Statistics

In the Department of Mathematics and Statistics
In the College of Sciences

OFFICE: Geology/Mathematics/Computer Science 413
TELEPHONE: (619) 594-6191

Faculty

F. David Lesley, Ph.D., Professor of Mathematics, Chair of Department
Kung-Jong Lui, Ph.D., Professor of Statistics (Graduate Adviser for the M.S. in Statistics)
Duane L. Steffey, Ph.D., Professor of Statistics (Statistics Coordinator)
Colleen Kelly, Ph.D., Associate Professor of Statistics (Graduate Adviser for the M.S. in Statistics with Concentration in Biostatistics)
Juanjuan Fan, Ph.D., Assistant Professor of Statistics
Richard Levine, Ph.D., Assistant Professor of Statistics
Chii-Dean Lin, Ph.D., Assistant Professor of Statistics

Associateships

Graduate teaching associateships in statistics and biostatistics are available and are awarded on a competitive basis by the Department of Mathematics and Statistics. Application forms and additional information may be secured from the office of the Department of Mathematics and Statistics.

General Information

The Department of Mathematics and Statistics offers graduate study leading to the Master of Science degree in statistics. Students may pursue either the general degree or a concentration in biostatistics that emphasizes statistical methods and applications in the biological, health, and medical sciences.

Statisticians and biostatisticians are engaged in the acquisition and use of knowledge through the collection, analysis, and interpretation of data. Today, almost all disciplines – from economics to engineering, from social science to medicine – employ statistical methods. Such methods are essential in studying relationships, predicting results, and making informed decisions in many different contexts. This diversity of application of this field has stimulated the current demand for well-trained statisticians and biostatisticians at all degree levels.

The Master of Science degree provides advanced training, with emphasis on statistical methodology, and prepares students for careers in industry and government as applied statisticians or biostatisticians, or for entry into a doctoral program in statistics or biostatistics.

As part of the degree requirements, graduate students conduct theses or research projects under the guidance of faculty with active research interests in most general areas of probability, statistics, and biostatistics. These research areas include biostatistical methods, survival analysis, mathematical demography, data analysis, inference, stochastic processes, time series, Bayesian statistics, categorical data analysis, statistical computing, nonparametric statistics, sample surveys, multivariate analysis, linear models, experimental design, and clinical trials.

Admission to Graduate Study

All students must satisfy the general requirements for admission to the University with classified graduate standing, as described in Part Two of this bulletin.

Advancement to Candidacy

All students must satisfy the general requirements for advancement to candidacy as described in Part Two of this bulletin.

Specific Requirements for the Master of Science Degree in Statistics

(Major Code: 17021)

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Part Two of this bulletin, the students must meet the following program requirements:

The student should have completed before entering the program the following undergraduate coursework: three semesters of calculus; and one semester each of linear algebra and probability theory. The student should also have working knowledge of a programming language before entering the program. Students lacking some of the above undergraduate coursework may be admitted conditionally and may make up this coursework during the first year of the program (these courses will not count toward the degree course requirements).

The student must complete a minimum of 30 units of coursework as described below. Upon entry to the program, the student will be assigned to a graduate adviser in statistics. Thereafter, the adviser will meet with the student each semester and discuss his or her academic program. A program of study must be approved by the graduate adviser in statistics.

1. Complete Statistics 560, 670A, 670B with no grade less than B in each course. These are core statistics courses.
2. Complete nine units of courses in statistics and biostatistics, selected from the following with the approval of the graduate adviser in statistics: Statistics 570, 671, 672, 676, 677, 678, 679, 680A, 680B.
3. Complete three additional units of 600- and 700-numbered courses offered by the Department of Mathematics and Statistics, except that Mathematics 600, 601, 602, and Statistics 799A may not be used to fulfill these units required.
4. Complete three additional units of graduate level or approved 500-level courses offered by the Department of Mathematics and Statistics, not including Statistics 799A.
5. Complete three units of approved electives.
6. The thesis option (Plan A) requires approval of the graduate adviser and the statistics division faculty member who will chair the thesis committee. Students who choose Plan A must include Statistics 799A in the 30-unit program and are required to pass a final oral examination on the thesis, open to the public.

7. In other cases, Plan B will be followed. Students who choose Plan B are required to complete at least two units of Statistics 795, one unit of Statistics 720 or 790 or one additional unit of 795, and pass a comprehensive written examination. Policy and procedures for the Plan B examination are documented and available from the Department of Mathematics and Statistics.

Specific Requirements for the Master of Science Degree in Statistics with Concentration in Biostatistics

(Major Code: 17021)

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Part Two of this bulletin, the student must meet the following program requirements:

The student should have completed before entering the program the following undergraduate coursework: three semesters of calculus and one semester each of linear algebra and probability theory. The student should also have working knowledge of a programming language before entering the program. Students lacking some of the above undergraduate coursework may be admitted conditionally and may make up this coursework during the first year of the program (these courses will not count toward the degree course requirements).

