UCL Statistics for Data Sets with Non-Detects

User Selected Options	
e/Time of Computation	8/13/2015 3:02:00 PM
From File	ProUCLinput_C-12-005_0-5.xls
Full Precision	OFF
Confidence Coefficient	95%
f Bootstrap Operations	2000

Chromium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	8.68	Mean	34.9
Maximum	196	Median	12.8
SD	57.4	Std. Error of Mean	18.1
Coefficient of Variation	1.64	Skewness	2.99

Normal GOF Test

Shapiro Wilk Test Statistic	0.49	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.84	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.37	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	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	68.2	95% Adjusted-CLT UCL (Chen-1995)	83.2
		95% Modified-t UCL (Johnson-1978)	71.1

Gamma GOF Test

A-D Test Statistic	1.52	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	ata Not Gamma Distributed at 5% Significance Lev
K-S Test Statistic	0.34	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.27	ata Not Gamma Distributed at 5% Significance Lev

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.97	k star (bias corrected MLE)	0.75
Theta hat (MLE)	35.6	Theta star (bias corrected MLE)	46.4
nu hat (MLE)	19.5	nu star (bias corrected)	15.0
MLE Mean (bias corrected)	34.9	MLE Sd (bias corrected)	40.2
		Approximate Chi Square Value (0.05)	7.29
Adjusted Level of Significance	0.02	Adjusted Chi Square Value	6.37

Assuming Gamma Distribution

oximate Gamma UCL (use when n>=50))	72.0	Adjusted Gamma UCL (use when n<50)	82.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.84	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.30	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.28	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.16	Mean of logged Data	2.96
Maximum of Logged Data	5.27	SD of logged Data	0.94

Assuming Lognormal Distribution

95% H-UCL	77.1	90% Chebyshev (MVUE) UCL	55.1

64	95% Chebyshev (MVUE) UCL				67.1	97.5% Chebyshev (MVUE) UCL					83.9
65	99% Chebyshev (MVUE) UCL				116.8						
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				64.8	95% Jackknife UCL					68.2
72	95% Standard Bootstrap UCL				62.5	95% Bootstrap-t UCL					228.1
73	95% Hall's Bootstrap UCL				210.1	95% Percentile Bootstrap UCL					70
74	95% BCA Bootstrap UCL				86.5						
75	90% Chebyshev(Mean, Sd) UCL				89.4	95% Chebyshev(Mean, Sd) UCL					114.1
76	97.5% Chebyshev(Mean, Sd) UCL				148.4	99% Chebyshev(Mean, Sd) UCL					215.7
77											
78	**Suggested UCL to Use**										
79	95% Chebyshev (Mean, Sd) UCL				114.1						
80											
81	stions regarding the selection of a 95% UCL are provided to help the user to select the most appropri										
82	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and										
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets										
84	For additional insight the user may want to consult a statistician.										
85											
86											
87	**Lead**										
88											
89	**General Statistics**										
90	Total Number of Observations				10	Number of Distinct Observations					9
91						Number of Missing Observations					0
92	Minimum				9.54	Mean					18.1
93	Maximum				48.2	Median					15.4
94	SD				10.8	Std. Error of Mean					3.42
95	Coefficient of Variation				0.59	Skewness					2.87
96											
97	**Normal GOF Test**										
98	Shapiro Wilk Test Statistic				0.57	**Shapiro Wilk GOF Test**					
99	5% Shapiro Wilk Critical Value				0.84	Data Not Normal at 5% Significance Level					
100	Lilliefors Test Statistic				0.38	**Lilliefors GOF Test**					
101	5% Lilliefors Critical Value				0.28	Data Not Normal at 5% Significance Level					
102	**Data Not Normal at 5% Significance Level**										
103											
104	**Assuming Normal Distribution**										
105	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**					
106	95% Student's-t UCL				24.4	95% Adjusted-CLT UCL (Chen-1995)					27.0
107						95% Modified-t UCL (Johnson-1978)					24.9
108											
109	**Gamma GOF Test**										
110	A-D Test Statistic				1.48	**Anderson-Darling Gamma GOF Test**					
111	5% A-D Critical Value				0.72	ata Not Gamma Distributed at 5% Significance Lev					
112	K-S Test Statistic				0.36	**Kolmogrov-Smirnoff Gamma GOF Test**					
113	5% K-S Critical Value				0.26	ata Not Gamma Distributed at 5% Significance Lev					
114	**Data Not Gamma Distributed at 5% Significance Level**										
115											
116	**Gamma Statistics**										
117	k hat (MLE)				5.22	k star (bias corrected MLE)					3.72
118	Theta hat (MLE)				3.46	Theta star (bias corrected MLE)					4.86
119	nu hat (MLE)				104.5	nu star (bias corrected)					74.5
120	MLE Mean (bias corrected)				18.1	MLE Sd (bias corrected)					9.39
121						Approximate Chi Square Value (0.05)					55.6
122	Adjusted Level of Significance				0.026	Adjusted Chi Square Value					52.8
123											
124	**Assuming Gamma Distribution**										
125	oximate Gamma UCL (use when n>=50))				24.25	Adjusted Gamma UCL (use when n<50)					25.5
126											

