

STATISTICS (STA)

College of Letters & Science

STA 010 – Statistical Thinking (4 units)

Course Description: Statistics and probability in daily life. Examines principles of collecting, presenting and interpreting data in order to critically assess results reported in the media; emphasis is on understanding polls, unemployment rates, health studies; understanding probability, risk and odds.

Prerequisite(s): Two years of high school algebra.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Credit Limitation(s): No credit if student has taken STA 013 or STA 013Y or higher.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 012 – Introduction to Discrete Probability (4 units)

Course Description: Random experiments; countable sample spaces; elementary probability axioms; counting formulas; conditional probability; independence; Bayes theorem; expectation; gambling problems; binomial, hypergeometric, Poisson, geometric, negative binomial and multinomial models; limiting distributions; Markov chains. Applications in the social, biological, and engineering sciences.

Prerequisite(s): Two years of high school algebra.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 013 – Elementary Statistics (4 units)

Course Description: Descriptive statistics; basic probability concepts; binomial, normal, Student's t, and chi-square distributions. Hypothesis testing and confidence intervals for one and two means and proportions. Regression.

Prerequisite(s): Two years of high school algebra or Mathematics D.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Credit Limitation(s): Not open for credit for students who have completed STA 013V, or higher.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 013Y – Elementary Statistics (4 units)

Course Description: Descriptive statistics; basic probability concepts; binomial, normal, Student's t, and chi-square distributions. Hypothesis testing and confidence intervals for one and two means and proportions. Regression.

Prerequisite(s): Two years of high school algebra or Mathematics D.

Learning Activities: Lecture 1 hour(s), Web Virtual Lecture 2 hour(s); Discussion 1 hour(s).

Credit Limitation(s): No credit if student has taken STA 013, or higher.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 015A – Introduction to Statistical Data Science I (4 units)

Course Description: Principles of descriptive statistics. Concepts of randomness, probability models, sampling variability, hypothesis tests and confidence interval.

Prerequisite(s): Two years of high school algebra or Mathematics D.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Credit Limitation(s): Not open for credit to students who have taken STA 013 or STA 032 or STA 100.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 015B – Introduction to Statistical Data Science II (4 units)

Course Description: Programming in R; Summarization and visualization of different data types; Concepts of correlation, regression, classification and clustering.

Prerequisite(s): STA 015A C- or better or STA 013 C- or better or STA 032 C- or better or STA 100 C- or better.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Visual Literacy (VL).

STA 015C – Introduction to Statistical Data Science III (4 units)

Course Description: Classical and Bayesian inference procedures in parametric statistical models. Nonparametric methods; resampling techniques; missing data. Use of statistical software.

Prerequisite(s): STA 015B C- or better.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 032 – Gateway to Statistical Data Science (4 units)

Course Description: Probability concepts; programming in R; exploratory data analysis; sampling distribution; estimation and inference; linear regression; simulations; resampling methods. Alternative to STA 013 for students with a background in calculus and programming.

Prerequisite(s): MAT 016B C- or better or MAT 017B C- or better or MAT 019B C- or better or MAT 021B C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Credit Limitation(s): Only 2 units of credit allowed to students who have taken STA 013; not open for credit to students who have taken STA 100.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 035A – Statistical Data Science I (4 units)

Course Description: Principles of descriptive statistics; basic R programming; probability models; sampling variability; hypothesis tests; confidence intervals; statistical simulation.

Prerequisite(s): MAT 016A (can be concurrent) or MAT 017A (can be concurrent) or MAT 019A (can be concurrent) or MAT 021A (can be concurrent).

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Credit Limitation(s): Not open for credit to students who have taken STA 032 or STA 100. Only 2 units credit for students who have taken STA 013.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 035B – Statistical Data Science II (4 units)

Course Description: Advanced programming and data manipulation in R. Principles of data visualization. Concepts of correlation, regression, analysis of variance, nonparametrics.

Prerequisite(s): (STA 013 C- or better or STA 013Y C- or better; ECS 032A C- or better or ECS 032AV C- or better) or STA 032 C- or better or STA 035A C- or better or STA 100 C- or better; MAT 016B or MAT 017B { can be concurrent } or MAT 019B { can be concurrent } or MAT 021B { can be concurrent }

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Visual Literacy (VL).

STA 035C – Statistical Data Science III (4 units)

Course Description: Introduction to statistical learning; Bayesian paradigm; model selection; simultaneous inference; bootstrap and cross validation; classification and clustering methods; PCA; nonparametric smoothing techniques.

