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This copy of the Validation Protocol / Report

ZTC-11, for version 3 of ZTCP's

"Normality Tests & Normality Transformations"

was prepared and performed for use *only*** by

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VALIDATION PROTOCOL #ZTC-11

for version 3 of ZTCP's

"NORMALITY TESTS & NORMALITY TRANSFORMATIONS"

For the name and signature of the author of this Protocol, see the cover-page of this combined Protocol + Report PDF file.

1.0 OBJECTIVE

This document outlines a validation protocol for version 3 of the file named by Zorich Technical Consulting & Publishing (ZTCP) as "Normality Tests & Normality Transformations" or "NTNT".

2.0 SCOPE

This document applies to the MS Excel file named in the "Objective" section above, but which might be named differently by purchasers of this file. Even if the file name is changed by the purchaser, the "Instructions" worksheet inside the file will always have the original file name on its first row.

It applies to all versions 3.XX of this program, starting with version 3.01. The XX refers to minor variations in the program that are designed to change the appearance of worksheets or to improve the clarity of error messages. The calculation cells (including those that provide error-message related changes to program out-put) remain unchanged in all 3.XX versions, and therefore re-validation is not required when changes are implemented in the 3.XX series. If a change is required to a calculation cell, the new revision will be given version number 4.01 and formally revalidated.

Most aspects of the file are not changeable by the user/owner; the file is password protected on every worksheet except the "Doc#etc" (password retained by ZTCP). Aspects that the user can change include the following:

- The user is allowed to make the following choices (using the equivalent of drop-down lists):
    - what “Significance” level (i.e., Alpha) is used in the Normality Tests
    - what "Transformation" is used on the raw data, prior to performing the Normality Tests
    - what Normality Tests to include in the Report.
- Charts can also be modified (e.g., to adjust the X-axis for better discrimination).

- The only cells changeable by the user are the ones that allow input of raw data or input of numerical options (e.g., the value to use for "A", in the "Sqrt(X+A)" transformation).

The main outputs of this program are:

- a cumulative probability chart of the raw data entered by the user, automaticly created as a simple line-graph using MSExcel's charting function; cumulative % is charted vs. the raw data values and vs. data values that would be expected if the raw data were Normally distributed;
- a set of Normal Probability Plots, each one constructed (automaticly, by Excel) with the raw data that has been "transformed" in one of 15 different ways (counting "untransformed" as one of the 15); the 95% prediction limits ("confidence limits" for individual observations) are also included;
- a set of probability distribution histograms, each one constructed (automaticly, by Excel) with the raw data that has been "transformed" in one of 15 different ways (counting "untransformed" as one of the 15);
- the results of 10 different Normality tests, and an estimate of the corresponding p-value for 8 of the tests (the p-value estimates are performed as described in the relevant literature references; for 2 of the 10 tests, the literature references do not provide a method for estimating p-values);
- a customizable report, listing the results and p-values of whatever Normality tests have been chosen by the user; the report also lists the Alpha level that had been used and indicates the Transformation used prior to the Normality tests.

3.0 POLICY

Custom statistical software must be formally validated for its intended use. The purpose of "Normality Tests & Normality Transformations" (i.e., "NTNT") is to provide objective evidence for assumptions of data Normality; such an assumption is necessary in order to validly use certain statistical tests (e.g., t-tests used in product comparisons, and ANOVA used in "design of experiments") or calculate certain statistics (e.g., process capability indices such as Cp, Cpk, Pp, and Ppk; confidence intervals of means; and product reliability confidence statements based upon "Normal K Tables").

By using the word "validation" in this protocol, it is not meant to imply that NTNT's program "code" is being validated. NTNT is a relatively simple "application" based upon a commercial program, MS Excel, which has been sold by Microsoft Corporation since the 1980's. By saying that NTNT is to be "validated" is to say that its functions and features will be critically and systematicly checked, to see if they meet their pre-determined design requirements and intended end-user purposes. NTNT contains no "macros" or other code-based add-ons (such as VBA scripts); NTNT does not even use any ActiveX controls. NTNT contains only standard Excel mathematical and statistical equation functions, and charts, and thus no additional code to validate.

4.0 REFERENCES

The primary general calculation/spreadsheet references are:

- *Excel 2002 Formulas*, by J. Walkenbach, 2002 by M&T Books.
- *Microsoft Excel Help,* on-line file from Microsoft Excel 2002 (Microsoft Office XP)
- *StatGraphics Centurion XV, User Manual*, 2007 by StatPoint Inc.

The primary statistical references are:

- D'Agostino, R. B., and Stephens, M. A, editors, *Goodness-of-Fit Techniques*, 1986 by Marcel Dekker Inc.
- Gross, J., *A Normal Distribution Course*, 2004 by Peter Lang GmbH
- Shapiro, S. S., *How to Test Normality and Other Distributional Assumptions*, 1990 by ASQC
- Thode, H. C. Jr., *Testing For Normality*, 2002 by Marcel Dekker Inc.
- Tobias, P. A., and Trinidade, D. C., *Applied Reliability*, 2nd edition, 1995 by Chapman and Hall

Additional statistical references include:

- Alder, H. L., and Roessler, E. B., *Introduction to Probability and Statistics*, 6th edition, 1977 by W. H. Freeman & Co.
- Amstadter, B. L., *Reliability Mathematics: Fundamentals, Practices, Procedures*, 1971 by McGraw-Hill
- Anscombe, F. J., and Glynn, W. J., "Distribution of the Kurtosis Statistic b2 for Normal Samples", *Biometrika*, Vol. 70, No. 1 (Apr., 1983), pp. 227-234
- Crow, E. L., *Statistics Manual...*, (1955 by U. S. Naval Ordnance Test Station) 1960 by Dover Publications, New York.
- Crowder, M. J., Kimber, A. C., Smith, R. L., and Sweeting, T. J., *Statistical Analysis of Reliability Data*, 1991 by Chapman & Hall
- Dixon, W. J., and Massey, F. J. Jr., *Introduction to Statistical Analysis*, 3rd ed., 1969 by McGraw Hill Inc.
- Eisenhart, C., Hastay, M. W., and Wallis, W. A., editors, *Selected Techniques of Statistical Analysis...*, 1947 by McGraw-Hill Book Co. Inc.
- Gan, F. F., and Koehler, K. J., "Goodness-of-Fit Tests Based on P-P Probability Plots", *Technometrics*, Vol. 32, No. 3 (Aug., 1990), pp. 289-303
- Hald, A., *Statistical Theory with Engineering Applications*, 1952 by John Wiley & Sons.
- Hawkins, M., Hawkins and Wixley, R. A. J., "A Note on the Transformation of Chi-Squared Variables to Normality", *The American Statisticia*n, Vol. 40, No. 4 (Nov., 1986), pp. 296-298.
- Juran, J. M., and Gryna, F. M., editors, *Juran's Quality Control Handbook*, 4th edition, 1988 by McGraw-Hill Inc.
- Natrella, M. G., *Experimental Statistics*: National Bureau of Standards Handbook 9, 1963 by the U.S. Government Printing Office.

- NIST/SEMATECH *Engineering Statistics Internet Handbook*, by US NIST, at http://www.itl.nist.gov/div898/handbook/index.htm
- Pyzdek, T., and Berger, R. W., editors, *Quality Engineering Handbook*, 1992 by Marcel Dekker Inc. / ASQC Quality Press
- Steel, R. G. D., and Torrie, J. H., *Principles and Procedures of Statistics*, 1960 by McGraw-Hill Book Co.
- Stephens, M. A., "EDF Statistics for Goodness of Fit and Some Comparisons", *J. Am. Stat. Assoc*., Vol. 69, No. 347 (Sep., 1974), pp. 730-737
- Zylstra, R. R., "Normality Tests for Small Sample Sizes", in Quality Engineering magazine, 7(1), 45-48,(1994-95), published by ASQC

5.0 DEFINITIONS

NTNT	The MSExcel file named by Zorich Technical Consulting & Publishing as "Normality Tests & Normality Transformations".
R_v2.12.0	The widely-used free-ware statistical software package maintained by the “R Foundation for Statistical Computing”. This program does not provide all of the normality tests that are provided in NTNT, and some that are provided are not calculated using the same methods as in NTNT.
SGC	The commercial statistical software package used to validate NTNT. This is a high-end software program that is typically sold to and used by large corporations. StatGraphics has been sold commercially since 1982. The version used to help validate NTNT is XV, which, at the time it was purchased by ZTCP had been in commercial distribution for about 4 years. This program does not provide all of the normality tests that are provided in NTNT, and some that are provided are not calculated using the same methods as in NTNT.
"Same"	When comparing the numerical output of Normality Tests, "same" means that the results from NTNT must be within 1% of those in the literature source or in SGC or in R_v2.12.0 (i.e., the ratio of one to the other must be in the range of 0.99 to 1.01). The reason that "same" doesn't mean "exactly the same" is that literature references and the other software programs may round intermediate calculation values and final values to fewer digits than NTNT, thus slightly changing the final result. Such a comparison will be made between literature sources and/or programs only when the method of calculation of the numerical values (especially p-values) is the same between programs. When comparing the non-numerical output of Normality

Tests, the results of NTNT and the literature source or SGC or R_2.12.0 must reach the identical conclusion (e.g., that the inputted or transformed data is or is not statistically significantly different from Normality).

p-value — This is a standard textbook term for one of the outputs of a statistical test of significance; in the significance tests in NTNT, "p-value" refers to the probability of obtaining the observed random sample, assuming that the population from which the sample was taken actually was Normally distributed.

