

Statistics (STAT) Courses 2011-2012 University Catalog

STAT 250 - Introductory Statistics I Credits: 3
Elementary introduction to statistics. Topics include descriptive statistics, probability, and estimation and hypothesis testing for means and proportions. Statistical software used for assignments.
Fulfills general education requirement in quantitative reasoning.

Prerequisite(s): High school algebra.
When Offered: Fall, Spring, Summer.

STAT 344 - Probability and Statistics for Engineers and Scientists I Credits: 3

Introduction to probability and statistics with applications to computer science, engineering, operations research, and information technology. Basic concepts of probability, random variables and expectation, Poisson process, bivariate distributions, sums of independent random variables, central limit theorem, sampling distributions, maximum likelihood and unbiased estimators, confidence interval construction, and hypothesis testing.

Prerequisite(s): MATH 114 or MATH 116. Prerequisite enforced by registration system.
When Offered: Fall, Spring, Summer.

STAT 346 - Probability for Engineers Credits: 3

Introduction to probability with applications to electrical and computer engineering, operations research, information technology, and economics. Basic concepts of probability, conditional probability, random variables and moments, specific probability distributions, multivariate distributions, moment-generating functions, limit theorems, and sampling distributions.

Prerequisite(s): MATH 213 Prerequisite enforced by registration system.
When Offered: Fall, Spring

STAT 350 - Introductory Statistics II Credits: 3

Emphasis on applications. Topics include analysis of variance, multiple regression, and nonparametric inference. A statistical computer package is used for data analysis.

Prerequisite(s): STAT 250.
When Offered: Fall, Spring, Summer

STAT 354 - Probability and Statistics for Engineers and Scientists II Credits: 3

Continuation of STAT 344. Multivariate probability distributions, variable transformations, regression, analysis of variance, contingency tables, and nonparametric methods. Applications to quality control, acceptance sampling, and reliability.

Prerequisite(s): STAT 344.
When Offered: Spring

STAT 362 - Introduction to Computer Statistical Packages Credits: 3

Use of computer packages in statistical analysis of data. Topics include data entry, checking, and manipulation, and use of computer statistical packages for regression and analysis of variance.

Prerequisite(s): STAT 250 or equivalent
When Offered: Fall

STAT 435 - Analysis of Experimental Data Using SPSS Credits: 3

Statistical methods for analysis of experimental data, including ANOVA and regression. Parametric and nonparametric inference methods appropriate for a variety of experimental designs are presented along with data analysis using SPSS. Intended primarily for researchers in the natural, social, and life sciences.

Prerequisite(s): STAT 250 or equivalent.
When Offered: Fall

STAT 455 - Experimental Design Credits: 3

Principles of analysis of variance and experimental design. Topics include computation and interpretation of analysis of variance; multiple comparisons; orthogonal contrasts; and design of experiments, including factorial, hierarchical, and split plot designs. Optional topics may include analysis of covariance; partial hierarchical designs; incomplete block designs; principles of blocking and confounding in 2**n experiments; or estimation of variance components. Computer statistical packages are used to perform computations.

Prerequisite(s): STAT 350 or 354, and STAT 362 or 501.
When Offered: Offered on an irregular basis at the discretion of the department or school

STAT 457 - Applied Nonparametric Statistics

Credits: 3

Introduction to nonparametric methods with applications to the decision and information sciences and operations analysis. Topics covered are testing and estimation for one- and two-sample problems, independent and paired samples, location and dispersion problems, one- and two-way layouts, tests for independence, regression, and discussion of efficiency.

Prerequisite(s): STAT 350 or 354, or equivalent.

When Offered: Offered on an irregular basis at the discretion of the department or school

STAT 463 - Introduction to Exploratory Data Analysis Credits: 3

Introduction to modern exploratory data analysis techniques. Topics include graphical techniques, such as box plots, parallel coordinate plots, and other graphical devices, re-expression and transformation of data, order statistics, influence and leverage, and dimensionality reduction methods such as projection pursuit.

Prerequisite(s): STAT 350 or 354, or equivalent.

