STA305H1/STA1004H: Experimental Design
Winter 2014

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Office hours: Mondays 12:10 – 13:00

Teaching Assistants: Yun Gao, Zhenhua Lin, Matthew Chang Kit, Haosui Duanmu

Course webpage: Can be accessed through the learning portal

Classroom sessions: Mon 11:00-12:00 in SS2135, Wed 11:00-13:00 in FG103

Course Content
This course will provide an introduction to the fundamental concepts of experimental design and observational studies. Students will be become acquainted with statistical methods used to design and analyze experiments and observational studies. In particular this course will cover: experiments versus observational studies, comparing several entities using a completely randomized design, randomized blocks, Latin squares, incomplete block designs, factorial designs, causal inference in randomized and non-randomized studies, and adjusting for selection bias using propensity score methods.

The learning objectives of this course are:
- Understand the ideas, principles, and considerations that are common to the design and analysis of experiments and observational studies.
- Develop a statistical toolbox of methods for the design and analysis of experiments and observational studies.
- Identify appropriate uses and interpretations of experimental designs, and observational studies, including their strengths and limitations.

Topics to be covered

A First Look at Experiments
Experiments versus observational studies, and causal inference in randomized experiments

Probability and Statistics
A review of probability and statistical methods that are used in experimental design.

Comparing Several Entities
Comparing several entities in an experimental and observational setting and deciding whether differences that are found are likely to be real or due to chance.

Factorial Designs
Factorial designs where each factor has two levels

Selection Bias in Observational Studies
Causal inference in randomized experiments versus observational studies. Introduction to the propensity score and three ways to user the propensity score to adjust for selection bias: matching; sub classification; and direct regression adjustment.

Textbooks

Required
Statistics for Experimenters: Design, Innovation, and Discovery. Box, G.E.P., Hunter, J.S., Hunter, W.G. Wiley 2nd Ed. 2005

Optional
Design and Analysis of Experiments. Dean, A., and Voss, D. Springer. 1999.
UofT link to electronic copy: http://go.utlib.ca/cat/2573215

Design of Observational Studies. Rosenbaum, P. R. Springer 2010.
UofT link to electronic copy: http://go.utlib.ca/cat/7068360

NB: Both optional textbooks are available electronically through the UofT library (i.e., electronic copies of both these textbooks are available at no extra cost)

Evaluation

	Weight*	Date	Time
Four hand-in assignments	15%	Jan. 15, Jan. 22, Jan. 29, Feb. 5	Due at 11:10
Factorial design assignment	15%	March 26	Due at 11:10
Term test	30%	Feb. 12	11:10-12:40
Final exam	40%	Scheduled by Faculty	

* If your final exam mark is better than your term test mark then the exam weight will be 55% and the term test weight will be 15%.

Computing

We will use R for all examples. R is freely available for download at http://cran.r-project.org for Windows, Mac, and Linux operating systems. For the test and exam, you will need to know how to interpret output from R. We will support the use of R to complete the assignments. If you wish to use other statistical software such as SAS or SPSS to complete the assignments you may do so, but we will not be providing sample code for you to complete the assignments in other languages.

If you wish to use R at UofT then you will need to sign up for a CQUEST account. To get an account and find out more information about using CQUEST go to http://www.cquest.utoronto.ca

I am assuming that students have never used R before. I will provide you with the R syntax for all examples in lecture, which should be sufficient for you to do your assignments.

Calculators
You will need a calculator. Any calculator that has logarithmic functions will be sufficient. Calculators on phones or other devices equipped to communicate with the outside world (for example, through the internet or cellular or satellite phone networks) will not be permitted during the term test and the final exam.

Additional help

Need extra help with the coursework? Here are some options:
For continued class discussion and questions outside of class, try posting on the discussion forums. The instructor and TAs will be monitoring them regularly.
You can visit your instructor or the teaching assistants during their office hours.

There is a drop-in Statistics Aid Centre in New College: Wetmore Hall 68A. See http://www.utstat.toronto.edu/wordpress/?page id=154 for the schedule. E-mail should only be used for emergencies or personal matters.

Assignments
Assignments are always due at 11:10 the beginning of class on the due date. Any assignments handed in later than 11:10 will be considered late, and will not be accepted without documentation of a valid reason.

Term test and exam
The test will be written during class time but in a room other than the usual classroom (location to be announced).

You are allowed a two-sided 8-1/2"x 11" (standard letter size) hand-written aid sheet on the term test and a two-sided hand-written aid sheet on the final exam. You must bring your student identification to the term test and the final exam.

You will not need to know R syntax on the tests and exam, but you will need to know how to interpret output from R.

Missed Tests
If a test is missed for a valid reason, you must submit the University of Toronto Student Medical Certificate, completed by your doctor, to your instructor within one week of the test. Print on it your name, student number, and date. If documentation is not received in time, your test mark will be zero. If a test is missed for a valid reason, its weight will be shifted to the final exam.

Marking concerns
Any requests to have marked work re-evaluated must be made in writing within two weeks of the date the work was returned to the class. The request must contain a justification for consideration.

How to communicate with your instructor
Questions about course material such as:
How do I do question 3.7 in the textbook?
What is standard deviation?
When is the midterm?

Can be posted on the discussion forums. Questions can be posted anonymously (so that the author is anonymous to other students but not to the instructors), if desired.

For private communication, such as: I missed the test because I was ill e-mail your instructor.

Use your utoronto.ca e-mail account to ensure that your message doesn't automatically go to a Junk folder and include your full name and student number.

Academic integrity

You are responsible for knowing the content of the University of Toronto's Code of Behaviour on Academic Matters at http://www.governingcouncil.utoronto.ca/policies/behaveac.htm. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact your instructor.

Accessibility needs

The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom, or course materials, please contact Accessibility Services as soon as possible: accessibility.services@utoronto.ca or http://accessibility.utoronto.ca.

Your responsibilities

The classroom sessions for this class is designed to actively engage you in the course material. We hope you'll find them interesting, challenging, and fun, and an excellent opportunity to truly learn the material. In order for these sessions to be effective, coming prepared, by learning about the week's concepts through the textbook, is essential.