MSBA Required Classes

1st semester: BZAN 530, 531, 533, 535,

2nd semester: BZAN 540, 542, 543, 544, 545, 548

3rd semester: BZAN 550

Course Number: BZAN 530
Course Name: Business Skills Development
Credit Hours: 1.5

Content: The Business Skills Development course is taught during the first session of the MSBA first-year core curriculum. This course augments other MSBA courses by providing all MSBA students with the opportunities to develop and grow technical and professional skills. While the course is divided into three key areas – communication, leadership, and career management, all work together to build contribution and leadership in the workplace.

The *Communication and Leadership* component of the class ensures that students develop and demonstrate graduate-level proficiency in written and oral communication skills and leadership skills. Effective communication skills are vital in every facet of business. The program fosters excellence in 1) interpersonal interaction, 2) personal presentation skills (including speaking and writing), 3) team leadership, group communication, and team process skills, and 4) organizational leadership and communication skills.

The *Career Management* component of the class provides students with the tools, resources and opportunities to assist in career progression and seeking internships and full-time employment. This component also ensures that the MSBA Program at Haslam is well represented by our students to our employers.

Number of Projects: Career: 5 projects; Communication: 3 projects
Number of Presentations: *See Communication projects*
Software and/or Programming Languages: n/a

Course Number: BZAN 531
Course Name: Decision Optimization
Credit Hours: 3

Content: This course provides an introduction to mathematical optimization. Students will learn the basic principles of linear, integer, and nonlinear programming, as well as several basic network flow models. Sensitivity analysis is presented from a graphical perspective. Students gain experience with numerous real world applications of optimization as well as Data Envelopment Analysis and Revenue Management. Students work in teams on two optimization

case projects and one custom project based on an anonymized real-world business problem. For each project, the teams present their recommendations in an oral presentation to a panel of faculty members and/or executives.

The course will equip students with the ability to:

- recognize a situation that would best be suited for solution using an optimization model,
- appropriately formulate the optimization model,
- understand the model solution and perform sensitivity analysis on model parameters;
- communicate recommendations and business insights to managers in the business world,
- form a basic framework of linear, integer, and nonlinear programming theory.

Number of Projects: 3

Number of Presentations: 3

Software and/or Programming Languages: Excel Solver, AMPL, Gurobi, CPLEX, R

Course Number: BZAN 533
Course Name: Quantitative Methods for Business Analytics
Credit Hours: 5

Content: This course introduces the fundamentals of probability and statistical inference as it is applied in business analytics. One key skill in the business analytics skills toolbox is statistical modeling, and an effective model hinges upon a deep understanding of probability distributions and how things processes vary. The course covers in both a qualitative and quantitative manner the most popular distributions used by practitioners. Inferences about the frequency of each value of the distribution or the average of the distribution will be discussed leading into the framework of hypothesis testing, estimation, and making confidence intervals for unknown parameters.

A second major component of this class involves learning the open-source software R for statistical programming. Proficiency in programmings opens the world of analytics beyond canned analyses, allowing you to conduct analyses where the only limit is your own innovation and creativity. Key concepts in control structures (loops, conditionals, function-development) are covered, especially how they relate to Monte Carlo simulation and ad-hoc testing.

Additional topics such as data structures, data manipulation (queries, joins), matrices (Markov Chains), and optimization (using calculus and maimum likelihood estimation) are covered. Several case studies which may include gauging customer similarity, estimating the lifetime value of a customer, studying churn rates, predicting consumer spending, and predicting the success or failure of a product launch are included as well.

Number of Projects: 2

Number of Presentations: 0

Software and/or Programming Languages: R, Tableau

Course Number: BZAN 535
Course Name: Statistical Methods for Business
Credit Hours: 3

Content: This course begins with learning to query relational databases using MySQL. This skill is reinforced throughout the semester as students query the dunnhumby Journey and Carbo tables to acquire the data to be analyzed for homework and projects. The second topic is data visualization. JMP's GraphBuilder and Tableau are introduced and each used to display graphical summaries of data. The subsequent statistical methods coverage is divided into four topics, depending on whether the response variable is numeric or categorical, and whether the explanatory variable is numeric or categorical:

- When the response and explanatory variables are numeric, the statistical methods involve scatterplots and regression.
- When the response is numeric and the explanatory variable is categorical, the statistical methods involve side-by-side box plots and ANOVA.
- When the response and explanatory variables are both categorical, the analysis is via contingency tables.
- When the response is categorical with two categories and the explanatory variable is numeric, the analysis is v loiagistic regression. Logistic regression is widely used in business application to estimate customer behaviors, such as purchases, churn, loan default, etc.