All other terms are equivalent to the common definitions in standard statistics textbooks.

6.0 INSTALLATION VALIDATION

NTNT is a standard Microsoft Excel File, without added macros, ActiveX controls, or VBA scripts. To function correctly, the file needs to be used on a computer running Microsoft Windows (v 95, NT4, or later) that is running MSExcel version 8 or later (i.e., "Excel 97" or later).

Installation validation is performed by verifying that the file is installed on a computer running one of those versions of Excel (or their Apple-computer equivalents). Since the file cannot run on any other type of installation, this validation is self-evident and will not be documented as part of implementing this protocol.

7.0 DESIGN VALIDATION

NTNT is designed based upon published methods. Design validation is achieved by ensuring that:

a) No calculation cells (equation-containing cells) on the user-accessible worksheets are user modifiable.
b) All “normality test” equations (on the hidden worksheets) match those in the published literature from which they were taken (by “match” is meant that they are mathematically equivalent; the actual format of an Excel equation is a unique representation of algebraic formulae, and would not be used in a textbook; for example, an average is calculated as "=AVERAGE(XX:YY)" where XX and YY refer to the spreadsheet identification numbers for the left uppermost cell and right lowermost cell in the range that contains the data to be averaged).
c) All “normality test” cut off values (as used on the hidden worksheets) match those in the published literature from which they were taken (as required by a given test, for a given significance level chosen by the user of NTNT).

d) Likewise, all “transformation” equations (on the hidden worksheets) match those listed on the drop-down menu in the “transformation” section of the “Step#3...” worksheet.
e) All charts on the "Step#2..." worksheet have as their "source data" the columns of data related to whatever is the title of the chart (e.g., if the chart is "LN(X)" then the "source data" must be shown to point to the (hidden worksheet) calculation column that contains equations for "LN(X)".
f) All results on the "Step#3..." worksheet are based upon the calculations and user-inputted-choices (i.e.., coefficients A, B, C...) indicated in the corresponding names of the Normality tests (e.g., the results for the Anderson-Darling test (which exist on a hidden worksheet) must show up on the "Step#3..." Summary Table line that is labeled "Anderson-Darling", rather than showing up on the line labeled "Chi-Square"; and (e.g.) if the "transformation" choice is "SQRT(X + A)" then the "used data" column (on the hidden worksheet has been populated with the numbers found in the (hidden) column whose title is "SQRT(X + A)")).
g) The output on the "Step#4..." worksheet are all taken from the corresponding input/choices provided by the user (e.g., if the user has chosen 5% Alpha, Log(X), transformation, and the Anderson-Darling Normality test for the report, the program actually uses those choices rather than mistakenly using other choices).

8.0 PERFORMANCE VALIDATION

Performance validation is to be accomplished by verifying that:

h) If all 2000 cells in the Data_Entry Table are filled, then all 2000 data points are automaticly transferred to the hidden calculation sheet, as the starting point for all subsequent charts and tests.
i) No matter where a set of 100 data points are put into the Data_Entry Table, those same 100 data points are automaticly transferred to the hidden calculation sheet, as the starting point for all subsequent charts and tests.
j) If a set of 100 data points are put into the Data_Entry Table, and then "cut" and pasted to another location in the table (not "copy" and pasted), those same 100 data points are automaticly transferred to the hidden calculation sheet, as the starting point for all subsequent charts and tests, and the calculations and charts are not caused to output nonsense as the result of using "cut" rather than "copy".
k) If a set of 100 positive numbers from 1 to 100 are placed into Data_Entry Table, along with the value 0, the column (on the hidden calculation sheet) that contains the actual numbers used for the Normality Tests, have all the values differ from the original data by the quantity 0.01 x 100 = 1. That is, instead of the "used" data being 0, 1, 2...100, the used data will have become 1, 2, 3...101.
l) If a set of 100 positive numbers from 1 to 100 are placed into Data_Entry Table, along with the value −100, the column (on the hidden calculation sheet) that contains the actual numbers used for the Normality Tests will have all its values differ from the original data by the quantity 1.01 x 100 = 101. That is, instead of

the "used" data being −100, 1, 2...100, the used data will have become 1, 102, 103...201.

m) The output of the various Normality Tests is the "same" as examples taken from various literature references, when the data in the literature examples is inputted to NTNT.

n) When the same data is inputted to NTNT, SGC, or R_v2.12.0, the "same" p-values or test conclusions (as applicable) are outputted, for the subset of Normality Tests that exist in NTNT and SGC or R_v2.12.0.

o) When 2000 numbers are inputted to both NTNT and SGC, the same basic descriptive statistics are outputted by both programs (NTNT shows such statistics at the top of the "Step # 1..." worksheet).

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VALIDATION REPORT for Protocol # ZTC-11

For version 3 of ZTCP's

"NORMALITY TESTS & NORMALITY TRANSFORMATIONS"

For the name and signature of the author of this Report, see the cover-page of this combined Protocol + Report PDF file.

1.0 INSTALLATION VALIDATION

Self-evident -- see Protocol for discussion.

2.0 DESIGN VALIDATION (see Attachment #'s 1 thru 5)

a) The only user-modifiable cells that were found on any of the user-accessible worksheets were the non-calculation ones intended for user input; sections of the "Report" w
"DOC#Etc

CONCLU **t.**

b) All "norma ch
those in the heant
that they a n is
a unique re
textbook; f where
XX and Y most
cell and rig d).

CONCLU **et.**

c) All "norma
found to m as
required by
NTNT).

CONCLU **et.**

d) All "transf ch
those listed on the drop-down menu in the "transformation" section of the "Step#3..." worksheet. (See "b" above for discussion of "match".)

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CONCLUSION: All of the P

e) All charts on the "Step#2..." w " the columns of data related to is "LN(X)" then the "source data t) calculation column that contai See " 1. " on Attachment # 5.

CONCLUSION: All of the P

f) All results on the "Step#3..." w calculations and user-inputted- the corresponding names of th n- Darling test must show up on t "Anderson-Darling", rather tha nd (e.g.) if the "transformation" c column (on the hidden worksh the (hidden worksheet) calcula + A)").
See " 2. " on Attachment # 5.

CONCLUSION: All of the P

g) The outputs on the "Step#4..." corresponding input/choices p % Alpha, Log(X) transformation, report, the program actually us er choices).
See " 3. " on Attachment # 5.

CONCLUSION: All of the P

3.0 PERFORMANCE VALIDATION

h) When all 2000 cells in the Dat were found to be automaticly t starting point for all subsequen

CONCLUSION: All of the P

i) No matter where a set of 100 data points are put into the Data_Entry Table, those same 100 data points were found to be automaticly transferred to the hidden calculation sheet, as the starting point for all subsequent charts and tests.

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CONCLUSION: All of the Proto

j) If a set of 100 data points are put int
pasted to another location in the tab
data points were found to be automa
sheet, as the starting point for all sul ns
and charts are not caused to output r
than "copy".

CONCLUSION: All of the Proto

k) If a set of 100 positive numbers fro ,
along with the value 0, the column (ns
the actual numbers used for the Nor ues
differ from the original data by the c ne
"used" data being 0, 1, 2...100, the u

CONCLUSION: All of the Proto

l) If a set of 100 positive numbers fro ,
along with the value −100, the colu
contains the actual numbers used fo
its values differ from the original da
instead of the "used" data being −10 e
1, 102, 103...201.

CONCLUSION: All of the Proto

m) The output of the various Normality
examples taken from various literat e
examples is inputted to NTNT.

