

# STAT - Statistics

## **STAT 216Q Introduction to Statistics: 3 Credits (3 Lec)**

PREREQUISITE: Math Level 300, or a C- or better in any 100 level or above M course. (F, Sp) Traditional and resistant estimators of location and spread, fundamentals of inference using randomization and classical methods, confidence intervals, and tests of hypotheses. This course is taught in the TEAL format. COMMON FINAL ONLY

## **STAT 290R Undergraduate Research: 1-8 Credits (1 Other)**

PREREQUISITE: Consent of department head. (F, Sp) Directed undergraduate research. Course will address responsible conduct of research.

Repeatable up to 8 credits.

## **STAT 291 Special Topics: 1-4 Credits (1-4 Lec)**

PREREQUISITE: None required but some may be determined necessary. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number  
Repeatable up to 12 credits.

## **STAT 332 Statistics for Scientists and Engineers: 3 Credits (3 Lec)**

PREREQUISITE: M 172. (F, Sp) Methods of estimation, data collection, analysis and display of quantitative information, continuous and discrete random variables, families of probability distributions, hypothesis testing, regression, ANOVA

## **STAT 337 Intermediate Statistics with Introduction to Statistical Computing: 3 Credits (3 Lec)**

PREREQUISITE: STAT 216Q or STAT 332. (F, Sp, Su) One- and two-sample tests and associated confidence intervals for means and proportions (and analogous randomization- and resampling-based techniques); One- and Two-way analysis of variance; F-tests, correlation, simple and multiple regression, contingency tables. Introduction to statistical computing, reproducible research, and analysis using a modern scripting language; emphasis on connecting study design to scope of inference in the context of authentic studies and understanding or reproducing statistical results as used in journal articles; COMMON FINAL ONLY

## **STAT 408 Statistical Computing and Graphical Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 337. (Sp) Introduction to statistical packages R or SAS, including data importation, cleaning, graphing, and basic programming. Emphasis on use of graphical displays to explore, understand, and present data, and on organization of code

## **STAT 411 Methods for Data Analysis I: 3 Credits (2 Lec, 1 Lab)**

PREREQUISITE: STAT 337. (F, Sp) Introduction to statistical inference and design, t-tools, non-parametric alternatives, one-way ANOVA, simple linear regression, multiple linear regression, with an emphasis on statistical thinking, appropriate inference, interpretation of results, and writing

## **STAT 412 Methods for Data Analysis II: 3 Credits (2 Lec, 2 Lab)**

PREREQUISITE: STAT 411. (F, Sp) Continuation of STAT 411/ STAT 511 to cover principles of experimental design, multi-factor ANOVA, repeated measures, logistic regression, Poisson log-linear regression, and introductions to multivariate and time series analyses, with an emphasis on statistical thinking, appropriate inference and interpretation, and writing. Co-convened with STAT 512

## **STAT 421 Probability Theory: 3 Credits (3 Lec)**

PREREQUISITE: M 273 and M 242 Strongly recommended. (F) Fundamentals of probability; discrete and continuous random variables; expected value; variance; joint, marginal, and conditional distributions; conditional expectations; applications; simulation; central limit theorem; order statistics

## **STAT 422 Mathematical Statistics: 3 Credits (3 Lec)**

PREREQUISITE: STAT 421. (Sp) Senior capstone course. Introduction to the theory of point estimation, interval estimation, and hypothesis testing

## **STAT 425 Biostatistical Data Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 412. (Spring Even Years) Statistical methodology applicable to vital statistics, life tables and survival curves, clinical trials, epidemiologic investigations, and cause-effect studies

## **STAT 431 Nonparametric Statistics: 3 Credits (3 Lec)**

PREREQUISITE: STAT 337 or STAT 511. () F alternate years, to be offered even years. Goodness-of-fit tests, sign tests, randomization and permutation tests, Wilcoxon and Mann-Whitney tests, Kruskal-Wallis and Friedman's tests, Spearman and Kendall's measures of association, bootstrap techniques, and other alternative nonparametric test procedures. Emphasis on methods and interpretations rather than theory

