BU.510 (QUANTITATIVE METHODS)

BU.510.601. Statistical Analysis. 2 Credits.
Students learn statistical techniques for further study in business, economics, and finance. The course covers sampling distributions, probability, confidence intervals, hypothesis testing, regression and correlation, basic modeling, analysis of variance, and chi-square testing. The course emphasizes statistics to solve management problems. Case studies, spreadsheets, and Excel Add-in Data Analysis ToolPak computer software are used.

BU.510.615. Python for Data Analysis. 2 Credits.
This is an introductory course in using Python for analytical purposes. Python (www.Python.org) is a general-purpose cross-platform programming language that has a strong presence in the diverse areas of analytics. This course will provide a pragmatic and hands-on introduction to the fundamental aspects of Python programming language with a focus on data exploration, analysis, and driving insights from data. Additionally, towards the end of the semester, students will be exposed to using Python for introductory optimization and machine learning. Class time will be used for short overview lectures followed by analysis of worked-out examples and in-class coding exercises. As the course progresses, students will learn to work with libraries such as statistics, random, numpy, scipy, pandas, matplotlib, seaborn, and plotly. By the end of this course, students should be able to start writing useful Python programs on their own or to understand and modify Python code written by others. Additionally, they should have a solid understanding of forecasting using time series.This course is an introductory Python course for students with a working statistical analysis knowledge. It does not assume any prior coding experience. If you have an extensive knowledge of Python, you might experience significant repetition.Starting the 3rd week, students will be exposed to basic time series analysis. Not only does time series analysis have a strong presence in all areas of business; it also provides a rich context for practicing Python's data handling capabilities (from applying a regression model for forecasting to data aggregation, dataset merging, slicing, and grouping). Time series analysis theory will be covered via a pre-recorded video; students are required to watch the videos prior to each class. The instructor will briefly review this theory at the beginning of each lecture; the majority of the lecture will be spent on learning and practicing Python's capabilities.

BU.510.650. Data Analytics. 2 Credits.
This course prepares students to gather, describe, and analyze data, using advanced statistical tools to support operations, risk management, and responses to disruptions. Analysis is done targeting economic and financial decisions in complex systems that involve multiple partners. Topics include probability, statistics, hypothesis testing, regression, clustering, decision trees, and forecasting.
Prerequisite(s): BU.510.601 OR BU.914.610 OR BU.920.621 OR PH.140.611 OR PH.140.621

BU.520.601. Business Analytics. 2 Credits.
Business analytics makes extensive use of data and modeling to drive decision making in organizations. To become a leader in a data driven world, it is therefore critical to acquire hands-on experience of both data-related (statistical) and modelling skills. This class focuses on the latter: it introduces students to analytical frameworks used for decision making to make sense of the data. The methodologies covered include Linear and Integer Linear Programming, Decision Analysis, Foundations of utility and risk, and Monte Carlo Simulation. For each topic/methodology students are first exposed to the basic mechanics of the framework, and then apply the methodology to several business problems using software.
Prerequisite(s): BU.510.601 OR BU.920.621 OR PH.140.611 OR PH.140.621

BU.520.620. Advanced Business Analytics. 2 Credits.
This course trains decision makers to function in the face of multi-dimensional uncertainty, through the development and use of optimization models. Mathematical abstractions are created which deal with issues including resource allocation, scheduling, pricing, and other responses to the realization of a variety of "known unknowns". Topics include linear programming, dynamic programming, multi-criteria optimization, and non-linear optimization.
Prerequisite(s): BU.520.601 OR BU.913.610 OR BU.920.711 OR BU.920.721

BU.520.650. Data Visualization. 2 Credits.
This project-based course prepares students to make informed decisions based on data using descriptive-analytical techniques. Students will view examples from real-world business cases in which data visualization helps the decision makers to visualize, discover, and decode the hidden information from within the data, and to exploit such information for making educated decisions. We will use R to import, clean, transform, analyze, visualize, and present data. It is assumed that students have basic knowledge of programming in R prior to taking this class. As the course progresses, students will learn to work with libraries such as readr, tidyr, ggplot2, leaflet, and shiny in R. During the eight weeks of the course, students will collaborate with each other in small teams to analyze real-world datasets as well as design, build, and deliver web applications containing interactive visualizations and dashboards. Topics include cognition and visual perception, design principles, fundamental charts, interactive visualizations, storytelling in dashboards, and maps and big data visualization.
Prerequisite(s): BU.510.650 OR BU.450.760 OR BU.330.780

BU.610.615. Simulation for Business Applications. 2 Credits.
This course provides a foundation for applying Simulation in managerial decision making in all areas of an organization. These decision areas could be in both predictive and prescriptive analytics area. Students learn to build quantitative models, in the presence/absence of reliable data, for quantifying and understanding impact of uncertain future on performance metrics under consideration. Simulation constructs probabilistic estimates of quantities of interest such as net present value of an investment, rate of a disease spread under a certain policy, or cost and time of a mega-project. This provides a very insightful information for decision makers to evaluate risks involved and make decisions accordingly. Results of Monte Carlo Simulation could be used for short-term and strategic planning of an organization. @Risk software package will be used for this part of the course. Additionally, in real world complex problems, where closed-form solutions, offered by classical mostly deterministic optimization methodologies, are not readily available/reachable, Simulation enables decision makers to see the distribution of all possible outcomes as a function of underlying uncertainties and using simulation-optimization methodology to make the best decision in the presence of uncertainty. Students will learn RiskOptimizer for this part of the course.
Prerequisite(s): BU.520.601 OR BU.232.620 OR BU.920.711 OR BU.920.721