

**UNIVERSITY OF SOUTHERN CALIFORNIA**  
**Marshall School of Business**  
**BUAD 425 – Data Analysis for Decision Making (Fall 2014)**

## **Syllabus**

### **Contact Information**

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### **Course Description**

Data are everywhere! Companies routinely collect large volumes of data on customer profiles, point of sales transactions, and operating performance at different units. How do companies use these data to make effective *financial, marketing, and operational* decisions? How do organizations convert these data into business intelligence and insights? This course will give you the tools and methods to answer these questions, providing you with a unique competitive advantage in an increasingly data-centric global business environment.

More specifically, we will investigate the following modules:

- Exploratory Data Analysis: How to convert raw data into a useful format for business analysis?
- Data-Driven Operations: Optimal Allocation of Resources via Linear Programming
- Data-Driven Marketing: Targeting via Logistic Regression and Decision Tree
- Data-Driven Customer Relationship Management: Segmentation via Clustering

### **Course Learning Objectives and relationship with Marshall’s Undergraduate Business Administration**

#### **Program Objectives**

The goal of this course is to learn how to convert raw data into actionable data that yields business intelligence and insights. The course focus is to build sophisticated models from raw data, and how to use these models to make effective business decisions. This is an integrative Capstone course that combines information technology, statistics, and decision theory, with applications to other business disciplines such as Finance, Management, Marketing, and Operations. The course will integrate the concepts that you’ve learned in other core classes. Align with the Marshall Undergraduate Learning Goals of “understanding key business areas and “developing critical thinking skills” , “developing a global mindset” and “developing effective communication skills”, the learning objectives of this course can be summarized as follow.

- Students will demonstrate technical proficiency in the use of EXCEL and JMP to understand large unstructured data sets, including selecting and applying statistical or operations knowledge to help solve problems and make decisions.
- Students will demonstrate the ability to critically analyze data and evaluate information gathered for decision making in the local, regional and global business environment.
- Students will demonstrate an understanding of ethics, ethical behavior and ethical decision making.
- Students will demonstrate the ability to communicate ideas both orally and in writing in a clear, organized and persuasive manner.
- Students will demonstrate leadership skills and the ability to work cooperatively and productively to accomplish established goals.

**Prerequisites:** BUAD 281, BUAD 306, BUAD 307, BUAD 310, and BUAD 311. The following courses are co-requisites: BUAD 302, BUAD 304, and BUAD 497.

### **Instructional Methods**

The class will consist of lectures, quizzes, case-based class discussion, and computer lab work. Each case will start with one or two classes of lectures followed by one or two classes of computer lab work, and a quiz.

**Lectures:** The course pack for the class is available for purchase at bookstore; it covers the theory for all the topics discussed in this course. The lecture notes in PowerPoint will summarize all of the theory and concepts needed for this class. The lecture notes will be posted on Blackboard.

**Case Assignments:** During the course we will analyze 4 case assignments, one for each of the 4 modules. These 4 case assignments are:

Case #1: Building Applichem's Information Infrastructure

Case #2: Resource Allocation at Applichem

Case #3: Targeting of Smart Partyware Customers

Case #4: Online Marketing Using Google Adwords

The case description will be posted on Blackboard. These cases are extremely important in learning the materials in class. Each of the 4 cases will address different skills and techniques in analyzing data. We will have in-class discussion of each case and work through parts of the case assignment during the computer lab session. Thus, it is important that you read the case materials before the lab session. You can earn participation credits by submitting a half-page discussion of the case via Blackboard by 8:00am on the day of the lab. The half-page discussion should address the case questions listed in the course outline. The final case assignment is usually due one week after the lab session. Below is the guideline for completing your case assignments:

- 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 and calculation!* You can write out your calculation in pens/pencils and stapled it to your final case submission.
- For questions that ask for charts and graphics, you must print out the graphics from Excel or JMP, and include them in your report. Please make sure to format your chart and graphics properly. Your scores on each assignment will depend on the quality of your submission.
- There will be some questions that ask you to assess and interpret the results of the model. In this case, you will need to provide appropriate outputs from the statistical analysis. When presenting the output of the statistical analysis, please be careful to format them so that it is easy to read and follow your logical arguments. Once again, your grade will depend on the quality of your submission.
- Finally, there may be questions that ask for you to identify the business insights that you obtain. *Please state your answers briefly and concisely!* Long-winded answers tend to receive lower scores.

