

STATISTICS (STAT)

STAT 301-1 Data Science 1 with R (1 Unit)

Series aims to develop the practical skills necessary for conducting data science while surveying foundational analytic methods with a focus on application. Substantial data analysis project required in each course. Data Science 1 focuses on data management, manipulation, and visualization skills and techniques for exploratory data analysis. Students may not receive credit for both this course and STAT 303-1.

Prerequisite: STAT 202-0 or equivalent.

Formal Studies Distro Area

STAT 301-2 Data Science 2 with R (1 Unit)

Series aims to develop the practical skills necessary for conducting data science while surveying foundational analytic methods with a focus on application. Substantial data analysis project required in each course. Data Science 2 focuses on foundational analytic methods such as linear regression, resampling, and tree-based methods. Students may not receive credit for both this course and STAT 303-2.

Prerequisite: STAT 301-1 or consent of instructor.

Formal Studies Distro Area

Formal Studies Distro Area

STAT 301-3 Data Science 3 with R (1 Unit)

Series aims to develop the practical skills necessary for conducting data science while surveying foundational analytic methods with a focus on application. Substantial data analysis project required in each course. Data Science 3 focuses on methods such as support vector machines, clustering, and neural networks. Students may not receive credit for both this course and STAT 303-3.

Prerequisite: STAT 301-2 or consent of instructor.

Formal Studies Distro Area

STAT 302-0 Data Visualization (1 Unit)

Introduction to the knowledge, skills, and tools required to visualize data of various formats across statistical domains and to create quality visualizations for both data exploration and presentation.

Prerequisite: STAT 202-0 or equivalent.

Formal Studies Distro Area

STAT 303-1 Data Science 1 with Python (1 Unit)

First course in Data Science, with focus on data management, manipulation, and visualization skills and techniques for exploratory data analysis. The course also introduces the Python programming language in the context of Data Science. Students may not receive credit for both this course and STAT 301-1.

Prerequisite: STAT 202-0 or STAT 210-0 or consent of the instructor.

Formal Studies Distro Area

STAT 303-2 Data Science 2 with Python (1 Unit)

This course introduces supervised machine learning in Python, with a focus on linear and logistic regression. It prepares students for learning advanced machine learning methods. Students may not receive credit for both this course and STAT 301-2.

Prerequisite: STAT 303-1 or consent of the instructor.

Formal Studies Distro Area

STAT 303-3 Data Science 3 with Python (1 Unit)

The course introduces advanced machine learning methods in Python, including supervised and unsupervised learning. It provides the knowledge and skills necessary to tackle real world problems with machine learning. Students may not receive credit for both this course and STAT 301-3.

Prerequisite: STAT 303-2 or consent of the instructor.

Formal Studies Distro Area

STAT 320-1 Statistical Theory & Methods 1 (1 Unit)

Sample spaces, computing probabilities, random variables, distribution functions, expected values, variance, correlation, limit theory. May not receive credit for both STAT 320-1 and any of STAT 383-0, MATH 310-1, MATH 311-1, MATH 314-0, MATH 385-0, ELEC_ENG 302-0, or IEMS 202-0.

Co-requisites: STAT 202-0 or STAT 210-0, MATH 226-0, and MATH 230-2.

Formal Studies Distro Area

STAT 320-2 Statistical Theory & Methods 2 (1 Unit)

Sampling, parameter estimation, confidence intervals, hypothesis tests.

Prerequisite: STAT 320-1 or MATH 310-1.

Formal Studies Distro Area

STAT 320-3 Statistical Theory & Methods 3 (1 Unit)

Comparison of parameters, goodness-of-fit tests, regression analysis, analysis of variance, and nonparametric methods.

Prerequisites: STAT 320-2, MATH 240-0.

Formal Studies Distro Area

STAT 325-0 Survey Sampling (1 Unit)

Probability sampling, simple random sampling, error estimation, sample size, stratification, systematic sampling, replication methods, ratio and regression estimation, cluster sampling.

Prerequisites: MATH 230-1 and 2 quarters of statistics, or consent of instructor.

Formal Studies Distro Area

STAT 328-0 Causal Inference (1 Unit)

Introduction to modern statistical thinking about causal inference.

Topics include completely randomized experiments, confounding, ignorability of assignment mechanisms, matching, observational studies, noncompliance, and Bayesian methods.

Prerequisites: STAT 320-2, STAT 350-0.

Formal Studies Distro Area

STAT 330-1 Applied Statistics for Research 1 (1 Unit)

First Quarter: Design of experiments and surveys, numerical summaries of data, graphical summaries of data, correlation and regression, probability, sample mean, sample proportion, confidence intervals and tests of significance, one and two sample problems, ANOVA. Second Quarter: Simple linear regression, inference, diagnostics, multiple regression diagnostics, autocorrelation, 1-way ANOVA, power and sample size determination, 2-way ANOVA, ANCOVA, randomized block designs.

STAT 330-2 Applied Statistics for Research 2 (1 Unit)

Second Quarter: Simple linear regression, inference, diagnostics, multiple regression diagnostics, autocorrelation, 1-way ANOVA, power and sample size determination, 2-way ANOVA, ANCOVA, randomized block designs.

