	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			2/20/2015 1:49:09 PM								
5	From File			EPC_204Sub_EU01.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												

	A	B	C	D	E	F	G	H	I	J	K	L
11	Aluminum											
12												
13						General Statistics						
14					Total Number of Observations	11				Number of Distinct Observations		5
15										Number of Missing Observations		0
16					Minimum	7900				Mean		11050
17					Maximum	13700				Median		11050
18					SD	1313				Std. Error of Mean		396
19					Coefficient of Variation	0.119				Skewness		-0.673
20												
21						Normal GOF Test						
22					Shapiro Wilk Test Statistic	0.689				Shapiro Wilk GOF Test		
23					5% Shapiro Wilk Critical Value	0.85				Data Not Normal at 5% Significance Level		
24					Lilliefors Test Statistic	0.394				Lilliefors GOF Test		
25					5% Lilliefors Critical Value	0.267				Data Not Normal at 5% Significance Level		
26						Data Not Normal at 5% Significance Level						
27												
28						Assuming Normal Distribution						
29					95% Normal UCL					95% UCLs (Adjusted for Skewness)		
30					95% Student's-t UCL	11768				95% Adjusted-CLT UCL (Chen-1995)		11615
31										95% Modified-t UCL (Johnson-1978)		11754
32												
33						Gamma GOF Test						
34					A-D Test Statistic	1.975				Anderson-Darling Gamma GOF Test		
35					5% A-D Critical Value	0.727				Data Not Gamma Distributed at 5% Significance Level		
36					K-S Test Statistic	0.409				Kolmogrov-Smirnoff Gamma GOF Test		
37					5% K-S Critical Value	0.255				Data Not Gamma Distributed at 5% Significance Level		
38						Data Not Gamma Distributed at 5% Significance Level						
39												
40						Gamma Statistics						
41					k hat (MLE)	72				k star (bias corrected MLE)		52.43
42					Theta hat (MLE)	153.5				Theta star (bias corrected MLE)		210.8
43					nu hat (MLE)	1584				nu star (bias corrected)		1153
44					MLE Mean (bias corrected)	11050				MLE Sd (bias corrected)		1526
45										Approximate Chi Square Value (0.05)		1076
46					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		1063
47												
48						Assuming Gamma Distribution						
49					95% Approximate Gamma UCL (use when n>=50))	11850				95% Adjusted Gamma UCL (use when n<50)		11987
50												
51						Lognormal GOF Test						
52					Shapiro Wilk Test Statistic	0.661				Shapiro Wilk Lognormal GOF Test		
53					5% Shapiro Wilk Critical Value	0.85				Data Not Lognormal at 5% Significance Level		
54					Lilliefors Test Statistic	0.417				Lilliefors Lognormal GOF Test		
55					5% Lilliefors Critical Value	0.267				Data Not Lognormal at 5% Significance Level		
56						Data Not Lognormal at 5% Significance Level						
57												
58						Lognormal Statistics						
59					Minimum of Logged Data	8.975				Mean of logged Data		9.303
60					Maximum of Logged Data	9.525				SD of logged Data		0.127
61												

	A	B	C	D	E	F	G	H	I	J	K	L
62					Assuming Lognormal Distribution							
63					95% H-UCL	11892				90% Chebyshev (MVUE) UCL		12323
64					95% Chebyshev (MVUE) UCL	12898				97.5% Chebyshev (MVUE) UCL		13696
65					99% Chebyshev (MVUE) UCL	15263						
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	11701				95% Jackknife UCL		11768
72					95% Standard Bootstrap UCL	11665				95% Bootstrap-t UCL		11646
73					95% Hall's Bootstrap UCL	11762				95% Percentile Bootstrap UCL		11627
74					95% BCA Bootstrap UCL	11582						
75					90% Chebyshev(Mean, Sd) UCL	12238				95% Chebyshev(Mean, Sd) UCL		12776
76					97.5% Chebyshev(Mean, Sd) UCL	13523				99% Chebyshev(Mean, Sd) UCL		14990
77												
78					Suggested UCL to Use							
79					95% Student's-t UCL	11768				or 95% Modified-t UCL		11754
80												
81					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
82					These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)							
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					Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be							
87					reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.							
88												
89												

