Learning Paths Outline

Learning Path 1: Foundations of Data Analysis

Descriptive Statistics and Graphical Analysis
- Types of Data
  - Basic Concepts
  - Types of Data
  - Quiz: Types of Data
- Using Graphs to Analyze Data
  - Basic Concepts
  - Bar Charts and Pareto Charts
  - Pie Charts
  - Histograms
  - Dotplots
  - Individual Value Plots
  - Boxplots
  - Time Series Plots
  - Quiz: Using Graphs to Analyze Data
  - Minitab Tools: Bar Chart
  - Minitab Tools: Pie Chart
  - Minitab Tools: Histogram
  - Minitab Tools: Dotplot
  - Minitab Tools: Individual Value Plot
  - Minitab Tools: Boxplot
  - Minitab Tools: Time Series Plot
  - Exercise: Graphical Analysis
- Using Statistics to Analyze Data
  - Basic Concepts
  - Mean and Median
  - Range, Variance and Standard Deviation
  - Quiz: Using Statistics to Analyze Data
  - Minitab Tools: Display Descriptive Statistics
  - Exercise: Descriptive Statistics

Statistical Inference
- Fundamentals of Statistical Inference
  - Basic Concepts
  - Random Samples
  - Quiz: Fundamentals of Statistical Inference
  - Minitab Tools: Random Sampling
- Sampling Distributions
  - Basic Concepts
  - Sampling Distribution of the Mean
  - Quiz: Sampling Distributions
- Normal Distribution
  - Basic Concepts
  - Probabilities Associated with a Normal Distribution
  - Probabilities Associated with the Sample Mean
  - Quiz: Normal Distribution
  - Minitab Tools: Cumulative Probabilities with a Normal Distribution
  - Exercise: Probabilities and Normal Distributions

Hypothesis Tests and Confidence Intervals
- Confidence Intervals for Population Parameters Primer
- Tests and Confidence Intervals

Learning Path 2: Statistical Quality Analysis

Control Charts
- Phase 1 and 2 Control Charts Primer
- Statistical Process Control
  - Basic Concepts
  - Patterns in Control Charts
  - Quiz: Statistical Process Control
- Control Charts for Variables Data in Subgroups
  - Basic Concepts
  - R Charts
  - S Charts
  - Individuals Charts
  - Quiz: Control Charts for Variables Data in Subgroups
  - Minitab Tools: X-R Chart
  - Exercise: X-R Chart
- Control Charts for Individual Observations
  - Basic Concepts
  - Moving Range Charts
  - Individuals Charts
  - Quiz: Control Charts for Individual Observations
  - Minitab Tools: I-MR Chart
  - Exercise: I-MR Chart
- Control Charts for Attributes Data
  - Basic Concepts
  - NP and P Charts
  - C and U Charts
  - Quiz: Control Charts for Attributes Data
  - Minitab Tools: P Chart
  - Exercise: P Chart

Process Capability
- Process Capability for Normal Data
  - Basic Concepts
  - Assumptions
  - Testing for Normality
  - Quiz: Process Capability for Normal Data
  - Minitab Tools: Normality Test
  - Exercise: Assumptions for Process Capability
- Capability Indices
  - Potential Capability: Cp and Cpk
  - Process Performance: Pp and Ppk
  - Sigma Level
  - Quiz: Capability Indices
  - Minitab Tools: Cp and Pp
  - Minitab Tools: Sigma Level
  - Exercise: Process Capability for Normal Data
- Process Capability for Nonnormal Data
  - Transformations and Alternate Distributions
  - Box-Cox Transformation
  - Johnson Transformation
  - Alternate Distributions
  - Quiz: Process Capability for Nonnormal Data
  - Minitab Tools: Box-Cox Transformation

