UCL Statistics for Uncensored Full Data Sets					
User Selected Options					
Date/Time of Computation	10/29/2015 12:03				
From File	EPC_013Sub_i.xls				
Full Precision	OFF				
Confidence Coefficient	95%				
Number of Bootstrap Operations	2000				
Manganese					
General Statistics					
Total Number of Observations		11	Number of Distinct Observations		11
			Number of Missing Observations		0
Minimum		328	Mean		615.8
Maximum		1200	Median		601
SD		259.3	Std. Error of Mean		78.18
Coefficient of Variation		0.421	Skewness		1.088
Normal GOF Test					
Shapiro Wilk Test Statistic		0.907	Shapiro Wilk GOF Test		
5% Shapiro Wilk Critical Value		0.85	Data appear Normal at 5% Significance Level		
Lilliefors Test Statistic		0.15	Lilliefors GOF Test		
5% Lilliefors Critical Value		0.267	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		757.5	95% Adjusted-CLT UCL (Chen-1995)		771.8
			95% Modified-t UCL (Johnson-1978)		761.8
Gamma GOF Test					
A-D Test Statistic		0.257	Anderson-Darling Gamma GOF Test		
5% A-D Critical Value		0.731	Detected data appear Gamma Distributed at 5% Significance Level		
K-S Test Statistic		0.139	Kolmogrov-Smirnoff Gamma GOF Test		
5% K-S Critical Value		0.256	Detected data appear Gamma Distributed at 5% Significance Level		
Detected data appear Gamma Distributed at 5% Significance Level					
Gamma Statistics					
k hat (MLE)		6.835	k star (bias corrected MLE)		5.031
Theta hat (MLE)		90.1	Theta star (bias corrected MLE)		122.4
nu hat (MLE)		150.4	nu star (bias corrected)		110.7
MLE Mean (bias corrected)		615.8	MLE Sd (bias corrected)		274.5
			Approximate Chi Square Value (0.05)		87.4
Adjusted Level of Significance		0.0278	Adjusted Chi Square Value		84.03
Assuming Gamma Distribution					
95% Approximate Gamma UCL (use when n>=50))		779.9	95% Adjusted Gamma UCL (use when n<50)		811.1
Lognormal GOF Test					
Shapiro Wilk Test Statistic		0.962	Shapiro Wilk Lognormal GOF Test		
5% Shapiro Wilk Critical Value		0.85	Data appear Lognormal at 5% Significance Level		
Lilliefors Test Statistic		0.117	Lilliefors Lognormal GOF Test		
5% Lilliefors Critical Value		0.267	Data appear Lognormal at 5% Significance Level		

Data appear Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	5.793	Mean of logged Data	6.348
Maximum of Logged Data	7.09	SD of logged Data	0.402
Assuming Lognormal Distribution			
95% H-UCL	804.2	90% Chebyshev (MVUE) UCL	841
95% Chebyshev (MVUE) UCL	943.6	97.5% Chebyshev (MVUE) UCL	1086
99% Chebyshev (MVUE) UCL	1366		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	744.4	95% Jackknife UCL	757.5
95% Standard Bootstrap UCL	739.3	95% Bootstrap-t UCL	803
95% Hall's Bootstrap UCL	809.8	95% Percentile Bootstrap UCL	744.3
95% BCA Bootstrap UCL	762.4		
90% Chebyshev(Mean, Sd) UCL	850.3	95% Chebyshev(Mean, Sd) UCL	956.6
97.5% Chebyshev(Mean, Sd) UCL	1104	99% Chebyshev(Mean, Sd) UCL	1394
Suggested UCL to Use			
95% Student's-t UCL	757.5		
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	11	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	0.05	Mean	3.714
Maximum	5	Median	5
SD	2.209	Std. Error of Mean	0.666
Coefficient of Variation	0.595	Skewness	-1.21
Normal GOF Test			
Shapiro Wilk Test Statistic	0.591	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.447	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.267	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	4.921	95% Adjusted-CLT UCL (Chen-1995)	4.55
		95% Modified-t UCL (Johnson-1978)	4.88
Gamma GOF Test			
A-D Test Statistic	2.344	Anderson-Darling Gamma GOF Test	

5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.468	Kolmogrov-Smirnoff Gamma GOF Test	
5% K-S Critical Value	0.263	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.893	k star (bias corrected MLE)	0.71
Theta hat (MLE)	4.16	Theta star (bias corrected MLE)	5.232
nu hat (MLE)	19.64	nu star (bias corrected)	15.62
MLE Mean (bias corrected)	3.714	MLE Sd (bias corrected)	4.408
		Approximate Chi Square Value (0.05)	7.692
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	6.804
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50))	7.539	95% Adjusted Gamma UCL (use when n<50)	8.523
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.614	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.435	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.267	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	0.656
Maximum of Logged Data	1.609	SD of logged Data	1.743
Assuming Lognormal Distribution			
95% H-UCL	109.5	90% Chebyshev (MVUE) UCL	18.17
95% Chebyshev (MVUE) UCL	23.34	97.5% Chebyshev (MVUE) UCL	30.51
99% Chebyshev (MVUE) UCL	44.6		
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Distribution Free UCLs			
95% CLT UCL	4.809	95% Jackknife UCL	4.921
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	5.712	95% Chebyshev(Mean, Sd) UCL	6.617
97.5% Chebyshev(Mean, Sd) UCL	7.873	99% Chebyshev(Mean, Sd) UCL	10.34
Suggested UCL to Use			
99% Chebyshev (Mean, Sd) UCL	10.34		
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.			

