STATISTICS & OPERATIONS RSRCH (STAT-GB)

STAT-GB 2301 Regression and Multivariate Data Analysis (3 Credits)
Typically offered occasionally
This is a data-driven applied statistics course focusing on the analysis of data using regression models. It emphasizes applications to the analysis of business and other data and makes extensive use of computer statistical packages. Topics include simple and multiple linear regression, residual analysis and other regression diagnostics, multicollinearity and model selection, auto regression, heteroscedasticity, regression models using categorical predictors, and logistic regression. All topics are illustrated on real data sets obtained from financial markets, market research studies, and other scientific inquiries.
Grading: Grad Stern Graded
Repeatable for additional credit: No
Prerequisites: MBA student and COR1-GB 1305.

STAT-GB 2302 Forecasting Time Series Data (3 Credits)
Typically offered occasionally
Presented in this course are practical time series forecasting techniques with emphasis on the BoxJenkins ARIMA autoregressive integrated moving average method and conditional volatility ARCH autoregressive conditional heterogeneity and GARCH generalized autoregressive conditional heterogeneity models The course gives a mix of practical data analysis along with an introduction to the relevant theory The ARIMA models are used to forecast series like interest spreads
Grading: Grad Stern Graded
Repeatable for additional credit: No
Prerequisites: MBA student and COR1-GB 1305.

STAT-GB 2308 Applied Stochastic Processes for Financial Models (3 Credits)
Typically offered occasionally
In this class we study stochastic models for the financial markets mostly in a discrete time setting. We shall discuss the concept of martingales and risk-neutral probability measures, and derive the general pricing formula for contingent claims. We shall study the binomial model and derive the price of a European call option on this model, called the binomial Black-Scholes (BS) formula. We study put options using the put-call parity. We shall compare the binomial BS formula to the continuous time BS formula, and analyze the latter via the "Greeks". We shall also look at exotic options such as the lookback and the knockout option. Additionally, American options, forward and future contracts, and fixed income models will be included as well.
Grading: Grad Stern Graded
Repeatable for additional credit: No
Prerequisites: MBA student and COR1-GB 1305.

STAT-GB 2309 Mathematics of Investment (3 Credits)
Typically offered occasionally
The course discusses mathematical and technical aspects of investments. Topics include measurement of interest and discount rates, accumulated value and present value, annuities, sinking funds, amortization of debt, and determination of yield rates on securities. Applications include bond evaluation, mortgages, capital budgeting, depreciation methods, and insurance.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 3127 Statistical Aspects of Market Risk (1.5 Credits)
Typically offered occasionally
The recent financial crisis has raised a lot of awareness as well as criticism of risk management models One potential problem is that easy access to software and statistical formula can result in a misplaced belief in the generated numbers without a clear understanding of the methodology and without questioning whether the numbers should be trusted The aim of this course is to introduce statistical concepts models methodology and terminology that are commonly used or referred to in market risk management to raise awareness of both the assumptions that are made in commonly used results and of the time series aspects of relevant data and their potential impact on the models and subsequent calculations
Grading: Graded
Repeatable for additional credit: No
Prerequisites: MBA student and COR1-GB 1305.

STAT-GB 3205 Analytics and Machine Learning for Managers (2.5 Credits)
Typically offered occasionally
There are a variety of statistical methods, old and new, that are used nowadays to analyze datasets, which can range in size from the small to the enormous. This course gives an introduction to, an overview of and a comparison between these various methods and the attendant terminology and the different kinds of questions they can help answer. Methods that will be discussed include Regression, the Lasso, Discriminant Analysis, Logistic regression, Regression and Classification Trees, etc. This course is not meant for the people doing the analysis but will be geared more towards helping managers understand the material and aid them in having meaningful conversations with the analytics groups in their firms. However, due to its very nature, there will be a mathematical aspect to the course (i.e. there will be formulae), though the aim is to try to understand the intuition behind them.
Grading: Grad Stern Pass/Fail Executive MBA
Repeatable for additional credit: No

STAT-GB 3301 Introduction to the Theory of Probability (3 Credits)
Typically offered occasionally
This course covers the basic concepts of probability. Topics include the axiomatic definition of probability; combinatorial theorems; conditional probability and independent events; random variables and probability distributions; expectation of functions of random variables; special discrete and continuous distributions, including the chi-square, t, and F distributions; joint distributions with emphasis on the bivariate normal distribution; law of large numbers, central limit theorem; and moment generating functions. The theory of statistical estimation is introduced with a discussion on maximum likelihood estimation.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 3302 Statistical Inference and Regression Analysis (3 Credits)
Typically offered occasionally
The course has two distinct components: statistical inference and regression analysis. Topics included in statistical inference are principles of statistical estimation and inference, Neyman-Pearson Lemma, testing of means, variances, tests of independence, and nonparametric methods. Regression analysis focuses on the general linear regression model least squares estimation, departures from standard assumptions, autocorrelation, multicollinearity, analysis of residuals, choice of variables, and nonlinear models.
Grading: Grad Stern Graded
Repeatable for additional credit: No
Prerequisites: MBA student and STAT-GB 3301.

