UCL Statistics for Data Sets with Non-Detects

User Selected Options	
e/Time of Computation	8/13/2015 2:37:39 PM
From File	ProUCLinput_36-003(a)_0-10.xls
Full Precision	OFF
Confidence Coefficient	95%
f Bootstrap Operations	2000

Beryllium

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	0.43	Mean	0.85
Maximum	5.57	Median	0.53
SD	1.26	Std. Error of Mean	0.31
Coefficient of Variation	1.47	Skewness	3.96

Normal GOF Test

Shapiro Wilk Test Statistic	0.33	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.88	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.45	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	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	1.40	95% Adjusted-CLT UCL (Chen-1995)	1.70
		95% Modified-t UCL (Johnson-1978)	1.46

Gamma GOF Test

A-D Test Statistic	3.76	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	ata Not Gamma Distributed at 5% Significance Lev
K-S Test Statistic	0.37	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.21	ata Not Gamma Distributed at 5% Significance Lev

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.68	k star (bias corrected MLE)	1.41
Theta hat (MLE)	0.50	Theta star (bias corrected MLE)	0.60
nu hat (MLE)	53.9	nu star (bias corrected)	45.1
MLE Mean (bias corrected)	0.85	MLE Sd (bias corrected)	0.72
		Approximate Chi Square Value (0.05)	30.7
Adjusted Level of Significance	0.03	Adjusted Chi Square Value	29.3

Assuming Gamma Distribution

oximate Gamma UCL (use when n>=50))	1.25	Adjusted Gamma UCL (use when n<50)	1.31

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.51	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.88	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.31	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.84	Mean of logged Data	-0.48
Maximum of Logged Data	1.71	SD of logged Data	0.60

Assuming Lognormal Distribution

95% H-UCL	1.04	90% Chebyshev (MVUE) UCL	1.08

64	95% Chebyshev (MVUE) UCL				1.24	97.5% Chebyshev (MVUE) UCL					1.46
65	99% Chebyshev (MVUE) UCL				1.9						
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				1.37	95% Jackknife UCL					1.40
72	95% Standard Bootstrap UCL				1.35	95% Bootstrap-t UCL					7.15
73	95% Hall's Bootstrap UCL				3.78	95% Percentile Bootstrap UCL					1.47
74	95% BCA Bootstrap UCL				1.8						
75	90% Chebyshev(Mean, Sd) UCL				1.80	95% Chebyshev(Mean, Sd) UCL					2.23
76	97.5% Chebyshev(Mean, Sd) UCL				2.82	99% Chebyshev(Mean, Sd) UCL					3.99
77											
78	**Suggested UCL to Use**										
79	95% Chebyshev (Mean, Sd) UCL				2.23						
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	**Chromium**										
88											
89	**General Statistics**										
90	Total Number of Observations				16	Number of Distinct Observations					16
91						Number of Missing Observations					0
92	Minimum				3.87	Mean					14.8
93	Maximum				59.1	Median					9.58
94	SD				15.5	Std. Error of Mean					3.89
95	Coefficient of Variation				1.05	Skewness					2.04
96											
97	**Normal GOF Test**										
98	Shapiro Wilk Test Statistic				0.71	**Shapiro Wilk GOF Test**					
99	5% Shapiro Wilk Critical Value				0.88	Data Not Normal at 5% Significance Level					
100	Lilliefors Test Statistic				0.28	**Lilliefors GOF Test**					
101	5% Lilliefors Critical Value				0.22	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				21.6	95% Adjusted-CLT UCL (Chen-1995)					23.3
107						95% Modified-t UCL (Johnson-1978)					21.9
108											
109	**Gamma GOF Test**										
110	A-D Test Statistic				0.78	**Anderson-Darling Gamma GOF Test**					
111	5% A-D Critical Value				0.75	ata Not Gamma Distributed at 5% Significance Lev					
112	K-S Test Statistic				0.18	**Kolmogrov-Smirnoff Gamma GOF Test**					
113	5% K-S Critical Value				0.21	d data appear Gamma Distributed at 5% Significar					
114	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**										
115											
116	**Gamma Statistics**										
117	k hat (MLE)				1.44	k star (bias corrected MLE)					1.21
118	Theta hat (MLE)				10.2	Theta star (bias corrected MLE)					12.2
119	nu hat (MLE)				46.2	nu star (bias corrected)					38.9
120	MLE Mean (bias corrected)				14.8	MLE Sd (bias corrected)					13.4
121						Approximate Chi Square Value (0.05)					25.6
122	Adjusted Level of Significance				0.03	Adjusted Chi Square Value					24.4
123											
124	**Assuming Gamma Distribution**										
125	roximate Gamma UCL (use when n>=50)				22.5	Adjusted Gamma UCL (use when n<50)					23.6
126											

