Methodology: Self-pace learning. All learning is presented using animated lessons, quizzes, and hands-on exercises to help you easily learn, apply statistics and how to use Minitab Statistical Software.

Medium: Web-based. Internet connection is required.

Duration: 34 hours

This learning path combines all learning path in Minitab Education Hub. You will explore a broad range of graphical and statistical tools, validate a measurement system, determine process stability, quantify a process is capable of meeting customer specifications, optimize a product or process performance and analyse patterns to gain better insights, and make predictions about the future. Specifically, the tools include histograms, bar charts, heatmaps, boxplots, scatterplots, hypothesis testing, confidence intervals, analysis of variance, correlation, simple regression, measurement systems analysis, control charts, capability analysis, design of experiments, multiple regression, binary logistic regression, CART® Classification, CART® Regression, Random Forest® Classification, TreeNet® Regression and MARS® Regression.

Prerequisite: None

Course – Descriptive Statistics and Graphical Analysis

Learning Objectives:

- Use graphs and descriptive statistics to gain insight into objects, processes, events and people.
- Distinguish among different types of data.
- Choose the most appropriate visual representation for a given type of data and for the question we are trying to answer.
- Choose the most appropriate descriptive statistics to summarize different aspects of a given data set, such as the central tendency and spread.

Section: Types of Data

- Basic Concepts
- Data Types
- Quiz: Types of Data

Section: Using Graphs to Analyze Data

- Basic Concepts
- Bar Charts and Pareto Charts
- Pie Charts
- Histograms

- Heatmaps
- Dotplots
- Individual Values Plots
- Boxplots
- Time Series Plots
- Quiz: Using Graphs to Analyze Data
- Minitab Tools: Bar Chart
- Minitab Tools: Pie Chart
- Minitab Tools: Histogram
- Minitab Tools: Heatmap
- Minitab Tools: Dotplot
- Minitab Tools: Individual Value Plot
- Minitab Tools: Boxplot
- Minitab Tools: Time Series Plot
- Exercise: Graphical Analysis

Section: Using Statistical to Analyze Data

- Basic Concepts
- Mean and Median
- Range, Variance, and Standard Deviation
- Quiz: Using Statistical to Analyze Data
- Minitab Tools: Display Descriptive Statistics
- Exercise: Descriptive Statistics

Course – Statistical Inference

Learning Objectives:

- Examine populations by looking at a subset of the population - a sample - and using inferential statistics.
- Define data collection methods that allow you to draw conclusions with a known level of risk.
- Define the sampling distribution, an important theoretical construct statistic, and explain its impact on how well a sample statistic estimates a population parameter.
- Identify basic characteristics of the normal distribution and use them to calculate how well a sample mean estimates a population mean.

Section: Fundamentals of Statistical Inference

- Basic Concepts
- Random Samples
- Quiz: Fundamentals of Statistical Inference
- Minitab Tools: Random Sampling

Section: Sampling Distributions

- Basic Concepts
- Sampling Distribution of the Mean
- Quiz: Sampling Distributions

Section: 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

Course – Hypothesis Tests and Confidence Intervals

Learning Objectives:

- Establish hypotheses about business problems and use statistics to test those hypotheses.
- Use a 1-sample t-test to determine whether a population mean is equal to a hypothesized value.
- Use a 2 variances test to determine whether two populations have the same variance for a given parameter.
- Use a 2-sample t-test to determine whether two populations have equal means.
- Use a paired t-test to determine whether two dependent populations have equal means.
- Use a 1 proportion test to determine whether a population proportion is equal to a hypothesized value.
- Use a 2 proportions test to determine whether the two populations have equal proportions.
- Use a chi-square test to determine whether the values of the two categorical variables are related.