## **STAT 436 Introduction to Time Series Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 411/STAT 511 or consent of instructor. () F alternate years, to be offered even years. An introduction to time series analysis considering time series regression, autoregressive, moving average, and ARIMA models, time series model building, estimation, and forecasting, and basic frequency domain methods. Co-convened with STAT 536

## **STAT 437 Introduction to Applied Multivariate Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 411 or STAT 511 or consent of instructor. () S alternate years, to be offered odd years. Classic multivariate methods, including but not limited to principal components analysis, canonical correlation analysis, factor analysis, discrimination and classification methods, cluster analysis, and other topics may depend on instructor

## **STAT 439 Introduction to Categorical Data Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 412/STAT 512. () S alternate years, to be offered even years. Contingency table analysis, Poisson regression, logistic regression, log-linear models, multcategory logit models

## **STAT 441 Experimental Design: 3 Credits (3 Lec)**

PREREQUISITE: STAT 411/STAT 511 and M 221 or M 333 or M 441 or consent of instructor. (Sp) An introduction to the design and analysis of experiments: topics include analysis of variance methods, matrix forms, multiple comparisons, fixed and random effects, factorial designs, balanced complete and incomplete blocking designs, designs with nested effects, and split plot designs

## **STAT 446 Sampling: 3 Credits (3 Lec)**

PREREQUISITE: STAT 337 or STAT 511. (F) Probability sampling, sources of bias and uncertainty, survey design, methods for the natural sciences, simple random sampling, stratified random sampling, systematic sampling, cluster sampling

## **STAT 448 Mixed Effects Models: 3 Credits (3 Lec)**

PREREQUISITE: STAT 411/STAT 511 or consent of instructor. () F alternate years, to be offered odd years. In depth analysis of random, fixed and mixed effects models including use of stat software and interpretation of results. Emphasis on observations correlated in time (repeated measures) and space, and on random coefficients models (growth curves)

## **STAT 456 Bayesian Statistical Inference: 3 Credits (3 Lec)**

PREREQUISITE: STAT 408 (Every other spring, in odd years.) This course will introduce the basic ideas of Bayesian statistics and provide a contrast with techniques for classical inference. The course focuses on both the philosophical foundations and practical implementation of Bayesian methods

**STAT 490R Undergraduate Research: 1-6 Credits (1 Other)**

PREREQUISITE: Junior standing in statistics and consent of department head. (F, Sp, Su) Directed undergraduate research/creative activity which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated Repeatable up to 12 credits.

**STAT 491 Special Topics: 1-4 Credits (1-4 Lec)**

PREREQUISITE: Course prerequisites as determined for each offering. On demand. Course not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number Repeatable up to 12 credits.

**STAT 492 Independent Study: 1-3 Credits (1-3 Other)**

PREREQUISITE: Junior standing, consent of instructor, and approval of department head. (F, Sp) Directed research and study on an individual basis Repeatable up to 6 credits.

**STAT 494 Seminar: 1 Credits (1 Other)**

PREREQUISITE: Junior standing and as determined for each offering. (Su) Topics offered at the upper division level which are not covered in regular courses. Students participate in preparing and presenting material Repeatable up to 4 credits.

**STAT 497 Educational Methods: Statistics: 1-3 Credits (1-3 Other)**

PREREQUISITE: Junior standing, consent of instructor, and approval of department head. (F, Sp) As co-teachers of a Statistics course, students will learn and have the opportunity to practice classroom teaching strategies as well as mentoring skills Repeatable up to 6 credits.

**STAT 498 Internship: 2-12 Credits (2-12 Other)**

PREREQUISITE: Junior standing, consent of instructor, and approval of department head. (F, Sp) An individualized assignment arranged with an agency business, or other organization to provide guided experience in the field Repeatable up to 12 credits.

