

## **“Quality Engineering & Six Sigma Black Belt Statistics” with Minitab**

(Course contains Theory, Long Hand & Minitab Solutions)

**Type:** On demand

**Format:** Online E-learning

**CEU Hours:** 2.81 (length is 28.1 hours)

**Instructor(s):** Ned Schneider

**Availability:** 365 days from original purchase date

**Facilitator:** Advanced Response Engineering, LLC

Statistics is a set of scientific tools used to extract meaningful information from numbers. Or said another way, Statistical tools are used to make Data Based Business Decisions. These are decisions, based on evidence, that have a very high probability of being correct.

Additionally, Statistical methodology provides an effective and efficient means to help you understand those cause-and-effect relationships between product or process “inputs” and “outputs”. This new knowledge will result in superior product and process performance that will be both stable and predictable.

Statistical Tools provide the best means to:

- Take your processes from an ART and make them a SCIENCE
- Perform Measurement System Analysis and Optimization
- Perform Comparisons (Identify the best: Material, Supplier, Machine, Settings, Method, etc.)
- Determine Product and Process Performance (Mean, Variation, Capability, etc.)
- Generate Tolerance Intervals
- Perform Product or Process Characterization (Scientific DOE Modeling) and Optimization
- Provide Process Control (SPC)
- **Perform Product & Process Validations**
- **Resolve CAPAs**
- Provide **Risk Reduction** due to increased product and process understanding
- Etc.

In this course, students will learn basic and advanced statistical methods plus strategies that will significantly increase their ability to take product and process performance to the next levels. These statistical tools provide the means to perform comprehensive root-cause-analysis to eliminate those difficult to resolve problems. Students will also learn statistical tools used to sustain improved process performance during the production phase.

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### **File: Statistics – 0, no slides (Length = 56 minutes)**

- “Minitab Introduction”

### **File: Statistics – 1, Slides 8-32 (Length = 33 minutes)**

- **CQE BOK VI.B. “Quantitative Concepts” or CSSBB BOK V.E. “Probability”**
  - Probability Introduction *Slide 11*
  - Probability Math Laws *Slide 22*
  - Probability Math & Relationships Summary Table *Slide 25*

### **File: Statistics – 2, Slides 33-75 (Length = 116 minutes)**

- **CQE BOK VI.B. “Quantitative Concepts” or CSSBB BOK V.E. “Probability”**
  - Permutations & Combinations *Slide 35*
- **CQE BOK VI.C. “Probability Distributions” or CSSBB BOK V.E. “Probability”**
  - Types of Distributions *Slide 42*
  - Normal & Std. Normal Distributions (Z-Dist.) *Slide 47, including Minitab Ex.*
  - t-Distribution *Slide 61*
  - Chi-Square Distribution *Slide 63*
  - F-Distribution *Slide 65*
  - Binomial Distribution *Slide 66, including Minitab Ex.*
  - Poisson Distribution *Slide 71, including Minitab Ex.*
  - Hypergeometric Distribution *Slide 74, including Minitab Ex.*

### **File: Statistics – 3, Slides 76-103 (Length = 64 minutes)**

- **CQE BOK VI.A. “Collecting and Summarizing Data” or CSSBB BOK V.B. “Data Collection”**
  - Data Collection *Slide 76*
- **CQE BOK VI.A. “Collecting and Summarizing Data” or “CSSBB BOK V.D. Basic Statistics”**
  - Definitions: Descriptive/Inference Statistics *Slide 82*
  - Skewness & Kurtosis *Slide 85*
  - Central Tendency Measures *Slide 86*
  - Dispersion Measures *Slide 89*
  - Data Collection Strategy *Slide 95*
  - Box Plot *Slide 99*
  - Data Collection & Analysis Ex. *Slide 102, includes Minitab Ex.*

### **File: Statistics – 4, Slides 104-122 (Length = 102 minutes)**

- **CQE BOK VI.D. “Statistical Decision Making” or CSSBB BOK VI.B. “Hypothesis Testing”**
  - Determining if the Data fit a Normal Dist. *Slide 104*
  - Parent & Sampling Distributions *Slide 106*
  - Confidence Intervals for the Mean *Slide 108, including Minitab Ex.*

- Confidence Intervals for the Variance *Slide 112, including Minitab Ex.*
- Confidence Intervals for Proportions *Slide 114, including Minitab Ex.*
- Statistical Tolerance Intervals *Slide 116, including Minitab Ex.*

**File: Statistics – 5, Slides 123-136 (Length = 47 minutes)**

- **CQE BOK VI.D. “Statistical Decision Making” or CSSBB BOK VI.B. “Hypothesis Testing”**
- Introduction to Hypothesis Testing *Slide 123*

**File: Statistics – 6 (Parts A, B), Slides 137-168 (Length = 156 minutes)**

- **CQE BOK VI.D. “Statistical Decision Making” or CSSBB BOK VI.B. “Hypothesis Testing”**
- One Sample Mean Hypothesis Testing *Slide 137*
- One Sample Z-Test *Slide 138, including Minitab Ex.*
- One Sample Power Calculation *Slide 143, including Minitab Ex.*
- Two Sample Means Hypothesis Testing *Slide 144*
- Two Sample t-Test *Slide 145, including Minitab Ex.*
- Paired t-Test *Slide 153, including Minitab Ex.*
- One Sample Variance Test (Chi-Square Test) *Slide 157, including Minitab Ex.*
- Two Sample Variance Test (F-Test) *Slide 163, including Minitab Ex.*

