# UCL Statistics for Data Sets with Non-Detects

|  |  |  |
|---|---|---|
| User Selected Options | | |
| Date/Time of Computation | ProUCL 5.110/13/2016 3:07:35 PM | |
| From File | ProUCL input 01-007(b) 0-1, 0-5, 0-10_b.xls | |
| Full Precision | OFF | |
| Confidence Coefficient | 95% | |
| Number of Bootstrap Operations | 2000 | |

**Chromium**

## General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 42 | Number of Distinct Observations | 38 |
| | | Number of Missing Observations | 0 |
| Minimum | 1.33 | Mean | 8.096 |
| Maximum | 41.1 | Median | 3.7 |
| SD | 8.796 | Std. Error of Mean | 1.357 |
| Coefficient of Variation | 1.086 | Skewness | 1.947 |

## Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.719 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.942 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.227 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.135 | Data Not Normal at 5% Significance Level |
| **Data Not Normal at 5% Significance Level** | | |

## Assuming Normal Distribution

| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 10.38 | 95% Adjusted-CLT UCL (Chen-1995) | 10.76 |
| | | 95% Modified-t UCL (Johnson-1978) | 10.45 |

## Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 1.664 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.773 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.194 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.14 | Data Not Gamma Distributed at 5% Significance Level |
| **Data Not Gamma Distributed at 5% Significance Level** | | |

## Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.213 | k star (bias corrected MLE) | 1.142 |
| Theta hat (MLE) | 6.673 | Theta star (bias corrected MLE) | 7.087 |
| nu hat (MLE) | 101.9 | nu star (bias corrected) | 95.97 |
| MLE Mean (bias corrected) | 8.096 | MLE Sd (bias corrected) | 7.575 |
| | | Approximate Chi Square Value (0.05) | 74.37 |
| Adjusted Level of Significance | 0.0443 | Adjusted Chi Square Value | 73.69 |

## Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 10.45 | 95% Adjusted Gamma UCL (use when n<50) | 10.54 |

## Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.876 | **Shapiro Wilk Lognormal GOF Test** |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | | | | 5% Shapiro Wilk Critical Value | | 0.942 | | Data Not Lognormal at 5% Significance Level | | | | |
| 54 | | | | Lilliefors Test Statistic | | 0.153 | | **Lilliefors Lognormal GOF Test** | | | | |
| 55 | | | | 5% Lilliefors Critical Value | | 0.135 | | Data Not Lognormal at 5% Significance Level | | | | |
| 56 | | | | | **Data Not Lognormal at 5% Significance Level** | | | | | | | |
| 57 | | | | | | | | | | | | |
| 58 | | | | | **Lognormal Statistics** | | | | | | | |
| 59 | | | | Minimum of Logged Data | | 0.285 | | | | Mean of logged Data | | 1.626 |
| 60 | | | | Maximum of Logged Data | | 3.716 | | | | SD of logged Data | | 0.947 |
| 61 | | | | | | | | | | | | |
| 62 | | | | | **Assuming Lognormal Distribution** | | | | | | | |
| 63 | | | | 95% H-UCL | | 11.19 | | | | 90% Chebyshev (MVUE) UCL | | 11.81 |
| 64 | | | | 95% Chebyshev (MVUE) UCL | | 13.6 | | | | 97.5% Chebyshev (MVUE) UCL | | 16.1 |
| 65 | | | | 99% Chebyshev (MVUE) UCL | | 21 | | | | | | |
| 66 | | | | | | | | | | | | |
| 67 | | | | | **Nonparametric Distribution Free UCL Statistics** | | | | | | | |
| 68 | | | | | **Data do not follow a Discernible Distribution (0.05)** | | | | | | | |
| 69 | | | | | | | | | | | | |
| 70 | | | | | **Nonparametric Distribution Free UCLs** | | | | | | | |
| 71 | | | | 95% CLT UCL | | 10.33 | | | | 95% Jackknife UCL | | 10.38 |
| 72 | | | | 95% Standard Bootstrap UCL | | 10.35 | | | | 95% Bootstrap-t UCL | | 11.06 |
| 73 | | | | 95% Hall's Bootstrap UCL | | 11.09 | | | | 95% Percentile Bootstrap UCL | | 10.32 |
| 74 | | | | 95% BCA Bootstrap UCL | | 10.87 | | | | | | |
| 75 | | | | 90% Chebyshev(Mean, Sd) UCL | | 12.17 | | | | 95% Chebyshev(Mean, Sd) UCL | | 14.01 |
| 76 | | | | 97.5% Chebyshev(Mean, Sd) UCL | | 16.57 | | | | 99% Chebyshev(Mean, Sd) UCL | | 21.6 |
| 77 | | | | | | | | | | | | |
| 78 | | | | | **Suggested UCL to Use** | | | | | | | |
| 79 | | | | 95% Chebyshev (Mean, Sd) UCL | | 14.01 | | | | | | |
| 80 | | | | | | | | | | | | |
| 81 | | | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | |
| 82 | | | Recommendations are based upon data size, data distribution, and skewness. | | | | | | | | | |
| 83 | | | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | | | | | | | |
| 84 | | | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | |
| 85 | | | | | | | | | | | | |
| 86 | | | | | | | | | | | | |
| 87 | **Nickel** | | | | | | | | | | | |
| 88 | | | | | | | | | | | | |
| 89 | | | | | **General Statistics** | | | | | | | |
| 90 | | | | Total Number of Observations | | 42 | | | Number of Distinct Observations | | | 36 |
| 91 | | | | | | | | | Number of Missing Observations | | | 0 |
| 92 | | | | Minimum | | 0.504 | | | | Mean | | 3.802 |
| 93 | | | | Maximum | | 15.9 | | | | Median | | 2.08 |
| 94 | | | | SD | | 3.756 | | | | Std. Error of Mean | | 0.58 |
| 95 | | | | Coefficient of Variation | | 0.988 | | | | Skewness | | 1.722 |
| 96 | | | | | | | | | | | | |
| 97 | | | | | **Normal GOF Test** | | | | | | | |
| 98 | | | | Shapiro Wilk Test Statistic | | 0.724 | | **Shapiro Wilk GOF Test** | | | | |
| 99 | | | | 5% Shapiro Wilk Critical Value | | 0.942 | | Data Not Normal at 5% Significance Level | | | | |
| 100 | | | | Lilliefors Test Statistic | | 0.287 | | **Lilliefors GOF Test** | | | | |
| 101 | | | | 5% Lilliefors Critical Value | | 0.135 | | Data Not Normal at 5% Significance Level | | | | |
| 102 | | | | | **Data Not Normal at 5% Significance Level** | | | | | | | |
| 103 | | | | | | | | | | | | |
| 104 | | | | | **Assuming Normal Distribution** | | | | | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 105 | | | 95% Normal UCL | | | | | | 95% UCLs (Adjusted for Skewness) | | | |
