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**Function**: gonogo (mlo=0,mhi=0,sg=0,newz=T,reso=0,ln=F,neyer=F)

**Purpose:** A modern sensitivity test tool to conduct a 3pod (default) test or a Neyer test

**Parameters**:

* mlo: scalar quantity
* mhi: scalar quantity ( greater than mlo )
* sg: scalar quantity ( less than (mhi-mlo)/6 )
* newz: logical (T or F)
* reso: scalar quantity ( greater than 0)
* ln: logical (T or F)
* neyer: logical (T or F)

**Starting a test**:

A 3pod test is begun by:

**w**=**gonogo(mlo,mhi,sg)**

A Neyer test is begun by:

**w**=**gonogo(mlo,mhi,sg,neyer=T)**

A "title" entry is requested: make it short & sweet. No need to say it's a 3pod or a Neyer test. No need to say it's done in the log scale either. This info, captured in the call, is automatically PREPENDED to the hopefully succinct title you provide for later use (e.g., in the graphics).

A "units" entry is also requested (used in subsequent axis labelling).

The bulk of subsequent inputs will be at a prompt: "Test at X ~ X0. Enter X & R". X0 will be a recommended stress level. The user will provide two numbers separated by a blank (or blanks). The first number, X, will be the actual stress level. Ideally, X would be X0, but sometimes it is not. Minor differences between X and X0 are not appreciably detrimental to the quality of the test. The second number, Y, is the response, which is either 0 or 1. The rule for deciding which binary response is a 1 is as follows: the probability of getting the Y=1 response will, in theory, increase as stress increases.

For example, in a drop test, as drop height increases, the probability that the unit under test will break should increase. Therefore, the "break" response will be identified as the Y = 1 response and the "no break" response will be identified as the Y=0 response.

The "ln=T" option quietly conducts the test in log(X) units whereas testing is done in X units. The ln=T option is experimental, especially if you continue on with a Phase III.

A "reso=.125" option, e.g., recommends test levels rounded to the nearest one eighth.

**Returned Values:** A list containing 14 named objects, which are:

w$d0: a data frame having colnames(w$d0) = c("X", "Y","COUNT","RX",

"EX","TX","ID"), where the columns contain the sequence of: X's, Y's, 1's, Recommended X's, Exact X's, Transformed X's (used for log transformed data), and ID's (Identifying the test Phase), respectively

w$about: A string containing mlo,mhi,sg,n1,n2,n3,p,lambda, and reso

w$title: A string containing the user defined title

w$units: A string containing the user defined units

w$en: A vector c(n1,n2,n3), the lengths of the 3 Phases (thus far)

w$p: The numeric value of the user define p (0 if not in Phase III)

w$reso: The resolution (0 default for no rounding of recommended stresses)

w$n2n3: An integer that the function fixw may when navigating backwards

w$ln: A logical (T or F), T when method operates on log transformed stresses

w$init: A vector containing the user defined mlo, mhi, and sg

w$lam: A numeric value of the user entry lambda (0 prior to Phase III)

w$neyer: A logical (T or F), T for Neyer Test, F for 3pod (default)

w$savinit: A saved version of w$init

w$jvec: An i by 9 matrix, 0 <= I <= n3+1 documenting the Phase III calculation

**Suspending a test**:

A test is gracefully suspended by entering: an (X,Y) pair with Y=-1; a negative sample size (n2 or n3); or an invalid (p, *λ*) pair (i.e., p < 0, p> 1 or *λ* <0).

When asked for 2 entries, make two entries, otherwise the test ends UNGRACEFULLY.

A successfully suspended (or completed) test is saved in a named list. If the list is named w, then w contains all pertinent information about the test.

**Resuming a test**:

Tests suspended gracefully are saved in the list "w" and may be resumed by the two commands:

**z**=**w; w**=**gonogo(newz**=**F)**

The variable named "z" has a special meaning for "gonogo". With the newz=F option, it looks for a list, saved as "z", in the immediate environment. So, reserve z for that use.

**Test Phase I**:

Both Tests begin by pursuing a region of overlap whereby the smallest responding stress (y=1) is less than the largest non-responding stress (y=0). The number of samples required is random and called n1. 3pod includes an additional 1 or 2 samples beyond n1 in its Phase I.

