

## **Reliability Statistics Training Course**

The Reliability Statistics Training Course is a three-day, applications-oriented course on statistical methods. Designed for the practitioner, this course covers the main statistical methods used in reliability and life data analysis. The course starts with an overview of the main results of probability and reliability theory. Then, the main discrete and continuous distributions used in reliability data analysis are overviewed. This review of reliability principles prepares the participants to address the main problems of estimating, testing and modeling system reliability data. Course materials include the course manual and RAC's publication "Practical Statistical Tools for the Reliability Engineer".

### **Course Contents**

#### **Review of Probability and Reliability Concepts**

1. Scope and Course Content and Objectives
  - A. Statistical Thinking v. Statistical Mechanics
2. Overview of Probability and Reliability Definitions
  - A. Reliability as a Product Performance Measure
3. Properties and Characteristics of the Hazard Function
  - A. Increasing, Decreasing and Constant Failure Rates
  - B. The Bathtub Curve and its Implications

#### **Statistical Distributions Frequently Used in Reliability Engineering**

1. Discrete Distributions, their Properties and their Parameters:
  - A. Binomial, Hypergeometric and Poisson
2. Continuous Distributions, their Properties and their Parameters:
  - A. Exponential, Normal, Log-normal and Weibull
3. Some Sampling Distributions and their Practical Uses
  - A. Student t, Fisher's F, Chi-Square
4. Some Graphical Methods of Distribution Identification
  - A. Normal Scores and Probability Plots
    - Interpretation and Uses
  - B. Weibull Graphical Analysis:
    - Weibull Plots and Parameter Estimation
    - Interpretation of the Model and its Parameters

#### **Derivation of Confidence Intervals**

1. Distribution of the Average of a Large Sample
  - A. The Central Limit Theorem and its Applications
2. C.I. for the Population Mean
  - A. From Both Large and Small Samples
  - B. Drawn from the Normal and Exponential Distributions
3. C.I. for the Difference of Two Population Means
  - A. From Two, Large and Small Samples
  - B. Drawn from the Normal and the Exponential Distributions
4. C.I. for the Population Proportion
  - A. And for the Difference of Two Population Proportions

#### **Hypothesis Testing**

1. Testing for the Population Mean
  - A. Drawn From Large and Small Samples
  - B. From the Normal and Exponential Distributions

2. Testing for the Difference of Two Population Means
  - A. Drawn From Large and Small Samples
  - B. From the Normal and Exponential Distributions
3. Testing for the Population Proportion
  - A. And for the Difference of Two Population Proportions

### **Testing the Goodness of Fit (GoF)**

1. Reasons and Uses of GoF Testing
2. The Chi-Square Goodness of Fit Test
  - A. For Large Samples and Arbitrary Distributions
3. The Anderson-Darling Goodness of Fit Test
  - A. For Large and Small Samples and Normal Distributions
4. Graphical GoF Tests

### **Introduction to Regression Modeling**

1. Reasons and Benefits of Performing a Regression
2. The Simple Linear Regression Model
3. Model Checking via Residual Analysis
4. Multiple Regression Models
5. Regression Model Assessment
6. Reliability Application Examples:
  - A. The Duane and AMSAA models

### **Analysis of Variance (ANOVA)**

1. Reasons and Benefits of Performing ANOVAs
2. Design and planning of an Experiment
3. One-way Analysis of Variance
4. Residual Analysis and Model Checks
5. ANOVAs with several Factors

### **Summary**

1. Industrial Applications Examples
2. Where Do You Go From Here