CONCLUSION: All of the Proto
see summary table in Attachment

n) When the same data is inputted to b
p-values or test conclusions (as appl
subset of Normality Tests that exist

CONCLUSION: All of the Proto
see summary table in Attachment

o) When 2000 numbers are inputted to
descriptive statistics were found to b ys
such statistics at the top of the "Step # 1..." worksheet).

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CONCLUSION: t;
see detailed resul

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6.0 CONCLUSION

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7.0 ATTACHMENTS

For detailed information on the textbooks and software programs referenced on the Attachments, see the Protocol.

Attachment # 1	Summary of Validation Results
Attachment # 2	Detailed Validation Results
Attachment # 3	Data Used in one of the Chi-square Tests
Attachment # 4a	Data Used in the "Descriptive Statistics" Evaluation and in the n=2000 Comparison of NTNT to SGC
Attachment # 4b	Data Used in the n=2000 Comparison of NTNT to R_v2.12.0
Attachment # 5	Validation Report from Colonel Colborne (a professional statistician)

ATTACHMENT # 1 Summary of Validation Results

	Summary Results for NTNT vs.Textbooks or Software (details are given in Attachment #2, below)					
	Worked Examples from Textbooks				Comparisons to Other Statististical Software	
	Gross	Thode	D'Agostino	Shapiro	StatGraphics Centurion XV	R_v2.12.0
Anderson-Darling's A2*	s					
Cramer-von Mises' W2*	s					
Shapiro-Francia's W'	s					
Watson's U2*						
Gan-Koehler's K2						
Skewness, per D'Agostino						
Kurtosis, per Anscombe & Glynn						
Kuiper's V*						
Lilliefors' Kolmogorov-Smirnov D*	s					
Chi-Square						

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ATTACHMENT # 2 Detailed Validation Results that are summarized in Attachment # 1, above)

Reference: Test results from Juergen Gross, pp. 110 thru 118.									
Raw Data from Juergen Gross, p. 3					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
78.9	69.1	64.6	75.2	66.5	**Lilliefors' Kolmogorov-Smirnov D* test**				
96.3	63	71.3	73.2	80.5	D				
74.5	69.5	79.7	78.7	49.8	D*				
66	78.1	78.5	63	60.7	p-value				
67.9	74.1	68.8	67.4	74	D* significant ?	non-			
74.1	77.8	83.8	64.1	64.8	**Cramer-von Mises W2* test**				
72.1	71.4	63.9	60	64.7	W2				
78.9	82.8	94.8	61.9	63.7	W2*				
65.2	57.3	60.1	59.7	59.6	p-value				
69.7	61.1	56	47.8	37.8	W2* significant ?				
74.4	74.9	63.7	62.3	62.9	**Anderson-Darling A2* test**				
75.5	80.5	70.5	68.7	72.9	A2				
75.4	66.4	73.6	75	67.2	A2*				
74.3	79.5	59.9	66.3	72.9	p-value				
67.5	68.2	75.3	70	51.9	A2* significant ?				
74.3	66.9	82.9	68.85	59	**Shapiro-Francia W' test**				
75.6	69.7	55.1	58	87.5	correlation coefficient				
83.9	74.4	49.2	53.6	52.8	W'				
50.9	60	52.5	57.3	71.5	p-value				
56.1	47.4	45.8	43.8	45.1	W' significant ?				

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Reference: Test results from Thode pp. 46-51									
Raw Data from Thode p. 343					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
1.32	2.03	2.49	2.96	3.65	**Skewness, per D'Agostino (skewness and related intermediary test coefficients are shown)**				
1.55	2.09	2.51	3.01	3.67	Skewness				
1.62	2.1	2.57	3.07	3.73	Y =				
1.71	2.2	2.57	3.12	3.77	B2=				
1.77	2.28	2.63	3.2	3.93	W^2 =				
1.83	2.29	2.69	3.33	4.04	δ =				
1.84	2.37	2.69	3.43	4.08	α =				
1.87	2.37	2.71	3.54	4.09	X (= observed Z value) =				
1.92	2.4	2.8	3.55	4.75	p-value				
1.95	2.44	2.94	3.58	4.83	Skewness significant ?	non-s			
4.96									

Reference: Test results from T						
Raw Data from Thode p. 342					Test name	F
72	115	127	114	80	**Lilliefors' Kolmogorov-Smirnov D* test**	
112	118	86	94	81	D	
111	128	142	126	84	D*	
107	128	132	122	106	p-value	n
119	123	87	126	103	D* significant ?	non-s
92	116	123	133	118	**Kuiper's V* test**	
126	125				V	
					V*	
					p-value	n
					V* significant ?	non-si

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Reference: Test results from Thode pp. 103-104									
Raw Data from Thode p. 346					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
16	168	11	56	62	**Cramer-von Mises W2* test**				
12	48	72	66	32	W2				
60	52	21	120	50	W2*				
60	132	54	44	72	p-value				
					W2* significant ?				

Reference: Test results from									
Raw Data from Thode p. 346					Test name				
7.7	11.1	11.5	6.2	7.7	**Anderson-Darling A2* test**				
8.5	8.8	10.2	10.4	5.2	A2				
6.9	8.9	8.7	12.5	3.8	A2*				
11.1	9	10.7	8.1	7.4	p-value				
17.1	11.2	8.8	5.9	5.6	A2* significant ?	nor			
13.3	6.2	9.5	10.7	7.8					
8.9									

Reference: Test results fr									
Raw Data from Thode p. 341					Test name				
50	41	6	14	75	**Gan-Koehler's K2**				
-67	24	23	29	60	K2				
8	16	28	56	-48	p-value				
					K2 significant ?	no			

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Reference: Test results from D'Agostino p. 125									
Raw Data from D'Agostino p. 98					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
156	190	214	236	270	**Lilliefors' Kolmogorov-Smirnov D* test**				
162	190	220	236	230	D				
168	196	226	242	210	D*				
182	202	230	246	186	p-value				
					D* significant ?	non-s			
					Cramer-von Mises W2* test				
					W2				
					W2*				
					p-value				
					W2* significant ?	non-s			
					Anderson-Darling A2* test				
					A2				
					A2*				
					p-value				
					A2* significant ?	non-s			
					Kuiper's V* test				
					V				
					V*				
					p-value				
					V* significant ?	non-s			
					Watson's U2*				
					U2				
					U2*				
					p-value				
					U2* significant ?	non-s			

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Reference: Test results from D'Agostino pp. 284-286									
Raw Data from D'Agostino p. 529					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
92.55	101.58	98.98	92.45	95.45	**Skewness, per D'Agostino (skewness and related intermediary test coefficients are shown)**				
96.2	106.82	100.42	115.92	108.52	Skewness				
84.27	98.7	118.52	103.61	112.69	Y =				
90.87	113.75	89.9	96.13	90.03	B2=				
					W^2 =				
					δ =				
					α =				
					X (= observed Z value) =				
					p-value				
					Skewness significant ?	non-s			

NOTE: The skewness "X=observed Z-value"and the p-value shown here are not provided by the reference source, but their formulas (different than what is used by NTNT) are provided in the reference (on pg 285) and were used to calculate them here.

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Reference: Test results from						
Raw Data from Shapiro p. 51					Test name	
12.01	12.13	12.22	12.88	12.47	**Anderson-Darling's A2***	
12.07	12.14	12.34	12.97	13.02	A2	
12.11	12.18				A2*	
					p-value	n
					A2* significant ?	sig

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Reference: Test results from StatGraphics Centurion XV (menu sequence: SPC, Capability Analysis, Variables, Individuals, Tables:Goodness of Fit)									
Raw Data from Juergen Gross, p. 3					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
78.9	69.1	64.6	75.2	66.5	**Lilliefors' Kolmogorov-Smirnov D* test**				
96.3	63	71.3	73.2	80.5	D				
74.5	69.5	79.7	78.7	49.8	D*				
66	78.1	78.5	63	60.7	p-value				
67.9	74.1	68.8	67.4	74	D* significant ?	non-			
74.1	77.8	83.8	64.1	64.8	**Cramer-von Mises W2* test**				
72.1	71.4	63.9	60	64.7	W2				
78.9	82.8	94.8	61.9	63.7	W2*				
65.2	57.3	60.1	59.7	59.6	p-value				
69.7	61.1	56	47.8	37.8	W2* significant ?	non-			
74.4	74.9	63.7	62.3	62.9	**Anderson-Darling A2* test**				
75.5	80.5	70.5	68.7	72.9	A2				
75.4	66.4	73.6	75	67.2	A2*				
74.3	79.5	59.9	66.3	72.9	p-value				
67.5	68.2	75.3	70	51.9	A2* significant ?	non-			
74.3	66.9	82.9	68.85	59	**Kuiper's V* test**				
75.6	69.7	55.1	58	87.5	V				
83.9	74.4	49.2	53.6	52.8	V*				
50.9	60	52.5	57.3	71.5	p-value				
56.1	47.4	45.8	43.8	45.1	V* significant ?	non-			
					Watson's U2*				
					U2				
					U2*				
					p-value				
					U2* significant ?	non-			

