Applied Statistics for Engineers and Scientists

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).

What You Will Learn:

1. **Overview**
   - 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 of 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**