

	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	Time of Computation		8/13/2015 1:57:49 PM									
5	From File		ProUCLinput 15-005(c) 0-5.xls									
6	Full Precision		OFF									
7	Confidence Coefficient		95%									
8	Bootstrap Operations		2000									
9												
10	Antimony											
11												
12	General Statistics											
13	Total Number of Observations				20		Number of Distinct Observations				17	
14	Number of Detects				9		Number of Non-Detects				11	
15	Number of Distinct Detects				9		Number of Distinct Non-Detects				8	
16	Minimum Detect				0.50		Minimum Non-Detect				1.08	
17	Maximum Detect				1.22		Maximum Non-Detect				1.41	
18	Variance Detects				0.05		Percent Non-Detects				55%	
19	Mean Detects				0.76		SD Detects				0.22	
20	Median Detects				0.66		CV Detects				0.29	
21	Skewness Detects				0.91		Kurtosis Detects				0.54	
22	Mean of Logged Detects				-0.30		SD of Logged Detects				0.28	
23												
24	Normal GOF Test on Detects Only											
25	Shapiro Wilk Test Statistic				0.90		Shapiro Wilk GOF Test					
26	5% Shapiro Wilk Critical Value				0.82		Detected Data appear Normal at 5% Significance Level					
27	Lilliefors Test Statistic				0.22		Lilliefors GOF Test					
28	5% Lilliefors Critical Value				0.29		Detected Data appear Normal at 5% Significance Level					
29	Detected Data appear Normal at 5% Significance Level											
30												
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
32	Mean				0.74		Standard Error of Mean				0.06	
33	SD				0.19		95% KM (BCA) UCL				0.84	
34	95% KM (t) UCL				0.85		95% KM (Percentile Bootstrap) UCL				0.84	
35	95% KM (z) UCL				0.84		95% KM Bootstrap t UCL				0.87	
36	90% KM Chebyshev UCL				0.93		95% KM Chebyshev UCL				1.02	
37	97.5% KM Chebyshev UCL				1.14		99% KM Chebyshev UCL				1.38	
38												
39	Gamma GOF Tests on Detected Observations Only											
40	A-D Test Statistic				0.34		Anderson-Darling GOF Test					
41	5% A-D Critical Value				0.72		Detected data appear Gamma Distributed at 5% Significance Level					
42	K-S Test Statistic				0.21		Kolmogorov-Smirnov GOF					
43	5% K-S Critical Value				0.27		Detected data appear Gamma Distributed at 5% Significance Level					
44	Detected data appear Gamma Distributed at 5% Significance Level											
45												
46	Gamma Statistics on Detected Data Only											
47	k hat (MLE)				13.44		k star (bias corrected MLE)				9.06	
48	Theta hat (MLE)				0.05		Theta star (bias corrected MLE)				0.08	
49	nu hat (MLE)				242.8		nu star (bias corrected)				163.2	
50	MLE Mean (bias corrected)				0.76		MLE Sd (bias corrected)				0.25	
51												
52	Gamma Kaplan-Meier (KM) Statistics											
53	k hat (KM)				14.24		nu hat (KM)				569.7	
54	Approximate Chi Square Value (569.68, α)				515.3		Adjusted Chi Square Value (569.68, β)				511.2	
55	Approximate KM-UCL (use when $n \geq 50$)				0.82		Gamma Adjusted KM-UCL (use when $n < 50$)				0.82	
56												
57	Gamma ROS Statistics using Imputed Non-Detects											
58	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
59	GROS may not be used when kstar of detected data is small such as < 0.1											
60	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
61	Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimate											
62	Minimum				0.50		Mean				0.73	
63	Maximum				1.22		Median				0.71	

[illegible]

	A	B	C	D	E	F	G	H	I	J	K	L
127												
128	Assuming Normal Distribution											
129	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
130	95% Student's-t UCL					199	95% Adjusted-CLT UCL (Chen-1995)					195.4
131							95% Modified-t UCL (Johnson-1978)					198.5
132												
133	Gamma GOF Test											
134	A-D Test Statistic					1.67	Anderson-Darling Gamma GOF Test					
135	5% A-D Critical Value					0.74	Data Not Gamma Distributed at 5% Significance Level					
136	K-S Test Statistic					0.24	Kolmogorov-Smirnov Gamma GOF Test					
137	5% K-S Critical Value					0.19	Data Not Gamma Distributed at 5% Significance Level					
138	Data Not Gamma Distributed at 5% Significance Level											
139												
140	Gamma Statistics											
141	k hat (MLE)					46.71	k star (bias corrected MLE)					39.74
142	Theta hat (MLE)					4.05	Theta star (bias corrected MLE)					4.76
143	nu hat (MLE)					1869	nu star (bias corrected)					1590
144	MLE Mean (bias corrected)					189.4	MLE Sd (bias corrected)					30.0
145							Approximate Chi Square Value (0.05)					1498
146	Adjusted Level of Significance					0.03	Adjusted Chi Square Value					1491
147												
148	Assuming Gamma Distribution											
149	Approximate Gamma UCL (use when n>=50)					200.9	Adjusted Gamma UCL (use when n<50)					201.9
150												
151	Lognormal GOF Test											
152	Shapiro Wilk Test Statistic					0.66	Shapiro Wilk Lognormal GOF Test					
153	5% Shapiro Wilk Critical Value					0.90	Data Not Lognormal at 5% Significance Level					
154	Lilliefors Test Statistic					0.26	Lilliefors Lognormal GOF Test					
155	5% Lilliefors Critical Value					0.19	Data Not Lognormal at 5% Significance Level					
156	Data Not Lognormal at 5% Significance Level											
157												
158	Lognormal Statistics											
159	Minimum of Logged Data					4.62	Mean of logged Data					5.23
160	Maximum of Logged Data					5.37	SD of logged Data					0.16
161												
162	Assuming Lognormal Distribution											
163	95% H-UCL					202.6	90% Chebyshev (MVUE) UCL					210.3
164	95% Chebyshev (MVUE) UCL					219.6	97.5% Chebyshev (MVUE) UCL					232.5
165	99% Chebyshev (MVUE) UCL					258						
166												
167	Nonparametric Distribution Free UCL Statistics											
168	Data do not follow a Discernible Distribution (0.05)											
169												
170	Nonparametric Distribution Free UCLs											
171	95% CLT UCL					198.5	95% Jackknife UCL					199
172	95% Standard Bootstrap UCL					198.3	95% Bootstrap-t UCL					196.7
173	95% Hall's Bootstrap UCL					196.4	95% Percentile Bootstrap UCL					197.7
174	95% BCA Bootstrap UCL					196						
175	90% Chebyshev(Mean, Sd) UCL					206.1	95% Chebyshev(Mean, Sd) UCL					213.7
176	97.5% Chebyshev(Mean, Sd) UCL					224.2	99% Chebyshev(Mean, Sd) UCL					244.9
177												
178	Suggested UCL to Use											
179	95% Student's-t UCL					199	or 95% Modified-t UCL					198.5
180												
181	Instructions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
182	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
183	Singh and Singh (2003). However, simulation results will not cover all Real World data sets											
184	For additional insight the user may want to consult a statistician.											
185												
186	highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may											
187	not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.											
188												
189												

