

# TI-83 Users Guide

to accompany

**Statistics: Unlocking the Power of Data**

**by Lock, Lock, Lock, Lock, and Lock**



## Getting Started

### Entering Data

Use the **STAT** menu, then select **EDIT** and hit Enter.

Enter data for a single variable in L1, using the arrow keys to move up and down in the column.

To clear data in order to enter new data:

Use the arrow keys to move the cursor all the way up over L1, then hit CLEAR then ENTER.

Troubleshooting: If you try to enter your data and L1 is not there (and the left-most column is labeled L2 or higher), go to STAT, then on the EDIT menu, select 5: SetUpEditor and hit enter and then enter again. (It will say “Done”.) You will now have L1 back in its rightful place.

## Chapter 2: Describing Data

### Single Quantitative Variable (Sections 2.2, 2.3, 2.4)

Enter Data: Enter data in the column labeled L1, as described earlier.

Summary Statistics: Use the **STAT** menu and move the cursor over **CALC** and hit enter. You may now select from the options given. For a single quantitative variable, select **1: 1-Var Stats**, so hit enter (or 1), then enter again.

You will see lots of statistics for the data, including the sample mean ( $\bar{x}$ ) and the sample standard deviation ( $S_x$ ). The down arrow next to  $n$  indicates that more statistics are given below. Use the arrow keys to scroll down and you will find the five-number summary there.

Graphs: Use the **STAT PLOT** menu ( $2^{\text{nd}}$  “Y =”) and then hit enter to select the first option. (You will see “Plot1 Plot2 Plot3” across the top of the screen.) Use the arrow keys to move down one row and, if necessary, move the cursor over “On” and hit enter to turn the plot on. Use the arrow keys to move the cursor down to the next line to select the graph you want: move the cursor over the histogram (third option – first row, far right) or the boxplot (fourth option – second row, far left) and hit enter. Press **ZOOM** then 9 and you will see the graph.

Select **TRACE** and use the arrow keys to see specific values. To leave the graph window, select **Quit** ( $2^{\text{nd}}$  – Mode).

## Chapter 2: Describing Data

### Two Quantitative Variables (Sections 2.5, 2.6)

Enter Data: Enter data as described earlier, making sure that the explanatory variable (X) is in column L1 and the response variable (Y) is in column L2.

Summary Statistics: Use the **STAT** menu and move the cursor over **CALC** and hit enter. You may now select from the options given. For two quantitative variables, select **8: LinReg(a+bx)**, so hit 8 or move the cursor to this option and press enter, then press enter again. You will see values for the intercept  $a$  and the slope  $b$ , along with the value for the correlation  $r$ . (If you don't see the correlation, see *Note 2* below.)

*Note 1:* You could also select option 4, which is "LinReg(ax+b)". This one is fine also, but pay attention to which one you picked so that you get the slope and the intercept in their correct locations.

*Note 2:* If you cannot see the value of the correlation  $r$  when you select Linear Regression, you need to do the following. (You only need to do this once, to reset your calculator.) Press the catalog button (2<sup>nd</sup> function then zero). Scroll down until the cursor is pointing to DiagnosticOn, and press enter. Press enter again (it will say Done). Now you should see the correlation automatically whenever you select Linear Regression.

Graphs: Use the **STAT PLOT** menu (2<sup>nd</sup> "Y=") and then hit enter to select the first option. (You will see "Plot1 Plot2 Plot3" across the top of the screen.) Use the arrow keys to move down one row and, if necessary, move the cursor over "On" and hit enter to turn the plot on. Use the arrow keys to move the cursor down to the next line to select the graph you want: move the cursor over the scatterplot (first option – first row, on left). Press ZOOM then 9 and you will see the graph.

Select TRACE and use the arrow keys to see specific values. To leave the graph window, select Quit (2<sup>nd</sup> – Mode).

## Chapter 5: The Normal Distribution

### Standard Normal:

Finding probabilities or areas on a Standard Normal:

Select **DISTR** (using 2<sup>nd</sup> – VARS), then select **2: normalcdf** and input a lower bound and upper bound for the area you wish to find. The command

**normalcdf**( *lowerbound*, *upperbound* )

gives the area between the lower bound and the upper bound. If you want everything to the right or left of a value, select a lower or upper bound that is extreme (such as -100 or 100).

*Example 1:* **normalcdf**( **-1, 1** ) gives the area between -1 and 1 in a standard normal distribution.

*Example 2:* **normalcdf**( **2.45, 100** ) gives the area above 2.45 in a standard normal distribution (that is, the area in the right tail of the distribution beyond 2.45).

*Example 2:* **normalcdf**( **-100, -3.1** ) gives the area below -3.1 in a standard normal distribution (that is, the area in the left tail of the distribution beyond -3.1).