| 106 | | | | 95% Student's-t UCL | | 4.777 | | | 95% Adjusted-CLT UCL (Chen-1995) | | | 4.92 |
| 107 | | | | | | | | | 95% Modified-t UCL (Johnson-1978) | | | 4.803 |
| 108 | | | | | | | | | | | | |
| 109 | | | | | | Gamma GOF Test | | | | | | |
| 110 | | | | A-D Test Statistic | | 1.956 | | | Anderson-Darling Gamma GOF Test | | | |
| 111 | | | | 5% A-D Critical Value | | 0.768 | | | Data Not Gamma Distributed at 5% Significance Level | | | |
| 112 | | | | K-S Test Statistic | | 0.232 | | | Kolmogorov-Smirnov Gamma GOF Test | | | |
| 113 | | | | 5% K-S Critical Value | | 0.139 | | | Data Not Gamma Distributed at 5% Significance Level | | | |
| 114 | | | | Data Not Gamma Distributed at 5% Significance Level | | | | | | | | |
| 115 | | | | | | | | | | | | |
| 116 | | | | | | Gamma Statistics | | | | | | |
| 117 | | | | k hat (MLE) | | 1.46 | | | k star (bias corrected MLE) | | | 1.371 |
| 118 | | | | Theta hat (MLE) | | 2.605 | | | Theta star (bias corrected MLE) | | | 2.773 |
| 119 | | | | nu hat (MLE) | | 122.6 | | | nu star (bias corrected) | | | 115.2 |
| 120 | | | | MLE Mean (bias corrected) | | 3.802 | | | MLE Sd (bias corrected) | | | 3.247 |
| 121 | | | | | | | | | Approximate Chi Square Value (0.05) | | | 91.4 |
| 122 | | | | Adjusted Level of Significance | | 0.0443 | | | Adjusted Chi Square Value | | | 90.65 |
| 123 | | | | | | | | | | | | |
| 124 | | | | | | Assuming Gamma Distribution | | | | | | |
| 125 | | 95% Approximate Gamma UCL (use when n>=50)) | | | | 4.791 | | | 95% Adjusted Gamma UCL (use when n<50) | | | 4.831 |
| 126 | | | | | | | | | | | | |
| 127 | | | | | | Lognormal GOF Test | | | | | | |
| 128 | | | | Shapiro Wilk Test Statistic | | 0.902 | | | Shapiro Wilk Lognormal GOF Test | | | |
| 129 | | | | 5% Shapiro Wilk Critical Value | | 0.942 | | | Data Not Lognormal at 5% Significance Level | | | |
| 130 | | | | Lilliefors Test Statistic | | 0.178 | | | Lilliefors Lognormal GOF Test | | | |
| 131 | | | | 5% Lilliefors Critical Value | | 0.135 | | | Data Not Lognormal at 5% Significance Level | | | |
| 132 | | | | Data Not Lognormal at 5% Significance Level | | | | | | | | |
| 133 | | | | | | | | | | | | |
| 134 | | | | | | Lognormal Statistics | | | | | | |
| 135 | | | | Minimum of Logged Data | | -0.685 | | | Mean of logged Data | | | 0.955 |
| 136 | | | | Maximum of Logged Data | | 2.766 | | | SD of logged Data | | | 0.853 |
| 137 | | | | | | | | | | | | |
| 138 | | | | | | Assuming Lognormal Distribution | | | | | | |
| 139 | | | | 95% H-UCL | | 5.015 | | | 90% Chebyshev (MVUE) UCL | | | 5.345 |
| 140 | | | | 95% Chebyshev (MVUE) UCL | | 6.091 | | | 97.5% Chebyshev (MVUE) UCL | | | 7.127 |
| 141 | | | | 99% Chebyshev (MVUE) UCL | | 9.162 | | | | | | |
| 142 | | | | | | | | | | | | |
| 143 | | | | | | Nonparametric Distribution Free UCL Statistics | | | | | | |
| 144 | | | | | | Data do not follow a Discernible Distribution (0.05) | | | | | | |
| 145 | | | | | | | | | | | | |
| 146 | | | | | | Nonparametric Distribution Free UCLs | | | | | | |
| 147 | | | | 95% CLT UCL | | 4.755 | | | 95% Jackknife UCL | | | 4.777 |
| 148 | | | | 95% Standard Bootstrap UCL | | 4.753 | | | 95% Bootstrap-t UCL | | | 5.044 |
| 149 | | | | 95% Hall's Bootstrap UCL | | 4.899 | | | 95% Percentile Bootstrap UCL | | | 4.801 |
| 150 | | | | 95% BCA Bootstrap UCL | | 4.899 | | | | | | |
| 151 | | | | 90% Chebyshev(Mean, Sd) UCL | | 5.541 | | | 95% Chebyshev(Mean, Sd) UCL | | | 6.329 |
| 152 | | | | 97.5% Chebyshev(Mean, Sd) UCL | | 7.422 | | | 99% Chebyshev(Mean, Sd) UCL | | | 9.569 |
| 153 | | | | | | | | | | | | |
| 154 | | | | | | Suggested UCL to Use | | | | | | |
| 155 | | | | 95% Chebyshev (Mean, Sd) UCL | | 6.329 | | | | | | |
| 156 | | | | | | | | | | | | |

