Program of Study

The Department of Statistics offers undergraduate programs leading to the Bachelor of Arts degree and graduate programs leading to the Master of Arts and Doctor of Philosophy degrees.

The undergraduate program is aimed both at preparing students for careers in statistics and at serving as a good foundation for graduate work in the area. The undergraduate program is quite flexible and students are encouraged to develop an outside area of application wherein statistical methodology is useful. These areas of application include economics, biology, accounting, finance, marketing, management, medicine, psychology, sociology, engineering, agriculture and atmospheric science.

The graduate program provides opportunities for graduate study and thesis direction in various areas of probability and statistics, both theoretical and applied. The Statistical Consulting Center, located in the Mathematical Sciences Building, provides opportunities for statistical consulting and assists faculty and graduate students in cooperative research with people in other areas.

The field of statistics is an expanding one, both at the theoretical and applied levels. In addition to the demand for statisticians at academic institutions, statisticians also are in demand not only in the business community and various branches of state and federal government, but also in the biomedical areas.

Research Facilities

Faculty and graduate students of the Department of Statistics are housed together in the Mathematical Sciences Building, along with the Departments of Mathematics and Computer Science. There is an excellent Mathematical Sciences Library located in the building. Also located in this building is the University Computer Network. Access to the central computer can be obtained through several regional terminals located in the building.

Financial Aid

Many graduate students are supported on teaching assistantships or research assistantships. Stipends for half-time teaching assistants and research assistants for the '82-'83 academic year range from $6,200 to $6,515. Funds also may be earned by both undergraduates and graduates through jobs such as paper grading and working in the Statistical Laboratory. Teaching duties normally consist of teaching six hours per week. Fellowships and summer support are also available.
Cost of Study

Cost of Living

Student Group

The Community

The University

lectures, concerts, films, plays, exhibits and other cultural and recreational activities are provided by the University.

Courses and Descriptions

31 ELEMENTARY STATISTICS (3). Collection, presentation of data; averages; dispersion; introduction to statistical inference, correlation and regression. Prerequisite: Math 10. f,w,s, cor.

150 INTRODUCTION TO PROBABILITY AND STATISTICS I (3). Designed primarily for students in College of Business and Public Administration. Prerequisite for 250. This two-semester sequence covers fundamentals of probability and statistics for students who have some knowledge of calculus. Probability theory; random variables; expectation; probability distributions. One section uses the computer to assist in learning statistical concepts. No prior computing experience necessary. Prerequisite: Math 61. f,w,s.

198-199 HONORS (2 hrs. each). Special work for Honors candidates in Statistics.

207 STATISTICAL ANALYSIS (3). For graduate students and superior seniors with no previous training in statistics. Intensive study of concepts, techniques of statistical analysis, and their applications. Prerequisite: Math 10 or equivalent. f,w,s.

234 INTERMEDIATE STATISTICS (3). Probability concepts; elements of sampling; tests of hypotheses; methods of estimation; regression and correlation. Prerequisite: 31. f,w,s.

250 INTRODUCTION TO PROBABILITY AND STATISTICS II (3). This course is a continuation of Statistics 150. Estimation; hypothesis testing; regression; correlation; statistical decision theory; nonparametric methods. One section uses the computer to assist in learning statistical concepts. No prior computing experience necessary. Prerequisite: 150. f,w,s.

300 PROBLEMS (1-3). Independent investigations. Reports on approved topics. Prerequisite: consent of faculty member involved. f,w,s.

301 TOPICS (cr. arr.) Organized study of selected topics. Subjects and earnable credit may vary from semester to semester. Repeatable with departmental consent. Prerequisite: junior standing and instructor’s consent.

304 STATISTICAL COMPUTING (3). Intended to acquaint students with requisite computing tools for organizing, summarizing, and manipulating large data sets, applying various statistical pro-
307 NONPARAMETRIC STATISTICAL METHODS (3). Statistical methods when the functional form of the population is unknown. Applications emphasized. Comparisons with parametric procedures. Goodness-of-fit, chi-square, comparison of several populations, measures of correlation. Prerequisite: 207 or 234 or equivalent.