Finding cutoff values on a Standard Normal:

Select **DISTR** (using 2<sup>nd</sup> – VARS), then select **3: invNorm**. This function always gives the cutoff for a **left tail area**. The command

**invNorm**( *left tail area* )

gives the cutoff with the given area to the left of it. Areas, of course, always must be between 0 and 1. To find a cutoff for a right tail or two-tails, figure out the area to the left using the fact that the total area is 1, and use the appropriate area to the left.

*Example 1:* **invNorm**(**0.05**) gives the value with 5% below it in a standard normal distribution.

*Example 2:* To find the cutoff value with 15% to the right of it, we note that this is the same as the cutoff value with 85% to the left of it, and find **invNorm**(**0.85**).

*Example 2:* To find the symmetric cutoff values with 95% between them, we note that the area in each of the tails must be 0.025, and find **invNorm**(**0.025**).

## Chapter 5: The Normal Distribution

### Other Normal Distributions:

Finding probabilities or areas for any normal distribution:

Select **DISTR** (using 2<sup>nd</sup> – VARS), then select **2: normalcdf** and input a lower bound and upper bound for the area you wish to find, as well as the mean and standard deviation of the normal distribution. The command

**normalcdf**( *lowerbound, upperbound, mean, standard deviation* )

gives the area between the lower bound and upper bound in a normal distribution with the given mean and standard deviation. If you want everything to the right or left of a value, select a lower or upper bound that is extreme (at least 4 or 5 standard deviations from the mean). (As we see on the previous page, for the standard normal, you can omit the mean 0 and standard deviation 1.)

*Example 1:* **normalcdf**(77,80,75,5) finds the area between 77 and 80 in a normal distribution with mean 75 and standard deviation 5.

*Example 2:* **normalcdf**(58,100,50,6) finds the area above 58 in the right tail of a normal distribution with mean 50 and standard deviation 3.

Finding cutoff values on any normal distribution:

Select **DISTR** (using 2<sup>nd</sup> – VARS), then select **3: invNorm** and input a **left tail area**, as well as the mean and standard deviation of the normal distribution. The command

**invNorm**( *left tail area, mean, standard deviation* )

gives the cutoff value with the given area to the left of it. Areas, of course, always must be between 0 and 1. To find a cutoff for a right tail or two-tails, figure out the area to the left and use that. (As we see on the previous page, for the standard normal, you can omit the mean 0 and standard deviation 1.)

*Example 1:* **invNorm**(0.25,75,5) gives the value with 25% below it in a normal distribution with mean 75 and standard deviation 5.

*Example 2:* To find the value with 20% above it in a normal distribution with mean 10 and standard deviation 2, note that if it has 20% above it then it has 80% below it, and use **invNorm**(0.80,10,2).

*Example 3:* To find the symmetric cutoff values with 90% between them in a standard normal with mean 25 and standard deviation 10, we note that the area in each of the tails must be 0.05, and use **invNorm**(0.05,25,10).

## Chapter 5: The Normal Distribution

### Using the DRAW Command to find Probabilities on a Normal Distribution:

The DRAW command gives the same information as normalcdf and also provides a graph, giving an alternate way to find areas or probabilities for a normal distribution.

To view the graph, you must make sure the window is appropriate for seeing the normal distribution you choose. Select WINDOW from the menu of blue buttons just below the screen and edit the values. For a standard normal, a window of -3 to 3 for X and 0 to 0.5 for Y works well.

Select **DISTR** (using 2<sup>nd</sup> – VARS) and move the cursor to the right over **DRAW**. Off the DRAW menu, select **1: ShadeNorm** and Enter.

For a standard normal area, input the lower bound and upper bound of the area you want, in the form:

**ShadeNorm**( *lowerbound, upperbound* )

You will see the normal curve with the appropriate area shaded and the area given.

For another normal area, input the lower bound and upper bound of the area you want, as well as the mean and standard deviation of the normal distribution, in the form:

**ShadeNorm**( *lowerbound, upperbound, mean, standard deviation* )

You will see the normal curve with the appropriate area shaded and the area given. (Make sure the window is correct to see the curve.)

## Chapter 6: The t-Distribution

### Finding probabilities or areas for a t-distribution:

Select **DISTR** (using 2<sup>nd</sup> – VARS), then select **5: tcdf** and input a lower bound and upper bound for the area you wish to find, as well as the degrees of freedom for the t-distribution. The command

**tcdf**( lowerbound, upperbound, df )

gives the area between the lower bound and upper bound in a t-distribution with the given degrees of freedom (*df*). If you want everything to the right or left of a value, select a lower or upper bound that is extreme (such as -100 or 100).

*Example 1: tcdf(-1,1,50)* gives the area between -1 and 1 in a t-distribution with  $df = 50$ .

*Example 2: tcdf(2.45,100,15)* gives the area above 2.45 in a t-distribution with  $df = 15$ .