127	**Lognormal GOF Test**											
128	Shapiro Wilk Test Statistic				0.74	**Shapiro Wilk Lognormal GOF Test**						
129	5% Shapiro Wilk Critical Value				0.84	Data Not Lognormal at 5% Significance Level						
130	Lilliefors Test Statistic				0.33	**Lilliefors Lognormal GOF Test**						
131	5% Lilliefors Critical Value				0.28	Data Not Lognormal at 5% Significance Level						
132	**Data Not Lognormal at 5% Significance Level**											
133												
134	**Lognormal Statistics**											
135	Minimum of Logged Data				2.25	Mean of logged Data						2.79
136	Maximum of Logged Data				3.87	SD of logged Data						0.41
137												
138	**Assuming Lognormal Distribution**											
139	95% H-UCL				24.05	90% Chebyshev (MVUE) UCL						24.8
140	95% Chebyshev (MVUE) UCL				28.12	97.5% Chebyshev (MVUE) UCL						32.6
141	99% Chebyshev (MVUE) UCL				41.4							
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				23.7	95% Jackknife UCL						24.4
148	95% Standard Bootstrap UCL				23.3	95% Bootstrap-t UCL						39.8
149	95% Hall's Bootstrap UCL				55.8	95% Percentile Bootstrap UCL						24.6
150	95% BCA Bootstrap UCL				28.0							
151	90% Chebyshev(Mean, Sd) UCL				28.4	95% Chebyshev(Mean, Sd) UCL						33.0
152	97.5% Chebyshev(Mean, Sd) UCL				39.5	99% Chebyshev(Mean, Sd) UCL						52.2
153												
154	**Suggested UCL to Use**											
155	95% Student's-t UCL				24.4	or 95% Modified-t UCL						24.9
156												
157	stions regarding the selection of a 95% UCL are provided to help the user to select the most appropri											
158	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
159	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
160	For additional insight the user may want to consult a statistician.											
161												
162												
163	**Uranium**											
164												
165	**General Statistics**											
166	Total Number of Observations				10	Number of Distinct Observations						10
167						Number of Missing Observations						0
168	Minimum				0.82	Mean						1.46
169	Maximum				2.77	Median						1.26
170	SD				0.60	Std. Error of Mean						0.19
171	Coefficient of Variation				0.41	Skewness						1.29
172												
173	**Normal GOF Test**											
174	Shapiro Wilk Test Statistic				0.87	**Shapiro Wilk GOF Test**						
175	5% Shapiro Wilk Critical Value				0.84	Data appear Normal at 5% Significance Level						
176	Lilliefors Test Statistic				0.19	**Lilliefors GOF Test**						
177	5% Lilliefors Critical Value				0.28	Data appear Normal at 5% Significance Level						
178	**Data appear Normal at 5% Significance Level**											
179												
180	**Assuming Normal Distribution**											
181	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
182	95% Student's-t UCL				1.81	95% Adjusted-CLT UCL (Chen-1995)						1.86
183						95% Modified-t UCL (Johnson-1978)						1.82
184												
185	**Gamma GOF Test**											
186	A-D Test Statistic				0.36	**Anderson-Darling Gamma GOF Test**						
187	5% A-D Critical Value				0.72	d data appear Gamma Distributed at 5% Significar						
188	K-S Test Statistic				0.19	**Kolmogrov-Smirnoff Gamma GOF Test**						
189	5% K-S Critical Value				0.26	d data appear Gamma Distributed at 5% Significar						

190	**Detected data appear Gamma Distributed at 5% Significance Level**											
191												
192	**Gamma Statistics**											
193					k hat (MLE)	7.60		k star (bias corrected MLE)				5.39
194					Theta hat (MLE)	0.19		Theta star (bias corrected MLE)				0.27
195					nu hat (MLE)	152.2		nu star (bias corrected)				107.9
196					MLE Mean (bias corrected)	1.46		MLE Sd (bias corrected)				0.63
197								Approximate Chi Square Value (0.05)				84.8
198					Adjusted Level of Significance	0.026		Adjusted Chi Square Value				81.3
199												
200	**Assuming Gamma Distribution**											
201	oximate Gamma UCL (use when n>=50))					1.86		Adjusted Gamma UCL (use when n<50)				1.94
202												
203	**Lognormal GOF Test**											
204					Shapiro Wilk Test Statistic	0.95		**Shapiro Wilk Lognormal GOF Test**				
205					5% Shapiro Wilk Critical Value	0.84		Data appear Lognormal at 5% Significance Level				
206					Lilliefors Test Statistic	0.17		**Lilliefors Lognormal GOF Test**				
207					5% Lilliefors Critical Value	0.28		Data appear Lognormal at 5% Significance Level				
208	**Data appear Lognormal at 5% Significance Level**											
209												
210	**Lognormal Statistics**											
211					Minimum of Logged Data	-0.18		Mean of logged Data				0.31
212					Maximum of Logged Data	1.01		SD of logged Data				0.37
213												
214	**Assuming Lognormal Distribution**											
215					95% H-UCL	1.90		90% Chebyshev (MVUE) UCL				1.98
216					95% Chebyshev (MVUE) UCL	2.22		97.5% Chebyshev (MVUE) UCL				2.55
217					99% Chebyshev (MVUE) UCL	3.2						
218												
219	**Nonparametric Distribution Free UCL Statistics**											
220	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
221												
222	**Nonparametric Distribution Free UCLs**											
223					95% CLT UCL	1.77		95% Jackknife UCL				1.81
224					95% Standard Bootstrap UCL	1.76		95% Bootstrap-t UCL				2.01
225					95% Hall's Bootstrap UCL	2.44		95% Percentile Bootstrap UCL				1.77
226					95% BCA Bootstrap UCL	1.84						
227					90% Chebyshev(Mean, Sd) UCL	2.03		95% Chebyshev(Mean, Sd) UCL				2.29
228					97.5% Chebyshev(Mean, Sd) UCL	2.65		99% Chebyshev(Mean, Sd) UCL				3.36
229												
230	**Suggested UCL to Use**											
231					95% Student's-t UCL	1.81						
232												
233	stions regarding the selection of a 95% UCL are provided to help the user to select the most appropri											
234	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
235	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
236	For additional insight the user may want to consult a statistician.											
237												