

A Quick Guide to the Statistical Capabilities of the TI-83, TI-83+, TI-84, and TI-84+

(04/2012)

Getting started:

Let's enter some specific data into L1, L2, and L3, for our problems in the packet:

Go to STAT – EDIT – Edit: Enter the data below into **L1**:

117	122	125	134	138	146
139	143	148	148	149	172

Go to STAT – EDIT – Edit. Enter this data into **L2**: 0 1 2 3 4

Go to STAT – EDIT – Edit. Enter this data into **L3**: 4 5 8 2 1

Note: When you are working in STAT and want to go back to the home screen, press **2nd** and **QUIT**, which is located above the MODE button.

Histograms

1. Draw a histogram for the data you have entered into **L1**. The data represent the weights of all students in a weight training class. Use these **classes**: 110-119, 120-129, 130-139, 140-149, 150-159, 160-169, 170-179.

Set the Window:

The key facts for setting a Window for a histogram are:

- Xmin must be the *smallest* number in the first *class*.
- Xmax must be large enough to accommodate the largest value in the list.
- Xscl must be the *size* of the *classes*.
- Ymin, Ymax, and Yscl must relate to the frequencies.

A suggested window for the L1 data is:

Xmin = 110 Ymin = -2
Xmax = 190 Ymax = 7
Xscl = 10 Yscl = 1

Draw the histogram:

STAT PLOTS – Plot1 – On. Choose the histogram picture. Xlist is L1, Freq is 1. Press the GRAPH key at the top right of the keyboard.

(If an error message occurs, check to see if you have any other active graphing situations open, such as another StatPlot that is on, or an active function in the Y= window. Turn off the other graphs.)

Check out what is going on in your histogram: Press the TRACE key and then the right arrow, noticing the significance of the numbers that are indicated at the bottom of the screen.

2. Draw a **frequency histogram** of the data you have placed in L2 and L3. The data represent the number of children in 20 families:

Number of Children	Frequency
0	4
1	5
2	8
3	2
4	1

Set the Window. A suggested window for this data is:

Xmin = 0 Ymin = -3
Xmax = 5 Ymax = 9
Xscl = 1 Yscl = 1

Draw the histogram:

STAT PLOTS – Plot1 – On. Choose the histogram. Xlist is L2, Freq is L3. Press the GRAPH key.
Check out what is going on: Press the TRACE key and press the right arrow, noticing the numbers at the bottom of the screen.

Factorials, combinations

- Find 5!
Starting on the home screen, type the number 5.
Find the exclamation mark at: MATH – PRB – !. Press ENTER. The result should be 120.
- Find $\binom{5}{3}$. This combination can also be written as ${}_5C_3$.
Starting at the home screen, type the 5.
Find the combination capability: MATH – PRB – nCr – type the number 3.
Your screen should look like **5 nCr 3**.
Press ENTER.
The result should be 10.

Mean, standard deviation, median, quartiles, mode

Find the **mean**, the **standard deviation**, and the **five number summary** of the weight training class data you have in L1:

To calculate: STAT – CALC – 1-VarStats

With some operating systems, make your screen look like:

1-Var Stats L1

With some operating systems, you'll fill in the blanks:

List: L1

FreqList: Leave blank.

Calculate

The following information will show on the screen:

$$\bar{x} = 140.0833333$$

$$\Sigma x = 1681$$

$$\Sigma x^2 = 237877$$

$$Sx = 14.76148757$$

$$\sigma x = 14.13304835$$

$$\downarrow n = 12$$

Using the down arrow will allow us to see the remainder of the information:

$$\uparrow n = 12$$

$$\min X = 117$$

$$Q1 = 129.5$$

$$\text{Med} = 141$$

$$Q3 = 148$$

$$\max X = 172$$

From this window we see that the **Mean** (\bar{x}) is 140.083; the **Standard Deviation** (σ) is 14.133; the **Median** (Med) is 141; the **Quartiles** (Q1, Med, Q3) are 129.5, 141, and 148.

The **Mode** can be found most easily by sorting the data into ascending order: **STAT → 2:SortA**.

Make the screen of the calculator look like: **SortA (L1)**.

Press ENTER.

