USCMarshall

BUAD 425 – Data Analysis for Decision Making
Syllabus: Spring 2021

Instructor: Bradley Rava
Office Hours: Tuesday 1-2pm PST, Thursday 3-4pm PST or by appointment *(https://calendly.com/brava-usc)*.
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Course Description

Over the last two decades, we have witnessed an explosion in the availability of data. Firms routinely collect point of sales transactions, monitor operations throughout their supply-chain, mine website traffic, and track customer engagement. Business analytics and data are transforming modern firms, and, in some cases, disrupting entire industries. Importantly, these changes are not limited to the "back-office" or operations; every aspect of the firm -- organizational structure, marketing, product design, and strategic planning – is shifting towards data-driven decision making. With this shift comes an increased need for "data-savvy" managers; managers who are not necessarily data-science experts, but understand what analytics can and cannot do, how to ask the right questions, and, most importantly, how to interpret data to make better decisions.

The goal of this course is to help you develop your skills as a data-savvy manager. To that end, we will study several basic analytics techniques, focusing on how you, yourself, can apply them in practice, interpret their output, build intuition, and leverage them in decision making. Specifically, we will focus on:

- **AB Testing**: How can we combine data and experimentation to incrementally improve our business model?
- **KPIs** and **Dashboarding**: How do we convert the ocean of raw data into a manageable insights for decision making? What are the right data to measure and track? How can we communicate that data most effectively to stakeholders?
- **Classification**: Can we utilize historical data to make useful predictions?
- **Clustering**: What hidden structure is in our data? What sorts of insights does that structure give us about our business?

BUAD 425 is an integrative capstone course that draws on your <u>entire</u> Marshall education: statistics, finance, marketing, operations, communications, economics and accounting. Our goal is to stress not only that data-driven decision making can be useful in all of these disciplines, but to help you think laterallly across these disciplines to solve problems.

Learning Objectives

At the end of this course, you will be able to:

I. **Explain** in your own words the key ideas behind fundamental techniques in data analytics, including dashboarding, classification, clustering and AB-testing;
II. **Identify** new opportunities to use these techniques across business domains to guide decision making;
III. Confidently **apply** these techniques to novel problems using a combination of Excel and JMP;
IV. **Formulate** and **communicate** actionable business recommendations based upon your analysis, including its limitations;
V. Critically **assess** the validity of analytics-based recommendations in the context of specific business decisions.

Please see the **Appendix I** for alignment of these goals with the **Marshall Learning Objectives**.

Required Materials

- This class will heavily leverage both Microsoft **Excel** and another analytic software (TBD).
- Other readings, lecture notes and videos will be distributed throughout the course via BlackBoard.
- **Important:** If you are on campus and would like to access the computer lab, you must have a MyMarshall account, which is provided free of charge to all Marshall students. If you do not have a MyMarshall account or forget your username/password, you can call Help Desk at (213)740-3000. Notice, your MyMarshall account is DISTINCT from your USC ID.

Prerequisites

- BUAD 281 (or 305), BUAD 302, BUAD 304, BUAD 306, BUAD 307, BUAD 310 and BUAD 311
- BUAD 497 is co-requisite

Course Notes

We use Blackboard for all assignments, course materials, and announcements. Please check Blackboard and your email daily. If you would like hard copies of any course materials, it will be your responsibility to print them out prior to class.

Working with software is an integral part of this course. Your quizzes and assignments (see below) require using this software. Thus, it is very important that you attend and actively participate in software exercises during class sessions.

Discussing assignments with a partner or study-group is permitted and highly encouraged. Your peers are now and will always be your best resource to learn. **However, each student is required to prepare, write-up, and submit his or her own solutions independently, including computer work.** Collaboration of any sort on quizzes and exams is prohibited **and will result in a zero on that quiz/exam and the appropriate University-level authorities to be notified**. See also the Marshall Guidelines on Academic Integrity below.