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Reference: Test results from StatGraphicsCenturionXV
(menu sequence: SPC, Capability Analysis, Variables, Individuals, Tables:Goodness of Fit; Analysis: Normal; Pane: Chi-square)

Raw Data from Juergen Gross, p. 3					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
78.9	69.1	64.6	75.2	66.5	**Chi-Square test**				
96.3	63	71.3	73.2	80.5	# categories				
74.5	69.5	79.7	78.7	49.8	df				
66	78.1	78.5	63	60.7	chi-square statistic				
67.9	74.1	68.8	67.4	74	p-value				
74.1	77.8	83.8	64.1	64.8	Chi-square significant ?	no			
72.1	71.4	63.9	60	64.7					
78.9	82.8	94.8	61.9	63.7		to ma			
65.2	57.3	60.1	59.7	59.6		cate			
69.7	61.1	56	47.8	37.8					
74.4	74.9	63.7	62.3	62.9					
75.5	80.5	70.5	68.7	72.9					
75.4	66.4	73.6	75	67.2					
74.3	79.5	59.9	66.3	72.9					
67.5	68.2	75.3	70	51.9					
74.3	66.9	82.9	68.85	59					
75.6	69.7	55.1	58	87.5					
83.9	74.4	49.2	53.6	52.8					
50.9	60	52.5	57.3	71.5					
56.1	47.4	45.8	43.8	45.1					

Reference: Test results from Sta
(menu sequence: SPC, Capability Analysis, Variables, Individuals, T

	Test name	
Raw Data is shown in Attachment # 3	**Chi-Square test**	
	# categories	
	df	
	chi-square statistic	
	p-value	
	Chi-square significant ?	no
		to ma cate

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Reference: Test results from StatGraphics Centurion XV (menu sequence: SPC, Capability Analysis, Variables, Individuals, Tables:Goodness of Fit)					
Random normal data set created by MS-Excel (n = 6 is the smallest sample size allowed by SGC for these tests)	Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
9.9353	**Lilliefors' Kolmogorov-Smirnov D* test**				
12.6549	D	0.273887	0.2738892	1.00	Yes
9.152	D*				
8.2296	p-value				
10.1816	D* significant ?	non-			
10.2968	**Cramer-von Mises W2* test**				
	W2				
	W2*				
	p-value				
	W2* significant ?	non-			
	Anderson-Darling A2* test				
	A2				
	A2*				
	p-value				
	A2* significant ?	non-			
	Kuiper's V* test				
	V				
	V*				
	p-value				
	V* significant ?	non-			
	Watson's U2*				
	U2				
	U2*				
	p-value				
	U2* significant ?	non-			

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Reference: Test results from StatGraphics Centurion XV					
Raw Data is shown in Attachment # 4a n = 2000 = maximum sample size allowed by NTNT	Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
	Lilliefors' Kolmogorov-Smirnov D* test				
	D				
	D*				
	p-value				
	D* significant ?				
	Cramer-von Mises W2* test				
	W2				
	W2*				
	p-value				
	W2* significant ?				
	Anderson-Darling A2* test				
	A2				
	A2*				
	p-value				
	A2* significant ?				
	Kuiper's V* test				
	V				
	V*				
	p-value				
	V* significant ?				
	Watson's U2*				
	U2				
	U2*				
	p-value				
	U2* significant ?				
	Chi-Square test				
	# categories				
	df				
	chi-square statistic				
	p-value				
	Chi-square significant ?				

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Reference: Test results from R_v.12.0 (using "Nortest" package)									
Raw Data from Juergen Gross, p. 3					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
78.9	69.1	64.6	75.2	66.5	**Cramer-von Mises W2* test**				
96.3	63	71.3	73.2	80.5	W2				
74.5	69.5	79.7	78.7	49.8	W2*				
66	78.1	78.5	63	60.7	p-value				
67.9	74.1	68.8	67.4	74	W2* significant ?				
74.1	77.8	83.8	64.1	64.8	**Anderson-Darling A2* test**				
72.1	71.4	63.9	60	64.7	A2				
78.9	82.8	94.8	61.9	63.7	A2*				
65.2	57.3	60.1	59.7	59.6	p-value				
69.7	61.1	56	47.8	37.8	A2* significant ?				
74.4	74.9	63.7	62.3	62.9	**Lilliefors' Kolmogorov-Smirnov D* t**				
75.5	80.5	70.5	68.7	72.9	D				
75.4	66.4	73.6	75	67.2	D*				
74.3	79.5	59.9	66.3	72.9	p-value				
67.5	68.2	75.3	70	51.9	D* significant ?				
74.3	66.9	82.9	68.85	59	**Shapiro-Francia W' test**				
75.6	69.7	55.1	58	87.5	correlation coefficient				
83.9	74.4	49.2	53.6	52.8	W'				
50.9	60	52.5	57.3	71.5	p-value				
56.1	47.4	45.8	43.8	45.1	W' significant ?				

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** As stated in the NTNT description of the D* test (on the NTNT "Step # 3" worksheet), the reference articles did not provide the formula for the D* p-value and so NTNT is using a "crude approximation" formula. The D* test does not use the p-value to determine significance, but rather uses a table of cut-off values obtained from reference-source articles.

**** Significance is not stated explicitly by R. However, based upon the p-values, it is implicit that the results of NTNT and R agree with each other. Therefore, all these tests have been marked as "Yes" having the "Same" significance result.

Reference: Test results from R_v.12.0 (using "Moments" package) (and Thode; see text box, below)									
Raw Data from Thode p. 343					Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
1.32	2.03	2.49	2.96	3.65	**Kurtosis, per Anscombe & Glynn (kurtosis and related intermediary test coefficient are shown)**				
1.55	2.09	2.51	3.01	3.67	Kurtosis				Yes
1.62	2.1	2.57	3.07	3.73	Z-value				Yes
1.71	2.2	2.57	3.12	3.77	p-value				Yes
1.77	2.28	2.63	3.2	3.93	Kurtosis significant ?				****
1.83	2.29	2.69	3.33	4.04					
1.84	2.37	2.69	3.43	4.08					
1.87	2.37	2.71	3.54	4.09					
1.92	2.4	2.8	3.55	4.75					
1.95	2.44	2.94	3.58	4.83					
4.96									

Reference: Test results from R_v.12.0 (using "Momen									
Raw Data from D'Agostino p. 529 (n = 20 is the smallest sample size allowed by NTNT for this test)					Test name				me" ?
92.55	101.58	98.98	92.45	95.45	**Kurtosis, per Anscombe & Glynn (ku**				
96.2	106.82	100.42	115.92	108.52	Kurtosis				Yes
84.27	98.7	118.52	103.61	112.69	Z-value				Yes
90.87	113.75	89.9	96.13	90.03	p-value				Yes
					Kurtosis significant ?				****

**** Significance is not stated explicitly by R. However, based upon the p-values, it is implicit that the results of NTN
Therefore, all these tests have been marked as "Yes" having the "Same" significance re
Additionally, this data and this test was used by D'Agostino (example 7.2.3.2, p. 284) to achieve a Kurtosis val
test conclusion.

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Reference: Test results from R_v.12.0 (using "Nortest" package)					
Random normal data set created by MS-Excel (n = 5 is the smallest sample size allowed by R_v.12.0 for this test)	Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
10.048	**Shapiro-Francia W' test**				
10.852	correlation coefficient				
9.7505	W'				
9.9804	p-value				
9.6225	W' significant ?				

**** Significance is not stated explicitly by R. However, based upon the p-values, it is implicit that the results of NTNT and R agree with each other. Therefore, all these tests have been marked as "Yes" having the "Same" significance result.

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Reference: Test results from R_v.12.0 (using "Nortest" and "Moments" packages)					
Raw Data is shown in Attachment # 4b n = 2000 = maximum sample size allowed by NTNT	Test name	Reference results	NTNT (from "Step#3..." & from hidden worksheets)	Ratio of NTNT to Reference	"Same" ?
	Cramer-von Mises W2* test				
	W2				
	W2*				
	p-value				
	W2* significant ?				
	Anderson-Darling A2* test				
	A2				
	A2*				
	p-value				
	A2* significant ?				
	Lilliefors' Kolmogorov-Smirnov D* test				
	D				
	D*				
	p-value				
	D* significant ?				
	Shapiro-Francia W' test				
	correlation coefficient				
	W'				
	p-value				
	W' significant ?				
	Kurtosis, per Anscombe & Glynn (kurto				
	Kurtosis				
	Z-value				
	p-value				
	Kurtosis significant ?				

