RPNStat: RPN Statistical Programs for the HP49G

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Introduction

This package provides a directory tree for the HP49G calculator which implements several statistical algorithms which take their input solely from the stack. These programs are unlike many other statistical programs (built in or third party) in that they do not rely upon stored "magic variables" (such as "ÓDAT" or "ÓPAR"). Furthermore, I have attempted to fully document the commands with this PDF documentation (developed in Microsoft Word 2000) using a format substantially similar to the HP Advanced User's Guide.

These programs were written by the author for use in a Data Analysis class for an Executive MBA program taught by Aaron Tenenbein of New York University's Stern School of Business. The author hopes that they will be of use to some people.

The latest version is available at http://www.admiral.com/.

Overview

After installation, the user will have a new directory called **RPNStat**. This directory contains several subdirectories, each of which implements a subset of the total functionality. These subdirectories are:

- **Pctile**: Calculates percentiles of a multi-column data set. (**PctM, Pct1**)
- **WeightedStat**: Calculates weighted means and weighted standard deviations. (**WMean, Wó**)
- **Binomial**: Calculates binomial distribution probabilities, means, standard deviations, and tables. (**BiDist, BiMean, Bió, BiProb**)
- **IntervalEstimation**: Calculates z- and t-table intervals/areas. (**zTable, zInv, tTable, tInv**)

All the programs were written in UserRPL and were not tested with extremely large inputs in the cases where matrices were used (about the largest was 100 rows and a few columns). The routines have not been optimized for speed or size, but for comprehensibility. If the user wishes, he can view the source along with my comments in the form "COMMENT" DROP. If these are helpful to anyone else writing their own code, the author is pleased.

The programs can be moved and used individually, and have no cross dependencies except for **PctM** and **Pct1** must be in the same directory (sorry).

Installation

Using the HP Graphing Calculator PC Connectivity Kit 3.0r2, simply drag the enclosed "RPNStat" file to the appropriate location on your calculator.

Acknowledgements

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- **Roger Metcalf**, metcalfdds@aol.com: Roger provided several responses to inquiries about current HP49 statistics programs and how to implement some features.
- **Christian Meland**: Christian went so far as to even provide some sample code for the ROOT command which was used in several of the commands described below.
- **Tom Sears**: Tom showed me a way of un-losing my programs when I accidentally blue-variable: Press blue-ANS STO blue-ANS. Flag 55 must be clear (default) to enable LASTARG.
- **Diego Berge**: Explained a few ways of writing UserRPL programs on a PC without having any special software.
- **Virgil,** vmhjr@frii.com: Virgil showed me some code for the "inverse standard normal" which I didn't quite understand, but more importantly explained the ROOT command much more fully than any HP manual.
- **Scott Guth,** saguth@msn.com: Scott wrote the Stat49 package which would have solved all my problems if only it were fully RPN and well documented. An extremely full featured package, it probably does everything mine does (and a ton more), but forces you to navigate a whole bunch of CHOOSE menus and INFORM screens: not the easiest thing when you have to do many statistical operations quickly and repeatedly.

Commands

These commands are listed alphabetically and include a few commands which are native HP49G commands but which are reasonably similar to the provided programs. I have attempted to mimic the appearance of the HP49 Advanced User's Guide.

BiDist

Type: New command
Description: Returns the probabilities of n successes for a binomial distribution of probability p for a single success. The result is a two column by $(n + 1)$ row matrix with the first column the number of successes and the second the probability of exactly that many successes out of n trials.
Input/Output: p must be in the range [0.0, 1.0]. n must be positive.

Level 2	Level 1		Level 1
P	n	$\rightarrow$	probability matrix

See also: BiMean, Bió, BiProb

BiMean

Type: New command
Description: Returns the average number of successes in n trials for a binomial distribution of probability p for a single success.
Input/Output: p must be in the range [0.0, 1.0]. n must be positive.

Level 2	Level 1		Level 1
p	*n*	→	binomial mean

See also: BiDist, Bió, BiProb

BiProb

Type: New command

Description: Returns the probability of exactly *x* successes out of *n* trials for a binomial distribution of probability *p* for a single success.

Input/Output: *x* must be nonnegative and no greater than *n*. *p* must be in the range [0.0, 1.0]. *n* must be positive.

Level 3	Level 2	Level 1		Level 1
P	*N*	*x*	→	probability

See also: BiDist, Bió, BiMean

Bió

Type: New command

Description: Returns the standard deviation of the distribution of successes of *n* trials for a binomial distribution of probability *p* for a single success.