When Offered: Offered on an irregular basis at the discretion of the department or school

STAT 474 - Introduction to Survey Sampling

Credits: 3

Introduction to design and analysis of sample surveys. Sample designs include simple random sampling; systematic sampling; and stratified, cluster, and multistage sampling. Analytical methods include sample size determination, ratio and regression estimation, imputation for missing data, and nonsampling error adjustment. Practical problems encountered in conducting a survey are discussed. Methods applied to case studies of actual surveys. Class project may be required.

Prerequisite(s): STAT 346 and a course in Statistics, or STAT 344.

Notes: Recommended for students of decision, information, social sciences, and mathematics.

When Offered: Fall

STAT 498 - Independent Study in Statistics

Credits: 1-3

Directed self-study of special topics of current interest in statistics.

Prerequisite(s): 60 undergraduate credits; must be arranged with instructor and approved by the department chair before registering.

Notes: May be repeated for maximum 6 credits if topics are substantially different.

STAT 499 - Special Topics in Statistics Credits: 3

Topics of special interest to undergraduates.

Prerequisite(s): 60 undergraduate credits and permission of instructor; specific prerequisites vary with nature of topic.

Notes: May be repeated for maximum 6 credits if topics substantially differ.

STAT 501 - SAS Language and Basic Procedures

Credits: 1

Introduction to the SAS Data Step and Base SAS Procedures. Preparation for graduate students in use of SAS for other graduate courses offered by department. Topics include observation and variable structures, data interfaces, formats, functions, and procedures for summarizing and displaying data.

Prerequisite(s): Course in statistics and experience with Microsoft OS.

When Offered: Spring

STAT 502 - Introduction to SAS/GRAPH Credits: 1

Introduction to SAS/GRAPH. Continued preparation beyond STAT 501 for graduate students in the use of SAS for other graduate courses offered by department. Topics included: an overview of SAS/GRAPH and SAS/GRAPH procedures; introduction to SAS/GRAPH output options; and in-depth coverage of the SGPLOT, GPLOT, and GCHART procedures.

Prerequisite(s): Working knowledge of SAS.

When Offered: Spring

STAT 503 - SAS Macro Language Credits: 1

Introduction to SAS Macro Language. Continued preparation beyond STAT 501 for graduate students in use of SAS for other graduate courses offered by department. Topics include macro language processing, macro variables, defining and calling macro variables, macro quoting, macro facility error messages, and examples of efficient code using macros.

Prerequisite(s): Working knowledge of SAS.

When Offered: Spring

STAT 535 - Analysis of Experimental Data Using SPSS Credits: 3

Statistical methods for analysis of experimental data, including ANOVA and regression. Parametric and nonparametric inference methods appropriate for a variety of experimental designs are presented along with data analysis using SPSS. Intended primarily for researchers in the natural, social, and life sciences.

Prerequisite(s): STAT 250 or equivalent.

Notes: Can be used to satisfy requirements for certificates in federal statistics and biostatistics, but not MS in statistical science. Certificate program students granted credit for only one of STAT 535 or 554.

When Offered: Fall

STAT 544 - Applied Probability Credits: 3

Random variables and expectation, multivariate and conditional distributions, conditional expectation, order statistics, transformations, moment generating functions, special distributions, limit theorems.

Prerequisite(s): MATH 213 and STAT 346, or permission of instructor.

When Offered: Fall, Spring

STAT 554 - Applied Statistics Credits: 3

Application of basic statistical techniques. Focus is on the problem (data analysis) rather than on the theory. Topics include one- and two-sample tests and confidence intervals for means and medians, descriptive statistics, goodness-of-fit tests, one- and two-way ANOVA, simultaneous inference, testing variances, regression analysis, and categorical data analysis. Normal theory is introduced first with discussion of what happens when assumptions break down. Alternative robust and nonparametric techniques are presented.

Prerequisite(s): STAT 346 or permission of instructor.

Notes: Certificate program students granted credit for only one of STAT 535 or 554.

When Offered: Fall, Spring

STAT 574 - Survey Sampling I Credits: 3

Design and implementation of sample surveys. Covers components of a survey; probability sampling designs to include simple random, systematic, Bernoulli, proportional to size, stratified, cluster and two-stage sampling; and ratio and regression estimators. Discusses practical problems in conducting a survey. Methods applied to case studies of actual surveys. Class project required.

