

Introduction to Statistical Inference

36 - 226: Course policies and syllabus, Spring 2013

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Instructor's Office Hours: Tuesday 12:30PM – 1:30PM, Baker Hall 228C

Teaching Assistants and office hours:

Giuseppe Vinci (gvinci@andrew.cmu.edu), office hours Tuesdays 8:00AM - 10:00AM, FMS 320
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Lectures: MWF 9:30AM – 10:20AM, Gates Hillman Complex 4401

Prerequisite: 15-359 or 21-325 or 36-217 or 36-225 (or equivalent) **Units:** 9

Course Website: <http://www.cmu.edu/blackboard/>

REQUIRED TEXTBOOK

Moore et al., “Mathematical Statistics with Applications” 7th Edition, Brooks/Cole, Cengage Learning, 2008. If you choose to use an earlier edition, you are responsible for ensuring that you read the correct sections and do the correct exercises.

COURSE DESCRIPTION

In recent years, the growth of statistics has made itself felt in almost every phase of human activity. Statistics no longer consists merely of the collection of data and their presentation in charts and tables (*descriptive statistics*) - it is now considered to encompass the science of basing inferences on observed data and the entire problem of making decisions in the face of uncertainty (*inferential statistics*). This covers considerable ground since uncertainties are met when we flip a coin, when a dietician experiments with food additives, when an actuary determines life expectancy, when a quality control engineer accepts or rejects manufactured products, when a teacher compares the abilities of students, when an economist forecasts market trends, when a newspaper predicts an election, and so forth.

It would be presumptuous to say that statistics, in its present state of development, can handle all situations involving uncertainties, but new techniques are constantly being developed and modern statistics can, at least, provide the framework for looking at these situations in a logical and systematic fashion. In other words, statistics provides the formalisms that are needed to study situations involving uncertainties.

This course, using the probability theory developed in 36 - 225, deals with the basic ideas and methods of analyzing data and making inferences about an unknown population based on information contained in a sample. We will study the formalisms behind frequently used statistical methods, and develop a link between statistical theory and practice. In addition, we will emphasize the application of statistical methods and the interpretation and the analysis of data.

OBJECTIVES

This course is the second half of a year long course in probability and mathematical statistics. Topics include point and interval estimation, properties of estimators, maximum likelihood estimation, and hypothesis testing. If time permits there will also be a discussion of linear regression and the analysis of variance.

- To introduce the basic ideas and methods that underlie the mathematical theory of statistics.
- To develop and use methods for summarizing and evaluating numerical data.
- To develop skills in the applications of statistical methods to problems in the sciences and the social sciences, including specification of models, assessment of model assumptions, and interpretation of results.
- To learn to use a statistical package, e.g. R, to analyze data.

COURSE STRUCTURE AND POLICIES

Homework. Homework will be assigned by 5 PM every Wednesday and due at the beginning of class the following Wednesday unless otherwise noted. The assignment will include pages of the textbook to read along with a problem set. Your lowest weekly homework grade will be dropped at the end of the semester - **this is to account for illness, emergencies, technical issues, etc.** *You will be able to find the assignment on the course's Blackboard website.*

The purpose of these assignments is to help you learn the material. It is okay to discuss an assignment with other students *but the written solutions to homework problems must be your own and not copied from someone else.*

- **Format.** Write your full name, the course number, and the homework number at the top of each page. **STAPLE** your entire assignment together with a staple (not with a paper clip, folding the pages together, etc.). It is your responsibility to make your homework legible - if the grader cannot read your work, you will receive a zero on the assignment. *Electronic submission of homework assignments is not accepted.*
- **Show all your work.** You will not receive credit for simply writing down a numerical answer even if the calculations seem simple enough to do in your head. Showing the method of solution is as important as the correct answer.
- **Homeworks are due at the beginning of class.** An assignment turned in before the end of class will be accepted but PENALIZED 10 PERCENT FOR BEING LATE; assignments turned in by 12 noon on the day that the assignment is due will be accepted but will be PENALIZED 15 PERCENT; assignments turned in after 12 noon **WILL NOT RECEIVE ANY POINTS**, but will be corrected in order to give you feedback on your work. No assignments will be accepted after 4:00 PM on the day it is due. *No excuses please.*
- Assignments are designed to take on average of about 6 hours to complete. Please start homeworks early so that you can get help if you need it. Each homework assignment will be worth 100 points. These points will be divided approximately equally among each of the parts of the assignment.