	A	B	C	D	E	F	G	H	I	J	K	L
127	**Lognormal GOF Test**											
128					Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk Lognormal GOF Test**					
129					5% Shapiro Wilk Critical Value	0.88	Data appear Lognormal at 5% Significance Level					
130					Lilliefors Test Statistic	0.15	**Lilliefors Lognormal GOF Test**					
131					5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level					
132	**Data appear Lognormal at 5% Significance Level**											
133												
134	**Lognormal Statistics**											
135					Minimum of Logged Data	1.35			Mean of logged Data			2.31
136					Maximum of Logged Data	4.07			SD of logged Data			0.85
137												
138	**Assuming Lognormal Distribution**											
139					95% H-UCL	25.3			90% Chebyshev (MVUE) UCL			23.9
140					95% Chebyshev (MVUE) UCL	28.4			97.5% Chebyshev (MVUE) UCL			34.6
141					99% Chebyshev (MVUE) UCL	46.7						
142												
143	**Nonparametric Distribution Free UCL Statistics**											
144	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
145												
146	**Nonparametric Distribution Free UCLs**											
147					95% CLT UCL	21.2			95% Jackknife UCL			21.6
148					95% Standard Bootstrap UCL	20.9			95% Bootstrap-t UCL			29.6
149					95% Hall's Bootstrap UCL	47.2			95% Percentile Bootstrap UCL			21.0
150					95% BCA Bootstrap UCL	23.3						
151					90% Chebyshev(Mean, Sd) UCL	26.5			95% Chebyshev(Mean, Sd) UCL			31.8
152					97.5% Chebyshev(Mean, Sd) UCL	39.1			99% Chebyshev(Mean, Sd) UCL			53.5
153												
154	**Suggested UCL to Use**											
155					95% Adjusted Gamma UCL	23.6						
156												
157	tions 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	**Cobalt**											
164												
165	**General Statistics**											
166					Total Number of Observations	16			Number of Distinct Observations			16
167									Number of Missing Observations			0
168					Minimum	0.73			Mean			2.18
169					Maximum	6.75			Median			1.62
170					SD	1.60			Std. Error of Mean			0.40
171					Coefficient of Variation	0.73			Skewness			1.83
172												
173	**Normal GOF Test**											
174					Shapiro Wilk Test Statistic	0.77	**Shapiro Wilk GOF Test**					
175					5% Shapiro Wilk Critical Value	0.88	Data Not Normal at 5% Significance Level					
176					Lilliefors Test Statistic	0.30	**Lilliefors GOF Test**					
177					5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level					
178	**Data Not 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	2.88			95% Adjusted-CLT UCL (Chen-1995)			3.04
183									95% Modified-t UCL (Johnson-1978)			2.91
184												
185	**Gamma GOF Test**											
186					A-D Test Statistic	0.74	**Anderson-Darling Gamma GOF Test**					
187					5% A-D Critical Value	0.74	ata Not Gamma Distributed at 5% Significance Lev					
188					K-S Test Statistic	0.25	**Kolmogrov-Smirnoff Gamma GOF Test**					
189					5% K-S Critical Value	0.21	ata Not Gamma Distributed at 5% Significance Lev					