Prerequisite(s): STA 035B C- or better; (MAT 016B C- or better or MAT 017B C- or better or MAT 019B C- or better or MAT 021B C- or better).

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL).

STA 090X – Seminar (1-2 units)

Course Description: Examination of a special topic in a small group setting.

Prerequisite(s): Consent of instructor; high school algebra.

Learning Activities: Seminar 1-2 hour(s).

Grade Mode: Letter.

STA 092 – Internship in Statistics (1-12 units)

Course Description: Work experience in Statistics. Supervised internship, on or off campus in areas of Statistics including data analysis, data science, machine learning, optimization, quantitative finance, geographic information systems, engineering, or statistics applications in other fields of inquiry. Final written report on internship experience required.

Prerequisite(s): Consent of instructor.

Learning Activities: Internship.

Grade Mode: P/NP only.

STA 098 – Directed Group Study (1-5 units)

Course Description: Directed group study.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

STA 099 – Special Study for Undergraduates (1-5 units)

Course Description: Special study for undergraduates.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

STA 100 – Applied Statistics for Biological Sciences (4 units)

Course Description: Descriptive statistics, probability, sampling distributions, estimation, hypothesis testing, contingency tables, ANOVA, regression; implementation of statistical methods using computer package.

Prerequisite(s): MAT 016B C- or better or MAT 017B C- or better or MAT 019B C- or better or MAT 021B C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Credit Limitation(s): Only 2 units credit allowed to students who have taken STA 013, STA 032 or 103; not open for credit to students who have taken STA 102.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 101 – Advanced Applied Statistics for the Biological Sciences (4 units)

Course Description: Basic experimental designs, two-factor ANOVA without interactions, repeated measures ANOVA, ANCOVA, random effects vs. fixed effects, multiple regression, basic model building, resampling methods, multiple comparisons, multivariate methods, generalized linear models, Monte Carlo simulations.

Prerequisite(s): STA 035B C- or better or STA 100 C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 103 – Applied Statistics for Business & Economics (4 units)

Course Description: Descriptive statistics; probability; random variables; expectation; binomial, normal, Poisson, other univariate distributions; joint distributions; sampling distributions, central limit theorem; properties of estimators; linear combinations of random variables; testing and estimation; Minitab computing package. May be taught abroad.

Prerequisite(s): (STA 013 C- or better or STA 013Y C- or better or STA 032 C- or better or STA 035B C- or better or STA 100 C- or better); (MAT 016B C- or better or MAT 017B C- or better or MAT 019B C- or better or MAT 021B C- or better).

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Credit Limitation(s): Only 2 units credit to students who have completed STA 100.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 104 – Applied Statistical Methods: Nonparametric Statistics (4 units)

Course Description: Sign and Wilcoxon tests, Walsh averages. Two-sample procedures. Inferences concerning scale. Kruskal-Wallis test. Measures of association. Chi square and Kolmogorov-Smirnov tests.

Prerequisite(s): STA 013 C- or better or STA 013Y C- or better or STA 032 C- or better or STA 035B C- or better or STA 100 C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 106 – Applied Statistical Methods: Analysis of Variance (4 units)

Course Description: Basics of experimental design. One-way and two-way fixed effects analysis of variance models. Randomized complete and incomplete block design. Multiple comparisons procedures. One-way random effects model.

Prerequisite(s): STA 013 C- or better or STA 013Y C- or better or STA 032 C- or better or STA 035B C- or better or STA 100 C- or better.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

STA 108 – Applied Statistical Methods: Regression Analysis (4 units)

Course Description: Simple linear regression, variable selection techniques, stepwise regression, analysis of covariance, influence measures, computing packages.

Prerequisite(s): STA 013 C- or better or STA 013Y C- or better or STA 032 C- or better or STA 035B C- or better or STA 100 C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL).

STA 109 – Fundamentals of Statistical Learning (4 units)

Course Description: Principles of supervised and unsupervised statistical learning. Regularization and cross validation; classification, clustering and dimension reduction techniques; nonparametric smoothing methods.

Prerequisite(s): STA 015C C- or better or STA 106 C- or better or STA 108 C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Credit Limitation(s): Not open for credit to students who have taken STA 142A or ECS 171; only 2 units credit for students who have taken STA 035C.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

STA 130A – Mathematical Statistics: Brief Course (4 units)

Course Description: Basic probability, densities and distributions, mean, variance, covariance, Chebyshev's inequality, some special distributions, sampling distributions, central limit theorem and law of large numbers, point estimation, some methods of estimation, interval estimation, confidence intervals for certain quantities, computing sample sizes.

