MKTG 309 and MKTG 809, Spring 2015
Special Topics: Experiments for Business Decision Making
Preliminary

Instructor: Dr. Nathan Fong
Co-developed by Dr. Elea McDonnell Feit and Prof. Eric Bradlow
Tuesday and Thursday 1:30-3:00 from 1/15/2015 through 4/28/2015
Office hours Tuesday 3:00-5:00 or by appointment
Room TBD
Course website TBD

Course Goals
In the past decade, the shift of advertising dollars to measureable digital marketing channels has suddenly made tactical experiments an economically feasible way to inform marketing decisions such as how advertising should be designed and targeted, what types of promotions are most effective, what products should be offered, how sales staff should be compensated, which sales channels should be emphasized, etc. Many marketers engaged in online retailing, direct marketing, online advertising, media management, and service operations are rapidly embracing a "test and learn" philosophy and a number of platforms such as Adobe Target, Optimizely and Google Content Experiments, have been developed to facilitate rigorous field experiments in the online environment. The rapid rise of the "test and learn" philosophy in marketing has created a huge demand for those who can design, field, and analyze experiments. Through this course, you will learn about, discuss and practice a wide range of critical skills for experimentation, from the statistical methods used to design and analyze experiments to the management and strategy required to execute an experiment and act on the results. Although our cases and examples will focus on marketing problems, the material covered can be applied in a number of other domains, particularly operations, management and product design.

Course Approach
Creating an effective experiment, one that truly provides value to the organization, requires equal measures of creativity and technical skill. Consequently, this course will alternate lectures and homework exercises on statistical methods with case discussions, readings and guest lecturers that will expose you to broader managerial issues such as "How do we decide what we should test?" and "How do we minimize impact on the operations while still learning something from the test?" Although the course outline is structured around the statistical topics, I have designed the schedule so that each week will include discussions and exercises that emphasize creativity and intuition, as well as the statistical mechanics. Ultimately, my goal is for you to develop an understanding of the *interplay* between creativity and rigorous data analysis in business decision making. Through the assignments and discussions, you will develop and exercise your ability to frame ill-defined problems, determine what data and analysis might provide information about that problem, and examine the evidence for or against a particular business decision.

During the first half of the course, we will cover a number of experimental methods that are widely used in practice and that most marketers should be able to execute independently. You will develop a high level of hands-on skill with A/B/… testing, ANOVA, multivariate testing, regression and optimal design. Towards the end of the course, we will cover several more sophisticated methods including sequential testing and decision theory that are typically handled in practice by experts but are rapidly becoming more accessible through software.

Who should take this course?
For MKTG 309: This course is ideal for students with a background in statistics that covers hypothesis testing, ANOVA, and multiple regression (STAT 101, STAT 431, or equivalent). I will motivate statistical material with concrete examples from marketing, so some experience with marketing (MKTG 101) or marketing research (MKTG 212) may also be helpful**, but is not necessary**. Students from engineering, business, math, and science are all encouraged to enroll. If you have any concerns about whether this course is appropriate for you, please don't hesitate to contact me. **The course has been approved to count toward undergraduate concentrations in Business Analytics & Statistics.**

For MKTG 809: This course is ideal for students with a background in statistics that covers hypothesis testing, ANOVA, and multiple regression (STAT 621 or equivalent). I will motivate statistical material with concrete examples from marketing, so some experience with marketing (MKTG 621/622) or marketing research (MKTG 756) may also be helpful, but is not necessary. If you have any concerns about whether this course is appropriate for you, please don't hesitate to contact me.

Required Textbook:
> Ledolter and Swersey (2007), *Testing 1-2-3: Experimental Design with Applications in Marketing and Service Operations*, Stanford University Press. We will cover chapters 1-5 and 8 in depth.

Required Software:
> JMP 10 or 11 (Student licenses available at http://www.onthehub.com/jmp/. JMP is also installed in all Wharton computer labs.)

