Statistics Courses (Statistics and Actuarial Science) (STAT)

STAT Courses

This is a list of courses with the subject code STAT. For more information, see Statistics and Actuarial Science (College of Liberal Arts and Sciences) in the catalog.

STAT:1000 First-Year Seminar 1 s.h.
Small discussion class taught by a faculty member; topics chosen by instructor; may include outside activities (e.g., films, lectures, performances, readings, visits to research facilities). Requirements: first- or second-semester standing.

STAT:1010 Statistics and Society 3 s.h.
Statistical ideas and their relevance to public policy, business, humanities, and the social, health, and physical sciences; focus on critical approach to statistical evidence. Requirements: one year of high school algebra or MATH:0100. GE: Quantitative or Formal Reasoning.

STAT:1015 Introduction to Data Science 3 s.h.
In today's world, massive amounts of data are increasingly collected and leveraged for knowledge discovery, policy assessment, and decision-making across many fields, including business, natural sciences, social sciences, and humanities. Topics covered include data collection, visualization, and data wrangling; basics of probability and statistical inference; fundamentals of data learning, including regression, classification, prediction, and cross-validation; computing, learning, and reporting in the R environment; and literate programming and reproducible research. Requirements: one year of high school algebra or MATH:0100. GE: Quantitative or Formal Reasoning. Same as DATA:1015.

STAT:1020 Elementary Statistics and Inference 3 s.h.
Graphing techniques for presenting data, descriptive statistics, correlation, regression, prediction, logic of statistical inference, elementary probability models, estimation and tests of significance. Requirements: one year of high school algebra or MATH:0100. GE: Quantitative or Formal Reasoning. Same as PSQF:1020.

STAT:1030 Statistics for Business 4 s.h.
Descriptive statistics, graphical presentation, elementary probability, estimation and testing, regression, correlation; statistical computer packages. GE: Quantitative or Formal Reasoning.

STAT:2010 Statistical Methods and Computing 3 s.h.
Methods of data description and analysis using SAS; descriptive statistics, graphical presentation, estimation, hypothesis testing, sample size, power; emphasis on learning statistical methods and concepts through hands-on experience with real data. Recommendations: undergraduate standing. GE: Quantitative or Formal Reasoning.

STAT:2020 Probability and Statistics for the Engineering and Physical Sciences 3 s.h.
Probability, random variables, important discrete and continuous distributions, joint distributions, transformations of random variables, descriptive statistics, point and interval estimation, tests of hypotheses, regression. Prerequisites: MATH:1560 or MATH:1860.

STAT:3100 Introduction to Mathematical Statistics I 3 s.h.
Descriptive statistics, probability, conditional probability, discrete and continuous univariate and multivariate distributions, sampling distributions. Prerequisites: MATH:1860 or MATH:1560. Same as IGPI:3100.

STAT:3101 Introduction to Mathematical Statistics II 3 s.h.
Point and interval estimation, testing statistical hypotheses, simple regression, nonparametric methods. Prerequisites: STAT:3100. Same as IGPI:3101.

STAT:3120 Probability and Statistics 4 s.h.
Models, discrete and continuous random variables and their distributions, estimation of parameters, testing statistical hypotheses. Prerequisites: MATH:1560 or MATH:1860. Same as DATA:3120, IGPI:3120.

STAT:3200 Applied Linear Regression 3 s.h.
Regression analysis with focus on applications; model formulation, checking, and selection; interpretation and presentation of analysis results; simple and multiple linear regression; logistic regression; ANOVA; polynomial regression; tree models; bootstrapping; hands-on data analysis with computer software. Prerequisites: STAT:2020 or STAT:2010 or STAT:3120. Same as DATA:3200, IGPI:3200, ISE:3760.

STAT:3210 Experimental Design and Analysis 3 s.h.
Single- and multifactor experiments; analysis of variance; multiple comparisons; contrasts; diagnostics; fixed, random, and mixed effects models; designs with blocking and/or nesting; two-level factorials and fractions thereof; use of statistical computing packages. Prerequisites: STAT:3200.

STAT:3510 Biostatistics 3 s.h.
Statistical concepts and methods for the biological sciences; descriptive statistics, elementary probability, sampling distributions, confidence intervals, parametric and nonparametric methods, one-way ANOVA, correlation and regression, categorical data. Requirements: MATH:0100 or MATH:1005 or ALEKS score of 30 or higher. Same as IGPI:3510.

STAT:3620 Quality Control 3 s.h.
Basic techniques of statistical quality control; application of control charts for process control variables; design of inspection plans and industrial experimentation; modern management aspects of quality assurance systems. Offered fall semesters. Prerequisites: STAT:2020 or BAIS:9100 or (STAT:3100 and STAT:3101 and STAT:3200). Same as CEE:3142, ISE:3600.