STAT 342-0 Statistical Data Mining (1 Unit)

Methods for modeling binary responses with multiple explanatory variables. Potential topics include statistical decision theory, binary regression models, cluster analysis, probabilistic conditional independence, and graphical models.

Prerequisites: courses in probability and statistics comparable to STAT 320-1, STAT 320-2; a course in multiple regression comparable to STAT 350-0; familiarity with statistical computing software such as MINITAB or SPSS.

Formal Studies Distro Area

STAT 344-0 Statistical Computing (1 Unit)

Exploration of theory and practice of computational statistics with emphasis on statistical programming in R.

Prerequisite: STAT 320-2 or equivalent.

Formal Studies Distro Area

STAT 345-0 Statistical Demography (1 Unit)

Introduction to statistical theory of demographic rates (births, deaths, migration) in multistate setting; statistical models underlying formal demography; analysis of error in demographic forecasting.

Prerequisite: STAT 350-0, MATH 240-0, or equivalent.

Formal Studies Distro Area

STAT 348-0 Applied Multivariate Analysis (1 Unit)

Statistical methods for describing and analyzing multivariate data. Principal component analysis, factor analysis, canonical correlation, clustering. Emphasis on statistical and geometric motivation, practical application, and interpretation of results.

Prerequisites: STAT 320-2, MATH 240-0.

Formal Studies Distro Area

STAT 350-0 Regression Analysis (1 Unit)

Simple linear regression and correlation, multiple regression, residual analysis, selection of subsets of variables, multi-collinearity and shrinkage estimation, nonlinear regression. Prerequisite or corequisite: STAT 320-2.

Formal Studies Distro Area

STAT 351-0 Design and Analysis of Experiments (1 Unit)

Methods of designing experiments and analyzing data obtained from them: one-way and two-way layouts, incomplete block designs, factorial designs, random effects, split-plot and nested designs.

Prerequisite: STAT 320-1 or equivalent.

Formal Studies Distro Area

STAT 352-0 Nonparametric Statistical Methods (1 Unit)

Survey of nonparametric methods, with emphasis on understanding their application. Estimation of a distribution function, density estimation, and nonparametric regression.

Prerequisite: STAT 350-0.

Formal Studies Distro Area

STAT 353-0 Advanced Regression (1 Unit)

This course covers modern regression methods, including: (1) generalized linear models (binary, categorical, and count data), (2) random effects, mixed effects, and nonlinear models, and (3) model selection. The course emphasizes both the theoretical development of the methods, as well as their application, including the communication of models and results both verbally and in writing.

Prerequisites: STAT 320-2 (or 420-2 or MATH 310-2) and STAT 350-0.

Formal Studies Distro Area

STAT 355-0 Analysis of Qualitative Data (1 Unit)

Introduction to the analysis of qualitative data. Measures of association, loglinear models, logits, and probits.

Prerequisite: STAT 320-2 or equivalent.

Formal Studies Distro Area

STAT 356-0 Hierarchical Linear Models (1 Unit)

Introduction to the theory and application of hierarchical linear models. Two and three level linear models, hierarchical generalized linear models, and application of hierarchical models to organizational research and growth models.

Prerequisites: STAT 320-2, STAT 350-0.

Formal Studies Distro Area

STAT 357-0 Introduction to Bayesian Statistics (1 Unit)

Introduction to basic concepts and principles in Bayesian inference such as the prior, likelihood, posterior and predictive distributions, as well as an introduction to a variety of computational algorithms for Bayesian inference. Students learn how to develop, describe, implement and critique statistical models from a Bayesian perspective.

Prerequisites: STAT 320-1, STAT 320-2, STAT 301-2 or 350-0, or consent of instructor.

Formal Studies Distro Area

STAT 359-0 Topics in Statistics (1 Unit)

Topics in theoretical and applied statistics to be chosen by instructor.

Prerequisite: consent of instructor.

Formal Studies Distro Area

STAT 365-0 Introduction to the Analysis of Financial Data (1 Unit)

Statistical methods for analyzing financial data. Models for asset returns, portfolio theory, parameter estimation.

Prerequisites: STAT 320-3, MATH 240-0.

Formal Studies Distro Area

STAT 370-0 Human Rights Statistics (1 Unit)

Development, analysis, interpretation, use, and misuse of statistical data and methods for description, evaluation, and political action regarding war, disappearances, justice, violence against women, trafficking, profiling, elections, hunger, refugees, discrimination, etc.

Prerequisites: Two of STAT 325-0, STAT 350-0, STAT 320-2, STAT 320-3; or ECON 381-1, ECON 381-2; or MATH 386-1, MATH 386-2; or IEMS 303-0, IEMS 304-0.

Formal Studies Distro Area

STAT 420-1 Introduction to Statistical Theory & Methodology-1 (1 Unit)

First Quarter: Distribution theory, characteristic functions, moments and cumulants, random variables, sampling theory, and common statistical distributions. Second Quarter: Methods of estimation, hypothesis tests, confidence intervals, least squares, likelihood methods, and large-sample methods. Third Quarter: Theories of inference, multivariate methods, and contingency tables.