**STAT 500 Applied Methods in Statistics: 3 Credits (2 Lec, 1 Lab)**

PREREQUISITE: Graduate standing or consent of instructor. This course is intended for graduate students not majoring in mathematical sciences. Graphical techniques, data collection plans, populations, samples, sampling distributions, analysis of variance for one-way classifications, multiple comparisons, simple linear regression, scope of inference and transparent communication of uncertainty

**STAT 501 Intermediate Probability and Statistics: 3 Credits (3 Lec)**

PREREQUISITE: STAT 422 or consent of instructor. (F, Su) Families of probability distributions, distributions of functions of random variables, limiting distributions, order statistics. Cross-listed with M 501

**STAT 502 Intermediate Mathematical Statistics: 3 Credits (3 Lec)**

PREREQUISITE: STAT 501 or M 501. (Sp) Estimation, likelihood inference, statistical hypothesis tests, sufficient statistics, exponential families, Bayesian statistics. Cross-listed with M 502

**STAT 505 Linear Models: 3 Credits (3 Lec)**

PREREQUISITE: STAT 412 or STAT 512. (F) Special matrix theory for statistics, multivariate normal distribution, distributions of quadratic forms, estimation and testing for the general linear model, one-way and two-way classification models, contrasts (main effect, simple effect and interaction), multiple comparison techniques

**STAT 506 Advanced Regression Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 505. (Sp) Applications of linear models using statistical packages; detecting and dealing with violations of assumptions including nonconstant variance, nonnormality, and collinearity; mixed effects models

**STAT 509 Stochastic Processes: 3 Credits (3 Lec)**

PREREQUISITE: STAT 421. () S on demand. Conditional probability theory, discrete and continuous time markov chains including birth and death processes and long run behavior; Poisson processes; queuing systems; system reliability. Cross-listed with M 509

**STAT 510 Statistical Consulting Seminar: 1 Credits (1 Other)**

PREREQUISITE: Graduate standing in statistics. (F, Sp) Seminar discussions of issues and cases in statistical consulting. Supervised practice in consulting with researchers from various disciplines Repeatable up to 6 credits.

**STAT 511 Methods of Data Analysis I: 3 Credits (2 Lec, 1 Lab)**

PREREQUISITE: STAT 216Q or equivalent or STAT 500. (F, Sp) For non-statistics graduate students. Introduction to statistical inference and design, t-tools, non-parametric alternatives, one-way ANOVA, simple linear regression and multiple linear regression, with an emphasis on statistical thinking, appropriate inference, interpretation of results and writing. Semester project required

**STAT 512 Methods of Data Analysis II: 3 Credits (2 Lec, 2 Lab)**

PREREQUISITE: STAT 411/STAT 511 (co-convened). (F, Sp) Continuation of STAT 411/STAT 511 to cover principles of experimental design, multi-factor ANOVA, repeated measures, logistic regression, Poisson log-linear regression, and introductions to multivariate and time series analyses, with an emphasis on statistical thinking, appropriate inference and interpretation, and writing. A semester project is required. Co-convened with STAT 412

**STAT 520 Topics in Applied Statistics: 3 Credits (3 Lec)**

PREREQUISITE: STAT 422 and consent of instructor. () On demand. Current topics selected from computational statistics, time series and spatial statistics, decision theory, sampling, linear and mixed models, and multivariate statistics

**STAT 525 Biostatistics: 3 Credits (3 Lec)**

PREREQUISITE: STAT 412 or STAT 512 or STAT 505. (F) Department of Mathematical Sciences

**STAT 528 Statistical Quality Control: 3 Credits (3 Lec)**

PREREQUISITE: STAT 421 or an equivalent transfer course in probability theory. () F alternate years, to be offered odd years. Modeling process quality, traditional SQC tools, control charts for variable and attribute data, CUSUM and WMA charts, process capability analysis, reliability statistics, accelerated testing

**STAT 532 Bayesian Data Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 422 or STAT 502 or M 502 and STAT 506 recommended. (F) Fundamentals of Bayesian inference, methods of Bayesian data analysis, computational methods for posterior simulation, fundamentals of hierarchical modeling

**STAT 534 Spatial Data Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 412, STAT 512, and STAT 422, or equivalent, or consent of the instructor. () S alternate years, to be offered odd years. Statistical methods of spatial data analysis, stationary and nonstationary random fields, covariance structures, geostatistical models and analysis, spatial point process models and analysis, spatial lattice models and analysis

**STAT 536 Time Series Analysis: 3 Credits (3 Lec)**

PREREQUISITE: STAT 411, STAT 511, or consent of the instructor. An introduction to time series analysis considering time series regression, autoregressive, moving average, and ARIMA models, time series model building, estimation, and forecasting, and basic frequency domain methods. Co-convened with STAT 436 Department of Mathematical Sciences.

