# STATISTICS (STAT)

**STAT 110 - Introduction to Statistical Reasoning (3 Credits)**
A course in statistical literacy. Topics include data sources and sampling, concepts of experimental design, graphical and numerical data description, measuring association for continuous and categorical variables, introduction to probability and statistical inference, and use of appropriate software. Credit given only for STAT 110 or STAT 112.
**Carolina Core:** ARP

**STAT 112 - Statistics and the Media (3 Credits)**
Statistics and the Media. (3) Statistical and information literacy. Experimental and survey design; descriptive statistics; basic probability; simple confidence intervals and hypothesis tests; statistical software; collection, management, and evaluation of information; and presentation of statistics in the media. Credit given for only STAT 110 or STAT 112.
**Carolina Core:** ARP, INF

**STAT 201 - Elementary Statistics (3 Credits)**
Introduction to the fundamentals of modern statistical methods, including descriptive statistics, probability, random sampling, simple linear regression, correlation, tests of hypotheses, and estimation.
**Prerequisites:** C or better in MATH 111 or higher; or C or better in STAT 110 or STAT 112; or through placement exam.

**Carolina Core:** ARP

**STAT 205 - Elementary Statistics for the Biological and Life Sciences (3 Credits)**
Introduction to fundamental statistical methods with applications in the biological and life sciences. Includes descriptive statistics; probability; one and two-sample models for population means; contingency tables (including relative risk, odds ratios, case-control studies, and estimation of sensitivity and specificity); linear regression; logistic regression; aspects of survival analysis, and ANOVA.
**Prerequisites:** C or better in MATH 111 or higher; or through placement exam.

**Carolina Core:** ARP

**STAT 206 - Elementary Statistics for Business (3 Credits)**
Fundamental statistical methods with applications in business. Includes descriptive statistics, graphical methods, probability, distributions, sampling, inference, contingency tables, and linear regression.
**Prerequisites:** C or better in MATH 111 or higher; or through placement exam.

**Carolina Core:** ARP

**STAT 301 - Statistical Methods for Data Analytics (3 Credits)**
A second course in statistical methods. Multiple linear regression, model building and regularization, one-way ANOVA, multiple comparisons, and introductions to the ideas of experimental design and generalized linear models. Focused on choosing correct methods, conceptual understanding, using statistical software, checking assumptions, and practical implications. May not be taken concurrently with or after STAT 516.
**Prerequisites:** C or better in STAT 201, STAT 205, STAT 206, PSYC 220 or SOCY 392.

**STAT 399 - Independent Study (3-6 Credits)**
Contract approved by instructor, advisor, and department chair is required for undergraduate students.
**Graduation with Leadership Distinction:** GLD: Research

**STAT 506 - Introduction to Experimental Design (3 Credits)**
Techniques of experimentation based on statistical principles with application to quality improvement and other fields. Full and fractional factorial designs for factors at two levels; dispersion effects; related topics.
**Prerequisites:** C or higher in MATH 122 or MATH 141; or both MATH 111 or higher and any statistical class.

**STAT 509 - Statistics for Engineers (3 Credits)**
Basic probability and statistics with applications and examples in engineering. Elementary probability, random variables and their distribution, random processes, statistical inference, linear regression, correlation and basic design of experiments with application to quality assurance, reliability, and life testing. May not be taken concurrently with or after STAT 513, STAT 515, or STAT 516. Not for C.A.S., M.A.S., or Ph.D credit in Statistics.
**Prerequisites:** MATH 142 or equivalent.

**STAT 511 - Probability (3 Credits)**
Probability and independence; discrete and continuous random variables; joint, marginal, and conditional densities, moment generating functions; laws of large numbers; binomial, Poisson, gamma, univariate, and bivariate normal distributions.
**Prerequisite or Corequisite:** C or better in MATH 241.

**Cross-listed course:** MATH 511

**STAT 512 - Mathematical Statistics (3 Credits)**
Functions of random variables, order statistics, sampling distributions, central limit theorem, quality of estimators, interval estimation, sufficient statistics, minimum-variance unbiased estimator, maximum likelihood, large-sample theory, introduction to hypothesis testing.
**Prerequisites:** C or better in STAT 511 or MATH 511.

**STAT 513 - Theory of Statistical Inference (3 Credits)**
Hypothesis testing, Neyman-Pearson lemma, likelihood ratio tests, power, the theory of linear models including multiple linear regression and ANOVA, the Chi-square goodness-of-fit test, Chi-square inference for contingency tables, Bayesian inference, and advanced topics including survival analysis (only if time permits).
**Prerequisites:** C or better in STAT 512.