	A	B	C	D	E	F	G	H	I	J	K	L
90	**Manganese**											
91												
92						**General Statistics**						
93					Total Number of Observations	11				Number of Distinct Observations		11
94										Number of Missing Observations		0
95					Minimum	454				Mean		606.5
96					Maximum	828				Median		586
97					SD	133.7				Std. Error of Mean		40.31
98					Coefficient of Variation	0.22				Skewness		0.56
99												
100						**Normal GOF Test**						
101					Shapiro Wilk Test Statistic	0.906				**Shapiro Wilk GOF Test**		
102					5% Shapiro Wilk Critical Value	0.85				Data appear Normal at 5% Significance Level		
103					Lilliefors Test Statistic	0.155				**Lilliefors GOF Test**		
104					5% Lilliefors Critical Value	0.267				Data appear Normal at 5% Significance Level		
105						**Data appear Normal at 5% Significance Level**						
106												
107						**Assuming Normal Distribution**						
108					**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**		
109					95% Student's-t UCL	679.5				95% Adjusted-CLT UCL (Chen-1995)		680
110										95% Modified-t UCL (Johnson-1978)		680.7
111												
112						**Gamma GOF Test**						
113					A-D Test Statistic	0.38				**Anderson-Darling Gamma GOF Test**		
114					5% A-D Critical Value	0.729				Detected data appear Gamma Distributed at 5% Significance Level		
115					K-S Test Statistic	0.167				**Kolmogrov-Smirnoff Gamma GOF Test**		
116					5% K-S Critical Value	0.255				Detected data appear Gamma Distributed at 5% Significance Level		
117						**Detected data appear Gamma Distributed at 5% Significance Level**						
118												
119						**Gamma Statistics**						
120					k hat (MLE)	23.47				k star (bias corrected MLE)		17.13
121					Theta hat (MLE)	25.84				Theta star (bias corrected MLE)		35.41
122					nu hat (MLE)	516.3				nu star (bias corrected)		376.8
123					MLE Mean (bias corrected)	606.5				MLE Sd (bias corrected)		146.5
124										Approximate Chi Square Value (0.05)		332.8
125					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		326.1
126												
127						**Assuming Gamma Distribution**						
128					95% Approximate Gamma UCL (use when n>=50))	686.6				95% Adjusted Gamma UCL (use when n<50)		700.8
129												
130						**Lognormal GOF Test**						
131					Shapiro Wilk Test Statistic	0.921				**Shapiro Wilk Lognormal GOF Test**		
132					5% Shapiro Wilk Critical Value	0.85				Data appear Lognormal at 5% Significance Level		
133					Lilliefors Test Statistic	0.156				**Lilliefors Lognormal GOF Test**		
134					5% Lilliefors Critical Value	0.267				Data appear Lognormal at 5% Significance Level		
135						**Data appear Lognormal at 5% Significance Level**						
136												
137						**Lognormal Statistics**						
138					Minimum of Logged Data	6.118				Mean of logged Data		6.386
139					Maximum of Logged Data	6.719				SD of logged Data		0.216
140												

	A	B	C	D	E	F	G	H	I	J	K	L
141	Assuming Lognormal Distribution											
142					95% H-UCL	690.4				90% Chebyshev (MVUE) UCL		725.1
143					95% Chebyshev (MVUE) UCL	779				97.5% Chebyshev (MVUE) UCL		853.7
144					99% Chebyshev (MVUE) UCL	1001						
145												
146	Nonparametric Distribution Free UCL Statistics											
147	Data appear to follow a Discernible Distribution at 5% Significance Level											
148												
149	Nonparametric Distribution Free UCLs											
150					95% CLT UCL	672.8				95% Jackknife UCL		679.5
151					95% Standard Bootstrap UCL	668.7				95% Bootstrap-t UCL		687.5
152					95% Hall's Bootstrap UCL	685				95% Percentile Bootstrap UCL		670.6
153					95% BCA Bootstrap UCL	675						
154					90% Chebyshev(Mean, Sd) UCL	727.4				95% Chebyshev(Mean, Sd) UCL		782.2
155					97.5% Chebyshev(Mean, Sd) UCL	858.2				99% Chebyshev(Mean, Sd) UCL		1008
156												
157	Suggested UCL to Use											
158					95% Student's-t UCL	679.5						
159												
160	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
161	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
162	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
163	For additional insight the user may want to consult a statistician.											
164												
165												