Silver											
General Statistics											
Total Number of Observations					11	Number of Distinct Observations					4
						Number of Missing Observations					0
Minimum					0.036	Mean					36.09
Maximum					50	Median					50
SD					22.24	Std. Error of Mean					6.705
Coefficient of Variation					0.616	Skewness					-1.152
Normal GOF Test											
Shapiro Wilk Test Statistic					0.625	Shapiro Wilk GOF Test					
5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
Lilliefors Test Statistic					0.37	Lilliefors GOF Test					
5% Lilliefors Critical Value					0.267	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					48.25	95% Adjusted-CLT UCL (Chen-1995)					44.63
						95% Modified-t UCL (Johnson-1978)					47.86
Gamma GOF Test											
A-D Test Statistic					2.203	Anderson-Darling Gamma GOF Test					
5% A-D Critical Value					0.768	Data Not Gamma Distributed at 5% Significance Level					
K-S Test Statistic					0.43	Kolmogrov-Smirnoff Gamma GOF Test					
5% K-S Critical Value					0.266	Data Not Gamma Distributed at 5% Significance Level					
Data Not Gamma Distributed at 5% Significance Level											
Gamma Statistics											
k hat (MLE)					0.68	k star (bias corrected MLE)					0.555
Theta hat (MLE)					53.09	Theta star (bias corrected MLE)					65.02
nu hat (MLE)					14.96	nu star (bias corrected)					12.21
MLE Mean (bias corrected)					36.09	MLE Sd (bias corrected)					48.45
						Approximate Chi Square Value (0.05)					5.367
Adjusted Level of Significance					0.0278	Adjusted Chi Square Value					4.649
Assuming Gamma Distribution											
95% Approximate Gamma UCL (use when n>=50))					82.13	95% Adjusted Gamma UCL (use when n<50)					94.82
Lognormal GOF Test											
Shapiro Wilk Test Statistic					0.612	Shapiro Wilk Lognormal GOF Test					
5% Shapiro Wilk Critical Value					0.85	Data Not Lognormal at 5% Significance Level					
Lilliefors Test Statistic					0.401	Lilliefors Lognormal GOF Test					
5% Lilliefors Critical Value					0.267	Data Not Lognormal at 5% Significance Level					
Data Not Lognormal at 5% Significance Level											
Lognormal Statistics											
Minimum of Logged Data					-3.324	Mean of logged Data					2.694
Maximum of Logged Data					3.912	SD of logged Data					2.324
Assuming Lognormal Distribution											
95% H-UCL					16835	90% Chebyshev (MVUE) UCL					382.2

95% Chebyshev (MVUE) UCL	500.5	97.5% Chebyshev (MVUE) UCL	664.7
99% Chebyshev (MVUE) UCL	987.2		
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Distribution Free UCLs			
95% CLT UCL	47.12	95% Jackknife UCL	48.25
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	56.21	95% Chebyshev(Mean, Sd) UCL	65.32
97.5% Chebyshev(Mean, Sd) UCL	77.97	99% Chebyshev(Mean, Sd) UCL	102.8
Suggested UCL to Use			
99% Chebyshev (Mean, Sd) UCL	102.8		
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.			
Vanadium			
General Statistics			
Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	85	Mean	104.5
Maximum	138	Median	101
SD	16.33	Std. Error of Mean	4.924
Coefficient of Variation	0.156	Skewness	0.866
Normal GOF Test			
Shapiro Wilk Test Statistic	0.923	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.222	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.267	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	113.5	95% Adjusted-CLT UCL (Chen-1995)	114
		95% Modified-t UCL (Johnson-1978)	113.7
Gamma GOF Test			
A-D Test Statistic	0.335	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.211	Kolmogrov-Smirnoff Gamma GOF Test	
5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	47.51	k star (bias corrected MLE)	34.62
Theta hat (MLE)	2.2	Theta star (bias corrected MLE)	3.02
nu hat (MLE)	1045	nu star (bias corrected)	761.5
MLE Mean (bias corrected)	104.5	MLE Sd (bias corrected)	17.77
		Approximate Chi Square Value (0.05)	698.5
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	688.7
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50))	114	95% Adjusted Gamma UCL (use when n<50)	115.6
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.945	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.199	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.267	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	4.443	Mean of logged Data	4.639
Maximum of Logged Data	4.927	SD of logged Data	0.151
Assuming Lognormal Distribution			
95% H-UCL	114.1	90% Chebyshev (MVUE) UCL	118.8
95% Chebyshev (MVUE) UCL	125.3	97.5% Chebyshev (MVUE) UCL	134.2
99% Chebyshev (MVUE) UCL	151.9		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	112.6	95% Jackknife UCL	113.5
95% Standard Bootstrap UCL	112.2	95% Bootstrap-t UCL	115.7
95% Hall's Bootstrap UCL	118.3	95% Percentile Bootstrap UCL	112.6
95% BCA Bootstrap UCL	113.3		
90% Chebyshev(Mean, Sd) UCL	119.3	95% Chebyshev(Mean, Sd) UCL	126
97.5% Chebyshev(Mean, Sd) UCL	135.3	99% Chebyshev(Mean, Sd) UCL	153.5
Suggested UCL to Use			
95% Student's-t UCL	113.5		
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.			