

# MA151 – Introduction to Statistics

Course Times: Mon & Wed, 17:30 – 19:00

Seminar Leader: Dr. Seraphine F. Maerz

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## Course Description

The goal of this course is to introduce students to quantitative methods in political science and economics. The course covers the basics of descriptive and inferential statistics, including probability theory, hypothesis testing, and regression analysis. To facilitate students' ability to understand and critically engage with these methods, examples of quantitative social science research are discussed throughout the course. Classes are complemented with exercises to build students' skills in applying the learned methods independently. Many of these exercises use data from public opinion surveys, which cover a wide range of social, economic, and political topics. Working with this survey data, students will also have the opportunity to explore research questions of their own. At the end of the course, students will be able to read and engage with the majority of modern quantitative research. They also will be well prepared to pursue a variety of more advanced quantitative research courses.

## Requirements

### Prerequisites

Calculus and linear algebra as covered in MA120 Mathematics for Economics.

### Attendance & Participation

**Students are expected to attend ALL classes.** This is especially important for a methods class where every class builds on the previous. If you miss a class, it is your responsibility to catch up on the missed material immediately. In addition to doing the readings, talk to me or one of your class mates about what you missed in class. More than two absences (that is absences from two sessions of 90 minutes) in a semester will significantly affect the participation grade for the course. Please consult the Student Handbook for regulations governing periods of illness or leaves of absence. Everybody is expected to participate actively in class.

### Readings

Unless otherwise indicated, readings are mandatory and to be completed BEFORE class. Reading will greatly facilitate your learning experience. Ideally you will have a set of questions prepared for every class, so that we can discuss together issues which are unclear.

### Assignments

Problem sets will be assigned as take-home exercises. These are either to be completed by hand or in Open Office. Problem sets are due Wednesdays, by the beginning of class. There is a total of five graded problem sets, whereby the lowest-graded one will not count towards your final grade.

### Mid-Term Exam

The mid-term exam takes place a bit earlier than half way through the course, on **March 20**. The exam focuses on the statistical techniques covered until then and includes conceptual question and statistical exercises. The exam is closed books, but you may bring a hand-written “cheat sheet” (A5, two-sided). Calculators without graphing capabilities are allowed (no phones!). If you are uncertain whether your calculator has graphing capabilities show it to me or send me a picture of it (at least a week before the exam).

### Research Project and Final Research Report

As part of the course, every student conducts an independent research project on a question of their own interest. I will provide survey data that you can use for the project. This data covers a wide (but limited) range of topics and countries. If you want to cover other topics or places in your project, you are free to use other data sources or to collect your own data. However, as this is more challenging, please talk to me about it as early as possible. The final product of your project is a research report, which is due at the end of the course. A template for the report will be provided.

- To assist the implementation of your project you are required to submit a **research plan** (based on the research template) by **April 26, 23:59**. This plan needs to motivate your research question, lay out your hypotheses and the data and methods you plan on using. I will provide you with quick feedback so that you can continue with the statistical analyses of your project.
- In week 14, we will hold a **research workshop** in which every student presents preliminary results of their research project. Presentation slides have to be submitted by **May 5, 23:59**. Following each presentation, the project will be shortly discussed, and all students are expected to actively participate with questions and suggestions. The point of the discussion is to give the presenter helpful input that will help them in finalizing their analyses and in writing up the research report. Presentation and discussion time will be adjusted to class size, about 5 minutes each.
- The final **research report** is due on **May 17, 23:59**. Together with this report, you have to submit OpenOffice spreadsheets that show how you conducted the analysis. These spreadsheets need to include the original data and lay out the full path of how results were derived (including annotations of statistical procedures).

### Computer Requirements

Throughout the course you learn how to apply statistical techniques both by hand and with the help of your computer. Please bring a laptop to all sessions marked with a star (\*). The program we are using is *Open Office Calc*, which is similar to MS Excel but freely available. Please make sure to install Open Office Calc (Version 4.1.5) before we begin using the laptops in class (install files and instruction are available from [www.openoffice.org](http://www.openoffice.org)). If you do not have access to a laptop that runs Open Office Calc or have problems installing it, let me know in the first week of the course.

