

DSGN 160 - Designing through experiments (and experimental design)

**Course Description:** When developing a product, service, website, etc., how do you determine the optimal design features? Instead of relying solely on principles and instinctive intuition, experiments can be employed to generate compelling evidence. In this class, we will learn how to utilize experiments and causal methods to evaluate different designs and enhance the design process. Students will gain insights into how to leverage behavioral economics to devise rigorous and informative experiments, the results of which can be seamlessly integrated into the design framework. Additionally, students will acquire the skills to employ statistical methods for analyzing the outcomes of these experiments. The class will include many examples and applications, as well as a final project to provide opportunities for students to apply the skills they have learnt.

**Lectures:** M-W-F 10-10:50 in DIB 121, Fridays will be lab sessions to either learn to use R or work on the group project.

**Webpage:**

**Course Outline:**

Ch1 Introduction – Why perform experiments?

Part I: Research design and AB testing

Ch2 Basic Statistics.

Ch3 Principles of research design.

Ch4 Principles of A/B testing.

Part II: More advanced techniques

Ch5 Multivariate testing and regression analysis.

Ch6 Factorial design.

*Statistical software:* We will use R with R-studio as an interface on this course, which are both open-source. You are expected to submit your problem set solutions and final project code in R.

*Grading:* There will be weekly quizzes with unlimited attempts until deadline, two R problem sets, one group project, on midterm in class on Friday February 23<sup>rd</sup> and one final on Friday March 22<sup>nd</sup> from 8am to 9:30am (location TBD). The assignments have a total weight of 20% of the final grade (10% for doing the quizzes and 10% for the problem sets), the group project will be worth 40% (of which, 5% is attendance to group lab sessions), the midterm 15% and the final 25% of your final grade. For the project, you will work in small groups to design, execute and analyze an experiment.

**Quizzes:** There will be weekly quizzes from week 2 to week 9 (8 quizzes total), quizzes will close at 11:59pm on Sunday of these weeks. You will have unlimited attempts to complete the quizzes.

*Exam policies:* You may use a calculator, a simple one is enough (phones, PDA's etc are not allowed). All grading problems (exams and problem sets) must be rectified within a week. Makeup exams will only be given if absence is due to medical reasons (Doctors certificate required). In general, makeup exams will be at least as difficult as the regular exam, most likely harder.

*Group project instructions:*

Groups of 4 to 5 students. You must communicate by email your group by January 22<sup>nd</sup>. Please use piazza to facilitate finding a group. You will make progress on your group project throughout the quarter. There are 3 deliverables to ensure you are on track and give you feedback as you progress.

1. Friday 02/02: Submit the project proposal on canvas (max 500 words).  
This proposal should include:
  - a. The question you want to answer with your experiment with a clear statement of the hypothesis.
  - b. Some background on the question (very brief literature review)
  - c. Some reasoning on why the experiment will be useful.
2. Friday 02/26: Submit the experimental protocol on canvas (max 3 pages)  
This protocol should include:
  - a. A statement of the question you are trying to answer.
  - b. A description of the recruiting of participants and the desired sample size
  - c. A description of the outcome(s) you plan to collect and expected results.
  - d. A description of the experimental protocol (timeline, participant enrollment, randomization, data collection, follow-up etc.)
  - e. A discussion of the main threats to the experiment
3. Week of 03/11-03/15 (you will be assigned a slot randomly): Presentation of experiments and results (max 10 minutes and 5 slides). You will present your experiment and its results to the class (at the end of the week on 03/15, you will be asked to submit your slides and code on canvas). The presentation should include.
  - a. A statement of the question you tried to answer.
  - b. A description of the experimental protocol
  - c. A presentation and discussion of the results
  - d. A discussion of the potential weaknesses of your experiment and follow-ups you would conduct

*Office Hours:* Thursdays from 2-3pm on zoom (<https://ucsd.zoom.us/j/92752728516>) or by appointment