Prerequisite(s): (MAT 016C C- or better or MAT 017C C- or better or MAT 019C C- or better or MAT 021C C- or better); (STA 013 C- or better or STA 013Y C- or better or STA 032 C- or better or STA 035B C- or better or STA 100 C- or better).

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Credit Limitation(s): Only 2 units of credit allowed to students who have taken STA 131A.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 130B – Mathematical Statistics: Brief Course (4 units)

Course Description: Transformed random variables, large sample properties of estimates. Basic ideas of hypotheses testing, likelihood ratio tests, goodness-of-fit tests. General linear model, least squares estimates, Gauss-Markov theorem. Analysis of variance, F-test.

Regression and correlation, multiple regression. Selected topics.

Prerequisite(s): STA 130A C- or better or STA 131A C- or better or MAT 135A C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 131A – Introduction to Probability Theory (4 units)

Course Description: Fundamental concepts of probability theory, discrete and continuous random variables, standard distributions, moments and moment-generating functions, laws of large numbers and the central limit theorem.

Prerequisite(s): MAT 021C C- or better; (MAT 022A C- or better or MAT 027A C- or better or MAT 067 C- or better); MAT 021D strongly recommended.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Credit Limitation(s): Not open for credit to students who have completed MAT 135A.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 131B – Introduction to Mathematical Statistics (4 units)

Course Description: Sampling, methods of estimation, bias-variance decomposition, sampling distributions, Fisher information, confidence intervals, and some elements of hypothesis testing.

Prerequisite(s): STA 131A C- or better or MAT 135A C- or better; consent of instructor.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

STA 131C – Introduction to Mathematical Statistics (4 units)

Course Description: Testing theory, tools and applications from probability theory, Linear model theory, ANOVA, goodness-of-fit.

Prerequisite(s): STA 131B C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

STA 135 – Multivariate Data Analysis (4 units)

Course Description: Multivariate normal distribution; Mahalanobis distance; sampling distributions of the mean vector and covariance matrix; Hotellings T²; simultaneous inference; one-way MANOVA; discriminant analysis; principal components; canonical correlation; factor analysis. Intensive use of computer analyses and real data sets.

Prerequisite(s): (STA 130B C- or better or STA 131B C- or better); (MAT 022A C- or better or MAT 027A C- or better or MAT 067 C- or better); MAT 167 recommended.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 137 – Applied Time Series Analysis (4 units)

Course Description: Time series relationships; univariate time series models: trend, seasonality, correlated errors; regression with correlated errors; autoregressive models; autoregressive moving average models; spectral analysis: cyclical behavior and periodicity, measures of periodicity, periodogram; linear filtering; prediction of time series; transfer function models.

Prerequisite(s): STA 108 C- or better; (MAT 022A C- or better or MAT 027A C- or better or MAT 067 C- or better).

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 138 – Analysis of Categorical Data (4 units)

Course Description: Varieties of categorical data, cross-classifications, contingency tables, tests for independence. Multidimensional tables and log-linear models, maximum likelihood estimation; tests of goodness-of-fit. Logit models, linear logistic models. Analysis of incomplete tables. Packaged computer programs, analysis of real data.

Prerequisite(s): (STA 130B or STA 131B) or (STA 106, STA 108).

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 141A – Fundamentals of Statistical Data Science (4 units)

Course Description: Introduction to computing for data analysis & visualization, and simulation, using a high-level language (e.g., R). Computational reasoning, computationally intensive statistical methods, reading tabular & non-standard data.

Prerequisite(s): STA 108 C- or better or STA 106 C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One & Pass Two: open to Statistics Majors, Biostatistics & Statistics graduate students; registration open to all students during schedule adjustment.

Credit Limitation(s): Not open for credit to students who have taken STA 141 or STA 242.

Grade Mode: Letter.

STA 141B – Data & Web Technologies for Data Analysis (4 units)

Course Description: Essentials of using relational databases and SQL. Processing data in blocks. Scraping Web pages and using Web services/APIs. Basics of text mining. Interactive data visualization with Web technologies. Computational data workflow and best practices. Statistical methods.

Prerequisite(s): STA 141A C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One and Pass Two restricted to Statistics majors and graduate students in Statistics and Biostatistics. Open to all students during Open Registration.

Grade Mode: Letter.

STA 141C – Big Data & High Performance Statistical Computing (4 units)

Course Description: High-performance computing in high-level data analysis languages; different computational approaches and paradigms for efficient analysis of big data; interfaces to compiled languages; R and Python programming languages; high-level parallel computing; MapReduce; parallel algorithms and reasoning.

