USC Marshall

BUAD 425 – Data Analysis for Decision Making
Syllabus Fall 2015

Professor: Dr. Robertas Gabrys
Office: BRI 401 O
Office Hours: Wed 4:30 pm – 5:30 pm or by appointment
Phone: 213 740 9668
Email: gabrys@marshall.usc.edu

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 operating performance 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:

- 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?
- AB Testing: How can we combine data and experimentation to incrementally improve our business model?

BUAD 425 is an integrative capstone course that draws on your entire 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 begin to 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 for alignment of these goals with the Marshall Learning Objectives.

Required Materials

- This class will heavily leverage both Microsoft Excel and JMP. Both pieces of software are available from USC computer labs, or for download to a personal computer from http://itservices.usc.edu/software/.
- Other readings, lecture notes and videos will be distributed throughout the course via BlackBoard.
- **Important:** 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, you can get one from Academic Information Services in HOH 300.

Optional Text:

- Some **Optional** readings will come from our custom course reader, *BUAD 425 Data-Analysis for Decision Making*, available for purchase from the USC bookstore. There will also be a limited number of copies on reserve at Crocker Library. The textbook is not required for the course.

Prerequisites:

- BUAD 281, BUAD 306, BUAD 307, BUAD 310, and BUAD 311.
- BUAD 302, BUAD 304, and BUAD 497 are co-requisites.

Course Notes:

We will use Blackboard for all assignments, course materials, and announcements. Please check the Blackboard site 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 in the computer lab is an integral part of this course. We will have at least one lab session for each case assignment. During these sessions, we will discuss the case and practice using software. Your quizzes and assignments (see below) will often require you to use this software. Thus, it is very important that you attend and actively participate in lab sessions.

Discussing homework assignments, pre-class preparation, and pre-case 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 her 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 Details

All assignments are accepted ONLY via Blackboard.
Late submissions will not be accepted.

The course grade will be based upon your performance on the quizzes, homework assignments, several pre-class and pre-case assignments, a final case project, a final exam and class participation. These will be combined using the following weights:

Case work and Class Participation	5%
Pre-Class / Pre-Case Assignments	10%
Quizzes (Best 3 of 4)	25%
Homework	25%
Final Case Project	15%
Final Exam	20%

Marshall does not have a "curve" or hard target for the distribution of grades for individual assignments or the course as a whole. Our principle is that students should be given the grade they deserve based on class performance and should not be assigned an undeserved grade simply to fit a curve. That said, historically the average performance of students in this course is a "B+." The average performance this year for this section may be higher, lower, or the same.

Assignments

Class Participation / Pre-Class Assignments

One of the key learning outcomes of this course is to develop the ability to effectively discuss analytics techniques and communicate recommendations based on these techniques. Consequently, class participation is critical. Your participation is evaluated mainly on the quality of your contribution and insights. I will make every effort to call on as many students who wish to speak up as possible to provide a fair chance for contributions.

Please note that it is impossible to contribute to the learning environment if you are unprepared. Throughout the semester there will be short readings and videos distributed prior to class. With each reading or video, there may be a short assignment. These assignments will be very easy *provided you have done the reading or watched the video*. These assignments should be submitted via BB prior to class.

Quizzes

A second key learning outcome of this course is to develop the ability to confidently apply the analytics methods taught with software. Quizzes support that outcome, asking you to complete a straightforward application of data analysis techniques learned in class to new data; this will require using the computer lab. There will be four quizzes—one each for Basic Excel skills, KPIs and Dashboarding, Clustering, and Classification. Only the best 3 will count towards your final grade.

All quizzes are closed book and no Internet access, but WILL involve software in the computer lab. You are allowed to use one double-sided crib sheet (8.5x11) on each quiz/exam. Crib sheets cannot be shared. *No make-up exams or quizzes are offered* – accordingly, all quizzes must be taken on their assigned date and in the section in which students are registered in the computer lab.

Homework

Homework assignments mirror the cases we explore in the lab and provide an opportunity for you to apply your skills to a new business problem. In many ways, these assignments are a good example of the kinds of analytics work you may expect to do in your first job out of Marshall.

Answer the questions that you are asked clearly and concisely. Some questions will ask for specific numbers and calculations. To receive full credits, you must show your work. In some cases, you may wish to include a chart or graph. Please make sure to format it appropriately. Your scores on each assignment will depend on the quality and clarity of your submission. Finally, there may be questions that ask for you to make business recommendations based on your insights. Persuasive arguments tend to be brief. Long-winded answers often receive poorer scores.

Cases/Labs and Pre-Case Assignments

The four cases/labs in the class integrate the material with the rest of your Marshall education. They are an important opportunity for you to draw-upon and practice all of the tools you have amassed over the past four years.

Each case will have an associated pre-case assignment. These assignments require you to think about the business context of the case. Please submit your responses to the questions via BB before class, and come prepared to discuss the case in detail during class. Class sessions will focus on using analytics techniques to guide the decision-making process and ultimately formulating a cogent recommendation.

