

# Ti 83/84

## Descriptive Statistics for a List of Numbers

Quiz scores in a (fictitious) class were 10.5, 13.5, 8, 12, 11.3, 9, 9.5, 5, 15, 2.5, 10.5, 7, 11.5, 10, and 10.5. It's hard to get much of a sense of the class by just staring at the numbers, but you can easily compute the common measures of center and spread by using your TI-83 or TI-84.

### Step 1: Enter the numbers in L1

By the way, this note uses list L1, but you can actually use any list you like, as long as you enter the actual list name in the 1-Var Stats command in Step 2. (It doesn't matter whether there are numbers in any other list.)

Enter the data points.

L1	L2	L3	1
2.5			
10.5			
7			
11.5			
10			
10.5			
.....			
L1(16) =			

[STAT] [1] selects the list-edit screen.

Cursor onto the label L1 at top of first column, then [CLEAR] [ENTER] erases the list. Enter the x values.

### Step 2: Compute the Statistics

Select the 1-Var Stats command.

[STAT] [►] [1] pastes the command to the home screen.

Assuming you used L1, enter [2nd 1 makes L1].

Specify which statistics list contains the data set.

1-Var Stats
$\bar{x}$ = 9.72
$\Sigma x$ = 145.8
$\Sigma x^2$ = 1557.44
$S_x$ = 3.165257832
$\sigma_x$ = 3.057929583
↓ n = 15
█

Press [ENTER] to execute the command.

The important statistics are

- **sample size**  $n = 15$   
Always check this first to guard against leaving out numbers or entering numbers twice.
- **mean**  $\bar{x} = 9.72$   
(Use symbol  $\mu$  if this is a population mean.)
- **standard deviation**  $s = 3.17$   
Since this data set is a sample, use  $S_x$  or  $s$  for the standard deviation. When the data set is the whole population, use  $\sigma_x$  or  $\sigma$  for the standard deviation.  
If rounding is necessary, remember that we **round mean and standard deviation to one decimal place more than the data.**
- **variance** is not shown on this screen; see [Step 3](#) below.

The down arrow on the screen tells you that there's more information if you scroll down — in this case it's the five-number summary.

```

1-Var Stats
n=15
minX=2.5
Q1=8
Med=10.5
Q3=11.5
maxX=15

```

[▼ 5 times]

for the five-number summary.

You can tell the shape of the distribution. Since the mean  $\bar{x} = 9.72$  is just a hair less than the median  $Med$  or  $\tilde{x} = 10.5$ , you know that the distribution is **slightly skewed left**.

The **range** is  $max - min = 15 - 2.5 = 12.5$ .

The **interquartile range or IQR** is  $Q3 - Q1 = 11.5 - 8 = 3.5$ . Recall that we use  $1.5 \times IQR$  to classify outliers: we call a data point an outlier if it's at least that far below  $Q1$  or above  $Q3$ .

In this case  $1.5 \times IQR = 1.5 \times 3.5 = 5.25$ ,  $Q1 - 5.25 = 2.75$ , and  $Q3 + 5.25 = 16.75$ , so we can say that any data points below 2.75 or above 16.75 are outliers. But it's easier to make a [box-whisker plot](#) and let the calculator identify the outliers.

### Step 3: Find the Variance

Your TI-83 or TI-84 doesn't find the variance for you automatically, but since the standard deviation is the square root of the variance, you can **find the variance by squaring the standard deviation**.

It would be **wrong to compute**  $s^2 = 3.17^2 = 10.05$  — see [The Big No-no](#) for the reason. You could enter  $3.165257832^2$ , but that's tedious and error prone, as well as being overkill.

Instead, **use the value that the calculator has stored in a variable.**

Select statistics variables.

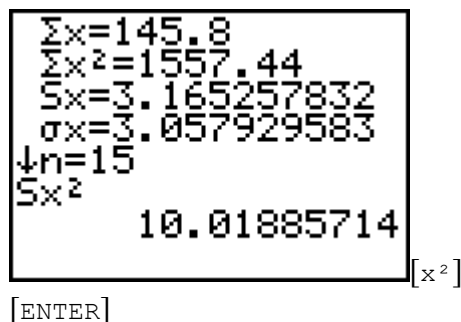
[VARS] [5]

Select the correct standard deviation:  $S_x$  for a sample or  $\sigma_x$  for a population.

