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# Statistics

In the College of Sciences

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

## Faculty

Emeritus: Bell, Burdick, Macky, Moser, Park, Romano

Chair: Shen

Coordinator for Statistics: Lui

Professor: Lui

Associate Professors: Fan, Levine, Lin

Assistant Professors: Bailey, Chen, Duncan

Lecturers: Manchester, Noble

## Offered by the Department of Mathematics and Statistics

Master of Science degree in statistics.

Concentration in biostatistics.

Major in statistics with the B.S. degree in applied arts and sciences.

Emphasis in actuarial science.

Emphasis in statistical computing.

Minor in statistics.

## The Major

Statistics is the science which studies data – its collection, description, analysis, and interpretation. Almost all modern professions, from economists to engineers and from social scientists to medical scientists, rely on statistics. Statistical methods are used for studying relationships, predicting results, testing hypothesis, and a variety of other purposes.

The Bachelor of Science degree in statistics is designed to provide students with a fundamental understanding of probability and mathematical statistics, a complementary knowledge of basic methods for data collection and inference, and practical computing skills to carry out statistical analyses of problems in many different areas of application.

One option within the major allows students with a strong interest in statistical or biostatistical aspects of a particular science to apply courses in that science to their major. This option should provide the interested student with a good background for employment or graduate work in statistics, biostatistics, or in that science. Emphases in actuarial science and statistical computing enable students to pursue further specializations aligned with professional opportunities in these areas.

Statistics is the discipline at the heart of the scientific method of discovery. Statistical principles are used in designing experiments and surveys to collect information, and statistical procedures are applied to summarize information, draw conclusions, and make decisions.

Because of the broad applicability of their training in statistical reasoning and data analysis, undergraduate majors are prepared for careers in diverse fields – such as biotechnology, environmental science, insurance, industrial manufacturing, and market research – in which the need for professionally trained statisticians is great.

Graduates who seek to acquire additional skills in applied or theoretical statistics may also consider programs of advanced study at the master's or doctoral level. Statisticians with advanced degrees are sought for senior positions in industry and government, as well as teaching positions in secondary schools, community colleges, and universities.

## Major Academic Plans (MAPs)

Visit <http://www.sdsu.edu/mymap> for the recommended courses needed to fulfill your major requirements. The MAPs Web site was created to help students navigate the course requirements for their majors and to identify which General Education course will also fulfill a major preparation course requirement.

## Statistics Major

**With the B.S. Degree in Applied Arts and Sciences**

**(Major Code: 17021)**

All candidates for a degree in applied arts and sciences must complete the graduation requirements listed in the section of this catalog on "Graduation Requirements."

A minor is not required with this major.

Upon entry to the program, the student will be assigned to an undergraduate adviser in statistics. Thereafter, the student will meet with the adviser each semester and discuss his or her academic program. A program of study must be approved by the undergraduate adviser in statistics.

In addition to meeting the requirements for undergraduate standing and the basic requirements for the bachelor of science degree as described in this catalog, the student must complete a Graduation Writing Assessment Requirement and must complete a minimum of 60 units of coursework as described below.

**Preparation for the Major.** Statistics 119 or 250; Mathematics 150, 151, 245, 254. (17 units)

**Graduation Writing Assessment Requirement.** Passing the Writing Proficiency Assessment with a score of 10 or above or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See "Graduation Requirements" section for a complete listing of requirements.

**Additional Lower Division Coursework Required.** Mathematics 252, Computer Science 106 or 107. (7 units)

**Major.** A minimum of 36 upper division units to include Statistics 350A, 350B, 510, 551A, 551B, 560; six units selected (with the approval of the undergraduate adviser in statistics) from Statistics 325, 496, 520, 570, 575, 580, 596; 12 upper division units in statistics, mathematics (excluding Mathematics 302, 303, 312, 313, 414), computer science, or a science of application (selected with the approval of the undergraduate adviser in statistics).

**Master Plan.** A master plan of the courses taken to fulfill the major must be approved by the adviser and filed with the Office of Advising and Evaluations.