	A	B	C	D	E	F	G	H	I	J	K	L
166	PAH, Total											
167												
168						General Statistics						
169					Total Number of Observations	11				Number of Distinct Observations		3
170										Number of Missing Observations		0
171					Minimum	0.00806				Mean		0.329
172					Maximum	0.49				Median		0.329
173					SD	0.124				Std. Error of Mean		0.0375
174					Coefficient of Variation	0.378				Skewness		-1.578
175												
176						Normal GOF Test						
177					Shapiro Wilk Test Statistic	0.675				Shapiro Wilk GOF Test		
178					5% Shapiro Wilk Critical Value	0.85				Data Not Normal at 5% Significance Level		
179					Lilliefors Test Statistic	0.409				Lilliefors GOF Test		
180					5% Lilliefors Critical Value	0.267				Data Not Normal at 5% Significance Level		
181						Data Not Normal at 5% Significance Level						
182												
183						Assuming Normal Distribution						
184					95% Normal UCL					95% UCLs (Adjusted for Skewness)		
185					95% Student's-t UCL	0.397				95% Adjusted-CLT UCL (Chen-1995)		0.372
186										95% Modified-t UCL (Johnson-1978)		0.394
187												
188						Gamma GOF Test						
189					A-D Test Statistic	2.675				Anderson-Darling Gamma GOF Test		
190					5% A-D Critical Value	0.739				Data Not Gamma Distributed at 5% Significance Level		
191					K-S Test Statistic	0.502				Kolmogrov-Smirnoff Gamma GOF Test		
192					5% K-S Critical Value	0.258				Data Not Gamma Distributed at 5% Significance Level		
193						Data Not Gamma Distributed at 5% Significance Level						
194												
195						Gamma Statistics						
196					k hat (MLE)	2.037				k star (bias corrected MLE)		1.542
197					Theta hat (MLE)	0.162				Theta star (bias corrected MLE)		0.214
198					nu hat (MLE)	44.82				nu star (bias corrected)		33.93
199					MLE Mean (bias corrected)	0.329				MLE Sd (bias corrected)		0.265
200										Approximate Chi Square Value (0.05)		21.61
201					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		20.02
202												
203						Assuming Gamma Distribution						
204					95% Approximate Gamma UCL (use when n>=50))	0.517				95% Adjusted Gamma UCL (use when n<50)		0.558
205												
206						Lognormal GOF Test						
207					Shapiro Wilk Test Statistic	0.445				Shapiro Wilk Lognormal GOF Test		
208					5% Shapiro Wilk Critical Value	0.85				Data Not Lognormal at 5% Significance Level		
209					Lilliefors Test Statistic	0.5				Lilliefors Lognormal GOF Test		
210					5% Lilliefors Critical Value	0.267				Data Not Lognormal at 5% Significance Level		
211						Data Not Lognormal at 5% Significance Level						
212												
213						Lognormal Statistics						
214					Minimum of Logged Data	-4.821				Mean of logged Data		-1.376
215					Maximum of Logged Data	-0.713				SD of logged Data		1.154
216												

	A	B	C	D	E	F	G	H	I	J	K	L
217					Assuming Lognormal Distribution							
218					95% H-UCL	1.639			90% Chebyshev (MVUE) UCL			0.952
219				95% Chebyshev (MVUE) UCL		1.179			97.5% Chebyshev (MVUE) UCL			1.495
220				99% Chebyshev (MVUE) UCL		2.115						
221												
222					Nonparametric Distribution Free UCL Statistics							
223					Data do not follow a Discernible Distribution (0.05)							
224												
225					Nonparametric Distribution Free UCLs							
226					95% CLT UCL	0.391			95% Jackknife UCL			0.397
227				95% Standard Bootstrap UCL		N/A			95% Bootstrap-t UCL			N/A
228				95% Hall's Bootstrap UCL		N/A			95% Percentile Bootstrap UCL			N/A
229				95% BCA Bootstrap UCL		N/A						
230				90% Chebyshev(Mean, Sd) UCL		0.442			95% Chebyshev(Mean, Sd) UCL			0.493
231				97.5% Chebyshev(Mean, Sd) UCL		0.564			99% Chebyshev(Mean, Sd) UCL			0.703
232												
233					Suggested UCL to Use							
234				95% Chebyshev (Mean, Sd) UCL		0.493						
235												
236					Recommended UCL exceeds the maximum observation							
237												
238					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
239					These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)							
240					and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.							
241					For additional insight the user may want to consult a statistician.							
242												
243					Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be							
244					reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.							
245												
246												