Grading Policies

Grading policies and practices for the University are described below.
https://arr.usc.edu/services/grades/gradinghandbook/gradingpolicies.html#Definitions%20of%20Grades%20and%20Marks

Letter Grade	Definition of Grades
A	Work of **excellent** quality; represents **Exceptional** work; a grade of "**A**" will be assigned for outstanding work only.
B	Work of **good** quality.
C	Work of **fair** quality for **undergraduate credit.**
D	Work of **minimum passing** quality for **undergraduate credit**.

F	**F = Failure** This grade is awarded to any undergraduate student failing to meet the minimum standards for passing the course. The grade of F indicates that the student failed at the end of the semester or was doing failing work and stopped attending the course after the twelfth week of the semester.

Your course grade is calculated using the following weight scheme:

Assignment	Weight
Participation 8 Pre-Class assignments (Best 7 out of 8) In-class participation	18%
3 Practice quizzes (All 3 count)	6%
3 Quizzes (All 3 count)	36%
Final Exam	40%
Total	**100%**

Grades for the class are expected to average around 3.3 (B+). Letter grades will not be given for individual assignments and exam.

Assignments

Preparation for Class: Pre-Class assignments

Preparation for lectures is an extremely important part of the learning experience in this course as the richness of the learning experience will be largely dependent upon the degree of preparation by all students prior to class sessions. Throughout the semester there will be short pre-class assignments based on readings and videos. These assignments are very easy provided you have done the reading or watched the video.

Disclaimer: This is not a course in how to use Excel. It is expected that all students have a foundational knowledge and skills in Excel developed in previous Marshall classes (BUAD 310, BUAD 311, etc.). Accordingly, there will be an Excel pre-class assignment that you **must** complete (see Tentative Course Plan below on page 7). There are some reference materials for you to "brush-up" on your Excel skills on blackboard. If you have a lot of difficulty with the Excel pre-class assignment, you may consider dropping BUAD 425 and taking DSO 401 to develop your Excel skills first.

Your class preparation is assessed mainly on the completion and quality of the answers to pre-class assignments questions.

Class Participation

In-class participation is also a critical part of this course's learning experience. A key learning outcome for this course is developing the ability to effectively explain data analysis and communicate recommendations based on this analysis. Students will offer their opinions in group settings many times in their careers; thus, class participation serves to prepare students for this business experience. Consequently, class participation is essential.

Cold calling will take place to encourage active participation and to gain multiple perspectives and points of view, thus lending itself to the richness of the learning experience. While some students are far more comfortable than others with class participation, all students should make an effort to contribute meaningfully in every class. Throughout the semester there will be assignments on which we will work together in class.

Your participation is assessed mainly on the completion and quality of your class work, contribution and insights.

Practice Quizzes: 3 Practice Quizzes

Practices quizzes will help you prepare for in-class quizzes. Practice quizzes will be graded and administered on blackboard. You will have unlimited attempts on the practice quizzes.

Quizzes: 3 Quizzes

There will be three 40 min non-cumulative quizzes, administered using the Proctorio software (additional instructions on Proctorio will be provided):

- Quiz #1: 6 PM (PST time zone), Friday, February 19th
- Quiz #2: 6 PM (PST time zone), Friday, March 19th
- Quiz #3: 6 PM (PST time zone), Friday, April 16th

The quizzes will be closed book and without Internet access, but they WILL require the use of analytical software and blackboard. You are allowed to use one double-sided crib sheets (8.5 x 11) during each quiz. Crib sheets cannot be shared during the quiz. No make-up quizzes are offered.

Final Exam

Time and Date: 5:00 PM – 7:00 PM (PST time zone), Wednesday, May 5th
Format: online using Proctorio

Final exam will be cumulative. BUAD425 is a common course. All sections will have final exam at the same time. Collaboration of any sort on exams is strictly prohibited. Any suspicion of cheating will be reported and investigated by USC. Please see the "Academic Integrity and Conduct" section below for further details.