### Emphasis in Actuarial Science

This emphasis is designed to prepare students for careers in the actuarial profession, applying probability and statistical models to problems of insurance and finance. Actuaries improve financial decision making by evaluating the current financial implications of uncertain future events. Students completing this emphasis would also be well prepared for graduate study in actuarial science or statistics.

**Preparation for the Major.** Statistics 119 or 250; Accountancy 201; Computer Science 106 or 107; Economics 101, 102; Mathematics 150, 151, 245, 252, 254. (33 units) The student must complete these courses before being allowed to register for the upper division finance courses.

**Graduation Writing Assessment Requirement.** Passing the Writing Proficiency Assessment with a score of 10 or above or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See "Graduation Requirements" section for a complete listing of requirements.

**Major.** A minimum of 36 upper division units to include Statistics 350A, 350B, 551A, 551B, 575; Economics 320, 321; Finance 323, 327; three units selected from Statistics 325, 496, 510, 560, 570, 596; six units selected from Finance 421, 427; Mathematics 544, 580, 581.

**Master Plan.** A master plan of the courses taken to fulfill the major must be approved by the adviser and filed with the Office of Advising and Evaluations.

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### Emphasis in Statistical Computing

Modern day statistics applications require heavy computing for manipulating massive data sets, mining immense databases, and implementing computationally intensive data analytic tools to solve complex scientific problems. This emphasis is designed to prepare students for careers in statistics by providing them with the data analytic and computational machinery needed to excel in all avenues of statistical science during an information age where statistical computing plays a crucial role. Students completing this emphasis would also be well prepared for graduate study in statistical computing and statistics.

**Preparation for the Major.** Statistics 250, Mathematics 150, 151, 245, 252, 254, Computer Science 107, 108, 205. (30 units)

**Graduation Writing Assessment Requirement.** Passing the Writing Proficiency Assessment with a score of 10 or above or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See "Graduation Requirements" section for a complete listing of requirements.

**Major.** A minimum of 39 upper division units to include Statistics 325, 350A, 510, 551A, 551B, 580; Mathematics 541, Computer Science 310, 320; six units selected (with the approval of the undergraduate adviser in statistics) from Computer Science 501, 503, 505, 514, 520, 550, 553, 558, 559, 560; six upper division units in statistics, computer science, or a science of application with a heavy statistical computing component (selected with the approval of the undergraduate adviser in statistics).

**Master Plan.** A master plan of the courses taken to fulfill the major must be approved by the adviser and filed with the Office of Advising and Evaluations.

### Statistics Minor

The minor in statistics consists of a minimum of 15 units in statistics to include Statistics 250 (or equivalent), 350A, 350B or 510, and six units of upper division electives in statistics excluding Statistics 357. For Statistics 550 and 551A, students must satisfy lower division calculus and linear algebra prerequisites (Mathematics 151, 252, and 254 as appropriate).

The minor program includes a combination of courses in applied statistical methods, computer-oriented data analysis, probability, and mathematical statistics, which can be tailored to the student's major, academic, or professional interests. For example, business students interested in actuarial science may wish to consider a minor comprising Statistics 350A, 350B, 551A, and 551B. Students in the social, behavioral, and natural sciences who are particularly interested in applications and data analysis may wish to consider a minor comprising Statistics 350A, 350B, 510, and 520.

Students considering a minor in statistics are encouraged to consult with their major adviser and with the minor adviser in statistics. Courses in the minor may not be counted toward the major, but may be

used to satisfy preparation for the major and general education requirements, if applicable. A minimum of six upper division units must be completed at San Diego State University.

## Courses (STAT)

Refer to *Curricula and Courses and University Policies* sections of this catalog for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

### LOWER DIVISION COURSES

**NOTE: Proof of completion of Entry-Level Mathematics requirement required for Statistics 119 and 250: Copy of ELM score or verification of exemption.**

#### STAT 119. Elementary Statistics for Business (3) [GE]

Prerequisite: Satisfaction of the Entry-Level Mathematics requirement.