Prerequisite(s): STA 141B C- or better or (STA 141A C- or better, (ECS 010 C- or better or ECS 032A C- or better or ECS 032AV C- or better)).

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One and Pass Two restricted to Statistics majors and graduate students in Statistics and Biostatistics; open to all students during Open registration.

Grade Mode: Letter.

STA 142A – Statistical Learning I (4 units)

Course Description: Fundamental concepts and methods in statistical learning with emphasis on supervised learning. Principles, methodologies and applications of parametric and nonparametric regression, classification, resampling and model selection techniques.

Prerequisite(s): STA 141A C- or better; (STA 130A C- or better or STA 131A C- or better or MAT 135A C- or better); (MAT 022A C- or better or MAT 027A C- or better or MAT 067 C- or better); STA 131A or MAT 135A preferred; MAT 167 recommended.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One restricted to Statistics majors.

Credit Limitation(s): Only 2 units of credit for students who have previously taken ECS 171.

Grade Mode: Letter.

STA 142B – Statistical Learning II (4 units)

Course Description: Fundamental concepts and methods in statistical learning with emphasis on unsupervised learning. Principles, methodologies and applications of clustering methods, dimension reduction and manifold learning techniques, graphical models and latent variables modeling..

Prerequisite(s): STA 141A C- or better; (STA 130A C- or better or STA 131A C- or better or MAT 135A C- or better); (MAT 022A C- or better or MAT 027A C- or better or MAT 067 C- or better); STA 131A or MAT 135A preferred; MAT 167 recommended.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One restricted to Statistics majors.

Grade Mode: Letter.

STA 144 – Sampling Theory of Surveys (4 units)

Course Description: Simple random, stratified random, cluster, and systematic sampling plans; mean, proportion, total, ratio, and regression estimators for these plans; sample survey design, absolute and relative error, sample size selection, strata construction; sampling and nonsampling sources of error.

Prerequisite(s): (STA 130B or STA 131B) or (STA 106, STA 108).

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 145 – Bayesian Statistical Inference (4 units)

Course Description: Subjective probability, Bayes Theorem, conjugate priors, non-informative priors, estimation, testing, prediction, empirical Bayes methods, properties of Bayesian procedures, comparisons with classical procedures, approximation techniques, Gibbs sampling, hierarchical Bayesian analysis, applications, computer implemented data analysis.

Prerequisite(s): STA 130A C- or better or STA 131A C- or better or MAT 135A C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

STA 160 – Practice in Statistical Data Science (4 units)

Course Description: Principles and practice of interdisciplinary, collaborative data analysis; complete case study review and team data analysis project.

Prerequisite(s): STA 141A C- or better.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Enrollment Restriction(s): Open to undergraduate Statistics and Data Science majors.

Grade Mode: Letter.

STA 190X – Seminar (1-2 units)

Course Description: In-depth examination of a special topic in a small group setting.

Prerequisite(s): STA 013 or STA 013Y or STA 032 or STA 100 or STA 103.

Learning Activities: Seminar 1-2 hour(s).

Grade Mode: Letter.

STA 192 – Internship in Statistics (1-12 units)

Course Description: Work experience in statistics.

Prerequisite(s): Consent of instructor; upper division standing.

Learning Activities: Internship 3-36 hour(s), Term Paper.

Grade Mode: Pass/No Pass only.

STA 194HA – Special Studies for Honors Students (4 units)

Course Description: Directed reading, research and writing, culminating in the completion of a senior honors thesis or project under direction of a faculty advisor.

Prerequisite(s): Senior qualifying for honors.

Learning Activities: Independent Study 12 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

STA 194HB – Special Studies for Honors Students (4 units)

Course Description: Directed reading, research and writing, culminating in the completion of a senior honors thesis or project under direction of a faculty advisor.

Prerequisite(s): Senior qualifying for honors.

Learning Activities: Independent Study 12 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

STA 198 – Directed Group Study (1-5 units)

Course Description: Directed group study.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

STA 199 – Special Study for Advanced Undergraduates (1-5 units)

Course Description: Special study for advanced undergraduates.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

STA 200A – Introduction to Probability Theory (4 units)

Course Description: Fundamental concepts of probability theory, discrete and continuous random variables, standard distributions, moments and moment-generating functions, laws of large numbers and the central limit theorem.