STAT-GB 3310 Applications of Statistical Models to Business, Politics and Policy (3 Credits)
Typically offered occasionally
This course is intended to provide students with a basic understanding of how statistical models can be applied to the areas of business, politics, and public policy as well as common pitfalls, limitations with different approaches, and lessons learned from recent events. The goal is to give students an understanding of what techniques are used in contemporary statistical analyses of these topics and with the tools to carry out their own empirical analyses and to evaluate the work of others. The course covers techniques used to forecast economic, financial, and political events as well as econometric approaches used to identify causal relationships and to evaluate business and government policies. Much of the instruction is motivated by empirical examples that are assigned as readings for each class. Prerequisites: any introductory Statistics course
Grading: Grad Stern Graded
Repeatable for additional credit: No
Prerequisites: MBA student and COR1-GB 1305.

STAT-GB 3315 Analytics and Machine Learning for Managers (3 Credits)
Typically offered occasionally
There are a variety of statistical methods, old and new, that are used nowadays to analyze datasets, which can range in size from the small to the enormous. This course gives an introduction to, an overview of, and a comparison between these various methods and the attendant terminology, and the different kinds of questions they can help answer. Methods that will be discussed include Regression, the Lasso, Discriminant Analysis, Logistic regression, Regression and Classification Trees, etc. This course is not meant for the people doing the analysis but will be geared more towards helping managers understand the material and aid them in having meaningful conversations with the analytics groups in their firms. However, due to its very nature, there will be a mathematical aspect to the course (i.e. there will be formulae), though the aim is to try to understand the intuition behind them.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 3321 Introduction to Stochastic Processes (3 Credits)
Typically offered occasionally
This is an introductory course in stochastic processes. Its purpose is to introduce students to the classes of stochastic processes, which are widely used as modeling tools in business fields such as finance, marketing and actuarial science as well as in physical and social sciences. The course covers basic theory of discrete and continuous time Markov chains, of Brownian motion and its generalizations, and of martingales. The discussion of Markov chains and Brownian motion includes statistical aspects of these processes. If time permits, the idea of stochastic integration is introduced and the rules of stochastic calculus are developed.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 3370 Independent Study (3 Credits)
Typically offered occasionally
Independent Study
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 3385 Foundations of Machine Learning and Deep Learning with Applications to Business (3 Credits)
Typically offered occasionally
This course contains two parts: (1) In the first part, we will cover the basics of supervised (regression and classification) and unsupervised learning (clustering and dimension reduction). We will also discuss modern topics such as deep neural networks, semi-supervised learning, multi-armed bandit learning, and stochastic optimization for training web-scale data. (2) In the second part, we will cover applications relevant to information and operations, including crowdsourcing, dynamic pricing, and choice-model based recommendation. The Ph.D. students should also prepare the course project and present in class how to use machine learning techniques to address challenges in their own domains.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 4101 Research Practicum-Stat (1 Credit)
Typically offered occasionally
RESEARCH PRACTICUM-STAT
Grading: Grad Stern Pass/Fail
Repeatable for additional credit: No

STAT-GB 4102 Research Practicum (1 Credit)
Typically offered occasionally
RESEARCH PRACTICUM
Grading: Grad Stern Pass/Fail
Repeatable for additional credit: No

STAT-GB 4103 Research Practicum (1 Credit)
Typically offered occasionally
RESEARCH PRACTICUM
Grading: Grad Stern Pass/Fail
Repeatable for additional credit: No

STAT-GB 4104 Research Pract IV - Stat (1 Credit)
Typically offered occasionally
RESEARCH PRACT IV - STAT
Grading: Grad Stern Pass/Fail
Repeatable for additional credit: No

STAT-GB 4105 Research Practicum - 5 (1 Credit)
Typically offered occasionally
RESEARCH PRACTICUM - 5
Grading: Grad Stern Pass/Fail
Repeatable for additional credit: No

STAT-GB 4150 Teaching Pract-Stat/Or (1 Credit)
Typically offered occasionally
TEACHING PRACT-STAT/OR
Grading: Grad Stern Pass/Fail
Repeatable for additional credit: No

