UCL Statistics for Uncensored Full Data Sets					
User Selected Options					
Date/Time of Computation		10/29/2015 12:17			
From File		EPC_013Sub.xls			
Full Precision		OFF			
Confidence Coefficient		95%			
Number of Bootstrap Operations		2000			
Manganese					
General Statistics					
Total Number of Observations			15	Number of Distinct Observations	15
				Number of Missing Observations	0
Minimum			200	Mean	497.7
Maximum			1000	Median	423
SD			237.5	Std. Error of Mean	61.31
Coefficient of Variation			0.477	Skewness	0.962
Normal GOF Test					
Shapiro Wilk Test Statistic			0.9	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value			0.881	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic			0.174	Lilliefors GOF Test	
5% Lilliefors Critical Value			0.229	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level					
Assuming Normal Distribution					
95% Normal UCL				95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL			605.7	95% Adjusted-CLT UCL (Chen-1995)	614.8
				95% Modified-t UCL (Johnson-1978)	608.2
Gamma GOF Test					
A-D Test Statistic			0.34	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value			0.739	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic			0.138	Kolmogrov-Smirnoff Gamma GOF Test	
5% K-S Critical Value			0.222	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level					
Gamma Statistics					
k hat (MLE)			5.156	k star (bias corrected MLE)	4.169
Theta hat (MLE)			96.53	Theta star (bias corrected MLE)	119.4
nu hat (MLE)			154.7	nu star (bias corrected)	125.1
MLE Mean (bias corrected)			497.7	MLE Sd (bias corrected)	243.7
				Approximate Chi Square Value (0.05)	100.2
Adjusted Level of Significance			0.0324	Adjusted Chi Square Value	97.5
Assuming Gamma Distribution					
95% Approximate Gamma UCL (use when n>=50))			620.9	95% Adjusted Gamma UCL (use when n<50)	638.4
Lognormal GOF Test					
Shapiro Wilk Test Statistic			0.967	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value			0.881	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic			0.121	Lilliefors Lognormal GOF Test	

5% Lilliefors Critical Value					0.229	Data appear Lognormal at 5% Significance Level					
Data appear Lognormal at 5% Significance Level											
Lognormal Statistics											
Minimum of Logged Data					5.298	Mean of logged Data					6.11
Maximum of Logged Data					6.908	SD of logged Data					0.46
Assuming Lognormal Distribution											
95% H-UCL					642.2	90% Chebyshev (MVUE) UCL					678.4
95% Chebyshev (MVUE) UCL					760.6	97.5% Chebyshev (MVUE) UCL					874.8
99% Chebyshev (MVUE) UCL					1099						
Nonparametric Distribution Free UCL Statistics											
Data appear to follow a Discernible Distribution at 5% Significance Level											
Nonparametric Distribution Free UCLs											
95% CLT UCL					598.5	95% Jackknife UCL					605.7
95% Standard Bootstrap UCL					594.8	95% Bootstrap-t UCL					633.9
95% Hall's Bootstrap UCL					627.9	95% Percentile Bootstrap UCL					596.3
95% BCA Bootstrap UCL					602.9						
90% Chebyshev(Mean, Sd) UCL					681.6	95% Chebyshev(Mean, Sd) UCL					764.9
97.5% Chebyshev(Mean, Sd) UCL					880.6	99% Chebyshev(Mean, Sd) UCL					1108
Suggested UCL to Use											
95% Student's-t UCL					605.7						
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
For additional insight the user may want to consult a statistician.											
PCB, Total											
General Statistics											
Total Number of Observations					15	Number of Distinct Observations					6
						Number of Missing Observations					0
Minimum					0.05	Mean					3.401
Maximum					5	Median					5
SD					2.343	Std. Error of Mean					0.605
Coefficient of Variation					0.689	Skewness					-0.792
Normal GOF Test											
Shapiro Wilk Test Statistic					0.617	Shapiro Wilk GOF Test					
5% Shapiro Wilk Critical Value					0.881	Data Not Normal at 5% Significance Level					
Lilliefors Test Statistic					0.419	Lilliefors GOF Test					
5% Lilliefors Critical Value					0.229	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					4.466	95% Adjusted-CLT UCL (Chen-1995)					4.263
						95% Modified-t UCL (Johnson-1978)					4.445
Gamma GOF Test											

