Online Course Syllabus

Course Information

Course Number/Section	MIS 6392.001/ BUAN 6392.001
Course Title	Causal Analytics and A/B Testing
Term	Spring 2023

Instructor Contact Information

Professor	Amit Mehra
Email Address	Amit.Mehra@utdallas.edu
Office Location	JSOM 3.433
Online Office Hours	By appointment. Please email the instructor to schedule a Microsoft Teams meeting.
TA Contact Information	Listed in eLearning

About the Instructor

Amit Mehra is a tenured professor at JSOM in UT Dallas. His research focuses on how technology shapes human behavior and the resulting impact on firm strategies in different contexts like retail and education. He publishes his work on these subjects in leading journals like *Management Science*, *Information Systems Research*, *Management Information Systems Quarterly,* and *Production and Operations Management*. He has won numerous nominations and awards at prestigious conferences like the Workshop on Information Systems and Economics (WISE), Conference on Information Systems and Technology (CIST), and Workshop on Information Technology and Systems (WITS). For his research, Amit works or has worked in the past with several firms like Infosys, Nordstrom, and Nowfloats, and with governments like the Education department of the government of Andhra Pradesh in India. He teaches or has taught courses related to Causal Analytics and Web analytics to undergraduate, masters, and PhD students as well as executives.

Course Pre-requisites, Co-requisites, and/or Other Restrictions

OPRE 6301 or OPRE 6359 or BUAN 6359

Course Description

All managers need to make decisions to achieve specific objectives. For example, a firm like Spotify wants to grow its customer base (it's objective). It intends to send promotional emails to potential subscribers to achieve its goal. So, it must decide what design of promotional email messages would help it get the maximum number of new subscribers. This is a cause and effect question because the design of the email message (cause) induces a person receiving the email to purchase the subscription (effect). Common sense dictates that Spotify can analyze email designs used in the past to ascertain the most effective email design. Unfortunately, this common-sense approach is wrong! This is because email designs that are correlated with high subscription rates may not be better. To identify the best email design, Spotify must make a distinction between correlation and causation in data. The gold standard in making this distinction is a randomized control trial (aka, an A/B Test).

Organizations and policymakers in government constantly grapple with such causal questions. For example, firms want to know how does a price change affect the sales of a product, or how to create websites that increase consumer engagement and lead generation; political parties

want to know what messaging on social media sites can boost their political influence, and governments want to know whether allowing parents to pay for private schools using publicly funded vouchers make the education system more effective.

In particular, firms rooted in the digital economy like Netflix, Airbnb, eBay, Groupon, Booking.com, Uber and Amazon, etc. make extensive and continuous use of A/B tests and have a dedicated team of data scientists and IT-personnel to implement, monitor and analyze such tests. Banks and Insurance companies constitute another important sector where the use of A/B testing is ubiquitous.

While A/B tests are the best way to answer causal questions, sometimes they are too expensive, too time taking, or even unethical to implement. In such situations, the only recourse for data scientists is to use observational data to tease out the causal effects of an intervention. Therefore, the course will focus on the design and analysis of A/B tests and also on statistical techniques that can be used with observational data to achieve reliable causal inferences. We will employ a combination of lectures, cases, and other assignments to discuss the course material. The approach is hands-on, exposing students to simulated and real-world datasets, and equipping them with the tools and experience they can leverage immediately on the job.

Student Learning Objectives/Outcomes

1. Appreciate the difference between correlation and causation and understand the limitations of observational data in teasing out causation.
2. Understand why experiments and A-B testing are the gold standards in teasing out causation.
3. Understand how to design, implement, and analyze A-B tests.
4. Learn the role of advanced methods like Fixed Effects and Difference-in-Difference to analyze observational data for causal analysis.

Required Textbooks and Materials

Required Texts

None.

Required Materials

1. **A set of cases is required** for the course. The link to purchase these cases is listed in eLearning under *Course Homepage > Course Information.* All students must buy these cases. The cost of this course-pack is $17.
2. A **simulation software is required** for the course. The link to purchase the simulation is also listed in eLearning under *Course Homepage > Course Information*. All students must buy access to this simulation. The cost of this simulation is $25.

Suggested Course Materials

Suggested Readings and materials are listed in eLearning under *Course Homepage > Course Information.*

Textbooks and bookstore materials can be ordered online or purchased at the UT Dallas Bookstore.

Technical Requirements
In addition to a confident level of computer and Internet literacy, certain minimum technical requirements must be met to enable a successful learning experience. Please review the important technical requirements on the Getting Started with eLearning webpage.

Course Access and Navigation
This course can be accessed using your UT Dallas NetID account on the eLearning website. Please see the course access and navigation section of the Getting Started with eLearning webpage for more information. To become familiar with the eLearning tool, please see the Student eLearning Tutorials webpage. UT Dallas provides eLearning technical support 24 hours a day, 7 days a week. The eLearning Support Center includes a toll-free telephone number for immediate assistance (1-866-588-3192), email request service, and an online chat service.

Communication
For any communication, please use **E-learning emails** only. Otherwise, your email may be missed, and you may not receive any response. The instructor will reply to emails as soon as possible, but sometimes responses may take up to 3 working days.

The instructor and the TA will post several **announcements** during the semester on E-Learning, and you are responsible for checking the course website regularly to ensure that you are up to date with announcements. For more details, please visit the Student eLearning Tutorials webpage for video demonstrations on eLearning tools.

Distance Learning Student Resources
Online students have access to resources including the McDermott Library, Academic Advising, The Office of Student AccessAbility, and many others. Please see the eLearning Current Students webpage for more information.