**Test Phase II**:

Stresses are chosen sequentially in accordance with a D-optimality criterion. Phase II consists of n2 trials, where n2 is user defined at Phase II startup. An n2 = 0 entry is allowed which effectively skips Phase II.

**Test Phase III**:

Phase III stresses are chosen sequentially in accordance with the Skewed Robbins-Munro-Josephs (RMJ) procedure [3]. Three user entries are elicited upon entry into Phase III.

The first is the number of trials to run, n3. An n3 = 0 entry is allowed which effectively skips Phase III and ends the test. A standard Neyer test ends in Phase II with n3 = 0.

The second required entry is p, the percentile being sought.

The final required entry is *λ*: a skewedness coefficient. For p near 0, a large *λ* is recommended. This forces an upward bias whereby bigger upward (than downward) steps are taken, increasing the chance of a response (y=1). For p near 1, a small *λ* is recommended. This forces a downward bias whereby bigger downward steps are taken, increasing the chance of a non-response (y=0). From [3]: "Our simulations do not tell us exactly what value of *λ* should be chosen. The optimal choice of *λ* is a complicated function of various factors, and theory does not help here. Simulations do suggest that a wide range of *λ* values give good performance. To find a good *λ* value requires some tweaking on the part of the experimenter".

**Limitations**:

gonogo test analyses rely primarily on maximum likelihood estimation of parameters of a normal (or log normal) distribution. The interested R savvy user can perform similar analyses and produce comparable graphs based upon another distribution, e.g., the logistic distribution. One function is made available to gonogo users, namely **nyqrda**, which partially makes up for this shortfall.

Confidence limit tables are provided whose rows contain, from left to right, the following six entries: ql, q, qu, pl, p and pu. These numbers are to be understood to be:

the lower confidence limit on the quantile q, the point estimate of the quantile, the upper confidence limit on the quantile q, the lower confidence limit on the percentile p, the point estimate of the percentile p, and the upper confidence limit of the percentile p, respectively. The tables were constructed for a given set of fifteen p's ranging from .000001 to .999999. A user interested in having such a row for an arbitrary p, or having such a row for an arbitrary q would be out of luck with this table.

**New 3pod Implementations**:

Phase I1 has been modified slightly (by Wu, et. al.) to accelerate the expected time to exit when a poor choice of mlo, mhi and sg are made. This modified 3pod is incorporated into gonogo. Later it was found that Phase III wasn't invariant under a rescaling of the stresses (e.g., if stress were measured in inches instead of centimeters). A fix for this problem has been proposed by Wu, et. al. and is also incorporated in gonogo. This last development alters the published 3pod example slightly as follows (changes are in bold):

|  |
| --- |
| **Table 1 Scale-free version (NW1)** |
| X Y COUNT RX EX TX ID  1 5.50000 0 1 5.50000 5.500000 5.50000 I1(iii)  2 16.50000 1 1 16.50000 16.500000 16.50000 I1(iii)  3 11.00000 0 1 11.00000 11.000000 11.00000 I2(ib)  4 13.80000 1 1 13.75000 13.750000 13.80000 I2(ib)  5 10.10000 0 1 10.10000 10.100000 10.10000 I2(id)  6 14.70000 1 1 14.70000 14.700000 14.70000 I2(id)  7 10.40000 1 1 10.40000 10.400000 10.40000 rI2(id)  8 11.70000 1 1 11.70000 11.700000 11.70000 I3  9 9.70000 1 1 9.70000 9.700000 9.70000 I3  10 7.30000 0 1 7.26438 7.264376 7.30000 II1  11 7.80000 0 1 7.75467 7.754671 7.80000 II2  12 8.10000 0 1 8.08350 8.083502 8.10000 II2  13 12.20000 1 1 12.16394 12.163939 12.20000 II2  14 8.50000 0 1 8.51676 8.516761 8.50000 II2  15 11.80000 1 1 11.82596 11.825963 11.80000 II2  16 **11.71060** 1 1 **11.71214\*** 11.712138 11.71060 III1  17 **11.40675** 1 1 11.40675 11.406753 11.40675 III2  18 **11.15419** 0 1 11.15419 11.154188 11.15419 III2  19 **12.46178** 1 1 12.46178 12.461778 12.46178 III2  20 **12.27455** 1 1 12.27455 12.274548 12.27455 III2  21 **12.10918** 1 1 12.10918 12.109181 12.10918 III2  22 **11.96126** 1 1 11.96126 11.961260 11.96126 III2  23 **11.82756** 1 1 11.82756 11.827560 11.82756 III2  24 **11.70565** 1 1 11.70565 11.705654 11.70565 III2  25 **11.59367** 1 1 11.59367 11.593674 11.59367 III2  26 **11.49016** 1 1 11.49016 11.490161 11.49016 III2  27 **11.39395** 1 1 11.39395 11.393952 11.39395 III2  28 **11.30410** 1 1 11.30410 11.304099 11.30410 III2  29 **11.21983** 1 1 11.21983 11.219831 11.21983 III2  30 **11.14050** 1 1 11.14050 11.140500 11.14050 III2  301 0.00000 0 0 **11.06557** 0.000000 0.00000 III3 |