**Selenium**

## General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 42 | Number of Distinct Observations | 30 |
| Number of Detects | 26 | Number of Non-Detects | 16 |
| Number of Distinct Detects | 18 | Number of Distinct Non-Detects | 12 |
| Minimum Detect | 0.17 | Minimum Non-Detect | 0.54 |
| Maximum Detect | 1.6 | Maximum Non-Detect | 3.07 |
| Variance Detects | 0.095 | Percent Non-Detects | 38.1% |
| Mean Detects | 0.384 | SD Detects | 0.308 |
| Median Detects | 0.285 | CV Detects | 0.801 |
| Skewness Detects | 2.921 | Kurtosis Detects | 9.707 |
| Mean of Logged Detects | -1.136 | SD of Logged Detects | 0.547 |

## Normal GOF Test on Detects Only

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.642 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.92 | Detected Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.313 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.17 | Detected Data Not Normal at 5% Significance Level | |

**Detected Data Not Normal at 5% Significance Level**

## Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.375 | KM Standard Error of Mean | 0.0555 |
| KM SD | 0.29 | 95% KM (BCA) UCL | 0.478 |
| 95% KM (t) UCL | 0.469 | 95% KM (Percentile Bootstrap) UCL | 0.473 |
| 95% KM (z) UCL | 0.466 | 95% KM Bootstrap t UCL | 0.542 |
| 90% KM Chebyshev UCL | 0.542 | 95% KM Chebyshev UCL | 0.617 |
| 97.5% KM Chebyshev UCL | 0.722 | 99% KM Chebyshev UCL | 0.927 |

## Gamma GOF Tests on Detected Observations Only

| | | | |
|---|---|---|---|
| A-D Test Statistic | 1.543 | **Anderson-Darling GOF Test** | |
| 5% A-D Critical Value | 0.751 | Detected Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.226 | **Kolmogorov-Smirnov GOF** | |
| 5% K-S Critical Value | 0.172 | Detected Data Not Gamma Distributed at 5% Significance Level | |

**Detected Data Not Gamma Distributed at 5% Significance Level**

## Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.937 | k star (bias corrected MLE) | 2.624 |
| Theta hat (MLE) | 0.131 | Theta star (bias corrected MLE) | 0.147 |
| nu hat (MLE) | 152.7 | nu star (bias corrected) | 136.4 |
| Mean (detects) | 0.384 | | |

## Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 209 | For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates | | | | | | | | | | | |
| 210 | | | | | Minimum | 0.17 | | | | | Mean | 0.362 |
| 211 | | | | | Maximum | 1.6 | | | | | Median | 0.317 |
| 212 | | | | | SD | 0.248 | | | | | CV | 0.685 |
| 213 | | | | | k hat (MLE) | 4.093 | | | | | k star (bias corrected MLE) | 3.817 |
| 214 | | | | | Theta hat (MLE) | 0.0884 | | | | | Theta star (bias corrected MLE) | 0.0948 |
| 215 | | | | | nu hat (MLE) | 343.8 | | | | | nu star (bias corrected) | 320.6 |
| 216 | | | | Adjusted Level of Significance (β) | | 0.0443 | | | | | | |
| 217 | | | Approximate Chi Square Value (320.62, α) | | | 280.1 | | | Adjusted Chi Square Value (320.62, β) | | | 278.8 |
| 218 | | | 95% Gamma Approximate UCL (use when n>=50) | | | 0.414 | | | 95% Gamma Adjusted UCL (use when n<50) | | | 0.416 |
| 219 | | | | | | | | | | | | |
| 220 | | | | | Estimates of Gamma Parameters using KM Estimates | | | | | | | |
| 221 | | | | | Mean (KM) | 0.375 | | | | | SD (KM) | 0.29 |
| 222 | | | | | Variance (KM) | 0.0842 | | | | | SE of Mean (KM) | 0.0555 |
| 223 | | | | | k hat (KM) | 1.672 | | | | | k star (KM) | 1.569 |
| 224 | | | | | nu hat (KM) | 140.5 | | | | | nu star (KM) | 131.8 |
| 225 | | | | | theta hat (KM) | 0.224 | | | | | theta star (KM) | 0.239 |
| 226 | | | | 80% gamma percentile (KM) | | 0.578 | | | | 90% gamma percentile (KM) | | 0.773 |
| 227 | | | | 95% gamma percentile (KM) | | 0.963 | | | | 99% gamma percentile (KM) | | 1.39 |
| 228 | | | | | | | | | | | | |
| 229 | | | | | Gamma Kaplan-Meier (KM) Statistics | | | | | | | |
| 230 | | | Approximate Chi Square Value (131.77, α) | | | 106.3 | | | Adjusted Chi Square Value (131.77, β) | | | 105.4 |
| 231 | | 95% Gamma Approximate KM-UCL (use when n>=50) | | | | 0.465 | | | 95% Gamma Adjusted KM-UCL (use when n<50) | | | 0.469 |
| 232 | | | | | | | | | | | | |
| 233 | | | | | Lognormal GOF Test on Detected Observations Only | | | | | | | |
| 234 | | | | Shapiro Wilk Test Statistic | | 0.885 | | | Shapiro Wilk GOF Test | | | |
| 235 | | | | 5% Shapiro Wilk Critical Value | | 0.92 | | | Detected Data Not Lognormal at 5% Significance Level | | | |
| 236 | | | | | Lilliefors Test Statistic | 0.174 | | | Lilliefors GOF Test | | | |
| 237 | | | | 5% Lilliefors Critical Value | | 0.17 | | | Detected Data Not Lognormal at 5% Significance Level | | | |
| 238 | | | | | Detected Data Not Lognormal at 5% Significance Level | | | | | | | |
| 239 | | | | | | | | | | | | |
| 240 | | | | | Lognormal ROS Statistics Using Imputed Non-Detects | | | | | | | |
| 241 | | | | Mean in Original Scale | | 0.358 | | | | Mean in Log Scale | | -1.148 |
| 242 | | | | SD in Original Scale | | 0.245 | | | | SD in Log Scale | | 0.44 |
| 243 | | | 95% t UCL (assumes normality of ROS data) | | | 0.422 | | | | 95% Percentile Bootstrap UCL | | 0.427 |
| 244 | | | | 95% BCA Bootstrap UCL | | 0.446 | | | | 95% Bootstrap t UCL | | 0.482 |
| 245 | | | | 95% H-UCL (Log ROS) | | 0.397 | | | | | | |
| 246 | | | | | | | | | | | | |
| 247 | | | Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution | | | | | | | | | |
| 248 | | | | | KM Mean (logged) | -1.151 | | | | | KM Geo Mean | 0.316 |
| 249 | | | | | KM SD (logged) | 0.522 | | | | 95% Critical H Value (KM-Log) | | 1.914 |
| 250 | | | | KM Standard Error of Mean (logged) | | 0.101 | | | | 95% H-UCL (KM -Log) | | 0.424 |
| 251 | | | | | KM SD (logged) | 0.522 | | | | 95% Critical H Value (KM-Log) | | 1.914 |
| 252 | | | | KM Standard Error of Mean (logged) | | 0.101 | | | | | | |
| 253 | | | | | | | | | | | | |
| 254 | | | | | DL/2 Statistics | | | | | | | |
| 255 | | DL/2 Normal | | | | | | DL/2 Log-Transformed | | | | |
| 256 | | | | Mean in Original Scale | | 0.719 | | | | Mean in Log Scale | | -0.657 |
| 257 | | | | SD in Original Scale | | 0.559 | | | | SD in Log Scale | | 0.83 |
| 258 | | | | 95% t UCL (Assumes normality) | | 0.864 | | | | 95% H-Stat UCL | | 0.97 |
| 259 | | | | DL/2 is not a recommended method, provided for comparisons and historical reasons | | | | | | | | |
| 260 | | | | | | | | | | | | |

**Data do not follow a Discernible Distribution at 5% Significance Level**

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% KM (Chebyshev) UCL | 0.617 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Plutonium-239/240**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 35 | Number of Distinct Observations | 34 |
| Number of Detects | 25 | Number of Non-Detects | 10 |
| Number of Distinct Detects | 25 | Number of Distinct Non-Detects | 9 |
| Minimum Detect | 0.135 | Minimum Non-Detect | -0.0117 |
| Maximum Detect | 20.1 | Maximum Non-Detect | 0.224 |
| Variance Detects | 30.35 | Percent Non-Detects | 28.57% |
| Mean Detects | 5.613 | SD Detects | 5.509 |
| Median Detects | 3.96 | CV Detects | 0.981 |
| Skewness Detects | 1.235 | Kurtosis Detects | 1.045 |

**Normal GOF Test on Detects Only**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.854 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.918 | Detected Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.16 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.173 | Detected Data appear Normal at 5% Significance Level | |

**Detected Data appear Approximate Normal at 5% Significance Level**

**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**

| | | | |
|---|---|---|---|
| KM Mean | 4.007 | KM Standard Error of Mean | 0.901 |
| KM SD | 5.221 | 95% KM (BCA) UCL | 5.571 |
| 95% KM (t) UCL | 5.53 | 95% KM (Percentile Bootstrap) UCL | 5.559 |
| 95% KM (z) UCL | 5.489 | 95% KM Bootstrap t UCL | 5.988 |
| 90% KM Chebyshev UCL | 6.709 | 95% KM Chebyshev UCL | 7.933 |
| 97.5% KM Chebyshev UCL | 9.632 | 99% KM Chebyshev UCL | 12.97 |