	A	B	C	D	E	F	G	H	I	J	K	L
190	**Data Not Gamma Distributed at 5% Significance Level**											
191												
192	**Gamma Statistics**											
193					k hat (MLE)	2.71	k star (bias corrected MLE)					2.24
194					Theta hat (MLE)	0.80	Theta star (bias corrected MLE)					0.97
195					nu hat (MLE)	86.8	nu star (bias corrected)					71.9
196					MLE Mean (bias corrected)	2.18	MLE Sd (bias corrected)					1.45
197							Approximate Chi Square Value (0.05)					53.4
198					Adjusted Level of Significance	0.03	Adjusted Chi Square Value					51.5
199												
200	**Assuming Gamma Distribution**											
201	oximate Gamma UCL (use when n>=50))					2.94	Adjusted Gamma UCL (use when n<50)					3.04
202												
203	**Lognormal GOF Test**											
204					Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**					
205					5% Shapiro Wilk Critical Value	0.88	Data appear Lognormal at 5% Significance Level					
206					Lilliefors Test Statistic	0.21	**Lilliefors Lognormal GOF Test**					
207					5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level					
208	**Data appear Lognormal at 5% Significance Level**											
209												
210	**Lognormal Statistics**											
211					Minimum of Logged Data	-0.31	Mean of logged Data					0.58
212					Maximum of Logged Data	1.91	SD of logged Data					0.61
213												
214	**Assuming Lognormal Distribution**											
215					95% H-UCL	3.06	90% Chebyshev (MVUE) UCL					3.16
216					95% Chebyshev (MVUE) UCL	3.63	97.5% Chebyshev (MVUE) UCL					4.28
217					99% Chebyshev (MVUE) UCL	5.55						
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	2.84	95% Jackknife UCL					2.88
224					95% Standard Bootstrap UCL	2.83	95% Bootstrap-t UCL					3.30
225					95% Hall's Bootstrap UCL	3.18	95% Percentile Bootstrap UCL					2.83
226					95% BCA Bootstrap UCL	2.95						
227					90% Chebyshev(Mean, Sd) UCL	3.38	95% Chebyshev(Mean, Sd) UCL					3.93
228					97.5% Chebyshev(Mean, Sd) UCL	4.68	99% Chebyshev(Mean, Sd) UCL					6.17
229												
230	**Suggested UCL to Use**											
231					95% H-UCL	3.06						
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												
238	**ProUCL computes and outputs H-statistic based UCLs for historical reasons only.**											
239	**often results in unstable (both high and low) values of UCL95 as shown in examples in the Technica**											
240	**It is therefore recommended to avoid the use of H-statistic based 95% UCLs.**											
241	**metric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma**											
242												
243												
244	**Copper**											
245												
246	**General Statistics**											
247					Total Number of Observations	16	Number of Distinct Observations					16
248							Number of Missing Observations					0
249					Minimum	2.23	Mean					4.01
250					Maximum	12.3	Median					3.26
251					SD	2.34	Std. Error of Mean					0.58
252					Coefficient of Variation	0.58	Skewness					3.27