	A	B	C	D	E	F	G	H	I	J	K	L
247	Uranium-238											
248												
249						General Statistics						
250					Total Number of Observations	11				Number of Distinct Observations		5
251										Number of Missing Observations		0
252					Minimum	0.168				Mean		0.843
253					Maximum	1.76				Median		0.843
254					SD	0.398				Std. Error of Mean		0.12
255					Coefficient of Variation	0.472				Skewness		0.713
256												
257						Normal GOF Test						
258					Shapiro Wilk Test Statistic	0.806				Shapiro Wilk GOF Test		
259					5% Shapiro Wilk Critical Value	0.85				Data Not Normal at 5% Significance Level		
260					Lilliefors Test Statistic	0.318				Lilliefors GOF Test		
261					5% Lilliefors Critical Value	0.267				Data Not Normal at 5% Significance Level		
262						Data Not Normal at 5% Significance Level						
263												
264						Assuming Normal Distribution						
265					95% Normal UCL					95% UCLs (Adjusted for Skewness)		
266					95% Student's-t UCL	1.06				95% Adjusted-CLT UCL (Chen-1995)		1.068
267										95% Modified-t UCL (Johnson-1978)		1.065
268												
269						Gamma GOF Test						
270					A-D Test Statistic	1.328				Anderson-Darling Gamma GOF Test		
271					5% A-D Critical Value	0.733				Data Not Gamma Distributed at 5% Significance Level		
272					K-S Test Statistic	0.386				Kolmogrov-Smirnoff Gamma GOF Test		
273					5% K-S Critical Value	0.257				Data Not Gamma Distributed at 5% Significance Level		
274						Data Not Gamma Distributed at 5% Significance Level						
275												
276						Gamma Statistics						
277					k hat (MLE)	3.903				k star (bias corrected MLE)		2.899
278					Theta hat (MLE)	0.216				Theta star (bias corrected MLE)		0.291
279					nu hat (MLE)	85.87				nu star (bias corrected)		63.78
280					MLE Mean (bias corrected)	0.843				MLE Sd (bias corrected)		0.495
281										Approximate Chi Square Value (0.05)		46.41
282					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		44
283												
284						Assuming Gamma Distribution						
285					95% Approximate Gamma UCL (use when n>=50))	1.159				95% Adjusted Gamma UCL (use when n<50)		1.222
286												
287						Lognormal GOF Test						
288					Shapiro Wilk Test Statistic	0.757				Shapiro Wilk Lognormal GOF Test		
289					5% Shapiro Wilk Critical Value	0.85				Data Not Lognormal at 5% Significance Level		
290					Lilliefors Test Statistic	0.405				Lilliefors Lognormal GOF Test		
291					5% Lilliefors Critical Value	0.267				Data Not Lognormal at 5% Significance Level		
292						Data Not Lognormal at 5% Significance Level						
293												
294						Lognormal Statistics						
295					Minimum of Logged Data	-1.784				Mean of logged Data		-0.304
296					Maximum of Logged Data	0.565				SD of logged Data		0.609
297												

	A	B	C	D	E	F	G	H	I	J	K	L
298	Assuming Lognormal Distribution											
299					95% H-UCL	1.391				90% Chebyshev (MVUE) UCL		1.366
300					95% Chebyshev (MVUE) UCL	1.59				97.5% Chebyshev (MVUE) UCL		1.901
301					99% Chebyshev (MVUE) UCL	2.511						
302												
303	Nonparametric Distribution Free UCL Statistics											
304	Data do not follow a Discernible Distribution (0.05)											
305												
306	Nonparametric Distribution Free UCLs											
307					95% CLT UCL	1.04				95% Jackknife UCL		1.06
308					95% Standard Bootstrap UCL	1.027				95% Bootstrap-t UCL		1.072
309					95% Hall's Bootstrap UCL	1.224				95% Percentile Bootstrap UCL		1.05
310					95% BCA Bootstrap UCL	1.053						
311					90% Chebyshev(Mean, Sd) UCL	1.203				95% Chebyshev(Mean, Sd) UCL		1.366
312					97.5% Chebyshev(Mean, Sd) UCL	1.592				99% Chebyshev(Mean, Sd) UCL		2.036
313												
314	Suggested UCL to Use											
315					95% Chebyshev (Mean, Sd) UCL	1.366						
316												
317	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
318	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
319	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
320	For additional insight the user may want to consult a statistician.											
321												
322												