**** Significance is not stated explicitly by R. However, based upon the p-values, it is implicit that the results of NTNT and R agree with each other. Therefore, all these tests have been marked as "Yes" having the "Same" significance result.

** As stated in the NTNT description of the D* test (on the NTNT "Step # 3" worksheet), the reference articles did not provide the formula for the D* p-value and so NTNT is using a "crude approximation" formula. The D* test does not use the p-value to determine significance, but rather uses a table of cut-off values obtained from reference-source articles.

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DESCRIPTIVE STATISTICS

Raw Data is shown in Attachment # 4a	STATGRAPHICS CENTURION XV	NTNT (from "Step#1..." worksheet)	Ratio of NTNT to SGCXV	"Same" ?
Count =	2000	2000	1.00	Yes
Average Value =	99.7151	99.7151	1.00	Yes
Median =	99.9885	99.9885	1.00	Yes
Maximum value =	137.416	137.416	1.00	Yes
Minimum value =	63.888	63.888	1.00	Yes
Standard Deviation =	10.1787	10.1787	1.00	Yes
Variance =	103.606	103.606	1.00	Yes

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ATTACHMENT # 3 Data used in one of the Chi-square Tests

84.159	102.848	107.172	96.820	94.337	103.375	100.656	97.086	95.906	102.745
104.371	102.662	104.741	107.157	90.782	93.715	106.560	107.216	102.566	102.132
95.762	103.861	98.212	108.879	95.964	88.271	95.233	106.214	112.525	111.542
125.132	104.165	97.577	117.890	96.307	127.168	101.695	108.514	78.038	85.056
109.518	100.502	98.951	106.489	105.567	85.588	113.030	111.741	97.211	100.587
93.741	81.917	92.743	85.086	113.903	112.971	85.627	94.658	84.247	97.532
97.697	85.061	98.174	102.157	90.142	99.073	117.260	108.538	91.039	113.164
114.771	88.197	94.778	93.815	84.056	92.113	98.659	115.643	86.624	99.865
104.291	108.417	99.274	99.422	91.168	111.641	97.706	100.909	122.317	92.343
105.847	85.711	100.525	86.488	111.418	114.403	81.092	107.293	80.689	90.759
104.677	105.435	98.476	113.285	104.852	98.125	113.005	106.062	120.947	95.499
109.794	98.291	98.937	115.024	96.776	86.634	100.995	109.672	105.787	104.179
90.763	113.009	102.342	107.551	98.402	95.824	86.796	107.024	96.832	124.516
99.167	103.085	94.512	94.794	98.610	115.993	111.012	103.395	87.197	93.875
88.187	74.627	87.547	121.370	114.008	102.121	114.719	90.261	102.652	103.281
115.876	104.148	98.341	85.033	103.344	95.712	111.456	119.321	109.723	100.443
92.710	103.463	90.699	93.773	99.675	100.363	89.579	93.630	97.698	83.216
94.773	102.439	108.963	106.664	118.533	85.580	93.432	111.564	107.028	108.264
101.197	118.821	125.590	96.652	98.257	110.218	81.316	95.992	91.542	96.450
100.535	111.657	96.792	89.510	104.230	102.715	93.541	96.674	114.128	102.791
98.223	106.364	97.253	93.539	118.972	97.687	112.993	110.372	89.916	108.344
93.590	95.531	108.098	94.745	113.169	120.020	97.954	94.327	100.211	95.955
90.729	101.684	97.731	100.596	105.333	104.563	85.942	95.258	102.410	91.167
95.214	110.200	120.489	87.331	101.974	107.414	108.994	96.681	90.960	99.618
105.025	86.898	102.657	102.466	100.713	91.956	101.463	122.682	79.877	89.800

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ATTACHMENT # 4a Data Used in "Descriptive Statistics" Evaluation and in the n=2000 Comparison of NTNT to SGC

92.389	103.247	88.494	91.926	102.596	110.034	94.556	104.118	91.989	104.416
92.952	95.271	95.824	90.646	100.194	111.847	98.361	111.082	98.790	87.564
93.391	114.536	105.406	83.918	92.778	104.590	113.104	100.823	94.652	108.911
86.577	100.596	105.163	99.024	104.821	110.776	88.034	101.406	99.216	116.220
102.700	102.566	98.255	109.015	102.263	95.413	114.956	93.643	100.767	93.487
85.324	97.075	99.128	108.382	103.947	94.293	80.664	106.644	104.961	91.877
88.738	111.384	108.829	114.703	119.277	101.186	100.355	103.224	100.137	116.952
103.721	84.740	80.694	114.483	80.549	95.773	84.995	114.132	103.265	119.467
91.767	91.403	91.654	104.596	122.477	104.562	107.342	99.185	102.358	102.202
111.591	101.017	97.720	96.011	82.064	102.320	90.661	107.148	92.625	113.144
109.831	86.734	113.606	121.546	108.140	115.287	97.521	131.939	104.009	101.529
85.070	110.167	92.402	103.429	92.563	86.022	107.655	115.431	89.957	100.856
97.339	85.037	87.569	110.527	97.785	103.886	106.891	108.158	105.508	89.237
121.333	99.950	117.273	104.601	97.343	102.358	100.085	85.981	99.169	95.682
80.186	99.754	106.966	102.808	103.378	104.859	84.934	87.249	101.858	103.175
117.355	95.323	90.603	92.038	101.346	111.691	91.422	111.147	122.136	105.826
93.615	111.346	98.857	102.815	99.895	85.616	93.095	104.659	82.784	117.635
104.097	93.905	103.038	102.898	92.679	113.455	107.005	103.049	90.092	103.789
112.460	98.169	95.896	101.705	116.624	91.794	114.122	106.828	102.492	106.026
107.867	99.181	108.440	94.785	110.596	110.697	110.815	94.980	103.775	115.406
101.841	95.835	116.286	89.800	104.457	99.827	84.511	94.554	91.941	110.719
99.776	82.159	82.222	105.155	100.111	114.455	81.648	97.061	98.616	79.114
92.979	102.987	92.644	81.913	101.905	114.833	114.728	93.511	92.999	83.856
109.066	119.089	100.988	88.693	109.784	106.055	91.335	95.996	110.015	91.960
111.656	120.927	101.650	124.470	86.433	98.470	104.713	116.388	72.863	93.025
112.384	103.203	100.652	102.150	98.523	95.605	88.088	97.983	116.627	92.890
102.866	103.734	73.529	94.410	104.326	97.604	96.275	89.408	119.538	82.641
91.768	80.131	114.996	106.052	98.096	103.678	113.122	95.229	88.938	87.152
106.084	98.276	101.531	114.760	103.456	95.629	101.532	90.248	92.814	102.096
106.067	103.344	106.008	85.627	99.619	94.795	118.009	97.362	85.100	118.032
102.277	87.906	108.876	127.695	109.449	122.534	103.575	100.620	88.967	103.797