	A	B	C	D	E	F	G	H	I	J	K	L
253												
254	**Normal GOF Test**											
255	Shapiro Wilk Test Statistic					0.58	**Shapiro Wilk GOF Test**					
256	5% Shapiro Wilk Critical Value					0.88	Data Not Normal at 5% Significance Level					
257	Lilliefors Test Statistic					0.30	**Lilliefors GOF Test**					
258	5% Lilliefors Critical Value					0.22	Data Not Normal at 5% Significance Level					
259	**Data Not Normal at 5% Significance Level**											
260												
261	**Assuming Normal Distribution**											
262	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
263	95% Student's-t UCL					5.04	95% Adjusted-CLT UCL (Chen-1995)					5.49
264							95% Modified-t UCL (Johnson-1978)					5.12
265												
266	**Gamma GOF Test**											
267	A-D Test Statistic					1.40	**Anderson-Darling Gamma GOF Test**					
268	5% A-D Critical Value					0.74	ata Not Gamma Distributed at 5% Significance Lev					
269	K-S Test Statistic					0.22	**Kolmogrov-Smirnoff Gamma GOF Test**					
270	5% K-S Critical Value					0.21	ata Not Gamma Distributed at 5% Significance Lev					
271	**Data Not Gamma Distributed at 5% Significance Level**											
272												
273	**Gamma Statistics**											
274	k hat (MLE)					5.58	k star (bias corrected MLE)					4.57
275	Theta hat (MLE)					0.72	Theta star (bias corrected MLE)					0.87
276	nu hat (MLE)					178.6	nu star (bias corrected)					146.5
277	MLE Mean (bias corrected)					4.01	MLE Sd (bias corrected)					1.87
278							Approximate Chi Square Value (0.05)					119.5
279	Adjusted Level of Significance					0.03	Adjusted Chi Square Value					116.7
280												
281	**Assuming Gamma Distribution**											
282	oximate Gamma UCL (use when n>=50))					4.92	Adjusted Gamma UCL (use when n<50)					5.04
283												
284	**Lognormal GOF Test**											
285	Shapiro Wilk Test Statistic					0.81	**Shapiro Wilk Lognormal GOF Test**					
286	5% Shapiro Wilk Critical Value					0.88	Data Not Lognormal at 5% Significance Level					
287	Lilliefors Test Statistic					0.18	**Lilliefors Lognormal GOF Test**					
288	5% Lilliefors Critical Value					0.22	Data appear Lognormal at 5% Significance Level					
289	**Data appear Approximate Lognormal at 5% Significance Level**											
290												
291	**Lognormal Statistics**											
292	Minimum of Logged Data					0.80	Mean of logged Data					1.29
293	Maximum of Logged Data					2.51	SD of logged Data					0.39
294												
295	**Assuming Lognormal Distribution**											
296	95% H-UCL					4.81	90% Chebyshev (MVUE) UCL					5.11
297	95% Chebyshev (MVUE) UCL					5.65	97.5% Chebyshev (MVUE) UCL					6.39
298	99% Chebyshev (MVUE) UCL					7.85						
299												
300	**Nonparametric Distribution Free UCL Statistics**											
301	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
302												
303	**Nonparametric Distribution Free UCLs**											
304	95% CLT UCL					4.98	95% Jackknife UCL					5.04
305	95% Standard Bootstrap UCL					4.92	95% Bootstrap-t UCL					6.66
306	95% Hall's Bootstrap UCL					8.93	95% Percentile Bootstrap UCL					5.08
307	95% BCA Bootstrap UCL					5.64						
308	90% Chebyshev(Mean, Sd) UCL					5.77	95% Chebyshev(Mean, Sd) UCL					6.57
309	97.5% Chebyshev(Mean, Sd) UCL					7.68	99% Chebyshev(Mean, Sd) UCL					9.85
310												
311	**Suggested UCL to Use**											
312	95% Student's-t UCL					5.04	or 95% Modified-t UCL					5.12
313												
314	stions regarding the selection of a 95% UCL are provided to help the user to select the most appropri											
315	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											