The student must complete a minimum of 30 units of coursework as described below. Upon entry to the program, the student will be assigned to a graduate adviser in biostatistics. Thereafter, the adviser will meet with the student each semester and discuss his or her academic program. A program of study must be approved by the graduate adviser in biostatistics.

1. Complete Statistics 560, 670A, 670B with no grade less than B in each course. These are core statistics courses.
2. Complete Statistics 680A and 680B with no grade less than B in each course. These are biostatistics concentration courses.
3. Complete at least six units of courses in biostatistics and statistics, selected from the following with the approval of the graduate adviser in biostatistics: Statistics 510, 520, 570, 596, 671, 672, 676, 677, 678, 679, 696, 720, and 798.
4. Complete at least six units of 500-level or graduate courses from a science of application of biostatistics (e.g., bioscience, health science, or medical science), selected with the approval of the graduate adviser in biostatistics. If the student has an undergraduate degree in an area of application of biostatistics, 500-level or graduate mathematical sciences courses may be substituted with the approval of the graduate adviser in biostatistics.
5. With approval of the graduate adviser and the faculty member who will chair the thesis committee, the student may choose Plan A and complete three units of Statistics 799A. The chair of the thesis committee must be a faculty member from the division of statistics in the Department of Mathematics and Statistics. One of the other two members of the thesis committee must be a faculty member from a science of application of biostatistics (i.e., bioscience, health science, or medical science). The student must pass an oral defense of the thesis, open to the public.
6. In other cases, Plan B will be followed. Students who choose Plan B are required to complete at least two units of Statistics 795, one unit of Statistics 720 or 790 or one additional unit of 795, and pass a comprehensive written examination. Policy and procedures for the Plan B examination are documented and available from the Department of Mathematics and Statistics.

Courses Acceptable on Master's Degree Programs in Statistics (STAT)

UPPER DIVISION COURSES

(**Note:** Statistics 550, 551A, or 551B are not acceptable on the Master of Science degree in Statistics.)

(**Note:** Proof of completion of prerequisites required for all upper division courses: Copy of transcript.)

STAT 510. Applied Regression Analysis (3) I

Prerequisite: Statistics 250 or comparable course in statistics.

Methods for simple and multiple regression models, model fitting, variable selection, diagnostic tools, model validation, and matrix forms for multiple regression. Applications of these methods will be illustrated with SAS, SPSS, and/or S-Plus computer packages. (Formerly numbered Statistics 554A.)

STAT 520. Applied Multivariate Analysis (3) II

Prerequisite: Statistics 350A or comparable course in statistics.

Multivariate normal distribution, multivariate analysis of variance, principal components, factor analysis, discriminant function analysis, classification, and clustering. Statistical packages will be adapted for data analysis. (Formerly numbered Statistics 554B.)

STAT 550. Applied Probability (3) I, II, S

Prerequisites: Mathematics 151 and 254.

Computation of probabilities via enumeration and simulation, discrete and continuous distributions, moments of random variables. Markov chains, counting and queuing processes, and selected topics.

STAT 551A. Probability and Mathematical Statistics (3) I

Prerequisite: Mathematics 252.

Discrete and continuous random variables, probability mass functions and density functions, conditional probability and Bayes' theorem, moments, properties of expectation and variance, joint and marginal distributions, functions of random variables, moment generating functions. Special distributions and sampling distributions.

STAT 551B. Probability and Mathematical Statistics (3) II

Prerequisite: Statistics 551A.

Point and interval estimation and hypothesis testing in statistical models with applications to problems in various fields.

STAT 560. Sample Surveys (3) I

Prerequisite: Statistics 550 or 551A.

Methods for design and analysis of sample surveys with applications to social and biological sciences. Simple random sampling, stratification and clustering, ratio and regression estimators, subsampling, selected topics in survey methodology. (Formerly numbered Statistics 552.)

STAT 570. Stochastic Processes (3)

Prerequisite: Statistics 550 or 551A.

Introduction to stochastic processes with selected applications. (Formerly numbered Statistics 553.)

STAT 575. Actuarial Modeling (3)

Prerequisite: Statistics 550 or 551A.

Actuarial models and applications of probability and statistics to insurance and other financial risks. Utility theory; risk models, compound processes; survival distributions and life tables; life insurance, annuities and benefits.

STAT 596. Advanced Topics in Statistics (1-4) I, II

Prerequisite: Consent of instructor.