Prerequisite(s): MAT 021A; MAT 021B; MAT 021C; MAT 022A; consent of instructor.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 200B – Introduction to Mathematical Statistics I (4 units)

Course Description: Sampling, methods of estimation, bias-variance decomposition, sampling distributions, Fisher information, confidence intervals, and some elements of hypothesis testing.

Prerequisite(s): STA 200A; or consent of instructor.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 200C – Introduction to Mathematical Statistics II (4 units)

Course Description: Testing theory, tools and applications from probability theory, Linear model theory, ANOVA, goodness-of-fit.

Prerequisite(s): STA 200B; or consent of instructor.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 201 – SAS Programming for Statistical Analysis (3 units)

Course Description: Introductory SAS language, data management, statistical applications, methods. Includes basics, graphics, summary statistics, data sets, variables and functions, linear models, repetitive code, simple macros, GLIM and GAM, formatting output, correspondence analysis, bootstrap. Prepare SAS base programmer certification exam.

Prerequisite(s): Introductory, upper division statistics course; some knowledge of vectors and matrices; STA 106 or STA 108 or the equivalent suggested.

Learning Activities: Lecture 2 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

STA 205 – Statistical Methods for Research with SAS (4 units)

Course Description: Focus on linear statistical models widely used in scientific research. Emphasis on concepts, methods and data analysis using SAS. Topics include simple and multiple linear regression, polynomial regression, diagnostics, model selection, variable transformation, factorial designs and ANCOVA.

Prerequisite(s): An introductory upper division statistics course and some knowledge of vectors and matrices; STA 100, or STA 102, or STA 103 suggested or the equivalent.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

STA 206 – Statistical Methods for Research I (4 units)

Course Description: Focus on linear statistical models. Emphasis on concepts, method and data analysis. Topics include simple and multiple linear regression, polynomial regression, diagnostics, model selection, factorial designs and analysis of covariance. Use of professional level software.

Prerequisite(s): Introductory statistics course; some knowledge of vectors and matrices.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

STA 207 – Statistical Methods for Research II (4 units)

Course Description: Linear and nonlinear statistical models emphasis on concepts, methods/data analysis using professional level software. Topics include linear mixed models, repeated measures, generalized linear models, model selection, analysis of missing data, and multiple testing procedures.

Prerequisite(s): STA 206; knowledge of vectors and matrices.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

STA 208 – Statistical Methods in Machine Learning (4 units)

Course Description: Focus on linear and nonlinear statistical models. Emphasis on concepts, methods, and data analysis. Topics include resampling methods, regularization techniques in regression and modern classification, cluster analysis and dimension reduction techniques. Use professional level software.

Prerequisite(s): STA 206; STA 207; STA 135; or their equivalents.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Grade Mode: Letter.

STA 209 – Optimization for Big Data Analytics (4 units)

Course Description: Optimization algorithms for solving problems in statistics, machine learning, data analytics. Review computational tools for implementing optimization algorithms (gradient descent, stochastic gradient descent, coordinate descent, Newton's method.)

Prerequisite(s): STA 200A; STA 208.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 220 – Data & Web Technologies for Data Analysis (4 units)

Course Description: Essentials of using relational databases and SQL. Processing data in blocks. Scraping Web pages and using Web services/APIs. Basics of text mining. Interactive data visualization with Web technologies. Computational data workflow and best practices. Statistical Methods.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 221 – Big Data & High Performance Statistical Computing (4 units)

Course Description: High-performance computing in high-level data analysis languages; different computational approaches and paradigms for efficient analysis of big data; interfaces to compiled languages; R and Python programming languages; high-level parallel computing; MapReduce; parallel algorithms and reasoning.

Prerequisite(s): STA 220.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 222 – Biostatistics: Survival Analysis (4 units)

Course Description: Incomplete data; life tables; nonparametric methods; parametric methods; accelerated failure time models; proportional hazards models; partial likelihood; advanced topics.

Prerequisite(s): STA 131C.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Cross Listing: BST 222.

Grade Mode: Letter.

STA 223 – Biostatistics: Generalized Linear Models (4 units)

Course Description: Likelihood and linear regression; generalized linear model; Binomial regression; case-control studies; dose-response and bioassay; Poisson regression; Gamma regression; quasi-likelihood models; estimating equations; multivariate GLMs.

Prerequisite(s): STA 131C.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Cross Listing: BST 223.

Grade Mode: Letter.

STA 224 – Analysis of Longitudinal Data (4 units)

Course Description: Standard and advanced methodology, theory, algorithms, and applications relevant for analysis of repeated measurements and longitudinal data in biostatistical and statistical settings.