[3] for  $S_x$  or [4] for  $\sigma_x$ .

Square it.

The variance is  $s^2 = 10.02$



### Step 4: Make a Box-Whisker Plot

**Easy way:** Rather than make box-whisker plots “by hand”, you might prefer to use a downloadable program. Part 2 of [Descriptive Statistics Utilities for TI-83/84](#) makes box-whisker plots of one, two, or three samples.

You already have the data in L1, so all you have to do is set up the `Stat Plot` screen. Fortunately, there’s no need to mess with the Window screen, because a `ZOOM` command will adjust the window nicely.

Turn off other plots.

Press `[Y=]`. Cursor to each highlighted = sign or Plot number and press `[ENTER]` to deactivate.

Turn on Stat Plot 1 as a modified box-whisker diagram.

`[2nd Y= makes STAT PLOT] [1] [ENTER]`

Select the modified box-whisker plot, which is the first one in the second row.

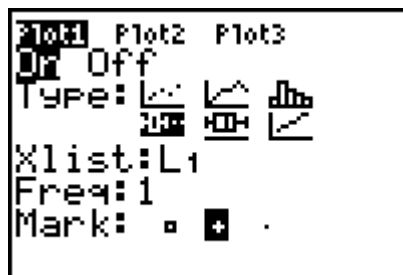
`[▼] [▶ 3 times] [ENTER]`

Specify L1 and a frequency of 1.

`[▼] [2nd 1 makes L1]`

`[▼]` then `[ALPHA]` to turn off alpha mode, followed by `[1]`

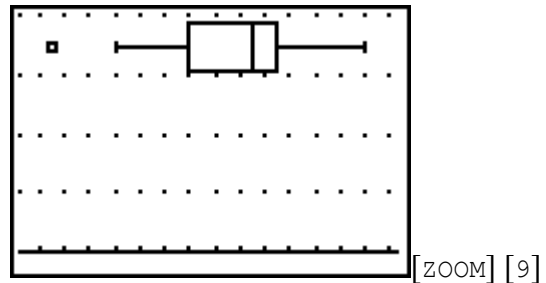
Select a square or cross for plotting any outliers.



`[▼], [▶]` if you wish, then `[ENTER]`

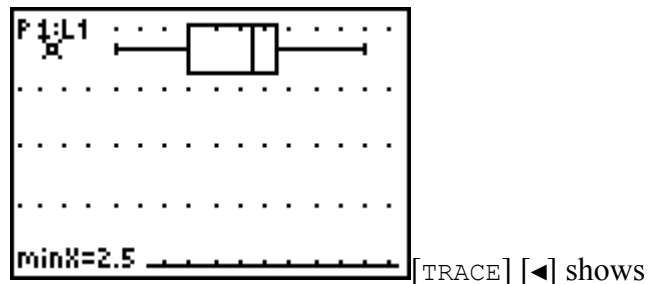
Display the plot by zooming automatically to the statistics.

This particular plot doesn't show clear skewness, which is no surprise since [the mean and median told us](#) that the skewness is slight.



executes the `ZoomStat` command, which adjusts the window according to the numbers that you're plotting.

The plot also shows that **there is an outlier** in this data set. You can press the `[TRACE]` key and then use the left and right arrows to reveal the numeric values of the minimum, Q1, median, Q3, and maximum, as well as the outlier.



the outlier of 2.5. The arrow keys give you the values in the five-number summary.

## Descriptive Statistics for a Frequency Distribution

Class Boundaries	Class Marks	Frequency
$20 \leq x < 30$	25	34
$30 \leq x < 40$	35	58
$40 \leq x < 50$	45	76
$50 \leq x < 60$	55	187
$60 \leq x < 70$	65	254
$70 \leq x < 80$	75	241
$80 \leq x < 90$	85	147

The grouped frequency distribution at right is the ages reported by Roman Catholic nuns, from Johnson & Kuby, *Elementary Statistics 9/e* (Thomson, 2004), page 67. Let's use the TI-83/84 to compute statistics.

### Step 1: Enter class marks in L1 and frequencies in L2

By the way, this note uses L1 and L2, but you can use any lists you like, as long as you enter the actual list names in the `1-Var Stats` command in Step 2. (It doesn't matter whether there are numbers in any other list.)

