



# Applied Statistics for Engineers and Scientists

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Statistics is undoubtedly one of the most useful of all disciplines, since virtually all organizations have data from which inferences must be drawn. In this course you will learn the fundamental concepts of applied statistics including descriptive statistics, confidence intervals, hypothesis tests, analysis of variance, regression analysis, and distribution fitting, and be able to apply them *immediately* to the problems that you encounter on the job. This will be accomplished by lectures that carefully explain each statistical technique

and then illustrate it by one or more examples using real-world data. This is reinforced by an extensive number of in-class exercises that students perform using a calculator or Excel. **Whether you are new to statistics or looking for a refresher course, you will find this seminar a great way to get up to speed quickly in a cost-effective manner.** Versions of this seminar have been presented to Lockheed Martin and the U.S. Navy (three times).

Dr. Averill M. Law, the course instructor, has taught statistical concepts and techniques for more than 35 years, both in 17 years of university teaching and in presenting more than 500 short courses in 18 countries. He is the developer of ExpertFit®, which has been the world's leading distribution-fitting software since 1983. Dr. Law is the author or coauthor of three books and numerous journal articles. He has been a tenured faculty member at the University of Wisconsin-Madison and the University of Arizona. He has a Ph.D. from the University of California at Berkeley.

## What You Will Learn:

### 1. Introduction

- Populations and samples
- Types of data

### 2. Random Variables

- Definition and distribution function
- Discrete random variables
  - Probability mass function
  - Bernoulli, binomial, geometric, and Poisson distributions and their applications
- Continuous random variables
  - Probability density function
  - Normal, exponential, gamma, Weibull, and lognormal distributions and their applications
- Characteristics of a random variable (mean, median, variance, standard deviation)

### 3. Joint Probability Distributions

- Jointly distributed random variables
- Marginal distributions
- Independent random variables
- Covariance and correlation
- Statistics and their distributions
- Distribution of the sample mean and the central limit theorem

### 4. Point Estimation

- Unbiased estimator
- Variance of a point estimator
- Estimators for the mean and variance

### 5. Descriptive Statistics

- Graphical plots (histogram, box plot, scatter plot)
- Numerical summaries (sample mean, variance, and skewness)

### 6. Confidence Intervals Based on a Single Sample

- Correct interpretation
- For large sample sizes
- For normally distributed data
- Intervals for means and proportions

### 7. Hypothesis Tests Based on a Single Sample

- Hypotheses and test procedures
- Type I error, type II error, and power
- P-values
- Tests for means and proportions
- Shortcomings

### 8. Inferences Based on Two Samples

- Hypothesis tests and confidence intervals
- Comparing two means
- Comparing two proportions

### 9. Analysis of Variance (ANOVA)

- Comparing three or more means
- Dealing with the required assumptions

### 10. Regression Analysis

- Linear regression models with one or more independent variables
- Estimating model parameters
- Determining the adequacy of the model

### 11. Fitting Distributions to Data

- Estimating a distribution's parameters
- Determining the quality of fit
  - Graphical comparisons
  - Goodness-of-fit tests (chi square)

### 12. Commercial Statistical Packages and Their Benefits

*“It was a great experience to attend your seminar. I came into the seminar with no idea what statistics is and I left with a broad understanding of the subject.”*

*Engineer, U.S. Navy*

*“The seminar was just what I needed and has already helped in my work. Thank you for the excellent instruction.”*

*Cost Analyst, U.S. Air Force*

*“Excellent class – very practical!”*

*Systems Engineer, Lockheed Martin*

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