Prerequisite(s): STAT 346 and a course in Statistics, or STAT 344

When Offered: Fall

STAT 634 - Case Studies in Data Analysis

Credits: 3

Examination of a wide variety of case studies illustrating data-driven model building and statistical analysis. With each case study, various methods of data management, data presentation, statistical analysis, and report writing are compared.

Prerequisite(s): STAT 554 and working knowledge of SAS, or permission of instructor. Prerequisite enforced by registration system.

When Offered: Fall

STAT 645 - Stochastic Processes Credits: 3

Selected applied probability models, including Poisson processes, discrete- and continuous-time Markov chains, renewal and regenerative processes, semi-Markov processes, queuing and inventory systems, reliability theory, and stochastic networks. Emphasis on applications in practice, as well as analytical models.

Equivalent to OR 645

Prerequisite(s): OR 542 or STAT 544, or permission of instructor.

STAT 652 - Statistical Inference Credits: 3

Fundamental principles of estimation and hypothesis testing. Topics include limiting distributions and stochastic convergence, sufficient statistics, exponential families, statistical decision theory and optimality for point estimation, Bayesian methods, maximum likelihood, asymptotic results, interval estimation, optimal tests of statistical hypotheses, and likelihood ratio tests.

Equivalent to CSI 672

Prerequisite(s): STAT 544 with a grade of B- or better, and STAT 554 with grade of B- or better. Prerequisite enforced by registration system.

When Offered: Spring

STAT 655 - Analysis of Variance Credits: 3

Single and multifactor analysis of variance, planning sample sizes, introduction to the design of experiments, random block and Latin square designs, and analysis of covariance.

Prerequisite(s): STAT 544, STAT 554, and working knowledge of SAS. Prerequisite enforced by registration system.

When Offered: Alternate Spring

STAT 656 - Regression Analysis Credits: 3

Simple and multiple linear regression, polynomial regression, general linear models, subset selection, step-wise regression, and model selection. Also covered are multicollinearity, diagnostics, and model building as well as the theory and practice of regression analysis.

Equivalent to CSI 676

Prerequisite(s): STAT 544, STAT 554, matrix algebra, and working knowledge of SAS. Prerequisite enforced by registration system.

When Offered: Fall

STAT 657 - Nonparametric Statistics Credits: 3

Distribution-free procedures for making inferences about one or more samples. Tests for lack of independence, association or trend, and monotone alternatives are included. Measures of association in bivariate samples and multiple classifications are discussed. Both theory and applications are covered. Students are introduced to appropriate statistical software.

Prerequisite(s): STAT 544 and 554. Prerequisite enforced by registration system.

When Offered: Alternate Fall

STAT 658 - Time Series Analysis and Forecasting

Credits: 3

Modeling stationary and nonstationary processes, autoregressive, moving average and mixed model processes, autocovariance functions, autocorrelation functions, partial autocorrelation functions, spectral density functions, identification of models, estimation of model parameters, and forecasting techniques.

Equivalent to CSI 678.

Prerequisite(s): STAT 544 or equivalent. Prerequisite enforced by registration system.

When Offered: Alternate Fall

STAT 660 - Biostatistical Methods Credits: 3

Focuses on biostatistical aspects of design and analysis of biomedical studies, including epidemiologic observational studies and randomized clinical trials. Topics include randomization principle, confounding, ethics in human experimentation, methods of randomization, stratification, primary outcome analyses, covariate-adjusted analyses, epidemiologic measures, and sample size and power computation.

Prerequisite(s): STAT 554 or STAT 535; and a working knowledge of a statistical software package, such as SAS or SPSS.

When Offered: Spring

STAT 662 - Multivariate Statistical Methods

Credits: 3

Standard techniques of applied multivariate analysis. Topics include review of matrices, T square tests, principle components, multiple regression and general linear models, analysis of variance and covariance, multivariate ANOVA, canonical correlation, discriminant analysis, classification, factor analysis, clustering, and multidimensional scaling. Computer implementation via a statistical package is an integral part of the course.

