## Abbreviated Syllabus

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| **Course Objectives** | |
| **Course Overview** | Research studies are used in many fields, from economics and political science to physics, biology, and medical research. All of them share a need for statistically valid methods for study design and the analysis of results. This course covers the statistical principles and challenges behind randomized and non-randomized studies in these and other fields, highlighting the role statisticians play in the research process. Mathematical theory, examples, and simulations in R are considered in evaluating study designs. |
| **Learning Objectives** | By the end of this course, students will be able to:   * identify the key statistical and scientific goals of research studies; * explain the benefits, drawbacks, and limitations of various study designs and features; * read methods sections of scientific papers, understand the statistical concepts discussed therein, and assess the choices made in the study design; * understand the role of statisticians in the design and execution of studies; * communicate the course concepts to audiences with varying mathematical and statistical backgrounds; * use the mathematical tools of probability and statistics to evaluate study design features; and * explain how scientific goals affect statistical needs and how statistical limitations of study designs shape feasible scientific goals. |
| **Assignments and Grading** | |
| **Engagement** | You are responsible for coming to class having done any readings and ready to discuss and engage with the material (or letting me know in advance if you won’t be able to attend so we can make an alternate plan). Throughout the semester, please ask questions during class and during office hours, and participate fully in group activities. |
| **Homework** | Five homeworks will be assigned roughly every other week throughout the course. These may involve reading reactions, delving more deeply into class topics, or calculating or simulating statistical properties of designs. In many cases, homework questions will go beyond the math covered in class, so be prepared to stretch your statistical thinking! |
| **Midterm Assignment** | I will post a few topics, each with an associated scientific article. You will select one of these topics and write a scientific summary of this article, placing it into context among the designs we have studied. You will also create something to explain this article to a general, non-scientist audience. |
| **Final Project** | In groups of 3 or 4, you will design a scientific study using the principles and designs we have discussed in class. You will conduct a short literature review on the topic and come up with a study design. You will present these results to the class and prepare a scientific paper according to the given template. |
| **Grading** | Engagement 15%  Homework 30%  Midterm Assignment 25%  Final Project 30% |