Final Case Project

Students will work in teams of four or five to analyze a case. This case will require you to apply a variety of data analytics you've learned throughout the semester to a complex problem in promotional pricing and formulate actionable recommendations. Your project will involve a short write-up summarizing and justifying your recommendations, a 10-15 minute presentation to the class of your findings, and providing constructive feedback on other team's presentations and analyses. Details of the case and requirements for the project, including grading expectations, will be distributed later in the semester.

Final Exam

The final exam will be cumulative. It will involve both written and computer portions. All quizzes/exams are closed book and no Internet access. You are allowed to use one double-sided crib sheet (8.5x11) on each quiz/exam. Crib sheets cannot be shared.

The Final exam date and location will be announced shortly on BlackBoard and in class. It may differ from the date announced on the university web page, because it will require using the computer lab.

MARSHALL GUIDELINES

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 class sessions; the instructor is not required to notify the student that s/he is being dropped. If you are absent six or more times prior to November 15 (the last day to withdraw from a course with a grade of "W"), 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.

Computer and Smartphone Policy

In order to emphasize learning practical, employable skills, this class involves heavy computer usage. Despite the temptations posed by computers in a classroom, I expect students to be engaged and to act like responsible adults. This means focusing on class, not doing other work or surfing the internet. In particular, when the class convenes after computer exercises to discuss results, you should cease working on the computer and join the discussion. Fiddling with the computers during discussion is disrespectful to your peers who are sharing, and generally unprofessional.

Smartphone use during class is not permitted under any circumstances. Do not take it out. Do not check it. Definitely silence it.

Students who act unprofessionally or fail to meet the Marshall standards of excellence may be asked to leave the classroom.

Summary of Deliverables[1]

	Date			
Session	**Wednesday**		**Topic**	**Deliverables**
1	26-Aug		Why study analytics?	
2	2-Sep		KPIs, Metrics and Dashboards	Quiz 1: Excel Basics (in class) Applichem Extension Pre-Case HW: Excel Pre-Test
3	9-Sep		Applichem Extension Case (Lab)	Vlookup Exercise
4	16-Sep		Introduction to Classification	HW 1: Dashboarding
5	23-Sep		Logistic Regression and Decision Trees	Quiz 2: Dashboarding (in class) Classification Pre-Class
6	30-Sep		Trojan Horse Style (Lab)	Trojan Horse Style Pre-Case
7	7-Oct		Introduction to Clustering	HW 2: Classification Clustering Applications
8	14-Oct		K-Means and Hierarchical Clustering	Quiz 3: Classification (in class)
9	21-Oct		Chow Hound Market Segmentation (Lab)	Chow Hound Pre-Case Choose teams for Final Case
10	28-Oct		Introduction to AB Testing	HW 3: Clustering "Trust Engineers" Assignment
11	4-Nov		Winning an Election (Lab) + Start Final Projects	Quiz 4: Clustering (in class)
12	11-Nov		Final Case Presentations	Final Case Report
13	18-Nov		Final Case Presentations + Debrief	
14	25-Nov		Final Exam Review	
Final Exam	TBD	TBD		

Course Outline

Module I: KPIs, Metrics and Dashboards

Session 1: 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

Readings:

- McKinsey Global Institute Report on Big Data Executive Summary

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

- pg. 2 from “Digital data is now everywhere…” through pg. 7 “The Use of Big Data Will Underpin New Waves of Productivity…”
- pg. 10 from “There will be a Shortage of Talent…” through pg. 11 “Several Issues Will Have to be Addressed…”

Session 2: KPIs, Metrics and Dashboards
Quiz 1: Excel Basics (in class)
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:

- 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"

Due:

- Applichem Pre-Case Assignment
- HW 1: Excel Basics

Session 3: Applichem Lab
We will use Excel to create, compute and track KPIs for the Applichem case, and, ultimately, design a dashboard. At the end of this session, you will be able to

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

Readings:

- Vlookup Video, Pivot Table Video
- **(Optional)** A Guide to Creating Dashboards People Love to Use. (long-ish)

Due:

- Vlookup Pre-Class Assignment

Module II: Classification

Session 4: 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
- Judge the business value of a potential classifier

Readings:
- "How Target Figured out a Teenage Girl was Pregnant Before Her Father Did"

Due:
- HW 1: Assessing New Market Entry

Session 5: Logistic Regression and Decision Trees
Quiz 2: KPIs and Dashboarding (in class)
At the end of this session you will be able to
- Explain the mathematical foundation of logistic regression and decision trees
- Use JMP to fit a linear classifier using logistic regression and decision tree classifier
- Assess the quality of fit for both classifiers and interpret the fitted models

Readings:
- "Introduction to Machine Learning" Visualization
    - Focus on the portions regarding the decision tree
- **(Optional) "**Logistic Regression" from Course Reader
- **(Optional)** Video: Predicting Supreme Court Decisions with Decision Trees

Due:
- Decision Tree Pre-Class assignment

Session 6: Trojan Horse Style Lab
We use logistic regression and 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 logistic-regression and 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:
- Trojan Horse Style Case