STAT:4100 Mathematical Statistics I 3 s.h.
Probability, conditional probability, random variables, distribution and density functions, joint and conditional distributions, various families of discrete and continuous distributions, mgf technique for sums, convergence in distribution, convergence in probability, central limit theorem. Prerequisites: MATH:2850 and MATH:2700. Same as IGPI:4100.
STAT:4101 Mathematical Statistics II 3 s.h.
Transformations, order statistics, point estimation, sufficient statistics, Rao-Blackwell Theorem, delta method, confidence intervals, likelihood ratio tests, applications. Prerequisites: STAT:4100. Same as IGPI:4101.

STAT:4143 Introduction to Statistical Methods 3 s.h.
Analysis, interpretation of research data; descriptive statistics; introduction to probability, sampling theory, statistical inference (binomial, normal distribution, t-distribution models); linear correlation, regression. Same as PSQF:4143.

STAT:4200 Statistical Methods and Computing 3 s.h.
Methods of data description and analysis using SAS; descriptive statistics, graphical presentation, estimation, hypothesis testing, sample size, power; emphasis on learning statistical methods and concepts through hands-on experience with real data. Recommendations: graduate standing in non-statistics or less quantitative major. Same as IGPI:4200.

STAT:4520 Bayesian Statistics 3 s.h.
Bayesian statistical analysis, with focus on applications; Bayesian and frequentist methods compared; Bayesian model specification, choice of priors, computational methods; hands-on Bayesian data analysis using appropriate software; interpretation and presentation of analysis results. Prerequisites: STAT:3200 and (STAT:3101 or STAT:4101 or STAT:3120). Same as IGPI:4522, PSQF:4520.

STAT:4540 Statistical Learning 3 s.h.
Introduction to supervised and unsupervised statistical learning, with a focus on regression, classification, and clustering; methods will be applied to real data using appropriate software; supervised learning topics include linear and nonlinear (e.g., logistic) regression, linear discriminant analysis, cross-validation, bootstrapping, model selection, and regularization methods (e.g., ridge and lasso); generalized additive and spline models, tree-based methods, random forests and boosting, and support-vector machines; unsupervised learning topics include principal components and clustering. Requirements: an introductory statistics course and a regression course. Recommendations: prior exposure to programming and/or software, such as R, SAS, and Matlab. Same as BAIS:4540, DATA:4540, IGPI:4540.

STAT:4560 Statistics for Risk Modeling I 3 s.h.
Simple linear regression, multiple linear regression, model diagnostics, linear models from a statistical learning perspective, generalized linear models, and implementations of these models on real data. Prerequisites: STAT:4101 with a minimum grade of C+ or STAT:5101 with a minimum grade of C+.

STAT:4561 Statistics for Risk Modeling II 3 s.h.
Regression-based time series models, decision trees, principal components analysis, cluster analysis, and implementations of these analytic techniques on real data. Prerequisites: STAT:4560 with a minimum grade of C+.

STAT:4580 Data Visualization and Data Technologies 3 s.h.
Introduction to common techniques for visualizing univariate and multivariate data, data summaries, and modeling results; how to create and interpret these visualizations and assess effectiveness of different visualizations based on an understanding of human perception and statistical thinking; data technologies for obtaining and preparing data for visualization and further analysis; students learn how to present results in written reports and use version control to manage their work. Requirements: an introductory statistics course and a regression course. Recommendations: prior exposure to basic use of statistical programming software (e.g., R or SAS) as obtained from a regression course strongly recommended. Same as DATA:4580, IGPI:4580.

STAT:4600 Causal Inference for Data Science 3 s.h.
Introduce methods for reasoning about causes, effects, and bias when analyzing experimental and observational data. Topics include the potential outcomes framework, counterfactuals, confounding, and missing data; the identification and estimation of causal effects via propensity score methods, marginal structural models, instrumental variables, and directed acyclic graphs; as well as applications of machine learning and Bayesian methods to causal inference. Prerequisites: (DATA:3120 or STAT:3120) and (DATA:3200 or STAT:3200). Requirements: familiarity with the R programming. Same as DATA:4600.

STAT:4740 Large Data Analysis 3 s.h.
Current areas that deal with problem of big data: techniques from computer science, mathematics, statistics; high-performance and parallel computing, matrix techniques, cluster analysis, visualization; variety of applications including Google PageRank, seismology, Netflix-type problems, weather forecasting, fusion of data with simulation; projects. Prerequisites: (CS:1210 with a minimum grade of C- or ENGR:2730 with a minimum grade of C-) and (MATH:3800 or CS:3700) and (STAT:3200 or IE:3760 or IGPI:3200). Same as CS:4740, IGPI:4740, MATH:4740.