Prerequisite(s): STAT 544, STAT 554, matrix algebra, and working knowledge of SAS. Prerequisite enforced by registration system.

When Offered: Alternate Spring

STAT 663 - Statistical Graphics and Data

Exploration I Credits: 3

Introduces statistical graphics that show distribution features and functional relationships in the presence of noise. Introduces cognitive research guidance for graphics design and reasoning. Stresses quantitative comparisons from multiple perspectives. Features new micromaps designs for spatial and temporal comparisons. Introduces R, the grammar of graphics, and dynamic graphics software.

Equivalent to CSI 773

Prerequisite(s): A 300-level statistics course and a programming course.

When Offered: Fall

STAT 664 - Bayesian Inference and Decision

Theory Credits: 3

Introduces decision theory and relationship to Bayesian statistical inference. Teaches commonalities, differences between Bayesian and frequentist approaches to statistical inference, how to approach a statistics problem from the Bayesian perspective and how to combine data with informed expert judgment in a sound way to derive useful and policy-relevant conclusions. Teaches necessary theory to develop firm understanding of when and how to apply Bayesian and frequentist methods, and practical procedures for inference, hypothesis testing, and developing statistical models for phenomena. Teaches fundamentals of Bayesian theory of inference, including probability as a representation for degrees of belief, likelihood principle, use of Bayes Rule to revise beliefs based on evidence, conjugate prior distributions for common statistical models, and methods for approximating the posterior distribution. Introduces graphical models for constructing complex probability and decision models from modular components.

Equivalent to SYST 664/CSI 674

Prerequisite(s): STAT 544 or 554, or equivalent.

When Offered: Spring

STAT 665 - Categorical Data Analysis Credits: 3

Analyzes cross-classified categorical data in two and higher dimensions. Topics include association tests and measures of association in two- and three-dimensional contingency tables, logistic regression, and log linear models. SAS is used extensively for data analysis.

Prerequisite(s): STAT 656 and working knowledge of SAS. Prerequisite enforced by registration system.

When Offered: Alternate Spring

STAT 668 - Survival Analysis Credits: 3

Survival Analysis is a class of statistical methods for studying the occurrence and timing of events. In medical research, the events may be deaths, and the objective is to determine factors affecting survival times of patients following treatment, usually in the setting of clinical trials. Methods can also be applied to the social and natural sciences and engineering where they are known by other names (reliability, event history analysis). Concepts of censored data, time-dependent variables, and survivor and hazard functions are central. Nonparametric methods for comparing two or more groups of survival data are studied. The Cox regression model (proportional hazards model), Weibull model, and the accelerated failure time model are studied in detail. Concepts are applied to analysis of real data from major medical studies using SAS software.

Prerequisite(s): STAT 544, STAT 554, and working knowledge of SAS. Prerequisite enforced by registration system.

When Offered: Alternate Fall

STAT 674 - Survey Sampling II Credits: 3

Continuation of STAT 574. Regression estimators for complex sampling designs, domain estimation, two-phase sampling, weighting adjustments for nonresponse, imputation, nonresponse models, measurement error models, introduction to variance estimation. Applications to case studies of actual surveys.

Prerequisite(s): STAT 574. Prerequisite enforced by registration system.

When Offered: Spring

STAT 719 - Computational Models of Probabilistic Reasoning Credits: 3

Introduces theory and methods for building computationally efficient software agents that reason, act, and learn environments characterized by noisy and uncertain information. Covers methods based on graphical probability and decision models. Students study approaches to representing knowledge about uncertain phenomena, and planning and acting under uncertainty. Topics include knowledge engineering, exact and approximate inference in graphical models, learning in graphical models, temporal reasoning, planning, and decision making. Practical model building experience is provided. Students apply what they learn to semester-long project of their choosing.

Equivalent to OR 719/CSI 775

Prerequisite(s): STAT 652 or SYST/STAT 664, or permission of instructor.