**Gamma GOF Tests on Detected Observations Only**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.374 | **Anderson-Darling GOF Test** | |
| 5% A-D Critical Value | 0.777 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.129 | **Kolmogorov-Smirnov GOF** | |
| 5% K-S Critical Value | 0.18 | Detected data appear Gamma Distributed at 5% Significance Level | |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics on Detected Data Only**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.903 | k star (bias corrected MLE) | 0.821 |
| Theta hat (MLE) | 6.219 | Theta star (bias corrected MLE) | 6.838 |
| nu hat (MLE) | 45.13 | nu star (bias corrected) | 41.05 |
| Mean (detects) | 5.613 | | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 313 | Estimates of Gamma Parameters using KM Estimates ||||||||||||
| 314 | | | | | Mean (KM) | 4.007 | | | | | SD (KM) | 5.221 |
| 315 | | | | | Variance (KM) | 27.26 | | | | | SE of Mean (KM) | 0.901 |
| 316 | | | | | k hat (KM) | 0.589 | | | | | k star (KM) | 0.558 |
| 317 | | | | | nu hat (KM) | 41.23 | | | | | nu star (KM) | 39.03 |
| 318 | | | | | theta hat (KM) | 6.803 | | | | | theta star (KM) | 7.186 |
| 319 | | | | 80% gamma percentile (KM) | | 6.602 | | | | 90% gamma percentile (KM) | | 10.59 |
| 320 | | | | 95% gamma percentile (KM) | | 14.8 | | | | 99% gamma percentile (KM) | | 25.06 |
| 321 | | | | | | | | | | | | |
| 322 | Gamma Kaplan-Meier (KM) Statistics ||||||||||||
| 323 | | | | | | | | | Adjusted Level of Significance (β) | | | 0.0425 |
| 324 | | | Approximate Chi Square Value (39.03, α) | | | 25.72 | | | Adjusted Chi Square Value (39.03, β) | | | 25.21 |
| 325 | | 95% Gamma Approximate KM-UCL (use when n>=50) | | | | 6.081 | | 95% Gamma Adjusted KM-UCL (use when n<50) | | | | 6.205 |
| 326 | | | | | | | | | | | | |
| 327 | Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution ||||||||||||
| 328 | | | | KM Mean (logged) | | N/A | | | | | KM Geo Mean | N/A |
| 329 | | | | KM SD (logged) | | N/A | | | | 95% Critical H Value (KM-Log) | | N/A |
| 330 | | | KM Standard Error of Mean (logged) | | | N/A | | | | 95% H-UCL (KM -Log) | | N/A |
| 331 | | | | KM SD (logged) | | N/A | | | | 95% Critical H Value (KM-Log) | | N/A |
| 332 | | | KM Standard Error of Mean (logged) | | | N/A | | | | | | |
| 333 | | | | | | | | | | | | |
| 334 | DL/2 Statistics ||||||||||||
| 335 | | | | Mean in Original Scale | | 4.018 | | | | | SD in Original Scale | 5.289 |
| 336 | | | | 95% t UCL (Assumes normality) | | 5.529 | | | | | | |
| 337 | DL/2 is not a recommended method, provided for comparisons and historical reasons ||||||||||||
| 338 | | | | | | | | | | | | |
| 339 | Nonparametric Distribution Free UCL Statistics ||||||||||||
| 340 | Detected Data appear Approximate Normal Distributed at 5% Significance Level ||||||||||||
| 341 | | | | | | | | | | | | |
| 342 | Suggested UCL to Use ||||||||||||
| 343 | | | | 95% KM (t) UCL | | 5.53 | | | | | | |
| 344 | | | | | | | | | | | | |
| 345 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test ||||||||||||
| 346 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL ||||||||||||
| 347 | | | | | | | | | | | | |
| 348 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. ||||||||||||
| 349 | Recommendations are based upon data size, data distribution, and skewness. ||||||||||||
| 350 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). ||||||||||||
| 351 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. ||||||||||||
| 352 | | | | | | | | | | | | |