Other Recommended Books:
> The current "bible" of website analytics is Kaushik (2009) *Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity*. If you are only going to have one book on digital marketing on your shelf, it is a great general reference on and it includes a nice chapter on A/B testing. There are also several popular books with more in-depth coverage of testing with lots of engaging examples and "stories from the testing trenches".   Siroker and Koomen (2013) *A/B Testing: the Most Powerful Way to Turn Clicks into Customers*, Goward (2012) *You Should Test That: Conversion Optimization for More Leads, Sales and Profit or The Art and Science of Optimized Marketing* and McFarland (2012) *Experiment! Website conversion rate optimization with A/B and multivariate testing* are all light and informative reads and are only slighly self-promoting.
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> Since we will be using JMP, Goupy and Creighton (2007) *Introduction to Design of Experiments with JMP Examples*, SAS Press, provides more comprehensive treatment of the JMP modules than we can cover in class, but it is much more directed at an engineering audience. It might be a useful reference if you plan to use JMP a lot.
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> For those of you who want more technical coverage of the design and analysis methods, the classic textbook on Design of Experiments is Montgomery (2008) *Design and Analysis of Experiments*, Wiley.

Selected Readings and Cases:
> Almquist, Eric and Gordon Wyner (2001) "Boost Your Marketing ROI With Experimental Design," *Harvard Business Review,* October.
> Anderson, Eric and Duncan Simester (2011) "A Step-by-Step Guide to Smart Business Experiments:, *Harvard Business Review*.
> Ariely, Dan (2010), "Why Businesses Don't Experiment," Harvard Business Review, April.
> .

Christian, James, Eleanor McDonnel Feit and Mark A. Beltramo (2007) "Expert Feature: Conjoint Analysis at General Motors" in Feinberg, Kinnear and Taylor, *Modern Marketing Research: Methods and Cases*.

Davenport, Thomas (2009), "How to Design Smart Business Experiments," *Harvard Business Review*, February.

Groupy, Jacques and Lee Creighton (2007*) Introduction to Design of Experiments with JMP Examples*, SAS Institute p 307-350.

JMP (2007), "JMP Design of Experiments"

Lewis, Randall and David Reiley (2009WP), "Does Retail Advertising Work? Measuring the Effects of Advertising on Sales via a Controlled Experiment on Yahoo!"

(optional) Scott, Steven L. (2010) "A modern Bayesian look at the multi-armed bandit," *Applied Stochastic Models in Business and Industry*," 26, 639-658.

Venkatensan, Rajkumar and Paul W. Farris (2008) Advertising Experiments at the Ohio Art Company, *Harvard University Press*.

Course website:

I will use Canvas to handle all course logistics and paperwork, so that we can use class time to focus on the course content. Your readings and preparation for each class meeting will be listed as an ungraded assignment in Canvas. Lecture slides will be posted to Canvas Files following each class meeting. All graded assignments will be announced, turned in and graded via Canvas. We may occasionally hold class virtually via the "conference tool" in Canvas or hold office hours via the chat tool in Canvas. If you have any issues accessing material in Canvas, please bring it up in class or e-mail me.

Classroom Manners:

One great advantage of taking a course that meets in a classroom is that we can rapidly build a community, and I ask that you do your best to create an environment where we all can learn from each other. Asking questions or providing comments that help you and your classmates understand the material better is great. Eating or drinking is fine, so long as it isn't distracting to the rest of the class. Using electronics in a way that contributes to the learning environment is encouraged, and don't be surprised if I ask you to look something up or do a calculation for me. Personally, I find it very distracting when there are students in class who not engaged, so I would appreciate it if you would give your full attention to the class and avoid sleeping, checking e-mail, posting to social media, playing games, etc. during class.