STAT 751 - Computational Statistics Credits: 3
Covers basic computationally intensive statistical methods and related methods, which would not be feasible without modern computational resources. Covers nonparametric density estimation including kernel methods, orthogonal series methods and multivariate methods, recursive methods, cross validation, nonparametric regression, penalized smoothing splines, the jackknife and bootstrapping, computational aspects of exploratory methods including the grand tour, projection pursuit, alternating conditional expectations, and inverse regression methods.
Equivalent to CSI 771
Prerequisite(s): STAT 544, STAT 554, and STAT 652. Prerequisite enforced by registration system.
When Offered: Alternate Fall

STAT 758 - Advanced Time Series Analysis
Credits: 3
Mathematical modeling and methods for model identification and forecasting of nonstationary and seasonal time series data (ARIMA models), multivariate time series, and state-space models.
Prerequisite(s): STAT 658. Prerequisite enforced by registration system.
When Offered: Offered on an irregular basis at the discretion of the department or school

STAT 760 - Advanced Biostatistical Methods
Credits: 3
Advanced statistical methods in the drug development process. Provides the theoretical statistical basis for the design and analysis of pharmaceutical clinical trials. Topics include the theory of randomization, randomization-based inference, restricted, response-adaptive, and covariate-adaptive randomization, the modern theory of group sequential monitoring, statistical aspects of determination of dose-response relationships.
Prerequisite(s): STAT 652, STAT 656, and working knowledge of statistical programming language.
Prerequisite enforced by registration system.
When Offered: Alternate Fall

STAT 763 - Statistical Graphics and Data Exploration II Credits: 3
Addresses data set size and human comprehension challenges. Introduces case and variable reduction methods, and overview production. Incorporates cognitive science guidance. Utilizes data mining models and visual analytic algorithms to find patterns and prioritize graphics. Addresses applications from both information and scientific visualization. Tracks advances in web graphics including citizen science projects harnessing the visual power of thousands of people.
Prerequisite(s): STAT 663 or permission of instructor.
When Offered: Spring

STAT 765 - Advanced Topics in Categorical Data Analysis Credits: 3
Covers advanced techniques for categorical data analysis and the theoretical basis for the analysis of categorical data. Topics include: models for multinomial responses, matched pairs, repeated measures, and ordinal data; random effects models; asymptotic theory for parametric models; theory for maximum likelihood and alternative estimation methods; and exact inference. Statistical software packages are used extensively for data analysis.
Prerequisite(s): STAT 652 and STAT 665. Prerequisite enforced by registration system.
When Offered: Alternate Fall.

STAT 773 - Statistical Methods for Longitudinal Data Analysis Credits: 3
Presents modern statistical approaches to the analysis of longitudinal data, i.e., data collected repeatedly on experimental units over time (or other conditions). Topics include linear mixed effects models, generalized linear models for correlated data (including generalized estimating equations), and computational issues and methods for fitting models.
Prerequisite(s): STAT 652, STAT 656, and working knowledge of SAS. Prerequisite enforced by registration system.
When Offered: Alternate Spring.

STAT 781 - Data Mining and Knowledge Discovery Credits: 3
Statistical and computational methods and systems for deriving user-oriented knowledge from large databases and other information sources, and applying knowledge to support decision making. Information sources can be in numerical, textual, visual, or multimedia forms. Covers theoretical and practical aspects of current methods and selected systems for data mining, knowledge discovery, and knowledge management, including those for text mining, multimedia mining and web mining.
Equivalent to SYST 781
Prerequisite(s): One of the following courses: CS 687, CS 650, INFS 614, STAT 663, STAT 664, or permission of instructor.
Notes: Content may vary from semester to semester.

STAT 789 - Advanced Topics in Statistics
Credits: 1-6
Topics in statistics not covered in regular statistics sequence.
Prerequisite(s): Permission of instructor.
Notes: May be repeated for credit.
When Offered: Offered on an irregular basis at the discretion of the department or school

STAT 796 - Directed Reading and Research
Credits: 1-3
Reading and research on specific topic in statistics under direction of faculty member.
Prerequisite(s): Admission to PhD in Statistical Science Program.

STAT 797 - Directed Reading and Research

Credits: 1-3

Reading and research on specific topic in statistics under direction of faculty member.

Prerequisite(s): Admission to PhD in Statistical Science Program.

