

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.16/19/17 5:19:22 PM
From File	ProUCLinput_53-009_0-1.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	14.2	Mean	124.1
Maximum	250	Median	77.1
SD	99.31	Std. Error of Mean	33.1
Coefficient of Variation	0.8	Skewness	0.239

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.

For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.819	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.238	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	185.7	95% Adjusted-CLT UCL (Chen-1995)	181.4
		95% Modified-t UCL (Johnson-1978)	186.1

Gamma GOF Test

A-D Test Statistic	0.614	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.254	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.285	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.366	k star (bias corrected MLE)	0.985
Theta hat (MLE)	90.89	Theta star (bias corrected MLE)	126.1

nu hat (MLE)	24.59	nu star (bias corrected)	17.72
MLE Mean (bias corrected)	124.1	MLE Sd (bias corrected)	125.1
		Approximate Chi Square Value (0.05)	9.192
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	7.93
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when $n \geq 50$)	239.4	95% Adjusted Gamma UCL (use when $n < 50$)	277.5
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.881	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.243	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	2.653	Mean of logged Data	4.413
Maximum of Logged Data	5.521	SD of logged Data	1.052
Assuming Lognormal Distribution			
95% H-UCL	499.3	90% Chebyshev (MVUE) UCL	275.9
95% Chebyshev (MVUE) UCL	341.1	97.5% Chebyshev (MVUE) UCL	431.5
99% Chebyshev (MVUE) UCL	609.3		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	178.6	95% Jackknife UCL	185.7
95% Standard Bootstrap UCL	176.7	95% Bootstrap-t UCL	183.8
95% Hall's Bootstrap UCL	163.3	95% Percentile Bootstrap UCL	175.4
95% BCA Bootstrap UCL	181.1		
90% Chebyshev(Mean, Sd) UCL	223.5	95% Chebyshev(Mean, Sd) UCL	268.4
97.5% Chebyshev(Mean, Sd) UCL	330.9	99% Chebyshev(Mean, Sd) UCL	453.5
Suggested UCL to Use			
95% Student's-t UCL	185.7		

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

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.

Chromium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	1.2	Mean	7.206
Maximum	14.9	Median	7.14
SD	3.701	Std. Error of Mean	1.234
Coefficient of Variation	0.514	Skewness	0.721

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.

For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.931	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.193	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	9.5	95% Adjusted-CLT UCL (Chen-1995)	9.552
		95% Modified-t UCL (Johnson-1978)	9.549

Gamma GOF Test

A-D Test Statistic	0.492	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.22	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.251	k star (bias corrected MLE)	2.241
Theta hat (MLE)	2.217	Theta star (bias corrected MLE)	3.215
nu hat (MLE)	58.51	nu star (bias corrected)	40.34
MLE Mean (bias corrected)	7.206	MLE Sd (bias corrected)	4.813
		Approximate Chi Square Value (0.05)	26.79
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	24.48

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when $n \geq 50$)	10.85	95% Adjusted Gamma UCL (use when $n < 50$)	11.87
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.829	Shapiro Wilk Lognormal GOF Test	
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5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.271	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.182	Mean of logged Data	1.813
Maximum of Logged Data	2.701	SD of logged Data	0.692

Assuming Lognormal Distribution

95% H-UCL	14.74	90% Chebyshev (MVUE) UCL	12.91
95% Chebyshev (MVUE) UCL	15.33	97.5% Chebyshev (MVUE) UCL	18.7
99% Chebyshev (MVUE) UCL	25.31		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9.235	95% Jackknife UCL	9.5
95% Standard Bootstrap UCL	9.093	95% Bootstrap-t UCL	9.849
95% Hall's Bootstrap UCL	11.19	95% Percentile Bootstrap UCL	9.196
95% BCA Bootstrap UCL	9.461		
90% Chebyshev(Mean, Sd) UCL	10.91	95% Chebyshev(Mean, Sd) UCL	12.58
97.5% Chebyshev(Mean, Sd) UCL	14.91	99% Chebyshev(Mean, Sd) UCL	19.48

Suggested UCL to Use

95% Student's-t UCL	9.5
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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.

