	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3		User Selected Options										
4		Date/Time of Computation		ProUCL 5.111/9/2016 6:10:23 AM								
5		From File		ProUCL input 01-001(d1) 0-10 ft.xls								
6		Full Precision		OFF								
7		Confidence Coefficient		95%								
8		Number of Bootstrap Operations		2000								
9												
10												
11	Copper											
12												
13						General Statistics						
14		Total Number of Observations			8				Number of Distinct Observations			8
15									Number of Missing Observations			0
16				Minimum		0.513				Mean		2.966
17				Maximum		17.9				Median		0.718
18				SD		6.043				Std. Error of Mean		2.137
19				Coefficient of Variation		2.037				Skewness		2.811
20												
21		Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use										
22		guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.										
23		For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).										
24		Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1										
25												
26						Normal GOF Test						
27		Shapiro Wilk Test Statistic				0.465		Shapiro Wilk GOF Test				
28		5% Shapiro Wilk Critical Value				0.818		Data Not Normal at 5% Significance Level				
29		Lilliefors Test Statistic				0.478		Lilliefors GOF Test				
30		5% Lilliefors Critical Value				0.283		Data Not Normal at 5% Significance Level				
31		Data Not Normal at 5% Significance Level										
32												
33						Assuming Normal Distribution						
34		95% Normal UCL						95% UCLs (Adjusted for Skewness)				
35				95% Student's-t UCL		7.014		95% Adjusted-CLT UCL (Chen-1995)				8.75
36								95% Modified-t UCL (Johnson-1978)				7.368
37												
38						Gamma GOF Test						
39		A-D Test Statistic				1.631		Anderson-Darling Gamma GOF Test				
40		5% A-D Critical Value				0.752		Data Not Gamma Distributed at 5% Significance Level				
41		K-S Test Statistic				0.416		Kolmogorov-Smirnov Gamma GOF Test				
42		5% K-S Critical Value				0.306		Data Not Gamma Distributed at 5% Significance Level				
43		Data Not Gamma Distributed at 5% Significance Level										
44												
45						Gamma Statistics						
46				k hat (MLE)		0.644				k star (bias corrected MLE)		0.486
47				Theta hat (MLE)		4.605				Theta star (bias corrected MLE)		6.105
48				nu hat (MLE)		10.31				nu star (bias corrected)		7.774
49				MLE Mean (bias corrected)		2.966				MLE Sd (bias corrected)		4.255
50										Approximate Chi Square Value (0.05)		2.605
51				Adjusted Level of Significance		0.0195				Adjusted Chi Square Value		1.912
52												

	A	B	C	D	E	F	G	H	I	J	K	L
53	Assuming Gamma Distribution											
54	95% Approximate Gamma UCL (use when n>=50))					8.852	95% Adjusted Gamma UCL (use when n<50)					12.06
55												
56	Lognormal GOF Test											
57	Shapiro Wilk Test Statistic					0.689	Shapiro Wilk Lognormal GOF Test					
58	5% Shapiro Wilk Critical Value					0.818	Data Not Lognormal at 5% Significance Level					
59	Lilliefors Test Statistic					0.31	Lilliefors Lognormal GOF Test					
60	5% Lilliefors Critical Value					0.283	Data Not Lognormal at 5% Significance Level					
61	Data Not Lognormal at 5% Significance Level											
62												
63	Lognormal Statistics											
64	Minimum of Logged Data					-0.667	Mean of logged Data					0.138
65	Maximum of Logged Data					2.885	SD of logged Data					1.169
66												
67	Assuming Lognormal Distribution											
68	95% H-UCL					12.48	90% Chebyshev (MVUE) UCL					4.564
69	95% Chebyshev (MVUE) UCL					5.719	97.5% Chebyshev (MVUE) UCL					7.321
70	99% Chebyshev (MVUE) UCL					10.47						
71												
72	Nonparametric Distribution Free UCL Statistics											
73	Data do not follow a Discernible Distribution (0.05)											
74												
75	Nonparametric Distribution Free UCLs											
76	95% CLT UCL					6.481	95% Jackknife UCL					7.014
77	95% Standard Bootstrap UCL					6.407	95% Bootstrap-t UCL					55.85
78	95% Hall's Bootstrap UCL					47.44	95% Percentile Bootstrap UCL					7.16
79	95% BCA Bootstrap UCL					9.24						
80	90% Chebyshev(Mean, Sd) UCL					9.376	95% Chebyshev(Mean, Sd) UCL					12.28
81	97.5% Chebyshev(Mean, Sd) UCL					16.31	99% Chebyshev(Mean, Sd) UCL					24.23
82												
83	Suggested UCL to Use											
84	95% Hall's Bootstrap UCL					47.44						
85												
86	Recommended UCL exceeds the maximum observation											
87												
88	In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	Recommendations are based upon data size, data distribution, and skewness.											