STAT 420-2 Introduction to Statistical Theory & Methodology-2 (1 Unit)

First Quarter: Distribution theory, characteristic functions, moments and cumulants, random variables, sampling theory, and common statistical distributions. Second Quarter: Methods of estimation, hypothesis tests, confidence intervals, least squares, likelihood methods, and large-sample methods. Third Quarter: Theories of inference, multivariate methods, and contingency tables.

STAT 420-3 Introduction to Statistical Theory & Methodology-3 (1 Unit)

First Quarter: Distribution theory, characteristic functions, moments and cumulants, random variables, sampling theory, and common statistical distributions. Second Quarter: Methods of estimation, hypothesis tests, confidence intervals, least squares, likelihood methods, and large-sample methods. Third Quarter: Theories of inference, multivariate methods, and contingency tables.

STAT 425-0 Sampling Theory and Applications (1 Unit)

Sampling designs (simple random, unequal probability, stratified, cluster, systematic, random walk, induced, multiphase, choosing sample sizes), sample adjustment (weighting/calibration), variance estimation, non-sampling errors, topics re government statistical agencies.

Prerequisites: Two previous courses in probability and statistics, at least one at the 300 level in Statistics (other than STAT 330-1, STAT 330-2), Econometrics, IE/MS, Math; or permission of instructor.

STAT 435-0 Mathematical Foundations of Machine Learning (1 Unit)

In this course, students are expected to explore some mathematical foundations of modern machine learning under a problem-solving framework. Topics include probability theory, frequentist statistics, Bayesian statistics, tensor algebra, vector calculus, convex and stochastic optimization, stochastic processes and sampling, Markov Chain Monte Carlo, sequential optimization and dynamic programming. This class strongly emphasizes on developing problem-solving skills.

Prerequisite: 420-1 (recommended but not required).

STAT 439-0 Meta-Analysis (1 Unit)

Statistical methods for combining results of replicated experiments. Effect size indexes and their estimators, combined estimation and test of heterogeneity, modeling between-study variation in effect sizes, models for publication selection.

Prerequisite: A graduate-level course in statistics.

STAT 448-0 Multivariate Statistical Methods (1 Unit)

Multivariate normal distribution, Hotelling's T²-test, multivariate analysis of variance, discriminant analysis, canonical correlation, principal components, and factor analysis. Use of computer packages.

STAT 451-0 Design & Analysis of Social Experiments (1 Unit)

This course covers the design and analysis of social experiments conducted in field settings. It will focus on experiments based on samples from populations with hierarchical structure and experiments that involve randomization of intact groups (statistical clusters) to treatments. Design and analysis considerations will be covered in detail, and students will carry out exercises in the design and analysis of social experiments in realistic settings.

Prerequisite: Permission of the instructor.

STAT 453-0 Survival Analysis (1 Unit)

Life-table construction, Kaplan-Meier estimation, exponential survival distributions, Weibull distributions, and Cox regression models.

STAT 454-0 Time Series Analysis (1 Unit)

Harmonic analysis, power spectra, filtering, cross-spectra, linear processes, and forecasting.

STAT 455-0 Advanced Qualitative Data Analysis (1 Unit)

Probit, logit, log-linear, and latent-class models. Multi-dimensional contingency tables; polytomous responses with continuous independent variables.

STAT 456-0 Generalized Linear Models (1 Unit)

Inference and fitting of generalized linear models with application to classical linear models, binomial and multinomial logit models, log-linear models, Cox's proportional hazards model and GEE's for longitudinal data.

Prerequisites: STAT 350-0 and STAT 420-3.

STAT 457-0 Applied Bayesian Inference (1 Unit)

Introduction to computational algorithms for Bayesian inference. Observed data and data augmentation methods are considered in detail. Methods are illustrated with real examples.

Prerequisites: STAT 350-0 and STAT 420-1 or equivalent.

STAT 461-0 Advanced Topics in Statistics (1 Unit)

STAT 465-0 Statistical Methods for Bioinformatics and Computational Biology (1 Unit)

An introduction of statistical methodologies in cutting-edge fields of computational biology and bioinformatics topics including microarray gene expression data analysis; biological sequence analysis; EST and SAGE data analysis.

STAT 466-0 Likelihood Methods (1 Unit)

Recent results in the theory of likelihood-based inference. Topics covered will include higher-order asymptotic theory, based both on Edgeworth expansions and saddlepoint methods, conditional and marginal likelihood functions, the modified profile likelihood function and adjustments to the signed likelihood ratio statistic.

Prerequisite: STAT 420-2.

STAT 498-0 Advanced Practicum (1 Unit)

Supervised statistical consultation.

STAT 499-0 Independent Study (1-3 Units)

SEE DEPT FOR SECTION AND PERMISSION NUMBERS.

STAT 519-0 Responsible Conduct of Research Training (0 Unit)

STAT 590-0 Research (1-3 Units)

SEE DEPT FOR SECTION AND PERMISSION NUMBERS.