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89.961	106.543	96.321	106.993	94.177	105.058	100.829	92.037	107.281	93.507
80.684	97.224	102.410	104.508	88.045	122.994	101.757	95.661	105.769	99.650
85.326	89.692	97.316	106.622	96.321	94.868	94.619	108.858	95.144	101.971
91.641	97.666	85.740	89.859	95.214	91.017	97.747	86.234	118.115	93.087
93.785	92.785	110.924	118.858	98.031	77.514	87.091	104.967	102.531	102.725
99.962	92.170	123.271	85.751	100.578	107.785	101.529	79.866	96.171	97.609
85.983	89.707	95.084	92.522	93.212	100.368	95.259	109.588	110.142	104.592
98.932	86.982	94.801	103.266	97.454	102.673	102.737	105.159	107.393	89.093
116.223	93.566	89.912	94.341	121.010	100.483	112.468	105.793	90.868	89.026
94.486	88.721	87.497	132.640	98.799	97.309	84.516	113.277	96.220	119.326
74.160	98.796	95.282	86.880	89.233	111.452	101.869	106.297	86.199	91.050
76.517	116.161	78.667	95.582	109.314	101.171	106.322	104.168	91.757	105.578
71.603	100.937	105.016	100.059	86.305	94.226	97.271	110.418	114.949	95.524
105.067	82.825	110.180	108.298	103.510	92.349	86.396	95.239	102.647	117.149
95.096	95.902	99.391	97.201	92.976	107.094	113.703	76.529	99.313	86.847
115.233	101.783	110.090	79.941	97.817	91.501	93.185	101.650	104.744	91.551
95.163	104.441	112.533	103.269	110.479	100.099	94.284	88.126	99.321	91.849
123.147	79.718	94.341	98.326	102.783	97.315	86.465	97.639	88.385	109.968
115.724	108.909	96.107	107.179	101.335	94.611	102.410	83.147	96.192	109.285
103.942	105.060	104.898	106.609	108.110	99.328	82.798	107.500	111.065	97.286
104.223	105.300	100.261	109.842	100.747	89.154	103.400	101.113	110.006	112.540
98.085	96.478	98.165	92.344	99.606	97.810	77.165	118.056	116.071	124.871
104.884	98.354	97.920	93.160	101.664	93.592	99.985	99.471	115.999	95.309
116.324	83.485	83.976	110.941	92.561	99.249	87.185	101.000	114.876	105.046
104.344	94.136	85.662	83.893	106.490	88.666	90.334	94.739	112.418	99.195
94.885	94.868	85.706	91.021	111.229	98.186	99.830	109.719	103.798	94.898
105.118	109.453	102.895	103.714	85.447	104.119	99.668	89.196	105.318	118.826
89.313	112.822	99.740	106.439	102.958	101.242	92.637	106.689	104.862	97.850
110.355	99.104	100.458	89.866	111.343	93.719	104.768	99.034	110.478	117.294
92.372	96.303	110.297	82.814	112.876	88.568	90.716	118.444	106.892	98.900
87.124	107.979	120.300	101.394	87.736	112.018	111.037	103.610	109.294	101.630
96.756	90.858	89.495	83.054	101.615	82.911	117.179	93.981	92.611	90.499
109.427	89.971	111.614	108.762	101.615	104.690	102.191	97.841	94.726	98.686
97.534	93.473	94.633	109.552	97.589	93.442	89.698	87.029	116.667	96.452
107.325	79.168	98.727	78.407	80.436	100.598	122.682	102.028	94.877	99.883

73.983	93.764	99.459	104.510	103.100	102.246	100.400	119.004	107.765	95.828
103.323	89.534	89.736	114.549	96.276	117.488	101.221	111.133	85.086	96.681
90.547	101.449	90.158	88.772	90.816	107.311	100.542	82.662	116.981	119.456
91.249	99.967	107.338	107.353	104.343	107.748	120.324	96.832	111.958	83.143
90.312	96.724	83.803	94.814	103.239	86.012	122.702	94.460	107.647	107.217
89.335	107.906	94.052	106.635	98.078	111.697	94.527	99.941	106.983	128.107
101.571	109.385	107.174	115.730	97.653	102.165	86.954	103.234	104.318	108.688
99.405	99.164	100.496	90.146	105.424	100.771	101.911	105.846	87.941	91.356
97.700	101.632	99.854	101.481	90.803	93.525	101.334	100.236	87.032	87.289
104.395	94.409	91.965	100.990	99.369	107.322	100.060	92.376	96.313	101.404
80.982	99.515	99.681	90.214	91.246	71.689	91.774	92.947	99.110	85.824
99.595	82.041	94.415	104.217	85.091	125.097	87.557	104.307	101.167	81.806
99.802	97.873	101.275	109.540	92.764	113.410	111.048	102.672	97.627	107.110
103.210	104.208	90.567	115.879	106.409	99.992	110.891	86.800	127.951	117.671
94.726	93.173	98.142	105.565	91.955	105.160	103.673	74.181	102.758	99.400
85.723	98.337	115.983	75.262	100.188	82.095	102.179	95.614	83.805	109.687
94.557	93.703	94.314	104.727	109.660	105.375	101.544	106.311	103.351	99.945
96.271	93.546	120.181	114.068	87.428	87.343	91.951	108.874	109.861	91.035
96.061	92.979	88.725	93.318	100.310	96.975	106.214	102.029	107.701	101.485
100.028	110.920	84.244	117.770	94.658	87.018	115.396	92.476	93.683	105.303
110.074	88.012	97.205	113.596	115.643	103.859	112.080	96.318	101.458	102.910
85.128	115.815	100.427	95.718	96.635	63.888	109.548	111.808	84.632	92.941
99.710	104.503	99.577	101.815	97.879	85.037	100.449	102.249	106.306	107.457
112.274	123.004	98.110	106.135	82.648	106.312	95.965	92.302	89.064	112.621
99.668	89.936	103.367	92.615	98.186	90.676	98.732	117.079	101.334	108.300
113.780	112.725	96.151	90.195	102.999	111.362	110.629	96.606	77.028	108.276
102.681	91.015	105.583	101.546	101.288	118.021	85.922	104.294	87.278	86.725
112.403	84.375	106.380	117.617	103.141	108.883	105.590	88.200	103.788	106.617
90.352	113.246	97.855	101.211	90.125	109.815	87.290	98.062	97.777	101.715
90.538	83.854	98.291	95.577	106.232	89.394	108.811	94.755	98.359	97.883
99.837	108.363	100.242	109.506	78.928	126.471	120.088	89.044	94.021	94.688
98.156	103.399	96.548	97.436	93.745	94.346	94.222	111.170	102.649	91.641
109.835	120.906	99.361	113.833	92.675	103.842	115.623	81.416	95.652	96.755
101.405	88.734	117.380	89.802	78.777	87.321	93.728	104.963	111.472	98.019
95.677	100.212	94.584	115.576	104.385	116.121	109.042	95.181	97.902	105.303
101.512	116.584	93.561	89.735	106.001	103.556	95.882	97.209	102.111	88.467
124.547	99.718	105.004	85.265	94.699	83.169	98.465	84.031	69.208	110.703
104.426	95.363	95.881	98.573	116.118	103.272	103.137	90.606	83.006	123.329
94.406	99.529	102.110	94.187	100.670	92.599	115.446	98.264	113.387	92.429
100.292	114.199	137.416	102.233	102.785	114.856	85.442	82.494	107.401	105.314
95.734	83.488	81.968	102.655	84.564	98.937	105.183	74.665	95.206	92.563

101.826	102.316	94.691	91.319	84.012	101.632	81.416	94.235	110.603	101.699
92.598	112.277	100.061	101.088	95.018	94.256	92.842	90.915	114.262	94.045
107.805	106.256	115.925	110.433	108.969	99.345	100.866	104.868	106.680	92.099
101.334	98.523	103.336	107.627	110.943	100.519	109.423	99.899	92.571	86.299
98.943	102.564	86.421	114.041	115.050	105.357	97.883	95.771	93.798	104.275
102.073	96.745	97.709	110.101	87.038	102.209	87.202	113.155	103.008	100.830
97.690	86.920	100.502	76.493	87.029	88.739	106.708	97.997	113.294	101.315
92.840	111.199	116.090	114.963	97.642	113.385	98.685	106.080	95.318	113.459
99.603	93.528	110.219	103.097	96.476	97.449	103.614	118.263	105.345	103.721
94.652	87.745	103.900	98.914	88.130	95.116	99.436	97.074	106.834	75.978
95.889	86.975	103.356	109.192	107.077	92.981	114.730	112.012	98.486	95.874
113.468	110.643	87.950	101.369	102.692	108.191	95.381	102.746	94.727	114.230
105.494	112.606	85.096	96.303	101.538	108.611	108.215	93.432	99.859	93.787
116.212	100.970	98.587	90.857	103.896	102.161	85.229	93.861	81.065	73.892
116.118	105.192	91.430	88.844	99.346	90.775	109.496	92.757	86.133	104.533
91.366	107.393	96.683	115.522	101.448	113.960	87.564	99.534	97.890	110.068
89.865	85.234	91.455	98.710	101.799	106.437	102.470	100.303	91.433	106.542
117.199	104.602	111.330	95.425	85.398	97.082	103.767	88.744	101.677	105.221
103.638	110.194	108.533	112.548	92.076	100.390	91.918	105.678	75.179	99.741
86.278	117.545	103.044	100.015	103.528	95.165	92.687	99.967	128.228	94.556
75.499	121.945	96.180	95.504	107.019	90.591	115.703	104.134	81.152	97.785
115.719	86.437	79.511	95.345	72.770	84.661	99.697	88.827	99.980	96.146
103.674	91.842	100.058	108.863	95.609	109.709	98.565	111.377	108.943	101.030
96.771	100.801	88.721	104.959	106.034	103.226	113.184	102.613	87.381	108.884
114.126	101.289	90.643	119.257	98.529	95.888	101.185	93.648	98.758	82.427
91.040	98.847	92.621	118.606	102.666	99.615	116.353	95.780	105.204	88.609
110.220	100.883	105.523	102.692	106.331	89.459	92.671	97.054	104.461	79.986
90.599	106.403	96.019	101.310	101.387	85.488	93.030	89.353	95.201	100.127
99.265	83.518	108.571	77.007	103.744	99.501	106.688	90.184	109.808	106.542
92.771	108.155	99.354	94.468	121.523	108.570	89.784	103.248	103.091	101.803
109.609	104.028	93.104	113.668	92.548	115.958	98.935	100.404	101.572	108.550
102.165	73.629	109.563	112.727	90.719	80.954	100.414	87.903	103.758	94.909
105.591	98.543	118.849	97.705	121.423	91.508	97.565	106.981	94.947	101.191
103.234	94.213	110.885	80.009	106.099	110.566	108.742	93.584	94.230	104.525
123.655	86.289	99.821	108.701	114.184	111.870	89.769	91.747	104.205	94.524
99.505	101.592	95.744	87.644	101.671	92.511	101.024	77.655	101.871	111.575
111.492	94.541	92.227	109.001	104.050	98.857	114.979	112.102	104.157	101.345
106.178	105.784	93.819	106.191	101.743	90.407	89.574	82.593	96.149	102.205
107.842	93.592	104.818	115.351	109.326	85.188	102.549	107.177	110.404	114.205
97.693	106.265	122.057	101.385	95.953	102.489	90.553	95.833	91.701	88.631

