Technology Toolbox

Using the definition to calculate correlation

Freshmen at the Webb Schools go on a backpacking trip at the start of each school year. Students are divided into hiking groups of size 8 by selecting names from a hat. Prior to departure, each student's body weight and backpack weight are measured (both in pounds). Here are data from one hiking group in a recent year:

Body weight (lb):	120	187	109	103	131	165	158	116
Backpack weight (lb):	26	30	26	24	29	35	31	28

We will use these data to show how to calculate the correlation using the definition and the list features of the TI-83/84/89.

- Begin by entering the body weights (x-values) in L_1/list1 and the backpack weights (y-values) in L_2/list2. Then calculate two-variable statistics for the x- and y-values. The calculator will remember all of the computed statistics until the next time you calculate one- or two-variable statistics.

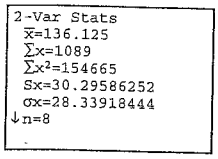
TI-83/84

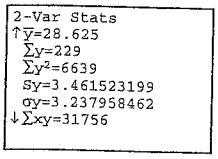
- Press STAT, choose CALC, then 2:2-Var Stats.

TI-89

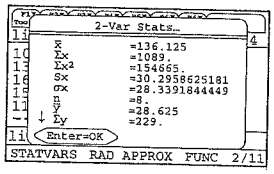
- In the Statistics/List Editor, press F4 and choose 2:2-Var Stats.

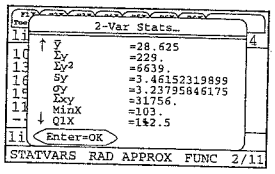
- Complete the command 2-Var Stats L1, L2 and press ENTER.





- In the new window, enter list1 as the Xlist and list2 as the Ylist, then press ENTER.

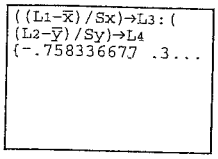


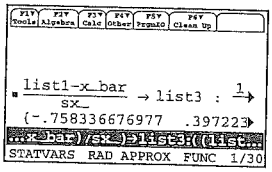


- Define $L_3 = ((L_1 - \bar{x})/s_x)$ and $L_4 = ((L_2 - \bar{y})/s_y)$

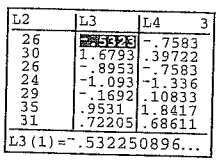
- Define list3 = ((list1 − $\bar{x}$)/s_x) and list4 = ((list2 − $\bar{y}$)/s_y)

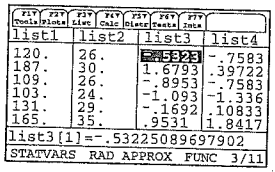
from the home screen as shown. Note that $\bar{x}$, $\bar{y}$, s_x, and s_y can be found under VARS/5:Statistics (in the VAR-LINK menu on the TI-89).





- Go into the Statistics/List Editor to look at the results. The first student listed has a body weight of 120 lb. and a backpack weight of 26 lb. In L_3, we see that his standardized body weight is $z = \dfrac{120 - 136.125}{30.296} = -0.53$. In other words, his weight is 0.53 standard deviations below the mean body weight for this group of 8 hikers. In L_4, we see that the z-score for his pack weight is $z = \dfrac{26 - 28.625}{3.462} = -0.76$. So his pack weight is 0.76 standard deviations below the mean backpack weight for the group.





(continued)

Using the definition to calculate correlation *(continued)*

- Define $L_5 = L_3 * L_4$ (list5 = list3*list 4 on the TI-89). Notice that most of the values in L_5/list5 are positive.

L3	L4	L5
-.5323	-.7583	.40363
1.6793	.39722	.66705
-.8953	-.7583	.67897
-1.093	-1.336	1.4609
-.1692	.10833	-.0183
.9531	1.8417	1.7553
.72205	.68611	.49541

L5=L3*L4

list2	list3	list4	list5
26.	-.5323	-.7583	.40363
30.	1.6793	.39722	.66705
26.	-.8953	-.7583	.67897
24.	-1.093	-1.336	1.4609
29.	-.1692	.10833	-.0183
35.	.9531	1.8417	1.7553

list5=list3*list4

STATVARS RAD APPROX FUNC 5/11

- To finish calculating the correlation $r = \frac{1}{n-1}\Sigma\left(\frac{x-\bar{x}}{s_x}\right)\left(\frac{y-\bar{y}}{s_y}\right)$, we just need to add up the values in L_5/list5 and then to divide by 7. To do this, enter the command shown in the appropriate calculator screen. Press ENTER to see the correlation.

```
(1/(8-1))*sum(L5
)
                .7946926677
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$\frac{1}{8-1} \cdot \text{sum}(\text{list5})$

.794692667734

(1/(8-1))*sum(list5)

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