Statistics (STAT)

Course information contained within the Bulletin is accurate at the time of publication in June 2025 but is subject to change. For the most up-to-date course information, please refer to the Course Catalog.

STAT 5001. Quantitative Methods for Business. 3 Credit Hours.
This course is designed to introduce you to contemporary elementary applied statistics and to provide you with an appreciation for the uses of statistics in business, economics, everyday life, as well as hands-on capabilities needed in your later coursework and professional employment.

Repeatability: This course may not be repeated for additional credits.

STAT 5002. Introduction to Biostatistics. 3 Credit Hours.
Topics cover statistical methods and concepts with special emphasis on applications in health and biological sciences.

Repeatability: This course may not be repeated for additional credits.

STAT 5170. Special Topics. 1 to 6 Credit Hour.
Repeatability: This course may be repeated for additional credit.

STAT 5182. Independent Study. 1 to 6 Credit Hour.
Special study in a particular aspect of statistics under the direct supervision of an appropriate graduate faculty member. No more than six semester hours of independent study may be counted toward degree requirements.

Repeatability: This course may be repeated for additional credit.

STAT 5190. Special Topics - Stat. 1 to 6 Credit Hour.
Repeatability: This course may be repeated for additional credit.

STAT 5282. Independent Study. 1 to 3 Credit Hour.
Repeatability: This course may be repeated for additional credit.

Pre-requisites: Minimum grade of B- in STAT 5001.

STAT 5602. Visualization: The Art of Numbers and the Psychology of Persuasion. 3 Credit Hours.
Organizations are collecting an unprecedented volume of data, and analysts are producing information from data using analytics and models. None of the information that is extracted from the data is usable unless it can be effectively communicated. In this course, we will begin with the fundamental questions of communication: Who is the audience? What is the information? What is the goal? Using these questions to focus our thoughts, we will explore the techniques that allow you to select appropriate information and to craft a narrative that clearly and effectively communicates this information using visual elements. Producing good visual displays is a combination of art and science and compromise between function and form. We will discuss how humans process and encode visual and textual information in relation to selecting an appropriate visual display, and we will cover topics including: exploratory data analyses, charts, tables, graphics, static and dynamic displays, effective presentations, multimedia content, animation, and dashboard design. Examples and cases will be used from a variety of industries.

Repeatability: This course may not be repeated for additional credits.

STAT 5603. Statistical Learning and Data Mining. 3 Credit Hours.
This course is designed to change the way you think about data. Numerous firms have demonstrated that the ability to reliably extract managerially-relevant information from data is a potent and enduring source of competitive advantage, a realization that transforms data into an asset that can be a primary source of competitive advantage. Competition is pushing organizations to "mine" (or extract) these insights faster, with greater reliability, and in ways that maximize the probability of implementation. In this course we will explore how statistical learning and data mining techniques can be used to improve decision-making and profitability. The course will provide an overview of the fundamental principles and techniques of data mining, and we will use real-world examples, cases, and "hands-on" techniques to demonstrate data-mining techniques in context, to develop your analytic thinking, and to develop your model building acumen.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (STAT 5001, STHM 5111, (STAT 5301 and MIS 5301), or (STAT 5401 and MIS 5401)) and STAT 5606.

STAT 5604. Experiments: Knowledge by Design. 3 Credit Hours.
How do we know which policies, strategies, and decisions work, which should be continued, and which should be changed? Organizations frequently implement strategies and changes, only to find that they fail to produce their intended effects. Thus, there is a gap between what "sounded good" and what was "right." Ultimately, the gold standard for assessing what is "right" is a controlled experiment, which is the least utilized technique in the corporate arsenal. Experiments provide a structured way to construct a feedback loop that allows us to identify errors in our beliefs and to ascertain the real drivers of outcomes. In this course, we will explore how to use this "test and learn" paradigm to answer questions such as how advertising should be designed and targeted, what types of promotions are most effective, what products should be offered, how employees should be compensated, which sales channels should be emphasized, how webpages should be designed, and more. Experiments are an ideal way to understand how to implement a "test and learn" approach to management and to separate the "signal" from the "noise."