90.821	95.303	93.507	100.346	102.194	90.807	99.347	96.373	98.712	106.584
106.063	102.631	86.509	101.238	90.115	103.156	127.802	88.353	96.776	116.581
87.931	97.763	95.126	94.810	100.551	65.128	101.353	92.157	95.650	93.859
103.546	108.912	102.639	104.026	102.952	105.906	115.553	105.119	85.897	98.026
107.650	101.764	98.337	72.512	104.292	100.178	90.481	86.526	94.283	90.526
105.221	110.188	88.079	100.876	134.872	105.570	117.921	98.315	102.469	90.402
109.757	82.754	104.187	103.641	127.989	87.477	102.175	93.363	77.926	107.841
95.129	102.344	89.369	101.268	117.506	113.613	108.356	100.928	69.540	73.451
109.169	92.377	95.451	91.882	89.213	103.705	102.059	111.496	92.181	96.079
110.697	86.847	101.210	104.327	98.744	98.250	106.908	106.084	91.706	96.230
96.957	83.419	99.311	99.043	101.811	114.409	101.585	108.904	94.976	90.939
106.345	100.132	93.635	97.375	100.256	114.307	75.196	100.643	104.634	80.939
103.768	77.637	99.113	95.079	87.760	96.284	92.138	107.946	100.020	86.199
112.303	105.136	87.770	98.890	113.449	108.757	103.096	93.712	107.713	97.445
100.329	98.856	105.909	104.449	118.903	113.585	92.924	94.486	85.593	104.294
107.952	97.354	76.073	94.772	91.095	94.151	88.875	100.593	107.191	98.649
87.348	94.196	91.314	91.808	90.126	85.556	91.337	91.155	108.068	92.651
98.349	94.149	95.236	90.787	87.038	83.343	114.017	87.204	101.273	102.709
91.887	107.568	101.042	110.749	100.376	110.729	121.371	96.619	106.659	95.238
98.609	113.617	103.604	111.102	82.610	92.766	90.970	91.768	106.734	109.045
120.920	103.902	103.142	102.117	88.143	103.782	80.977	96.994	99.169	102.154
104.420	117.216	110.100	106.623	98.843	94.411	108.582	79.883	122.448	104.099
104.046	75.620	93.004	90.872	98.450	115.566	103.131	99.275	99.252	91.694
99.005	100.823	101.716	96.725	106.127	96.300	110.570	94.611	84.784	78.399
102.285	95.703	106.620	103.492	114.049	105.029	101.080	111.615	89.365	96.805
83.583	90.215	82.026	91.230	104.861	76.231	83.352	86.941	118.728	89.295
97.276	92.924	99.564	112.045	95.546	97.494	97.923	110.579	90.389	90.833
88.973	91.501	97.889	101.700	87.847	106.012	113.724	98.265	94.613	101.577
98.512	82.927	103.761	97.257	103.325	102.258	112.727	94.363	94.549	96.807
89.203	87.625	100.905	107.601	98.095	82.989	120.042	110.021	85.051	104.957
101.184	112.425	101.288	98.931	104.984	110.298	90.017	94.945	106.337	95.159
92.683	102.294	92.266	87.490	118.995	107.731	105.424	103.963	100.941	102.137
85.016	101.513	110.596	104.373	101.537	86.723	106.993	110.073	132.800	103.732
102.436	110.660	82.056	106.504	74.329	92.634	101.105	82.026	117.033	106.839

92.579	102.102	107.592	97.035	103.737	90.859	97.228	99.487	96.382	115.339
77.485	80.868	106.334	102.226	110.961	107.045	107.508	100.481	101.241	96.418
118.198	112.589	109.148	104.141	100.726	101.716	101.774	101.181	89.959	97.741
93.601	82.784	90.047	104.159	97.059	104.479	100.331	89.012	88.544	110.642
80.806	102.781	84.536	101.272	106.397	89.033	106.988	110.366	97.289	107.982
97.285	120.181	112.408	93.069	86.615	108.217	103.046	109.768	116.411	81.850
104.200	87.278	100.058	89.196	92.711	110.833	120.940	115.057	100.805	91.480
97.124	91.398	99.064	98.250	90.507	103.617	107.775	95.613	99.083	110.929
103.615	85.049	101.129	93.702	112.058	99.332	99.435	94.734	102.335	77.917
92.774	91.873	96.009	92.610	108.286	102.847	102.091	81.092	76.218	94.247
113.138	104.964	87.319	94.564	107.054	107.638	96.666	99.242	90.164	96.909
121.016	105.158	101.615	111.977	108.015	86.591	109.081	92.169	110.148	99.429
103.369	102.206	97.142	112.450	98.457	107.257	115.492	95.331	82.230	100.779
106.782	101.292	90.655	101.384	91.264	111.165	110.011	88.793	113.410	85.683
120.181	104.894	113.100	90.713	91.964	91.739	100.052	101.773	83.932	80.315
94.341	96.648	97.457	81.594	106.994	108.502	92.625	87.220	104.072	81.717
94.877	105.173	104.660	89.143	96.820	109.653	98.132	110.378	117.982	91.958
82.774	94.837	105.384	103.390	112.713	87.328	101.088	97.225	101.238	85.996
89.357	95.026	93.327	108.315	98.945	110.064	95.480	93.122	88.699	101.178

ATTACHMENT # 4b Data Used in the n=2000 Comparison of NTNT to R_v2.12.0

284	449	472	394	340	350	449	352	175	268
293	302	574	377	484	299	460	542	444	471
560	283	436	467	401	325	516	431	376	339
461	404	280	427	347	306	519	442	344	538
500	322	370	333	367	546	449	253	426	391
402	191	390	615	214	198	308	333	285	413
440	298	515	428	423	545	214	183	483	512
222	593	420	481	469	399	429	212	420	448
321	339	263	381	374	594	511	399	437	452
456	442	483	254	481	461	561	460	656	306
470	567	268	338	286	365	509	363	416	361
495	314	325	431	493	601	170	419	556	220
417	492	283	464	457	429	589	440	272	397
656	393	409	506	524	465	536	522	259	565
282	381	252	569	494	316	540	357	422	307
357	441	294	342	431	326	356	340	311	352
403	268	431	374	548	380	298	398	528	463
417	236	322	454	321	394	462	269	363	485
387	258	374	409	273	294	338	327	423	387
399	485	301	500	330	265	476	373	515	474
421	444	337	261	494	409	389	381	313	486
522	361	552	395	478	936	453	519	521	401
396	385	325	363	417	382	170	358	556	385
358	607	615	514	524	288	555	309	339	431
658	327	247	425	384	399	375	409	462	369

