



Sophia Learning

BUSI2090: Business Data Analytics (ACE recommends 3 credits)

COURSE DESCRIPTION

Sophia Learning's Business Data Analytics course equips students with essential business data analytics skills, from foundational concepts to advanced statistical and machine learning techniques. It covers data types, collection methods, and ethical considerations, along with data cleaning, summarization, and visualization using Excel and Python. Students will apply descriptive statistics, probability, and hypothesis testing to extract insights and use regression analysis to assess variable relationships. They will also learn forecasting methods, such as moving averages and exponential smoothing, to predict business trends.

Advanced topics include machine learning models and Monte Carlo simulations for evaluating risk and uncertainty. The course concludes with optimization models and prescriptive analytics, teaching students to develop linear, integer, and nonlinear optimization solutions for business challenges. By the end, students will have the analytical mindset and practical experience to leverage data for strategic decision-making.

COURSE EFFECTIVE DATES: May 2025 - Present

PREREQUISITES: No prerequisites; prior completion of Introduction to Statistics and Introduction to Business are recommended.

LENGTH OF COURSE: This is a self-paced course. Students may use as much or as little time as needed to complete the course.

ACE LEARNING EVALUATIONS RECOMMENDATION: In the Upper-Division Baccalaureate category, 3 semester hours in Business Analytics (ACE ID: SOPH-0091).

GRADING: This is a pass/fail course. Students must complete 15 Challenges (formative assessments), 6 Milestones (summative assessments), and 2 Touchstones (project-based or written assessments) with an overall score of 70% or better.

Challenges	Points Possible
Challenge 1.1: Business Data Analytics Defined	5
Challenge 1.2: Types of Data	7
Challenge 1.3: Cleaning Data	7
Challenge 2.1: Descriptive Measures	5
Challenge 2.2: Data Visualization	7
Challenge 3.1: Concepts of Probability	6
Challenge 3.2: Probability Distributions	7
Challenge 4.1: Foundations of Hypothesis Testing	6
Challenge 4.2: Hypothesis Testing	7
Challenge 5.1: Linear Regression	6
Challenge 5.2: Forecasting	4
Challenge 5.3: Machine Learning	3
Challenge 5.4: Monte Carlo Simulation	3
Challenge 6.1: Linear Programming	3
Challenge 6.2: Integer Linear Programming and Nonlinear Models	3
Total	79

Milestones	Points Possible
Milestone 1	57
Milestone 2	33
Milestone 3	39
Milestone 4	27
Milestone 5	30
Milestone 6	15
Total	201

Touchstones	Points Possible
Touchstone 2: Carl's Cookies	100
Touchstone 6: TechGear Inc. Analysis	100
Total	200

Touchstones are projects that illustrate comprehension of the course material, help refine skills, and demonstrate application of knowledge. Read further for information on the touchstones in this course:

- **Touchstone 2: Carl's Cookies (100 points):** Students will analyze sales, marketing, financial trends, customer behavior, and inventory management for a boutique bakery. Using Excel-based analysis and visualizations, students will assess product performance, evaluate marketing effectiveness, forecast financial trends, examine customer spending habits, and determine the impact of discounts on satisfaction. The final deliverable is a PowerPoint presentation with speaker notes, providing actionable insights and strategic recommendations to help Carl optimize operations, increase profitability, and improve decision-making.
- **Touchstone 6: TechGear Inc. (100 points):** Students will analyze historical sales data for TechGear Inc. using various analytical techniques. Using Python, students will apply linear regression, forecasting, machine learning, Monte Carlo simulations, and linear programming to derive actionable insights that can help optimize marketing strategies and production planning. The final deliverable is a PowerPoint presentation with Python code snippets, visualizations, and speaker notes explaining the findings, enabling TechGear Inc. to make data-driven decisions for improving sales and profitability.

For more general information on assessments, please visit the Student Guide located on your course dashboard.

LEARNING OUTCOMES

Upon completion of the course, the student will be able to:

1. Apply the data analytics lifecycle to collect, prepare, analyze, and interpret business data using Excel and advanced methods.
2. Use descriptive statistics and visualizations to analyze business data, identify patterns, and support decision-making utilizing Excel.
3. Apply probability models to assess uncertainty, quantify risk, and inform business strategy in Excel.
4. Perform statistical inference using confidence intervals, hypothesis testing, and ANOVA to derive insights in Excel.
5. Build predictive models in Python for forecasting, trend analysis, and risk assessment using regression and simulations.
6. Develop optimization models using linear, integer, and nonlinear programming to solve business problems in Python.

COURSE TOOLS

This course utilizes three essential tools for business data analytics:

- **Excel with XL Data Miner Toolpak** – A powerful spreadsheet application enhanced with the XL Data Miner Toolpak for advanced data analysis, including regression, forecasting, and machine learning techniques. Students will use Excel for data cleaning, visualization, and statistical modeling.
- **Jupyter Labs** – An interactive computing environment that allows students to write and execute Python code for data analysis. Jupyter Labs supports dynamic visualization, statistical computing, and machine learning, making it an essential tool for hands-on analytics.
- **GitHub** – While GitHub is not required, students will have access to shared links for Excel sheets that can be used seamlessly in both Python and Excel. This setup ensures flexibility in working with data while maintaining accessibility across different tools.