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (STAT 5001, STHM 5111, (STAT 5301 and MIS 5301), or (STAT 5401 and MIS 5401))

STAT 5605. Decision Models: From Data to Decisions. 3 Credit Hours.
Good analysts know that predictions are always uncertain. However, merely expressing uncertainty is not sufficient for decision making. In addition, we need to combine the results of uncertain inputs into a more general model, account for the relative severity of negative outcomes, and choose a strategy that best achieves our goals (e.g. highest expected value, most robust, least chance of losing, etc.). We also need to communicate the process and conclusions to constituents and to decision-makers. This course focuses on techniques for combining uncertain inputs into a decision model that can be used to characterize likely and unlikely outcomes, to quantify risk, and to identify inputs to a decision that are "high leverage" (i.e., outcomes are very sensitive to those inputs). In addition, you will learn how to build a decision model, how to make better decisions in the presence of uncertainty, and how to deal with multi-stage decisions.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (STAT 5001, STHM 5111, (STAT 5301 and MIS 5301), or (STAT 5401 and MIS 5401))

STAT 5606. Data: Care, Feeding, and Cleaning in Python. 3 Credit Hours.
Data is ubiquitous. Real data is also "dirty." Analysis of unclean data can significantly distort the results of analyses, and it can reduce or eliminate the benefits of an information-driven strategy. Thus, the first step in generating good information from data is to "clean" the data. Substantial research has been done on procedures to automatically or semi-automatically identify--and, when possible, correct--errors in large datasets. Even after data have been "scrubbed" the datasets are frequently not in the correct configuration for analysis. Data combination and manipulation involves techniques for merging and summarizing datasets, extracting subsets of data, and transforming variables within the datasets. In this course we explore tools and techniques for cleaning raw data (fixing errors, identifying outliers, etc.), extracting subsets or samples of data, merging and combining datasets, summarizing disaggregate data, and manipulating and transforming individual variables within the datasets. We will also discuss good procedures for ensuring data quality and reliability in data collection. In addition, we will discuss techniques to identify issues in data collection and how to clean the data.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (STAT 5001 (may be taken concurrently), STHM 5111 (may be taken concurrently), (STAT 5301 (may be taken concurrently) and MIS 5301 (may be taken concurrently)), or (STAT 5401 (may be taken concurrently) and MIS 5401 (may be taken concurrently)))

STAT 5607. Advanced Business Analytics. 3 Credit Hours.
This course builds upon the foundation in Business Analytics. In previous courses, we saw that data by itself is useless, and that it must be transformed into information in order to have value to decision makers. This course will extend your understanding of the art and science of extracting information from data into increasingly complex and "real world" data. Specifically, we will cover extensions to regression, logistic regression, hierarchical modeling, model selection, and other topics spanning the process of building and evaluating models. In addition, we will practice drawing intuition and insight from models and effectively communicating that insight in a format that can help decision-makers to make better decisions.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (STAT 5001, STHM 5111, (STAT 5301 and MIS 5301), or (STAT 5401 and MIS 5401))

STAT 5611. Business Analytics II. 1.5 Credit Hour.
Organizations are drowning in a sea of data. However, data by itself is useless. To have value, it must be transformed into information that can be used to make decisions. It has been shown by myriad companies that one path to success in the business arena is through superior use of information - information about customers, markets, and operations. This course extends the material presented in Business Analytics I, continuing the development of the art and science of extracting information from data. The emphasis is on using extracted information to improve business decisions. It also delves into the presentation of quantitative data using state of the art tools and techniques.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in ((STAT 5301 and MIS 5301), (STAT 5401 and MIS 5401), or STAT 5001)

STAT 5651. Capstone in Analytics. 3 Credit Hours.
The capstone in analytics is the culmination of analytics-focused coursework. You will work with real data from "live" clients. Some of you will work on projects at companies for which you are interning. Others will work with MBA teams as part of our Fox Management Consulting program, providing analytics support for a live client. Others will work on primarily analytics focused projects.

Repeatability: This course may not be repeated for additional credits.

STAT 5801. Data Analysis to Support Managerial Decisions. 3 Credit Hours.
In this course, you'll learn how to use statistics to help solve business problems throughout an enterprise. You'll examine case examples of statistical analysis in areas such as marketing, finance and management. You'll learn descriptive and inferential techniques such as regression analysis and how to analyze data and reach decisions, using statistical computer software and Excel.

Repeatability: This course may not be repeated for additional credits.

STAT 5802. Quantitative Techniques for Management. 3 Credit Hours.
In this course you'll apply advanced quantitative techniques for managerial decision-making such as forecasting, linear programming, simulation, decision analysis, Markov chains and game theory. You'll use customized software and Excel to analyze these models extensively and apply them to decisions regarding resource allocation and other managerial problems.

