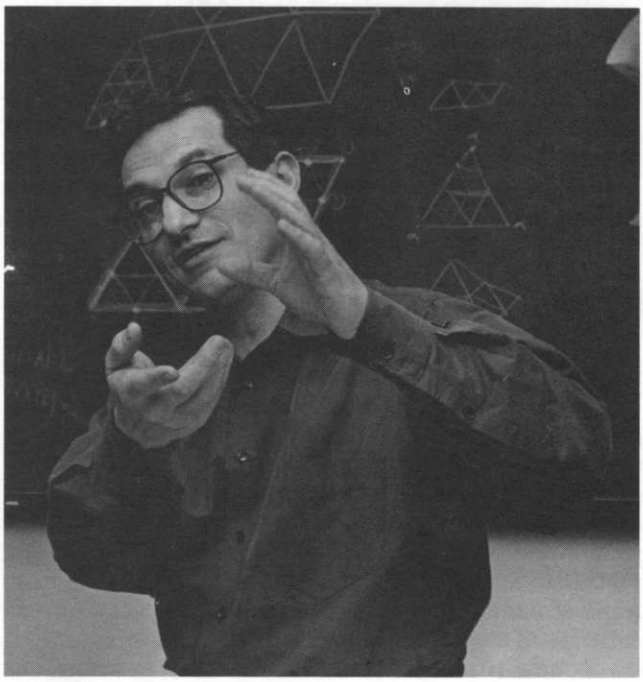
Snedecor and Bancroft Awards

The 1993 George W. Snedecor Award in Statistics for the most outstanding Ph.D. candidate in the Department of Statistics was presented to Rohit S. Deo. Selection was made from those students completing the doctoral preliminary examination in 1992. Deo came here in 1990 after completing a master's degree in statistics, with distinction, at the University of Poona. He has been a research assistant in the Survey Section, working on joint research projects headed by Wayne Fuller. The award honors the founder and first director of the Statistical Laboratory.

The T. A. Bancroft Award for 1993 was given to Paul J. Boettcher, a graduate student in animal science with a statistics minor. This award recognizes achievements in statistics by a doctoral student who has a declared minor in statistics or a joint major in statistics and another area. Students who completed prelims in the 1992 calendar year were eligible. The award honors Theodore A. Bancroft, director of the Statistical Laboratory and head of the Department of Statistics from 1950 to 1972. Boettcher completed B.S. and M.S. degrees in dairy science and animal science, respectively, at the University of Minnesota and received Graduate College and Land-O-Lakes (John Brandt Memorial) fellowships there, as well as an award in 1991 as outstanding master's degree student. He came to Iowa State as a graduate research assistant for doctoral studies in summer 1991. He now has publications based on work at Minnesota. His current research interests concern the interface of molecular biology and applied animal breeding, working with A. E. Freeman, Curtiss Distinguished Professor in Agriculture.

George Zyskind Memorial Lecture

The 17th George Zyskind Memorial Lecture was given by Persi Diaconis, who spoke on "The Search for Randomness," on November 10. He gave a Statistical Laboratory seminar on the following day (see p. 51). The Zyskind lecture series honors the late George Zyskind, professor of statistics at ISU from 1959 to 1974.



Persi Diaconis, Zyskind lecturer

Diaconis has been a professor in the Department of Mathematics, Harvard University, since 1987. Previously he was at Bell Labs and then for 13 years at Stanford. He received his B.S. degree at City College of New York and graduate degrees at Harvard. Diaconis is author of the book *Use of Group Representation in Probability and Statistics* and a fellow of the Institute of Mathematical Statistics and the American Academy of Arts and Sciences. He has been awarded the Rollo Davidson Prize by Cambridge University and the MacArthur Foundation Prize. He is also known for his avocation, magic tricks.

B. V. Sukhatme Memorial Lecture

The 10th B. V. Sukhatme Memorial Lecture was presented by James Durbin on May 5, 1993. He spoke on "Time Series Analysis Based on State Space Models for Non-Gaussian Observations." Durbin received B.A. and M.A. degrees at St. John's College, Cambridge, then was employed at Cambridge for two years. He joined the London School of Economics and Political Science in 1950, becoming professor of statistics in the Department of Statistical and Mathematical Sciences, London School of Economics and Political Science, in 1961. Since 1988 he has held visiting positions at the University of California-Santa Barbara, National University of Singapore, University of Trento, Italy, the U.S. Bureau of the Census, and Ohio State University. Durbin is a past president of the Royal Statistical Society and of the International Statistical Institute. He is a fellow of the Econometric Society, the Institute of Mathematical Statistics, and the American Statistical Association. He has published extensively on serial correlation, other time series and econometrics, sample

survey methodology, goodness-of-fit tests and the sample distribution function, and other areas of probability and statistical theory.