	A	B	C	D	E	F	G	H	I	J	K	L
316	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
317	For additional insight the user may want to consult a statistician.											
318												
319												
320	**Nickel**											
321												
322	**General Statistics**											
323	Total Number of Observations					16	Number of Distinct Observations					16
324							Number of Missing Observations					0
325	Minimum					2.46	Mean					5.92
326	Maximum					39.9	Median					3.47
327	SD					9.13	Std. Error of Mean					2.28
328	Coefficient of Variation					1.54	Skewness					3.89
329												
330	**Normal GOF Test**											
331	Shapiro Wilk Test Statistic					0.37	**Shapiro Wilk GOF Test**					
332	5% Shapiro Wilk Critical Value					0.88	Data Not Normal at 5% Significance Level					
333	Lilliefors Test Statistic					0.41	**Lilliefors GOF Test**					
334	5% Lilliefors Critical Value					0.22	Data Not Normal at 5% Significance Level					
335	**Data Not Normal at 5% Significance Level**											
336												
337	**Assuming Normal Distribution**											
338	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
339	95% Student's-t UCL					9.92	95% Adjusted-CLT UCL (Chen-1995)					12.0
340							95% Modified-t UCL (Johnson-1978)					10.2
341												
342	**Gamma GOF Test**											
343	A-D Test Statistic					2.83	**Anderson-Darling Gamma GOF Test**					
344	5% A-D Critical Value					0.75	ata Not Gamma Distributed at 5% Significance Lev					
345	K-S Test Statistic					0.33	**Kolmogrov-Smirnoff Gamma GOF Test**					
346	5% K-S Critical Value					0.21	ata Not Gamma Distributed at 5% Significance Lev					
347	**Data Not Gamma Distributed at 5% Significance Level**											
348												
349	**Gamma Statistics**											
350	k hat (MLE)					1.48	k star (bias corrected MLE)					1.25
351	Theta hat (MLE)					3.98	Theta star (bias corrected MLE)					4.73
352	nu hat (MLE)					47.5	nu star (bias corrected)					39.9
353	MLE Mean (bias corrected)					5.92	MLE Sd (bias corrected)					5.29
354							Approximate Chi Square Value (0.05)					26.5
355	Adjusted Level of Significance					0.03	Adjusted Chi Square Value					25.2
356												
357	**Assuming Gamma Distribution**											
358	oximate Gamma UCL (use when n>=50))					8.93	Adjusted Gamma UCL (use when n<50)					9.37
359												
360	**Lognormal GOF Test**											
361	Shapiro Wilk Test Statistic					0.65	**Shapiro Wilk Lognormal GOF Test**					
362	5% Shapiro Wilk Critical Value					0.88	Data Not Lognormal at 5% Significance Level					
363	Lilliefors Test Statistic					0.26	**Lilliefors Lognormal GOF Test**					
364	5% Lilliefors Critical Value					0.22	Data Not Lognormal at 5% Significance Level					
365	**Data Not Lognormal at 5% Significance Level**											
366												
367	**Lognormal Statistics**											
368	Minimum of Logged Data					0.9	Mean of logged Data					1.40
369	Maximum of Logged Data					3.68	SD of logged Data					0.67
370												
371	**Assuming Lognormal Distribution**											
372	95% H-UCL					7.53	90% Chebyshev (MVUE) UCL					7.68
373	95% Chebyshev (MVUE) UCL					8.88	97.5% Chebyshev (MVUE) UCL					10.5
374	99% Chebyshev (MVUE) UCL					13.8						
375												
376	**Nonparametric Distribution Free UCL Statistics**											
377	**Data do not follow a Discernible Distribution (0.05)**											
378												