**STAT 537 Multivariate Analysis I: 3 Credits (3 Lec)**

PREREQUISITE: STAT 505. () S alternate years, to be offered even years. Multivariate regression, principal components analysis, exploratory and confirmatory factor analysis, discriminant and classification analysis, cluster analysis, classification and regression trees, basic structural equation modeling, along with bagging and boosting methods

**STAT 538 Multivariate Analysis II: 3 Credits (3 Lec)**

PREREQUISITE: STAT 537. () On demand. Special topics in multivariate analysis including general latent variable methods, analysis of covariance structures, common principle components, robust and distribution free multivariate analysis

**STAT 539 Generalized Linear Models: 3 Credits (3 Lec)**

PREREQUISITE: STAT 422 and STAT 411/STAT 511. () S alternate years, to be offered odd years. Analysis of categorical data including logistic regression, log-linear models, analysis of deviance, extrabinomial variation, quasi-likelihood

**STAT 541 Experimental Design: 3 Credits (3 Lec)**

PREREQUISITE: STAT 411/STAT 511 and M 221 or M 333 or M 441. (Sp) An introduction to the design and analysis of experiments: topics include analysis of variance methods, matrix forms, multiple comparisons, fixed and random effects, factorial designs, balanced complete and incomplete blocking designs, designs with nested effects, and split plot designs

**STAT 550 Advanced Mathematical Statistics: 3 Credits (3 Lec)**

PREREQUISITE: STAT 502 or M 502 and either M 384, M 505, or M 547. () S alternate years, to be offered even years. Sufficiency, completeness, ancillary statistics, invariance, likelihood-based inference, large sample theory, Edgeworth and saddlepoint approximations

**STAT 575 Professional Paper and Project: 1-4 Credits (1-4 Lec)**

PREREQUISITE: Graduate standing. (F, Sp, Su) A research or professional paper or project dealing with a topic in the field. The topic must have been mutually agreed upon by the student, his or her major advisor, and graduate committee  
Repeatable up to 6 credits.

**STAT 576 Internship: 1-12 Credits (1-12 Other)**

PREREQUISITE: Graduate standing, consent of instructor and approval of department head. (F, Sp, Su) An individualized assignment arranged with an agency, business or other organization to provide guided experience in the field  
Repeatable up to 99 credits.

**STAT 578 Response Surface Methodology: 3 Credits (3 Lec)**

PREREQUISITE: STAT 541 or STAT 505. (Su) Diagnostics; fractional-factorial designs; method of steepest ascent; canonical analysis; response optimization; ridge analysis; response surface design including central composite designs, orthogonal designs, rotatable designs, and optimal designs; mixture designs

**STAT 589 Graduate Consultation: 3 Credits (3 Other)**

PREREQUISITE: Master's standing. (F, Sp) This course may be used only by students who have completed all of their coursework (and thesis, if on a thesis plan) but who need additional faculty or staff time

**STAT 590 Master's Thesis: 1-10 Credits (1-10 Other)**

PREREQUISITE: Master's standing  
Repeatable up to 99 credits.

**STAT 591 Special Topics: 1-4 Credits (1-4 Lec)**

PREREQUISITE: Upper division courses and others as determined for each offering. On demand. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number  
Repeatable up to 12 credits.

**STAT 592 Independent Study: 1-3 Credits (1-3 Other)**

PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. (F, Sp, Su) Directed research and study on an individual basis  
Repeatable up to 6 credits.

**STAT 594 Seminar: 1 Credits (1 Other)**

PREREQUISITE: Graduate standing or seniors by petition. () On demand. Course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material  
Repeatable up to 6 credits.

**STAT 689 Doc Reading & Research: 3-5 Credits (3-5 Other)**

PREREQUISITE: Doctoral standing. (F, Sp, Su) This course may be used by doctoral students who are reading research publications in the field in preparation for doctoral thesis research  
Repeatable up to 15 credits.

**STAT 690 Doctoral Thesis: 1-10 Credits (1-10 Other)**

PREREQUISITE: Doctoral standing  
Repeatable up to 99 credits.