Copper

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	1.41	Mean	6.211
Maximum	11.8	Median	7.07
SD	3.19	Std. Error of Mean	1.063
Coefficient of Variation	0.514	Skewness	0.25

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.956	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.198	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	8.188	95% Adjusted-CLT UCL (Chen-1995)	8.055
		95% Modified-t UCL (Johnson-1978)	8.203

Gamma GOF Test

A-D Test Statistic	0.365	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.22	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.453	k star (bias corrected MLE)	2.376
Theta hat (MLE)	1.799	Theta star (bias corrected MLE)	2.614
nu hat (MLE)	62.15	nu star (bias corrected)	42.76
MLE Mean (bias corrected)	6.211	MLE Sd (bias corrected)	4.03
		Approximate Chi Square Value (0.05)	28.77
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	26.37

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	9.232	95% Adjusted Gamma UCL (use when n<50)	10.07
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.903	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.226	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.344	Mean of logged Data	1.675
Maximum of Logged Data	2.468	SD of logged Data	0.639

Assuming Lognormal Distribution

95% H-UCL	11.55	90% Chebyshev (MVUE) UCL	10.54
95% Chebyshev (MVUE) UCL	12.43	97.5% Chebyshev (MVUE) UCL	15.04
99% Chebyshev (MVUE) UCL	20.18		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.96	95% Jackknife UCL	8.188
95% Standard Bootstrap UCL	7.847	95% Bootstrap-t UCL	8.389
95% Hall's Bootstrap UCL	8.065	95% Percentile Bootstrap UCL	7.882
95% BCA Bootstrap UCL	8.023		
90% Chebyshev(Mean, Sd) UCL	9.401	95% Chebyshev(Mean, Sd) UCL	10.85
97.5% Chebyshev(Mean, Sd) UCL	12.85	99% Chebyshev(Mean, Sd) UCL	16.79

Suggested UCL to Use

95% Student's-t UCL	8.188
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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.

Lead

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	3.38	Mean	26.97
Maximum	201	Median	4.98
SD	65.28	Std. Error of Mean	21.76
Coefficient of Variation	2.421	Skewness	2.996

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.413	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.5	Lilliefors GOF Test
5% Lilliefors Critical Value	0.274	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	67.44	95% Adjusted-CLT UCL (Chen-1995)	85.99
		95% Modified-t UCL (Johnson-1978)	71.06

Gamma GOF Test

A-D Test Statistic
5% A-D Critical Value
K-S Test Statistic
5% K-S Critical Value

2.208 **Anderson-Darling Gamma GOF Test**
0.771 Data Not Gamma Distributed at 5% Significance Level
0.46 **Kolmogorov-Smirnov Gamma GOF Test**
0.294 Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)
Theta hat (MLE)
nu hat (MLE)
MLE Mean (bias corrected)

Adjusted Level of Significance

0.497 k star (bias corrected MLE) 0.406
54.23 Theta star (bias corrected MLE) 66.49
8.952 nu star (bias corrected) 7.301
26.97 MLE Sd (bias corrected) 42.35
Approximate Chi Square Value (0.05) 2.337
0.0231 Adjusted Chi Square Value 1.79

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when $n \geq 50$)

84.25 95% Adjusted Gamma UCL (use when $n < 50$) 110

Lognormal GOF Test

Shapiro Wilk Test Statistic
5% Shapiro Wilk Critical Value
Lilliefors Test Statistic
5% Lilliefors Critical Value

0.613 **Shapiro Wilk Lognormal GOF Test**
0.829 Data Not Lognormal at 5% Significance Level
0.346 **Lilliefors Lognormal GOF Test**
0.274 Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data
Maximum of Logged Data

1.218 Mean of logged Data 2.016
5.303 SD of logged Data 1.268

Assuming Lognormal Distribution

95% H-UCL
95% Chebyshev (MVUE) UCL
99% Chebyshev (MVUE) UCL

95.01 90% Chebyshev (MVUE) UCL 34.04
42.8 97.5% Chebyshev (MVUE) UCL 54.97
78.87

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL
95% Standard Bootstrap UCL
95% Hall's Bootstrap UCL
95% BCA Bootstrap UCL
90% Chebyshev(Mean, Sd) UCL
97.5% Chebyshev(Mean, Sd) UCL

62.76 95% Jackknife UCL 67.44
60.13 95% Bootstrap-t UCL 1418
624.6 95% Percentile Bootstrap UCL 70.31
92.3
92.25 95% Chebyshev(Mean, Sd) UCL 121.8
162.9 99% Chebyshev(Mean, Sd) UCL 243.5

Suggested UCL to Use

95% Hall's Bootstrap UCL

624.6

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

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.