### Academic Integrity

Academic community builds on original scholarly work and a constant exchange of ideas. It is therefore imperative to fully acknowledge one's use of other people's work, be it as a quotation or by paraphrasing it. Failure to acknowledge any source, also called plagiarism, leads to downgrading, and possible failure of the course if done repeatedly (see also the *Academic Integrity* clause in the student handbook). Please note that specialized software makes it extremely easy to discover plagiarism. Proper acknowledgement is done by citing the respective source, indicating the name(s) of the authors or institutions and date of publication. A reference list at the end of your document then lists details of all citations, e.g. names, dates, title of publication, publisher. There are different citation styles. I recommend the widely used Harvard style, but you may use any other as long as you use it consistently.

### Policy on Late Submission of Papers

In line with the Student Handbook the following rules apply to late submissions of all assignments: *submissions that are up to 24 hours late will be downgraded one full grade (from B+ to C+, for example). Instructors are not obliged to accept essays that are more than 24 hours late. Where an instructor agrees to accept a late essay, it must be submitted within four weeks of the deadline and cannot receive a grade of higher than C. Thereafter, the student will receive a failing grade for the assignment.*

### Grade Breakdown

- Problem Sets (30%)
- Mid-Term (25%)
- Research Project (25%)
- Participation (20%)
  - In-class
  - Presentation in project workshop
  - Participation in project workshop

### Readings

Readings are to be completed before each class as listed in the schedule. All readings are mandatory. The main textbook of this course is **Gravetter & Wallnau, 2013, *Statistics for the Behavioral Sciences*, 9<sup>th</sup> edition** (henceforth, "GW"). Two copies are available in the library. If you get your own copy, make sure you get the same edition that we use for the course.

### Schedule

#### Week 01

##### Session 01 – Welcome: What is quantitative research (good for)?

- Readings
  - GW, Chapter 1.
- Install OpenOffice Calc

##### Session 02 – Variables, scales, frequencies

- Readings
  - GW, Chapter 2.1-5.

## Week 02 – Working with Open Office

Problem Set 1 (due Wednesday)

### Session 03 – Data manipulation and visualization in OpenOffice

- Readings
  - OpenOffice.org 3.3 Calc Guide (2011), Chapters 2 & 3.

### Session 04\* – Lab

## Week 03 – Describing data

### Session 05 – Measures of central tendency and variability

- Readings
  - GW, Chapter 3 & 4.

### Session 06\* – Lab

## Week 04 – Standardization (z-scores) and probability

Problem Set 2 (due Wednesday)

### Session 07 – Standardizing scores and distributions for comparability

- Readings
  - GW, Chapter 5.

### Session 08 – Introducing probability

- Readings
  - GW, Chapter 6.

## Week 05 – Basics of inferential statistics

### Session 09 – Probability and samples

- Readings
  - GW, Chapter 7.

### Session 10 – Introducing hypothesis testing

- Readings
  - GW, Chapter 8.

Week 06 – Testing hypotheses about population means

Problem Set 3 (due Wednesday)

Session 11\* – One-sample t-tests (+Lab)

- Readings
  - GW, Chapter 9.

Session 12\* – Lab

Week 07 – Testing hypotheses about differences in means

Problem Set 4 (due Wednesday)

Session 13\* – Independent samples t-test (+Lab)

- Readings
  - GW, Chapter 10.

Session 14 – Recap session

Week 08 – Exam

Session 15\* – Related samples t-test (+Lab)

- Readings
  - GW, Chapter 11.

Session 16 – MID-TERM-EXAM

Week 09 – Testing hypotheses about relationships: continuous variables

Session 17 – Exam review and road ahead: Conducting a research project

Session 18 – Pearson's correlation

- Readings
  - GW, Chapter 15.1-4.

Week 10 – Testing hypotheses about relationships: continuous variables

Problem Set 5 (due Wednesday)

Session 19 – Spearman's and partial correlation

- Readings
  - GW, Chapter 15.5.

Session 20\* – Lab

Week 11 – NO STATISTICS CLASSES

(we will have two extra lab sessions in completion week instead)

\*\*\* SPRING BREAK \*\*\*

Week 12 – Testing hypotheses about relationships: Categorical variables

Research plans (due Friday!)

Session 21 – No classes (public holiday)

Session 22\* – Chi-squared test (+Lab)

- Readings
  - GW, Chapter 17.

Week 13 – Outlook: Regression analysis

Session 23\* – Linear regression (+Lab)

- Readings
  - GW, Chapter 16.1-3.

Session 24 – No classes (public holiday)

Week 14 – Research project workshop

Slides due on Sunday, May 5

Session 25 – Project presentations

Session 26 – Project presentations

Week 15 – Completion Week

Research project (due Friday)

Session 27 – Extra lab session I (assistance for research project)

Session 28 – Extra lab session II (assistance for research project)