

## TI-83 Statistics & Regression

These are recent golf scores for Andy Taylor and Barney Fife:

Andy	78	83	81	84	80
Barney	82	92	74	100	78

To input statistical lists:

Hit the **STAT** key, then select **1**: Edit under EDIT and **ENTER**.

(If there are already numbers in any list, arrow up to L1, L2, etc.; then hit **CLEAR** and **ENTER** to clear an entire column of numbers. Another option is to use the **4**: ClrList command in the STAT EDIT menu followed by the name of the list.)

Enter elements in each list by typing the number and then **ENTER** or use the arrow down key. When you've entered one list, arrow right **▶** to start the next list.

Note: For regression analysis, the list of ordered pairs must have the same size; if they're not the same size, the calculator gives a dimension error.

For Andy's and Barney's golf scores, the input might look like this:

L1	L2	L3	3
78	82		
83	92		
81	74		
84	100		
80	78		
-----	-----		
L3(1)=			



To perform one-variable statistical calculations:

Hit the **STAT** key, then arrow once to the right **▶** to CALC, then hit **1**: 1-Var Stats and **ENTER**. Type the appropriate list name (L1, L2, etc.), then hit **ENTER** and the calculator will perform several calculations nearly instantaneously.

The calculator finds the mean  $[\bar{x}]$ , sum of the data values  $[\Sigma x]$ , sum of the squares of the data values  $[\Sigma x^2]$ , sample standard deviation  $[s_x]$ , population standard deviation  $[\sigma_x]$ , sample size  $[n]$ , minimum value  $[\min X]$ , first quartile  $[Q_1]$ , median  $[\text{Med}]$ , third quartile  $[Q_3]$ , and maximum value  $[\max X]$ , in this order.

Note: The calculator can also handle 2-variable statistics, but this is primarily used for regression situations.

## TI-83 Statistics & Regression

For Andy's golf scores, the statistics would look like this:

```

1-Var Stats
 $\bar{x}$ =81.2
 $\Sigma x$ =406
 $\Sigma x^2$ =32990
 $S_x$ =2.387467277
 $\sigma_x$ =2.13541565
 $\downarrow$ n=5
    
```

```

1-Var Stats
 $\uparrow$ n=5
minX=78
Q1=79
Med=81
Q3=83.5
maxX=84
    
```

To make a statistical graph (box plot):

Using the golf data above (already stored in lists L1 and L2), the next step is to hit  $2^{nd}$   $Y=$  to enter the "STAT PLOT" menu. Hit  $\text{ENTER}$  to go into 1: Plot1, then choose the settings you'll see in the image to the right below.

```

STAT PLOTS
1:Plot1...On
  L1 L2
2:Plot2...Off
  L1 L2
3:Plot3...Off
  L1 L2
4:PlotsOff
    
```

```

Plot1 Plot2 Plot3
On Off
Type: L1 L2 L3
Xlist:L1
Freq:1
    
```

The other options are a scatter plot, a broken line graph, a histogram, a modified box plot, and a cumulative broken line graph. All are created using similar steps.

With an appropriate window, we would then hit GRAPH to see the box plot for Andy's golf score. We'll proceed in a similar fashion with Barney and show both graphs together. We have L1 associated with Andy and L2 associated with Barney.

To request a second box plot, arrow to Plot2 and hit  $\text{ENTER}$ . Make similar choices. Then hit  $\text{WINDOW}$ , and enter the values you see in the chart below.

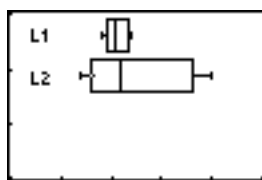
```

Plot1 Plot2 Plot3
On Off
Type: L1 L2 L3
Xlist:L2
Freq:1
    
```

```

WINDOW
Xmin=60
Xmax=110
Xscl=10
Ymin=0
Ymax=3
Yscl=1
Xres=1
    
```

Both plots are on; the box plot options are selected; the window is appropriate for the data; and so we are ready to hit  $\text{GRAPH}$ .



