Introduction to Probability and Statistics  
(MATH8A) - Fall 2015

Instructor: Olivier Bernardi

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**Office hours:** (to be confirmed) 2.30-3.30 on Tuesdays and 3.30-4.30 on Fridays.

**Course description and objective:** The goal of this class is to provide the theoretical and practical tools to analyze large data sets, in view of extracting some concrete, concise, and precise knowledge. For instance, consider such questions as

1. Does reducing class size improve elementary school education?
2. Is there gender discrimination in the market for home loans?
3. How much do cigarette taxes reduce smoking?

To answer such questions, one needs to collect large sets of data, and analyze them in order to extract useful information from it. The theoretical tools needed to think about the data sets are provided by probability theory (the mathematical framework for thinking about non-deterministic phenomena). The practical tools needed to extract information from data sets are given by statistical methods (the methods for formulating and testing hypotheses about data).

**Expectation of students’ effort:** Success in this course is based on the expectation that students will spend a minimum of 9 hours of study time per week in preparation for class (reviewing class material, completing homeworks, preparation for exams, etc.).
Learning goals: The students should acquire the skills allowing them to deal with large data set (use to analyse a non-deterministic phenomenon) and extract information from it. In particular,

- Describe concisely some information contained in a data-set (that is, describe statistical variables).
- Understand how to perform and interpret a “linear regression” between two statistical variables from a data set.
- Learn the techniques and pitfalls of data collection.
- Understand probability theory, that is, the mathematical framework in which non-deterministic phenomenons can be analyzed.
- Understand how to use data to test precise hypotheses about non-deterministic phenomenon, and how to interpret the results of such tests (perform and interpret confidence intervals and statistical hypotheses).

Textbook: We will use the book *Intro Stats, 4th edition* by De Veaux, Velleman and Bock. The textbook is required for the class, but the accompanying CD is NOT required.

Prerequisite: There is no prerequisite for this class. While calculus knowledge is helpful, the class is designed to be followed by students who have not taken the calculus classes (MATH05, MATH10).

Course plan: The schedule for the semester is as follows: (1 session is 80 minutes - there are 27 sessions this semester).

1. Description of statistical variables (1 or 2 variables, either qualitative or quantitative) (Part I of textbook, 5 sessions)
2. Linear regression for a pair of two quantitative variables (Part II of textbook, 5 sessions)
3. Data collections techniques (Part III of textbook, 3 sessions)
4. Probability theory (Part IV of textbook, 6 sessions)
5. Statistical analysis: confidence intervals and hypothesis testing for quantitative variables (Part V of textbook, 8 sessions)
**Grading Policy:** The grade will be based at 25% on the weekly homework assignments and at 75% on three midterms (25% each).

**Late homework policy:** You will get a 10 points penalty if you are late by less than 24 hours. After 24 hours, the homework will not be accepted, unless you get a special extension to be requested and approved in advance.

**Date of midterms:** (to be confirmed) October 2nd, October 30th, December 4th. These are in-class 80-minutes midterms. There will be no final for the class.

**Disabilities:** If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please see me immediately.

**Academic Integrity:** You are expected to be familiar with, and to follow, the University’s policies on academic integrity. Please consult Brandeis University Rights and Responsibilities for all policies and procedures. All policies related to academic integrity apply to in-class and take home projects, assignments, exams, and quizzes. Students may only collaborate on assignments with permission from the instructor. Allegations of alleged academic dishonesty will be forwarded to the Director of Academic Integrity. Sanctions for academic dishonesty can include failing grades and/or suspension from the university.