Input/Output: *p* must be in the range [0.0, 1.0]. *n* must be positive.

Level 2	Level 1		Level 1
p	*n*	→	binomial std. dev.

See also: BiDist, BiMean, BiProb

PctM

Type: New command

Description: Calculates the percentile *p* of each column of a matrix, and returns a single row matrix with the result. Uses the program Pct1 to calculate individual column percentiles.

Input/Output: The percentile should be in the range (0.0, 100.0).

Level 2	Level 1		Level 1
matrix	*p*	→	requested percentiles

See also:

Future enhancements: Fully document the Pct1 program.

tInv

Type: New command

Description: Returns the t-value in the Student's t-distribution for a given number of degrees of freedom for the area to the left of the desired t-value (standard deviation). This command is the inverse of the tTable command. This command is usually done as a table lookup by hand as there is no mathematical inverse of the Student's t-distribution. (In the picture for zTable, this would be the area to the right of the red shaded area.)

Input/Output: The t-value input must be in the range [0.0, 1.0].

Level 2	Level 1		Level 1
Degrees of freedom	t-area (right)	→	t-value

See also: tTable, UTPT

tTable

Type: New command
Description: Exact copy of the UTPT command with a new name for ease of reference.

UTPN

Type: Built-in command
Description: Returns the (non-shaded) area to the right of the line at point z in the graph for zTable. This routine allows specification of the mean and standard deviation for any normal distribution. For the standard normal (as used in the zTable and zInv commands), use a mean of zero and a standard deviation of one.
Input/Output: The output will be in the range [0.0, 1.0].

Level 3	Level 2	Level 1		Level 1
ì (mean)	ó (std. dev.)	z-value	→	z-area (right)

See also: zInv, zTable, NDIST

UTPT

Type: Built-in command
Description: Returns the area in the Student's t-distribution for a given number of degrees of freedom to the left of the given t-value (standard deviation).
Input/Output: The output will be in the range [0.0, 1.0].

Level 2	Level 1		Level 1
Degrees of freedom	t-value	→	t-area (right)

See also: tTable, tInv

WMean

Type: New command
Description: Returns the weighted mean of the two column matrix argument. The first column is the value, and the second column is the weight.
Input/Output: The sum of all values in the weight column must be one.

Level 1		Level 1
weighted statistic matrix	→	weighted mean

See also: Wó
Future enhancements: The requirement that the weights must sum to one may be relaxed.

Wó

Type: New command
Description: Returns the weighted standard deviation of the two column matrix argument. The first column is the value, and the second column is the weight.
Input/Output: The sum of all values in the weight column must be one.

Level 1		Level 1
weighted statistic matrix	→	weighted std. dev.

See also: WMean
Future enhancements: The requirement that the weights must sum to one may be relaxed.

zInv

Type: New command

Description: Returns the z-value for a given area. This command is the inverse of the zTable command. This command is usually done as a table lookup by hand as there is no mathematical inverse of the normal distribution function.

Input/Output: The input must be in the range [-0.5, 0.5].

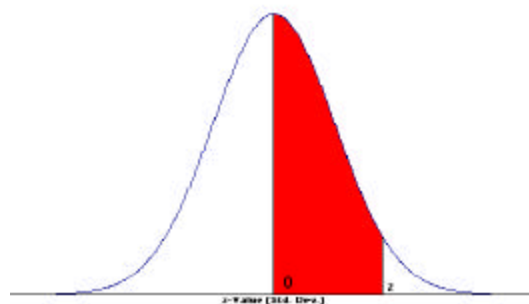| Level 1		Level 1
z area	→	z

See also: zInv, UTPN, NDIST

References: Hildebrand/Ott, *Basic Statistical Ideas for Managers*. Page 636: Table 3: Normal Curve areas.

zTable

Type: New command

Description: Returns the normal curve area corresponding to the passed z value. z is the number of standard deviations from the mean. In the picture, this command returns the shaded area of the standard normal. The standard normal has a mean of zero and a standard deviation of one.

Input/Output: The output value will be in the range [-0.5, 0.5].

Level 1		Level 1
Z	→	z area (shaded)

See also: zInv, UTPN, NDIST

References: Hildebrand/Ott, *Basic Statistical Ideas for Managers*. Page 636: Table 3: Normal Curve areas.