Now look back at your L1 in the Stat-Edit. By arrowing down, we can see that 148 occurs more than any other value, so 148 is the mode.

Boxplots

Draw a boxplot for the weight training data in L1:

Set up the boxplot:

STAT PLOT

On

Choose the boxplot (which is the middle choice in the 2nd row of Type.

Xlist is L1.

Freq is 1.

ENTER

To graph: ZOOM – 9:ZoomStat (The ZoomStat finds a good window for the boxplot.)

Press TRACE and use the left and right arrows to review the 5-number summary:

minX=117, Q1 = 129.5, Med = 141, Q3 = 148, maxX=172

Assessing Normality

To assess whether the weight training class data in L1 are normally distributed, we will use the **normal probability plot** that is available within the StatPlot graph choices:

STAT PLOT

On

Choose the last plot in the 2nd line of Type.

Data List: L1

Data Axis: X should be highlighted.

Mark: The little square is a good choice.

To graph: ZOOM – 9:ZoomStat (The ZoomStat finds a good window for the normal probability plot.)

If the points appear to be in approximately a straight line, the data are approximately normally distributed.

Clearing a list in STAT-EDIT-Edit

To clear a list in STAT – EDIT – Edit, there are 2 possibilities:

1. While in STAT – EDIT – Edit, move the cursor to the very top of the column, actually *on* the list *name*. When the cursor is on the list name, press the **CLEAR** key and then ENTER.
or
2. STAT – EDIT – 4:ClrList. Then type the name of the list, such as L1. Press ENTER.

Turning off a STAT PLOT

To turn off a STAT PLOT, there are 3 possibilities:

1. STAT PLOT: Go into the StatPlot you wish to turn off and place the cursor on OFF. Press ENTER.
or
2. Press the **Y=** key. At the top of the screen, if Plot1, Plot2, or Plot3 have a dark box, then they are turned on. To turn off a particular StatPlot, put the cursor on the Plot to be turned off and then press ENTER. (This is just a toggle, so pressing ENTER again will turn the particular Stat Plot on again.)
or
3. STAT PLOT – 4:PlotsOff – ENTER
This turns off *all* stat plots.

Re-inserting a list that has accidentally been deleted

Sometimes when you want to clear a list, you might accidentally delete it instead. This occurs when we accidentally use DEL when we should have used CLEAR. Then the list seems to disappear completely. You can **re-instate** the list by: Placing the cursor on the very top of the next list, the list that is after your insertion point. For instance, if L2 is missing, place the cursor on the very top of L3. Press **2nd INS** and then press **2nd L2**. ENTER. Your list should reappear in the appropriate position.

Distribution Functions (All are found in 2nd DISTR, above VARS)

- **binompdf** finds the probability of a particular outcome in a binomial situation.

Example: Suppose it is known that 23% of the people that take a particular medication become drowsy. Out of 8 people, find the probability that *exactly* 3 will become drowsy.

We know that $n = 8$, $p = .23$, and $x = 3$. In DISTR, choose **A:binompdf**

With some operating systems, the screen should look like binompdf (8, .23, 3)	With some operating systems, you'll fill in the blanks: trials: 8 p: .23 x value: 3 Paste: ENTER You'll see binompdf (8, .23, 3) on your screen. ENTER
---	---

The result should be .1844272799.

So, the probability that exactly 3 people will become drowsy is approximately 0.18.

- **binomcdf** finds a cumulative probability in a binomial situation.

Example: It is known that 23% of people that take a particular medication become drowsy. Out of 8 people, what is the probability that *at most* 3 people will become drowsy?

We know that $n = 8$, $p = .23$, and $x = 3$. In DISTR, choose **B:binomcdf**

With some operating systems, the screen should look like binomcdf (8, .23, 3)	With some operating systems, you'll fill in the blanks: trials: 8 p: .23 x value: 3 Paste: ENTER You'll see binomcdf (8, .23, 3) on your screen. ENTER
---	---

The result should be .9120089668.

So, the probability that at most 3 people will become drowsy is approximately 0.912.

Note: cdf means "cumulative density function," so think left to right to accommodate the accumulation.

- **binompdf** can be used to create a probability distribution in a binomial situation.

Example: It is known that 23% of the people that take a particular medication become drowsy. Create the *probability distribution* for a sample of 8 people.