Due:
- Trojan Horse Style Pre-Case Assignment

Module III: Clustering

Session 7: Introduction to 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

Readings:
- Video: "Recommendations worth a Million"
- **(Optional)** Clustering section of Course reader

Due:
- HW2: Predicting a Billboard Chart Topper

Session 8: K-Means and Hierarchical Clustering
Quiz 3: Classification (in class)
We apply k-means and hierarchical 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 and hierarchical Clustering
- Use JMP to apply both clustering algorithms
- Assess the quality of fit for both algorithms

Readings:
- **(Optional)** Clustering section of Course reader

Session 9: 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:
- Chow Hound case

Due:
- Chow Hound Pre-Case Assignment

Module IV: AB Testing

Session 10: AB Testing
We will 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

Readings:

- Podcast: “The Trust Engineers”
- TED Talk: “Social Experiments to Fight Poverty” by Esther Duflo
- **(Optional:)** Visualization: Bias in the Berkley Admissions Process

Due:

- HW 3: Clustering
- Trust Engineers Class Preparation Assignment

Session 11: Winning an Election Case (Lab)
Quiz 3: Clustering (in class)
We use ideas from AB-testing to design and interpret an experiment around creating the most persuasive email flyer to persuade voters to support a particular political candidate. We will use the remaining time to let teams begin working on their Final Case reports. 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

Sessions 12 & 13: Group Case Presentations
Groups will present their work and recommendations for the final case project “Targeted Promotions at Artsy.”

Due:

- 2 page final project report (one per team) on Session 12, complete with any visual aids you intend to use
- In-class presentation (Sessions 12 and 13)

Session 14: Final Review
Answer any questions to review for final exam. Course-wrap up.

Appendix: Statement on Academic Conduct and Support Systems

Academic Conduct

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 Section 11, Behavior Violating University Standards https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. 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.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity http://equity.usc.edu or to the Department of Public Safety http://adminopsnet.usc.edu/department/department-public-safety. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students.

Statement for Students with Disabilities

Students requesting test-related accommodations will need to share and discuss their DSP recommended accommodation letter/s with their faculty and/or appropriate departmental contact person at least three weeks before the date the accommodations will be needed. Additional time may be needed for final exams. Reasonable exceptions will be considered during the first three weeks of the semester as well as for temporary injuries and for students recently diagnosed. Please note that a reasonable period of time is still required for DSP to review documentation and to make a determination whether a requested accommodation will be appropriate.
(https://sait.usc.edu/academicsupport/centerprograms/dsp/registration/accommodationletters_howto.asp)

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. Please be sure the letter is delivered to me (or to your TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776. For more information visit www.usc.edu/disability .

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute http://dornsife.usc.edu/ali, which

sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations.

Emergency Preparedness/Course Continuity

If an officially declared emergency makes travel to campus infeasible, USC Emergency Information http://emergency.usc.edu/will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other
Please activate your course in Blackboard with access to the course syllabus. Whether or not you use Blackboard regularly, these preparations will be crucial in an emergency. USC's Blackboard learning management system and support information is available at blackboard.usc.edu.

Appendix: Undergraduate Program Learning Goals

Goal	Description	Emphasis	Corresponding Course Learning Outcomes
1	Our graduates will understand types of markets and key business areas and their interaction *to effectively manage different types of enterprises.* *Specifically, students will:*	High	
	1.1 Demonstrate foundational knowledge of core business disciplines, including business analytics and business economics	High	I - IV
	1.2 Understand the interrelationships between functional areas of business so as to develop a general perspective on business management	High	II, IV
	1.3 Apply theories, models, and frameworks to analyze relevant markets (e.g. product, capital, commodity, factor and labor markets)	High	III, IV
	1.4 Show the ability to utilize technologies (e.g., spreadsheets, databases, software) relevant to contemporary business practices	High	III
3	Our graduates will demonstrate critical thinking skills *so as to become future-oriented decision makers, problem solvers and innovators.* *Specifically, students will:*	High	
	3.2 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	High	I, IV, V
	3.3 Be effective at gathering, storing, and using qualitative and quantitative data and at using analytical tools and frameworks to understand and solve business problems	High	III, IV

	3.4 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 contingencies	High	IV, V
	3.5 Students will demonstrate the ability to be accurate, clear, expansive (thorough, detailed) and fair-minded in their thinking	High	IV, V
5	Our graduates will demonstrate ethical reasoning skills, understand social, civic, and professional responsibilities *and aspire to add value to society. Specifically, students will:* 5.2 Recognize ethical challenges in business situations and assess appropriate courses of action	Moderate	IV
6	Our graduates will be effective communicators *to facilitate information flow in organizational, social, and intercultural contexts.* *Specifically, students will* 6.3 Demonstrate an ability to gather and disseminate information and communicate it clearly, logically, and persuasively in professional contexts.	High	I, IV, V

Goals not explicitly covered in this course:

2	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.*
4	Our graduates will develop people and leadership skills to promote their effectiveness as business managers and leaders.