	A	B	C	D	E	F	G	H	I	J	K	L
323	Vanadium											
324												
325					General Statistics							
326					Total Number of Observations	11				Number of Distinct Observations		10
327										Number of Missing Observations		0
328					Minimum	90				Mean		113.8
329					Maximum	131				Median		114
330					SD	12.5				Std. Error of Mean		3.77
331					Coefficient of Variation	0.11				Skewness		-0.476
332												
333					Normal GOF Test							
334					Shapiro Wilk Test Statistic	0.964				Shapiro Wilk GOF Test		
335					5% Shapiro Wilk Critical Value	0.85				Data appear Normal at 5% Significance Level		
336					Lilliefors Test Statistic	0.142				Lilliefors GOF Test		
337					5% Lilliefors Critical Value	0.267				Data appear Normal at 5% Significance Level		
338					Data appear Normal at 5% Significance Level							
339												
340					Assuming Normal Distribution							
341					95% Normal UCL					95% UCLs (Adjusted for Skewness)		
342					95% Student's-t UCL	120.7				95% Adjusted-CLT UCL (Chen-1995)		119.4
343										95% Modified-t UCL (Johnson-1978)		120.6
344												
345					Gamma GOF Test							
346					A-D Test Statistic	0.249				Anderson-Darling Gamma GOF Test		
347					5% A-D Critical Value	0.726				Detected data appear Gamma Distributed at 5% Significance Level		
348					K-S Test Statistic	0.157				Kolmogrov-Smirnoff Gamma GOF Test		
349					5% K-S Critical Value	0.254				Detected data appear Gamma Distributed at 5% Significance Level		
350					Detected data appear Gamma Distributed at 5% Significance Level							
351												
352					Gamma Statistics							
353					k hat (MLE)	87.58				k star (bias corrected MLE)		63.75
354					Theta hat (MLE)	1.3				Theta star (bias corrected MLE)		1.785
355					nu hat (MLE)	1927				nu star (bias corrected)		1403
356					MLE Mean (bias corrected)	113.8				MLE Sd (bias corrected)		14.25
357										Approximate Chi Square Value (0.05)		1317
358					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		1303
359												
360					Assuming Gamma Distribution							
361					95% Approximate Gamma UCL (use when n>=50))	121.2				95% Adjusted Gamma UCL (use when n<50)		122.5
362												
363					Lognormal GOF Test							
364					Shapiro Wilk Test Statistic	0.95				Shapiro Wilk Lognormal GOF Test		
365					5% Shapiro Wilk Critical Value	0.85				Data appear Lognormal at 5% Significance Level		
366					Lilliefors Test Statistic	0.162				Lilliefors Lognormal GOF Test		
367					5% Lilliefors Critical Value	0.267				Data appear Lognormal at 5% Significance Level		
368					Data appear Lognormal at 5% Significance Level							
369												
370					Lognormal Statistics							
371					Minimum of Logged Data	4.5				Mean of logged Data		4.729
372					Maximum of Logged Data	4.875				SD of logged Data		0.113
373												

	A	B	C	D	E	F	G	H	I	J	K	L
374					Assuming Lognormal Distribution							
375					95% H-UCL	121.5				90% Chebyshev (MVUE) UCL		125.5
376					95% Chebyshev (MVUE) UCL	130.8				97.5% Chebyshev (MVUE) UCL		138.2
377					99% Chebyshev (MVUE) UCL	152.6						
378												
379					Nonparametric Distribution Free UCL Statistics							
380					Data appear to follow a Discernible Distribution at 5% Significance Level							
381												
382					Nonparametric Distribution Free UCLs							
383					95% CLT UCL	120				95% Jackknife UCL		120.7
384					95% Standard Bootstrap UCL	119.6				95% Bootstrap-t UCL		119.8
385					95% Hall's Bootstrap UCL	119.6				95% Percentile Bootstrap UCL		119.6
386					95% BCA Bootstrap UCL	119.4						
387					90% Chebyshev(Mean, Sd) UCL	125.1				95% Chebyshev(Mean, Sd) UCL		130.3
388					97.5% Chebyshev(Mean, Sd) UCL	137.4				99% Chebyshev(Mean, Sd) UCL		151.3
389												
390					Suggested UCL to Use							
391					95% Student's-t UCL	120.7						
392												
393	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
394	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
395	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
396	For additional insight the user may want to consult a statistician.											
397												
398	Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
399	reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.											
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