\* **11.71060 was used to begin Phase III with the paper's value. The**

**Gonogo recommendation of 11.71214 is the value we would recommend here.**

**References**:

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10. Barlow, R. E., Bartholomew, D. J., Bremner, J. M., Brunk, H. D., 1972, Statistical Inference under Order Restrictions, J. Wiley & Sons

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**Function**: fixw(w,n)

**Purpose:** Correct an error made in a previous entry

**Parameter**:

* w: a test saved as a list produced by gonogo
* n: a positive integer

**Usage:**

Suppose the test, saved as w, had an error in the nth previous console (i.e., keyboard) entry. The two command syntax (on one line) to go back, fix and continue would be:

**z**=**fixw(w,n); w**=**gonogo(newz**=**F)**

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**Function**: wxdat(i)

**Purpose:** Sample data sets ready to be graphed

**Parameter**:

* i: an integer between 1 and 25

**Usage:**

Twenty five sample sensitivity tests are provided (as lists). To obtain one, execute

**wx**=**wxdat(i)**

wx will be a suitable argument to the graphical function ptest. Some of the trivial data sets (small n, single point overlap, no overlap) provide special insight into the behavior of joint likelihood ratio (LR) confidence bounds featured in Neyer's SenTest™ graphics. Such plots may be obtained with the commands

**ptest(wx,4) and ptest(wx,5)**.

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**Function**: lrmax(w)

**Purpose:** List features of w pertinent to likelihood ratio (LR) confidence intervals and regions

**Parameter**:

* w: a test saved as a list produced by gonogo

This function returns several test data features, including an overlap category "one23" (1 for interval overlap; 2 for point overlap; and 3 for no overlap); c1max and c2max, which indicate when the joint likelihood ratio (LR) confidence region is bounded (conf1 < c1max, or conf2 < c2max); and con, the number of responses divided by the total number tested. "con" determines the axis of the joint LR confidence region. conf1 and conf2 are related via the identity

c1max=pchisq(qchisq(c2max,2),1).

In the various likelihood ratio (LR) graphics provided in the package there is reference to two confidences: c1 (or conf1) and c2 (or conf2). The first, c1, is applicable to two-sided individual confidence intervals about either p, a probability, or q, a quantile. The second, c2, is applicable to the joint confidence region (about the estimated muhat, sigma hat).

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**Function**: **nyqrda**(w$d0, lgit = F, ln = F, conf = 0.95, labx = "", laby = "PROBABILITY OF RESPONSE", zee = 0)

**Purpose:** Fit a normal, logistic, log normal, log logistic distribution to a data set produced by a gonogo test. Additionally, produce a graph of the distribution, its density, and the distribution-free pooled adjacent violator (PAV) solution. No graph titles are provided in this call.

