



# Applied Statistics for Engineers and Scientists

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Statistics is undoubtedly one of the most valuable 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 statistics (descriptive statistics, confidence intervals, hypothesis tests, regression, etc.) and be able to apply them immediately to the problems that you encounter on the job. This will be accomplished by the use of intuition, graphical plots, real-world examples, and numerous in-class student exercises using paper/pencil and a calculator. **Whether you are new to statistics or are looking for a refresher course, you will find this seminar a great way to get up to speed quickly in a cost-effective manner. In fact, you will learn most of the important topics covered in a semester-long university course in just four days.** This seminar has been presented to the U.S. Navy several 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 480 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. Overview

- Populations and samples
- Descriptive statistics
- Inferential statistics (confidence intervals and hypothesis tests)
- Determining the relationship between two or more variables (regression analysis)

### 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, sample variance, 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

### 8. Inferences Based on Two Samples

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

### 9. Regression Analysis

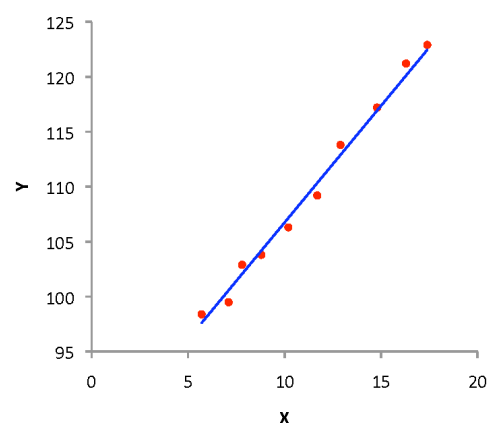
- Linear regression models with one or more independent variables
- Estimating model parameters
- Determining the adequacy of the model

### 10. Fitting Distributions to Data

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

### 11. Statistical Packages and Their Benefits

#### Observed Data and Fitted Regression Line



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