	A	B	C	D	E	F	G	H	I	J	K	L		
190	Chromium													
191														
192	General Statistics													
193	Total Number of Observations					20		Number of Distinct Observations				17		
194								Number of Missing Observations				0		
195	Minimum					5.94		Mean				10.64		
196	Maximum					13.9		Median				10.44		
197	SD					1.72		Std. Error of Mean				0.38		
198	Coefficient of Variation					0.16		Skewness				-0.44		
199														
200	Normal GOF Test													
201	Shapiro Wilk Test Statistic					0.92		Shapiro Wilk GOF Test						
202	5% Shapiro Wilk Critical Value					0.90		Data appear Normal at 5% Significance Level						
203	Lilliefors Test Statistic					0.18		Lilliefors GOF Test						
204	5% Lilliefors Critical Value					0.19		Data appear Normal at 5% Significance Level						
205	Data appear Normal at 5% Significance Level													
206														
207	Assuming Normal Distribution													
208	95% Normal UCL							95% UCLs (Adjusted for Skewness)						
209	95% Student's-t UCL					11.24		95% Adjusted-CLT UCL (Chen-1995)					11.24	
210								95% Modified-t UCL (Johnson-1978)					11.24	
211														
212	Gamma GOF Test													
213	A-D Test Statistic					0.77		Anderson-Darling Gamma GOF Test						
214	5% A-D Critical Value					0.74		Data Not Gamma Distributed at 5% Significance Level						
215	K-S Test Statistic					0.16		Kolmogrov-Smirnoff Gamma GOF Test						
216	5% K-S Critical Value					0.19		Data appear Gamma Distributed at 5% Significance Level						
217	Detected data follow Appr. Gamma Distribution at 5% Significance Level													
218														
219	Gamma Statistics													
220	k hat (MLE)					35.9		k star (bias corrected MLE)					30.54	
221	Theta hat (MLE)					0.29		Theta star (bias corrected MLE)					0.34	
222	nu hat (MLE)					1436		nu star (bias corrected)					1222	
223	MLE Mean (bias corrected)					10.62		MLE Sd (bias corrected)					1.92	
224								Approximate Chi Square Value (0.05)					1142	
225	Adjusted Level of Significance					0.034		Adjusted Chi Square Value					1136	
226														
227	Assuming Gamma Distribution													
228	Approximate Gamma UCL (use when n>=50))					11.36		Adjusted Gamma UCL (use when n<50)					11.44	
229														
230	Lognormal GOF Test													
231	Shapiro Wilk Test Statistic					0.86		Shapiro Wilk Lognormal GOF Test						
232	5% Shapiro Wilk Critical Value					0.90		Data Not Lognormal at 5% Significance Level						
233	Lilliefors Test Statistic					0.18		Lilliefors Lognormal GOF Test						
234	5% Lilliefors Critical Value					0.19		Data appear Lognormal at 5% Significance Level						
235	Data appear Approximate Lognormal at 5% Significance Level													
236														
237	Lognormal Statistics													
238	Minimum of Logged Data					1.78		Mean of logged Data					2.34	
239	Maximum of Logged Data					2.63		SD of logged Data					0.17	
240														
241	Assuming Lognormal Distribution													
242	95% H-UCL					11.44		90% Chebyshev (MVUE) UCL					11.9	
243	95% Chebyshev (MVUE) UCL					12.44		97.5% Chebyshev (MVUE) UCL					13.24	
244	99% Chebyshev (MVUE) UCL					14.84								
245														
246	Nonparametric Distribution Free UCL Statistics													
247	Data appear to follow a Discernible Distribution at 5% Significance Level													
248														
249	Nonparametric Distribution Free UCLs													
250	95% CLT UCL					11.24		95% Jackknife UCL					11.24	
251	95% Standard Bootstrap UCL					11.24		95% Bootstrap-t UCL					11.24	
252	95% Hall's Bootstrap UCL					11.24		95% Percentile Bootstrap UCL					11.24	

	A	B	C	D	E	F	G	H	I	J	K	L
253	95% BCA Bootstrap UCL					11.2						
254	90% Chebyshev(Mean, Sd) UCL					11.7	95% Chebyshev(Mean, Sd) UCL					12.3
255	97.5% Chebyshev(Mean, Sd) UCL					13.0	99% Chebyshev(Mean, Sd) UCL					14.4
256												
257	Suggested UCL to Use											
258	95% Student's-t UCL					11.2						
259												
260	tions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
261	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
262	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
263	For additional insight the user may want to consult a statistician.											
264												
265	highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may											
266	reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.											
267												
268												
269	Cobalt											
270												
271	General Statistics											
272	Total Number of Observations					20	Number of Distinct Observations					20
273							Number of Missing Observations					0
274	Minimum					2.93	Mean					5.58
275	Maximum					9.87	Median					5.52
276	SD					1.40	Std. Error of Mean					0.31
277	Coefficient of Variation					0.25	Skewness					1.1
278												
279	Normal GOF Test											
280	Shapiro Wilk Test Statistic					0.89	Shapiro Wilk GOF Test					
281	5% Shapiro Wilk Critical Value					0.90	Data Not Normal at 5% Significance Level					
282	Lilliefors Test Statistic					0.16	Lilliefors GOF Test					
283	5% Lilliefors Critical Value					0.19	Data appear Normal at 5% Significance Level					
284	Data appear Approximate Normal at 5% Significance Level											
285												
286	Assuming Normal Distribution											
287	95% Normal UCL					95% UCLs (Adjusted for Skewness)						
288	95% Student's-t UCL					6.12	95% Adjusted-CLT UCL (Chen-1995)					6.18
289							95% Modified-t UCL (Johnson-1978)					6.14
290												
291	Gamma GOF Test											
292	A-D Test Statistic					0.64	Anderson-Darling Gamma GOF Test					
293	5% A-D Critical Value					0.74	data appear Gamma Distributed at 5% Significance Level					
294	K-S Test Statistic					0.15	Kolmogorov-Smirnov Gamma GOF Test					
295	5% K-S Critical Value					0.19	data appear Gamma Distributed at 5% Significance Level					
296	Detected data appear Gamma Distributed at 5% Significance Level											
297												
298	Gamma Statistics											
299	k hat (MLE)					17.11	k star (bias corrected MLE)					14.6
300	Theta hat (MLE)					0.32	Theta star (bias corrected MLE)					0.38
301	nu hat (MLE)					687.2	nu star (bias corrected)					585.4
302	MLE Mean (bias corrected)					5.58	MLE Sd (bias corrected)					1.46
303							Approximate Chi Square Value (0.05)					530.3
304	Adjusted Level of Significance					0.03	Adjusted Chi Square Value					526.2
305												
306	Assuming Gamma Distribution											
307	Approximate Gamma UCL (use when n>=50)					6.16	Adjusted Gamma UCL (use when n<50)					6.21
308												
309	Lognormal GOF Test											
310	Shapiro Wilk Test Statistic					0.93	Shapiro Wilk Lognormal GOF Test					
311	5% Shapiro Wilk Critical Value					0.90	Data appear Lognormal at 5% Significance Level					
312	Lilliefors Test Statistic					0.17	Lilliefors Lognormal GOF Test					
313	5% Lilliefors Critical Value					0.19	Data appear Lognormal at 5% Significance Level					
314	Data appear Lognormal at 5% Significance Level											
315												

