# Six Sigma Quality: Concepts & Cases - Volume II
# Statistical Tools in Six Sigma DMAIC Process with MINITAB® Applications

## Major Topics

### Six Sigma Analysis Tools with Computer Applications

Presentation and Organization of Data

Descriptive Statistics: Graphical and Numerical Methods

Probability Concepts

Discrete Probability Distributions (with computer applications and simulations)

- Frequency Distribution and Probability Distributions
- Expected Value, Variance, and Standard Deviation of a Discrete Distribution
- Binomial Distribution and Applications
- Approximating Binaomial Distribution with Normal Distributions
- Poisson Distribution
- Poisson Approximation
- Hypergeometric Distribution
- Geometric Distribution
- Negative Binomial or Pascal Distribution
- Multinomial Distributions
- Discrete Uniform Distribution

Continuous Probability Distributions (with computer applications and simulations)

- Normal Distribution
- Important Properties of Normal Distribution
- Distributions Related to Normal Distribution: t-distribution, F-distribution, Chi-Square Distribution
- Computer Applications: Checking Distributions using Probability Plots
- Fitting Distributions to Data using MINITAB
- Exponential Distribution and Applications
- Simulating Data from Exponential Distribution
- Uniform Distribution and Random Samples
- The Lognormal distribution
- The Weibull Distribution
- Gamma Distribution
- Beta Distribution
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Sampling and Sampling Distribution

- Sampling Techniques
- Random Sampling using MINITAB
- Sampling Distribution
- Central Limited Theorem

- Sampling Distribution of the Sample Proportion
- Sampling from Normal and Non normal Distributions
  Computer Simulations: Sampling Applications

Inference Procedure: Parameter Estimation

- Point Estimate: Properties of Estimators
- Confidence Interval Estimation
- Confidence Interval for a Single Mean and Proportion
- Confidence Interval for the Difference between Two Means and Two Proportions
- Confidence Interval for the Variance and Ratio of Two Variances
- Sample Size Determination
- Computer Applications

Inference Procedure: Hypothesis Testing

- Statistical Hypothesis: Concepts
- Type I and Type II Errors
- One-sided and Two-sided Hypothesis Tests
- Test of Hypothesis on the Mean, Variance Known
- Choice of Sample Size
- Relationship to Confidence Interval
- Test of Hypothesis for the Equality of Two Means: Equal and Unequal Variance
- Sample Size Determination
- The Paired t-test
- Test of Hypothesis on One Variance, Two Variances
- Test of Hypothesis on One and Two Proportions

Chi-Square Goodness-of-fit Tests

Nonparametric Tests

Regression and Correlation Analysis and Model Building

Analysis of Variance (ANOVA): Fixed and Random Effect Model

## Six Sigma Improvement Tools with Computer Applications

Design of Experiment (DOE) Techniques

- Experimentation
- One-factor Design
- Analysis of Variance (ANOVA)
- Two-factor/Three-factor and Four-factor Designs
- Mult-vari Charts
- Randomized Block Design
- Latin Square Design
- Factorial Designs
- 2k Design
- Two-level Fractional Factorial Designs

- Three-level Fractional factorial Design
- Blocking and Confounding
- Resolution III, IV Designs
- Response Surface Methodology
- Central Composite Designs
- Plakett  Burman Design
- Taguchi Method/Process Optimization
- Computer Applications of above designs

### Other Improvement Techniques

- JIT and Kaizen (Continuous Improvement)
- Cycle Time Reduction/ Agility
- Process Reengineering
- Process Maps/ High Level Process Maps
- Value Stream Mapping
- Kaizen Blitz/ Poka-yoke
- Lean Principles

## Six Sigma Control Tools with Computer Applications

### Quality Concepts

- Quality Costs/Quality and Productivity
- Statistical Methods in Quality Improvement
- Describing Variation/Inference about process quality
- Modeling Process Quality
- Quality Audits/Inspection and Planning

### Statistical Process Control

- Chance and Assignable Causes of Variation
- Control Chart Theory
- Statistical Basis of Control Chart
- Why and How Control Charts Work
- Types of Control Charts
- Control Limits/Sample Size and Frequency
- Rational Subgroup
- Analysis of Patterns in Control Charts
- Manufacturing and Non-manufacturing Applications of Control Charts
- Computer Applications
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### Variables Control Charts

- Control Charts for x-bar and R
- Control Chart for $S^2$
- Control Chart for S
- Individual Charts
- Median Charts
- Applications and Guidelines for Implementing Control Charts
- Computer Applications

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Other Variables Control Charts

- CUSUM Chart
- EWMA Chart
- Control Charts for Short-run Production
- Selection of Control Charts
- Computer Applications

Attribute Control Charts

- The p-chart
- np-Chart
- c-chart
- u-chart/ The OC Curve and applications

**Lean Six Sigma Tools with Computer Applications**