**Parameters**:

* w$d0: the d0 portion of a test saved as the list w produced by gonogo
* lgit = F (default) for a GLM analysis with a probit link, lgit =T for the logit link
* ln = T (not the default) means fit a log normal or log logistic (depending on lgit option)
* conf =.95 (default) means that each GLM curve is a 1-Sided 95% confidence curve
* labx and laby are axis labels
* zee = 0 (the default) means: use the t distribution to compute the GLM confidence curves

zee = 1 means: use the z distribution instead

Having run a viable test one may want certain statistics. The function ***nyqrda*** computes basic information about the maximum likelihood (ML) fit, as follows:

**u**=**nyqrda(w$d0)**

Then, u$a is the intercept, u$b is the slope, u$mu is muhat and u$sig is sighat

Additionally, u$xglm is returned, and R's ***predict*** can be used to compute vertical confidence limits. ***summary***(u$xglm) will produce the following kind of output (here we use the Wu/Tian example, which we have saved as NW1):

|  |
| --- |
| summary(NW1$d0)  Call:  glm(formula = y ~ x, family = binomial(link = probit))  Deviance Residuals:  Min 1Q Median 3Q Max  -1.96146 -0.00057 0.21606 0.39463 1.53625  Coefficients:  Estimate Std. Error z value Pr(>|z|)  (Intercept) -10.8896 4.5494 -2.394 0.01668 \*  x 1.0707 0.4141 2.586 0.00971 \*\*  ---  Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1  (Dispersion parameter for binomial family taken to be 1)  Null deviance: 34.795 on 29 degrees of freedom  Residual deviance: 14.139 on 28 degrees of freedom  AIC: 18.139  Number of Fisher Scoring iterations: 8 |

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**Function**: ptest(w,i)

**Purpose:** Provide eight graphs based upon a given gonogo test

**Parameters**:

* w: a test saved as a list produced by gonogo
* i: an integer between 1 and 8

**Summary:**

|  |  |
| --- | --- |
| **i** | **Graphic** |
| 1 | History plot |
| 2 | Maximum Likelihood Estimates (MLE) of mu and sigma |
| 3 | Response curve (with data) , the Pooled Adjacent Violators (PAV) solution (an optimal step function solution), and  95% 1-Sided ***confidence bounds*** computed via the General Linear Model (GLM) Methodology |
| 4 | A simple visual of the data |
| 5 | Joint likelihood ratio (LR) multi-***confidence bounds*** |
| 6 | Joint & Individual LR multi-***confidence bounds*** |
| **\*** 7 | Joint and/or Individual LR ***confidence bound*** |
| 8 | ***Confidence bounds*** on Probability (p) and Quantile (q)  computed via the methods: LR (if applicable), FM and GLM |

**\*** The likelihood ratio (LR) tools (graphics and tabulations) focus on ***confidence bounds*** (CB's) as featured in Neyer's SenTest™ program. ***Confidence bounds*** computed via two other more commonly used methods are also included. These two methods are dubbed Fisher Matrix (FM) and General Linear Model (GLM).LR ***confidence bounds*** graphed withptest(w,7) are restricted to data sets having interval overlap and conf1 < c1max. LR ***confidence bounds*** may be graphed with ptest(w,i=5) & ptest(w,i=6) for data sets satisfying fewer conditions (e.g., tests having only a single point of overlap, tests having no overlap at all, or when conf1 > c1max).

**An aside**: Critical decisions are often based upon ***Confidence bounds.*** Appendix G of MIL-STD-331C [7] chose NOT to get into this subject. Guidance for decision making based on ***confidence bounds*** would be beneficial. Some say that ***confidence bounds*** in a logistic regression setting must be taken with a large grain of salt. ***Confidence bounds*** are minimized to some extent in D-optimal test strategies.

The following table gives more detail about the graph-producing functions for i= 5, 6, 7 and 8:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Miscellany** | | | | | **i** | | | |
| **Input**  **required** | **Method** | **Joint**  **Region** | **Overlap** | **Outputs** | **5** | **6** | **7** | **8** |
| conf1 |  |  |  |  |  |  |  | X |
| conf1 or conf2 |  |  |  |  | X | X | X |  |
| conf1's or conf2's |  |  |  |  | X | X |  |  |
| p 0 or 0 q |  |  |  |  |  | X | X |  |
| p 0, 0 q or 0 0 |  |  |  |  |  |  | X |  |
|  | LR | bounded | Y |  | X | X | X**\*** | X**\*** |
|  | N |  | X | X |  |  |
|  | unbounded | Y |  | X | X | X**\*** | X**\*** |
|  | N |  | X | X |  |  |
|  | FM |  | Y |  |  |  |  | X**\*** |
|  | GLM |  | Y |  |  |  |  | X**\*** |
|  |  |  |  | joint LR Confidence Bounds | X | X | X |  |
|  |  |  |  | individual LR Confidence Bounds |  | X | X |  |
|  |  |  |  | (x,qnorm(p)), for x=q, qlo & qhi |  | X |  | X |
|  |  |  |  | (q,x),for x=q, qlo & qhi |  | X |  | X |
|  |  |  |  | (q,qnorm(x)), for x=p, plo & phi |  | X |  | X |
|  |  |  |  | 100\*(p,x), for x=p, plo & phi |  | X |  | X |
|  |  |  |  | list returned | X |  |  |  |
|  |  |  |  | text file created |  | X | X | X |