	A	B	C	D	E	F	G	H	I	J	K	L
316	Lognormal Statistics											
317	Minimum of Logged Data					1.07	Mean of logged Data					1.69
318	Maximum of Logged Data					2.28	SD of logged Data					0.25
319												
320	Assuming Lognormal Distribution											
321	95% H-UCL					6.21	90% Chebyshev (MVUE) UCL					6.53
322	95% Chebyshev (MVUE) UCL					6.96	97.5% Chebyshev (MVUE) UCL					7.56
323	99% Chebyshev (MVUE) UCL					8.73						
324												
325	Nonparametric Distribution Free UCL Statistics											
326	Data appear to follow a Discernible Distribution at 5% Significance Level											
327												
328	Nonparametric Distribution Free UCLs											
329	95% CLT UCL					6.10	95% Jackknife UCL					6.12
330	95% Standard Bootstrap UCL					6.08	95% Bootstrap-t UCL					6.19
331	95% Hall's Bootstrap UCL					6.52	95% Percentile Bootstrap UCL					6.09
332	95% BCA Bootstrap UCL					6.21						
333	90% Chebyshev(Mean, Sd) UCL					6.52	95% Chebyshev(Mean, Sd) UCL					6.95
334	97.5% Chebyshev(Mean, Sd) UCL					7.55	99% Chebyshev(Mean, Sd) UCL					8.71
335												
336	Suggested UCL to Use											
337	95% Student's-t UCL					6.12						
338												
339	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
340	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
341	Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
342	For additional insight the user may want to consult a statistician.											
343												
344												
345	Copper											
346												
347	General Statistics											
348	Total Number of Observations					20	Number of Distinct Observations					20
349							Number of Missing Observations					0
350	Minimum					4.9	Mean					9.93
351	Maximum					30.6	Median					8.53
352	SD					5.40	Std. Error of Mean					1.20
353	Coefficient of Variation					0.54	Skewness					3.17
354												
355	Normal GOF Test											
356	Shapiro Wilk Test Statistic					0.64	Shapiro Wilk GOF Test					
357	5% Shapiro Wilk Critical Value					0.90	Data Not Normal at 5% Significance Level					
358	Lilliefors Test Statistic					0.25	Lilliefors GOF Test					
359	5% Lilliefors Critical Value					0.19	Data Not Normal at 5% Significance Level					
360	Data Not Normal at 5% Significance Level											
361												
362	Assuming Normal Distribution											
363	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
364	95% Student's-t UCL					12.02	95% Adjusted-CLT UCL (Chen-1995)					12.8
365							95% Modified-t UCL (Johnson-1978)					12.1
366												
367	Gamma GOF Test											
368	A-D Test Statistic					0.98	Anderson-Darling Gamma GOF Test					
369	5% A-D Critical Value					0.74	Data Not Gamma Distributed at 5% Significance Level					
370	K-S Test Statistic					0.17	Kolmogrov-Smirnoff Gamma GOF Test					
371	5% K-S Critical Value					0.19	Data appear Gamma Distributed at 5% Significance Level					
372	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
373												
374	Gamma Statistics											
375	k hat (MLE)					5.84	k star (bias corrected MLE)					5
376	Theta hat (MLE)					1.7	Theta star (bias corrected MLE)					1.98
377	nu hat (MLE)					233.7	nu star (bias corrected)					200
378	MLE Mean (bias corrected)					9.93	MLE Sd (bias corrected)					4.44

	A	B	C	D	E	F	G	H	I	J	K	L
379							Approximate Chi Square Value (0.05)					168.3
380	Adjusted Level of Significance					0.03	Adjusted Chi Square Value					166
381												
382	Assuming Gamma Distribution											
383	Approximate Gamma UCL (use when n>=50)					11.8	Adjusted Gamma UCL (use when n<50)					11.9
384												
385	Lognormal GOF Test											
386	Shapiro Wilk Test Statistic					0.89	Shapiro Wilk Lognormal GOF Test					
387	5% Shapiro Wilk Critical Value					0.90	Data Not Lognormal at 5% Significance Level					
388	Lilliefors Test Statistic					0.14	Lilliefors Lognormal GOF Test					
389	5% Lilliefors Critical Value					0.19	Data appear Lognormal at 5% Significance Level					
390	Data appear Approximate Lognormal at 5% Significance Level											
391												
392	Lognormal Statistics											
393	Minimum of Logged Data					1.58	Mean of logged Data					2.20
394	Maximum of Logged Data					3.42	SD of logged Data					0.39
395												
396	Assuming Lognormal Distribution											
397	95% H-UCL					11.6	90% Chebyshev (MVUE) UCL					12.4
398	95% Chebyshev (MVUE) UCL					13.6	97.5% Chebyshev (MVUE) UCL					15.2
399	99% Chebyshev (MVUE) UCL					18.5						
400												
401	Nonparametric Distribution Free UCL Statistics											
402	Data appear to follow a Discernible Distribution at 5% Significance Level											
403												
404	Nonparametric Distribution Free UCLs											
405	95% CLT UCL					11.9	95% Jackknife UCL					12.0
406	95% Standard Bootstrap UCL					11.9	95% Bootstrap-t UCL					14.0
407	95% Hall's Bootstrap UCL					20.8	95% Percentile Bootstrap UCL					12.0
408	95% BCA Bootstrap UCL					12.9						
409	90% Chebyshev(Mean, Sd) UCL					13.5	95% Chebyshev(Mean, Sd) UCL					15.2
410	97.5% Chebyshev(Mean, Sd) UCL					17.4	99% Chebyshev(Mean, Sd) UCL					21.9
411												
412	Suggested UCL to Use											
413	95% Adjusted Gamma UCL					11.9						
414												
415	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
416	recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Singh											
417	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
418	For additional insight the user may want to consult a statistician.											
419												
420												
421	Iron											
422												
423	General Statistics											
424	Total Number of Observations					20	Number of Distinct Observations					17
425							Number of Missing Observations					0
426	Minimum					7940	Mean					13092
427	Maximum					16000	Median					13200
428	SD					1782	Std. Error of Mean					398.4
429	Coefficient of Variation					0.13	Skewness					-1.23
430												
431	Normal GOF Test											
432	Shapiro Wilk Test Statistic					0.91	Shapiro Wilk GOF Test					
433	5% Shapiro Wilk Critical Value					0.90	Data appear Normal at 5% Significance Level					
434	Lilliefors Test Statistic					0.18	Lilliefors GOF Test					
435	5% Lilliefors Critical Value					0.19	Data appear Normal at 5% Significance Level					
436	Data appear Normal at 5% Significance Level											
437												
438	Assuming Normal Distribution											
439	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
440	95% Student's-t UCL					13781	95% Adjusted-CLT UCL (Chen-1995)					13630
441							95% Modified-t UCL (Johnson-1978)					13763

	A	B	C	D	E	F	G	H	I	J	K	L
442												
443	Gamma GOF Test											
444	A-D Test Statistic				0.82	Anderson-Darling Gamma GOF Test						
445	5% A-D Critical Value				0.73	Data Not Gamma Distributed at 5% Significance Level						
446	K-S Test Statistic				0.20	Kolmogorov-Smirnov Gamma GOF Test						
447	5% K-S Critical Value				0.19	Data Not Gamma Distributed at 5% Significance Level						
448	Data Not Gamma Distributed at 5% Significance Level											
449												
450	Gamma Statistics											
451	k hat (MLE)				49.21	k star (bias corrected MLE)				41.9		
452	Theta hat (MLE)				265.8	Theta star (bias corrected MLE)				312.4		
453	nu hat (MLE)				1970	nu star (bias corrected)				1676		
454	MLE Mean (bias corrected)				13092	MLE Sd (bias corrected)				2022		
455						Approximate Chi Square Value (0.05)				1582		
456	Adjusted Level of Significance				0.03	Adjusted Chi Square Value				1575		
457												
458	Assuming Gamma Distribution											
459	Approximate Gamma UCL (use when n>=50)				13871	Adjusted Gamma UCL (use when n<50)				13934		
460												
461	Lognormal GOF Test											
462	Shapiro Wilk Test Statistic				0.84	Shapiro Wilk Lognormal GOF Test						
463	5% Shapiro Wilk Critical Value				0.90	Data Not Lognormal at 5% Significance Level						
464	Lilliefors Test Statistic				0.21	Lilliefors Lognormal GOF Test						
465	5% Lilliefors Critical Value				0.19	Data Not Lognormal at 5% Significance Level						
466	Data Not Lognormal at 5% Significance Level											
467												
468	Lognormal Statistics											
469	Minimum of Logged Data				8.98	Mean of logged Data				9.47		
470	Maximum of Logged Data				9.68	SD of logged Data				0.15		
471												
472	Assuming Lognormal Distribution											
473	95% H-UCL				13943	90% Chebyshev (MVUE) UCL				14448		
474	95% Chebyshev (MVUE) UCL				15058	97.5% Chebyshev (MVUE) UCL				15903		
475	99% Chebyshev (MVUE) UCL				17564							
476												
477	Nonparametric Distribution Free UCL Statistics											
478	Data appear to follow a Discernible Distribution at 5% Significance Level											
479												
480	Nonparametric Distribution Free UCLs											
481	95% CLT UCL				13747	95% Jackknife UCL				13781		
482	95% Standard Bootstrap UCL				13736	95% Bootstrap-t UCL				13688		
483	95% Hall's Bootstrap UCL				13659	95% Percentile Bootstrap UCL				13697		
484	95% BCA Bootstrap UCL				13615							
485	90% Chebyshev(Mean, Sd) UCL				14287	95% Chebyshev(Mean, Sd) UCL				14828		
486	97.5% Chebyshev(Mean, Sd) UCL				15580	99% Chebyshev(Mean, Sd) UCL				17056		
487												
488	Suggested UCL to Use											
489	95% Student's-t UCL				13781							
490												
491	Conditions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
492	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
493	Singh and Singh (2003). However, simulation results will not cover all Real World data sets											
494	For additional insight the user may want to consult a statistician.											
495												
496	Highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may											
497	not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.											
498												
499												
500	Lead											
501												
502	General Statistics											
503	Total Number of Observations				20	Number of Distinct Observations				19		
504						Number of Missing Observations				0		