Repeatability: This course may not be repeated for additional credits.

STAT 5890. Special Topics. 1 to 6 Credit Hour.
Repeatability: This course may be repeated for additional credit.

STAT 8001. Probability and Statistics Theory I. 3 Credit Hours.
Topics include basic probability theory and combinatorial problems, generating functions, random variables, probability distributions, law of large numbers, and limit theorems.

Repeatability: This course may not be repeated for additional credits.

STAT 8002. Probability and Statistics Theory II. 3 Credit Hours.
A comprehensive development of the theory of statistics, including standard distributions, sampling distributions, general theory of estimation, testing of hypotheses, statistical decision theory, order statistics, linear statistical estimation.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8001.

STAT 8003. Statistical Methods and Concepts. 3 Credit Hours.
Introduction to applied statistics. Topics include data management, probability distributions, parameter estimation, hypothesis testing, sampling methodologies, graphical display, analysis of variance, and simple and multiple regression. Use of R, S-Plus and SAS statistical software.

Repeatability: This course may not be repeated for additional credits.

STAT 8004. Statistical Modeling and Inference. 3 Credit Hours.
Design of experiments, analysis of discrete data, introduction to nonparametric methods, logistic regression, ARIMA time series analysis, bootstrapping, jackknife, robustness, and selected topics in multivariate analysis. Use of R, S-Plus and SAS statistical software.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8003.

STAT 8101. Stochastic Processes. 3 Credit Hours.
This is a first course in stochastic processes, with an emphasis on continuous-time models that support applications in financial mathematics and derivative evaluation. The course covers: fundamentals of probability, limit theorems, conditional expectation, change of measures, Markov chains, random walks, martingales, Brownian motion, the Ito integral, stochastic differential equations, the Black-Scholes model and its use in evaluating a variety of financial derivatives.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (STAT 8001 or STAT 8112)

STAT 8102. High Dimensional Inference. 3 Credit Hours.
This course covers current topics on high-dimensional statistical learning methods for data science with large and complex data sets. Methods exploiting sparsity and other data and model structures are introduced including penalized regression approaches for linear models, generalized linear models, and high-dimensional classifications. Other selected high-dimensional statistical learning topics will be discussed including tree methods, boosting, random forest, neural networks and unsupervised learning.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8003.

STAT 8103. Sampling Theory. 3 Credit Hours.
Theory and application of sampling from finite populations. Topics include random, stratified, cluster, and systematic sampling; estimation of means and variances; optimal allocation of resources; problems of nonsampling errors; and ratio and regression estimation.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8003.

STAT 8104. Mathematics for Statistics. 3 Credit Hours.
Vector spaces; linear independence of vectors and basis; matrices and algebraic operations on matrices; determinants; rank of a matrix; inverse of nonsingular matrices; linear equations and their solutions; generalized inverse of a matrix; eigen values and vectors of matrices; diagonalization theorems; quadratic forms and their reduction to sum of squares; Jacobians.

Repeatability: This course may not be repeated for additional credits.

STAT 8105. Univariate Time Series Analysis. 3 Credit Hours.
Theory and application of univariate time series analysis. Includes both time domain and frequency domain methods. Considers stationary and nonstationary linear processes, time series model building, forecasting, unit root test, intervention models and outlier detection, spectral theory of stationary processes, spectral windows, and estimation of spectrum.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8002.

STAT 8106. Linear Models I. 3 Credit Hours.
Covers the basic theory and practice of generalized linear models (GLM), such as the logistic, Poisson and gamma regression, as well as models for multilevel or longitudinal Gaussian responses, such as the hierarchical linear model and linear mixed model. The students will need to work with R and SAS throughout the semester.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8002, STAT 8004, and STAT 8104.

STAT 8107. Design of Experiments I. 3 Credit Hours.
Principles of experimental designs, completely randomized designs, multiple comparisons, randomized block design, latin square design, missing value problems, analysis of covariance, and factorial experiments.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8004.

STAT 8108. Applied Multivariate Analysis I. 3 Credit Hours.
Multivariate normal distribution; marginal and conditional distributions; estimation of population mean vector and dispersion matrix; correlation, partial correlation, and multiple correlation coefficients; Hotelling's T2; MANOVA; discriminant function; repeated measurements analysis; principal components and canonical correlation; factor analysis; and multidimensional scaling.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8003.