\* interval overlap only

**i=1:** **ptest(w,1) or v**=**ptest(w,1)**

**Return Value (v):** NULL

ptest(w,1) creates a history plot of the data in serial order. During gonogo test conduct, a history plot is generated at practically every keyboard entry. The various phases of the particular test are indicated. Upon test completion, there will appear on the right margin a small black bar on the inside border of the graph: this indicates the location of the next recommended stress, had the test continued. If the test completed Phase III, the maximum likelihood estimates of mu and sigma are used to estimate the percentile of interest (which was entered in as p at the beginning of Phase III). This value will be indicated by a small black bar on the outside border of the graph.

****

**i=2:** **ptest(w,2) or v**=**ptest(w,2)**

**Return Value (v):** A matrix of MLE estimates whose first two columns are: mu and sigma. If the test w has a Phase III with a non-zero p, then a third column will be added for: mu+qnorm(p)\*sig.

This graph depicts the series of maximum likelihood estimates of mu and sigma beginning at the earliest point in the test for which they were estimable.



**i=3:** **ptest(w,3) or v**=**ptest(w,3)**

**Return Value (v):** NULL

This is an enhanced version of a call to nyqrda(w$d0) that has titles added. The confidence curves depicted are two 1-Sided 95% curves (which could be interpreted as a 2-Sided 90% confidence interval) about the predicted response probability p. The GLM portion of cbs.txt (last 15 lines) generated by ptest(w,8) with conf1 = .90 will provide numerical values that match up with the ptest(w,3) graph.



**i=4:** **ptest(w,4) or v**=**ptest(w,4)**

**Return Value (v):** NULL

This is a simple minded visualization of the data helps capture at glance the quality of data residing in the overlap region (if indeed there is an overlap region). Responses (Y=1) appear on the upper line, non-responses on the lower line, and, when there is overlap, verticle lines highlight the region. Exact duplicates are stacked up (or down) at the stress if it was non-responding (responding). This graph is automatically produced when executing wx=wxdat(i), for any I between 1 and 25 (inclusive).



**i=5:** **ptest(w,5) or v**=**ptest(w,5)**

**Return Value (v):**

A list with three major components: the first contains the plotted values for all of the bounded curves; the second contains the plotted values for all of the unbounded curves; and the last contains the plot range.

**Inputs**: conf1's (separated by blanks), for example: .5 .7 .8 .9 .95 .99

The conf1's would ultimately be confidences applicable to statements about the **Individual** m (mean) or **Individual** s (standard deviation). Such confidences are the ones the user should be familiar with and have no problem defining.

In the likelihood ratio (LR) methodology, **Individual** confidence bounds at conf1 are derived from a **Joint** likelihood ratio confidence region with associated confidence conf2, where

**conf2 = pchisq(qchisq(conf1,df=1),df=2).**

**Output:** Joint Likelihood Ratio (LR) curves (depicted as s versus m).

**Interpretation:**

An Individual 2-Sided confidence interval about m (mean) at confidence conf1 is depicted by examining the Joint likelihood ratio confidence region associated with conf2 and picking out the minimum and maximum value for m. That's what's involved in computing confidence intervals in accordance with this LR methodology.

Sometimes the Joint region at conf2 is not bounded (i.e., a closed finite region). Actually, for any set of data you can find a value of conf2 such that the Joint region is unbounded. The rule is this: when cconf2 < c2max, the Joint region is bounded. When conf2 >= c2max, then the Joint region is unbounded.

In case you're wondering when the Joint LR confidence region exists: It does whenever there's at least 2 unique X's and there's 2 unique Y's. And, when it does exist, you may like to what c2max is. The formula is described below:

Let L(Our Data | M) be the probability of getting the (X,Y)'s we got given model M.