Number of Projects: 2

Number of Presentations: 1 or 2

Software and/or Programming Languages: JMP Pro, Tableau, MySQL

Course Number: BZAN 540
Course Name: Applied Regression Analysis for Business
Credit Hours: 3

Content and Outcomes: Regression methodology forms the core of modern applied statistics. This course will emphasize basic analysis skills that will be required of Business Analytics Professionals in almost any career path. Mathematical, methodological, and computational concepts learned in this course will be critical to lifelong learning in this area. Topics covered include: linear model formulation, inference, diagnostics and variable selection, logistic regression model formulation and inference, an introduction to generalized linear models, models for survival analysis, an introduction to design of experiments, and some topics on causal

inference from observational data. The R programming environment is utilized for computations, and the rmarkdown notebook for reports and presentations. After completing this course, you should be able to:

1. Understand which modeling methods are appropriate in various situations.
2. Understand strengths and limitations of different methods, as well as the overlap.
3. Fit models, examine assumptions, interpret and critique model results.
4. Examine fitted models and evaluate their predictive and explanatory power.
5. Use regression analysis and the R language to solve real problems in Business Analytics.
6. Discern context for proper causal inference, and be able to account for potential selection bias for causal inference.
7. Use R notebook to fit models and communicate results in a neat and convincing way.
8. Learn new methods and appreciate how statistical methods are used in other areas.

Number of Projects: 1

Number of Presentations: 1

Software and/or Programming Languages: R

Course Number: BZAN 542
Course Name: Data Mining Methods for Business Applications
Credit Hours: 3

Content: Each data mining project one will ever engage in involves six phases: business understanding, data understanding, data preparation, modeling, model evaluation, and model deployment. This course teaches students all the skills that are needed to successfully complete these phases. Students will work with technology (called 'R' and 'Python') that contains the latest algorithm developments. To be able to use R and Python students will learn how to program/code. Algorithms covered include: Naïve Bayes, Regularized Logistic, Neural Networks, K-Nearest Neighbors, Decision Trees, Support Vector Machines, Bagged Trees, Random Forest, Adaptive Boosting, Rotation Forest, Hoeffding Trees, K-means.

Students will learn

1. to program/code in R and Python,
2. to process and manipulate data,
3. to understand and apply high performance data mining and machine learning algorithms,
4. to tune and evaluate models,
5. how to collaborate on data mining problems.

Number of Projects: 0

Number of Presentations: 0

Software and/or Programming Languages: R and Python

Course Number: BZAN 543
Course Name: Enterprise Data Management for Business Analytics
Credit Hours: 1.5

Content: A majority of large enterprises use SAS software. This course focuses on software to manage and manipulate large data sets in preparation for analysis using the SAS data step, PROC SQL, and the SAS macro language. Brief attention will be given to other SQL tools.

Number of Projects: 0

Number of Presentations: 0

Software and/or Programming Languages: SAS

Course Number: BZAN 544
Course Name: Decision Support Systems for Business Analytics
Credit Hours: 1.5

Content: This course introduces Python programming language and Visual Basic for Applications for Excel. Students will learn the syntax of the programming languages, work with various modules, and build decision models with graphical user interfaces (GUIs).

Students will gain experience with using Python modules for

- reading and writing text files;
- reading and writing Excel files;
- analyzing data by applying statistical models;
- plotting the data and regression lines.

Visual Basic for Applications for Excel will be used to

- manipulate Excel objects;
- build graphical user interfaces for easy real-time user interaction and/or feedback.

Students will work in teams on a final group project to combine Python and VBA skills and connect the two to build a visualization of anonymized real-world business problem solution.