	A	B	C	D	E	F	G	H	I	J	K	L
505					Minimum	9.03					Mean	19.2
506					Maximum	69.6					Median	14.2
507					SD	16.4					Std. Error of Mean	3.66
508					Coefficient of Variation	0.85					Skewness	2.80
509												
510					Normal GOF Test							
511					Shapiro Wilk Test Statistic	0.48					Shapiro Wilk GOF Test	
512					5% Shapiro Wilk Critical Value	0.90					Data Not Normal at 5% Significance Level	
513					Lilliefors Test Statistic	0.42					Lilliefors GOF Test	
514					5% Lilliefors Critical Value	0.19					Data Not Normal at 5% Significance Level	
515					Data Not Normal at 5% Significance Level							
516												
517					Assuming Normal Distribution							
518					95% Normal UCL						95% UCLs (Adjusted for Skewness)	
519					95% Student's-t UCL	25.6					95% Adjusted-CLT UCL (Chen-1995)	27.7
520											95% Modified-t UCL (Johnson-1978)	26.0
521												
522					Gamma GOF Test							
523					A-D Test Statistic	3.55					Anderson-Darling Gamma GOF Test	
524					5% A-D Critical Value	0.74					Data Not Gamma Distributed at 5% Significance Level	
525					K-S Test Statistic	0.38					Kolmogrov-Smirnoff Gamma GOF Test	
526					5% K-S Critical Value	0.19					Data Not Gamma Distributed at 5% Significance Level	
527					Data Not Gamma Distributed at 5% Significance Level							
528												
529					Gamma Statistics							
530					k hat (MLE)	2.99					k star (bias corrected MLE)	2.57
531					Theta hat (MLE)	6.44					Theta star (bias corrected MLE)	7.48
532					nu hat (MLE)	119.7					nu star (bias corrected)	103.1
533					MLE Mean (bias corrected)	19.2					MLE Sd (bias corrected)	12.0
534											Approximate Chi Square Value (0.05)	80.6
535					Adjusted Level of Significance	0.03					Adjusted Chi Square Value	79.1
536												
537					Assuming Gamma Distribution							
538					Approximate Gamma UCL (use when n>=50))	24.6					Adjusted Gamma UCL (use when n<50)	25.1
539												
540					Lognormal GOF Test							
541					Shapiro Wilk Test Statistic	0.66					Shapiro Wilk Lognormal GOF Test	
542					5% Shapiro Wilk Critical Value	0.90					Data Not Lognormal at 5% Significance Level	
543					Lilliefors Test Statistic	0.33					Lilliefors Lognormal GOF Test	
544					5% Lilliefors Critical Value	0.19					Data Not Lognormal at 5% Significance Level	
545					Data Not Lognormal at 5% Significance Level							
546												
547					Lognormal Statistics							
548					Minimum of Logged Data	2.20					Mean of logged Data	2.78
549					Maximum of Logged Data	4.24					SD of logged Data	0.51
550												
551					Assuming Lognormal Distribution							
552					95% H-UCL	23.4					90% Chebyshev (MVUE) UCL	24.8
553					95% Chebyshev (MVUE) UCL	27.8					97.5% Chebyshev (MVUE) UCL	31.9
554					99% Chebyshev (MVUE) UCL	40.0						
555												
556					Nonparametric Distribution Free UCL Statistics							
557					Data do not follow a Discernible Distribution (0.05)							
558												
559					Nonparametric Distribution Free UCLs							
560					95% CLT UCL	25.3					95% Jackknife UCL	25.6
561					95% Standard Bootstrap UCL	25.0					95% Bootstrap-t UCL	60.6
562					95% Hall's Bootstrap UCL	70.1					95% Percentile Bootstrap UCL	25.2
563					95% BCA Bootstrap UCL	27.8						
564					90% Chebyshev(Mean, Sd) UCL	30.2					95% Chebyshev(Mean, Sd) UCL	35.2
565					97.5% Chebyshev(Mean, Sd) UCL	42.1					99% Chebyshev(Mean, Sd) UCL	55.7
566												
567					Suggested UCL to Use							

	A	B	C	D	E	F	G	H	I	J	K	L
568	95% Chebyshev (Mean, Sd) UCL					35.26						
569												
570	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
571	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
572	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
573	For additional insight the user may want to consult a statistician.											
574												
575												
576	Manganese											
577												
578	General Statistics											
579	Total Number of Observations					20	Number of Distinct Observations					19
580							Number of Missing Observations					0
581	Minimum					204	Mean					357.3
582	Maximum					693	Median					357.5
583	SD					102.9	Std. Error of Mean					23.07
584	Coefficient of Variation					0.28	Skewness					1.57
585												
586	Normal GOF Test											
587	Shapiro Wilk Test Statistic					0.83	Shapiro Wilk GOF Test					
588	5% Shapiro Wilk Critical Value					0.90	Data Not Normal at 5% Significance Level					
589	Lilliefors Test Statistic					0.18	Lilliefors GOF Test					
590	5% Lilliefors Critical Value					0.19	Data appear Normal at 5% Significance Level					
591	Data appear Approximate Normal at 5% Significance Level											
592												
593	Assuming Normal Distribution											
594	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
595	95% Student's-t UCL					397.1	95% Adjusted-CLT UCL (Chen-1995)					403.8
596							95% Modified-t UCL (Johnson-1978)					398.4
597												
598	Gamma GOF Test											
599	A-D Test Statistic					0.88	Anderson-Darling Gamma GOF Test					
600	5% A-D Critical Value					0.74	Data Not Gamma Distributed at 5% Significance Level					
601	K-S Test Statistic					0.18	Kolmogrov-Smirnoff Gamma GOF Test					
602	5% K-S Critical Value					0.19	Data appear Gamma Distributed at 5% Significance Level					
603	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
604												
605	Gamma Statistics											
606	k hat (MLE)					14.04	k star (bias corrected MLE)					11.94
607	Theta hat (MLE)					25.43	Theta star (bias corrected MLE)					29.83
608	nu hat (MLE)					562.1	nu star (bias corrected)					479.1
609	MLE Mean (bias corrected)					357.3	MLE Sd (bias corrected)					103.2
610							Approximate Chi Square Value (0.05)					429.3
611	Adjusted Level of Significance					0.038	Adjusted Chi Square Value					425.6
612												
613	Assuming Gamma Distribution											
614	Approximate Gamma UCL (use when n>=50)					398.7	Adjusted Gamma UCL (use when n<50)					402.2
615												
616	Lognormal GOF Test											
617	Shapiro Wilk Test Statistic					0.89	Shapiro Wilk Lognormal GOF Test					
618	5% Shapiro Wilk Critical Value					0.90	Data Not Lognormal at 5% Significance Level					
619	Lilliefors Test Statistic					0.19	Lilliefors Lognormal GOF Test					
620	5% Lilliefors Critical Value					0.19	Data Not Lognormal at 5% Significance Level					
621	Data Not Lognormal at 5% Significance Level											
622												
623	Lognormal Statistics											
624	Minimum of Logged Data					5.31	Mean of logged Data					5.84
625	Maximum of Logged Data					6.54	SD of logged Data					0.27
626												
627	Assuming Lognormal Distribution											
628	95% H-UCL					401.5	90% Chebyshev (MVUE) UCL					423.5
629	95% Chebyshev (MVUE) UCL					453.6	97.5% Chebyshev (MVUE) UCL					495.3
630	99% Chebyshev (MVUE) UCL					577.3						