You'll immediately recognize that Andy's box is "tighter", indicating greater consistency. His median is lower than Barney's, indicating better overall scores. (In golf, less is best!)

Because of its importance in algebra, we'll also focus on the scatter plot and regression.

## TI-83 Statistics & Regression

To make a statistical graph (scatter plot):

These are (possible) prices of chicken nuggets at a local restaurant.

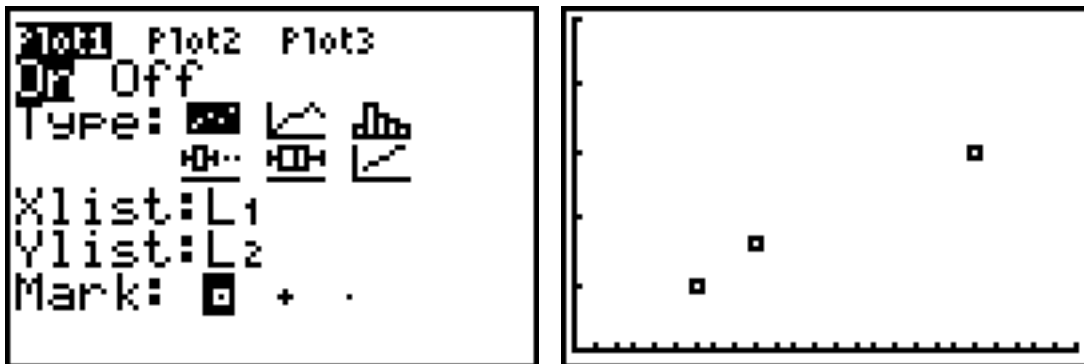
# of pieces	Price
6	\$0.99
9	\$1.59
20	\$2.99



Once the lists are entered into L1 (# of pieces) and L2 (price), hit  $2^{nd}$   $Y=$  to enter the STAT PLOT menu, then hit  $\text{ENTER}$ .

As before, turn the Plot On; select the statistical graph (the scatter plot is the first option next to Type); and check to see if your lists are matching up correctly with Xlist and Ylist. In this scenario, price clearly depends on the number of pieces in the box, so the Xlist (used for the independent variable) is L1 and the Ylist (typically used for the dependent variable) is L2.

When plot characteristics are set, you may enter  $\text{ZOOM}$   $9$  (the statistical zoom) to view a scatter plot. The calculator automatically sets the window for you. You may also enter WINDOW to change the window settings [Xmin, Xmax, Xscl, Ymin, Ymax, Yscl], if you wish. For this particular example, we suggest [0, 25, 1, 0, 5, 1]. Then hit  $\text{GRAPH}$ . For the chicken pieces pricing structure, the scatter plot request and graph should look like these:



Note: In a similar way, you can use the calculator to make a broken line graph (suitable for the chicken pieces and the Andy/Barney golf situations), and a histogram (suitable for both data sets).

To perform regression analysis and graph a linear regression function:

Regression is a 5-step process.

1. Data entry (using  $\text{STAT}$  EDIT, as described earlier)
2. Selecting and fine-tuning the scatter plot (using the  $2^{nd}$   $Y=$  STAT PLOT menu)
3. Making appropriate  $\text{WINDOW}$  settings (perhaps using  $\text{ZOOM}$   $9$ )

## TI-83 Statistics & Regression

We assume that these first 3 steps are completed (with images showing the process in previous sections of this appendix). The fourth step is the big one!

4. Hit **[STAT]**, then arrow right **▶** to **CALC**, then select **[4]**: **LinReg(ax+b)**.

Since the data is in L1 and L2, enter **[2<sup>nd</sup>][L1]**, **[,]**, **[2<sup>nd</sup>][L2]**.