COURSE COMPETENCIES AND TOPICS

Unit	Competencies	Major Topics
1. Data in Business	• Explain the fundamental principles and processes of data analytics in a business context by describing the data lifecycle, differentiating between analytical types, addressing ethical considerations, and identifying key skills necessary for effective data analysis. • Classify and summarize data by distinguishing types, sources, and structures while organizing and analyzing distributions. • Apply data preparation and cleaning techniques in Excel by formatting, sorting, filtering, and merging datasets while identifying and resolving missing or inconsistent data to ensure accuracy and usability.	• Business Data Analytics Defined • Why Businesses Analyze Data • The Data Lifecycle • Types of Data (Quantitative vs. Categorical) • Populations and Samples • Primary vs. Secondary Data • Cross-sectional vs. Time Series Data • Frequency and Relative Frequency Tables for Categorical Data • Constructing and Interpreting Frequency Distributions for Quantitative Data • Identifying and Evaluating Outliers • Why Data Needs to be Cleaned

		• Steps for Cleaning Data • Formatting Data in Excel • Sorting and Filtering Data • Splitting and Combining Data • Identifying and Handling Missing Data • Supplementing and Enriching Data
2. Descriptive Statistics	• Analyze data distributions and relationships by calculating and interpreting measures of location, measures of variability, correlation, covariance, and regression equations to assess significance and trends in business data. • Analyze business data for decision-making by employing sound design principles in constructing data visualizations.	• Using Measures of Center • Calculating Measures of Spread • Correlation and Covariance • Regression Analysis • Applying Descriptive Statistics to a Real-World Business Problem • Telling Your Data Story • Table Design Principles • Crosstabulation • PivotTables • Best Practices for Choosing the Right Chart Type • Histograms and Visualizing Distributions of Data • Effective Data Dashboards
3. Probability and Statistical Distributions	• Apply probability concepts to business data analytics by classifying events, using probability rules, and evaluating conditional probabilities to support data-driven decision making. • Apply probability distributions and statistical models to analyze and interpret business data.	• Events and Probabilities • Independent and Disjoint Events • Probability Rules • Conditional Probabilities

		• General Multiplication Rule • Bayes' Theorem • Discrete and Continuous Random Variables • Expected Value and Variance • Discrete and Continuous Uniform Probability Distribution • Binomial Distribution • Poisson Probability Distribution • The Normal Distribution Model • Standardizing: Z-Scores
4. Statistical Inference	• Apply various sampling techniques, evaluate point estimations and confidence intervals, differentiate appropriate sampling distributions, and analyze sampling errors to enhance the accuracy and reliability of statistical analyses. • Apply statistical methods to analyze numeric and categorical data by performing and interpreting hypothesis tests and calculating and evaluating analyses of variances (ANOVA) to make informed, data-driven decisions.	• Sample Selection • Point Estimation • Sampling Distributions • Sampling Error • Confidence Intervals – Means • Confidence Intervals – Proportions • Hypothesis Testing Basics • One-Sample Hypothesis Testing – Means • One-Sample Hypothesis Testing – Proportions • Two-Sample Hypothesis Testing for Means: Two-Tailed Test • Two-Sample Hypothesis Testing for Means: Right-Tailed Test • Two-Sample Hypothesis Testing for Means: Left-

		Tailed Test ANOVA (Analysis of Variance)
5. Forecasting and Predictive Modeling	- Utilize Python to construct, interpret, and evaluate simple and multiple linear regression models, analyze their results, and diagnose multicollinearity using scatter plots and the Variance Inflation Factor (VIF) for business data analytics. - Analyze time series data to identify trends, interpret the impact of errors on forecasting accuracy, and apply and evaluate moving average and exponential smoothing forecasting techniques using Python, to determine the most effective method of prediction. - Apply fundamental concepts of data mining to construct multiple linear regression models and produce decision trees using Python. - Apply the techniques of Monte Carlo simulations to construct and evaluate Monte Carlo models using Python.	- Python Basics for Business Data Analytics - Simple Linear Regression Model in Python - Assessing the Fit of the Sample Linear Regression Model using Python - Multiple Linear Regression Model in Python - Inference and Linear Regression - Multicollinearity - Introduction to Time Series Analysis in Python - Forecasting Accuracy - Moving Averages - Exponential Smoothing - Introduction to Machine Learning - Multiple Linear Regression as a Machine Learning Model - Classification and Regression Trees (CART)
6. Prescriptive Analytics	- Apply linear optimization models to analyze business problems and generate data-driven solutions for decision making. - Apply the tenets of integer linear optimization models, determine logical constraints, and utilize nonlinear and non-smooth optimization models to analyze complex business challenges.	- Optimization Models - Applications of Linear Optimization - Developing Linear Optimization Models - Integer Linear Optimization Models

- | | | |
|--|--|---|
| | | <ul style="list-style-type: none">• Models with Binary Variables• Nonlinear and Non-Smooth Optimization Models |
|--|--|---|