

# STATISTICS (STAT)

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## STAT 153 Introduction to Statistical Reasoning (3 credits)

General Education: Mathematical Ways of Knowing

Cross-listed with MATH 153

A course in statistical literacy, an introduction with emphasis on examples and case studies. Topics include data sources and the distinction between experiments, observational studies, and surveys; graphical and numerical description of data; understanding randomness; central tendency; correlation versus causation; line of best fit; estimation of proportions; and statistical testing. Typically Offered: Fall, Spring and Summer.

## STAT 204 (s) Special Topics (1-16 credits)

Credit arranged

## STAT 251 Statistical Methods (3 credits)

General Education: Mathematical Ways of Knowing

Intro to statistical methods including design of statistical studies, basic sampling methods, descriptive statistics, probability and sampling distributions; inference in surveys and experiments, regression, and analysis of variance. (Credit will not be awarded for STAT 251 after STAT 301 or STAT 416, or for STAT 416 after STAT 251 or STAT 301.) Typically Offered: Fall, Spring and Summer.

**Prereqs:** MATH 108 (with grade of C or better) or MATH 143 or MATH 160 or MATH 170 or sufficient score on SAT, ACT, or math placement test (see [www.uidaho.edu/registrar/registration/placement](http://www.uidaho.edu/registrar/registration/placement)).

## STAT 299 (s) Directed Study (1-16 credits)

Credit arranged

## STAT 301 Probability and Statistics (3 credits)

Credit not awarded for STAT 251 after STAT 301. Intended for engineers, mathematicians, and physical scientists. Intro to sample spaces, random variables, statistical distributions, hypothesis testing, basic experimental design, regression, and correlation.

**Prereqs:** MATH 175.

## STAT 404 (s) Special Topics (1-16 credits)

Credit arranged

## STAT 407 Experimental Design (3 credits)

Joint-listed with STAT 507

Methods of constructing and analyzing designs for experimental investigations; analysis of designs with unequal subclass numbers; concepts of blocking randomization and replication; confounding in factorial experiments; incomplete block designs; response surface methodology. Additional work required for graduate credit. Cooperative: open to WSU degree-seeking students.

**Prereqs:** STAT 431

## STAT 414 Nonparametric Statistics (3 credits)

Joint-listed with STAT 514

Conceptual development of nonparametric methods including one, two, and k-sample tests for location and scale, randomized complete blocks, rank correlation, and runs test. Permutation methods, nonparametric bootstrap methods, density estimation, curve smoothing, robust and rank-based methods for the general linear model, and comparison. Comparison to parametric methods. Additional coursework/project required for graduate credit. Typically Offered: Varies.

**Prereqs:** STAT 431 Cooperative: open to WSU degree-seeking students.

## STAT 417 Statistical Learning and Predictive Modeling (3 credits)

Joint-listed with STAT 517

A comprehensive overview of statistical learning and predictive modeling techniques to analyze large data sets in science, social science, and other data-rich fields including, for example, biology, business, and engineering. Topics include regression, classification, resampling methods, model selection and regularization, tree-based methods, support vector machines, clustering, and text mining. The implementation of the methods will be in R and Python as needed. Basic experience with computer programming is assumed. Additional coursework/project required for graduate credit. Typically Offered: Fall.

**Prereqs:** STAT 431

## STAT 418 Multivariate Analysis (3 credits)

Joint-listed with STAT 519

The multivariate normal, Hotelling's T<sup>2</sup>, multivariate general linear model, discriminant analysis, covariance matrix tests, canonical correlation, and principle component analysis. Additional coursework/project required for graduate credit. Typically Offered: Spring.

**Prereqs:** STAT 431 Cooperative: open to WSU degree-seeking students.

## STAT 419 Introduction to SAS/R Programming (3 credits)

An introduction to the SAS and R programming languages. Topics include creating data, importing data, accessing subsets of data, exporting data, plotting and graphing, loops and functions. Course provides a basic knowledge of SAS and R to help students master statistical tools available in SAS and R, including basic statistical analyses.

**Prereqs:** STAT 251 or STAT 301

## STAT 422 Survey Sampling Methods (3 credits)

Introduction to survey sampling designs and inference including simple, stratified, and cluster sampling; ratio and regression estimators, unequal probability sampling, and population size estimation. Cooperative: open to WSU degree-seeking students.

**Prereqs:** 'C' or better in either STAT 251 or STAT 301

## STAT 426 SAS Programming (3 credits)

Coverage of a variety of methods for data manipulation, data management, and programming in the SAS language. DATA step programming methods including data transformation, functions for numeric and character data, input of complicated data files, and do loop usage. Data management topics include concatenating data files, sorting and merging data files and ARRAY statement usage. SAS programming with SAS modules such as SAS/Graph, SAS/IML, and SAS/Macro language. Other topics in SAS programming, such as covering other SAS modules in depth.