Students must attend all quizzes and exams at the indicated times and dates above. If you foresee a conflict, you must contact the instructor within the first three weeks of the semester to explore alternative options, to be determined by the BUAD 425 faculty committee. No rescheduling of exams will be allowed after the first three weeks of class. The only exception is a "documented medical emergency," for which the student must provide all of the following documentation by the time of the exam: (1) A signed doctor's note, with the name and phone number of the medical professional verifying the medical emergency; (2) An email from the student's Marshall advisor; (3) An email from a USC Support and Advocacy advisor (see "Support Systems" below). For all other reasons of missing a quiz or an exam, including travels for non-emergencies, interviews, adverse traffic conditions, or forgetfulness about exam time, the student will not be allowed to reschedule, and missing a quiz or an exam will result in a zero for the quiz or the exam.

Assignment Submission Policy

All assignments must be turned in via Blackboard prior to the due date listed in this syllabus. For pre-class assignments, this is typically before the start of class. Specifically,

- Please plan ahead as the internet might break down unexpectedly if you wait until the last minute.
- Assignments are accepted through **BB ONLY**. Please **DO NOT** email me your assignments.
- **Any assignment turned in late for any reasons except medical emergency, even if by only a few minutes, will NOT be accepted.**

Late additions to the class should meet with their instructor within TWO weeks of adding the class to make arrangements for completing missed previous work.

MARSHALL GUIDELINES AND USC POLICIES

Add/Drop Process

BUAD 425 will remain in open enrollment (R-clearance) for the first three weeks of the term. If there is an open seat, students will be freely able to add a class using Web Registration throughout the first three weeks of the term. If the class is full, students will need to continue checking Web Registration to see if a seat becomes available. There are no wait lists for these courses, and professors cannot add students. An instructor may drop any student who, without prior consent, does not attend the first two sessions; the instructor is not required to notify the student that s/he is being dropped. If you are absent three or more times prior to the end of week 3, your instructor may ask you to withdraw from the class by that date. These policies maintain professionalism and ensure a system that is fair to all students.

Students with Disabilities

USC is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. If you have a disability which may impact your performance, attendance, or grades in this course and require accommodations, you must first register with the Office of Disability Services and Programs (www.usc.edu/disability). DSP provides certification for students with disabilities and helps arrange the relevant accommodations. Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. **Students must notify the instructor of their intention to use their accommodation at least 2 weeks in advance of each quiz/exam date.**

DSP is located in GFS (Grace Ford Salvatori Hall) 120 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776. Email: ability@usc.edu.

Technical Support

The Help Desk is available to provide assistance 24 hours a day, every day. This assistance is restricted primarily to problems with the course delivery platform. Contact the Help Desk to resolve problems that you believe are not associated with the hardware and software you have purchased from a vendor. Examples include being unable to view multimedia files or view responses to comments you have posted in the discussion area. If you are not sure whether the problem is due to your computer system, contact the Help Desk for guidance; otherwise, contact the vendor. To talk to a live technical support agent, please call: **877-807-8557** or visit our Support Website http://usc.echelp.org/.

USC Statement on Academic Conduct and Support Systems

Academic Conduct

Students are expected to make themselves aware of and abide by the University community's standards of behavior as articulated in the Student Conduct Code. Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" https://policy.usc.edu/scampus-part-b/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention and Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Campus Support & Intervention (CSI) - (213) 740-0411
https://campussupport.usc.edu/
A team of professionals here to assist students, faculty, and staff in navigating complex issues. Whether you are here seeking support for yourself or someone else, we are available to help you problem solve, understand options, and connect with resources. Please note that we are not an emergency resource and are not available 24/7.

Office of Equity and Diversity (OED)- (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
uscsa.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Emergency Preparedness/Course Continuity

In case of a declared emergency if travel to campus is not feasible, the *USC Emergency Information* web site (http://emergency.usc.edu/) will provide safety and other information, including electronic means by which instructors will conduct class using a combination of USC's Blackboard learning management system (blackboard.usc.edu), teleconferencing, and other technologies.

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TENTATIVE COURSE PLAN[1]

See Excel file

Course Outline

Please check Blackboard for class preparation for each session.