Section: Tests and Confidence Intervals

- Confidence Intervals
- Hypothesis Testing
- Using Hypothesis Tests to Make Decisions
- Type I and Type II Errors and Power
- Quiz: Tests and Confidence Intervals

Section: 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

Section: 2 Variance Test

- Basic Concepts
- Boxplots
- 2 Variances Test Results
- Assumptions
- Quiz: 2 Variances Test
- Minitab Tools: 2 Variance Test
- Exercise: 2 Variances Test

Section: 2-Sample t-Test

- Basic Concepts
- Individual Value Plot
- 2-Sample t-Test Results
- Assumptions
- Quiz: 2-Sample t-Test
- Minitab Tools: 2-Sample t-Test
- Exercise: 2-Sample t-Test

Section: 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

Section: 1 Proportion Test

- Basic Concepts
- 1 Proportion Test Results
- Assumptions
- Quiz: 1 Proportion Test
- Minitab Tools: 1 Proportion Test
- Exercise: 1 Proportion Test

Section: 2 Proportion Test

- Basic Concepts
- 2 Proportions Test Results
- Assumptions
- Quiz: 2 Proportions Test
- Minitab Tools: 2 Proportions Test
- Exercise: 2 Proportions Test

Section: Chi-Square Test

- Basic Concepts
- Chi-Square Test Results
- Assumptions
- Quiz: Chi-Square Test
- Minitab Tools: Chi-Square Test
- Exercise: Chi-Square Test

Course – Analysis of Variance (ANOVA)

Learning Objectives:

- Detect significant differences in the mean responses from two or more groups.
- Use individual value plots to visualize within- and between-group variation and identify group means.
- Identify groups whose mean responses differ from the mean responses of other groups in the set.
- Detect significant differences in a mean response due to either of two factors or to the interaction between those factors.

Section: Fundamentals of ANOVA

- Basic Concepts
- Graphs and Summary Statistics
- Quiz: Fundamentals of ANOVA

Section: One-Way ANOVA

- Hypothesis Test
- F-Statistics and P-Values
- Multiple Comparisons
- Assumptions and Residual Plots
- Quiz: One-Way ANOVA
- Minitab Tools: One Way ANOVA
- Exercise: One-Way ANOVA

Section: 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

Course – Correlation and Regression

Learning Objectives:

- Identify and characterize relationships between variables and use the relationships to predict the outcomes of business decisions.
- Use scatterplots and correlation to visualize and quantify the strength and nature or relationships between numeric variables.
- Use regression to define linear relationships between numeric variables mathematically, producing equations to predict one value from another.

Section: Relationship Between Two Quantitative Variables

- Basic Concepts
- Scatterplot
- Correlation
- Quiz: Relationship Between Two Quantitative Variables
- Minitab Tools: Scatterplot
- Minitab Tools: Correlation
- Exercise: Scatterplot and Correlation

Section: Simple Regression

- Basic Concepts
- Regression
- Hypothesis Tests and R2
- Assumptions and Residual Plots
- Quiz: Simple Regression
- Minitab Tools: Simple Linear Regression
- Exercise Simple Regression

Course – Control Charts

Learning Objectives:

- Identify the common goals and applications of control charts.
- Monitor processes that are measured with variables data collected in subgroups.
- Monitor processes that are measured with individual observations of variables data.
- Monitor processes whose performance is most meaningfully described by attributes data.

Section: Statistical Process Control

- Basic Concepts
- Patterns in Control Charts
- Quiz: Statistical Process Control

Section: Control Charts for Variables Data in Subgroups

- Basic Concepts
- R Charts
- S Charts
- Xbar Charts
- Quiz: Control Charts for Variables Data in Subgroups
- Minitab Tools: Xbar-R Chart
- Exercise: Xbar-R Chart

Section: 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

Section: Control Charts for Attribute Data

- Basic Concepts
- NP and P Charts
- C and U Charts
- Quiz: Control Charts for Attributes Data
- Minitab Tools: P Chart
- Exercise: P Chart

Course – Process Capability

Learning Objectives:

- Describe how well a process is performing in relation to its specification limits by using capability indices.
- Recognize when data about a business process permits a reliable capability analysis.
- Interpret various measures of process capability.
- Apply capability analysis to processes that involve non-normal data.

