

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
 - \bar{X} Charts
 - Quiz: Control Charts for Variables Data in Subgroups
 - Minitab Tools: \bar{X} -R Chart
 - Exercise: \bar{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

- Confidence Intervals
- Hypothesis Testing
- Using Hypothesis Tests to Make Decisions
- Type 1 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

Learning Path 3: Design of Experiments

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

Learning Path 4: Predictive Analytics

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

- 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

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

- Basic Concepts
- Machine Learning
- Quiz: Overview of Predictive Analytics
- 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