Measures of central tendency and variability, frequency distributions; probability, Bayes theorem, probability distributions (including binomial, hypergeometric, and normal), sampling distributions, confidence intervals, significance testing, regression and correlation. Not open to students with credit in Statistics 250. Students with credit or concurrent registration in the following lower division statistics courses other than Statistics 250 will be awarded a total of four units for the two (or more) courses: Statistics 119; Administration, Rehabilitation and Postsecondary Education 201; Biology 215; Civil Engineering 160; Economics 201; Political Science 201; Psychology 270; Sociology 201.

#### STAT 250. Statistical Principles and Practices (3) [GE]

Prerequisite: Satisfaction of the Entry-Level Mathematics requirement.

Descriptive statistics, data displays, measures of central tendency and variability, random variables, sampling distribution. Estimation and hypothesis tests for means and proportions, linear regression and correlation. Not open to students with credit in Statistics 119. Students with credit or concurrent registration in the following lower division statistics courses other than Statistics 119 will be awarded a total of four units for the two (or more) courses: Statistics 250; Administration, Rehabilitation and Postsecondary Education 201; Biology 215; Civil Engineering 160; Economics 201; Political Science 201; Psychology 270; Sociology 201.

#### STAT 296. Experimental Topics (1-4)

Selected topics. May be repeated with new content. See *Class Schedule* for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree.

#### STAT 299. Special Study (1-3)

Prerequisite: Consent of instructor.

Individual study. Maximum credit six units.

**UPPER DIVISION COURSES  
(Intended for Undergraduates)**

**NOTE: Proof of completion of prerequisites required for all upper division courses: Copy of transcript.**

**STAT 325. SAS Programming and Data Management (3)**

Prerequisite: Statistics 250 or comparable course in statistics.  
Entry, management, and summary of statistical data using SAS programming language. Data structures and manipulation, screen editing, visual displays, macros, related topics.

**STAT 350A. Statistical Methods (3)**

Prerequisite: Statistics 250 or comparable course in statistics.  
One- and two-sample hypothesis tests, paired difference tests, tests for variances, analysis of variance. Linear regression and correlation. Chi-square tests. Simple nonparametric tests. Power of hypothesis tests.

**STAT 350B. Statistical Methods (3)**

Prerequisite: Statistics 350A.  
Multiple regression, factorial models and nonparametric methods, all with emphasis on applications.

**STAT 357. Probability and Statistics (3)**

Prerequisite: Mathematics 150.  
Probability, measures of central tendency and dispersion, characteristics of frequency functions of discrete and continuous variates; applications. Highly recommended for all prospective secondary school teachers of mathematics.

**STAT 496. Experimental Topics (1-4)**

Selected topics. May be repeated with new content. See *Class Schedule* for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree.

**STAT 499. Special Study (1-3)**

Prerequisite: Consent of instructor.  
Individual study. Maximum credit six units.

**UPPER DIVISION COURSES  
(Also Acceptable for Advanced Degrees)**

**NOTE: Proof of completion of prerequisites required for all upper division courses: Copy of transcript.**

**STAT 510. Applied Regression Analysis (3)**

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.

**STAT 520. Applied Multivariate Analysis (3)**

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.

**STAT 550. Applied Probability (3)**

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)**

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)**

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)**

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.

**STAT 570. Stochastic Processes (3)**

Prerequisite: Statistics 551A.  
Introduction to stochastic processes with selected applications.

**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 580. Statistical Computing (3)**

Prerequisite: Statistics 551B.  
Machine computation in development, application, and evaluation of advanced statistical techniques. Floating arithmetic and algorithm stability; numerical methods for parameter estimation (including maximum likelihood) and multivariate probability integration; simulation and other computer-intensive statistical techniques.

**STAT 596. Advanced Topics in Statistics (1-4)**

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. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

**GRADUATE COURSES  
Refer to the *Graduate Bulletin*.**

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