Stat 50 : Introduction to Probability and Statistics

California State University, Sacramento · Department of Mathematics & Statistics

This course is intended for students who have completed one semester of calculus and who wish to take an introductory course in probability and statistics. Statistics 50 concentrates on the fundamentals of probability, sample spaces, combinatorics, and random variables. Density and distribution functions, expectation, variance, and covariance, the binomial, uniform poisson, negative binomial, hypergeometric, exponential, and normal distributions, gamma beta, central limit theorem, confidence interval estimation, and hypothesis tests. Students will be given periodic writing assignments which encourage them to think through concepts of the course.

Catalog Description

Sample spaces, combinatorics, and random variables. Density and distribution functions. Expectation, variance, and covariance. The binomial, uniform, poisson, negative binomial, hypergeometric, exponential, and normal distributions. Sampling distributions, estimation, and hypothesis tests. **Graded**: Graded Student. **Units**: 3.0.

Prerequisites

Math 26A, Math 30 or AP credit for AB calculus in high school.

Learning Objectives

- Understand the basic principles of probability including the laws for unions, intersections, and complementation, Bayes theorem and use these principles in problem solving situations.
- Understand the definitions of discrete, continuous, and joint random variables, compute the mean, variance and covariance of random variables, know the definition of density and distribution function of a random variable and be able to find one from the other, and be able to find the marginal density and distribution functions from the joint density function.
- Define the binomial, uniform, Poisson, negative binomial, hypergeometric, exponential, Gamma, Beta and normal random variables, know their probability density and distribution functions, compute the mean and variance of these random variables, and use the normal and Poisson distributions to approximate binomial probabilities.
- Estimate population parameters from data sets and use the sampling distributions to compute confidence intervals for these population parameters.
- Learn the basic components of hypothesis testing and perform hypothesis tests on population means, variances and proportions.

Text

Probability and Statistics for Engineers 2/e, by Hayter

Coverage

Chapters 1 through 10. The use of statistical software software will be discussed.

Assignments

A variety of reading and problem solving assignments will be part of the course.

Examinations

There will be regular midterm examinations and a comprehensive final examination for this course.

Writing Component

STAT 50 is an area B4 GE course and has a writing component. To satisfy the writing requirement graded assignments involving writing and understanding of complex technical prose, interpretation of theoretical ideas, and the use of mathematical ideas will be part of the course.

Area B-4 Mathematical Concepts and Quantitative Reasoning Student Learning Outcomes

Students will be able to:

1. Solve problems by thinking logically, making conjectures, and constructing valid mathematical arguments.
2. Make valid inferences from numerical, graphical and symbolic information.
3. Apply mathematical reasoning to both abstract and applied problems, and to both scientific and non-scientific problems.

Topics

I. Probability (2 Weeks)

   A. Sample spaces and events
   B. Operations on events (union, intersection, complement)
   C. Counting principles
   D. Independent and dependent events
   E. Conditional probability
   F. Bayes' theorem

II. Random Variables (3 Weeks)

   A. Definitions v Density and distribution functions
   B. Expectation
   C. Variance
   D. Joint probability distributions
   E. Independent and dependent random variables
   F. Covariance and correlation

III. Special Random Variables (3 Weeks)

   A. Discrete uniform
   B. Binomial

C. Poisson
D. Geometric and negative binomial
E. Hypergeometric
F. Multinomial
G. Normal
H. Exponential
I. Gamma
J. Beta

IV. Introduction to Estimation (1 Week)

A. Describing samples
    1. Measures of center (mean, median, mode)
    2. Measure of spread (range, variance)
    3. Shape (quartiles, percentiles, histograms)
B. Distribution of Sample Means – Central Limit Theorem (1 Week)
    1. Difference between parameter and statistics
    2. Distribution of sample means
    3. Mean and standard deviation of sample means
C. Estimation (2 Weeks)

V. Hypothesis Testing (2 Weeks)