STAT 8109. Applied Statistics and Data Science. 3 Credit Hours.
PART I: Elements of a scientific problem, including estimands, the role of statistical models, the language of statistical modeling, notions of likelihood, finite vs infinite populations, and types of analysis. PART II: Elements of statistical modeling, including transformation theorems, sufficiency, 1-parameter and multi-parameter models, multivariate Normal models, Dirichlet-multinomial models, hierarchical models, generalized linear models, mixture models, text analysis, social network analysis. PART III: Concepts and algorithms for estimation and inference, including information, statistical efficiency, asymptotic approximations, maximum likelihood estimators, method of moments estimators, Bayesian estimators, empirical Bayes vs full Bayes estimation strategies, expectation-maximization algorithm, Monte Carlo approximations, Gibbs samplers, Metropolis-Hastings samplers, prior and posterior predictive checks, and Bayesian vs. frequentist coverage. Data Science visitors: The course will feature a series of short talks and Q&A sessions with prominent data scientists spanning academia, government, and the Tech industry.

Repeatability: This course may not be repeated for additional credits.

STAT 8112. Statistical Methods for Business Research I. 3 Credit Hours.
Part I of a doctoral level, one-year sequence of courses for the PhD students in Business Administration program. The course covers a variety of statistical methods useful in business research, such as: multiple regression analysis, ANOVA, linear models, analysis of covariance, logistic regression, principal component analysis, exploratory factor analysis and canonical correlation analysis. Emphases are placed on rationales, assumptions, techniques, and interpretation of results from computer packages. Relevant mathematical results will be presented, but proofs or abstract arguments shall be avoided. The lectures cover computer usages, such as R and/or SAS, and the students are expected to work with SAS (or equivalent packages) throughout the semester.

Repeatability: This course may not be repeated for additional credits.

STAT 8113. Statistical Methods for Business Research II. 3 Credit Hours.
Part II of a doctoral level, one-year sequence of courses for the PhD students in Business Administration program. Topics covered in this course are: discriminant analysis, confirmatory factor analysis and structural equations modeling, time-series intervention analysis, survival (event history) analysis, MANOVA, multivariate profile analysis, hierarchical linear models (HLM), linear mixed models (LMM) for multilevel data.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8112.

STAT 8114. Survival Analysis I. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

STAT 8115. Nonparametric Methods. 3 Credit Hours.
A thorough course in nonparametric statistics. Estimation and testing of hypothesis when the function form of the population distribution function is not completely specified.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8003.

STAT 8116. Categorical Data Analysis. 3 Credit Hours.
Sampling models and analyses for discrete data: Fisher's exact test; Logistic regression; ROC analysis; Log-linear models and Poisson regression; Conditional logistic regression; Cochran-Mantel-Haenszel test; Measures of agreement between observers; Quasi-independence; Multinomial logit models; Proportional odds model; Association models; generalized estimating equations (GEE); generalized linear mixed model (GLIMMIX); GSK models; Composite link functions. The students will need to work with R and SAS throughout the semester.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8003.

STAT 8117. Clinical Trials. 3 Credit Hours.
Introduction to the special problems associated with medical trials on humans. Topics include randomization, sample-size determination, methods for early trial termination, and tests for superiority, equivalence, and non-inferiority. Also discussed are choice of endpoints, control, side effects, use of historical data, meta-analysis and ethics of experimentation on humans.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (STAT 8002 or STAT 8004)

STAT 8121. Statistical Computing and Optimization. 3 Credit Hours.
Use of computers in the solution of statistical problems. Topics include: floating point architecture, random number generation, design of statistical software, computational linear algebra, numerical integration, optimization methods.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8004.

STAT 8122. Advanced SAS Programming. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (MATH 1042 or MATH 1942), STAT 8001, and STAT 8002.

STAT 8123. Time Series Analysis and Forecasting. 3 Credit Hours.
A time series analysis with financial and business applications. Topics include important univariate and multivariate time series methods including ARIMA models, intervention analysis, outlier detection, time series regression, volatility and GARCH models, vector time series and co-integration. Projects using software are required.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in (STAT 8002 or STAT 8004)

STAT 8515. Data Wrangling and Curation. 3 Credit Hours.
This course will explore advanced tools and techniques for cleaning "raw" data. Real data is ubiquitous, but it is almost always "dirty". Analysis of "dirty" data can significantly distort results, which can reduce or eliminate the benefits from an analytic solution. The first step in extracting actionable information from data is to "clean" the data, and this process frequently occupies the majority of the analysis time. In this course, we will provide an in-depth look at the techniques that can be used to identify and deal with problematic data. Even after data have been "scrubbed", datasets are frequently not in the correct configuration for analysis, and we will explore techniques for merging and summarizing datasets, extracting subsets of data, and transforming variables. We will also discuss procedures for ensuring data quality and reliability in data collection.