Durbin's lecture was followed by the spring meeting of the Iowa Chapter of the American Statistical Association. The Sukhatme lecture series honors the late B. V. Sukhatme, who was professor of statistics at Iowa State from 1968 to 1979.

Undergraduate Students

The George W. Snedecor Undergraduate Statistics Award for 1992-1993 was given to Angelita Dawn Nason on May 5, 1993, by Dean L. Isaacson, department head. She has a double major in mathematics and statistics, and was also recognized as the highest graduating senior in statistics at the 1993 Scholarship Recognition Dinner on April 20. The undergraduate Snedecor Award recognizes the junior or senior statistics major who has demonstrated the highest level of academic achievement and scholarship. It consists of a certificate and a $200 cash recognition.

A new undergraduate scholarship is being endowed by the Edward Schillmoeller family. Ed Schillmoeller, senior vice president of A. C. Nielsen Company, Northbrook, Illinois, is a 1953 alumnus of Iowa State University in mathematics and the father of Michael and Laura, who received degrees in statistics here--B.S. and M.S., respectively, in 1979 and 1992.

The Eli Lilly/Department of Statistics scholarship is given to an entering freshman student in the fall, who intends to major in statistics; the award consists of $1,000 for the first year of study. Selection is on the basis of excellent academic performance in secondary school and demonstrated potential for success in statistics. Vera Boulaevskaia was selected in the spring to receive a scholarship for the 1993-94 year.

On April 28, five undergraduate majors were inducted into Mu Sigma Rho, the national statistics honor society. These students were Heather E. Doane, David A. Jensen, Kelley Jo Mechem, David L. Ramsey, and Grant S. Runyan.

Fourteen students received B.S. degrees in statistics during the period July 1, 1992, to June 30, 1993. 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.

***Shawn Marcel Bates** (Spring 1993).

Richard Alan Burkle (Spring 1993) is a teller in Boatmen's National Bank, Des Moines, Iowa.

Brian Neil Denker (Fall 1992) is a trade support analyst, Chicago Research and Training, Ltd., Chicago, Illinois.

Jeffrey Todd Eickholt (Fall 1992) is a data analyst at Mayo Clinic, Rochester, Minnesota.

Lenny Magwani Hood (Fall 1992).

David Alan Jensen (with distinction, Spring 1993) is a statistician in the Physical Plant Office, University of Iowa.

Tracy Lee McKee (Spring 1993) has taken temporary employment in London, England.

***Angelita Dawn Nason** (mathematics and statistics, with distinction, Spring 1993).

David Lee Ramsey (Spring 1993) accepted a position as statistical analyst with the Procter and Gamble Company, Cincinnati, Ohio.

Grant Scott Runyan (chemical engineering and liberal arts and sciences: mathematics and statistics, Spring 1993) will begin graduate studies in statistics at the University of Minnesota.

Ronald Michael Schewe (Spring 1993) is a research associate with the Procter and Gamble Company, Cincinnati, Ohio.

C. Adam Sharp (Spring 1993) is a product analyst, Information Resources Incorporated, Chicago, Illinois.

Chenwen Yeh (Spring 1993).

***Weiye Zhu** (Summer 1992).

Angelita Nason has a cooperative statistics internship at Mayo Clinic, Rochester, Minnesota, for summer 1993. Heather Doane, David Ramsey, and Ronald Schewe--who worked as data analysts with ICI (Garst Seed Company), Slater, Iowa, during summer 1992--continued to work part-time there throughout the 1992-93 academic year, with Doane's activity extending through summer 1993.

Statistics Club

The purpose of the Statistics Club (STAT CLUB) is to promote interest in statistics among undergraduate students at Iowa State University. The first activity of the year was the traditional pizza party in September. We were a little late getting started as we had to find officers for the club. It turned out for the best with Shawn Bates serving as president, Adam Sharp as vice president, and Lori Mattusch as secretary/treasurer. Mattusch is a mathematics major with an interest in statistics and actuarial science. Sharp also served as the Department of Statistics representative to the College of Liberal Arts and Sciences Council. W. Robert Stephenson serves as advisor to the club.