Selected topics in statistics. May be repeated with the approval of the instructor. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree. Maximum credit of six units of 596 applicable to a bachelor's degree. Maximum combined credit of six units of 596 and 696 applicable to a 30-unit master's degree.

GRADUATE COURSES

STAT 670A-670B. Advanced Mathematical Statistics (3-3)

Prerequisite: Statistics 550 or 551A. Statistics 670A is prerequisite to 670B.

Distribution of random variables, characteristic functions, limiting distributions, sampling distributions, hypothesis testing and estimation, optimality considerations, applications of the linear hypothesis, invariance and unbiasedness to analysis of variance and regression problems, sequential techniques, decision theory.

STAT 671. Statistical Computing (3)

Prerequisite: Statistics 551B or 670B.

Machine computation in the development, application, and evaluation of advanced statistical techniques. Floating point arithmetic and algorithm stability; numerical methods for parameter estimation (including maximum likelihood) and multivariate probability integration; Monte Carlo simulation and other computer-intensive statistical techniques.

STAT 672. Nonparametric Statistics (3)

Prerequisite: Statistics 551B or 670B.

Theory and application of commonly used distribution-free test statistics, including sign and Wilcoxon tests, and corresponding nonparametric point and interval estimators. Kruskal-Wallis and Friedman tests for analysis of variance, nonparametric regression methods, and other selected topics.

STAT 676. Bayesian Statistics (3)

Prerequisite: Statistics 551B or 670B.

Bayes' theorem; conjugate priors; likelihood principle; posterior probability intervals; Bayes factors; prior elicitation; reference priors; computational techniques; hierarchical models; empirical and approximate Bayesian inference; posterior sensitivity analysis; decision theory.

STAT 677. Design of Experiments (3)

Prerequisite: Statistics 550 or 551A.

Methods for design and analysis of experiments with applications to industry, agriculture, and medicine. Concepts of randomization, blocking, and replication. Incomplete block designs, fractional factorial experiments, response surface methods, selected topics.

STAT 678. Survival Analysis (3)

Prerequisites: Statistics 551B or 670B.

Survival distributions; inference in parametric survival models; life tables; proportional hazards model; time-dependent covariates; accelerated time model and inference based on ranks; multivariate time data and competing risks.

STAT 679. Analysis of Discrete Data (3)

Prerequisite: Statistics 551B or 670B.

Discrete sampling models; goodness-of-fit testing; methods for binary data with covariates, including logistic regression and probit analysis; loglinear modeling of multidimensional contingency tables; ordered categories; incomplete tables; Bayesian methods; hierarchical models.

STAT 680A-680B. Advanced Biostatistical Methods (3-3)

Prerequisites: Statistics 550 or 551A. Statistics 680A is prerequisite to 680B.

Design, conduct, and analysis of experimental and observational studies. Cohort studies. Multifactor screening. Survival studies. Case-control studies. Biological assays. Selected current topics.

STAT 696. Selected Topics in Statistics (3)

Prerequisite: Graduate Standing.

Intensive study in specific areas of statistics. May be repeated with new content. See Class Schedule for specific content. Maximum combined credit of six units of 596 and 696 applicable to a 30-unit master's degree.

STAT 720. Seminar (1-3)

Prerequisite: Consent of instructor.

An intensive study in advanced statistics. May be repeated with new content. See Class Schedule for specific content. Maximum credit six units applicable to a master's degree.

STAT 790. Practicum in Teaching of Statistics (1) Cr/NC

Prerequisite: Award of graduate teaching associateship in statistics.

Supervision in teaching statistics. Lecture writing, style of lecture presentation and alternatives, test and syllabus construction, and grading system. Not applicable to an advanced degree. Required for first semester GTA's. Maximum credit four units applicable to a master's degree.

STAT 795. Practicum in Statistical Consulting (1-2) Cr/NC

Prerequisite: Statistics 670B.

Statistical communication and problem solving. Short-term consulting to campus clients in design and analysis of experiments, surveys, and observational studies. Heuristics for effective problem identification, client interactions, oral and written presentations. Maximum credit three units applicable to a master's degree.

STAT 797. Research (1-3) Cr/NC/RP

Prerequisite: Six units of graduate level statistics.

Research in one of the fields of statistics. Maximum credit six units applicable to a master's degree.

STAT 798. Special Study (1-3) Cr/NC/RP

Prerequisite: Consent of staff; to be arranged with department chair and instructor.

Individual study. Maximum credit six units applicable to a master's degree.

STAT 799A. Thesis or Project (3) Cr/NC/RP

Prerequisites: An officially appointed thesis committee and advancement to candidacy.

Preparation of a project or thesis for the master's degree.

STAT 799B. Thesis Extension (0) Cr/NC

Prerequisite: Prior registration in Thesis 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis is granted final approval.