Repeatability: This course may not be repeated for additional credits.

STAT 8982. Independent Study. 1 to 3 Credit Hour.
Special study in statistics theory and methods under the supervision of a graduate faculty member.

Repeatability: This course may be repeated for additional credit.

STAT 9001. Advanced Statistical Inference I. 3 Credit Hours.
Background: Matrix Theory Estimation: Sufficiency, Completeness, UMVU Estimation, Information Inequality, Invariance Principle, Bayes Estimation, Admissibility, Maximum Likelihood Estimation, Large Sample Properties of Estimators.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8001 and STAT 8002.

STAT 9002. Advanced Statistical Inference II. 3 Credit Hours.
Testing of Hypotheses: Neyman-Pearson Fundamental Lemma; Uniformly Most Powerful Tests, Confidence Intervals, Likelihood Ratio Tests; Asymptotic Tests, Multiple Hypotheses Testing.

Repeatability: This course may not be repeated for additional credits.

STAT 9090. Special Topics. 1 to 6 Credit Hour.
Repeatability: This course may be repeated for additional credit.

STAT 9101. Multivariate Time Series Analysis. 3 Credit Hours.
Theory and application of multiple time series analysis and special topics. Covers transfer function models, time series regression with autocorrelated errors, ARCH and GARCH models, vector time series models, cointegration, state space models, long memory processes and nonlinear processes, time series aggregation and disaggregation.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8105.

STAT 9103. Stat Lrng & Data Mining. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8001, STAT 8002, STAT 8003, and STAT 8004.

STAT 9106. Linear Models II. 3 Credit Hours.
Continuation of Stat 8106, covers the theory and practice of analyzing multivariate repeated/correlated non-Gaussian responses, with or without missing observations. Missing at random (MAR) models; informative missingness; EM algorithm; multiple imputations; quasi-likelihood estimation; generalized estimating equations (GEE); transition models; Gibbs sampling; Markov Chain Monte-Carlo (MCMC) technique. The students will need to work with R, SAS and WinBugs throughout the semester.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8106.

STAT 9107. Design of Experiments II. 3 Credit Hours.
Covers symmetric and asymmetrical factorial experiments, fractional replication, split plot design, balanced and partially balanced incomplete block designs without and with recovery of interblock information and lattice designs.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8107.

STAT 9108. Multivariate Analysis II. 3 Credit Hours.
A study of specialized topics in multivariate analysis.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8002 and STAT 8108.

STAT 9114. Survival Analysis II. 3 Credit Hours.
Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B- in STAT 8114.

STAT 9116. Statistical Genetics: An Advanced Graduate Course. 3 Credit Hours.
An advanced level graduate course in statistical genetics covering the basic concepts of allele, gene, genotype, phenotype, Hardy-Weinberg equilibrium, linkage analysis, QTL mapping using marker analysis, functional mapping for longitudinal traits, analysis of ultra-high dimensional data, genome-wide association studies.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites: Minimum grade of B in STAT 8001, STAT 8002, STAT 8003, and STAT 8004.

STAT 9180. Seminar in New Topics in Statistics. 3 Credit Hours.
Special topics in Statistics.

Repeatability: This course may be repeated for additional credit.

STAT 9183. Directed Study in Statistics. 1 to 6 Credit Hour.
Repeatability: This course may be repeated for additional credit.

STAT 9190. Seminar in New Topics in Statistics. 3 Credit Hours.
Special topics in Statistics.

Repeatability: This course may be repeated for additional credit.

STAT 9994. Preliminary Examination Preparation. 1 Credit Hour.
Preparation for preliminary examinations.

Repeatability: This course may be repeated for additional credit.

STAT 9998. Pre-Dissertation Research. 1 Credit Hour.
Proposal design. Registration required until approved proposal is on file at the Graduate School.

Repeatability: This course may be repeated for additional credit.

STAT 9999. Dissertation Research. 1 to 12 Credit Hour.
For students elevated to candidacy and doing their dissertation research. Registration required until successful defense and graduation.

Repeatability: This course may be repeated for additional credit.