STAT-GB 4304 Modern Statistics & Causal Inference for Data Science (3 Credits)
Typically offered occasionally
This course surveys theory and methods addressing important statistical aspects of data science with a focus on high-dimensional data, statistical learning, and causal inference. We will begin with advances in hypothesis testing such as control of the false discovery rate for multiple comparisons. Then we will discuss statistical theory for popular learning and model selection methods such as the lasso, including recent advances in post-selection inference. Finally, after reviewing frameworks for causal inference the course will conclude by reading literature on the application of statistical learning methods to causal inference. Throughout the course we will combine theory, through mathematical understanding, with practice, through empirical understanding and competency with applications such as simulation studies. We assume a working knowledge of probability and linear algebra, familiarity with statistics, and willingness to code in the R statistical programming language, but otherwise the course is self-contained.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 6008 Appl Stoch Proc F/Fin Models (3 Credits)
Typically offered occasionally
Presents a mathematical background for the stochastic processes that are widely employed as modeling tools in finance. The emphasis is on an intuitive approach and examples rather than on proofs and mathematical rigor. Topics include random walks, martingales, Markov chains, Poisson process and other continuous time Markov chains, Brownian motion, geometric Brownian motion, and other diffusion processes. The relevance of the considered processes to financial modeling is stressed throughout. In particular, applications to pricing of derivative securities and to modeling of the term structure of interest rates are discussed.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 6014 Intro Theory of Probability (3 Credits)
Typically offered occasionally
Covers the basic concepts of probability. Topics include the axiomatic definition of probability; combinatorial theorems; conditional probability and independent events; random variables and probability distributions; expectation of functions of random variables; special discrete and continuous distributions, including the chi-square, t, F, and bivariate normal distributions; law of large numbers; central limit theorem; and moment generating functions. The theory of statistical estimation is introduced with a discussion on maximum likelihood estimation.
Grading: Grad Stern Graded
Repeatable for additional credit: No
Prerequisites: MATH-UA 122 OR MATH-UA 123 OR MATH-UA 221 OR MATH-UH 1020Q OR MATH-SHU 131 OR MATH-UA 132 OR AP CALCULUS 4.00 OR MATH 7.

STAT-GB 6015 Stat Infer/Regress Analy (3 Credits)
Typically offered occasionally
Consists of two distinct components: statistical inference and regression analysis. Statistical inference topics include the principles of statistical estimation and inference, Neyman Pearson Lemma, testing of means, variances, tests of independence, and nonparametric methods. Regression analysis discusses the general linear regression model, least squares estimation, departures from standard assumptions, autocorrelation, multicollinearity, analysis of residuals, choice of variables, and nonlinear models.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 6017 Regression & Multivariate Data Analysis (3 Credits)
Typically offered occasionally
This is a data-driven, applied statistics course focusing on the analysis of data using regression models. It emphasizes applications to the analysis of business and other data and makes extensive use of computer statistical packages. Topics include simple and multiple linear regression, residual analysis and other regression diagnostics, multicollinearity and model selection, autoregression, heteroscedasticity, regression models using categorical predictors, and logistic regression. All topics are illustrated on real data sets obtained from financial markets, market research studies, and other scientific inquiries.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 6018 Forecasting Time Series Data (3 Credits)
Typically offered occasionally
A model-based approach to forecasting time series data, with emphasis on model building, foundations, and applications. Students will use the methodology of the course to analyze data sets of their choice in two projects. Weekly homework assignments on data analysis and theory. Topics of the course include the following: Autocorrelation vs. trend; Mean Squared Error for measuring forecast performance; Conditional distribution of future given present and past; Mean reversion (stationarity) and differencing; ARIMA models, their properties, and the corresponding forecasts; Box-Jenkins approach to statistical modeling: estimation, identification, diagnostic checking; Model Selection using information criteria; Exponential Smoothing; Linear vs. Nonlinear models; Chaos; Best possible forecast vs. best linear forecast; ARCH/GARCH models for forecasting volatility; Fractional ARIMA and long-memory models; Seasonal ARIMA models; Unit root tests and cointegration.
Grading: Grad Stern Graded
Repeatable for additional credit: No

STAT-GB 6027 Mathematics of Investment (3 Credits)
Typically offered occasionally
Discusses the mathematical and technical aspects of investments. Topics include measurement of interest and discount rates, accumulated value and present value, annuities, sinking funds, amortization of debt, and determination of yield rates on securities. Applications include bond evaluation, mortgages, capital budgeting, and depreciation methods.
Grading: Grad Stern Graded
Repeatable for additional credit: No