This example is for a grouped frequency distribution. If you have an **ungrouped frequency distribution**, you can compute statistics in the same way. The only difference is that your first list will contain the actual values instead of the class marks.

[STAT] [1] selects the list-edit screen.

Enter the class marks in L1.

Cursor onto the label L1 at top of first column, then [CLEAR] [ENTER] erases the list. Enter the class marks.

(The **class mark** is the midpoint of each class.)

(If you have only the class boundaries, you can make the TI-83/84 do the work for you. It will compute the class marks automatically if you enter the class boundaries in the form  $(20+30) \div 2$ .)

Enter the frequencies in L2.

L1	L2	L3	2
25	34	-----	
35	58		
45	76		
55	187		
65	254		
75	241		
85			
L2(?) = 147			

Cursor onto the label L2 at top of first column, then [CLEAR] [ENTER] erases the list. Enter the frequencies.

## Step 2: Compute the Statistics

Select the 1-Var Stats command.

[STAT] [▶] [1] pastes the command to the home screen.

Specify which statistics lists contain the data set and the frequencies, in that order.

Assuming you used L1 and L2, enter [2nd 1 makes L1] [, ] [2nd 2 makes L2].

Important: **You must supply both lists.** That's the only way the calculator knows you have a frequency distribution. Always check the sample size n in the output, to guard against forgetting to enter the second list.

1-Var Stats
$\bar{x}=63.85656971$
$\Sigma x=63665$
$\Sigma x^2=4302725$
$Sx=15.4353244$
$\sigma x=15.42758961$
$\downarrow n=997$

Press [ENTER] to execute the command.

The important statistics are

- **sample size**  $n = 997$   
Again, if this is a low number it means you forgot to specify frequencies on the 1-Var Stats command.

- **mean**  $\bar{x} = 63.9$   
(Use symbol  $\mu$  if this is a population mean.)
- **standard deviation**  $s = 15.4$   
If this data set is a sample, use  $S_x$  or  $s$  for the standard deviation; if this data set is the whole population (including a probability distribution), use  $\sigma_x$  or  $\sigma$  for the standard deviation.
- **variance** is not shown on this screen; see [Step 3](#) below.

Remember that **the values on this screen are approximate** because the frequency distribution is an approximation of the original raw data. For most real-life data sets, the approximation is quite good, and it is very good for moderate to large data sets.

The down arrow on the screen tells you that there's more information if you scroll down. However, since the numbers you enter in a grouped frequency distribution are only approximate, the five-number summary is only approximate. The Min and Max are just the highest and lowest classes. Q1, Med, and Q3 are at best the midpoints of the classes that actually contain those statistics.

As a general rule, **the five-number summary from a grouped frequency distribution is not worth reporting.**

The box-whisker plot is a picture of the five-number summary. Therefore, **don't draw a box-whisker plot of a grouped frequency distribution.**

### Step 3: Find the Variance

Just as with a simple list of numbers, you **find the variance by squaring the standard deviation.**

It would be **wrong to compute**  $s^2 = 15.4^2 = 237.2$  — see [The Big No-no](#) for the reason.

Instead, use the value that the calculator has stored in a variable.

Select statistics variables.

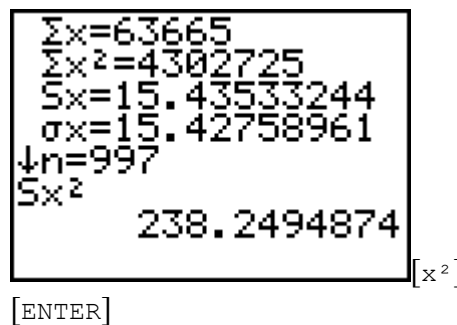
[VARS] [5]

Select the correct standard deviation:  $S_x$  for a sample or  $\sigma_x$  for a population.

[3] for  $S_x$  or [4] for  $\sigma_x$ .

Square it.