Note: The same information can also be found using the DRAW option under DISTR. See the description for the normal distribution.

### Finding cutoff values on a t-Distribution:

Unfortunately, **there is no command to do this on a standard TI-83 calculator**, although future calculators hopefully will have an **invt** command. Other models (such as a TI-84) may have an **invt** command. If it appears on your menu, it works the same as invNorm, described earlier, with the degrees of freedom added: **invt**( left tail area, df).

It is possible, but a bit awkward, to find values for **invt** on a TI-83. One option is to input a program to calculate the inverse t values. Programs for this can be found on the web. Another option, which does not require inputting a program, follows. Usually, we would use the inverse t command to find a confidence interval, and we can find the  $t^*$  values by going in reverse. Here are the instructions:

- Select STAT then move the cursor over TESTS, and select option 8: TInterval.
- Keep “Stats” highlighted, and use the arrow keys to move to the different inputs.
- Enter 0 for  $\bar{x}$
- Enter  $\sqrt{n}$  for  $S_x$  where  $n = df + 1$
- Enter  $df + 1$  for  $n$
- Enter the confidence level desired (or relevant confidence level for the tail area desired)
- Put the cursor over Calculate and hit Enter.
- You will see both  $t^*$  values.

Hopefully, future TI calculators will all have an invt command!

## Chapters 7 – 10: The $\chi^2$ and F-Distributions

### The $\chi^2$ Distribution:

Finding probabilities or areas for a chi-square distribution:

Select **DISTR** (using 2<sup>nd</sup> – VARS), then select **7:  $\chi^2$ cdf** and input a lower bound and upper bound for the area you wish to find, as well as the degrees of freedom for the distribution. The command

$$\chi^2\text{cdf}( \text{lowerbound}, \text{upperbound}, \text{df} )$$

gives the area between the lower bound and upper bound in a  $\chi^2$ -distribution with the given degrees of freedom (*df*). In a  $\chi^2$  test, you will usually want everything to the right of a test statistic, so select an upper bound that is extreme (such as 100).

*Example:*  $\chi^2\text{cdf}(5.2,100,3)$  gives the area above 5.2 in a  $\chi^2$ -distribution with  $df = 3$ .

Note: The same information can also be found using the DRAW option under DISTR. See the description for the normal distribution.

### The F-Distribution:

Finding probabilities or areas for an F-distribution:

Select **DISTR** (using 2<sup>nd</sup> – VARS), then select **9: Fcdf** and input a lower bound and upper bound for the area you wish to find, as well as both degrees of freedom for the distribution. The command

$$\text{Fcdf}( \text{lowerbound}, \text{upperbound}, \text{df}(\text{numerator}), \text{df}(\text{denominator}) )$$

gives the area between the lower bound and upper bound in an F-distribution with the given degrees of freedom (*df*). In an ANOVA test, you will usually want everything to the right of a test statistic, so select an upper bound that is extreme (such as 100).

*Example:*  $\text{Fcdf}(5.2,100,3,46)$  gives the area above 5.2 in an F-distribution with numerator  $df = 3$  and denominator  $df = 46$ .

Note: The same information can also be found using the DRAW option under DISTR. See the description for the normal distribution.

## Tests and Intervals for Means and Proportions

### Inference for Means

To find confidence intervals and p-values using your graphing calculator:

Select **STAT**, then **TESTS**, then select one of the following:

- **8: TInterval**                      for a confidence interval for a mean
- **2: T-Test**                            for a hypothesis test for a mean
- **0: 2-SampTInterval**            for a confidence interval for a difference in means
- **4: 2-SampTTest**                 for a hypothesis test for a difference in means

If you will enter the summary statistics, leave “Stats” highlighted at the top and use the arrow keys to enter all the requested information and then, with the cursor over “Calculate”, hit enter. You will see the confidence interval or, for a test, the test statistic and the p-value.

If you have previously entered the raw data in the L1 column (and the L2 column for difference in means), move the cursor at the top over “Data” to highlight it and hit Enter. Scroll down to highlight “Calculate” (first changing the alternative hypothesis to one-sided if desired) and hit enter. You will see the confidence interval or, for a test, the test statistic and the p-value.

### Inference for Proportions

To find confidence intervals and p-values using your graphing calculator:

Select **STAT**, then **TESTS**, then select one of the following:

- **A: 1-PropZInterval**            for a confidence interval for a proportion
- **5: 1-PropZTest**                    for a hypothesis test for a proportion
- **B: 2-PropZInterval**            for a confidence interval for a difference in proportions
- **6: 2-PropZTest**                 for a hypothesis test for a difference in proportions

Enter the count and the sample size for the proportion (or the two proportions) and then, with the cursor over “Calculate”, hit enter. You will see the confidence interval or, for a test, the test statistic and the p-value.