Statistics

STAT 5191 Statistical Computing Packages (1 semester credit hour) Introduction to use of major statistical packages such as SAS, BMD, and Minitab. Based primarily on self-study materials. May not be used to fulfill degree requirements. Prerequisites: One semester of statistics and instructor consent required. (1-0) S

STAT 5351 Probability and Statistics I (3 semester credit hours) A mathematical treatment of probability theory. Random variables, distributions, conditioning, expectations, special distributions and the central limit theorem. The theory is illustrated by numerous examples. This is a basic course in probability and uses calculus extensively. Prerequisite: Calculus through multivariate calculus or instructor consent required. (3-0) T

STAT 5352 Probability and Statistics II (3 semester credit hours) Theory and methods of statistical inference. Sampling, estimation, confidence intervals, hypothesis testing, analysis of variance, and regression with applications. Prerequisite: STAT 5351. (3-0) T

STAT 5353 Probability and Statistics for Data Science and Bioinformatics (3 semester credit hours) Probability; Kolmogorov's axioms; independence; random variables; discrete and continuous distributions; expected values; joint, marginal and conditional distributions; Monte Carlo simulation; sampling distributions; law of large numbers; central limit theorem; maximum likelihood estimation; confidence intervals and hypothesis testing involving one- and two-sample problems; linear regression; proofs of key results; practical examples illustrating the theory; and introduction to a statistical software package. Prerequisite: Calculus through multivariate calculus and department consent required. (3-0) Y

STAT 5390 Topics in Statistics - Level 5 (3 semester credit hours) May be repeated for credit as topics vary. Instructor consent required. Additional prerequisites may be required depending on the specific course topic. (3-0) R

STAT 6313 (CS 6313) Statistical Methods for Data Science (3 semester credit hours) Statistical methods for data science. Statistical Methods are developed at an intermediate level. Sampling distributions. Point and interval estimation. Parametric and nonparametric hypothesis testing. Analysis of variance. Regression, model building and model diagnostics. Monte Carlo simulation and bootstrap. Introduction to a statistical software package. Prerequisite: CS 3341 or SE 3341 or STAT 3341 or equivalent. (3-0) S

STAT 6326 Sampling Theory (3 semester credit hours) Introduction to sampling theory and methods. Statistical inference for the popular sampling designs. Simple random sampling; stratified, systematic, cluster, unequal probability, multistage, and spatial sampling designs. Statistical methods for a finite population. Use of auxiliary data. Optimal allocation. Capture-recapture methods. Detectability. Multiplicity. Prerequisite: STAT 5351 or a course in basic statistics or instructor consent required. (3-0) T

STAT 6329 Applied Probability and Stochastic Processes (3 semester credit hours) Basic random processes used in stochastic modeling, including Poisson, Gaussian, and Markov processes with an introduction to renewal processes and queuing theory. Measure theory not required. Prerequisite: STAT 5351. (3-0) T

STAT 6331 Statistical Inference I (3 semester credit hours) Introduction to fundamental concepts and methods of statistical modeling and decision making. Basic distribution theory. Decision theory. Exponential families of models. Sufficiency. Estimation and hypothesis testing. Likelihood methods and optimality. Large sample approximations. Prerequisites: (STAT 5352 or equivalent) and (MATH 5302 or equivalent). (3-0) Y

STAT 6332 Statistical Inference II (3 semester credit hours) Elementary and advanced asymptotic methods, treating sample quantiles, U-statistics, differentiable statistical functions, and incluence curves, the MLE, L-statistics, M-statistics, and the bootstrap. Advanced aspects of statistical inference, likelihood-based inference, robust statistics. General forms of Neyman-Pearson Lemma. Metrics on spaces of probability distributions. Prerequisite: STAT 6331. Prerequisite or Corequisite: STAT 6344. (3-0) T

STAT 6337 Advanced Statistical Methods I (3 semester credit hours) Statistical methods most often used in the analysis of data. Univariate and multivariate statistics. P-values. Contingency tables. Simple and multiple regression. Model selection. Diagnostics and remedial measures. Analysis of residuals. Lack of fit. Ridge regression and multicollinearity. Influential data analysis. Categorical data and dummy variables. Nonlinear regression. Logistic regression. Data analysis using statistical software packages. Prerequisites: a course in linear algebra and (STAT 5352 or STAT 6331). (3-0) T

STAT 6338 Advanced Statistical Methods II (3 semester credit hours) This course continues STAT 6337. Topics include one-way and multi-way analysis of variance, general and generalized linear models with fixed, random, and mixed effects, diagnostics, and implementation of statistical methods using statistical software. Prerequisite: STAT 6337. (3-0) T

STAT 6339 Linear Statistical Models (3 semester credit hours) Theoretical treatment of general and generalized linear models. Topics include random vectors; multivariate normal distribution; distributions of quadratic forms; general linear models for normal data; extension to generalized linear models for non-normal data such as binary, polytomous and count data; point and interval estimation; and hypothesis testing. Prerequisite: STAT 6331 or equivalent. (3-0) T