267	388	179	391	124	369	477	574	508	425
352	281	273	450	442	541	574	554	422	485
379	233	388	448	317	496	363	292	390	481
404	538	341	298	326	435	458	382	369	562
401	596	495	525	173	432	453	486	466	527
495	392	551	498	376	516	378	615	292	357
385	415	531	311	430	355	319	607	413	322
393	351	384	328	385	295	313	440	459	542
352	249	470	301	291	341	327	548	419	437
337	530	277	483	342	343	252	362	240	382
581	429	453	368	554	484	292	300	233	491
514	252	405	296	398	470	434	493	502	368
365	250	326	422	403	430	416	458	367	339
532	488	452	437	330	513	247	464	561	279
338	348	498	389	622	404	312	237	347	255
446	293	324	296	419	205	595	344	315	375
225	476	550	516	476	398	483	549	439	482
535	276	490	388	492	451	284	310	217	463
347	481	453	418	370	389	512	472	276	327
301	436	369	322	357	339	400	398	425	275
354	361	282	293	558	475	419	487	282	497
329	379	260	522	379	378	506	318	455	335
485	214	577	304	391	425	360	412	389	294
380	358	395	386	448	283	309	541	367	323
563	484	240	424	366	385	507	489	383	338
460	509	324	380	436	277	301	421	323	305
403	268	415	622	349	481	469	507	359	456
182	471	365	254	470	450	302	446	422	358
448	307	420	503	496	345	474	714	280	398
337	402	488	296	500	489	472	465	401	255

404	280	501	445	528	347	441	203	472	604
452	562	591	278	576	371	363	452	388	477
468	347	483	496	480	340	433	621	425	351
292	372	260	336	459	425	514	477	271	492
462	524	492	182	382	540	425	414	489	500
353	484	339	434	307	353	297	422	488	259
359	305	530	360	449	382	243	422	369	394
387	320	544	279	277	352	584	270	331	358
399	262	410	489	444	478	480	245	523	365
490	256	346	437	250	366	342	246	476	272
346	104	281	329	392	398	334	223	345	484
449	432	616	558	487	601	455	450	239	233
342	222	424	363	412	457	548	487	252	469
359	695	343	433	408	502	477	230	393	473
518	499	466	322	291	268	362	510	557	574
381	308	515	314	433	459	593	203	495	536
415	335	465	413	478	345	302	522	413	550
405	401	649	446	336	490	269	366	550	386
452	501	369	335	402	421	561	366	323	510
285	500	407	396	403	385	180	416	402	282
471	395	446	438	445	386	283	210	341	467
499	268	268	334	383	658	346	271	263	527
460	312	321	440	219	399	452	464	611	450
269	318	443	304	470	159	466	537	328	368
371	370	524	426	195	471	287	170	435	485
287	356	453	426	406	355	382	403	523	556
393	419	396	458	484	432	275	484	488	407
412	339	376	416	386	301	297	423	229	494
319	530	449	257	294	367	404	459	356	534
320	556	234	470	337	290	628	439	425	437

335	367	206	238	426	468	370	365	561	431
478	515	595	475	530	580	494	379	445	434
437	325	349	224	243	390	243	498	356	311
437	418	334	315	447	565	405	414	281	323
436	373	616	397	306	554	387	324	351	351
406	464	415	296	363	558	433	409	405	278
318	358	308	178	467	377	412	275	623	466
425	291	334	271	353	536	356	259	407	398
551	346	429	436	411	406	257	472	444	404
358	300	342	366	445	487	392	250	451	416
279	331	349	551	422	422	396	346	331	219
516	490	490	332	407	498	360	363	455	208
516	419	324	258	399	448	287	318	545	522
323	343	344	288	330	496	322	365	321	450
158	484	472	435	508	458	519	461	665	483
203	440	457	412	545	516	261	512	261	506
378	332	334	282	308	437	567	389	403	423
339	244	609	406	614	491	467	534	354	435
487	304	357	602	385	544	324	392	411	438
423	491	147	306	571	499	465	308	402	504
429	265	387	339	490	403	512	430	559	446
406	475	367	553	393	464	263	504	546	446
444	530	334	415	414	362	405	279	320	341
403	388	387	357	419	270	384	327	341	454
451	410	314	338	415	462	488	258	392	288
515	326	407	446	314	564	452	285	305	405
273	439	268	275	457	388	401	322	244	348
426	298	201	441	257	297	409	358	330	412
310	324	558	469	393	305	254	337	505	397
302	412	318	301	543	253	536	328	284	323

305	398	473	386	465	513	555	364	461	450
318	278	429	331	214	483	289	462	256	313
323	273	479	422	427	492	314	149	348	285
362	425	412	465	325	392	384	438	421	463
509	522	441	284	537	584	258	483	381	516
543	491	475	339	361	548	441	487	436	600
552	323	293	467	329	290	582	403	395	291
501	219	547	310	269	364	208	490	231	277
410	338	512	437	342	583	319	479	104	388
403	389	437	342	394	594	421	539	400	341
194	289	422	534	321	619	410	638	445	516
551	636	569	461	451	417	341	488	465	335
415	329	427	355	228	458	365	397	314	397
517	513	647	261	453	543	342	507	413	427
364	524	474	427	382	329	455	526	267	260
365	366	408	489	330	512	406	425	505	378
597	377	447	486	279	270	284	412	587	405
320	311	365	334	430	208	668	549	472	362
495	457	403	218	375	589	339	476	335	437
184	472	272	371	194	699	515	553	486	297
376	504	293	289	470	197	416	326	606	272
327	236	367	349	441	264	554	444	259	296
319	330	576	393	214	345	408	475	413	206
463	200	633	520	398	331	371	528	461	270
606	312	200	406	372	272	353	336	310	199
421	397	276	382	494	370	402	298	374	509
319	385	556	361	379	487	560	461	515	334
339	379	517	486	418	452	356	117	192	314
392	346	324	454	394	526	477	325	414	296
351	375	446	534	392	322	438	590	455	314

435	276	368	521	499	454	505	543	380	419
356	385	374	534	614	282	430	644	199	441
394	431	405	550	421	494	375	434	552	514
408	444	508	291	333	276	349	488	365	555
446	216	505	386	511	387	367	387	427	460
479	327	507	247	478	377	355	327	507	401
488	306	447	419	405	446	299	422	125	311
291	528	522	333	322	418	224	439	381	493
350	471	357	377	416	284	374	310	265	496
607	437	263	449	589	466	366	458	364	465
556	252	464	366	433	470	260	264	368	376
458	478	367	378	576	415	465	428	315	191
497	606	562	473	503	370	462	379	550	535
307	523	376	499	337	347	334	464	292	301
425	472	363	337	320	440	634	565	492	397
410	261	351	450	584	400	395	372	498	327
410	413	561	336	583	225	358	256	529	223
281	514	463	548	582	430	230	284	477	473
404	514	353	564	227	436	341	368	434	650
448	332	342	427	227	611	394	366	282	392
396	298	473	319	257	338	457	425	505	273
458	268	488	228	575	425	358	295	297	495
330	433	317	541	218	448	511	271	249	446
345	441	453	328	516	242	315	345	349	365
376	409	324	543	616	382	378	380	343	315
523	319	407	527	507	277	390	245	505	414
295	596	261	332	219	273	337	321	575	445
577	396	333	200	467	298	422	431	302	319
470	383	494	471	630	412	436	265	746	442
393	316	379	383	329	323	466	321	477	372

401	333	385	546	460	492	474	423	389	364
326	300	376	293	355	437	376	396	256	408
514	255	321	482	505	366	226	620	515	452
347	311	332	162	218	258	554	501	487	562
455	413	301	517	441	342	478	541	500	478
323	405	263	409	430	106	454	337	350	362
331	356	463	283	526	263	416	457	478	440
375	498	464	332	221	369	463	389	431	415
435	439	441	412	380	559	327	373	405	468
370	408	391	413	217	430	383	479	370	223
552	397	285	479	325	442	391	260	433	548
350	384	379	395	404	400	386	505	440	386
279	432	291	294	536	387	303	152	282	414
368	436	505	321	422	324	290	304	423	486
280	432	355	356	264	481	384	449	400	393
401	410	421	496	616	324	472	475	291	405
402	191	570	406	474	369	382	396	454	344
261	479	469	282	315	549	497	342	426	489
459	442	385	583	353	393	509	316	580	548
617	346	380	551	253	275	455	304	352	490
389	454	296	440	519	436	394	497	286	481
459	628	181	567	292	542	598	488	329	537
330	602	476	371	584	326	315	315	392	384
561	364	314	334	406	390	432	261	465	409
457	355	231	463	253	404	355	402	401	336

ATTACHMENT # 5 -- The image below is a copy of the signed validation report from Colonel Colborne (a professional statistical consultant)

TO WHOM IT MAY CONCERN:

On December 4, 2010, Zorich Technical Consulting & Publishing provided me with a copy of the spreadsheet "Normality Tests & Normality Transformations.xls, version 1.10". I have examined its visible and "hidden" worksheets and thereby have been able to confirm the following:

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