L is called the likelihood of Our Data given model M.

Let Lm =L(Our Data | M = MLE best fit normal) , and

Lc = L(Data | M=C), where C = sum(Y)/length(Y)

Then, c2max = pchisq(2\*(log(Lm/Lc))) if Our Data has any overlap, and

c2max = 1 - 4\*exp(log(Lc)) if Our Data has no overlap



**i=6:** **ptest(w,6) or v**=**ptest(w,6)**

**Return Value (v):** NULL

**Inputs**: conf1's (separated by blanks), for example: .5 .6 .7 .8 .9 .95 .99

p and q (one must be 0), for example: .75 0

**Output:** A text file called "lrcb.txt containing: for each confidence entered lines are generated (one for each of 49 p's ranging from .000001 to .999999). The text is similar to that file generated by pest(w,8), but more voluminous. For that reason, an example won't be reproduced here.

4 plots: 1 containing the Joint LR regions, 2 containing the resulting Individual LR Regions (1 for p, the other for q), and lastly, 1 containing the resulting Linearized LR confidence limit curves



**i=7:** **ptest(w,7) or v**=**ptest(w,7)**

**Return Value (v):** A 45 X 6 matrix

**Inputs**: conf1 and conf2 (one must be 0), for example: .9 0

p and q (at least one must be 0), for example: .75 0

**Output:** AGraph (similar to ptest(w,6) but without the 4th one), and this graph handles just one conf1 (or conf2)

****

**i=8:** **ptest(w,8) or v**=**ptest(w,8)**

**Return Value (v):** same 45 by 6 matrix as in ptest(w,7)

**Inputs**: conf1, for example: .9

**Output:** four visuals visual of the above matrix

\*\*\*\* (Graph converts heading to 2-Sided 100\*(1+conf1)/2) \*\*\*\*

A conf1 entry is required, generating 4 plots depicting the 3 differently computed confidence intervals (FM, LR and GLM).

The conf1 entry applies to the 2-sided situation. The plot depicts TWO 1-sided limits each having (1+conf1)/2 confidence. So, if you're interested in 1-sided limits only, say at 90% confidence, you would want to enter .80 at the prompt for conf1.

Besides a plot, ptest(w,8) also creates a text file cbs.txt in your R working directory. What you may want do with cbs.txt (outside of R) is: copy its contents, paste it into a word document, and highlight what you have just pasted. Next, select the Table tab; select Table; and select Convert Text to Table. For the record: the 1st 15 lines of cbs.txt are computed using Fisher Matrix (FM) theory; the 2nd group is computed using likelihood ratio (LR) theory; and the 3rd group is computed using general linear model (GLM) theory (here, R's function "predict" is employed for bounds on p whereas a generic version of dose.p is employed for bounds on q).

The resulting table produced from cbs.txt yields: vertical limits (pl,pu) about p (for various p's) and horizontal limits (ql,qu) about q (for various q's).

Of the three types of confidence bounds, LR bounds are the only ones having the property that its curves about p (in the up down direction) are the same as its curves bounding q (in the left right direction).

The first result of executing ptest(NW1,8) (NW1 is the saved new version of the Wu/Tian example, Table 1 of [1]) and entering conf1=.90 is the production of the following graph:



The second result that is obtained (after processing cbs.txt as described above, and making a few embellishments) is the table below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Method** | **ql** | **q** | **qh** | **pl** | **p** | **pu** |
| **FM** | 2.361065 | 5.730874 | 9.100683 | 0 | 0.000001 | 0.000019 |
| 3.102844 | 6.18714 | 9.271437 | 0 | 0.00001 | 0.000158 |
| 3.930523 | 6.69696 | 9.463397 | 0 | 0.0001 | 0.001273 |
| 4.881777 | 7.284214 | 9.686651 | 0 | 0.001 | 0.009661 |
| 6.03258 | 7.997644 | 9.962709 | 0 | 0.01 | 0.066077 |
| 7.589317 | 8.973433 | 10.357549 | 0 | 0.1 | 0.360089 |
| 8.473065 | 9.540399 | 10.607733 | 0 | 0.25 | 0.61316 |
| 9.407798 | 10.170339 | 10.932881 | 0.174276 | 0.5 | 0.825724 |
| 10.213007 | 10.80028 | 11.387553 | 0.550181 | 0.75 | 0.949819 |
| 10.729627 | 11.367246 | 12.004865 | 0.780185 | 0.9 | 1 |
| 11.283857 | 12.343034 | 13.402211 | 0.959774 | 0.99 | 1 |
| 11.596158 | 13.056465 | 14.516772 | 0.993735 | 0.999 | 1 |
| 11.834443 | 13.643718 | 15.452994 | 0.999133 | 0.9999 | 1 |
| 12.034496 | 14.153538 | 16.272581 | 0.999888 | 0.99999 | 1 |
| 12.210275 | 14.609805 | 17.009335 | 0.999986 | 0.999999 | 1 |
| **LR** | 0.472863 | 5.730874 | 8.0803 | 0 | 0.000001 | 0.026292 |
| 1.390702 | 6.18714 | 8.336612 | 0 | 0.00001 | 0.045465 |
| 2.413503 | 6.69696 | 8.624101 | 0 | 0.0001 | 0.078954 |
| 3.589675 | 7.284214 | 8.957452 | 0 | 0.001 | 0.138194 |
| 5.012542 | 7.997644 | 9.367294 | 0 | 0.01 | 0.245615 |
| 6.934724 | 8.973433 | 9.945904 | 0.001106 | 0.1 | 0.454026 |
| 8.022125 | 9.540399 | 10.304244 | 0.022301 | 0.25 | 0.59795 |
| 9.159269 | 10.170339 | 10.755014 | 0.185142 | 0.5 | 0.762821 |
| 10.120302 | 10.80028 | 11.387803 | 0.523802 | 0.75 | 0.906658 |
| 10.765502 | 11.367246 | 12.256497 | 0.744507 | 0.9 | 0.981137 |
| 11.522702 | 12.343034 | 14.066165 | 0.909083 | 0.99 | 0.999921 |
| 11.965315 | 13.056465 | 15.462946 | 0.960618 | 0.999 | 1 |
| 12.311225 | 13.643718 | 16.628065 | 0.98174 | 0.9999 | 1 |
| 12.6053 | 14.153538 | 17.64554 | 0.991218 | 0.99999 | 1 |
| 12.865596 | 14.609805 | 18.558828 | 0.995676 | 0.999999 | 1 |
| **GLM** | 2.245931 | 5.730874 | 9.215817 | 0 | 0.000001 | 0.153384 |
| 2.997464 | 6.18714 | 9.376817 | 0 | 0.00001 | 0.197763 |
| 3.836002 | 6.69696 | 9.557918 | 0 | 0.0001 | 0.255998 |
| 4.799692 | 7.284214 | 9.768736 | 0 | 0.001 | 0.333596 |
| 5.965437 | 7.997644 | 10.029851 | 0.000003 | 0.01 | 0.440215 |
| 7.542021 | 8.973433 | 10.404845 | 0.002445 | 0.1 | 0.599128 |
| 8.43659 | 9.540399 | 10.644208 | 0.031701 | 0.25 | 0.694056 |
| 9.381732 | 10.170339 | 10.958947 | 0.199229 | 0.5 | 0.800771 |
| 10.192925 | 10.80028 | 11.407634 | 0.509647 | 0.75 | 0.907381 |
| 10.707826 | 11.367246 | 12.026665 | 0.717523 | 0.9 | 0.976572 |
| 11.24766 | 12.343034 | 13.438408 | 0.875649 | 0.99 | 0.999767 |
| 11.546259 | 13.056465 | 14.566671 | 0.929655 | 0.999 | 0.999999 |
| 11.772622 | 13.643718 | 15.514815 | 0.956882 | 0.9999 | 1 |
| 11.962093 | 14.153538 | 16.344984 | 0.972474 | 0.99999 | 1 |
| 12.128289 | 14.609805 | 17.09132 | 0.981977 | 0.999999 | 1 |

A few examples of how the table may be used (with GLM entries) are:

Pr[Y=1 response | X = 10.8] ~ .75

A lower 95% confidence limit on the above probability is about .510

A lower 95% confidence limit on the 1 in a 1000 point is about 4.80

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*gonogoUserFunctions.docx*