STAT 6340 Statistical and Machine Learning (3 semester credit hours) Statistical models, including linear models, generalized linear models, spline models and additive models; model selection, validation and regularization; smoothing techniques; classification; support vector machines; clustering; principal components analysis; and principal components regression. Prerequisite: (STAT 5353 or equivalent) or instructor consent required. (3-0) Y

STAT 6341 Numerical Linear Algebra and Statistical Computing (3 semester credit hours) A study of computational methods used in statistics. Topics to be covered include the simulation of stochastic processes, numerical linear algebra, QR decomposition and least squares regression, SV decomposition and multivariate data, statistical programming languages, and graphical methods.

Prerequisite: STAT 5352 or STAT 6337. (3-0) T

STAT 6343 Experimental Design (3 semester credit hours) Basic design principles; sample size computation; crossed and nested treatment factors; confounding; inference on contrasts; analysis of variance; analysis of covariance; designs such as completely randomized designs, factorial designs, complete block designs, incomplete block designs, Latin square designs, crossover designs, repeated measures designs and split plot designs; fractional replication in factorial experiments; variance components models; and implementation of statistical methods using a statistical software package. Prerequisite: STAT 6337 or equivalent. (3-0) T

STAT 6344 Probability Theory I (3 semester credit hours) Measure theoretic coverage of probability theory. Topics include: Axioms of probability, Integration; Distributions and moments; Probability Inequalities; Convergence of probability measures; Laws of large numbers; Central limit theorem; Three-series theorem; Zero-one laws; Glivenko-Cantelli theorem; Law of iterated logarithm; Conditional probability and expectation; Introduction to martingales. Prerequisite: MATH 5302 or equivalent. (3-0) T

STAT 6347 Applied Time Series Analysis (3 semester credit hours) Introduction to time series data; autocorrelation function; stationarity; classical decomposition of a time series; linear processes; forecasting stationary time series; basic time series models such as autoregressive models, moving average models, ARMA models, ARIMA models and seasonal ARIMA models; model fitting; model checking; model-based forecasting; regression with ARMA errors; spectral analysis; multivariate time series; and implementation of statistical methods using a statistical software package. Prerequisite: STAT 6337 or equivalent. (3-0) T

STAT 6348 Applied Multivariate Analysis (3 semester credit hours) Statistical methods used in analysis of multivariate data. Topics include Hotelling's T test, the multivariate ANOVA, principal components analysis, factor analysis, cluster analysis, discriminant analysis, classification problems, graphics and visualization tools. Emphasis on computations with R or other software. Additional topics may be covered as time allows. Prerequisite: STAT 5352 or STAT 6331. Corequisite: STAT 6337. (3-0) T

STAT 6365 Statistical Quality and Process Control (3 semester credit hours) Statistical methodology of monitoring, testing, and improving the quality of goods and services is developed at the intermediate level. Topics include control charts for variables and attributes, assessment of process stability and capability, construction and interpretation of CUSUM, moving average charts and V-masks, optimal sampling techniques, and evaluation of operating-characteristic curves and average time to detection. Prerequisite: STAT 5351 or equivalent. (3-0) T

STAT 6390 Topics in Statistics - Level 6 (3 semester credit hours) Topics selected from but not limited to choices such as spatial statics, nonparametric curve estimation, functional data analysis, statistical learning and data mining, actuarial science, sampling theory, statistical quality and process control, sequential analysis, survival analysis, longitudinal data analysis, categorical data analysis, and clinical trials, for example. May be repeated for credit as topics vary. Additional prerequisites may be required depending on the specific course topic. (3-0) R

STAT 6V98 Masters Thesis (3-9 semester credit hours) Pass/Fail only. May be repeated for credit. Instructor consent required. ([3-9]-0) S

STAT 6V99 Statistical Consulting (1-3 semester credit hours) Practical experience in collaboration with individuals who are working on problems which are amenable to statistical analysis. Problem formulation, statistical abstraction of the problem, and analysis of the data. May be repeated for credit. Only a maximum of three semester credit hours may be used to fulfill the master's degree. Instructor consent required. ([1-3]-0) T

STAT 7330 Bayesian Data Analysis (3 semester credit hours) Bayesian modeling fundamentals; prior distributions; large-sample theory and connection with classical inference; model checking and evaluation; Markov chain Monte Carlo methods, including Gibbs, Metropolis and related algorithms; convergence diagnostics; approximation of posterior mode and posterior density; single and multiparameter models such as those based on binomial, Poisson and normal distributions; regression models, including linear models, hierarchical linear models, generalized linear models, and basis function models; models for missing data; and implementation of methods using a software package. Prerequisite: STAT 6337 or instructor consent required. (3-0) T