Session 1: Excel bootcamp 1

Session 2: Why study analytics?
We introduce the structure of the class and define business analytics. At the end of this class you will be able to

- Recognize opportunity to apply data analytics in real-world situations
- Describe how this course connects to your previous courses at Marshall
- Explain the value of analytics and your skills to a potential employer

Module I: A/B Testing

Session 3: Intro to AB testing.
We introduce AB testing and experimentation as a means to incrementally improve a business model. At the end of this session you will be able to

- Define AB testing and confounding variables in your own words
- Recognize business opportunities to leverage AB testing
- Use Excel to perform AB tests, and assess for confounding variables
- Critique test design and analyses

Session 4: LAB1: Winning an Election Case
We use ideas from AB-testing to design and interpret an experiment around creating the most persuasive email campaign to persuade voters to support a particular political candidate. At the end of this session you will be able to:

- Design a simple AB test to assess the effectiveness of an intervention, complete with sample size calculations
- Analyze the results of an AB test in excel and formulate appropriate business recommendations

Readings/Preparation for class

- Video: Pivot Tables Exercise (on BB)
- Winning an Election

Module II: KPIs, Metrics and Dashboards

[1] See "Course Outline" below for readings, videos and podcasts for each session. Additional short readings/videos may be assigned via BB throughout the semester.

Session 5: KPIs, Metrics and Dashboards
How do we translate raw data into actionable insights? At the end of this session, you will be able to:

- Define a KPI in your own words
- Evaluate the data-requirements of a KPI
- Assess the appropriateness of a KPI for a particular business task
- Construct your own KPIs
- Describe how dashboards are used in management
- Evaluate the quality of a dashboard for a particular business task

Readings/Preparation for class

- Measuring What Matters: How to Pick a Good Metric
  - First 2 pages up to "Qualitative versus Quantitative Metrics"
- What is a Good Performance Metric?
- "Know the difference between your data and your metrics"

Session 6: LAB2 _ Part (1): Dashboarding at Applichem
We will use Excel to create, compute and track KPIs for the Applichem case. At the end of this session, you will be able to

- Use Pivot Tables in Excel to compute KPIs
- Interpret KPIs with respect to the underlying operational issues of a business

Readings/Preparation for class

- Vlookup Video
- Applichem Case

Session 7: LAB2 _ Part (2): Dashboarding at Applichem
We will apply the KPIs developed in session 5 to create a dashboard in Excel. At the end of this session, you will be able to

- Create a simply yet meaningful dashboard
- Present your dashboard to support the business decision making

Readings/Preparation for class

- A Guide to Creating Dashboards People Love to Use.

Module III: Classification

Session 8: Introduction to Classification.
We introduce the basic idea of classification and measures of accuracy. At the end of this session you will be able to

- Explain the idea of classification in your own words
- Recognize opportunities to use classification in business contexts
- Compute various measures of accuracy of a classifier with Excel
- Build a simple tree model. Explain the key elements in the tree.
- The validation approach.

Session 9: Decision Trees
At the end of this session you will be able to

- Explain the mathematical foundation of decision trees
- Goodness of fit metrics, stopping criterion.

- Fit a tree model (classifier) using the loan default data
- Interpret the fitted model and evaluate through confusion matrix

Session 10: Logistic Regression
At the end of this session you will be able to
- Explain the mathematical foundation of logistic regression
- Goodness of fit metrics
- Fit a logistic regression model (classifier) using the loan default data
- Interpret the fitted model and evaluate through confusion matrix

Session 11: LAB3: Trojan Horse Style Lab
We use decision trees to create a personalized marketing campaign for a Men's Fashion retailer. At the end of this session, you will be able to
- Create and tune decision-tree classifiers in JMP and Excel
- Interpret the accuracy of a classifier in terms of revenues and costs for a firm
- Formulate and argue for a particular business recommendation based on your analysis
- Critique the analysis of peers

Readings/Preparation for class
- Trojan Horse

Module IV: Clustering

Session 12: Introduction to Clustering, K-Means Clustering
We introduce the basic ideas behind clustering and describe its business applications. At the end of this session you will be able to
- Explain the intuition behind clustering and prototypical members in your own words
- Recognize opportunities to use clustering in business applications
- Describe the challenges behind defining similarity and choosing the number of clusters