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• Confidence Intervals
  • Hypothesis Testing
  • Using Hypothesis Tests to Make Decisions
  • Type I and Type II Errors and Power
  • Quiz: Tests and Confidence Intervals
• 1-Sample t-Test
  • Basic Concepts
  • Individual Value Plots
  • 1-Sample t-Test Results
  • Assumptions
  • Quiz: 1-Sample t-Test
  • Minitab Tools: 1-Sample t-Test
  • Exercise: 1-Sample t-Test
• 2 Variances Test
  • Basic Concepts
  • Boxplots
  • 2 Variances Test Results
  • Assumptions
  • Quiz: 2 Variances Test
  • Minitab Tools: 2 Variances Test
  • Exercise: 2 Variances Test
• 2-Sample t-Test
  • Basic Concepts
  • Individual Value Plots
  • 2-Sample t-Test Results
  • Assumptions
  • Quiz: 2-Sample t-Test
  • Minitab Tools: 2-Sample t-Test
  • Exercise: 2-Sample t-Test
• Paired t-Test
  • Basic Concepts
  • Individual Value Plots
  • Paired t-Test Results
  • Assumptions
  • Quiz: Paired t-Test
  • Minitab Tools: Paired t-Test
  • Exercise: Paired t-Test
• 1 Proportion Test
  • Basic Concepts
  • 1 Proportion Test Results
  • Assumptions
  • Quiz: 1 Proportion Test
  • Minitab Tools: 1 Proportion Test
  • Exercise: 1 Proportion Test
• 2 Proportions Test
  • Basic Concepts
  • 2 Proportions Test Results
  • Assumptions
  • Quiz: 2 Proportions Test
  • Minitab Tools: 2 Proportions Test
  • Exercise: 2 Proportions Test
• Chi-Square Test
  • Basic Concepts
  • Chi-Square Test Results
  • Assumptions
  • Quiz: Chi-Square Test
  • Minitab Tools: Chi-Square Test
  • Exercise: Chi-Square Test
• Minitab Tools: Johnson Transformation
• Minitab Tools: Capability Analysis with Johnson Transformation
• Minitab Tools: Alternate Distributions
• Minitab Tools: Capability Analysis with Alternate Distributions
• Exercise: Process Capability with Data Transformations
• Exercise: Process Capability with Alternate Distributions

Measurement Systems Analysis
• Fundamentals of Measurement Systems Analysis
  • Basic Concepts
  • Accuracy
  • Precision
  • Comparing Accuracy to Precision
  • Quiz: Fundamentals of Measurement Systems Analysis
• Repeatability and Reproducibility
  • Basic Concepts
  • Gage R&R Studies
  • Quiz: Repeatability and Reproducibility
• Graphical Analysis of a Gage R&R Study
  • Basic Concepts
  • Components of Variation
  • \( \bar{X} \) and R Charts
  • Interaction Between Operator and Part
  • Comparative Plots
  • Gage Run Charts
  • Quiz: Graphical Analysis of a Gage R&R Study
  • Minitab Tools: Crossed Gage R&R Study
  • Minitab Tools: Gage Run Chart
  • Exercise: Graphical Analysis of a Gage R&R Study
• Variation
  • Standard Deviation and Study Variation
  • Tolerance
  • Quiz: Variation
  • Exercise: Numerical Analysis of a Gage R&R Study
• ANOVA with a Gage R&R Study
  • Variance Components
  • Analysis of Variance Tables
  • Quiz: ANOVA with a Gage R&R Study
  • Exercise: ANOVA Output for a Gage R&R Study
• Gage Linearity and Bias Study
  • Basic Concepts
  • Gage Linearity
  • Gage Bias
  • Quiz: Gage Linearity and Bias Study
  • Minitab Tools: Gage Linearity and Bias Study
  • Exercise: Gage Linearity and Bias Study
• Attribute Agreement Analysis
  • Basic Concepts
  • Binary Data
  • Nominal Data
  • Ordinal Data
  • Quiz: Attribute Agreement Analysis
  • Minitab Tools: Attribute Agreement Analysis with Binary Data
  • Minitab Tools: Attribute Agreement Analysis with Nominal Data
  • Minitab Tools: Attribute Agreement Analysis with Ordinal Data
  • Exercise: Attribute Agreement Analysis
Analysis of Variance (ANOVA)

- Fundamentals of ANOVA
  - Basic Concepts
  - Graphs and Summary Statistics
  - Quiz: Fundamentals of ANOVA
- One-Way ANOVA
  - Hypothesis Tests
  - F-Statistics and P-Values
  - Multiple Comparisons
  - Assumptions and Residual Plots
  - Quiz: One-Way ANOVA
  - Minitab Tools: One-Way ANOVA
  - Exercise: One-Way ANOVA
- Two-Way ANOVA
  - Basic Concepts
  - Graphs
  - Hypothesis Tests
  - F-Statistics and P-Values
  - Assumptions and Residual Plots
  - Quiz: Two-Way ANOVA
  - Minitab Tools: Two-Way ANOVA
  - Exercise: Two-Way ANOVA

Correlation and Regression

- Relationship Between Two Quantitative Variables
  - Basic Concepts
  - Scatterplot
  - Correlation
  - Quiz: Relationship Between Two Quantitative Variables
  - Minitab Tools: Scatterplot
  - Minitab Tools: Correlation
  - Exercise: Scatterplots and Correlation
- Simple Regression
  - Basic Concepts
  - Regression
  - Hypothesis Tests and R2
  - Assumptions and Residual Plots
  - Quiz: Simple Regression
  - Minitab Tools: Simple Linear Regression
  - Exercise: Simple Regression
- Trend Analysis in Time Series Primer