320 INTRODUCTION TO MATHEMATICAL STATISTICS (3) (same as Mathematics 320). Introduction to theory of probability and statistics using concepts and methods of calculus. Prerequisite: Math 201 or instructor's consent. f,w,s.

325 INTRODUCTION TO PROBABILITY THEORY (3) (same as Mathematics 325). Probability spaces; random variables and their distributions; repeated trials; probability limit theorems. Prerequisite: Math 201 or instructor's consent. f,w,s.

326 STATISTICAL INFERENCE I (3) (same as Mathematics 326). Sampling; point estimation; sampling distribution; tests of hypotheses; regression and linear hypotheses. Prerequisite: 325.

328 INTRODUCTION TO STOCHASTIC PROCESSES (3). Study of random processes, including topics selected from: Markov chains, birth and death processes, random walks, Poisson processes, renewal theory, Brownian motion and Gaussian processes, white noise and spectral analysis, applications such as queueing theory, sequential probability ratio test. Prerequisite: 325.

329 APPLIED PROBABILITY (3). Probability in its applied context. Designed for seniors and beginning graduate students. Construction of probability models. Examples in physical and behavioral sciences. Multivariate normal and exponential distributions, extreme value distributions, stochastic processes, queueing. Prerequisite: 325 or equivalent.

360 INDUSTRIAL STATISTICS (3). Study of probability and statistical techniques as applied in controlling quality of manufactured products. Prerequisite: 207 or 234 or 250 or 320 or 326.

370 SAMPLING TECHNIQUES (3). Theory of probability sampling designs. Unrestricted random sampling, Stratified sampling, Cluster sampling, Multi-stage of subsampling. Ratio estimates, Regression estimates, Double sampling. Prerequisite: 207 or 234 or 250 or 320 or 326.

375 OPERATIONS RESEARCH (3). Study of mathematical and statistical models employed in operations research. Prerequisite: 207 or 234 or 250 or 320 or 326. f.

380 STATISTICAL FORECASTING (3) (same as Management 380, Marketing 380, Finance 380).

385 REGRESSION AND CORRELATION ANALYSIS (3). Measurement of relationships among variables including multiple regression, partial correlation, and some nonparametric methods. Prerequisites: 207 or 234 or 250 or 320 or 326 & Math 80. f,w.

395 ANALYSIS OF VARIANCE (3). Study of problems of measuring separate and joint effects of two or more factors on results of an experiment. Prerequisite: 207 or 234 or 250 or 320 or 326. f,w,s.

400 PROBLEMS AND SPECIAL READINGS (cr. arr.) Approved reading and study, independent investigations, and reports on approved topics. Prerequisites: graduate standing & consent of faculty member involved. f,w,s.


411 STATISTICS SEMINAR (cr. arr.)

416 STATISTICAL CONSULTING (3). Statistical consulting under faculty supervision. Formulation of statistical problem. Planning of surveys and experiments, Statistical Computing. Interpretation and summarization of results in statistical practice. (Prerequisite: 326 and 464 or 385 and 395; and instructor's consent.)

420 BAYESIAN STATISTICS (3). Bayes theorem, subjective probability as a measure of belief, likelihood principle, noninformative priors, conjugate priors, nuisance parameters, statistical decision, backwards induction, stable estimation, Bayesian hypothesis testing, applications. Prerequisites: 326, Math 331, and Math 302.

423 EXPERIMENTAL DESIGN (3). Examination and analysis of modern statistical techniques applicable to experimentation in social, physical, or biological sciences. Prerequisite: 395 or instructor's consent.

ADVANCED PROBABILITY (3) (same as Mathematics 440). Measure theoretic probability theory. Characteristic functions; conditional probability and expectation; sums of independent random variables including strong law of large numbers and central limit problem. Prerequisites: 325 or instructor's consent.

STOCHASTIC PROCESSES (3) (same as Mathematics 441). Markov processes, martingales, orthogonal sequences, processes with independent and orthogonal increments, stationarity, linear prediction. Prerequisite: 440.