Chris Whitney Helterbrand, a graduate of the ISU Department of Statistics (M.S. 1991), spoke to the STAT CLUB in November. She graduated from St. Olaf College in Northfield, Minnesota, with a degree in economics and statistics. Before coming here for graduate school, she was an intern at Process Management Institute (PMI) in Bloomington, Minnesota. As a graduate student, she worked as a research assistant for the Iowa Quality Coalition. Helterbrand is currently employed by the Center for Continuous Quality Improvement in Ames. As you might have guessed, she spoke on quality improvement, specifically the connection between quality improvement efforts and statistics. She mentioned that, with her clients, the statistical methods used to attack quality problems are not very sophisticated. As the quality problems get more difficult, more complex statistical methods will be needed.

Two former undergraduate statistics majors, Diane Hamilton (B.S. 1988) and Holly Vancil (B.S. 1992), spoke to the club in March. They work for ICI Seeds, formerly Garst Seeds, in Slater, Iowa. There are one other B.S., two M.S., and two Ph.D. statisticians in their group. They are involved with the

research conducted by breeders on new and old varieties of corn and other crops. They use the computer, and SAS, to analyze the mounds of data generated in field trials across Iowa and the world. In addition to computing and statistics, Vancil and Hamilton stressed the need for good communication skills. Three of our current undergraduate statistics majors, Heather Doane, Dave Ramsey, and Ron Schewe, worked part time for ICI Seeds during the school year.

The STAT CLUB was a cosponsor of this year's Mu Sigma Rho lecture. Together with the Department of Statistics, the club also supports the STAT CLUB Award. The recipient of this award for 1992-93 is Kelley Mechem, a junior statistics major.

Seminars

The series of regular weekly seminars offered by the Statistical Laboratory and the Department of Statistics throughout the 1992-93 year was planned by H. A. David and Soumendra Lahiri. Bryan Olin and Thomas Kirchoff were co-chairs for the Iowa STAT-er seminar series.

Statistical Laboratory Seminars

Summer 1992

July 7 Least squares estimation for repeated surveys. Ibrahim Yansaneh

8 Variance estimation under random imputation. Margot Tollefson

8 Statistical problems in fission track analysis. Geoffrey N. Laslett, CSIRO Division of Mathematics and Statistics, Melbourne, Australia

9 Tests of rank in multivariate mixed-effect model analysis. Sellem Remadi

10 Covariance estimation for characteristics of the Current Population Survey. Abdoulaye Adam

Fall 1992

August 26 TQM within a university Statistics Department. Dean L. Isaacson

September 2 The home-court advantage: How large is it and does it vary from team to team? David Harville

9 A second-order correct bootstrap procedure for the mean of lattice variables. Soumendra Nath Lahiri

16 A natural extension of a stepwise Bayes procedure. Eiichiro Funo, Department of Economics, Kanto Gakuin University, Yokohama, Japan

23 Some problems in ROC studies. Shashikala Sukhatme

30 Bayesian monitoring for clinical trials. Thomas A. Louis, Biostatistics Division, University of Minnesota School of Public Health

October 7 Estimation of the parameters of the non-truncated marginal of a truncated bivariate normal distribution. Richard A. Groeneveld

9 Statistical inference for heavytailed distributions. Wei Wu

14 Robust tests for survival data involving a single continuous covariate. Michael P. Jones, Biostatistics Division, Department of Preventive Medicine, University of Iowa

October 21 Multitiered experiments and their analysis. C. J. Brien, University of South Australia and University of Wisconsin-Madison

28 Estimating the effects of age on the severity of injuries received by drivers and front-seat passengers in head-on vehicular collisions. Mack C. Shelley II

November 4 Evaluation of experimental designs using dynamic graphics. Phil Iversen

6 Reliability analysis of components subject to degradation failure with in-service inspections. Christian Garrigoux

11 Analysis of random algorithms. Persi Diaconis, Department of Mathematics, Harvard University

18 Trend-free and nearly trend-free designs: Some selected results. John Stufken

19 Statistical methods for multivariate survival data. Hamid Reza Navvabpous

December 2 Nonlinear factor analysis. Yasuo Amemiya

9 Regression estimation in the presence of measurement error. Wayne A. Fuller

16 A Bayesian approach to sequential assembly experiments. Klaus Llemke

Spring 1993

January 18 An application of geostatistical tools to design-based variance estimation. Cliff Cordy, Department of Statistics, Oregon State University

20 Monte Carlo Markov chain sampling for evaluating multidimensional integrals with application to Bayesian computation. Ming-Hui Chen, Department of Statistics, Purdue University

22 Some methods of constructing multivariate distributions. Abderrahamane Chakak

25 Stability of iterated probability distributions. Burkhard Rauhut, Institute for Statistics and Mathematical Economics, Technical University of Rhineland and Westphalia