Assignments and Grading:

Designing experiments and analyzing the resulting data is a skill that must be practiced, and so assignments, midterm exams and a project are a critical components of this course. Sometimes I will give you textbook-style exercises designed to help you practice the mechanics of designing and analyzing experiments. Other times I will give you more open-ended tasks designed to help you learn the art of applying these methods in practice. These open-ended tasks will require you think broadly about business challenges and organizational context, in addition to working through the statistical mechanics. For instance, I may ask you to "Analyze at this data set and tell me what it says about the effectiveness of advertising." When I ask a question like this I expect you to provide me a write-up similar to what you might present to a decision-maker; it should succinctly describe the key business issues, provide supporting analysis and then conclude with a direct statement of the implications of the analysis for the business decision.

Homework assignments (25%)
Written homework assignments will be due weekly during the first part of the semester. Details of the assignments including due dates will be provided via the course website. You may discuss assignments with other students, but each student should write up his or her submission independently. All assignments will be submitted electronically through the course website. Late assignments will be marked down by 15%.

Mid-term Exam (25%)
The in-class, pencil-and-paper mid-term exam will cover research design and A/B testing and will combine short-answer, computational and essay questions.

Project (40%)
For the project, you will work in small groups to design, execute and analyze an experiment. Working with a business or non-profit organization, you will identify an opportunity for testing, design an experiment, field the experiment and analyze the results. The experiment should involve communicating with potential customers via any marketing channel including e-mail, website, display advertising, social media or even a physical store. You may also use the project as an opportunity to participate in the Google Online Marketing Challenge, which will give you a budget of $250 to purchase display or search advertising for your experiment, as well as the opportunity to win awards. More details on the project will be distributed via the course website.

Participation (10%)
Active participation, particularly during case discussions, is expected. *Your contributions to the discussion will be evaluated based on how your questions or comments contribute to the learning of your classmates*. Attendance in class and participation on the course website is encouraged. Grandstanding is discouraged.

Disabilities
In compliance with Penn policy and equal access laws, I am available to discuss academic accommodations that you may require as a student with a disability. Requests for academic accommodations need to be made during the first two weeks of the semester, except under unusual circumstances, to arrange reasonable accommodations. Students must register with Student Disabilities Services (SDS) for disability verification and for determination of reasonable academic accommodations. Even if you situation doesn't require a formal accommodations, I encourage you to discuss with me any special learning needs that you may have, so that I can work with you to make sure that you have the best possible learning experience. In many cases, I can make simple adjustments that will improve learning for the entire class. All such discussions will be confidential.

Academic Honesty
Academic honesty is fundamental to our class and the University community and I take issues related to academic honesty very seriously. Our University Code of Academic Integrity is posted at http://www.upenn.edu/academicintegrity/ and covers cheating, plagiarism, facilitating cheating and other attempts to gain unfair advantage. I expect that everyone in this course will familiarize themselves with and follow this code. Suspected violation of the Code in this course will be referred to the Office of Student Conduct.

Tentative Course Outline

Introduction (one week)
- Testing in the digital environment
- Experimentation versus data analysis
- Review of basic statistics

A/B Testing and Research Design (three weeks)
- Statistics of A/B experiments (hypothesis testing, sample size planning)
- Art of A/B experiments (randomization, control conditions, internal and external validity)
- Tools for online testing
- Case: Experiments at the Ohio Art Company
- A/B/C/D experiments, ANOVA and blocking (L&S, Chapter 3)
- Building an testing capability

Decision Theory
- When should you do an experiment?

Midterm Exam

Multivariate Testing with Two-level Factors (two weeks)
- Review of regression
- Two-level full factorial experiments (L&S, Chapter 4)
- Two-level fractional factorial designs (L&S, Chapter 5)
- Cases: Eagle Brands & Magazine Price Test
- A/B and multivariate testing in practice

General Optimal Design (two weeks)
- Introduction to model building
- Optional design, information theory and D-optimal designs (L&S, Appendix 8.1, plus additional readings)
- Design of conjoint studies, i.e. multinomial logit studies, Bayesian D-optimality

More Decision Theory (one week)
- More concepts from decision theory
- Sequential experiments & multi-armed bandits

Experiments in Practice (three weeks)
- Guest lecture on integrating experiments into the organization
- Consulting on projects