SPECIAL TOPICS IN STATISTICS (cr. arr.) Prerequisite: instructor's consent.


ADVANCED INFECTION (3). Uniformly most powerful tests; unbiasedness; invariance; the general linear hypothesis; Bayes and minimax procedures; sequential tests. Prerequisite: 460, Math 302 or 310, or instructor's consent.

LINEAR MODELS I (3). Elementary regression (curve fitting) and analysis of variance (crossed classification, blocking, and analysis of covariance) applied to scientific examples. Various numerical examples will be provided. Prerequisites: Calculus, a first course in statistical inference.

LINEAR MODELS II (3). Mathematically more mature study and application of the general linear model. Other related regression and analysis of variance models. Prerequisite: 464, Corequisite: 326, Math 302 or 310, Math 331.

MULTIVARIATE ANALYSIS (3). Distribution of sample correlation coefficients. Derivation of generalized $T^2$ and Wishart distributions. Distribution of certain characteristic roots, vectors. Tests of hypotheses about covariance matrices and mean vectors. Discriminant analysis. Prerequisite: 403 or instructor's consent.

THEORY OF NONPARAMETRIC STATISTICS (3). Estimation, hypothesis testing, confidence intervals, etc., when functional form of the population distribution is unknown. Prerequisite: 403 or instructor's consent.

Program 1

Mathematics

Background in matrix algebra, advanced calculus, and elementary computer programming, equivalent to Mathematics 331, Mathematics 302, and Computer Science 104, is presumed.

Statistics

307, Nonparametric Statistical Methods (3)
325, Introduction to Probability Theory (3)
326, Statistical Inference I (3)
329, Applied Probability (3), or 328, Introduction to Stochastic Processes (3)
370. Sampling Techniques (3)
375. Operations Research (3)
403. Statistical Inference II (3)
420. Bayesian Statistics (3)
430. Life Testing and Reliability (3)
464. Linear Models I (3)
465. Linear Models II (3)
466. Multivariate Analysis (3)

PROGRAM 2
Mathematics
  Background same as for Program 1.
Statistics
  307. Nonparametric Statistical Methods (3)
  325. Introduction to Probability Theory (3)
  326. Statistical Inference I (3)
  328. Introduction to Stochastic Processes (3)
  370. Sampling Techniques (3)
  403. Statistical Inference II (3)
  470. Theory of Nonparametric Statistics (3)

PROGRAM 3
This program presumes that the student has not had any background in computer programming, matrix algebra, or advanced calculus.
Computer Science
  201. Programming as a Research Tool (3)
Mathematics
  302. Advanced Calculus with Applications (3)
  324. Numerical Linear Algebra (3), or 323. Numerical Analysis (3)
  331. Matrix Theory (3)
Statistics
  307. Nonparametric Statistical Methods (3)
  325. Introduction to Probability Theory (3)
  326. Statistical Inference I (3)
  370. Sampling Techniques (3)
  403. Statistical Inference II (3)
  470. Theory of Nonparametric Statistics (3)

PROGRAM 4
Background in advanced calculus and matrix algebra equivalent to Mathematics 310, 311, and 331 is presumed.
Mathematics
  404. Theory of Functions of Real Variables I (3)
  406. Measure Theory (3)
Statistics
  326. Statistical Inference I (3)
  329. Applied Probability (3), or 328, Introduction to Stochastic Processes (3)
  403. Statistical Inference II (3)
  470. Theory of Nonparametric Statistics (3)
Special courses are offered under the number Statistics 452. A student should watch these and make a change in his or her program to accommodate them if they are of interest.

The Ph.D. Program
The Ph.D. program is very flexible. In order to qualify, a student must take an exam on the basic course work in mathematics, theoretical statistics and applied statistics. A student joining with a Bachelor's degree usually takes it during the last part of his Master of Arts program. A student joining with a Master's degree usually takes it at the end of his first year.