STAT 798 - Master's Essay Credits: 3

Project chosen and completed under guidance of graduate faculty member that results in acceptable technical report.

Prerequisite(s): 9 graduate credits, and permission of instructor.

STAT 799 - Master's Thesis Credits: 3

Project chosen and completed under guidance of graduate faculty member that results in acceptable technical report and oral defense.

Prerequisite(s): 9 graduate credits, and permission of instructor.

STAT 871 - Statistical Data Mining Credits: 3

Covers basic concepts, computational complexity, data preparation and compression, databases and SQL, rule-based machine learning and probability, density estimation, exploratory data analysis, cluster analysis and pattern recognition, artificial neural networks, classification and regression trees, correlation and nonparametric regression, time series, and visual data mining.

Prerequisite(s): STAT 554 or 663, or permission of instructor.

When Offered: Offered on an irregular basis at the discretion of the department or school

STAT 876 - Measure and Linear Spaces Credits: 3

Measure theory and integration; convergence theorems; theory of linear spaces and functional analysis; and probability theory. The theory of linear spaces includes normed linear spaces, inner product spaces, Banach and Hilbert spaces, Sobolev spaces, and reproducing kernels. Topics include wavelets, applications to stochastic processes, and nonparametric functional inference.

Equivalent to CSI 876

Prerequisite(s): STAT 544 and MATH 315.

When Offered: Alternate Fall

STAT 877 - Geometric Methods in Statistics

Credits: 3

Develops foundations of geometric methods for statistics. Topics include n-dimension Euclidian geometry; projective geometry; differential geometry, including curves, surfaces, and n-dimensional differentiable manifolds; and computational geometry, including computation of convex hulls, tessellations of two-, three-, and n-dimensional spaces, and finite element grid generation. Examples include applications to scientific visualization.

Equivalent to CSI 877

Prerequisite(s): STAT 751 or permission of instructor.

When Offered: Offered on an irregular basis at the discretion of the department or school

STAT 971 - Probability Theory Credits: 3

A rigorous measure-theoretic treatment of probability. Includes expectation, distributions, laws of large numbers and central limit theorems for independent random variables, characteristic function methods, conditional expectations, martingales, strong and weak convergence, and Markov chains.

Equivalent to CSI 971.

Prerequisite(s): STAT 544 and MATH 315. Prerequisite enforced by registration system.

When Offered: Spring

STAT 972 - Mathematical Statistics I Credits: 3

Focuses on theory of estimation. Includes method of moments, least squares, maximum likelihood, and maximum entropy methods. Details methods of minimum variance unbiased estimation. Topics include sufficiency and completeness of statistics, Fisher information, Cramer-Rao bounds, Bhattacharyya bounds, asymptotic consistency and distributions, statistical decision theory, minimax and Bayesian decision rules, and applications to engineering and scientific problems.

Equivalent to CSI 972.

Prerequisite(s): STAT 652/CSI 672 or equivalent, and either STAT 876/CSI 876 or STAT 971/CSI 971.

Prerequisite enforced by registration system.

When Offered: Fall

STAT 973 - Mathematical Statistics II Credits: 3

Continuation of STAT 972/CSI 972. Concentrates on theory of hypothesis testing. Topics include characterizing decision process, simple versus simple hypothesis tests, Neyman-Pearson Lemma, uniformly most powerful tests, unbiasedness and invariance of tests, and randomized and sequential tests. Applications of testing principles made to situations in normal distribution family and other families of distributions.

Equivalent to CSI 973

Prerequisite(s): STAT 972/CSI 972. Prerequisite enforced by registration system.

When Offered: Spring

STAT 998 - Doctoral Dissertation Proposal

Credits: 1-12

Work on research proposal that forms basis for doctoral dissertation.

Notes: May be repeated. No more than 24 credits of STAT 998 and 999 may be applied to doctoral degree requirements.

STAT 999 - Doctoral Dissertation Credits: 1-12

Formal record of commitment to doctoral dissertation research under direction of faculty member in statistics.

Prerequisite(s): Admission to candidacy.

Notes: May be repeated as needed; no more than 24 credits of STAT 998 and 999 may be applied to doctoral degree requirements.