**Case assignments are due in-class on the indicated due date. Late submissions are not accepted.**

**Computer Lab using Excel and JMP:** Computer lab is an integral part of this course. We will have at least one lab sessions for each case assignment. During the lab session, we will discuss the case in details, work through part of the required analysis, and provide guidance on how to complete the remaining questions in the case assignment. Thus, it is very important that you attend lab sessions. **IMPORTANT:** To access Excel and JMP from the computers in the lab, you need to have 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 the Academic Information Services in HOH 300.

**Case Presentation:** There will be in-class presentations for each case assignment, which will be done in teams. *Teams should be formed by the beginning of Session 3.* Each team will consist of 3 - 4 students. Once I receive the list of teams, I will assign each team **one** case assignment. Each team will then prepare a 10-minute PowerPoint presentation (and Excel files if applicable) for its assigned case. The presentation should

summarize the key analyses and results for each of the case in a compelling and concise fashion. *This is also an important opportunity for each team to extend their analyses beyond what is asked in each case assignment.*

**Quizzes:** We will have a short in-class quiz to check your understanding of the materials. The questions on the quizzes will be a straightforward application of the data analysis technique that you have just learned. The data for the quiz will be provided in-class.

### Grading

The course grade, is based on a final exam, 3 in-class quizzes, 4 case assignments, 1 case presentation, and class participation, according to the following weights:

Class Participation	5%
Case Presentation	10%
Quizzes	20%
Case Assignments	30%
Final Exam	35%

All exams/quizzes are closed books. You are allowed to use one double-sided crib sheet (8.5x11) on each quiz/exam. **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.

### Class Participation

It is very important for each student to actively participate in the class discussion. Read the course materials before the class and make sure you are familiar with the main issues to be discussed in class. You will be called upon to participate in class. 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. The participation credits include class participation and contribution, attendance, and submission of a half-page discussion for each of the 4 cases by 8am on the lab day.

### MARSHALL GUIDELINES

#### Learning Goals

In this class, emphasis will be placed on the USC Marshall School of Business learning goals as follows:

Goal	Description	Course Emphasis
1	Our graduates will understand types of markets and key business areas and their interaction <i>to effectively manage different types of enterprises</i>	High
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 <i>so as to anticipate new opportunities in any marketplace.</i>	Low
3	Our graduates will demonstrate critical thinking skills <i>so as to become future-oriented decision makers, problem solvers and innovators</i>	High
4	Our graduates will develop people and leadership skills to promote their effectiveness as <i>business managers and leaders</i>	Low
5	Our graduates will demonstrate ethical reasoning skills, understand social, civic, and professional responsibilities <i>and aspire to add value to society</i>	Low

- 6 Our graduates will be effective communicators *to facilitate information capture and flow in organizational, social, and intercultural contexts* Moderate

### **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.

### **Notice on Academic Integrity**

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, ([www.usc.edu/scampus](http://www.usc.edu/scampus) or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>. Failure to adhere to the academic conduct standards set forth by these guidelines and our programs will not be tolerated by the USC Marshall community and can lead to dismissal.

### **Class Notes Policy**

Notes or recordings made by students based on a university class or lecture may only be made for purposes of individual or group study, or for other non-commercial purposes that reasonably arise from the student’s membership in the class or attendance at the university. This restriction also applies to any information distributed, disseminated or in any way displayed for use in relationship to the class, whether obtained in class, via email or otherwise on the Internet, or via any other medium. Actions in violation of this policy constitute a violation of the Student Conduct Code, and may subject an individual or entity to university discipline and/or legal proceedings.

**No recording and copyright notice.** No student may record any lecture, class discussion or meeting with me without my prior express written permission. The word “record” or the act of recording includes, but is not limited to, any and all means by which sound or visual images can be stored, duplicated or retransmitted whether by an electro-mechanical, analog, digital, wire, electronic or other device or any other means of signal encoding. I reserve all rights, including copyright, to my lectures, course syllabi and related materials, including summaries, PowerPoints, prior exams, answer keys, and all supplementary course materials available to the students enrolled in my class whether posted on Blackboard or otherwise. They may not be reproduced, distributed, copied, or disseminated in any media or in any form, including but not limited to all course note-sharing websites. Exceptions are made for students who have made prior arrangements with DSP and me.

### **For Students with Disabilities**

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](http://www.usc.edu/disability).

### **Emergency Preparedness/Course Continuity**

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.

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](http://blackboard.usc.edu).

### **Course Disclaimer**

This syllabus is an invitation to students to engage in an exciting and interactive study of data analysis in decision making. The intention of the BUAD 425 team of instructors is to provide you with information, offer practice with skill sets, and enhance your capacity to model large datasets and translate your model to sound decisions. The learning environment will be collaborative and supportive; we will learn from one another both in and out of the classroom. To that end, modifications to this syllabus might be warranted as determined by the instructors as we assess the learning needs of this particular class of students.