Section: 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

Section: 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

Section: Process Capability for Nonnormal Data

- Transformation and Alternate Distributions
- Box-Cox Transformation
- Johnson Transformation
- Alternate Distributions
- Quiz: Process Capability for Nonnormal Data
- Minitab Tools: Box Cox Transformation
- 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

Course – Measurement Systems Analysis

Learning Objectives:

- Design measurement systems for business processes.
- Distinguish between the accuracy and precision of a measurement system.
- Distinguish between repeatability and reproducibility.
- Use graphs to assess the repeatability and reproducibility of a measurement system.
- Examine sources of variation in a measurement system.
- Use ANOVA to assess the repeatability and reproducibility of a measurement system.
- Assess the linearity and bias of a measurement system.
- Use attribute agreement analysis to assess a measurement process that records attribute responses.

Section: Fundamental of Measurement Systems Analysis

- Basic Concepts
- Accuracy
- Precision
- Comparing Accuracy and Precision
- Quiz: Fundamentals of Measurement System Analysis
-

Section: Repeatability and Reproducibility

- Basic Concepts
- Gage R&R Studies
- Quiz: Repeatability and Reproducibility

Section: 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

Section: Variation

- Standard Deviation and Study Variation
- Tolerance
- Quiz: Variation
- Exercise: Numerical Analysis of a Gage R&R Study

Section: 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

Section: 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

Section: 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

Course – Design of Experiments

Learning Objectives:

- Create and analyze factorial designs to find the optimal settings of multiple factors in a process.
- Use blocking to account for unwanted variation in an experiment.

- Use center points to detect curvature in the design space and estimate error without replicating corner points.
- Create and analyze fractional factorial designs to find the optimal settings of multiple factors in a process without running a full design.
- Use Minitab's Response Optimizer to find optimal factor settings.

Section: 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

Section: 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

Section: Fractional Factorial Designs

- Basic Concepts
- Create Fractional Factorial Designs
- Analyze Fractional Factorial Designs
- Quiz: Fractional Factorial Designs
- Minitab Tools: Create a Fractional Factorial Designs
- Minitab Tools: Analyze a Fractional Factorial Design

Section: Response Optimization

- Response Optimization
- Quiz: Response Optimization
- Minitab Tools: Response Optimization
- Exercise: Response Optimization

Course – Multiple Regression

Learning Objectives:

- Use a matrix plot to visualize the nature of relationships between numeric variables.
- Use correlation to quantify the strength of linear relationships.
- Use multiple linear regression to model a continuous response variable.
- Learn how to assess model accuracy and check model assumptions.
- Use stepwise and best subsets regression to select a model.
- Use binary logistic regression to model a categorical response variable

Section: Relationship Between Multiple Quantitative Variables

- Basic Concept
- Matrix Plot and Correlation
- Quiz: Relationship Between Variables
- Minitab Tools: Matrix Plot
- Minitab Tools: Multiple Correlation

Section: Multiple Regression

- Basic Concepts
- Multiple Regression Models
- Assumptions and Residual Plots
- Prediction
- Quiz: Multiple Regression
- Minitab Tools: Fit Regression
- Exercise: Multiple Regression

Section: 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

Section: 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

Section: 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

Course – Predictive Analytics

Learning Objectives:

- Learn what is meant by predictive analytics.
- Understand the fundamentals of machine learning.
- Learn how to use validation to assess models.
- Understand the basic concepts of regression trees.
- Use a CART classification tree to model a categorical response or target variable.
- Use a CART regression tree to model a continuous response or target variable.
- Use a Random Forest Classification to model a categorical response or target variable.
- Use a TreeNet Regression to model a continuous response or target variable.

Section: Predictive Analytics

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

Section: Model Validation

- Basic Concepts
- Validation Techniques
- Quiz: Validation Techniques
- Minitab Tools: Fit Regression Model with Validation

Section: Tree Based Model

- Basic Concepts
- Using Decision Trees
- Quiz: Tree-Based Methods

Section: CART Classification Trees

- Fitting a CART Classification Tree
- 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
- File Download: CART Classification Splitting

Section: 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
- File Download: CART Regression Splitting

Section: MARS Regression

- Basic Concepts
- Knots
- Basis Functions and Knots
- Fitting a MARS Model
- Using MARS Model Results
- Prediction with a MARS Model
- Quiz: MARS Regression
- Minitab Tools: MARS Regression
- Exercise: MARS Regression

Section: 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 Forest Classification
- File Download: Random Forests Classification

Section: 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
- File Download: TreeNet Regression