**Prereqs:** STAT 251 or STAT 301

## STAT 427 R Programming (3 credits)

Credit not awarded for STAT 427 after STAT 419. Introduction to the R computing language for scientific graphics, statistical analysis, simulation, and mathematical modeling. Topics include functions, data management and manipulation, loops and logical structures, vector and matrix calculations, contemporary graphical displays, probability and simulation, dynamic models, numerical optimization, standard methods of statistical analysis.

**Prereqs:** STAT 251 or STAT 301

## STAT 431 Statistical Analysis (3 credits)

Concepts and methods of statistical research including multiple regression, contingency tables and chi-square, experimental design, analysis of variance, multiple comparisons, and analysis of covariance. Cooperative: open to WSU degree-seeking students.

**Prereqs:** STAT 251 or STAT 301

**STAT 433 Econometrics (3 credits)**

Cross-listed with ECON 453

Application of statistical methods to economics and business studies; emphasis on regression analysis methods.

**Prereqs:** STAT 251 or STAT 301

**STAT 435 Introduction to Bayesian Statistics (3 credits)**

Joint-listed with STAT 535

Exploring the basics of Bayesian thinking with a comparative approach to interpretations of probability. Statistical methods, Bayesian approach to statistical inference. Methods include point and interval estimation under the Normal model, and inference under hierarchical models with emphasis on statistical model building. Computational methods, applications of methods useful for sampling posterior distributions such as rejection sampling, importance sampling, and Markov Chain Monte Carlo. Additional coursework/project required for graduate credit. Typically Offered: Varies.

**Prereqs:** STAT 431 or equivalent

**STAT 436 Applied Regression Modeling (3 credits)**

General Education: Senior Experience

Joint-listed with STAT 516

Statistical modeling and analysis of scientific data using regression model including linear, nonlinear, and generalized linear regression models. Topics also include analysis of survival data, censored and truncated response variables, categorical response variables, and mixed models. Emphasis is on application of these methods through the analysis of real data sets with statistical packages. Additional coursework/projects will be assigned at the 500-level. Typically Offered: Spring.

**Prereqs:** STAT 431

**STAT 451 Probability Theory (3 credits)**

Cross-listed with MATH 451

Random variables, expectation, special distributions (normal, binomial, exponential, etc. ), moment generating functions, law of large numbers, central limit theorem. Cooperative: open to WSU degree-seeking students. (Fall only)

**Prereqs or Coreqs:** MATH 275 or Permission

**STAT 452 Mathematical Statistics (3 credits)**

Cross-listed with MATH 452

Estimation of parameters, confidence intervals, hypothesis testing, likelihood ratio test, sufficient statistics. Cooperative: open to WSU degree-seeking students. (Spring only)

**Prereqs:** MATH 451 or Permission

**STAT 453 Stochastic Models (3 credits)**

Cross-listed with MATH 453

Joint-listed with MATH 538

Markov chains, stochastic processes, and other stochastic models; applications. Additional projects/assignments required for graduate credit. Cooperative: open to WSU degree-seeking students.

**Prereqs:** MATH 451 or Permission

**STAT 456 Enterprise Quality Management (3 credits)**

Cross-listed with OM 456

Principles of quality management, with a focus on Lean Six Sigma concepts and Define-Measure-Analyze-Improve-Control (DMAIC) approach to managing and improving enterprise quality. Additional work required for graduate credit. May include evening exams. May involve field trips. Typically Offered: Varies.

**Prereqs:** STAT 251 or STAT 301 or Permission

**STAT 498 (s) Internship (1-16 credits)**

Credit arranged

**Prereqs:** Permission

**STAT 499 (s) Directed Study (1-16 credits)**

Credit arranged

**STAT 500 Master's Research and Thesis (1-16 credits)**

Credit arranged

**STAT 501 (s) Seminar (1-16 credits)**

Credit arranged. This course addresses statistical ethics; statistically oriented research; and deeper and more extensive consideration of topics relevant to but not addressed in other graduate level statistics courses offered during that semester. Formal presentations and reports in journal format are used to enhance written, oral, and presentation communication experience and ability.

**STAT 502 (s) Directed Study (1-16 credits)**

Credit arranged

**STAT 503 (s) Workshop (1-16 credits)**

Credit arranged

**STAT 504 (s) Special Topics (1-16 credits)**

Credit arranged

**STAT 507 Experimental Design (3 credits)**

Joint-listed with STAT 407

Methods of constructing and analyzing designs for experimental investigations; analysis of designs with unequal subclass numbers; concepts of blocking randomization and replication; confounding in factorial experiments; incomplete block designs; response surface methodology. Additional work required for graduate credit. Cooperative: open to WSU degree-seeking students.