We know that $n = 8$ and $p = .23$. In DISTR, choose **A:binompdf**

With some operating systems, the screen should look like binompdf (8, .23)	With some operating systems, you'll fill in the blanks: trials: 8 p: .23 x value: Just leave blank. Paste: ENTER You'll see binompdf (8, .23) on your screen. ENTER
--	--

Your results will show in a long list on the calculator screen, so just arrow right to see them all.

We can place this data into a “table,” on the calculator with these steps:

- Go to L4 and enter the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8.
- 2nd Quit back to the Home Screen.
- Make your Home Screen look like: **binompdf (8, .23)**, but do not press ENTER yet.
- Find the STO key on the lower left of the keyboard. Press it and then L5, so that your screen looks like: **binompdf (8, .23) →L5**.
- Note that it is OK to get the results and then do **ANS → L5**.
- Check your L4 and L5 and you should see this “table.”

L4	L5
0	.12357
1	.29529
2	.30872
3	.18443
4	.06886
5	.01646
6	.00246
7	2.1E-4
8	7.8E-6

Remember what the E means: 2.1E-4 means 2.1×10^{-4} , or .00021.

- **normalcdf** finds area between a lower value and an upper value, given the mean and standard deviation.

Example: The weights of all the students in a weight training class have a mean weight of 175 lbs. and a standard deviation of 12 lbs. If the weights are normally distributed, find the *percentage* of students that weigh *less than* 180 lbs.

We know that the lower bound is $-\infty$, and we will use -10^{99} . We know the upper bound is 180, the mean is 175 and the standard deviation is 12. In DISTR, choose **2. normalcdf**.

With some operating systems, make your screen look like:
normalcdf (-10⁹⁹, 180, 175, 12)
 The values are (lower, upper, mean, standard dev.).
 -10^{99} is our estimate for negative infinity.

With some operating systems, you'll fill in the blanks:
lower: -10^{99} (Our estimate for negative infinity)
upper: 180
μ: 175
σ: 12
Paste: ENTER
 You'll see **normalcdf (-10⁹⁹, 180, 175, 12)** on your screen.
 ENTER

The result should be: .6615388433.

So, the percentage of students who weigh less than 180 lbs. is approximately 66.15%.

- **tcdf** finds the area between a lower value and an upper value in a t-distribution, given the degrees of freedom.

Example: Determine the area to the right of $t=2.5$ if $n = 16$.

We know the lower bound is 2.5, and the upper bound is ∞ , for which we will use 10^{99} . We know the degrees of freedom is 15. In DISTR, choose: **6. tcdf**.

With some operating systems, make your screen look like:
tcdf (2.5,10⁹⁹,15)
 The values are (lower, upper, df).
 10^{99} is our estimate for positive infinity.

With some operating systems, you'll fill in the blanks:
lower: 2.5
upper: 10^{99} (Our estimate for positive infinity)
df: 15
Paste: ENTER
 You'll see **tcdf (2.5,10⁹⁹,15)** on your screen.
 ENTER

The result should be .0122529014. So, the area to the right of $t=2.5$ is approximately .0122.

- **InvNorm** finds the z-score, given the area to its left, in a standard normal distribution.

Example: Find $z_{.05}$. In other words, determine the z value for which the area to the *right* is .05.

Since the calculator “thinks” *left to right* on the statistical calculations, we must use the area to the left, 0.95.

We also know that the mean is 0, and the standard deviation is 1. In DISTR. Choose: **3.invNorm**.

With some operating systems, the screen should look like: invNorm(.95) where the .95 is area on the left, or invNorm(.95, 0, 1) where the .95 is area to the left and the 0 and 1 are the mean and standard deviation of the standard normal distribution	With some operating systems, you'll fill in the blanks: area: .95, which is the area on the left μ: 0 which is the mean in a standard normal distr. σ: 1 which is the standard deviation in a standard normal distribution. Paste: ENTER You'll see invNorm(.95, 0, 1) on your screen. ENTER
--	--

The result is: 1.644853626. So, a z-score of 1.645 has an area to its right of .05.

- **InvNorm** finds the value, given the area on its left and the mean and standard deviation.