A-D Test Statistic				2.729	Anderson-Darling Gamma GOF Test				
5% A-D Critical Value				0.774	Data Not Gamma Distributed at 5% Significance Level				
K-S Test Statistic				0.436	Kolmogrov-Smirnoff Gamma GOF Test				
5% K-S Critical Value				0.23	Data Not Gamma Distributed at 5% Significance Level				
Data Not Gamma Distributed at 5% Significance Level									
Gamma Statistics									
k hat (MLE)				0.77	k star (bias corrected MLE)				0.66
Theta hat (MLE)				4.417	Theta star (bias corrected MLE)				5.149
nu hat (MLE)				23.1	nu star (bias corrected)				19.81
MLE Mean (bias corrected)				3.401	MLE Sd (bias corrected)				4.185
					Approximate Chi Square Value (0.05)				10.71
Adjusted Level of Significance				0.0324	Adjusted Chi Square Value				9.897
Assuming Gamma Distribution									
95% Approximate Gamma UCL (use when n>=50))				6.289	95% Adjusted Gamma UCL (use when n<50)				6.808
Lognormal GOF Test									
Shapiro Wilk Test Statistic				0.679	Shapiro Wilk Lognormal GOF Test				
5% Shapiro Wilk Critical Value				0.881	Data Not Lognormal at 5% Significance Level				
Lilliefors Test Statistic				0.412	Lilliefors Lognormal GOF Test				
5% Lilliefors Critical Value				0.229	Data Not Lognormal at 5% Significance Level				
Data Not Lognormal at 5% Significance Level									
Lognormal Statistics									
Minimum of Logged Data				-2.996	Mean of logged Data				0.449
Maximum of Logged Data				1.609	SD of logged Data				1.76
Assuming Lognormal Distribution									
95% H-UCL				50.68	90% Chebyshev (MVUE) UCL				15.32
95% Chebyshev (MVUE) UCL				19.56	97.5% Chebyshev (MVUE) UCL				25.45
99% Chebyshev (MVUE) UCL				37					
Nonparametric Distribution Free UCL Statistics									
Data do not follow a Discernible Distribution (0.05)									
Nonparametric Distribution Free UCLs									
95% CLT UCL				4.396	95% Jackknife UCL				4.466
95% Standard Bootstrap UCL				4.363	95% Bootstrap-t UCL				4.31
95% Hall's Bootstrap UCL				4.202	95% Percentile Bootstrap UCL				4.362
95% BCA Bootstrap UCL				4.362					
90% Chebyshev(Mean, Sd) UCL				5.215	95% Chebyshev(Mean, Sd) UCL				6.037
97.5% Chebyshev(Mean, Sd) UCL				7.178	99% Chebyshev(Mean, Sd) UCL				9.419
Suggested UCL to Use									
99% Chebyshev (Mean, Sd) UCL				9.419					
Recommended UCL exceeds the maximum observation									
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.									
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)									
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.									
For additional insight the user may want to consult a statistician.									
Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be									

reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.			
Uranium-238			
General Statistics			
Total Number of Observations	15	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.432	Mean	1.066
Maximum	1.64	Median	1.066
SD	0.301	Std. Error of Mean	0.0777
Coefficient of Variation	0.282	Skewness	-0.208
Normal GOF Test			
Shapiro Wilk Test Statistic	0.756	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.367	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.229	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	1.203	95% Adjusted-CLT UCL (Chen-1995)	1.19
		95% Modified-t UCL (Johnson-1978)	1.202
Gamma GOF Test			
A-D Test Statistic	2.236	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.737	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.407	Kolmogrov-Smirnoff Gamma GOF Test	
5% K-S Critical Value	0.221	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	11.11	k star (bias corrected MLE)	8.933
Theta hat (MLE)	0.096	Theta star (bias corrected MLE)	0.119
nu hat (MLE)	333.3	nu star (bias corrected)	268
MLE Mean (bias corrected)	1.066	MLE Sd (bias corrected)	0.357
		Approximate Chi Square Value (0.05)	231.1
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	226.9
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50))	1.237	95% Adjusted Gamma UCL (use when n<50)	1.259
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.704	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.881	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.421	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.229	Data Not Lognormal at 5% Significance Level	
Data Not Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-0.839	Mean of logged Data	0.0184
Maximum of Logged Data	0.495	SD of logged Data	0.335
Assuming Lognormal Distribution			

