Business Analytics (M.S.)

About The Program:

The M.S. in Business Analytics is designed to enable graduates to use data and models to recognize opportunities and improve organizational decision making. Data-driven decision making has been shown to have large positive effects on outcomes of interest to organizations of all types. This degree leverages the ever-increasing importance of data as a strategic asset to organizations, with students enhancing their analytic toolkit with a holistic view of how to improve decision making through analytics. The M.S. in Business Analytics is designed to allow students to acquire advanced skills and techniques that can be applied to discipline-specific and more general business problems. Graduates are prepared to meet the growing demand for talent in the areas of managing, analyzing, predicting, and discovering insights from the complex data available to modern corporations.

Career Options: Graduates are hired into various positions, such as:

- Big Data Analytics Specialist
- Data Analyst
- Data Scientist
- Management Analyst/Consultant
- Manager of Services or Manufacturing Operations
- Market Research Analyst
- Project Manager
- Research Analyst
- Supply Chain Manager

Prerequisites for Admission: Applicants are expected to have a strong quantitative background. Prior coursework in statistics is highly recommended.

Affiliation(s): Research is supported by Fox School of Business and Management's Center for Data Analytics, Center for Data Science, Center for Statistical Analysis, and numerous grants from government and industry.

Requirements of Programs:

- **Total Credit Hours**: 30
- **Culminating Events**:
  Capstone Course:
  All students in the Business Analytics M.S. program participate in a capstone experience that is designed to integrate "real world" problems into the curriculum. In general, a sponsoring corporation provides a problem and real data, and students divide into teams to work on the problem. At the end of the term, the top several groups as judged by professors present to the program's advisory board and other corporate judges.

Core Courses

MS Advanced Professional Development Strategies - Your academic education and your ongoing professional development will influence your career with unerring certainty. Because the personal stakes associated with managing one's career are high, the topics in this course involve more than "intellectual" comprehension. Accordingly, this course will focus on selected aspects of 1) career exploration; 2) the internship and job search and; 3) the "unwritten rules of engagement" in the professional work environment.

Quantitative Methods for Business – 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.

Visualization: The Art of Numbers and the Psychology of Persuasion – 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.

Statistical Learning and Data Mining – 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.

Experiments: Knowledge by Design – 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."

Decision Models: From Data to Decisions – 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.

Data: Care, Feeding, and Cleaning – 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.

Advanced Business Analytics– 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.

Electives

Select two from following:

Digital Business Strategy – Information Technology leadership is a critical function in organizations. This course teaches the skills of effective technology strategists. Students develop the business case for new technology initiatives, evaluate the success of existing initiatives and develop plans for technology-enabled organizational change. Through a series of case study analyses, students develop technological and organizational skills required of IT leaders.

Customer Data Analytics 1 (AND) – This course introduces students to methods for analyzing data residing in firms' customer databases. It will cover ways to profile customer segments based on their profitability to the firm, estimate individual customer's lifetime value, and demonstrate how this technique has been used in different organizations. The course will also review statistical concepts and introduce the software package SPSS, which is used to conduct a variety of marketing analyses using actual customer databases. Students will acquire skills to construct traditional RFM (recency/frequency/monetary) analyses to maximize response to marketing campaigns.

Customer Data Analytics 2 – Building on concepts learned during Customer Analytics 1, students will build more sophisticated models to predict customer response, such as predicting whether a customer will respond to a particular marketing offer (e.g. a direct mailing). Students will acquire skills to construct more advanced models (e.g., logit models, CHAID) to maximize response to marketing campaigns and to compare the effectiveness of alternative models. SPSS software will be utilized.

Market Research 1: Foundations of Marketing Research (AND) – This course presents a managerial perspective of marketing research. It focuses on developing skills for systematic problem analysis and to translate management problems into appropriate market research questions. The course also introduces and discusses primary and secondary sources of marketing research data (including the more recent advances in social media techniques), the questionnaire design, sampling schemes, and basic data analysis.

Market Research 2: Marketing Intelligence – Marketing Intelligence is an advanced level marketing course designed for users of market intelligence in consulting, marketing management, entrepreneurship, and finance to help you avoid drowning in data, become a more sophisticated user by assuming the role of research provider and by providing practice as evaluator of research, and improve your ability to use imperfect information to make decisions. This course is designed as a sequel to MKTG 5617 (Market Research 1: Foundations of Marketing Research). However, it can be taken independently. It will be necessary for students to read and understand the background material though. Students are expected to have a well-rounded background in marketing research including survey design, sampling and measurement tools.

Applied Statistics and Data Science – Intermediate level course that covers regression analysis, time series analysis, and forecasting. The course is application oriented and standard statistical packages such as MINITAB are introduced and extensively used.

Survey Techniques for Business Applications – Application oriented. A course dealing with statistical and nonstatistical aspects of organizing a sample survey. Included are discussions of objectives, measurement, sample selection, pilot testing, data collection, data editing, summarization and interpretation of results in addition to describing the various sampling schemes. Students may be required to plan and execute a survey.

Categorical Data Analysis – 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.

Advanced SAS Programming

Capstone Course

Business Analytics Capstone – The course is designed as the capstone experience for the MS in Business Analytics program and, as such, synthesizes all of the learning from previous coursework in this program. Student groups are paired with firms and work as consultants to provide data analytic solutions. This will allow students a first-hand perspective on decision making by management and understanding the organizational implications.

Courses:

Click HERE for more information on the courses below.

- Quantitative Methods for Business
- Introduction to Biostatistics
- Special Topics
- Independent Study
- Foundations for Data Analytics
- Visualization: The Art of Numbers and the Psychology of Persuasion
- Statistical Learning and Data Mining
- Experiments: Knowledge by Design
- Decision Models: From Data to Decisions
- Data: Care, Feeding, and Cleaning
- Advanced Business Analytics
- Business Analytics II
- Statistical Analysis for Management
- Quantitative Techniques for Management
- Probability and Statistics Theory I
- Probability and Statistics Theory II
- Statistical Methods I
- Statistical Methods II
- Probability and Large Sample Theory
- Stochastic Processes
- Statistical Methods III
- Sampling Theory
- Mathematics for Stat
- Univariate Time Series Analysis
- Linear Models I
- Design of Experiments I
- Applied Multivariate Analysis I
- Regression, Time Series, and Forecasting for Business Applications
- Survey Techniques for Business Applications
- Statistical Methods for Business Research I
- Statistical Methods for Business Research II
- Survival Analysis I
- Nonparametric Methods
- Categorical Data Analysis
- Clinical Trials
- Statistical Computing
- Advanced SAS Programming
- Time Series Analysis and Forecasting
- Advanced Statistical Inference I
- Linear Models II
- Design of Experiments II
- Multivariate Analysis II
- Survival Analysis II
- Statistical Genetics: An Advanced Graduate Course
- Seminar in New Topics in Statistics
- Directed Study in Statistics