In order to place the best-fit equation into Y1 automatically, hit **[VARS]**, then arrow right **▶** to **Y-VARS**, hit **[ENTER]** (on **Function**), then hit **[ENTER]** again (on **Y1**).

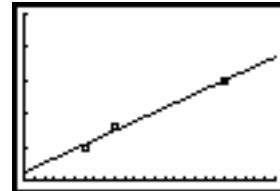
Another **[ENTER]** runs the regression calculations. The calculator will give the values for **a** (slope of line) and **b** (y-intercept) for the line of best fit. If you press **[Y=]**, you'll see the regression equation pasted in Y1. If Plot 1 is on, press **[GRAPH]** to see both the line of best fit and the scatter plot.

Note: If your calculator doesn't show the  $r^2$  or  $r$  values, hit **[2<sup>nd</sup>][CATALOG]** and scroll down to turn "DiagnosticOn". Then the calculator will find the constants for the regression equation along with the correlation coefficient ( $r$ ),  $r^2$ , or both values, depending on which regression function is involved.

For the chicken pieces pricing situation, the regression analysis yields these results:

```
LinReg
y=ax+b
a=.1386503067
b=.2390797546
r2=.9916129533
r=.9957976468
```

```
Plot1 Plot2 Plot3
Y1=.1386503067
847X+.2390797546
012
Y2=
Y3=
Y4=
Y5=
```



5. The next most important step is making predictions. Use **[2<sup>nd</sup>][TBLSET]** to select the "ASK" (Independent variable) and "AUTO" (Dependent variable) options. When you go back into **[2<sup>nd</sup>][TABLE]**, the table is blank. You input any X-value, and the calculator will compute the corresponding Y value using the formula. The predicted prices for various numbers of nuggets are shown below, along with the decision.

X	Y1
4	.79368
6	1.071
9	1.4869
12	1.9029
20	3.0121
24	3.5667

The linear regression equation suggests 79¢ for 4 pieces, \$1.90 for 12 pieces, and \$3.57 for 24 pieces. In each case, the restaurant would probably charge prices close to these values. Notice that the predictions for 6, 9, and 20 pieces are very close to the actual data values.

NOTE:

The calculator can also fit a parabola to the scatter plot (QuadReg), a cubic function (CubicReg), a quartic function (QuartReg), an exponential function (ExpReg), a logarithmic function (LnReg), a logistic function (Logistic), and a power function (PwrReg), and these are accomplished in a very similar manner. The particular regression equation forms are given in Section 5.1.

## TI-83 Statistics & Regression

The format in each case is the regression type followed by the Xlist, Ylist, and the Y-variable location to paste your equation.

For example, the step 4 commands may be Logistic L1, L2, Y2 or ExpReg L1, L2, Y3 or another similar command.

```

EDIT [2nd] [MODE] TESTS
1:1-Var Stats
2:2-Var Stats
3:Med-Med
4:LinReg(ax+b)
5:QuadReg
6:CubicReg
7:↓QuartReg
    
```

```

EDIT [2nd] [MODE] TESTS
7:↑QuartReg
8:LinReg(a+bx)
9:LnReg
0:ExpReg
A:PwrReg
B:Logistic
[2nd] SinReg
    
```

For example, using the QuadReg L1, L2, Y1 command, we find that  $R^2 = 1$ , indicating a perfect correlation between the variables (with the correlation coefficient  $R$  also equal to 1 or  $-1$ ). While both the linear function and this quadratic function fit the scatter plot well, by this  $r$  value, we know the quadratic function fits better. It is also likely to predict better. The quadratic function gives the following predicted prices. Again, the company decides the price, but these should be very much in the neighborhood of what they would charge for the nuggets.

```

QuadReg
y=ax^2+bx+c
a=-.0051948052
b=.2779220779
c=-.4905194805
R^2=1
    
```

X	Y1
4	.53805
6	.99
9	1.59
12	2.0965
20	2.99
24	3.1874

X=4