Math 108
Elementary Statistics

Advising

The concepts introduced in this core course would be useful for any student looking for an understanding of modern statistics.

This course is a requirement for Business Management and Economics majors, and should be taken early in their program.

This course is a good preparation for the methods courses offered in other departments. However, this is a conceptual course, not a methods course.

Catalog Description

An introduction to basic concepts and techniques of statistics for students needing skills for research techniques in education, business, and the physical, life, and social sciences or to simply understand the mass of information in daily life. Topics included: graphical techniques such as histograms or box plots; measures of location and spread; scatter plots and correlation, sampling and sampling distribution, estimation and statistical inference (confidence intervals and/or hypothesis testing). Pre-requisites: High School Algebra II or Math 0103.

Course Objectives

Descriptive stats: Students will develop the skills to interpret and evaluate statistical results. They will be able to judge the validity of an experimental set-up, and design experiments. The abuses of statistics are discussed together with common mistakes and misconceptions. Students will learn how to represent data both graphically and using descriptive statistics. While students will compute parameters such as mean, standard deviation, skewness etc., the main focus will be on the interpretation of these statistical measures. Students will be introduced to the concept of probability and probability distributions and their properties.

Inferential stats: Students will learn how to investigate a claim and come up with a conclusion. They gain an appreciation for the power of statistics and an understanding of its limitations. The concepts of confidence and significance are discussed. Recognizing the extensive use of software in the work place today, the focus is again on using proper methods and set-ups, and on the interpretation of results.

Instructional Objectives

The students will understand and be able to compute, create, and interpret:
1. types of samples and data
2. experiment design
3. graphical representation of data (histogram, box plots)
4. measures of center and their implications (mean, median, mode, midrange)
5. measures of variation and their interpretation (range, standard deviation, variance, min, max)
6. measures of position (percentiles, quartiles, z-score)

7. detection of outliers, unusual and extreme values
8. Chebychev's theorem and the empirical rule
9. probability and probability distributions, expected values
10. Law of large numbers
11. binomial, uniform, and normal distribution
12. how to use the normal distribution to find probabilities given a data point and a data point given a probability
13. Rare event rule
14. Central limit theorem
15. how to compute confidence intervals for mean, proportion, standard deviation
    meaning of confidence level
    computation of margin of error
    choosing the correct distribution
    determining sample size
16. student-t distribution and χ^2- distribution
17. Correlation and regression
    how to choose an appropriate model
    how to interpret the r-value
18. hypothesis testing for claims about mean, proportion, standard deviation
    phrasing H_o and H_1
    meaning of the significance of a test
    type 1 and type 2 error
    how to choose a test statistic
    p-value method
    traditional method
    how to phrase conclusions

Some of topics 15, 16, 17, 18 may be omitted as time requires. However, an introduction to the general concepts is desirable.

Appropriate Texts: Appropriate texts that have been used in the past include:

Elementary Statistics, Picturing the World, 2nd edition, by Ron Larson. ISBN: 0130-659-38X, 3rd edition coming out 1/05. Prentice Hall

Essentials of Statistics, 2nd edition, by Triola. ISBN: 0201-771-292, Addison Wesley.

Core status

Math 108 is a core mathematics course satisfying the "Traditional Mathematics" sub-area. It satisfies these areas in the following ways (from the 1997 Core Inclusion Form):

COURSE OBJECTIVES

1. Recognize, understand, utilize, integrate and communicate mathematical concepts, mathematical methods and logical reasoning.

Students analyze problems to decide what statistical technique is appropriate, carry out data analyses, communicate results, and use the logic of statistical inference.

2. Apply mathematical concepts, mathematical methods, and mathematical reasoning within an analytic framework.

Statistical techniques, statistical reasoning are applied to problems from business, education, and the sciences.

4. Conceptualize and utilize algorithms and formal mathematical structures.

Algorithms for statistical calculations are studied and used. Formal mathematical structures such as intervals, probability formalism, and inequalities are used.

COURSE REQUIREMENTS (TRADITIONAL MATHEMATICS)

1. Introduce traditional mathematical concepts, constructs, systems, algorithms, and methods of inquiry and analysis.

Statistical techniques are studied in detail. Statistical reasoning and concepts are analyzed. Applications of data analysis to various problems are carried out.

2. Provide an environment where students can construct, investigate, learn, and/or apply those attributes described in Course Requirement 1.

Students solve problems in homework and in class, do projects and presentations, and discuss the results.