Example: The weights of all the students in a weight training class have a mean weight of 175 lbs. and a standard deviation of 12 lbs. The weights are normally distributed. 95% of the weights are less than ____?

We know the area to the left is 0.95, the mean is 175, and the standard deviation is 12.

In DISTR, choose: **3. invNorm**.

With some operating systems, make your screen look like: invNorm(.95, 175, 12) , where .95 is the area on the left, and 175 and 12 are the mean and standard deviation.	With some operating systems, you'll fill in the blanks: area: .95 which is the area on the left μ: 175 which is the mean of this problem σ: 12 which is the standard deviation of this problem Paste: ENTER You'll see invNorm(.95, 175, 12) on your screen. ENTER
--	--

The result is approximately 194.7382433. So, a weight of 194.74 is greater than 95% of the students.

- **invT** is available on the TI-84 Plus Silver with OS 2.30 or higher. InvT finds the t-value, given the area to its left and the degrees of freedom. If you have a TI-84 with an Operating System less than 2.30, you can ask the MRC staff to install a new OS that has invT.

Example: Find the t-value with .025 as the area to its right, if $n = 14$.

We know the area to the left is 0.975 and the degrees of freedom is 13. In DISTR, choose: **4. invT**.

With some operating systems, make your screen look like: invT(.975, 13) where the .975 is the area on the left and 13 is the df.	With some operating systems, you'll fill in the blanks: area: .975 which is the area on the left df: 13 Paste: ENTER You'll see invT(.975, 13) on your screen. ENTER
--	---

The result is approximately 2.160368652. So, a t-score of 2.16 has an area of .025 to its right.

Confidence Intervals and Hypothesis Tests (All are found in STAT – TESTS)

- **Z-Test** (Hypothesis Test) At STAT – TESTS, choose: **1. Z-Test**.

Inpt: Data μ_0 = State the original mean, μ_o σ = Type in the population standard deviation List = Type the list name (e.g., L1, L2) Freq = Type in the frequency, either the number 1 or a list name Choose: 2-tailed ($\neq \mu_0$), left-tailed ($< \mu_0$), or right-tailed ($> \mu_0$). Calculate	Inpt: Stats μ_0 = State the original mean, μ_o σ = Type in the population standard deviation \bar{x} = Enter the sample mean n = Enter the number of data Choose: 2-tailed ($\neq \mu_0$), left-tailed ($< \mu_0$), or right-tailed ($> \mu_0$). Calculate
--	--

The results state the z test statistic and the p-value. The conclusion is left to the student.

- **T-Test** (Hypothesis Test) At STAT – TESTS, choose **2. T-Test**

Inpt: Data μ_0 = State the original mean, μ_o List = Type the list name (e.g. L1, L2) Freq = Type in the frequency, either the number 1, or a list name. Choose: 2-tailed ($\neq \mu_0$), left-tailed ($< \mu_0$), or right-tailed ($> \mu_0$). Calculate	Inpt: Stats μ_0 = State the original mean, μ_o \bar{x} = Enter the sample mean Sx = Enter the sample standard deviation n = Enter the number of data Choose: 2-tailed ($\neq \mu_0$), left-tailed ($< \mu_0$), or right-tailed ($> \mu_0$). Calculate.
---	---

The results state the t test statistic and the p-value. The conclusion is left to the student.

- **1-Prop ZTest** (Hypothesis Test) At STAT – TESTS, choose: **5. 1-PropZTest**

- State the original population proportion, p_o
- State the x (the number that have the specified attribute).
- State the n (sample size).
- Choose 2-tailed ($\neq p_o$), left-tailed ($< p_o$), or right-tailed ($> p_o$).
- Calculate.

The results state the z test statistic and the p-value. The conclusion is left to the student.

- **ZInterval** (Confidence Interval) At STAT – TESTS, choose: **7. ZInterval**.

Inpt: Data σ = State the population standard deviation List = State the list name (e.g., L1, 2) Freq = Type in the frequency, either the number 1, or a list name C-Level = State the confidence level. Calculate.	Inpt: Stats σ = State the population standard deviation \bar{x} = Enter the sample mean n = Enter the number of data C-Level = State the confidence level. Calculate.
---	--

The result is the confidence interval in interval form.

- **TInterval** (Confidence Interval) At STAT – TESTS, choose: **8.TInterval**.