Prerequisite(s): ((STA 222, STA 223) or (BST 222, BST 223)); STA 232B; or consent of instructor.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Cross Listing: BST 224.

Grade Mode: Letter.

STA 225 – Clinical Trials (4 units)

Course Description: Basic statistical principles of clinical designs, including bias, randomization, blocking, and masking. Practical applications of widely-used designs, including dose-finding, comparative and cluster randomization designs. Advanced statistical procedures for analysis of data collected in clinical trials.

Prerequisite(s): STA 223 or BST 223; or consent of instructor.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Cross Listing: BST 225.

Grade Mode: Letter.

STA 226 – Statistical Methods for Bioinformatics (4 units)

Course Description: Standard and advanced statistical methodology, theory, algorithms, and applications relevant to the analysis of -omics data.

Prerequisite(s): STA 131C; or consent of instructor; data analysis experience recommended.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Cross Listing: BST 226.

Grade Mode: Letter.

STA 231A – Mathematical Statistics I (4 units)

Course Description: First part of three-quarter sequence on mathematical statistics. Emphasizes foundations. Topics include basic concepts in asymptotic theory, decision theory, and an overview of methods of point estimation.

Prerequisite(s): STA 131A; STA 131B; STA 131C; MAT 025; MAT 125A; or equivalent of MAT 025 and MAT 125A.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 231B – Mathematical Statistics II (4 units)

Course Description: Second part of a three-quarter sequence on mathematical statistics. Emphasizes: hypothesis testing (including multiple testing) as well as theory for linear models.

Prerequisite(s): STA 231A.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 231C – Mathematical Statistics III (4 units)

Course Description: Third part of three-quarter sequence on mathematical statistics. Emphasizes large sample theory and their applications. Topics include statistical functionals, smoothing methods and optimization techniques relevant for statistics.

Prerequisite(s): STA 231A; STA 231B.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

STA 232A – Applied Statistics I (4 units)

Course Description: Estimation and testing for the general linear model, regression, analysis of designed experiments, and missing data techniques.

Prerequisite(s): STA 106; STA 108; STA 131A; STA 131B; STA 131C; MAT 167.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

STA 232B – Applied Statistics II (4 units)

Course Description: Alternative approaches to regression, model selection, nonparametric methods amenable to linear model framework and their applications.

Prerequisite(s): STA 106; STA 108; STA 131A; STA 131B; STA 131C; STA 232A; MAT 167.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

STA 232C – Applied Statistics III (4 units)

Course Description: Multivariate analysis: multivariate distributions, multivariate linear models, data analytic methods including principal component, factor, discriminant, canonical correlation and cluster analysis.

Prerequisite(s): STA 106; STA 108; STA 131C; STA 232B; MAT 167.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

STA 233 – Design Experiments (3 units)

Course Description: Topics from balanced and partially balanced incomplete block designs, fractional factorials, and response surfaces.

Prerequisite(s): STA 131C.

Learning Activities: Lecture 3 hour(s).

Grade Mode: Letter.

STA 235A – Probability Theory (4 units)

Course Description: Measure-theoretic foundations, abstract integration, independence, laws of large numbers, characteristic functions, central limit theorems. Weak convergence in metric spaces, Brownian motion, invariance principle. Conditional expectation. Topics selected from: martingales, Markov chains, ergodic theory.

Prerequisite(s): (MAT 125B, MAT 135A) or STA 131A; or consent of instructor.

Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).

Cross Listing: MAT 235A.

Grade Mode: Letter.

STA 235B – Probability Theory (4 units)

Course Description: Measure-theoretic foundations, abstract integration, independence, laws of large numbers, characteristic functions, central limit theorems. Weak convergence in metric spaces, Brownian motion, invariance principle. Conditional expectation. Topics selected from: martingales, Markov chains, ergodic theory.

Prerequisite(s): STA 235A or MAT 235A; or consent of instructor.

Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).

Cross Listing: MAT 235B.

Grade Mode: Letter.

STA 235C – Probability Theory (4 units)

Course Description: Measure-theoretic foundations, abstract integration, independence, laws of large numbers, characteristic functions, central limit theorems. Weak convergence in metric spaces, Brownian motion, invariance principle. Conditional expectation. Topics selected from: martingales, Markov chains, ergodic theory.

Prerequisite(s): STA 235B or MAT 235B; or consent of instructor.

Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).

Cross Listing: MAT 235C.

Grade Mode: Letter.