Multiple Regression

- Relationships Between Multiple Quantitative Variables
  - Basic Concepts
  - Matrix Plot and Correlation
  - Quiz: Relationships Between Variables
  - Minitab Tools: Matrix Plot
  - Minitab Tools: Multiple Correlation
- Multiple Regression
  - Basic Concepts
  - Multiple Regression Models
  - Assumptions and Residual Plots
  - Prediction
  - Quiz: Multiple Regression
  - Minitab Tools: Fit Regression
  - Exercise: Multiple Regression
- Polynomial and Interacting Terms
  - Polynomial Terms
  - Interaction Terms
  - Quiz: Polynomial and Interaction Terms
  - Minitab Tools: Fit Regression Model with Polynomial
  - Minitab Tools: Fit Regression Model with Interaction
  - Exercise: Polynomial and Interaction Terms
- Model Selection
  - Stepwise Regression
  - Best Subsets Regression
  - Quiz: Model Selection
  - Minitab Tools: Fit Regression Model with Stepwise
  - Minitab Tools: Best Subsets Regression
  - Exercise: Model Selection
- Binary Logistic Regression
  - Basic Concepts
  - Model Fitting and Diagnostics
  - Model Visualization and Prediction
  - Quiz: Binary Logistic Regression
  - Minitab Tools: Fit Binary Logistic Regression Model
  - Exercise: Binary Logistic Model

Predictive Analytics

- Predictive Analytics
Design of Experiments

- T Tests for Effects in DOE Primer
- Factorial Designs
  - Basic Concepts
  - Creating Full Factorial Designs
  - Analyzing Full Factorial Designs
  - Quiz: Factorial Designs
  - Minitab Tools: Create a Full Factorial Design
  - Minitab Tools: Analyze a Full Factorial Design
  - Exercise: Create a Full Factorial Design
  - Exercise: Analyze a Full Factorial Design
- Blocking and Incorporating Center Points
  - Blocking
  - Center Points
  - Analyzing Designs with Blocks and Center Points
  - Quiz: Blocking and Incorporating Center Points
  - Minitab Tools: Create a Factorial Design with Blocks and Center Points
  - Minitab Tools: Analyze a Factorial Design with Blocks and Center Points
  - Exercise: Create a Factorial Design with Blocks and Center Points
  - Exercise: Analyze a Factorial Design with Blocks and Center Points
- Fractional Factorial Designs
  - Basic Concepts
  - Create Fractional Factorial Designs
  - Analyze Fractional Factorial Designs
  - Quiz: Fractional Factorial Designs
  - Minitab Tools: Create a Fractional Factorial Design
  - Minitab Tools: Analyze a Fractional Factorial Design
- Response Optimization Using Desirability Primer
- Response Optimization
  - Response Optimization
  - Quiz: Response Optimization
  - Minitab Tools: Response Optimization
  - Exercise: Response Optimization

- Model Validation
  - Basic Concepts
  - Validation Techniques
  - Quiz: Validation Techniques
  - Minitab Tools: Fit Regression Model with Validation
- Tree Based Methods
  - Basic Concepts
  - Using Decision Trees
  - Quiz: Tree-Based Methods
- CART Classification Splitting Primer
- CART Classification Trees
  - Fitting a CART Classification Trees
  - Model Summary Statistics
  - Using the CART Classification Tree Results
  - Prediction with CART Classification Trees
  - Quiz: CART Classification Trees
  - Minitab Tools: CART Classification
  - Exercise: CART Classification
- CART Regression Splitting Primer
- CART Regression Trees
  - Fitting a CART Regression Tree
  - Using the CART Regression Tree Results
  - Prediction with CART Regression Trees
  - Quiz: CART Regression Trees
  - Minitab Tools: CART Regression and Prediction
  - Exercise: CART Regression
- Random Forests Classification Primer
- Random Forests Classification
  - Bootstrap Sampling
  - Basic Concepts
  - Out-of-Bag Validation
  - Fitting a Random Forests Model
  - Using Random Forests Model Results
  - Prediction with a Random Forests Model
  - Quiz: Random Forests Classification
  - Minitab Tools: Random Forests Classification
  - Exercise: Random Forests Classification
- TreeNet Regression Primer
- TreeNet Regression
  - Basic Concepts
  - Fitting a TreeNet Regression Model
  - Using TreeNet Model Results
  - Prediction with a TreeNet Regression Model
  - Quiz: TreeNet Regression
  - Minitab Tools: TreeNet Regression
  - Exercise: TreeNet Regression