**STAT 515 - Statistical Methods I (3 Credits)**
Applications and principles of elementary probability, essential discrete and continuous probability distributions, sampling distributions, estimation, and hypothesis testing. Inference for means, variances, proportions, one-way ANOVA, simple linear regression, and contingency tables. Statistical packages such as SAS or R. May not be taken concurrently with or after STAT 509, STAT 513, or STAT 516. Not for CAS, MAS, MS, or PhD credit in Statistics.
**Prerequisites:** C or better in MATH 112, MATH 115, MATH 122 or MATH 141; or both C or better in STAT 110 or higher and C or better in MATH 111; or through placement exam.

**STAT 516 - Statistical Methods II (3 Credits)**
Applications and principles of linear models. Simple and multiple linear regression, analysis of variance for basic designs, multiple comparisons, random effects, and analysis of covariance. Statistical packages such as SAS. Not for CAS, MAS, MS, or PhD credit in Statistics.
**Prerequisites:** C or higher in STAT 515, STAT 509, STAT 512, or equivalent.

**STAT 517 - Advanced Statistical Models (3 Credits)**
Theory and applications of advanced statistical models. Includes implementation and assessment of generalized linear, nonlinear and nonparametric regression, mixed effect, repeated measures, multivariate regression, and spatial models.
**Prerequisites:** C or better in STAT 512, STAT 516, or equivalent.

**STAT 518 - Nonparametric Statistical Methods (3 Credits)**
Applications and principles of nonparametric statistics. Classical rank-based methods, and selected categorical data analysis and modern nonparametric methods. Statistical packages such as R.
**Prerequisites:** C or better in STAT 515, STAT 509 or STAT 512.

**STAT 519 - Sampling (3 Credits)**
Techniques of statistical sampling in finite populations with applications in the analysis of sample survey data. Topics include simple random sampling for means and proportions, stratified sampling, cluster sampling, ratio estimates, and two-stage sampling.
**Prerequisites:** C or higher in STAT 515, STAT 509, STAT 512, or equivalent.

**STAT 520 - Forecasting and Time Series (3 Credits)**
Time series analysis and forecasting using the multiple regression and Box-Jenkins approaches.
**Prerequisites:** C or better in STAT 516 or MGSC 391.

**Cross-listed course:** MGSC 520

**STAT 521 - Applied Stochastic Processes (3 Credits)**
An introduction to stochastic processes, including conditional probability, Markov chains, Poisson processes, and Brownian motion. Incorporates simulation and applications to actuarial science.
**Prerequisites:** C or higher in STAT 511.

**STAT 522 - Financial Mathematics I (3 Credits)**
Probability spaces. Random variables. Mean and variance. Geometric Brownian Motion and stock price dynamics. Interest rates and present value analysis. Pricing via arbitrage arguments. Options pricing and the Black-Scholes formula.
**Prerequisites:** C or better in MATH 241.

**Cross-listed course:** MATH 514

**STAT 523 - Financial Mathematics II (3 Credits)**
Convex sets. Separating Hyperplane Theorem. Fundamental Theorem of Asset Pricing. Risk and expected return. Minimum variance portfolios. Capital Asset Pricing Model. Martingales and options pricing. Optimization models and dynamic programming.
**Prerequisites:** C or better in MATH 514 or STAT 522.

**Cross-listed course:** MATH 515

**STAT 525 - Statistical Quality Control (3 Credits)**
Statistical procedures for process control including CUSUM and Shewhart Control Charts, and lot-acceptance sampling.
**Prerequisites:** STAT 509 or STAT 515 or MGSC 391.

**Cross-listed course:** MGSC 525

**STAT 528 - Environmental Statistics (3 Credits)**
Statistical analysis of environmental data. Review of multiple regression and ANOVA, nonlinear regression models and generalized linear models, analyses for temporally and spatially correlated data, and methods of environmental sampling.
**Prerequisites:** STAT 516.

**STAT 530 - Applied Multivariate Statistics and Data Mining (3 Credits)**
Introduction to fundamentals of multivariate statistics and data mining. Principal components and factor analysis; multidimensional scaling and cluster analysis; MANOVA and discriminant analysis; decision trees; and support vector machines. Use of appropriate software.
**Prerequisites:** C or better in STAT 301, STAT 515, STAT 205, STAT 509, STAT 512, ECON 436, MGSC 291, or PSYC 221 #.