STA 237A – Time Series Analysis (4 units)

Course Description: Advanced topics in time series analysis and applications. Models for experimental data, measures of dependence, large-sample theory, statistical estimation and inference. Univariate and multivariate spectral analysis, regression, ARIMA models, state-space models, Kalman filtering.

Prerequisite(s): STA 131B; or the equivalent of STA 131B.

Learning Activities: Lecture 3 hour(s), Term Paper.

Grade Mode: Letter.

STA 237B – Time Series Analysis (4 units)

Course Description: Advanced topics in time series analysis and applications. Models for experimental data, measures of dependence, large-sample theory, statistical estimation and inference. Univariate and multivariate spectral analysis, regression, ARIMA models, state-space models, Kalman filtering.

Prerequisite(s): STA 131B; STA 237A; or the equivalent of STA 131B.

Learning Activities: Lecture 3 hour(s), Term Paper.

Grade Mode: Letter.

STA 238 – Theory of Multivariate Analysis (4 units)

Course Description: Multivariate normal and Wishart distributions, Hotellings T-Squared, simultaneous inference, likelihood ratio and union intersection tests, Bayesian methods, discriminant analysis, principal component and factor analysis, multivariate clustering, multivariate regression and analysis of variance, application to data.

Prerequisite(s): STA 131B; STA 135.

Learning Activities: Lecture 3 hour(s), Term Paper.

Grade Mode: Letter.

STA 240A – Nonparametric Inference (4 units)

Course Description: Comprehensive treatment of nonparametric statistical inference, including the most basic materials from classical nonparametrics, robustness, nonparametric estimation of a distribution function from incomplete data, curve estimation, and theory of resampling methodology.

Prerequisite(s): STA 231C; STA 235A, STA 235B, STA 235C recommended.

Learning Activities: Lecture 3 hour(s), Term Paper.

Grade Mode: Letter.

STA 240B – Nonparametric Inference (4 units)

Course Description: Comprehensive treatment of nonparametric statistical inference, including the most basic materials from classical nonparametrics, robustness, nonparametric estimation of a distribution function from incomplete data, curve estimation, and theory of re-sampling methodology.

Prerequisite(s): STA 231C; STA 235A, STA 235B, STA 235C recommended.

Learning Activities: Lecture 3 hour(s), Term Paper.

Grade Mode: Letter.

STA 241 – Asymptotic Theory of Statistics (4 units)

Course Description: Topics in asymptotic theory of statistics chosen from weak convergence, contiguity, empirical processes, Edgeworth expansion, and semiparametric inference.

Prerequisite(s): STA 231C; STA 235A, STA 235B, STA 235C desirable.

Learning Activities: Lecture 3 hour(s), Term Paper.

Grade Mode: Letter.

STA 242 – Introduction to Statistical Programming (4 units)

Course Description: Essentials of statistical computing using a general-purpose statistical language. Topics include algorithms; design; debugging and efficiency; object-oriented concepts; model specification and fitting; statistical visualization; data and text processing; databases; computer systems and platforms; comparison of scientific programming languages.

Prerequisite(s): STA 130A; STA 130B; or equivalent of STA 130A and STA 130B.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

STA 243 – Computational Statistics (4 units)

Course Description: Numerical analysis; random number generation; computer experiments and resampling techniques (bootstrap, cross validation); numerical optimization; matrix decompositions and linear algebra computations; algorithms (markov chain monte carlo, expectation-maximization); algorithm design and efficiency; parallel and distributed computing.

Prerequisite(s): (STA 130A, STA 130B); (MAT 067 or MAT 167); or equivalent of STA 130A and 130B, or equivalent of MAT 167 or MAT 067.

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Grade Mode: Letter.

STA 250 – Topics in Applied & Computational Statistics (4 units)

Course Description: Resampling, nonparametric and semiparametric methods, incomplete data analysis, diagnostics, multivariate and time series analysis, applied Bayesian methods, sequential analysis and quality control, categorical data analysis, spatial and image analysis, computational biology, functional data analysis, models for correlated data, learning theory.

Prerequisite(s): STA 131A; STA 232A recommended, not required.

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Repeat Credit: May be repeated with consent of graduate advisor.

Grade Mode: Letter.

STA 251 – Topics in Statistical Methods & Models (4 units)

Course Description: Topics may include Bayesian analysis, nonparametric and semiparametric regression, sequential analysis, bootstrap, statistical methods in high dimensions, reliability, spatial processes, inference for stochastic process, stochastic methods in finance, empirical processes, change-point problems, asymptotics for parametric, nonparametric and semiparametric models, nonlinear time series, robustness.

