

MATHEMATICS 271 THE ELEMENTS OF APPLIED STATISTICS

I. Introduction

A. Catalog Description

A modern introduction to statistics concentrating on statistical concepts and the "why and when" of statistical methodology. The focus of the course is the process of learning to ask appropriate questions, to collect data effectively, to summarize and interpret that information, and to understand the limitations of statistical inference. Statistical software is used in the analysis of data and in statistical inference.
Prerequisite: Three years of high school mathematics. Satisfies the Mathematical Reasoning core requirement.

B. Objectives

The primary objective of the introductory statistics course is to introduce students to variability and uncertainty and to some common concepts of statistics. Statistical thinking is central to education. Liberated by modern computing tools, students of statistics are free to concentrate on statistical concepts and the role of statistics in understanding our quantitative world.

Mathematics 271 is a modern introduction to statistics concentrating on statistical concepts and the "why and when" of statistical methodology. Primarily, the student will learn about the process of learning to ask appropriate questions, to collect data effectively, to summarize and interpret that information, and to understand the limitations of statistical inference. Statistical software is used in the analysis of data and in statistical inference.

A secondary objective of the introductory statistics course is to teach the student some common statistical techniques and their application in a variety of fields.

This course satisfies the Mathematical Approaches category of the university's core curriculum by developing an appreciation of the power of Mathematics and formal methods to provide a way of understanding a problem unambiguously, describing its relation to other problems, and specifying clearly an approach to its solution. A student in this course will develop a variety of mathematical skills, an understanding of formal reasoning, and a facility with applications. Specifically, this course will provide the student with the ability to work with numeric data, to reason from those data, and to understand what can and can not be inferred from those data.

C. Prerequisites

Three years of high school mathematics.

II. Required Topics

A. Data Analysis

1. Graphical and tabular methods for investigating distributions of a single variable
2. Numerical summary measures for distributions of a single variable
3. Graphical and tabular methods for exploring relationships of two variables
4. Numerical measures of association of two variables
5. A descriptive use of regression

B. Data Collection

1. The reasons for the systematic collection of data
2. Some Sample Survey basics
3. Some fundamental principles of Experimental Design

C. Probability and Sampling Distributions

1. Basic concepts
2. Simple discrete univariate probability distributions
3. Expectation and variance of discrete random variables
4. Binomial probability distribution
5. Continuous probability distributions
6. Normal probability distribution
7. Mean and variance of a sum of independent random variables
8. Sampling distribution of a sample mean
9. Central Limit Theorem
10. Sampling distribution of a sample proportion

D. Statistical Inference

1. Introduction to interval estimation - large samples
2. Introduction to significance testing - large samples
3. The use and abuse of tests
4. Inferences for population means - small samples; dealing with nonnormal populations
5. Inferences for population proportions
6. Comparison of two populations
7. Inference for two-way tables
8. Inference in the regression setting

III. Optional Topics

- A. Analysis of variance
- B. Nonparametric methods
- C. Quality control

IV. Bibliography

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|---------------------------|---|
| Moore, D. & McCabe, G. | <u>Introduction to the Practice of Statistics</u> , Freeman |
| Freedman, Pisani & Purvis | <u>Statistics</u> , Norton |
| Devore, J. & R. Peck | <u>Statistics</u> , Duxbury |
| Moore, D. | <u>The Basic Practice of Statistics</u> , Freeman |

V. Assessment Tools

Assessment of the extent to which a student meets the course objectives will be measured with homework assignments, quizzes, computer exercises, case studies and/or projects, and examinations.