	A	B	C	D	E	F	G	H	I	J	K	L	
631													
632	Nonparametric Distribution Free UCL Statistics												
633	Data appear to follow a Discernible Distribution at 5% Significance Level												
634													
635	Nonparametric Distribution Free UCLs												
636	95% CLT UCL				395.2	95% Jackknife UCL				397.1			
637	95% Standard Bootstrap UCL				393.3	95% Bootstrap-t UCL				408.3			
638	95% Hall's Bootstrap UCL				451.3	95% Percentile Bootstrap UCL				395.5			
639	95% BCA Bootstrap UCL				405.8								
640	90% Chebyshev(Mean, Sd) UCL				426.4	95% Chebyshev(Mean, Sd) UCL				457.6			
641	97.5% Chebyshev(Mean, Sd) UCL				501	99% Chebyshev(Mean, Sd) UCL				586.3			
642													
643	Suggested UCL to Use												
644	95% Student's-t UCL				397.1								
645													
646	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
647	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and												
648	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets												
649	For additional insight the user may want to consult a statistician.												
650													
651													
652	Uranium												
653													
654	General Statistics												
655	Total Number of Observations				20	Number of Distinct Observations				19			
656						Number of Missing Observations				0			
657	Minimum				0.84	Mean				4.25			
658	Maximum				17.4	Median				3.05			
659	SD				4.06	Std. Error of Mean				0.91			
660	Coefficient of Variation				0.95	Skewness				1.88			
661													
662	Normal GOF Test												
663	Shapiro Wilk Test Statistic				0.78	Shapiro Wilk GOF Test							
664	5% Shapiro Wilk Critical Value				0.90	Data Not Normal at 5% Significance Level							
665	Lilliefors Test Statistic				0.20	Lilliefors GOF Test							
666	5% Lilliefors Critical Value				0.19	Data Not Normal at 5% Significance Level							
667	Data Not Normal at 5% Significance Level												
668													
669	Assuming Normal Distribution												
670	95% Normal UCL					95% UCLs (Adjusted for Skewness)							
671	95% Student's-t UCL				5.82	95% Adjusted-CLT UCL (Chen-1995)				6.15			
672						95% Modified-t UCL (Johnson-1978)				5.88			
673													
674	Gamma GOF Test												
675	A-D Test Statistic				0.74	Anderson-Darling Gamma GOF Test							
676	5% A-D Critical Value				0.76	data appear Gamma Distributed at 5% Significance Level							
677	K-S Test Statistic				0.20	Kolmogrov-Smirnoff Gamma GOF Test							
678	5% K-S Critical Value				0.19	Data Not Gamma Distributed at 5% Significance Level							
679	Detected data follow Appr. Gamma Distribution at 5% Significance Level												
680													
681	Gamma Statistics												
682	k hat (MLE)				1.37	k star (bias corrected MLE)				1.2			
683	Theta hat (MLE)				3.09	Theta star (bias corrected MLE)				3.54			
684	nu hat (MLE)				54.9	nu star (bias corrected)				48.0			
685	MLE Mean (bias corrected)				4.25	MLE Sd (bias corrected)				3.87			
686						Approximate Chi Square Value (0.05)				33.1			
687	Adjusted Level of Significance				0.03	Adjusted Chi Square Value				32.1			
688													
689	Assuming Gamma Distribution												
690	Approximate Gamma UCL (use when n>=50)					6.16	Adjusted Gamma UCL (use when n<50)					6.35	
691													
692	Lognormal GOF Test												
693	Shapiro Wilk Test Statistic				0.91	Shapiro Wilk Lognormal GOF Test							

	A	B	C	D	E	F	G	H	I	J	K	L	
694	5% Shapiro Wilk Critical Value					0.90	Data appear Lognormal at 5% Significance Level						
695	Lilliefors Test Statistic					0.18	Lilliefors Lognormal GOF Test						
696	5% Lilliefors Critical Value					0.19	Data appear Lognormal at 5% Significance Level						
697	Data appear Lognormal at 5% Significance Level												
698													
699	Lognormal Statistics												
700	Minimum of Logged Data					-0.17	Mean of logged Data					1.04	
701	Maximum of Logged Data					2.85	SD of logged Data					0.93	
702													
703	Assuming Lognormal Distribution												
704	95% H-UCL					7.60	90% Chebyshev (MVUE) UCL					7.24	
705	95% Chebyshev (MVUE) UCL					8.59	97.5% Chebyshev (MVUE) UCL					10.4	
706	99% Chebyshev (MVUE) UCL					14.14							
707													
708	Nonparametric Distribution Free UCL Statistics												
709	Data appear to follow a Discernible Distribution at 5% Significance Level												
710													
711	Nonparametric Distribution Free UCLs												
712	95% CLT UCL					5.74	95% Jackknife UCL					5.82	
713	95% Standard Bootstrap UCL					5.71	95% Bootstrap-t UCL					6.45	
714	95% Hall's Bootstrap UCL					7.32	95% Percentile Bootstrap UCL					5.86	
715	95% BCA Bootstrap UCL					6.16							
716	90% Chebyshev(Mean, Sd) UCL					6.97	95% Chebyshev(Mean, Sd) UCL					8.21	
717	97.5% Chebyshev(Mean, Sd) UCL					9.93	99% Chebyshev(Mean, Sd) UCL					13.3	
718													
719	Suggested UCL to Use												
720	95% Adjusted Gamma UCL					6.35							
721													
722	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
723	recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and												
724	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets												
725	For additional insight the user may want to consult a statistician.												
726													
727													
728	Uranium-234												
729													
730	General Statistics												
731	Total Number of Observations					20	Number of Distinct Observations					19	
732							Number of Missing Observations					0	
733	Minimum					0.98	Mean					2.39	
734	Maximum					7.59	Median					1.74	
735	SD					1.68	Std. Error of Mean					0.37	
736	Coefficient of Variation					0.70	Skewness					1.75	
737													
738	Normal GOF Test												
739	Shapiro Wilk Test Statistic					0.79	Shapiro Wilk GOF Test						
740	5% Shapiro Wilk Critical Value					0.90	Data Not Normal at 5% Significance Level						
741	Lilliefors Test Statistic					0.20	Lilliefors GOF Test						
742	5% Lilliefors Critical Value					0.19	Data Not Normal at 5% Significance Level						
743	Data Not Normal at 5% Significance Level												
744													
745	Assuming Normal Distribution												
746	95% Normal UCL					95% UCLs (Adjusted for Skewness)							
747	95% Student's-t UCL					3.04	95% Adjusted-CLT UCL (Chen-1995)					3.16	
748							95% Modified-t UCL (Johnson-1978)					3.06	
749													
750	Gamma GOF Test												
751	A-D Test Statistic					0.86	Anderson-Darling Gamma GOF Test						
752	5% A-D Critical Value					0.74	Data Not Gamma Distributed at 5% Significance Level						
753	K-S Test Statistic					0.18	Kolmogrov-Smirnoff Gamma GOF Test						
754	5% K-S Critical Value					0.19	Data appear Gamma Distributed at 5% Significance Level						
755	Detected data follow Appr. Gamma Distribution at 5% Significance Level												
756													