379	**Nonparametric Distribution Free UCLs**											
380					95% CLT UCL	9.67				95% Jackknife UCL	9.92	
381					95% Standard Bootstrap UCL	9.49				95% Bootstrap-t UCL	34.3	
382					95% Hall's Bootstrap UCL	24.3				95% Percentile Bootstrap UCL	10.5	
383					95% BCA Bootstrap UCL	12.7						
384					90% Chebyshev(Mean, Sd) UCL	12.7				95% Chebyshev(Mean, Sd) UCL	15.8	
385					97.5% Chebyshev(Mean, Sd) UCL	20.1				99% Chebyshev(Mean, Sd) UCL	28.6	
386												
387	**Suggested UCL to Use**											
388					95% Chebyshev (Mean, Sd) UCL	15.8						
389												
390	stions regarding the selection of a 95% UCL are provided to help the user to select the most appropri											
391	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
392	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
393	For additional insight the user may want to consult a statistician.											
394												
395												
396	**Sodium**											
397												
398	**General Statistics**											
399					Total Number of Observations	16				Number of Distinct Observations	15	
400										Number of Missing Observations	0	
401					Minimum	131				Mean	432.8	
402					Maximum	1720				Median	245	
403					SD	468.1				Std. Error of Mean	117	
404					Coefficient of Variation	1.08				Skewness	2.03	
405												
406	**Normal GOF Test**											
407					Shapiro Wilk Test Statistic	0.66				**Shapiro Wilk GOF Test**		
408					5% Shapiro Wilk Critical Value	0.88				Data Not Normal at 5% Significance Level		
409					Lilliefors Test Statistic	0.34				**Lilliefors GOF Test**		
410					5% Lilliefors Critical Value	0.22				Data Not Normal at 5% Significance Level		
411	**Data Not Normal at 5% Significance Level**											
412												
413	**Assuming Normal Distribution**											
414					**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**		
415					95% Student's-t UCL	637.9				95% Adjusted-CLT UCL (Chen-1995)	688.9	
416										95% Modified-t UCL (Johnson-1978)	647.9	
417												
418	**Gamma GOF Test**											
419					A-D Test Statistic	1.33				**Anderson-Darling Gamma GOF Test**		
420					5% A-D Critical Value	0.75	ata Not Gamma Distributed at 5% Significance Lev					
421					K-S Test Statistic	0.24				**Kolmogrov-Smirnoff Gamma GOF Test**		
422					5% K-S Critical Value	0.21	ata Not Gamma Distributed at 5% Significance Lev					
423	**Data Not Gamma Distributed at 5% Significance Level**											
424												
425	**Gamma Statistics**											
426					k hat (MLE)	1.49				k star (bias corrected MLE)	1.25	
427					Theta hat (MLE)	289.8				Theta star (bias corrected MLE)	344.8	
428					nu hat (MLE)	47.8				nu star (bias corrected)	40.1	
429					MLE Mean (bias corrected)	432.8				MLE Sd (bias corrected)	386.3	
430										Approximate Chi Square Value (0.05)	26.6	
431					Adjusted Level of Significance	0.03				Adjusted Chi Square Value	25.4	
432												
433	**Assuming Gamma Distribution**											
434	oximate Gamma UCL (use when n>=50))					652.4				Adjusted Gamma UCL (use when n<50)	684.6	
435												
436	**Lognormal GOF Test**											
437					Shapiro Wilk Test Statistic	0.86				**Shapiro Wilk Lognormal GOF Test**		
438					5% Shapiro Wilk Critical Value	0.88				Data Not Lognormal at 5% Significance Level		
439					Lilliefors Test Statistic	0.17				**Lilliefors Lognormal GOF Test**		
440					5% Lilliefors Critical Value	0.22				Data appear Lognormal at 5% Significance Level		
441	**Data appear Approximate Lognormal at 5% Significance Level**											

442												
443						**Lognormal Statistics**							
444						Minimum of Logged Data	4.87			Mean of logged Data	5.7	
445						Maximum of Logged Data	7.45			SD of logged Data	0.80	
446												
447						**Assuming Lognormal Distribution**							
448						95% H-UCL	685.3			90% Chebyshev (MVUE) UCL	664.9	
449						95% Chebyshev (MVUE) UCL	783.5			97.5% Chebyshev (MVUE) UCL	948	
450						99% Chebyshev (MVUE) UCL	1271					
451												
452						**Nonparametric Distribution Free UCL Statistics**							
453						**Data appear to follow a Discernible Distribution at 5% Significance Level**							
454												
455						**Nonparametric Distribution Free UCLs**							
456						95% CLT UCL	625.3			95% Jackknife UCL	637.9	
457						95% Standard Bootstrap UCL	617.7			95% Bootstrap-t UCL	847.6	
458						95% Hall's Bootstrap UCL	696.8			95% Percentile Bootstrap UCL	635.8	
459						95% BCA Bootstrap UCL	695.2					
460						90% Chebyshev(Mean, Sd) UCL	783.9			95% Chebyshev(Mean, Sd) UCL	942.9	
461						97.5% Chebyshev(Mean, Sd) UCL	1164			99% Chebyshev(Mean, Sd) UCL	1597	
462												
463						**Suggested UCL to Use**							
464						95% Chebyshev (Mean, Sd) UCL	942.9					
465												
466	stions regarding the selection of a 95% UCL are provided to help the user to select the most appropri											
467	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
468	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
469	For additional insight the user may want to consult a statistician.											
470												
471												
472	**Zinc**											
473												
474						**General Statistics**							
475						Total Number of Observations	16			Number of Distinct Observations	16	
476										Number of Missing Observations	0	
477						Minimum	33.6			Mean	41.8	
478						Maximum	51			Median	41.3	
479						SD	5.84			Std. Error of Mean	1.46	
480						Coefficient of Variation	0.14			Skewness	0.22	
481												
482						**Normal GOF Test**							
483						Shapiro Wilk Test Statistic	0.93			**Shapiro Wilk GOF Test**		
484						5% Shapiro Wilk Critical Value	0.88			Data appear Normal at 5% Significance Level		
485						Lilliefors Test Statistic	0.13			**Lilliefors GOF Test**		
486						5% Lilliefors Critical Value	0.22			Data appear Normal at 5% Significance Level		
487						**Data appear Normal at 5% Significance Level**							
488												
489						**Assuming Normal Distribution**							
490						**95% Normal UCL**				**95% UCLs (Adjusted for Skewness)**		
491						95% Student's-t UCL	44.4			95% Adjusted-CLT UCL (Chen-1995)	44.3	
492										95% Modified-t UCL (Johnson-1978)	44.4	
493												
494						**Gamma GOF Test**							
495						A-D Test Statistic	0.38			**Anderson-Darling Gamma GOF Test**		
496						5% A-D Critical Value	0.73			d data appear Gamma Distributed at 5% Significar		
497						K-S Test Statistic	0.13			**Kolmogrov-Smirnoff Gamma GOF Test**		
498						5% K-S Critical Value	0.21			d data appear Gamma Distributed at 5% Significar		
499						**Detected data appear Gamma Distributed at 5% Significance Level**							
500												
501						**Gamma Statistics**							
502						k hat (MLE)	54.9			k star (bias corrected MLE)	44.6	
503						Theta hat (MLE)	0.76			Theta star (bias corrected MLE)	0.93	
504						nu hat (MLE)	1758			nu star (bias corrected)	1430	

