

Mathematical Statistics

Instructor: E. D. Nordmoe
Meeting Hours: MWF 8:30–9:45
Office: OU 210A
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Purpose

To master the theory and application of the core ideas of estimation and statistical inference.

Description

Major topics of this course are:

1. **Statistics and Sampling Distributions:** sampling and the idea of sampling distributions; sampling distributions related to the normal distribution; the Central Limit theorem and its applications in statistics.
2. **Properties of Point Estimators and Methods of Estimation:** Criteria for evaluating estimators; minimum-variance unbiased estimators; estimation by the method of moments and by maximum likelihood.
3. **Interval Estimation:** properties of confidence intervals; constructing confidence intervals for means and proportions.
4. **Hypothesis Testing:** common hypothesis tests; Type I and Type II errors; relationship to confidence intervals; power of tests.
5. **Regression and Correlation:** linear statistical models; simple linear regression and the method of least squares; properties and inference for least squares parameter estimators; using least squares models for prediction; multiple regression.

Texts

Required: *Modern Mathematical Statistics with Applications*, Devore and Berk, 2006.

Recommended: *Student Solutions Manual for Devore/Berk's Modern Mathematical Statistics with Applications*, 2006.

Evaluation

Grades will be computed from performance on the following components using the corresponding weights:

Component	Weight
Homework assignments and participation	25%
Project	15%
Midterm exams	30%
Final exam	30%

Tentative Schedule

Week(s)	Topics	DB Readings
I–II	Statistics and Sampling Distributions	6.1–6.4
III–IV(a)	Point Estimation	7.1–7.3
IV(b)–V	Interval Estimation	8.1–8.5
VI–IX(a)	Hypothesis Testing and Two-sample Inference	9.1–9.4, 10.1–10.4, 10.6
IX(b)–X	Regression and Correlation	12.1–12.5

Exams

The tentative schedule of exams is as follows:

Midterm I	January 29 (Thursday, Week 4)
Midterm II	February 19 (Thursday, Week 7)
Final Exam	Take-home, due date TBA

Homework assignments

At the end of most sessions, I will assign *warm-up* odd-numbered exercises from our text (DB) corresponding to material discussed in class. These problems should be worked and checked against the answers in the back of the book or the detailed solutions provided in the Student Solutions Manual for this text. You should come to class prepared to discuss these problems and to ask questions about any problems you were unable to solve. For most warm-up problems, I will assign one person to present a solution to the group. Your presentation should include explanation of the solution process rather than simply reproducing the solution from the manual.

Write-ups of additional even-numbered *hand-in* problems will typically be collected at the class following the one at which the corresponding warm-ups were discussed. Hand-in problems will typically be graded on a 0 to 2 scale where 2 represents essentially correct, 1 represents partially correct, and 0 represents incorrect. Solutions are expected to be complete, well-organized, and clearly written. Students are welcome to *collaborate* on solving homework assignments but NOT in preparing the write-ups of the solutions. All final write-ups of solutions must be done independently.

Warm-up and hand-in problem assignments as well as required readings will be posted on the class website <http://kzoo.edu/enordmoe/math365>.

Computer software

From time to time, we will use the statistical software package R to illustrate theoretical concepts in statistics via graphics and simulations. Since the use of software is essential in both applied and theoretical work, I will assign several separate assignments during the term that will require the use of R to investigate and/or illustrate theoretical concepts discussed in the classroom. The R package is open source and may be freely downloaded to your personal computer (see links on the home page for this class). It is also available in many of the open labs on campus. We will spend some time during our first week getting acquainted or re-acquainted with R.

Attendance

It is expected that wise students will recognize the value of classroom learning and discussion; such recognition will inevitably be manifested by their daily presence in class. Absences will adversely effect the participation portion of your homework grade. If you must miss a class for a legitimate reason, you should be sure to consult one of your colleagues to find out what you missed. The instructor will *not* provide copies of notes or handouts for students absent from the normal class session (except in special circumstances when advance notice has been given).

Project

Working individually or in pairs, students will investigate in depth a concept in probability with an accompanying write-up in the form of a paper or poster. Details will be provided later.

Academic dishonesty

Representing another's work as one's own (i.e., copying) is not acceptable and will result in failure of the course.

Special accommodation

Any student who needs an accommodation or other assistance in this course should let me know as soon as possible.