We apply k-means clustering to cluster movies into genres and provide personalized recommendations similar to Netflix. At the end of this session you will be able to
- Explain the mathematical foundation of K-means clustering
- Apply K-means clustering algorithms
- Interpret the business meaning of the fit and assess the quality of fit

Session 13: LAB4: Chow Hound Market Segmentation Case
We apply our previous techniques to segment the customer base of an online restaurant delivery service. At the end of this session you will be able to
- Interpret the results of clustering in a business context
- Formulate and argue for a particular business recommendation based on your clustering analysis
- Critique the clustering analysis of peers

Readings/Preparation for class
- Chow Hound Case

At the end, we summarize the key topics introduced throughout the semester and go over the project guidelines.

Session 14: Final Review / Fairness in Machine Learning (if time permits / not tested)

APPENDIX I

How BUAD425 Contributes to Student Achievement of Marshall's Six Undergraduate Program Learning Goals

Goal	Marshall Program Learning Goal	Course Objectives that support this goal
1	**Our graduates will demonstrate critical thinking skills *so as to become future-oriented decision makers, problem solvers and innovators.*** Specifically, students will: 1.1 Students will understand the concepts of critical thinking, entrepreneurial thinking and creative thinking as drivers of innovative ideas (not explicit for this course). 1.2 Critically analyze concepts, theories and processes by stating them in their own words, understanding key components, identifying assumptions, indicating how they are similar to and different from others and translating them to the real world. 1.3 Be effective at gathering, storing, and using qualitative and quantitative data and at using analytical tools and frameworks to understand and solve business problems. 1.4 Demonstrate the ability to anticipate, identify and solve business problems. They will be able to identify and assess central problems, identify and evaluate potential solutions, and translate a chosen solution to an implementation plan that considers future contingencies.	**I, III, IV, V**
2	**Our graduates will develop people and leadership skills to promote their effectiveness as *business managers and leaders in the 21st century's evolving work and organizational structures.*** Specifically, students will: 2.1 Students will recognize, understand and analyze the roles, responsibilities and behaviors of effective managers and leaders in diverse business contexts e.g., functionally diverse, culturally diverse, geographically diverse, etc. 2.2 Students will understand factors that contribute to effective teamwork including how to elicit, manage and leverage diverse perspectives and competencies. 2.3 Students will recognize, understand, and analyze the motivations and behaviors of stakeholders inside and outside organizations (e.g., teams, departments, consumers, investors, auditors)	N/A
3	**Our graduates will be effective communicators *to facilitate information flow in organizational, social, and intercultural contexts*.** Specifically, students will: 3.1 Identify and assess diverse personal and organizational communication goals and audience information needs. 3.2 Understand individual and group communications patterns and dynamics in organizations and other professional contexts. 3.3 Demonstrate an ability to gather and disseminate information and communicate it clearly, logically, and persuasively in professional contexts.	**I, IV, V**
4	**Our graduates will demonstrate ethical reasoning skills, understand social, civic, and professional responsibilities *and aspire to add value to society.*** Specifically, students will:	**N/A**

		4.1 Understand professional codes of conduct. 4.2 Recognize ethical challenges in business situations and assess appropriate courses of action.	
5		**Our graduates will develop a global business perspective. They will understand how local, regional, and international markets, and economic, social and cultural issues impact business decisions *so as to anticipate new opportunities in any marketplace*.** Specifically, students will: 5.1 Understand how local, regional and global markets interact and are impacted by economic, social and cultural factors. 5.2 Understand that stakeholders, stakeholder interests, business environments (legal, regulatory, competitor) and business practices vary across regions of the world.	**N/A**
6		**Our graduates will understand types of markets and key business areas and their interaction *to effectively manage different types of enterprises*.** Specifically, students will: 6.1 Demonstrate foundational knowledge of core business disciplines, including business analytics and business economics. 6.2 Understand the interrelationships between functional areas of business so as to develop a general perspective on business management. 6.3 Apply theories, models, and frameworks to analyze relevant markets (e.g. product, capital, commodity, factor and labor markets). 61.4 Show the ability to utilize technologies (e.g., spreadsheets, databases, software) relevant to contemporary business practices.	**I, II, III, IV**