Inpt: Data List = Type the list name (e.g., L1, L2) Freq = Type in the frequency, either the number 1, or a list name, in LIST, above the minus sign C-Level = State the confidence level. Calculate by pressing F1 for Calc.	Inpt: Stats \bar{x} = Enter the sample mean Sx = Enter the sample standard deviation n = Enter the number of data C-Level = State the confidence level. Calculate by pressing F1 for Calc.
--	--

The result is the confidence interval in interval form.

- **1-Prop Z Interval** (Confidence Interval) At STAT – TESTS, choose: **A. 1-PropZInterval**
 - State the x (how many have the specified attribute).
 - State the n (sample size).
 - Type in the confidence level in decimal form (e.g. type .95 for a 95% confidence interval).
 - Calculate.

The result is the confidence interval in interval form.

- **χ^2 Test** (Chi Square Independence Test) At STAT – TESTS, choose: **C. χ^2 -Test**
 - Before accessing the **χ^2 Test**, put the original data matrix into matrix A in the calculator:
 - 2nd MATRIX
 - EDIT
 - State the size of the matrix (e.g. 4 x 3 is a matrix with 4 rows and 3 columns)
 - Enter the data into the matrix.
 - 2nd QUIT
 - Find the **χ^2 Test** in STAT – TESTS (Arrow down until you see it at C):
 - At Observed, go to 2nd MATRIX, highlight [A], and press ENTER.
 - At Expected, choose 2nd MATRIX, highlight [B], and press ENTER.
 - Calculate.

The result states the **χ^2** test statistic and the p-value. The conclusion is left to the student.

Regression

1. Calculate the **linear regression equation** for the following data representing both the number of hours a group of students studied for a test and their resulting test scores.

Number of hours of studying	10	12	11	13	15	20	11	17	8	6	7	10	12	11
Test score	82	91	88	89	90	99	85	94	75	65	62	89	88	95

Enter the number of hours and the tests scores into L1 and L2 respectively, with STAT – Edit.
2nd QUIT.

Calculate the regression equation: STAT – CALC – 4.LinReg(ax + b) or 8.LinReg(a + bx)

With some operating systems, make your screen look like: LinReg L1, L2, Y1 It is vital that the user not forget to state the L1 and L2. The Y1 is optional. (NOTE: If you use the Y1 as indicated, then the regression equation will automatically be pasted into Y1.) The Y1 is found in VARS – Y-VARS – Function – Y1.	With some operating systems, you'll fill in the blanks: Xlist: L1 Ylist: L2 FreqList: Arrow through this Store RegEQ: Y1. Find Y1 in VARS – Y-VARS – Function – Y1. The Y1 is optional. (NOTE: If you use the Y1 as indicated, then the regression equation will automatically be pasted into Y1.) Calculate
---	--

Your result screen should look like this:

$$y = ax + b$$

$$a = 2.357886618$$

$$b = 57.69032009$$

or

$$y = a + bx$$

$$a = 57.69032009$$

$$b = 2.357886618$$

Now mentally plug the “a” and “b” values into the equation, and that is your regression equation.

Take a look at $Y=$. Your equation should be there if you specified that the calculator paste the regression equation into $Y1$. It should look like:

$$Y1 = 2.3578866178172x + 57.690320092557, \text{ or } Y1 = 57.690320092557 + 2.3578866178172x.$$

The regression equation (with rounded values) would be $Y = 2.36x + 57.69$ or $Y = 57.69 + 2.36x$.

2. If you want to have the r^2 and r values and they are not visible, go to the CATALOG and arrow down to **Diagnostic On**.

Press ENTER.

The r^2 and r for our data are: $r^2 = .674911928$, $r = .8215302356$

You will only need to turn on the Diagnostic this one time only.

3. **Plot the ordered pairs and the regression equation:**

Steps:

STATPLOT

On

Choose the first Type, which is a scatterplot.

Xlist: L1 and Ylist: L2

The little square is a good mark.

2nd QUIT

Go back to the $Y=$. If your regression equation is there and the Plot 1 at the top of the screen has a black box, then both the points and the regression line are ready to graph.

Choose a good window with ZOOM – ZoomStat.

You should now see the points and the regression line on the same graph.