- SOLUTIONS will usually be available on Blackboard following the next lecture. The solutions will provide you with examples of what a complete answer should look like. *Read them.*

Exams. There will be three midterm exams. Examinations are *tentatively* scheduled for 6:00 - 7:30 PM on the evenings of **Thursday, February 21**, **Thursday, March 28**, and **Tuesday, April 30**. The exams will be closed-book and closed-notes, except that you may use one 8.5" by 11" sheet of paper (both sides) with whatever formulas, facts, or explanations you find helpful. Computers are not permitted, but calculators may be used. All exams are required and there will be no make-up exams.

- A student who misses an examination because of a medical reason must provide *documented* evidence of medical incapacitation to Professor Cisewski. Other reasons for missing an examination must be discussed with Professor Cisewski as soon as possible *before* the day of the examination. Each case will be considered on an individual basis.
- There will also be a *cumulative* final examination. The day and time for the final exam are determined by the registrar and will be announced during the semester. Travel plans for the end for the semester are made at your own risk.

COURSE AND EXAM SCHEDULE

Homework	Weekly (in class)	20%
Exam 1	Thursday, February 21 (6 - 7:30 PM)	20%
Exam 2	Thursday, March 28 (6 - 7:30 PM)	20%
Exam 3	Tuesday, April 30 (6 - 7:30 PM)	20%
Final Exam	TBD*	30%
Total		100%**

*Please do NOT make travel plans until the date of the final has been set.

**Of Exams 1, 2 and 3, the one corresponding to your lowest score will be reduced in weight from 20% to 10%.

Course grade. Your overall course score will be determined as a weighted average of each element as noted above. A letter grade will be assigned based on:

A: 90 - 100 **B:** 80 - 90 **C:** 70 - 80 **D:** 60 - 70 **F:** Below 60

If adjustments are made to this grading scale, it will only be in a direction that will result in a higher letter grade.

Emails. Be advised that sending an email to the instructor or a teaching assistant does not create a responsibility or obligation to respond to it. Sending us an email does not shift any responsibility from you to us; you are still responsible for the ontime, high quality completion of assignments. Do not send complicated questions or requests to us via email. Replies will not be given for email questions or problems requiring lengthy (more than a couple of sentences) or complicated responses. These types of communications should be done in person.

Office hours. The purpose of office hours is to provide you with an opportunity for additional conversation, guidance or help. Please feel free to come to our office hours at the time designated

above. If you are not able to attend Professor Cisewski's office hour, she would be happy to meet with you at a different time; *please email her to set up an appointment*.

Grades and regrades. Course grades will appear on the Blackboard site. Each student is responsible for verifying his or her recorded scores during the semester.

Although we strive for consistency and accuracy in grading, we understand that grading errors can occur.

- We will gladly correct all errors in tabulation or overlooked material.
- All regrading requests must be accompanied by a written statement carefully highlighting and explaining the items that were misgraded. Note that regrading requests can end in a positive, negative, or no change in points.
- Regrade requests should be submitted to the instructor within one week of when the assignment or exam is returned.

Statistical software. In this class you will be given the opportunity to work with **R**, a package commonly used by statisticians. **R** is free and can be downloaded at <http://www.r-project.org>.

Honor Code. The Honor Code will be observed at all times in this course. The ethical guidelines and cheating and plagiarism policies defined in the *Student Handbook* at <http://www.cmu.edu/policies/documents/Cheating.html>. You will be held accountable for violations of these guidelines and policies that come to our attention. We encourage you to be helpful to your classmates and to work together, the work you turn in must be your own. Any student who turns in work for credit that is identical, or similar beyond coincidence, to that of another student may face appropriate disciplinary action at the department, college, or university level. *Cheating and/or plagiarism will not be tolerated.*

Attendance. Attendance is expected and you will be asked to perform in-class work. Note that the lectures may cover some material that is not covered in the text, or covered in a different order. Only the combination of class lectures, homework sets, and your own reading will give you full exposure to the material and prepare you adequately for examinations.

Study skills and time management. Planning and time management are essential skills for academic success. It is essential that you make every effort to keep up with the lectures, readings and assignments. Manage your time effectively and bear in mind that you are ultimately responsible for your own performance in this course. Plan to start each assignment early so that you finish on time. This strategy will allow you to have time for questions or react to any problems. We do not want to hear excuses for failure to complete your work on time or at a low quality. Your procrastination or failure to manage your time effectively will not be considered as an extenuating circumstance for poor performance.