**File: Statistics – 7 (Parts A, B, C), Slides 169-192 (Length = 187 minutes)**

- **CQE BOK VI.D. “Statistical Decision Making” or CSSBB BOK VI.B. “Hypothesis Testing”**
- One Sample Proportion Test (Z-Test) *Slide 169, including Minitab Ex.*
- One Sample Defects/Unit Test (Z-Test) *Slide 174, including Minitab Ex.*
- Two + Sample Proportion Test (Chi-Square Test) *Slide 178, including Minitab Ex.*
- One Way ANOVA Test (F-Test) *Slide 183, including Minitab Ex.*
- Two Way ANOVA Test (F-Test) *Slides 192 & 263, including Minitab Ex.*

**File: Statistics – 8, Slides 193-219 (Length = 92 minutes)**

- **CSSBB BOK VI.B. “Hypothesis Testing (Nonparametric Tests)”**
- Nonparametric Tests Introduction *Slide 193*
- Common Nonparametric Tests *Slide 195*
- One Sample Median Test (Sign Test) *Slide 196, including Minitab Ex.*
- Two Sample Median Test (Mann-Whitney Test) *Slide 199, including Minitab Ex.*
- Three Sample Median Test (Kruskal-Wallis Test) *Slide 205, including Minitab Ex.*
- Three Sample Median Test (Mood’s Median Test) *Slide 209, including Minitab Ex.*
- Two Sample Variance Test (Levene’s Test) *Slide 214, including Minitab Ex.*

**File: Statistics – 9 (Parts A, B), Slides 220-249 (Length = 121 minutes)**

- **CSSBB BOK VI.A. “Measuring & Modeling Variable Relationships”**
- Recap Previously Discussed Statistical Tools *Slide 220*
- Multi-Vari Charts *Slide 231, including Minitab Ex.*

**- CQE BOK VI.E. “Relationships Between Variables” or CSSBB BOK VI.A. “Measuring & Modeling Variable Relationships”**

- Regression Analysis Introduction *Slide 236*
- Linear Regression *Slide 238, including Minitab Ex.*
- Curvilinear Regression *Slide 242, including Minitab Ex.*
- Multiple Regression *Slide 247, including Minitab Ex.*

**File: Statistics – 10 (Parts A, B), Slides 251-275 (Length = 109 minutes)**

**- CQE BOK IV.F. “Measurement System Analysis (MSA)” or CSSBB BOK V.C. “Measurement Systems”**

- Measurement System Analysis Introduction *Slide 251*
- Gage R&R Study Planning *Slide 261*
- Gage R&R Example using ANOVA Method *Slide 263, including Minitab Ex.*
- Gage R&R Linearity & Bias Study *Slide 271, including Minitab Ex.*

**File: Statistics – 11 (Parts A, B, C), Slides 276-307 (Length = 137 minutes)**

**- CQE BOK VI.F. “Statistical Process Control (SPC)” or CSSBB BOK VIII.A. “Statistical Process Control”**

- Statistical Process Control Introduction *Slide 276*
- Variable Control Chart Guidelines *Slide 281*
- Common Variable Control Charts *Slide 283*
- Control Chart Out-of-Control Decision Rules *Slide 291*
- Xbar & R Charts Example *Slide 292, including Minitab Ex.*
- I-MR Charts Example *Slide 297*
- EWMA Chart Example *Slide 300, including Minitab Ex.*
- Z-MR Charts Example *Slide 303*
- Pre-Control Charting *Slide 306*

**File: Statistics – 12 (Parts A, B, C, D), Slides 308-340 (Length = 178 minutes)**

**- CQE BOK VI.F. “Statistical Process Control (SPC)” or CSSBB BOK VIII.A. “Statistical Process Control”**

- Attribute Control Chart Guidelines *Slide 308*
- Common Attribute Control Charts *Slide 310*
- P-Chart Example *Slide 312, including Minitab Ex.*
- np-Chart Example *Slide 317*
- U-Chart Example *Slide 319, including Minitab Ex.*
- c-Chart Example *Slide 321*

**- CQE BOK VI.G. “Process & Performance Capability” or CSSBB BOK V.F. “Process Capability”**

- Process Capability Introduction *Slide 324*
- Process Capability Study (Continuous Data) *Slide 327*
- Process Capability Indices Cp & Cpk *Slide 328*
- Process Performance Indices Pp & Ppk & Cpm *Slide 330, including Minitab Ex.*
- Process Capability Indices Miscellaneous *Slide 333*
- Attribute Process Capability Study *Slide 339, including Minitab Ex.*

**File: Statistics 15 – 16 (Parts A, B, C, D, E), Slides 387-432 (Length = 291 minutes)**

**- CQE BOK VI.H. “Design & Analysis of Experiments” or CSSBB BOK VII.A. “Design of Experiments (DOE)”**

- Design of Experiments (DOE) Introduction *Slide 387*
- DOE Definitions *Slide 397*
- 3-Level DOEs VS 2-Level DOEs *Slide 402*
- One-Factor-At-A-Time VS DOE *Slide 403*
- Calculating DOE Effects *Slide 404*
- Sparsity of Effects Principle *Slide 408*
- DOE Analysis *Slide 409*
- General Steps in a DOE Study *Slide 414*
- Full Factorial DOE Example (with Replication) *Slide 415, including Minitab Ex.*
- Fractional Factorial DOEs *Slide 425*
- Resolution III, IV, V Designs *Slide 426*
- Fractional Factorial Example *Slide 430, including Minitab Ex.*