	A	B	C	D	E	F	G	H	I	J	K	L
757	Gamma Statistics											
758	k hat (MLE)				2.79	k star (bias corrected MLE)				2.40		
759	Theta hat (MLE)				0.85	Theta star (bias corrected MLE)				0.99		
760	nu hat (MLE)				111.7	nu star (bias corrected)				96.3		
761	MLE Mean (bias corrected)				2.39	MLE Sd (bias corrected)				1.54		
762						Approximate Chi Square Value (0.05)				74.6		
763	Adjusted Level of Significance				0.03	Adjusted Chi Square Value				73.1		
764												
765	Assuming Gamma Distribution											
766	Approximate Gamma UCL (use when n>=50)				3.08	Adjusted Gamma UCL (use when n<50)				3.14		
767												
768	Lognormal GOF Test											
769	Shapiro Wilk Test Statistic				0.90	Shapiro Wilk Lognormal GOF Test						
770	5% Shapiro Wilk Critical Value				0.90	Data Not Lognormal at 5% Significance Level						
771	Lilliefors Test Statistic				0.17	Lilliefors Lognormal GOF Test						
772	5% Lilliefors Critical Value				0.19	Data appear Lognormal at 5% Significance Level						
773	Data appear Approximate Lognormal at 5% Significance Level											
774												
775	Lognormal Statistics											
776	Minimum of Logged Data				-0.016	Mean of logged Data				0.68		
777	Maximum of Logged Data				2.02	SD of logged Data				0.60		
778												
779	Assuming Lognormal Distribution											
780	95% H-UCL				3.20	90% Chebyshev (MVUE) UCL				3.36		
781	95% Chebyshev (MVUE) UCL				3.82	97.5% Chebyshev (MVUE) UCL				4.45		
782	99% Chebyshev (MVUE) UCL				5.7							
783												
784	Nonparametric Distribution Free UCL Statistics											
785	Data appear to follow a Discernible Distribution at 5% Significance Level											
786												
787	Nonparametric Distribution Free UCLs											
788	95% CLT UCL				3.00	95% Jackknife UCL				3.04		
789	95% Standard Bootstrap UCL				3.00	95% Bootstrap-t UCL				3.37		
790	95% Hall's Bootstrap UCL				3.48	95% Percentile Bootstrap UCL				3.03		
791	95% BCA Bootstrap UCL				3.23							
792	90% Chebyshev(Mean, Sd) UCL				3.51	95% Chebyshev(Mean, Sd) UCL				4.02		
793	97.5% Chebyshev(Mean, Sd) UCL				4.73	99% Chebyshev(Mean, Sd) UCL				6.12		
794												
795	Suggested UCL to Use											
796	95% Adjusted Gamma UCL				3.14							
797												
798	Questions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
799	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
800	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
801	For additional insight the user may want to consult a statistician.											
802												
803	Uranium-235/236											
804												
805	General Statistics											
806	Total Number of Observations				20	Number of Distinct Observations				20		
807	Number of Detects				14	Number of Non-Detects				6		
808	Number of Distinct Detects				14	Number of Distinct Non-Detects				6		
809	Minimum Detect				0.07	Minimum Non-Detect				0.04		
810	Maximum Detect				0.40	Maximum Non-Detect				0.09		
811	Variance Detects				0.008	Percent Non-Detects				30%		
812	Mean Detects				0.16	SD Detects				0.09		
813	Median Detects				0.14	CV Detects				0.54		
814	Skewness Detects				1.39	Kurtosis Detects				2.36		
815	Mean of Logged Detects				-1.90	SD of Logged Detects				0.50		
816												
817	Normal GOF Test on Detects Only											
818	Shapiro Wilk Test Statistic				0.87	Shapiro Wilk GOF Test						
819	5% Shapiro Wilk Critical Value				0.87	Detected Data Not Normal at 5% Significance Level						

	A	B	C	D	E	F	G	H	I	J	K	L							
820	Lilliefors Test Statistic					0.15	Lilliefors GOF Test												
821	5% Lilliefors Critical Value					0.23	Detected Data appear Normal at 5% Significance Level												
822	Detected Data appear Approximate Normal at 5% Significance Level																		
823																			
824	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs																		
825	Mean					0.13	Standard Error of Mean					0.02							
826	SD					0.09	95% KM (BCA) UCL					0.17							
827	95% KM (t) UCL					0.16	95% KM (Percentile Bootstrap) UCL					0.16							
828	95% KM (z) UCL					0.16	95% KM Bootstrap t UCL					0.17							
829	90% KM Chebyshev UCL					0.19	95% KM Chebyshev UCL					0.22							
830	97.5% KM Chebyshev UCL					0.26	99% KM Chebyshev UCL					0.34							
831																			
832	Gamma GOF Tests on Detected Observations Only																		
833	A-D Test Statistic					0.30	Anderson-Darling GOF Test												
834	5% A-D Critical Value					0.74	data appear Gamma Distributed at 5% Significance Level												
835	K-S Test Statistic					0.15							Kolmogrov-Smirnoff GOF						
836	5% K-S Critical Value					0.23							data appear Gamma Distributed at 5% Significance Level						
837	Detected data appear Gamma Distributed at 5% Significance Level																		
838																			
839	Gamma Statistics on Detected Data Only																		
840	k hat (MLE)					4.28	k star (bias corrected MLE)					3.41							
841	Theta hat (MLE)					0.03	Theta star (bias corrected MLE)					0.04							
842	nu hat (MLE)					120	nu star (bias corrected)					95.6							
843	MLE Mean (bias corrected)					0.16	MLE Sd (bias corrected)					0.09							
844																			
845	Gamma Kaplan-Meier (KM) Statistics																		
846	k hat (KM)					2.03	nu hat (KM)					81.4							
847	Approximate Chi Square Value (81.46, α)					61.6	Adjusted Chi Square Value (81.46, β)					60.3							
848	Approximate KM-UCL (use when $n \geq 50$)					0.17	Gamma Adjusted KM-UCL (use when $n < 50$)					0.17							
849																			
850	Gamma ROS Statistics using Imputed Non-Detects																		
851	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs																		
852	GROS may not be used when kstar of detected data is small such as < 0.1																		
853	For such situations, GROS method tends to yield inflated values of UCLs and BTVs																		
854	Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates																		
855	Minimum					0.01	Mean					0.12							
856	Maximum					0.40	Median					0.10							
857	SD					0.10	CV					0.85							
858	k hat (MLE)					1.11	k star (bias corrected MLE)					0.97							
859	Theta hat (MLE)					0.11	Theta star (bias corrected MLE)					0.12							
860	nu hat (MLE)					44.4	nu star (bias corrected)					39.1							
861	MLE Mean (bias corrected)					0.12	MLE Sd (bias corrected)					0.12							
862							Adjusted Level of Significance (β)					0.03							
863	Approximate Chi Square Value (39.12, α)					25.7	Adjusted Chi Square Value (39.12, β)					24.9							
864	Gamma Approximate UCL (use when $n \geq 50$)					0.18	Gamma Adjusted UCL (use when $n < 50$)					0.19							
865																			
866	Lognormal GOF Test on Detected Observations Only																		
867	Shapiro Wilk Test Statistic					0.96	Shapiro Wilk GOF Test												
868	5% Shapiro Wilk Critical Value					0.87	Detected Data appear Lognormal at 5% Significance Level												
869	Lilliefors Test Statistic					0.13							Lilliefors GOF Test						
870	5% Lilliefors Critical Value					0.23							Detected Data appear Lognormal at 5% Significance Level						
871	Detected Data appear Lognormal at 5% Significance Level																		
872																			
873	Lognormal ROS Statistics Using Imputed Non-Detects																		
874	Mean in Original Scale					0.13	Mean in Log Scale					-2.24							
875	SD in Original Scale					0.09	SD in Log Scale					0.67							
876	95% t UCL (assumes normality of ROS data)					0.16	95% Percentile Bootstrap UCL					0.16							
877	95% BCA Bootstrap UCL					0.17	95% Bootstrap t UCL					0.18							
878	95% H-UCL (Log ROS)					0.18													
879																			
880	UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed																		
881	KM Mean (logged)					-2.26	95% H-UCL (KM -Log)					0.18							
882	KM SD (logged)					0.69	95% Critical H Value (KM-Log)					2.22							