92	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
93	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
94												
95												
96	Mercury											
97												
98	General Statistics											
99	Total Number of Observations					8	Number of Distinct Observations					8
100							Number of Missing Observations					0
101	Minimum					0.00778	Mean					0.236
102	Maximum					1.4	Median					0.0357
103	SD					0.482	Std. Error of Mean					0.17
104	Coefficient of Variation					2.045	Skewness					2.596

	A	B	C	D	E	F	G	H	I	J	K	L
105												
106					Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use							
107					guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.							
108					For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).							
109					Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1							
110												
111					Normal GOF Test							
112			Shapiro Wilk Test Statistic			0.558		Shapiro Wilk GOF Test				
113			5% Shapiro Wilk Critical Value			0.818		Data Not Normal at 5% Significance Level				
114			Lilliefors Test Statistic			0.385		Lilliefors GOF Test				
115			5% Lilliefors Critical Value			0.283		Data Not Normal at 5% Significance Level				
116				Data Not Normal at 5% Significance Level								
117												
118					Assuming Normal Distribution							
119			95% Normal UCL					95% UCLs (Adjusted for Skewness)				
120			95% Student's-t UCL			0.558		95% Adjusted-CLT UCL (Chen-1995)				0.683
121								95% Modified-t UCL (Johnson-1978)				0.584
122												
123					Gamma GOF Test							
124			A-D Test Statistic			0.777		Anderson-Darling Gamma GOF Test				
125			5% A-D Critical Value			0.779		Detected data appear Gamma Distributed at 5% Significance Level				
126			K-S Test Statistic			0.287		Kolmogorov-Smirnov Gamma GOF Test				
127			5% K-S Critical Value			0.313		Detected data appear Gamma Distributed at 5% Significance Level				
128				Detected data appear Gamma Distributed at 5% Significance Level								
129												
130					Gamma Statistics							
131			k hat (MLE)			0.402				k star (bias corrected MLE)		0.335
132			Theta hat (MLE)			0.585				Theta star (bias corrected MLE)		0.704
133			nu hat (MLE)			6.439				nu star (bias corrected)		5.358
134			MLE Mean (bias corrected)			0.236				MLE Sd (bias corrected)		0.407
135										Approximate Chi Square Value (0.05)		1.321
136			Adjusted Level of Significance			0.0195				Adjusted Chi Square Value		0.883
137												
138					Assuming Gamma Distribution							
139		95% Approximate Gamma UCL (use when n>=50)				0.956			95% Adjusted Gamma UCL (use when n<50)			1.43
140												
141					Lognormal GOF Test							
142			Shapiro Wilk Test Statistic			0.883		Shapiro Wilk Lognormal GOF Test				
143			5% Shapiro Wilk Critical Value			0.818		Data appear Lognormal at 5% Significance Level				
144			Lilliefors Test Statistic			0.22		Lilliefors Lognormal GOF Test				
145			5% Lilliefors Critical Value			0.283		Data appear Lognormal at 5% Significance Level				
146				Data appear Lognormal at 5% Significance Level								
147												
148					Lognormal Statistics							
149			Minimum of Logged Data			-4.856				Mean of logged Data		-3.079
150			Maximum of Logged Data			0.336				SD of logged Data		1.88
151												
152					Assuming Lognormal Distribution							
153			95% H-UCL			16.56				90% Chebyshev (MVUE) UCL		0.522
154			95% Chebyshev (MVUE) UCL			0.678				97.5% Chebyshev (MVUE) UCL		0.894
155			99% Chebyshev (MVUE) UCL			1.32						
156												

	A	B	C	D	E	F	G	H	I	J	K	L
157	Nonparametric Distribution Free UCL Statistics											
158	Data appear to follow a Discernible Distribution at 5% Significance Level											
159												
160	Nonparametric Distribution Free UCLs											
161	95% CLT UCL					0.516		95% Jackknife UCL				0.558
