



**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:** 8 Hours

This learning path emphasizes sound statistical approaches to make better decisions related to process quality. You will explore tools to validate a measurement system, determine process stability, and quantify if a process is capable of meeting customer specifications. Specifically, discover the fundamentals of measurement systems analysis, control charts, and capability analysis.

**Prerequisite:** Foundations of Data Analysis

### **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**

- Primer: Phase 1 and 2 Control Charts
- 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