	A	B	C	D	E	F	G	H	I	J	K	L	
883	KM Standard Error of Mean (logged)					0.16							
884													
885	DL/2 Statistics												
886	DL/2 Normal					DL/2 Log-Transformed							
887	Mean in Original Scale					0.12	Mean in Log Scale					-2.34	
888	SD in Original Scale					0.09	SD in Log Scale					0.82	
889	95% t UCL (Assumes normality)					0.16	95% H-Stat UCL					0.21	
890	DL/2 is not a recommended method, provided for comparisons and historical reasons												
891													
892	Nonparametric Distribution Free UCL Statistics												
893	Detected Data appear Approximate Normal Distributed at 5% Significance Level												
894													
895	Suggested UCL to Use												
896	95% KM (t) UCL					0.16	95% KM (Percentile Bootstrap) UCL					0.16	
897													
898	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
899	Recommendations are based upon data size, data distribution, and skewness.												
900	mmendations are based upon the results of the simulation studies summarized in Singh, Maichle, and												
901	ations results will not cover all Real World data sets; for additional insight the user may want to cons												
902													
903													
904	Uranium-238												
905													
906	General Statistics												
907	Total Number of Observations					20	Number of Distinct Observations					18	
908							Number of Missing Observations					0	
909	Minimum					1.07	Mean					2.93	
910	Maximum					7.77	Median					2.49	
911	SD					2.07	Std. Error of Mean					0.46	
912	Coefficient of Variation					0.70	Skewness					1.21	
913													
914	Normal GOF Test												
915	Shapiro Wilk Test Statistic					0.82	Shapiro Wilk GOF Test						
916	5% Shapiro Wilk Critical Value					0.90	Data Not Normal at 5% Significance Level						
917	Lilliefors Test Statistic					0.20	Lilliefors GOF Test						
918	5% Lilliefors Critical Value					0.19	Data Not Normal at 5% Significance Level						
919	Data Not Normal at 5% Significance Level												
920													
921	Assuming Normal Distribution												
922	95% Normal UCL					95% UCLs (Adjusted for Skewness)							
923	95% Student's-t UCL					3.74	95% Adjusted-CLT UCL (Chen-1995)					3.83	
924							95% Modified-t UCL (Johnson-1978)					3.76	
925													
926	Gamma GOF Test												
927	A-D Test Statistic					0.94	Anderson-Darling Gamma GOF Test						
928	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level						
929	K-S Test Statistic					0.21	Kolmogrov-Smirnoff Gamma GOF Test						
930	5% K-S Critical Value					0.19	Data Not Gamma Distributed at 5% Significance Level						
931	Data Not Gamma Distributed at 5% Significance Level												
932													
933	Gamma Statistics												
934	k hat (MLE)					2.42	k star (bias corrected MLE)					2.09	
935	Theta hat (MLE)					1.21	Theta star (bias corrected MLE)					1.40	
936	nu hat (MLE)					96.8	nu star (bias corrected)					83.6	
937	MLE Mean (bias corrected)					2.93	MLE Sd (bias corrected)					2.03	
938							Approximate Chi Square Value (0.05)					63.5	
939	Adjusted Level of Significance					0.03	Adjusted Chi Square Value					62.1	
940													
941	Assuming Gamma Distribution												
942	oximate Gamma UCL (use when n>=50))					3.86	Adjusted Gamma UCL (use when n<50)					3.95	
943													
944	Lognormal GOF Test												
945	Shapiro Wilk Test Statistic					0.88	Shapiro Wilk Lognormal GOF Test						

	A	B	C	D	E	F	G	H	I	J	K	L
946			5% Shapiro Wilk Critical Value		0.90		Data Not Lognormal at 5% Significance Level					
947			Lilliefors Test Statistic		0.20		Lilliefors Lognormal GOF Test					
948			5% Lilliefors Critical Value		0.19		Data Not Lognormal at 5% Significance Level					
949			Data Not Lognormal at 5% Significance Level									
950												
951			Lognormal Statistics									
952			Minimum of Logged Data		0.06					Mean of logged Data		0.85
953			Maximum of Logged Data		2.05					SD of logged Data		0.67
954												
955			Assuming Lognormal Distribution									
956			95% H-UCL		4.15		90% Chebyshev (MVUE) UCL					4.31
957			95% Chebyshev (MVUE) UCL		4.95		97.5% Chebyshev (MVUE) UCL					5.83
958			99% Chebyshev (MVUE) UCL		7.56							
959												
960			Nonparametric Distribution Free UCL Statistics									
961			Data do not follow a Discernible Distribution (0.05)									
962												
963			Nonparametric Distribution Free UCLs									
964			95% CLT UCL		3.70		95% Jackknife UCL					3.74
965			95% Standard Bootstrap UCL		3.68		95% Bootstrap-t UCL					3.92
966			95% Hall's Bootstrap UCL		3.93		95% Percentile Bootstrap UCL					3.75
967			95% BCA Bootstrap UCL		3.81							
968			90% Chebyshev(Mean, Sd) UCL		4.33		95% Chebyshev(Mean, Sd) UCL					4.96
969			97.5% Chebyshev(Mean, Sd) UCL		5.84		99% Chebyshev(Mean, Sd) UCL					7.56
970												
971			Suggested UCL to Use									
972			95% Chebyshev (Mean, Sd) UCL		4.96							
973												
974			Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate									
975			recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and									
976			and Singh and Singh (2003). However, simulations results will not cover all Real World data sets									
977			For additional insight the user may want to consult a statistician.									
978												
979												
980			Vanadium									
981												
982			General Statistics									
983			Total Number of Observations		20		Number of Distinct Observations					20
984							Number of Missing Observations					0
985			Minimum		14.3		Mean					25.8
986			Maximum		31.8		Median					26.6
987			SD		3.89		Std. Error of Mean					0.87
988			Coefficient of Variation		0.15		Skewness					-1.31
989												
990			Normal GOF Test									
991			Shapiro Wilk Test Statistic		0.91		Shapiro Wilk GOF Test					
992			5% Shapiro Wilk Critical Value		0.90		Data appear Normal at 5% Significance Level					
993			Lilliefors Test Statistic		0.15		Lilliefors GOF Test					
994			5% Lilliefors Critical Value		0.19		Data appear Normal at 5% Significance Level					
995			Data appear Normal at 5% Significance Level									
996												
997			Assuming Normal Distribution									
998			95% Normal UCL				95% UCLs (Adjusted for Skewness)					
999			95% Student's-t UCL		27.3		95% Adjusted-CLT UCL (Chen-1995)					27.0
1000							95% Modified-t UCL (Johnson-1978)					27.3
1001												
1002			Gamma GOF Test									
1003			A-D Test Statistic		0.75		Anderson-Darling Gamma GOF Test					
1004			5% A-D Critical Value		0.74		Data Not Gamma Distributed at 5% Significance Level					
1005			K-S Test Statistic		0.17		Kolmogrov-Smirnoff Gamma GOF Test					
1006			5% K-S Critical Value		0.19		Data appear Gamma Distributed at 5% Significance Level					
1007			Detected data follow Appr. Gamma Distribution at 5% Significance Level									
1008												