Faculty
Wallace E. Franck, Associate Professor of Statistics. Ph.D., University of New Mexico, 1964. Prior to completing his Ph.D. he worked as a physicist and mathematician for the U.S. Civil Service. His general area of specialization is probability theory and mathematical statistics. Current research interests include hypothesis testing and order restricted inference. His publications include, "On a Test for Inequality of Two Exponential Distributions," in Technometrics, 1973; and "The Most Powerful Invariant Test of Normal Versus Cauchy: With Applications to Stable Alternatives," Journal of the American Statistical Association, 1981.

John E. Hewett, Professor of Statistics. Ph.D., State University of Iowa 1965. His areas of specialization include multivariate analysis, distribution theory and biostatistics. His current research interests are double sample tests of hypotheses, tests of hypotheses pertaining to regression curves and nonparametric tests pertaining to multivariate populations. He is currently consulting with people who are using statistical methods in their own biological and medical research. Present Director of Statistical Consulting Center. Some of his publications are "Some Two-Stage k-Sample Tests," JASA 1979; "Comparison of Two Populations With Multivariate Data," Biometrics 1980; "Comparison of Two Regression Lines Over a Finite Interval," Biometrics 1982.

James E. Holstein, Associate Professor of Statistics and Director of Undergraduate Studies. Ph.D., State University of Iowa 1962. He is in charge of the multisection beginning course in statistics and the statistics laboratory. His areas of specialization include regression analysis and design of experiments. He serves as a consultant to graduate students, faculty, and staff on campus as well as to various government agencies and private industry. In addition to his published articles, he and Professor Willcox are joint authors of "An Introduction to Probability." published by Lucas Brothers in 1965. Fellow of the American Association for the Advancement of Science.

Shrinivas K. Katti, Professor of Statistics. Ph.D. Iowa State 1960. He was a faculty member at Florida State University prior to joining the University of Missouri-Columbia. He was a Visiting Professor at the University of New South Wales summer of 1971 and has traveled to Germany, Austria, Italy and India to deliver statistical papers. He is a Fellow of the American Statistical Association and has been an Associate Editor of the Biometrics Society. He is interested in computer applications and teaches a current research interests are illustrated by his two publications, "An Adaptive Estimator for a Parameter of the Log-Normal Distribution" in Communications, 1979 and 1982, "Testing Fishing Quality Index" in the Transactions of the American Fisheries Society, 1979 and "History of Statistics and Human Thought" in the Proceedings of Educ. Section of ASA, 1982.

Gary F. Kruse, Professor of Statistics and Agronomy. Ph.D., Virginia Polytechnic Institute 1963. Top taught at Kansas State University prior to coming to the University of Missouri-Columbia. His areas of specialization are in design of experiments, estimation and statistical genetics. As Agricultural Experiment Station Statistician he consults with researchers with a wide variety of problems. Over 50 refereed publications attest the scope and variety of statistical problems encountered. He has also done research in recreational use of public facilities and designed many surveys to permit estimates of fish and game harvests.


Ronald D. Platt, Visiting Assistant Professor of Statistics. Ph.D. University of Iowa, 1971. He has held previous teaching positions at Grinnell College, University of Iowa, and Northwest Missouri State University. More recently he has been a statistical consultant and manager of a statistical consulting group at the College of American Pathologists and at Miles Laboratories. His current research interests are in the area of quality assurance, medical decision making and the adequacy of clinical laboratory instrumentation. He is also interested in the problem of statistical consulting, educational techniques for this purpose, and behavioral objectives as a tool in instruction. He has 15 publications in various statistical and medical journals. Recent publications include "DATA ReCAP 1970-1980," a compilation of data from the CAP Proficiency Testing and Quality Assurance programs and "Precision of Clinical Laboratory results required for the Practice of Medicine," in preparation as final report to the Center for Disease Control and also for the American Journal of Clinical Pathology. He is also responsible for the publication of the Journal of Agricultural Biochemistry, a newsletter of the Missouri Society of Agronomy, and also the Missouri Entomologist, a newsletter of the Missouri Entomological Society.
Paul L. Speckman, Assistant Professor of Statistics. Ph.D., University of California at Los Angeles, 1976. Prior to coming to the University of Missouri-Columbia, he taught at the University of Oregon. His general area of interest is probability theory and mathematical statistics. Current research interests include topics in robustness and nonparametric regression and density estimation. He has several forthcoming articles including “Spline smoothing and optimal rates of convergence in nonparametric regression model” (Annals of Statistics) and “The asymptotic integrated mean square error for smoothing splines” (Numerische Mathematik).