Number of Projects: 1

Number of Presentations: 0

Software and/or Programming Languages: Python, Visual Basic for Applications (Excel)

Course Number: BZAN 545
Course Name: Big Data Analytics
Credit Hours: 3

Content: The course introduces basic concepts and platforms in big data management and explores the use of these platforms to query and analyze very large data sets. We utilize high performance computing and Amazon Web Services platforms and explore data processing with Hadoop, Spark and Neo4j after getting basic introductions to Linux commands. We also review building and querying databases and data warehouses using MySQL. Projects have included text mining and analysis of movie databases using PySpark and Spark SQL.

Number of Projects: 1

Number of Presentations: 1

Software and/or Programming Languages: Linux, shell scripting, SQL DDL & DQL, Neo4j, Hadoop, Spark, Spark SQL. AWS and high performance computing platforms are also used.

Course Number: BZAN 548
Course Name: Time Series Forecasting
Credit Hours: 1.5

Content: Forecasting with Box-Jenkins Autoregressive Integrated Moving Average (ARIMA) models. The Box-Jenkins iterative model building approach. Topics include, ARIMA notation, stationary vs. non-stationary models, models with trends, seasonal Models, model selection, the principle of parsimony and interpretation of residuals. The practical implication of long-term term forecast error and cumulative forecast error in service and manufacturing processes. Introduction to ARIMA models for predicting supply chain performance. Building and customizing ARIMA models in spreadsheets.

Number of Projects: One

Number of Presentations: One

Software and/or Programming Languages: Excel

(RE) Prerequisite(s): 535.

Course Number: BZAN 550
Course Name: Business Analytics Experience.
Credit Hours: 3

Content: Application of the principles of analytics through a team-based, experiential project. Students work on a real-world business problem through the stages of problem identification, data acquisition and preparation, analysis, determination of recommendations,

and presentation of findings. This is the capstone course for the Masters in Business Analytics, taken in the fall semester of the second year. Students work in teams with a client in industry or government. Each team has a faculty coach. Throughout the semester, students work with skills coaches in the areas of teamwork, leadership and communication.

Number of Projects: One

Number of Presentations: Weekly presentations.

Software and/or Programming Languages: Varies among projects.

MSBA Electives: BZAN 505, 520, 546, 552, 553, 554, 555, 556, 557; STAT 567, 578

Course Number: BZAN 505
Course Name: Operations Management
Credit Hours: 1.5

Elective

Content: This course provides an introduction to concepts and techniques relating to operations management. Students are exposed to the principles of lean production, Theory of Constraints (TOC), and product flow through case studies and experiential simulations such as the Beer Game. Students also learn how to analyze and improve product flow through the organization and across the supply chain using quantitative techniques relating to factory physics. Students work in teams on two real-world, case-based projects. The teams present their project findings and recommendations in a written report tailored to a managerial audience.

The course will equip students with the ability to:

- develop a basic understanding of the operations function and how it relates to the other functions of the organization and the organizational strategy
- develop a basic understanding of lean and the Toyota Production System and how these approaches can be leveraged for process improvement in services and manufacturing
- quantify how uncertainty in demand and capacity affects operational performance and product flow

Number of Projects: 2

Number of Presentations: 0

Software and/or Programming Languages: Excel

Course Number: BZAN 520
Course Name: Operations/Lean Supply Chain Management
Credit Hours: 3

Elective

Content: This course develops systems thinking and its application to help build and manage the lean supply chain. The course will provide students with the skill set required to analyze complex problems in business and to develop simple, practical solutions to these problems. The course is structured around the Theory of Constraints, a body of knowledge that emphasizes big-picture or systems thinking.

Upon completing this module, the student will have a clear idea on the strategies and processes that should be in place for an organization in the supply chain to execute superbly and deliver customer value. The concepts presented in this course are reinforced through a number of hands-on and computer-based simulations.