505	MLE Mean (bias corrected)					41.84	MLE Sd (bias corrected)					6.26
506							Approximate Chi Square Value (0.05)					1343
507	Adjusted Level of Significance					0.033	Adjusted Chi Square Value					1334
508												
509	**Assuming Gamma Distribution**											
510	oximate Gamma UCL (use when n>=50))					44.55	Adjusted Gamma UCL (use when n<50)					44.8
511												
512	**Lognormal GOF Test**											
513	Shapiro Wilk Test Statistic					0.93	**Shapiro Wilk Lognormal GOF Test**					
514	5% Shapiro Wilk Critical Value					0.88	Data appear Lognormal at 5% Significance Level					
515	Lilliefors Test Statistic					0.12	**Lilliefors Lognormal GOF Test**					
516	5% Lilliefors Critical Value					0.22	Data appear Lognormal at 5% Significance Level					
517	**Data appear Lognormal at 5% Significance Level**											
518												
519	**Lognormal Statistics**											
520	Minimum of Logged Data					3.51	Mean of logged Data					3.72
521	Maximum of Logged Data					3.93	SD of logged Data					0.13
522												
523	**Assuming Lognormal Distribution**											
524	95% H-UCL					44.6	90% Chebyshev (MVUE) UCL					46.2
525	95% Chebyshev (MVUE) UCL					48.2	97.5% Chebyshev (MVUE) UCL					50.9
526	99% Chebyshev (MVUE) UCL					56.4						
527												
528	**Nonparametric Distribution Free UCL Statistics**											
529	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
530												
531	**Nonparametric Distribution Free UCLs**											
532	95% CLT UCL					44.25	95% Jackknife UCL					44.4
533	95% Standard Bootstrap UCL					44.24	95% Bootstrap-t UCL					44.5
534	95% Hall's Bootstrap UCL					44.19	95% Percentile Bootstrap UCL					44.1
535	95% BCA Bootstrap UCL					44.29						
536	90% Chebyshev(Mean, Sd) UCL					46.23	95% Chebyshev(Mean, Sd) UCL					48.2
537	97.5% Chebyshev(Mean, Sd) UCL					50.98	99% Chebyshev(Mean, Sd) UCL					56.3
538												
539	**Suggested UCL to Use**											
540	95% Student's-t UCL					44.4						
541												
542	stions regarding the selection of a 95% UCL are provided to help the user to select the most appropri											
543	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
544	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
545	For additional insight the user may want to consult a statistician.											
546												