	A	B	C	D	E	F	G	H	I	J	K	L
1009	Gamma Statistics											
1010	k hat (MLE)				38.8	k star (bias corrected MLE)				33.0		
1011	Theta hat (MLE)				0.66	Theta star (bias corrected MLE)				0.78		
1012	nu hat (MLE)				1555	nu star (bias corrected)				1323		
1013	MLE Mean (bias corrected)				25.84	MLE Sd (bias corrected)				4.49		
1014						Approximate Chi Square Value (0.05)				1240		
1015	Adjusted Level of Significance				0.034	Adjusted Chi Square Value				1233		
1016												
1017	Assuming Gamma Distribution											
1018	Approximate Gamma UCL (use when n>=50))				27.64	Adjusted Gamma UCL (use when n<50)				27.7		
1019												
1020	Lognormal GOF Test											
1021	Shapiro Wilk Test Statistic				0.82	Shapiro Wilk Lognormal GOF Test						
1022	5% Shapiro Wilk Critical Value				0.90	Data Not Lognormal at 5% Significance Level						
1023	Lilliefors Test Statistic				0.19	Lilliefors Lognormal GOF Test						
1024	5% Lilliefors Critical Value				0.19	Data appear Lognormal at 5% Significance Level						
1025	Data appear Approximate Lognormal at 5% Significance Level											
1026												
1027	Lognormal Statistics											
1028	Minimum of Logged Data				2.66	Mean of logged Data				3.24		
1029	Maximum of Logged Data				3.45	SD of logged Data				0.17		
1030												
1031	Assuming Lognormal Distribution											
1032	95% H-UCL				27.8	90% Chebyshev (MVUE) UCL				28.9		
1033	95% Chebyshev (MVUE) UCL				30.3	97.5% Chebyshev (MVUE) UCL				32.2		
1034	99% Chebyshev (MVUE) UCL				35.9							
1035												
1036	Nonparametric Distribution Free UCL Statistics											
1037	Data appear to follow a Discernible Distribution at 5% Significance Level											
1038												
1039	Nonparametric Distribution Free UCLs											
1040	95% CLT UCL				27.3	95% Jackknife UCL				27.3		
1041	95% Standard Bootstrap UCL				27.2	95% Bootstrap-t UCL				27.1		
1042	95% Hall's Bootstrap UCL				27.1	95% Percentile Bootstrap UCL				27.2		
1043	95% BCA Bootstrap UCL				27.0							
1044	90% Chebyshev(Mean, Sd) UCL				28.4	95% Chebyshev(Mean, Sd) UCL				29.6		
1045	97.5% Chebyshev(Mean, Sd) UCL				31.3	99% Chebyshev(Mean, Sd) UCL				34.5		
1046												
1047	Suggested UCL to Use											
1048	95% Student's-t UCL				27.3							
1049												
1050	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
1051	recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
1052	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
1053	For additional insight the user may want to consult a statistician.											
1054												
1055	highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may											
1056	be unreliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.											
1057												
1058	Xylene[1,3-]+Xylene[1,4-]											
1059												
1060	General Statistics											
1061	Total Number of Observations				20	Number of Distinct Observations				19		
1062	Number of Detects				5	Number of Non-Detects				15		
1063	Number of Distinct Detects				5	Number of Distinct Non-Detects				14		
1064	Minimum Detect				4.0600E	Minimum Non-Detect				0.002		
1065	Maximum Detect				9.8400E	Maximum Non-Detect				0.002		
1066	Variance Detects				5.0975E	Percent Non-Detects				75%		
1067	Mean Detects				6.1240E	SD Detects				2.2578E		
1068	Median Detects				5.5600E	CV Detects				0.36		
1069	Skewness Detects				1.43	Kurtosis Detects				2.22		
1070	Mean of Logged Detects				-7.44	SD of Logged Detects				0.33		
1071												

	A	B	C	D	E	F	G	H	I	J	K	L
1072	Normal GOF Test on Detects Only											
1073	Shapiro Wilk Test Statistic					0.88	Shapiro Wilk GOF Test					
1074	5% Shapiro Wilk Critical Value					0.76	ected Data appear Normal at 5% Significance Level					
1075	Lilliefors Test Statistic					0.24	Lilliefors GOF Test					
1076	5% Lilliefors Critical Value					0.39	ected Data appear Normal at 5% Significance Level					
1077	Detected Data appear Normal at 5% Significance Level											
1078												
1079	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
1080	Mean					6.1240E	Standard Error of Mean					1.0097E
1081	SD					2.0194E	95% KM (BCA) UCL					7.7100E
1082	95% KM (t) UCL					7.8699E	95% KM (Percentile Bootstrap) UCL					7.8886E
1083	95% KM (z) UCL					7.7848E	95% KM Bootstrap t UCL					0.001
1084	90% KM Chebyshev UCL					9.1531E	95% KM Chebyshev UCL					0.001
1085	97.5% KM Chebyshev UCL					0.001	99% KM Chebyshev UCL					0.001
1086												
1087	Gamma GOF Tests on Detected Observations Only											
1088	A-D Test Statistic					0.29	Anderson-Darling GOF Test					
1089	5% A-D Critical Value					0.67	ected Data appear Gamma Distributed at 5% Significance Level					
1090	K-S Test Statistic					0.19	Kolmogorov-Smirnov GOF					
1091	5% K-S Critical Value					0.35	ected Data appear Gamma Distributed at 5% Significance Level					
1092	Detected data appear Gamma Distributed at 5% Significance Level											
1093												
1094	Gamma Statistics on Detected Data Only											
1095	k hat (MLE)					10.4	k star (bias corrected MLE)					4.32
1096	Theta hat (MLE)					5.8446E	Theta star (bias corrected MLE)					1.4161E
1097	nu hat (MLE)					104.8	nu star (bias corrected)					43.2
1098	MLE Mean (bias corrected)					6.1240E	MLE Sd (bias corrected)					2.9449E
1099												
1100	Gamma Kaplan-Meier (KM) Statistics											
1101	k hat (KM)					9.19	nu hat (KM)					367.9
1102	Approximate Chi Square Value (367.86, α)					324.4	Adjusted Chi Square Value (367.86, β)					321.2
1103	Approximate KM-UCL (use when $n \geq 50$)					6.9442E	Gamma Adjusted KM-UCL (use when $n < 50$)					7.0138E
1104												
1105	Gamma ROS Statistics using Imputed Non-Detects											
1106	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
1107	GROS may not be used when kstar of detected data is small such as < 0.1											
1108	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
1109	Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimate											
1110	Minimum					4.0600E	Mean					0.007
1111	Maximum					0.01	Median					0.01
1112	SD					0.004	CV					0.54
1113	k hat (MLE)					1.27	k star (bias corrected MLE)					1.11
1114	Theta hat (MLE)					0.006	Theta star (bias corrected MLE)					0.006
1115	nu hat (MLE)					50.7	nu star (bias corrected)					44.5
1116	MLE Mean (bias corrected)					0.007	MLE Sd (bias corrected)					0.007
1117							Adjusted Level of Significance (β)					0.03
1118	Approximate Chi Square Value (44.50, α)					30.2	Adjusted Chi Square Value (44.50, β)					29.2
1119	Gamma Approximate UCL (use when $n \geq 50$)					0.01	Gamma Adjusted UCL (use when $n < 50$)					0.01
1120												
1121	Lognormal GOF Test on Detected Observations Only											
1122	Shapiro Wilk Test Statistic					0.95	Shapiro Wilk GOF Test					
1123	5% Shapiro Wilk Critical Value					0.76	ected Data appear Lognormal at 5% Significance Level					
1124	Lilliefors Test Statistic					0.18	Lilliefors GOF Test					
1125	5% Lilliefors Critical Value					0.39	ected Data appear Lognormal at 5% Significance Level					
1126	Detected Data appear Lognormal at 5% Significance Level											
1127												
1128	Lognormal ROS Statistics Using Imputed Non-Detects											
1129	Mean in Original Scale					5.9172E	Mean in Log Scale					-7.44
1130	SD in Original Scale					1.1043E	SD in Log Scale					0.16
1131	t UCL (assumes normality of ROS data)					6.3441E	95% Percentile Bootstrap UCL					6.3311E
1132	95% BCA Bootstrap UCL					6.4594E	95% Bootstrap t UCL					6.5736E
1133	95% H-UCL (Log ROS)					6.3313E						
1134												

	A	B	C	D	E	F	G	H	I	J	K	L	
1135	DLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed												
1136	KM Mean (logged)					-7.44	95% H-UCL (KM -Log)					6.9485E	
1137	KM SD (logged)					0.30	95% Critical H Value (KM-Log)					1.85	
1138	KM Standard Error of Mean (logged)					0.15							
1139													
1140	DL/2 Statistics												
1141	DL/2 Normal						DL/2 Log-Transformed						
1142	Mean in Original Scale					0.001	Mean in Log Scale					-6.88	
1143	SD in Original Scale					3.2666E	SD in Log Scale					0.38	
1144	95% t UCL (Assumes normality)					0.001	95% H-Stat UCL					0.001	
1145	DL/2 is not a recommended method, provided for comparisons and historical reasons												
1146													
1147	Nonparametric Distribution Free UCL Statistics												
1148	Detected Data appear Normal Distributed at 5% Significance Level												
1149													
1150	Suggested UCL to Use												
1151	95% KM (t) UCL					7.8699E	95% KM (Percentile Bootstrap) UCL					7.8886E	
1152													
1153	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
1154	Recommendations are based upon data size, data distribution, and skewness.												
1155	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and												
1156	Simulation results will not cover all Real World data sets; for additional insight the user may want to consult												
1157													