162	95% Standard Bootstrap UCL					0.497		95% Bootstrap-t UCL				3.993
163	95% Hall's Bootstrap UCL					2.372		95% Percentile Bootstrap UCL				0.545
164	95% BCA Bootstrap UCL					0.719						
165	90% Chebyshev(Mean, Sd) UCL					0.747		95% Chebyshev(Mean, Sd) UCL				0.978
166	97.5% Chebyshev(Mean, Sd) UCL					1.299		99% Chebyshev(Mean, Sd) UCL				1.93
167												
168	Suggested UCL to Use											
169	95% Adjusted Gamma UCL					1.43						
170												
171	Recommended UCL exceeds the maximum observation											
172												
173	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
174	Recommendations are based upon data size, data distribution, and skewness.											
175	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
176	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
177												
178	Selenium											
179												
180	General Statistics											
181	Total Number of Observations					8		Number of Distinct Observations				8
182	Number of Detects					7		Number of Non-Detects				1
183	Number of Distinct Detects					7		Number of Distinct Non-Detects				1
184	Minimum Detect					0.19		Minimum Non-Detect				0.52
185	Maximum Detect					1.51		Maximum Non-Detect				0.52
186	Variance Detects					0.159		Percent Non-Detects				12.5%
187	Mean Detects					0.955		SD Detects				0.399
188	Median Detects					1.05		CV Detects				0.417
189	Skewness Detects					-1.013		Kurtosis Detects				2.7
190	Mean of Logged Detects					-0.184		SD of Logged Detects				0.677
191												
192	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use											
193	guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.											
194	For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).											
195	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1											
196												
197	Normal GOF Test on Detects Only											
198	Shapiro Wilk Test Statistic					0.891		Shapiro Wilk GOF Test				
199	5% Shapiro Wilk Critical Value					0.803		Detected Data appear Normal at 5% Significance Level				
200	Lilliefors Test Statistic					0.225		Lilliefors GOF Test				
201	5% Lilliefors Critical Value					0.304		Detected Data appear Normal at 5% Significance Level				
202	Detected Data appear Normal at 5% Significance Level											
203												
204	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
205	KM Mean					0.86		KM Standard Error of Mean				0.163
206	KM SD					0.428		95% KM (BCA) UCL				1.128
207	95% KM (t) UCL					1.169		95% KM (Percentile Bootstrap) UCL				1.116
208	95% KM (z) UCL					1.128		95% KM Bootstrap t UCL				1.104

	A	B	C	D	E	F	G	H	I	J	K	L
209				90% KM Chebyshev UCL		1.35				95% KM Chebyshev UCL		1.572
210				97.5% KM Chebyshev UCL		1.88				99% KM Chebyshev UCL		2.486
211												
212				**Gamma GOF Tests on Detected Observations Only**								
213				A-D Test Statistic		0.867		**Anderson-Darling GOF Test**				
214				5% A-D Critical Value		0.71		Detected Data Not Gamma Distributed at 5% Significance Level				
215				K-S Test Statistic		0.306		**Kolmogorov-Smirnov GOF**				
216				5% K-S Critical Value		0.313		Detected data appear Gamma Distributed at 5% Significance Level				
217				**Detected data follow Appr. Gamma Distribution at 5% Significance Level**								
218												
219				**Gamma Statistics on Detected Data Only**								
220				k hat (MLE)		3.77				k star (bias corrected MLE)		2.249
221				Theta hat (MLE)		0.253				Theta star (bias corrected MLE)		0.425
222				nu hat (MLE)		52.77				nu star (bias corrected)		31.49
223				Mean (detects)		0.955						
224												
225				**Gamma ROS Statistics using Imputed Non-Detects**								
226				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs								
227				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)								