Recommended Background: First-year MBA-level course in Operations Management

Number of Projects/Homework Assignments: 3

Software and/or Programming Languages: None

Course Number: BZAN 546
Course Name: Simulation Modeling
Credit Hours: 1.5

Elective

Content: This course provides an introduction to computer simulation for business decision making. Students learn modeling techniques, and tools from the areas of Monte-Carlo and discrete-event simulation, including random number generators, distribution fitting, input and output analysis. Students are exposed to real-world applications of simulation in areas such as process modeling and analysis, capacity management, supply chain management, and health care operations. In addition to 3 case-based homework assignments, students work in teams on one real-world simulation project, usually sponsored by a local company. The teams present their project recommendations in an oral presentation to a panel of faculty members and company representatives.

The course will equip students with the ability to:

- develop a basic understanding of Monte-Carlo and discrete-event simulation concepts, rooted in probability and statistical theory
- recognize situations that are best suited for simulation modeling

- build appropriate simulation models using GUI-driven, discrete-event simulation software
- understand the model solution and perform sensitivity analysis on model parameters
- communicate recommendations and business insights to managers in the business world

Number of Projects: 1

Number of Presentations: 1

Software and/or Programming Languages: ExtendSim, Excel, R

Course Number: BZAN 552
Course Name: Multivariate and Data Mining Techniques
Credit Hours: 3

Elective

Content: This course covers exploratory data analysis and data cleaning, dimension reduction techniques, clustering, outlier detection, association analysis, and select advanced methods. We emphasize hands-on experience with real-world data challenges (e.g., data quality, complexity, and low signal-noise ratios), encourage creative thinking in making use of available data, and practice scripting language programming (R and/or Python) to analyze multivariate data.

Upon completion of this course, students are expected to be able to:

1. Understand multivariate and data mining techniques and apply them appropriately to real-world problems;

2. Choose from alternative methods by comparing the pros and cons, and evaluating the choice of methods for a given task;

3. Program proficiently in R or Python for processing and analyzing larger datasets; and

4. Document data analysis using R markdown or Python notebook.

Number of Projects: 3

Number of Presentations: 3

Software and/or Programming Languages: R, Python

Course Number: BZAN 553
Course Name: Design of Experiments
Credit Hours: 3

Elective

Content: This course provides an introduction to design and analysis of experiments. Students will understand the basic principles of design of experiment, that is randomization, replication and blocking. It will cover topics such as factorial and fractional factorial designs, designs for conjoint analysis, optimal designs, split unit designs, orthogonal arrays. Students will learn these concepts through real examples, with particular emphasis in business applications. Students will work in teams to carry out a real experiment and present their results based on the data collected from the experiment.

Number of Projects: 1

Number of Presentations: 1

Software and/or Programming Languages: JMP, R

Course Number: BZAN 554
Course Name: Customer Analytics
Credit Hours: 3

Elective

Content: The primary objective of this course is to provide students a high- uncertainty, low-structure, learning environment that mimics how customer analytics projects typically unfold in real-life. To facilitate learning, class sessions will be used to consult with the instructor on problems and questions that will arise during the projects. Students will complete five coding projects in groups of three to four students: acquisition modeling, up-sell modeling, cross-sell modeling, churn modeling, customer lifetime modeling.

At the end of this course, students will

1. be able to analyze and process individual- level customer data bases containing multiple data tables
2. have gained proficiency in programming in R, Python, SQL, and Git(Hub)
3. be able to apply high performance data mining and machine learning techniques
4. be able to devise high performance CRM solutions for companies
5. be proficient in predictive analytics
6. be able to operate in high-uncertainty, low-structure environments
7. have gained experience in project presentations

The goal of this course is to provide a holistic and realistic, end-to-end learning experience applying all the concepts and skills learned in BZAN 542.

Number of Projects: 5

Number of Presentations: 5

Software and/or Programming Languages: R, Python, Git(Hub)

Course Number: BZAN 555
Course Name: Supply Chain Analytics
Credit Hours: 3

Elective

Content: Supply Chain Analytics is concerned with understanding, developing, and interpreting the models that underlie operations management problems. This course covers the major methodological areas you encounter in operations; we will study capacity planning, demand planning, forecasting, inventory planning, and scheduling.

The course will develop quantitative reasoning skills including the ability to critically assess material, summarize the problem, and propose solutions. The course will also develop qualitative reasoning skills including the ability to determine the criteria to gauge success and determining what data is important to include and what can be safely excluded.