February 4 Bayesian optimal designs for approximate normality. Merlise A. Clyde, School of Statistics, University of Minnesota

8 Optimal designs for a bivariate logistic regression model. Mark A. Heise, Department of Statistics, Virginia Polytechnic Institute and State University

11 Linear model selection. Jun Shao, Department of Mathematics, University of Ottawa

17 Variance component estimators for binary data derived from the dispersion-mean model. Deborah L. Reichert, Cornell University

22 Exploring multidimensional data with the grand tour and projection pursuit. Dianne Cook, Department of Statistics, Rutgers University

March 3 Some consequences of partial selfing and partial full sib mating. Edward Pollak

17 On Pitman domination. Seongmo Yoo

24 Planning accelerated life test plans with two or more experimental factors. William Q. Meeker, Jr.

25 Markov chain Monte Carlo estimates of probabilities on complex structures. Shili Lin, Department of Statistics, University of Washington

April 2 Some distribution-free tests for the equality of cause-specific hazard rates. Subhash C. Kochar, Indian Statistical Institute and Department of Statistics and Actuarial Science, University of Iowa

April 7 Estimation and detection of change-points in nonparametric regression models. Paul L. Speckman, Department of Statistics, University of Missouri-Columbia

14 Assessing the fit of a model to a contingency table using mixture methods. Támas Rudas, Institute of Sociology, Eötvös University, Budapest, Hungary, and Department of Mathematics, University of Toledo

21 Projected partial likelihood. Susan Murphy, Department of Statistics, Pennsylvania State University

Summer 1993

May 18 Partitioning forecast errors in numerical weather prediction models. David Giles McDonald, Department of Geological and Atmospheric Sciences and Department of Statistics, Iowa State University

June 2 Inference about the fixed and random effects in a mixed-effects linear model: An approximate Bayesian approach. Alan G. Zimmermann

30 Simple and efficient methods for constructing bootstrap confidence intervals. Kim-Ahn Do, Faculty of Information Sciences and Engineering, University of Canberra, Australia

Special Lectures and Seminars

November 10 George Zyskind Memorial Lecture: The search for randomness. Persi Diaconis, Department of Mathematics, Harvard University

April 28 Mu Sigma Rho Lecture: An introduction to regression graphics. Sanford Weisberg, School of Statistics, University of Minnesota

May 5 Sukhatme Memorial Lecture: Time series analysis based on state space models for non-Gaussian observations. James Durbin, Department of Statistical and Mathematical Sciences, London School of Economics and Political Science

Iowa STAT-ers Seminar

September 22 An American in Dortmund. Mike Hartfield

28 The excavating technique in matrix theory. Anthony B. An

October 26 Evaluation of a population monitoring methodology for Discus maclintockii, an endangered species. Michael J. Wallendorf

November 10 Computer-aided response surface methods for nonstatisticians. John W. Patterson, Department of Industrial Engineering and Manufacturing Systems Engineering, Iowa State University

30 Working at a pharmaceutical company. Vincent Shu, Abbott Laboratories

February 1 GIS research in landscape planning. Paul Anderson, Department of Landscape Architecture, Iowa State University

March 22 A simple alternative to the regular statistical model for the analysis of field experiments with Latin square designs. C. Philip Cox

30 Statistical consulting at Shell Oil USA. Daniel M. Wardrop, Shell Oil USA

April 5 On bootstrapping! Soumendra N. Lahiri

12 G*E applications: Stability analysis, selection of hybrids, and strip-testing. Ronald P. Mowers, ICI Seeds

Editor's Note

This issue of the Annual Report is in the nature of an experiment. In previous years the university Publications Office helped with final preparations of copy and art for printing. That office has now been closed and as a result we are venturing into desktop publishing. The effort, enabled by new software and a new PC, has been a time-consuming, up-and-down process of discovery, frustration, and adventure. As the editor gains experience, fewer quirks and a more timely publishing schedule may be expected. As has been the case for the last two issues, the cover stock for the Annual Report is made from recycled paper.

Photo Credits

The photo of the "Mt. Rushmore" statisticians on p. 2 was taken by the ISU Photo Service. P. 4 presents a black-and-white version of a photograph obtained from the Kempthornes, taken in Greece. Photos from the Winter Party are provided by Iowa STAT-ers. The photos of Sanford Weisberg and Persi Diaconis on pp. 48 and 49 are provided through the courtesy of the guest lecturers and their universities. The remaining photos and the layout design are by Jauvanta Walker.

A publication of the Statistical Laboratory
Iowa State University

Editor, Jauvanta M. Walker