Nickel

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	1.31	Mean	5.447
Maximum	9.5	Median	5.64
SD	2.4	Std. Error of Mean	0.8
Coefficient of Variation	0.441	Skewness	-0.0323

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.

For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.986	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.155	Lilliefors GOF Test
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	6.934	95% Adjusted-CLT UCL (Chen-1995)	6.753
		95% Modified-t UCL (Johnson-1978)	6.933

Gamma GOF Test

A-D Test Statistic	0.336	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.339	k star (bias corrected MLE)	2.967
Theta hat (MLE)	1.255	Theta star (bias corrected MLE)	1.836
nu hat (MLE)	78.1	nu star (bias corrected)	53.4
MLE Mean (bias corrected)	5.447	MLE Sd (bias corrected)	3.162
		Approximate Chi Square Value (0.05)	37.61
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	34.83

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when $n \geq 50$)	7.733	95% Adjusted Gamma UCL (use when $n < 50$)	8.349
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.877	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.22	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.27	Mean of logged Data	1.575
Maximum of Logged Data	2.251	SD of logged Data	0.579

Assuming Lognormal Distribution

95% H-UCL	9.308	90% Chebyshev (MVUE) UCL	8.895
95% Chebyshev (MVUE) UCL	10.39	97.5% Chebyshev (MVUE) UCL	12.46
99% Chebyshev (MVUE) UCL	16.54		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.763	95% Jackknife UCL	6.934
95% Standard Bootstrap UCL	6.697	95% Bootstrap-t UCL	6.901
95% Hall's Bootstrap UCL	6.957	95% Percentile Bootstrap UCL	6.729
95% BCA Bootstrap UCL	6.653		
90% Chebyshev(Mean, Sd) UCL	7.847	95% Chebyshev(Mean, Sd) UCL	8.934
97.5% Chebyshev(Mean, Sd) UCL	10.44	99% Chebyshev(Mean, Sd) UCL	13.41

Suggested UCL to Use

95% Student's-t UCL	6.934
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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.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Vanadium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	2.92	Mean	22.39
Maximum	36	Median	22.4
SD	10.69	Std. Error of Mean	3.564
Coefficient of Variation	0.477	Skewness	-0.594

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.

For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.963	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.138	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	29.02	95% Adjusted-CLT UCL (Chen-1995)	27.5
		95% Modified-t UCL (Johnson-1978)	28.9

Gamma GOF Test

A-D Test Statistic	0.534	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.2	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.837	k star (bias corrected MLE)	1.965
Theta hat (MLE)	7.893	Theta star (bias corrected MLE)	11.39
nu hat (MLE)	51.06	nu star (bias corrected)	35.38
MLE Mean (bias corrected)	22.39	MLE Sd (bias corrected)	15.97
		Approximate Chi Square Value (0.05)	22.77
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	20.66

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	34.79	95% Adjusted Gamma UCL (use when n<50)	38.34
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Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.788	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.247	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	1.072	Mean of logged Data	2.922
Maximum of Logged Data	3.584	SD of logged Data	0.781
Assuming Lognormal Distribution			
95% H-UCL	54.23	90% Chebyshev (MVUE) UCL	43.62
95% Chebyshev (MVUE) UCL	52.42	97.5% Chebyshev (MVUE) UCL	64.64
99% Chebyshev (MVUE) UCL	88.63		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	28.25	95% Jackknife UCL	29.02
95% Standard Bootstrap UCL	28.09	95% Bootstrap-t UCL	28.21
95% Hall's Bootstrap UCL	27.66	95% Percentile Bootstrap UCL	27.8
95% BCA Bootstrap UCL	27.82		
90% Chebyshev(Mean, Sd) UCL	33.08	95% Chebyshev(Mean, Sd) UCL	37.92
97.5% Chebyshev(Mean, Sd) UCL	44.65	99% Chebyshev(Mean, Sd) UCL	57.85
Suggested UCL to Use			
95% Student's-t UCL	29.02		

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.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.