STAT 7331 Multivariate Analysis (3 semester credit hours) Vector space foundations and geometric considerations. The multivariate normal distribution: properties, estimation, and hypothesis testing. Hotelling's T statistic. Classification problems. Sample covariance matrix and the Wishart distribution. General linear hypothesis and MANOVA. Testing independence of sets of variables. Principal components, canonical correlations, factor analysis. Curse of dimensionality. Dimension Reduction. Multidimensional Classification and Clustering. Multivariate symmetry. Multivariate signs, ranks, and quantiles. Functional data analysis. Selected further topics. Prerequisite: STAT 6331 or equivalent. (3-0) T

STAT 7334 Nonparametric and Robust Statistical Methods (3 semester credit hours) Order statistics, ranks, and related distribution theory. Sign, signed rank, and permutation statistics. U-statistics, L-statistics, M-statistics, R-statistics. One- and multi-sample location and scale problems. Nonparametric ANOVA. Pitman asymptotic relative efficiency. Locally most powerful rank tests. Maximum likelihood estimation for nonparametric families. Minimax asymptotic variance and minimum bias criteria for robust estimation. Robust confidence limits. Optimal influence curves. Nonparametric/robust density estimation, regression curve estimation, and smoothing. Nonparametric and robust methods for multivariate data. Selected other topics. Prerequisite: STAT 6331 or equivalent. (3-0) T

STAT 7336 Nonparametric Curve Estimation (3 semester credit hours) The course gives a unified account of modern nonparametric statistical methods for curve estimation. Topics include series estimation with emphasis on trigonometric series and wavelets; density estimation; nonparametric regression; filtering signals; time series analysis; survival analysis; handling modified and missing data; theoretical analysis based on rates and constants of the mean integrated squared error convergence; and non-series methods, including those based on kernels, local polynomials, nearest neighbors, and splines. Implementation of methods using a software package. Prerequisite: STAT 6331 or instructor consent required. (3-0) T

STAT 7338 Time Series Modeling and Filtering (3 semester credit hours) Theory of correlated observations observed sequentially in time. Stationary processes, Autocovariance function. ARMA models. Optimal forecasting in time domain and in frequency domain. Spectral representation. Estimation and model selection. Nonstationary time series models. Prerequisite: STAT 6331. (3-0) T

STAT 7339 Advanced Regression Modeling (3 semester credit hours) Linear and generalized linear mixed models with application to longitudinal data analysis; smoothing via basis expansion and penalization; spline smoothing; semiparametric regression; additive and generalized additive models and their mixed model extensions; and implementation of methods using a software package. Prerequisite: STAT 6337 or instructor consent required. (3-0) T

STAT 7340 Functional Data Analysis (3 semester credit hours) Topics include summarizing data; exploratory analysis; basis expansion; model fitting with regularization and roughness penalty; curve alignment; principal components analysis; regression modeling, including linear models and generalized linear models for scalar-on-function regression and functional response; analysis of sparse functional data; and implementation of methods using a software package. Prerequisite: STAT 6337 or instructor consent required. (3-0) T

STAT 7345 Advanced Probability and Stochastic Processes (3 semester credit hours) Taught as a continuation of STAT 6344. Exponential probability inequalities. Large deviation theory. Martingales, sub- and supermartingales, random walk, Markov chains, Yule and Poisson processes, the general birth and death process, shot noise, branching processes, renewal processes, Brownian motion and diffusion, stationary processes, and the empirical process. Selected other topics. Prerequisite: STAT 6344. (3-0) T

STAT 7390 Topics in Statistics - Level 7 (3 semester credit hours) Topics selected from but not limited to choices such as spatial statistics, nonparametric curve estimation, functional data analysis, statistical learning and data mining, actuarial science, sampling theory, statistical quality and process control, sequential analysis, survival analysis, longitudinal data analysis, categorical data analysis, and clinical trials, for example. May be repeated for credit as topics vary. Instructor consent required. Additional prerequisites may be required depending on the specific course topic. (3-0) R

STAT 8V02 Individual Instruction in Statistics (1-6 semester credit hours) Pass/Fail only. May be repeated for credit as topics vary. Instructor consent required. Additional prerequisites may be required depending on the specific course topic. ([1-6]-0) S

STAT 8V03 Advanced Topics in Statistics (1-6 semester credit hours) Pass/Fail only. May be repeated for credit as topics vary. Instructor consent required. Additional prerequisites may be required depending on the specific course topic. ([1-6]-0) R

STAT 8V07 Research in Statistics (1-9 semester credit hours) Open to students with advanced standing, subject to approval of the graduate advisor. Pass/Fail only. May be repeated for credit. Instructor consent required. ([1-9]-0) S

STAT 8V99 Dissertation (1-9 semester credit hours) Pass/Fail only. May be repeated for credit.

Instructor consent required. ([1-9]-0) S