228				For such situations, GROS method may yield incorrect values of UCLs and BTVs								
229				This is especially true when the sample size is small.								
230				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates								
231				Minimum		0.19				Mean		0.889
232				Maximum		1.51				Median		1.006
233				SD		0.414				CV		0.466
234				k hat (MLE)		3.472				k star (bias corrected MLE)		2.253
235				Theta hat (MLE)		0.256				Theta star (bias corrected MLE)		0.394
236				nu hat (MLE)		55.55				nu star (bias corrected)		36.05
237				Adjusted Level of Significance (β)		0.0195						
238				Approximate Chi Square Value (36.05, α)		23.31				Adjusted Chi Square Value (36.05, β)		20.76
239				95% Gamma Approximate UCL (use when n>=50)		1.374				95% Gamma Adjusted UCL (use when n<50)		1.543
240												
241				**Estimates of Gamma Parameters using KM Estimates**								
242				Mean (KM)		0.86				SD (KM)		0.428
243				Variance (KM)		0.183				SE of Mean (KM)		0.163
244				k hat (KM)		4.032				k star (KM)		2.603
245				nu hat (KM)		64.5				nu star (KM)		41.65
246				theta hat (KM)		0.213				theta star (KM)		0.33
247				80% gamma percentile (KM)		1.247				90% gamma percentile (KM)		1.573
248				95% gamma percentile (KM)		1.88				99% gamma percentile (KM)		2.55
249												
250				**Gamma Kaplan-Meier (KM) Statistics**								
251				Approximate Chi Square Value (41.65, α)		27.86				Adjusted Chi Square Value (41.65, β)		25.04
252				95% Gamma Approximate KM-UCL (use when n>=50)		1.285				95% Gamma Adjusted KM-UCL (use when n<50)		1.43
253												
254				**Lognormal GOF Test on Detected Observations Only**								
255				Shapiro Wilk Test Statistic		0.709		**Shapiro Wilk GOF Test**				
256				5% Shapiro Wilk Critical Value		0.803		Detected Data Not Lognormal at 5% Significance Level				
257				Lilliefors Test Statistic		0.345		**Lilliefors GOF Test**				
258				5% Lilliefors Critical Value		0.304		Detected Data Not Lognormal at 5% Significance Level				
259				**Detected Data Not Lognormal at 5% Significance Level**								
260												

	A	B	C	D	E	F	G	H	I	J	K	L
261	Lognormal ROS Statistics Using Imputed Non-Detects											
262	Mean in Original Scale					0.875	Mean in Log Scale					-0.307
263	SD in Original Scale					0.434	SD in Log Scale					0.717
264	95% t UCL (assumes normality of ROS data)					1.165	95% Percentile Bootstrap UCL					1.111
265	95% BCA Bootstrap UCL					1.087	95% Bootstrap t UCL					1.134
266	95% H-UCL (Log ROS)					2.013						
267												
268	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
269	KM Mean (logged)					-0.369	KM Geo Mean					0.691
270	KM SD (logged)					0.763	95% Critical H Value (KM-Log)					2.869
271	KM Standard Error of Mean (logged)					0.291	95% H-UCL (KM -Log)					2.116
272	KM SD (logged)					0.763	95% Critical H Value (KM-Log)					2.869
273	KM Standard Error of Mean (logged)					0.291						
274												
275	DL/2 Statistics											
276	DL/2 Normal						DL/2 Log-Transformed					
277	Mean in Original Scale					0.868	Mean in Log Scale					-0.33
278	SD in Original Scale					0.443	SD in Log Scale					0.749
279	95% t UCL (Assumes normality)					1.165	95% H-Stat UCL					2.129
280	DL/2 is not a recommended method, provided for comparisons and historical reasons											
281												
282	Nonparametric Distribution Free UCL Statistics											
283	Detected Data appear Normal Distributed at 5% Significance Level											
284												
285	Suggested UCL to Use											
286	95% KM (t) UCL					1.169						
287												
288	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
289	Recommendations are based upon data size, data distribution, and skewness.											
290	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
291	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
292												