STAT:4750 Probabilistic Statistical Learning 3 s.h.
Essential machine learning and statistics ideas that are critical in analyzing modern complex and large data; supervised learning topics include linear models, deep neural networks, and nonparametric models; essential topics include nonlinear dimension reduction, clustering, and recommender systems. Prerequisites: (CS:1210 with a minimum grade of C- or ENGR:2730 with a minimum grade of C-) and (MATH:2700 or MATH:2550) and (STAT:2010 or STAT:2020 or STAT:4200) and STAT:4540. Same as DATA:4750.

STAT:5090 ALPHA Seminar 1 s.h.
Resources available to students, program requirements, tips for academic success, professional statistical organizations, library and career center resources, statistical computing, scientific document preparation, history of statistics. Requirements: graduate standing in statistics.

STAT:5100 Statistical Inference I 3 s.h.
Review of probability, distribution theory (multiple random variables, moment-generating functions, transformations, conditional distributions), sampling distributions, order statistics, convergence concepts, generating random samples. Prerequisites: MATH:2850 and STAT:3101.

STAT:5101 Statistical Inference II 3 s.h.
Continuation of STAT:5100; principles of data reduction, point estimation theory (MLE, Bayes, UMVU), hypothesis testing, interval estimation, decision theory, asymptotic evaluations. Prerequisites: STAT:5100.
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STAT:7101 Advanced Inference II 3 s.h.
Hypothesis testing, asymptotics of the likelihood ratio test, asymptotic efficiency, statistical functionals, robustness, bootstrap and jackknife, estimation with dependent data. Prerequisites: STAT:7100.

Selected advanced topics in mathematical statistics.

STAT:7200 Linear Models 4 s.h.
Linear spaces and selected topics in matrix algebra, full rank and non-full rank linear models, estimability, least squares and best linear unbiased estimation, multivariate normal distribution and distributions of quadratic forms, interval estimation, hypothesis testing, random and mixed models, best linear unbiased prediction, variance component estimation. Prerequisites: STAT:5101 and STAT:5200 and STAT:5201.

Selected advanced topics in applied statistics.

STAT:7300 Advanced Probability 3 s.h.
Probability theory, with emphasis on constructing rigorous proofs; measure spaces, measurable functions, random variables and induced measures, distribution functions, Lebesgue integral, product measure and independence, Borel Cantelli lemma, modes of convergence. Prerequisites: STAT:5120.

STAT:7390 Seminar: Probability arr.
Selected advanced topics in probability.

STAT:7400 Computer Intensive Statistics 3 s.h.
Computer arithmetic, random variate generation, numerical optimization, numerical linear algebra, smoothing techniques, bootstrap methods, cross-validation, MCMC, EM and related algorithms; other topics per student/instructor interests. Prerequisites: (BIOS:5710 or STAT:5200) and STAT:3101 and STAT:5400. Requirements: proficiency in Fortran or C or C++ or Java. Same as DATA:7400, IGPI:7400.

STAT:7500 Statistical Machine Learning 3 s.h.
Regularization methods for sparse models, computational algorithms for large scale problems, statistical inference in high-dimensional models, reproducing kernel Hilbert space, supervised learning, nonparametric density and conditional density estimation, neural networks and deep learning, optimal transport and generative learning, dimension reduction and representation learning. Prerequisites: STAT:5100 or STAT:5200. Same as BAIS:7500.

STAT:7510 Analysis of Categorical Data 3 s.h.
Distributions and inference for categorical data; descriptive and inferential methods for contingency tables; theory and application of generalized linear models including methods for parameter estimation and testing, model selection and assessment of model adequacy; models for binary, count, and multi-category outcomes; loglinear models for contingency tables; generalized additive models; generalized linear models for longitudinal and clustered data. Offered spring semesters of even years. Prerequisites: (BIOS:5720 or STAT:5200) and (STAT:5101 or STAT:4101). Same as BIOS:7210.

STAT:7520 Bayesian Analysis 3 s.h.

STAT:7560 Time Series Analysis 3 s.h.
Stationary time series, ARIMA models, spectral representation, linear prediction inference for the spectrum, multivariate time series, state space models and processes, nonlinear time series. Prerequisites: STAT:4101 and (STAT:3200 or STAT:6560).

STAT:7570 Survival Data Analysis 3 s.h.
Types of censoring and truncation; survival function estimation; parametric inference using exponential, Weibull, and accelerated failure time models; nonparametric tests; sample size calculation; Cox regression with stratification and time-dependent covariates; regression diagnostics; competing risks; topics may include analysis of correlated survival data and/or recurrent events; designed for biostatistics and statistics majors. Offered fall semesters of odd years. Prerequisites: BIOS:5720 and ((STAT:4100 and STAT:4101) or (STAT:5100 and STAT:5101)). Same as BIOS:7210, IGPI:7210.

STAT:7990 Reading Research arr.
Supervised reading and research in statistics.