## **COURSE OUTLINE**

### **Module 1: Exploratory Data Analysis**

**Session 1 –08/25/14:** Introduction to the Applichem Case and Data Analysis Techniques

**Questions:** What is data analytics? Why data analytics?

**Learning Outcomes:** The purpose of this lesson is to introduce the structure of the class. You will discover that the tools and techniques learned in this class can be applied to many businesses and organizations.

- Define and recognize opportunity to apply data analytics in real-world situations
- Understand how companies organize and structure their data
- Introduce the Applichem Case and how to use Excel to evaluate key performance indicators (KPI)

**Session 2 –09/01/14:** Labor Day

**Session 3 - 09/08/14:** Introduction to Excel

**Questions:** How do we convert raw data into a usable format in Excel? How can we use basic functions in Excel to analyze data? How to convert date and time into usable format in Excel?

**Learning Outcomes:** You will develop familiarity with Excel as a tool for data analysis, evaluation of performance metrics, and basic excel functionalities.

- Understand how to import raw data into Excel
- Learn how to format data in Excel
- How to use CONCATENATE, IF, and date functions in Excel

**Session 4 - 09/15/14:** LAB: Advanced Data Analysis in Excel

**Questions:** How to analyze data and evaluate key performance metrics in Excel using pivot tables? How to create a dashboard? How to join data in Excel using VLOOKUP functions?

**Learning Outcomes:** You will develop familiarity with Excel as a tool for data analysis, evaluation of performance metrics, and creation of dashboard. We will work through the datasets for Case #1 for Applichem.

- Analyze data in Excel using pivot tables
- Understand how to use VLOOKUP functions in Excel
- Create charts and dashboards in Excel

**Due:** You can earn **participation credits** by submitting a half-page discussion of Case #1 by 8am before the class via Blackboard. *Case Preparation Questions:*

1. *What are the main issues in Case #1?*
2. *What is Tim Wright's action plan to solve the problems in the previous question?*
3. *Out of the four most important KPIs discussed in the case, which one you think is most difficult to obtain? Briefly explain why.*

**Due:** The list of teams for case presentation. Each team should send me an e-mail with the team name and the list of their team members and case choice. Each team will have at max 4 students. If I cannot find your name in any team, I will randomly assign you a team and a case.

## **Module 2: Data-Driven Operations: Optimal Allocation of Resources via Linear Programming**

**Session 5 – 09/22/14:** Linear Programming (LP)

**Questions:** How do we find the optimal solution of a linear programming using Excel Solver? What are business problems where LP techniques can be applied?

**Learning Outcomes:** Optimization gives business a critical edge. You will learn that optimization is a powerful tool that can be applied to various business problems. You will be able to formulate a linear program (LP) and solve LP problems using Excel Solver.

- Recognize linear program as a special optimization tool
- Understand the components of a linear program
- Formulate linear programs and solve it using Excel solver
- Make decisions utilizing optimization to allocate resources effectively

**Due:** Case #1 on Building Applichem's Information Infrastructure

**Due:** Case #1 presentation

**Session 6 – 09/29/14:** LAB: Resource Allocation at Applichem **Questions:** Using the data on operating performance at each plant and currency exchange rate, how do we build a linear program to determine the optimal resource allocation?

**Learning Outcomes:** You will practice how to formulate an LP for resource allocation that takes into account exchange rate between countries. We will work with the datasets from Case #2.

- Use data on transportation costs and operating performance to formulate an LP
- Solve the LP to hedge currency risk
- Calculate the expected production quantity at each plant and determine the shipment to each market that minimizes the total cost

**Due:** You will earn **participation credits** by submitting a half-page discussion of Case #2 by 8am on the day of this class via Blackboard. *Case Preparation Questions will be posted on BB.*

**Quiz # 1:** Data Analysis in Excel

## **Module 3: Data-Driven Marketing: Targeting via Decision Tree and Logistic Regression**

**Session 7 – 10/06/14:** Decision Tree

**Questions:** What is a decision tree? How to create decision trees from data? How to use decision trees for target marketing?

**Learning Outcomes:** Decision tree is a powerful tool for classification, and has many business applications including estimating likelihood of sales, target marketing, and credit scoring.

- Understand decision tree and the key concepts behind its construction
- Recognize business application where these tools can be applied
- Learn how to fit decision tree to the data using JMP

**Due:** Case #2 on Resource Allocation at Applichem

**Due:** Case #2 presentation

**Session 8 – 10/13/14:** Introduction to Logistic Regression

**Questions:** What is a logistic regression model? How is it related to classical linear regression? What are probabilities, odds, and log odds, and how are they related?