Student groups
Students are required to form **groups of 4-5 students from the class. The deadline to form the groups is specified in e-Learning**. Do not form groups of more than 5. This group must remain the same throughout the semester for all group tasks.
You will be provided with a peer-evaluation form towards the end of the semester to evaluate your peers. Any student who does not participate fairly in the group tasks is likely to receive bad peer evaluations from others in the group. In such a case, the student's score for peer evaluation will be suitably reduced.

Group Assignments
Several group homework assignments will be given during the semester. **Assignments are due by the specified dates and must only be submitted on the E-Learning site by a single student from each group**. **Direct emails to the instructor or the TA will not be accepted. Assignments submitted after the deadline will be considered late and given a zero.** Completing assignments on time is 100% a student's responsibility. No make-ups will be given for missed assignments.

Quizzes
There will be **a mid-term and a final quiz** during the semester. For each quiz, students will be responsible for making themselves familiar with the materials discussed in the lectures, the

lecture slides, all assigned readings, and any additional content discussed and/or posted on the E-learning site.

The quiz schedule for the mid-term and final quizzes is specified in the academic calendar below.

A make-up quiz can only be given for medical reasons certified by a doctor. However, such a quiz may be may have different questions/ format than the original quiz.

Required Software:
We will use R for data analysis and all students must have R and R-studio installed and ready for use.

Academic Calendar

Date	Lecture No.	Topic	Assessment/ Activity
18 Jan	1	Introduction	Discussion forum
25 Jan	2	A/B tests for causal analysis. Use of R in causal analysis	Discussion forum, Regressions with R for observational data
1 Feb	3	Making business decisions with A/B tests	Discussion forum, Analysis questions
8 Feb	4	Designing A/B tests. What tests to do?	Discussion forum
15 Feb	5	(a) Designing A/B tests (contd.) (b) A/B tests to avoid the interference problem	Discussion forum
22 Feb	6	A/B tests for product design and social networks	Discussion forum Design of an experiment; Targeting consumers based on data
1 Mar	7	A/B tests for website design	Discussion forum
7 March	**Mid-term Quiz**	Covers lecture sessions 1 to 6	
22 March	8	Analysis of A/B tests with regressions. Choosing outcome metrics	Discussion forum Regression analysis for experimental data
29 March	9	Intention to treat and non-compliance	Discussion forum

Date	Lecture No.	Topic	Assessment/ Activity
5 April	10	Quasi-experiments and causal analysis with observational data	Discussion forum Regression specifications and analysis
12 April	11	Application of causal analytics on observational data for designing retailer strategy	Discussion forum A holistic experimental design and analysis
19 April	12	Experimental platforms and introduction to simulation	Discussion forum Individual simulation; Team simulation
26 April	13	Simulation tournament debrief	Discussion forum
1 & 2 May	**Final Quiz**	Covers lecture sessions 7 to 13	

Notes:
(1) There are no classes during the weeks of the mid-term and final quizzes.
(2) The schedule provided is tentative and subject to change at the discretion of the instructor.

Proctored Final Exam Procedures
Students are required to take both quizzes at UTD Testing Center (must make a reservation at least 72 hours prior to the exam date); or at an **off-campus testing center** - please see Distance Learning Exam Proctoring Information page (must submit an application at least 15 business days prior to the exam date).

Class Materials

The instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course; however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Class Participation
Students who fail to participate in class regularly are inviting scholastic difficulty. A portion of the grade for this course is tied to your participation in group activities like homework assignments. Successful participation is defined as consistently adhering to University requirements, as presented in this syllabus. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Class Recordings
Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from

recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Grading Policy

The grades will be based on performance in quizzes, assignments, and simulation. Late submissions will not be graded. The grade distribution across different components will be as follows:

Course Component	Weightage
Mid-term quiz	30%
Final quiz	30%
Group Simulation exercise and report	15%
Group homework assignments	22%
Peer evaluation	3%

Grading Criteria

Your course grade will **depend on your overall score relative to your peers**.

1. The students with scores in the 80th percentile and above will get an A grade.
2. The students with scores between the 80th and the 55th percentile will get an A- grade.
3. The students with scores between the 55th and the 40th percentile will get a B+ grade.
4. The students with scores between the 40th and the 25th percentile will get a B grade.
5. The grade for students with scores below the 25th percentile will be decided by the instructor.

Note: The above is an indicative policy, and it may be adjusted based on the instructor's discretion.

Course Policies

Make-up exams

No make ups will be given except for documented medical reasons.

Extra Credit

None.

Late Work

Any late assignment will not be graded and awarded zero points. Students must make sure to keep up each week with the lectures and any submissions that may be due.

Special Assignments

No assignments will be given to make up for missed assignments etc.

Absence for medical reasons

Only absences for medical reasons certified by a doctor will be considered in case of absences for quizzes etc. A prescription is not enough, and the doctor must clearly state in their note the dates and reasons for your indisposition. Colds, flu, and headaches are not acceptable excuses for missing class, quiz, or failing to submit an assignment on time.

Comet Creed
This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same: *"As a Comet, I pledge honesty, integrity, and service in all that I do."*

Academic Support Resources
The information contained in the following link lists the University's academic support resources for all students. Please go to Academic Support Resources webpage for these policies.

UT Dallas Syllabus Policies and Procedures
The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please review the catalog sections regarding the credit/no credit or pass/fail grading option and withdrawal from class. Please go to UT Dallas Syllabus Policies webpage for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.