**STAT 531 - Advanced Machine Learning with Implementation (3 Credits)**
Theory and application of machine learning. Current mainstream programming libraries such as in Python, and implementation of regression, clustering, principal components, and linear discriminant analysis. Detailed coverage of methods such as random forests, support vector machines, and k-nearest neighbors. Introduction to neural networks.
**Prerequisites:** C or better in CSCE 106; C or better in STAT 530, CSCE 587, or STAT 587; C or better in MATH 241, MATH 328, MATH 344, or MATH 544.

**Cross-listed course:** CSCE 588

**STAT 535 - Introduction to Bayesian Data Analysis (3 Credits)**
Principles of Bayesian statistics, including: one- and multi-sample analyses; Bayesian linear models; Monte Carlo approaches; prior elicitation; hypothesis testing and model selection; hierarchical models; selected advanced models; statistical packages such as WinBUGS and R.
**Prerequisites:** C or better in STAT 512, CSCE 582 or STAT 582; or both STAT 511 and either STAT 509 or STAT 515; or equivalent.

**STAT 540 - Computing in Statistics (3 Credits)**
An introduction to statistical packages such as R and SAS with special focus on data management and computing procedures such as Monte Carlo simulation.
**Prerequisites:** C or better in STAT 301, STAT 515, STAT 509, STAT 512, or equivalent .

**STAT 541 - Advanced SAS Programming (3 Credits)**
Advanced programming techniques in SAS, including database management, macro language, and efficient programming practices.
**Prerequisites:** STAT 540.

**STAT 542 - Computing for Data Science (3 Credits)**
Techniques for data visualization and graphics including interactive graphics, data wrangling and cleaning, data ethics, database querying and administration.
**Prerequisites:** C or better in STAT 301, STAT 509, STAT 515 or equivalent, or permission of department.

**STAT 582 - Bayesian Networks and Decision Graphs (3 Credits)**
Normative approaches to uncertainty in artificial intelligence. Probabilistic and causal modeling with Bayesian networks and influence diagrams. Applications in decision analysis and support. Algorithms for probability update in graphical models.
**Prerequisites:** C or better in either CSCE 106 or CSCE 145 and either STAT 509 or STAT 515.

**Cross-listed course:** CSCE 582

**STAT 587 - Big Data Analytics (3 Credits)**
Foundational techniques and tools required for data science and big data analytics. Concepts, principles, and techniques applicable to any technology and industry for establishing a baseline that can be enhanced by future study.
**Prerequisites:** C or better in STAT 301, STAT 509, STAT 513, or STAT 515.

**Cross-listed course:** CSCE 587

**STAT 588 - Genomic Data Science (3 Credits)**
This course focuses on quantitative knowledge for interdisciplinary applications in genetics as well as hands-on experience in analyzing genetic data. In this course, students will have programming exercises in using analysis tools to conduct genome-wide analysis, annotation, and interpretation of genetic data using R/Bioconductor packages.
**Prerequisites:** C or better in STAT 201 or higher.

**Cross-listed course:** BIOL 588

**STAT 591 - Data Analysis for Teachers (3 Credits)**
Introduction to statistics for elementary, middle, and high school teachers. The fundamentals of data collection, descriptive statistics, probability, and inference with special focus on methods of teaching statistical reasoning. For M.A.T. (excluding mathematics) / M.Ed. / M.T. and nondegree credit only. For M.A.T. (excluding mathematics) / M.Ed. / M.T. and nondegree credit only.
**Cross-listed course:** SMED 591

**STAT 599 - Topics in Statistics (1-3 Credits)**
Course content varies and will be announced in the schedule of courses by title.

**STAT 600 - Statistics for Applied Management (3 Credits)**
Introduction to data collection, descriptive statistics, and statistical inference with examples from hospitality, retail, sport, and entertainment management. Focus on selecting, implementing, and interpreting the appropriate statistical methods using software such as Excel and SPSS. Not for minor or degree credit in Mathematics or Statistics. Does not prepare students for STAT 516, STAT 518, STAT 519 or STAT 525.

**STAT 650 - AP Statistics for Teachers (3 Credits)**
A thorough study of the topics covered on the AP Statistics Examination. A non-calculus-based introduction, including descriptive and inferential one- and two-variable statistics, and emphasizing activities illustrating statistical thinking. Current secondary high school teacher certification in mathematics. For I.M.A./M.A.T. (excluding mathematics)/M.Ed./M.T. and nondegree credit only. Restricted to graduate students.