**Prereqs:** STAT 431

**STAT 514 Nonparametric Statistics (3 credits)**

Joint-listed with STAT 414

Conceptual development of nonparametric methods including one, two, and k-sample tests for location and scale, randomized complete blocks, rank correlation, and runs test. Permutation methods, nonparametric bootstrap methods, density estimation, curve smoothing, robust and rank-based methods for the general linear model, and comparison. Comparison to parametric methods. Additional coursework/project required for graduate credit. Typically Offered: Varies. Cooperative: open to WSU degree-seeking students.

**Prereqs:** STAT 431

**STAT 516 Applied Regression Modeling (3 credits)**

General Education: Senior Experience

Joint-listed with STAT 436

Statistical modeling and analysis of scientific data using regression model including linear, nonlinear, and generalized linear regression models. Topics also include analysis of survival data, censored and truncated response variables, categorical response variables, and mixed models. Emphasis is on application of these methods through the analysis of real data sets with statistical packages. Additional coursework/projects will be assigned at the 500-level. Typically Offered: Spring.

**STAT 517 Statistical Learning and Predictive Modeling (3 credits)**

Joint-listed with STAT 417

A comprehensive overview of statistical learning and predictive modeling techniques to analyze large data sets in science, social science, and other data-rich fields including, for example, biology, business, and engineering. Topics include regression, classification, resampling methods, model selection and regularization, tree-based methods, support vector machines, clustering, and text mining. The implementation of the methods will be in R and Python as needed. Basic experience with computer programming is assumed. Additional coursework/project required for graduate credit. Typically Offered: Fall.

**STAT 519 Multivariate Analysis (3 credits)**

Joint-listed with STAT 418

The multivariate normal, Hotelling's  $T^2$ , multivariate general linear model, discriminant analysis, covariance matrix tests, canonical correlation, and principle component analysis. Additional coursework/project required for graduate credit. Typically Offered: Spring. Cooperative: open to WSU degree-seeking students.

**Prereqs:** STAT 431

**STAT 535 Introduction to Bayesian Statistics (3 credits)**

Joint-listed with STAT 435

Exploring the basics of Bayesian thinking with a comparative approach to interpretations of probability. Statistical methods, Bayesian approach to statistical inference. Methods include point and interval estimation under the Normal model, and inference under hierarchical models with emphasis on statistical model building. Computational methods, applications of methods useful for sampling posterior distributions such as rejection sampling, importance sampling, and Markov Chain Monte Carlo. Additional coursework/project required for graduate credit. Typically Offered: Varies.

**Prereqs:** STAT 431 or equivalent

**STAT 544 Stochastic Models (3 credits, max 3)**

Cross-listed with MATH 538

Joint-listed with STAT 453

Markov chains, stochastic processes, and other stochastic models; applications. Additional projects/assignments required for graduate credit. Cooperative: open to WSU degree-seeking students.

**Prereqs:** MATH 451 or Permission.

**STAT 550 Regression (3 credits)**

Theory and application of regression models including linear, nonlinear, and generalized linear models. Topics include model specification, point and interval estimators, exact and asymptotic sampling distributions, tests of general linear hypotheses, prediction, influence, multicollinearity, assessment of model fit, and model selection. Recommended preparation: MATH 330 and STAT 452.

**STAT 555 Statistical Ecology (3 credits)**

Cross-listed with WLF 555

Stochastic models in ecological work; discrete and continuous statistical distributions, birth-death processes, diffusion processes; applications in population dynamics, population genetics, ecological sampling, spatial analysis, and conservation biology. Cooperative: open to WSU degree-seeking students. (Spring, alt/years)

**Prereqs:** MATH 451 or Permission

**STAT 565 Computer Intensive Statistics (3 credits)**

Numerical stability, matrix decompositions for linear models, methods for generating pseudo-random variates, interactive estimation procedures (Fisher scoring and EM algorithm), bootstrapping, scatterplot smoothers, Monte Carlo techniques including Monte Carlo integration and Markov chain Monte Carlo. Cooperative: open to WSU degree-seeking students. (Alt/years)

**Prereqs:** STAT 451, STAT 452, MATH 330, and computer programming experience or Permission

**STAT 597 (s) Consulting Practicum (1-16 credits)**

Credit arranged. Students will gain experience in statistical consulting and data analysis, using multiple statistical software packages in the analysis process. Topics include communication of statistical information and analysis to non-statisticians, ethics, and computing. Emphasis is placed on written and oral presentation of statistical analysis plans and results.

**STAT 598 (s) Internship (1-16 credits)**

Credit arranged. Students gain experience in statistical consultation and/or statistical data analysis in their present place of employment or an arranged internship organization. Students are jointly accountable to a faculty advisor and a person providing oversight of the individual's efforts within the organization. All internship experiences must be pre-approved.

**STAT 599 (s) Research (1-16 credits)**

Credit arranged. Research not directly related to a thesis or dissertation.