Number of Projects: 3

Number of Presentations: 3

Software and/or Programming Languages: Excel, OpenSolver, Tableau, custom-developed Theory of Constraints software, custom-developed inventory optimization software

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Course Number: BZAN 556
Course Name: Systems Optimization

Credit Hours: 3

Elective

Content: This class is an applications-oriented course covering the modeling of systems in several decision-making domains and the optimization of such systems using state-of-the-art optimization tools. Application domains include: transportation and logistics planning, pattern classification, design of structures, facility location, scheduling in large systems, supply-chain management, marketing and financial engineering. Modeling tools and techniques include linear, network, discrete and nonlinear optimization, heuristic methods, sensitivity and post-optimality

analysis, decomposition methods for large-scale systems, and an introduction to dynamic and stochastic optimization.

Each class will start with an in-depth description of the theoretical foundations. Once these foundations are acquired, our focus will be on applying them to a series of real business cases. Emphasis will be put on the model design, the use of recent commercial solvers, and the analysis of solutions. The course has the objective to strengthen and deepen the ability of students to prescribe optimal decisions in different areas of business.

Number of Projects: 5

Number of Presentations: 2

Software and/or Programming Languages: Excel Solver, AMPL, Python, Gurobi, CPLEX, GLPK

Course Number: BZAN 557
Course Name: Text Mining
Credit Hours: 3

Elective

Content: This course will introduce computational methods, rooted from machine learning, natural language processing, and statistics, to find patterns in large text corpora, unlocking the power of large amounts of textual data.

This course is designed to be a general introductory level course for all graduate students who are interested in text mining.

Upon completion of this course, students are expected to be able to:

1. Conceptually understand the mechanism of advanced text mining algorithms for information extraction, text classification and clustering, sentiment analysis and opinion mining, and topic modeling;

2. Formulate text mining problems in real applications, choose appropriate technologies for specific text analysis tasks, and evaluate the benefits and challenges of the chosen technical solution; and

3. Use benchmark corpora or textual data extracted from a particular domain of interest and use open-source text analysis tools (e.g., R and/or Python) to clean textual data, explore interesting patterns, and create useful applications.

Number of Projects: 1

Number of Presentations: 2

Software and/or Programming Languages: R, Python

Course Number: STAT 567
Course Name: Survival Analysis
Credit Hours: 3

Elective

Content: Statistical analysis of time-to-event data with censored observations. Nonparametric methods as well as parametric regression models and the Cox proportional hazards model are explored. Case studies from both engineering and business analytics are used.

Number of Projects: 1 course project

Number of Presentations: 0

Software and/or Programming Languages: JMP and/or SAS

Course Number: STAT 578
Course Name: Categorical Data Analysis
Credit Hours: 3

Elective

Content: The course includes analysis of associations in categorical data through chi-square and Cochran-Mantel-Haenzel tests, goodness of fit, deviance, and exact testing, count data regression using generalized linear models and negative binomial distributions, analysis of binary response data using logistic regression, multinomial and ordinal logistic regression. Models for clustered and panel data include conditional logistic regression, generalized estimating equations, and generalized linear mixed models. Analysis is computed using both R and SAS programming languages. Data sources are pulled from a wide variety of disciplines including business, social science, and medicine.

Learning Outcomes:

1. Understand traditional analysis of tables using chi-square testing and CMH tests using SAS PROC FREQ.
2. Understanding Poisson regression, negative binomial, and zero inflated Poisson models for count data using PROC GENMOD, PROC COUNTREG.
3. Understanding and being comfortable building models using logistic, multinomial logistic, and ordinal regression. PROC GENMOD, PROC LOGISTIC

4. Understanding the use of marginal and conditional models for clustered, longitudinal or panel data. PROC GENMOD, PROC GLIMMIX
5. Knowledge of generalized linear mixed models. PROC GLIMMIX
6. Master SAS and R capabilities to analyze categorical data.

Number of Projects: 1 course project

Number of Presentations: 0

Software and/or Programming Languages: Multiple packages in R. SAS GENMOD, LOGISTIC, FREQ, and GLIMMIX procedures.