**Learning Outcomes:** Logistic regression is a powerful alternative to decision tree for classification and targeting. We will learn the basic concept of odds and log odds that are used in the logistic regression model. We will also discuss application of logistic regression to predictive marketing.

- Understand the relationship between probability, odd, and log odd
- Describe the basic logistic regression model and its underlying assumptions
- Identify business applications where logistic regression can be applied

**Quiz # 2:** Linear Programming

**Session 9 – 10/20/14:** Advanced Logistic Regression

**Questions:** How to select the appropriate regression model and decision tree? How to assess the validity and accuracy of logistic regression models? How to incorporate the results of these models in business decisions?

**Learning Outcomes:** We will learn how to select the appropriate regression model and understand how to assess the predictive power of the logistic regression model. We will also discuss application to predictive marketing.

- Understand the relevant issues in selecting logistic regression models
- Recognize the important of the Receiver Operating Characteristic (ROC) associated with the logistic regression model
- Use the information from the ROC curve to make an informed business decision

**Session 10 – 10/27/14:** LAB: Targeting of Smart Partyware Customers

**Questions:** How to apply logistic regression and decision tree to improve the customer response rate in a direct marketing campaign?

**Learning Outcomes:** You will learn how to use logistic regression and decision trees to develop a direct marketing campaign, estimate the resulting profit from your campaign, and generate business insights. We will work with the datasets from Case #3.

- Apply the concepts and tools in the last lecture on real marketing data
- Build the best model to predict the most likely customers who will respond to a marketing campaign
- Calculate profits using the prediction of the model

**Due:** You will earn **participation credits** by submitting a half-page discussion of Case #3 by 8am on the day of this class via Blackboard. *Case Preparation Questions will be posted on BB.*

**Module 4: Data-Driven Customer Relationship Management: Segmentation via Clustering**

**Session 11 – 11/03/14:** Introduction to Clustering and Segmentation

**Questions:** What is clustering? How do we use clustering to answer business questions? What is the right number of cluster? How do we assess the validity of the clustering output? How can we use regression with clustering to understand customer profiles?

**Learning Outcomes:** Clustering is a powerful tool for dealing with unstructured data, enabling us to segment customers and develop their profiles. You will learn to recognize business applications of clustering and implement it in JMP.

- Learn about unstructured data
- Familiarize with different clustering techniques such as K-mean and hierarchical clustering
- Implement clustering algorithms in JMP

You will learn how to assess the validity of your clustering outputs. You will also learn how to combine regression techniques with clustering to develop customer profile and identify hidden relationship.

- Learn about bias-variance tradeoffs
- Assess the validity of the clustering outputs
- Combine regression with clustering techniques

**Due:** Case #3 on Targeting of Smart Partyware Customers

**Due:** Case #3 presentation

**Session 12 – 11/10/14:** Introduction to Google Adwords and Search-Based Advertising

**Questions:** What are search-based advertising services? How can businesses use search-based advertising to identify new customers?

**Learning Outcomes:** You will learn about the Google Adwords program and search-based advertising services, and show how clustering algorithms can be applied to segment keywords.

- Introduce the Google Adwords program
- Use clustering techniques to segment keywords
- Understand how to model profits and losses associated with different keyword selections

**Quiz # 3:** Logistic Regression and Decision Tree

**Session 13 – 11/17/14:** LAB: Online Marketing Using Google Adwords

**Questions:** What keywords should Smart Partyware consider in its campaign?

**Learning Outcomes:** You will apply clustering techniques to identify the most appropriate keywords, predicts their cost, and evaluate the profitability of the resulting marketing campaign. We will work with the datasets from Case #3.

- Build a clustering model to identify the appropriate keywords for a Google Adwords campaign
- Predict the cost associated with each keyword, conversion rate, and number of new customers.
- Calculate the expected revenue associated with your marketing campaign.

**Due:** You will earn **participation credits** by submitting a half-page discussion of Case #4 by 8am on the day of this class via Blackboard. *Case Preparation Questions:*

1. *What is the overall objective for this case?*
2. *What statistical method will be used for this case?*
3. *What is the approximate amount of money spent per month on the “partyware” keyword?*
4. *How much is the allocated budget per month for SEM?*

**Session 14 – (Thanksgiving week) 11/24/14: TBA**

**Session 15 – 12/01/14:** Review for Final

**Due:** Case #4 on Online Marketing Using Google Adwords

**Due:** Case #4 presentation

**Session 16 –:** Final Exam date and place will be announced on blackboard and in class very soon. It is different from what the university web page says because the final exam includes lab portion.