Frederick Williams, Professor of Statistics. Ph.D., Northwestern University 1958. Held academic positions at Northwestern University and University of Illinois prior to coming to the University of Missouri-Columbia. Chairman of the Department of Statistics 1966-71 and 1973-76. Acting Chairman 1980-81. Primary areas of specialization sampling techniques, operations research, and applied probability. He has served as a consultant to various government organizations as well as private industry. From 1959-65 he served on the staff of the Executive Development Program sponsored by the University of Missouri in Kansas City. In addition to published articles, Professor Williams jointly with Professor Holstein is the author of “An Introduction to Probability” published by Lucas Brothers in 1965.

Some alumni with M.A. and their status immediately following graduation:

Herbert, Carolyn M., M.A. 1974, Research Specialist, Agricultural Experiment Station.
McKee, Bonnie L., M.A. 1975, Research Specialist, Agricultural Experiment Station.
Webber, Thomas M., M.A. 1975, Kodak.
Whiteman, David E., M.A. 1975, Los Alamos Scientific Laboratory.
Aune, David J., M.A. 1976, USDA, Lincoln, Nebraska.
Lei, Chao-Min, M.A. 1979, Missouri State Government, Jefferson City, Missouri.
Hanson, Randy G. M.A., 1982. Statistician, Hallmark Cards, Inc., Kansas City, Mo.

Some alumni with Ph.D. and their status immediately following graduation:
Robertson, Timothy J., Ph.D. 1966. Assistant Professor, University of Iowa.
Bowman, Raymond W., Ph.D. 1966. Monsanto Corporation.
Patton, Robert A., Ph.D. 1967. Assistant Professor, Bowling Green State University.
Wright, Farrol Tim, Ph.D. 1968. Assistant Professor, University of Missouri, Rolla.
Tebebe, Dennis Lee, Ph.D. 1968. Assistant Professor, University of Missouri, Columbia, Electrical Engineering Department.
Engelhardt, Maxwell Eugene, Ph.D. 1969. Assistant Professor, University of Missouri, Rolla.
Mann, Charles Roy, Ph.D. 1969. Assistant Professor, George Washington University.
Higgin, James J., Ph.D. 1970. Assistant Professor, University of Missouri, Rolla.
McDonald, Kendall L., Ph.D. 1970. Assistant Professor, Appalachian State University.
Le Duc, Sharon Kay, Ph.D. 1971. Lecturer and Programmer, Department of Atmospheric Science, University of Missouri, Columbia.
Goodsell, Carole Ann, Ph.D. 1971. Assistant Professor, University of Wisconsin, Oshkosh.
Bentley, Adrian E., Ph.D. 1972. Assistant Professor, University of Manitoba.
Spurrier, John D., Ph.D. 1974. Assistant Professor, University of South Carolina.
Lee, Larry L., Ph.D. 1975. Assistant Professor, Virginia Polytechnic Institute.
Walgren, Cheryl, Ph.D. 1977. Assistant Professor, Illinois State University at Normal.
Laud, Purushottam W., Ph.D. 1977. Assistant Professor, Northern Illinois University.

Kelley, Robert, Ph.D. 1978. Assistant Professor Virginia Commonwealth University.
Weier, Dennis, Ph.D. 1978. Assistant Professor, University of South Carolina.
Fairbanks, Kenneth, Ph.D. 1979. Assistant Professor, Murray State University, Murray, Kentucky.
Khedr, Magdy S., Ph.D. 1980. Assistant Professor, Cairo University, Cairo Egypt.
Klein, John, Ph.D. 1980. Assistant Professor, Department of Statistics, Howard University.
Patel, Bababhai G., Ph.D. 1980. Visiting Assistant Professor, Miami University, Oxford, Ohio.
George, Varghese, Ph.D., 1981. Assistant Professor, Southwest Missouri State University, Springfield, Missouri.