Prerequisite(s): STA 231B; or the equivalent of STA 231B.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Repeat Credit: May be repeated when topic differs and only with consent of graduate advisor.

Grade Mode: Letter.

STA 252 – Advanced Topics in Biostatistics (4 units)

Course Description: Biostatistical methods and models selected from the following: genetics, bioinformatics and genomics; longitudinal or functional data; clinical trials and experimental design; analysis of environmental data; dose-response, nutrition and toxicology; survival analysis; observational studies and epidemiology; computer-intensive or Bayesian methods in biostatistics.

Prerequisite(s): (STA 222 or BST 222); (STA 223 or BST 223).

Learning Activities: Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

Repeat Credit: May be repeated when topic differs and only with consent of graduate advisor.

Cross Listing: BST 252.

Grade Mode: Letter.

STA 260 – Statistical Practice & Data Analysis (3 units)

Course Description: Principles and practice of interdisciplinary collaboration in statistics, statistical consulting, ethical aspects, and basics of data analysis and study design. Emphasis on practical consulting and collaboration of statisticians with clients and scientists under instructor supervision.

Prerequisite(s): STA 207 or STA 232B; working knowledge of advanced statistical software and the equivalent of STA 207 or STA 232B.

Learning Activities: Lecture/Discussion 3 hour(s).

Enrollment Restriction(s): Open to students enrolled in the graduate program in Statistics or Biostatistics, as the class also serves to provide professional service to clients and collaborators who work with the students.

Repeat Credit: May be repeated 1 time(s).

Grade Mode: Letter.

STA 280 – Orientation to Statistical Research (2 units)

Course Description: Guided orientation to original statistical research papers, and oral presentations in class of such papers by students under the supervision of a faculty member.

Prerequisite(s): Consent of instructor.

Learning Activities: Seminar 2 hour(s).

Repeat Credit: May be repeated 1 time(s).

Grade Mode: Satisfactory/Unsatisfactory only.

STA 290 – Seminar in Statistics (1-6 units)

Course Description: Seminar on advanced topics in probability and statistics.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Satisfactory/Unsatisfactory only.

STA 292 – Graduate Group in Statistics Seminar (1-2 units)

Course Description: Advanced study in various fields of statistics with emphasis in applied topics, presented by members of the Graduate Group in Statistics and other guest speakers.

Prerequisite(s): Consent of instructor; graduate standing.

Learning Activities: Seminar 1-2 hour(s).

Repeat Credit: May be repeated.

Grade Mode: Satisfactory/Unsatisfactory only.

STA 298 – Directed Group Study (1-5 units)

Course Description: Special topics in Statistics appropriate for study at the graduate level.

Prerequisite(s): Consent of instructor. Graduate standing.

Learning Activities: Variable 3-15 hour(s).

Repeat Credit: May be repeated.

Grade Mode: Letter.

STA 299 – Individual Study (1-12 units)

Course Description: Individual study.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Satisfactory/Unsatisfactory only.

STA 299D – Dissertation Research (1-12 units)

Course Description: Research in Statistics under the supervision of major professor.

Prerequisite(s): Consent of instructor; advancement to candidacy for Ph.D.

Learning Activities: Variable 3-36 hour(s).

Repeat Credit: May be repeated.

Grade Mode: Satisfactory/Unsatisfactory only.

STA 390 – Methods of Teaching Statistics (2 units)

Course Description: Practical experience in methods/problems of teaching statistics at university undergraduate level. Lecturing techniques, analysis of tests and supporting material, preparation and grading of examinations, and use of statistical software. Emphasis on practical training.

Prerequisite(s): Graduate standing.

Learning Activities: Lecture/Discussion 1 hour(s), Laboratory 1 hour(s).

Repeat Credit: May be repeated.

Grade Mode: Satisfactory/Unsatisfactory only.

STA 396 – Teaching Assistant Training Practicum (1-4 units)

Course Description: Teaching assistant training practicum.

Prerequisite(s): Consent of instructor; graduate standing.

Learning Activities: Variable.

Repeat Credit: May be repeated.

Grade Mode: Pass/No Pass only.

STA 401 – Methods in Statistical Consulting (3 units)

Course Description: Introduction to consulting, in-class consulting as a group, statistical consulting with clients, and in-class discussion of consulting problems. Clients are drawn from a pool of University clients.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Students must be enrolled in the graduate program in Statistics or Biostatistics.

Repeat Credit: May be repeated with consent of graduate advisor.

Grade Mode: Satisfactory/Unsatisfactory only.