95% H-UCL	1.278	90% Chebyshev (MVUE) UCL	1.355
95% Chebyshev (MVUE) UCL	1.483	97.5% Chebyshev (MVUE) UCL	1.661
99% Chebyshev (MVUE) UCL	2.009		
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Distribution Free UCLs			
95% CLT UCL	1.194	95% Jackknife UCL	1.203
95% Standard Bootstrap UCL	1.189	95% Bootstrap-t UCL	1.199
95% Hall's Bootstrap UCL	1.22	95% Percentile Bootstrap UCL	1.181
95% BCA Bootstrap UCL	1.177		
90% Chebyshev(Mean, Sd) UCL	1.299	95% Chebyshev(Mean, Sd) UCL	1.405
97.5% Chebyshev(Mean, Sd) UCL	1.551	99% Chebyshev(Mean, Sd) UCL	1.839
Suggested UCL to Use			
95% Student's-t UCL	1.203	or 95% Modified-t UCL	1.202
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
For additional insight the user may want to consult a statistician.			
Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be			
reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.			
Vanadium			
General Statistics			
Total Number of Observations	15	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	72	Mean	87.47
Maximum	103	Median	85
SD	10.66	Std. Error of Mean	2.751
Coefficient of Variation	0.122	Skewness	0.192
Normal GOF Test			
Shapiro Wilk Test Statistic	0.917	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.881	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.155	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.229	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	92.31	95% Adjusted-CLT UCL (Chen-1995)	92.14
		95% Modified-t UCL (Johnson-1978)	92.34
Gamma GOF Test			
A-D Test Statistic	0.497	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.158	Kolmogrov-Smirnoff Gamma GOF Test	
5% K-S Critical Value	0.221	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			

Gamma Statistics			
k hat (MLE)	72.5	k star (bias corrected MLE)	58.05
Theta hat (MLE)	1.206	Theta star (bias corrected MLE)	1.507
nu hat (MLE)	2175	nu star (bias corrected)	1741
MLE Mean (bias corrected)	87.47	MLE Sd (bias corrected)	11.48
		Approximate Chi Square Value (0.05)	1645
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	1634
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50))	92.57	95% Adjusted Gamma UCL (use when n<50)	93.22
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.924	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.151	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.229	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	4.277	Mean of logged Data	4.464
Maximum of Logged Data	4.635	SD of logged Data	0.122
Assuming Lognormal Distribution			
95% H-UCL	92.67	90% Chebyshev (MVUE) UCL	95.72
95% Chebyshev (MVUE) UCL	99.47	97.5% Chebyshev (MVUE) UCL	104.7
99% Chebyshev (MVUE) UCL	114.9		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	91.99	95% Jackknife UCL	92.31
95% Standard Bootstrap UCL	91.84	95% Bootstrap-t UCL	92.58
95% Hall's Bootstrap UCL	91.99	95% Percentile Bootstrap UCL	91.93
95% BCA Bootstrap UCL	91.67		
90% Chebyshev(Mean, Sd) UCL	95.72	95% Chebyshev(Mean, Sd) UCL	99.46
97.5% Chebyshev(Mean, Sd) UCL	104.6	99% Chebyshev(Mean, Sd) UCL	114.8
Suggested UCL to Use			
95% Student's-t UCL	92.31		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
For additional insight the user may want to consult a statistician.			