The variance is  $s^2 = 238.2$



Calculator screen showing statistics:  
 $\Sigma x = 63665$   
 $\Sigma x^2 = 4302725$   
 $S_x = 15.43533244$   
 $\sigma_x = 15.42758961$   
 $\downarrow n = 997$   
 $S_x^2$  238.2494874

[ENTER]

### Step 4: Make a Box-Whisker Plot

If you have an **ungrouped frequency distribution**, you can make a box-whisker plot using the directions above for a [list of numbers](#). Just answer the `Freq:` prompt with the list that contains the frequencies. This doesn't make sense for a **grouped frequency distribution**, however.

## Box-Whisker Diagrams to Compare Data Sets

**Easy way:** Rather than make box-whisker plots “by hand”, you might prefer to use a downloadable program. Part 2 of [Descriptive Statistics Utilities for TI-83/84](#) makes box-whisker plots of one, two, or three samples.

Sullivan, Michael, *Fundamentals of Statistics* (Pearson Prentice Hall, 2008), page 163, shows data for two groups of rats. One group was sent into space; the control group was treated the same except for the space flight. Their red blood cell mass was measured in milliliters.

Flight								Control							
8.59	6.87	7.00	6.39	7.43	9.79	9.30	8.64	8.65	7.62	7.33	7.14	8.40	8.55	9.88	6.99
7.89	8.80	7.54	7.21	6.85	8.03			7.44	8.58	9.14	9.66	8.70	9.94		

Let's draw the boxplots on the same scale.

Enter the flight group in L1 and the control group in L2. (You could use any lists, but we'll use L1 and L2.)

L1	L2	L3	2
7.89	7.44		
8.8	8.58		
7.54	9.14		
7.21	9.66		
6.85	8.7		
8.03	9.94		
-----			
L2(15) =			

You already have the plot set up for the first group. If not, please review [Step 4](#) above.

Plot1	Plot2	Plot3
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Type:	<input type="checkbox"/>	<input type="checkbox"/>
Xlist:	L2	
Freq:	1	
Mark:	<input type="checkbox"/>	<input checked="" type="checkbox"/>

[2nd Y= makes STAT PLOT] [2]

[ENTER] turns on the plot.

Now set up the second plot.

[▼] [▶ 3 times] [ENTER] selects a modified box plot.

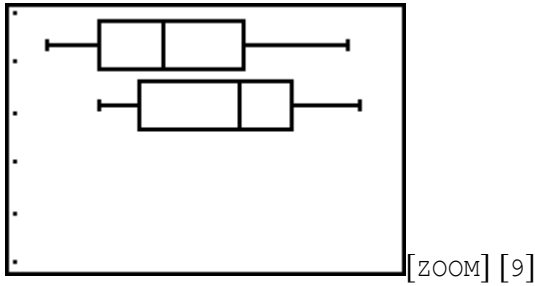
[▼] [2nd 2 makes L2] selects statistics list 2.

[▼] [ALPHA] [1] enters 1 for frequency. Select box or cross for any outliers.

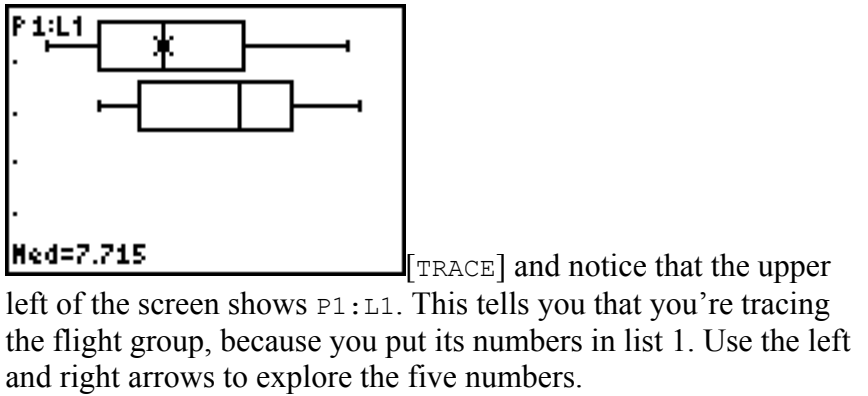
Order the calculator to plot both groups on the same scale.

You can see that the flight group had lower blood mass overall, and it was skewed right, meaning that most of the rats had lower scores.

There were no outliers in either group.



You can explore the five-number summaries by tracing the plots.



To switch between groups (lists), use the up or down arrow. The legend in the upper left corner of the screen always tells you which group you're tracing.