

Statistics Functions

The HP-11C calculator provides functions to perform one or two variable statistical calculations. The data samples are entered into the calculator using the **[$\Sigma+$]** key, which automatically calculates statistics sums and store them in the Storage Registers from 0 to 5 (called the “Statistics Registers”):

Register	Sum	Description
0	n	Number of data samples.
1	Σx	Summation of x-values.
2	Σx^2	Summation of squares of x-values.
3	Σy	Summation of y-values.
4	Σy^2	Summation of squares of y-values.
5	$\Sigma x \cdot y$	Summation of products of x and y-values.

One Variable Statistics

In one-variable statistical calculations, enter each data point (the “X-value”) by keying in the X-value and pressing **[$\Sigma+$]**.

Each time you press **[$\Sigma+$]** the calculator does the following:

- Adds 1 to the number in R_0 and displays the number of samples entered.
- The X-value is added to the number in R_1 .
- The square of the X-value is added to R_2 .

Two Variable Statistics

In two-variable statistical calculations, enter each data pair (the “X and Y-values”) by typing the Y-value into the display, pressing **[ENTER]**, then type in the X-value and finally press **[$\Sigma+$]**.

Each time you press **[$\Sigma+$]** the calculator does the following:

- Adds 1 to the number in R_0 and displays the number of samples entered.
- The X-value is added to the number in R_1 .
- The square of the X-value is added to R_2 .
- The Y-value is added to the number in R_3 .
- The square of the Y-value is added to R_4 .
- The product of the X and Y-values is added to R_5 .

The functions keys involved in the statistics calculations are:

Keys	Description
[g] [x̄]	Calculates the means (arithmetic averages) of the X and Y-values. The mean of the X-values appears in the display; to display the mean of the Y-values, press [X↔Y] .
[g] [s]	Calculates the standard deviation of the X and Y-values. The standard deviation of the X-values appears in the display. To display the standard deviation of the Y-values, press [X↔Y] .
[f] [ŷ]	Calculates a linear estimation of a new Y-value given a X-value. The new Y-value appears in the display. To display the correlation coefficient (R^2) of the regression, press [X↔Y] .
[f] [L.R.]	Calculates the coefficients “ A ” (slope) and “ B ” (y-intercept) of the linear regression equation $Y = A \cdot X + B$. The slope “ A ”-value is placed in the stack-Y and the y-intercept “ B ”-value is placed in the stack-X register.
[RCL] [Σ+]	Recalls the content of R_3 ($\sum y$ values) to the stack-Y and R_1 ($\sum x$ values) to the stack-X
[f] clear [Σ]	Clears the statistic registers R_0 to R_5 and the stack.

As a special feature, the RLM-11CX calculators have a special tool to perform additional regression calculations. To show it, press the **OPT** key, touch the “Statistics” menu and select “**Curve Fitting**”.

Correcting Accumulated Statistics:

If the data was entered incorrectly, the accumulated statistics can easily be corrected. Simply key in the incorrect data point or data pair again and press **[g] [Σ-]** to subtract the incorrect data from the statistic registers. Then enter the correct data point or data pair and press **[Σ+]**. Each time you press **[g] [Σ-]** the calculator does the following:

- Subtracts 1 from the number in R_0 displaying the new number of samples.
- The x-value is subtracted from the number in R_1 .
- The square of the x-value is subtracted from R_2 .
- The y-value is subtracted from the number in R_3 .
- The square of the y-value is subtracted from R_4 .
- The product of the x and y-values is subtracted from R_5 .

As a special feature, the RLM-11CX calculators have a convenient tool to create and edit statistical X,Y data samples. To show it, press the **OPT** key, touch the “Statistics” menu and select “**X,Y Data Editor**”.

Example of Statistic Calculations

Enter the following data samples :

Year	Coal Production (Billion Metric Tonnes)	Electric Ouput (Billions of MWh)
2009	1.761	5.552
2010	1.775	5.963
2011	1.792	6.135
2012	1.884	6.313
2013	1.943	6.713

To enter the data, follow this sequence:

Keystrokes	Display	Comment
[f] clear [Σ]	0.0000	Clears statistics registers.
“1.761” [ENTER] “5.552” [Σ+]	1.0000	First sample entry.
“1.775” [ENTER] “5.963” [Σ+]	2.0000	Second sample entry.
“1.792” [ENTER] “6.135” [Σ+]	3.0000	Third sample entry.
“1.884” [ENTER] “6.313” [Σ+]	4.0000	Fourth sample entry.
“1.943” [ENTER] “6.713” [Σ+]	5.0000	Fifth sample entry.

Based on the data entered, do the following:

• Calculate the accumulated statistics of the data
• Correct the “1.943, 6.713” data pair to “1.946, 6.713”
• Calculate the Mean of the corrected data.
• Calculate the Standard Deviation of the corrected data.
• Perform a Linear Regression and obtain the equation that relate the coal production with the electricity output.
• Estimate the coal production for an energy output of 7.1417

Keystrokes to find the accumulated statistics :

Keystrokes	Display	Comment
[RCL] [1]	30.6760	Sum of X-values ($\sum x$) from register 1.
[RCL] [2]	188.9386	Sum of squared X-values ($\sum x^2$) from register 2.
[RCL] [3]	9.1550	Sum of Y-values ($\sum y$) from register 3.
[RCL] [4]	16.7877	Sum of squared Y-values ($\sum y^2$) from register 4.
[RCL] [5]	56.2924	Sum of the product of X-values and Y-values ($\sum x \cdot y$) from register 5.

Keystrokes to correct the data and calculate the mean and standard deviation :

Keystrokes	Display	Comment
“1.943” [ENTER] “6.713” [g] [Σ-]	4.0000	Subtract the wrong data pair from the accumulated statistics.
“1.946” [ENTER] “6.713” [Σ+]	5.0000	Add the correct data to de accumulated statistics.
[g] [x̄]	6.1352	Calculates the mean of X-values (electric output).
[X⇌Y]	1.8316	Show the mean of Y-values (coal production).
[g] [s]	0.4287	Standard deviation of X-values (electric output).
[X⇌Y]	0.0800	Standard deviation of Y-values (coal production).

Keystrokes to get the linear regression and do the estimation :

Keystrokes	Display	Comment
[f] [L.R.]	0.7773	Calculates the y intercept (the value of y when x = 0).
[X⇌Y]	0.1718	Shows the slope of the linear regression.
Linear Regression Equation: Coal Production = 0.7773 + 0.1718 • (Electric Output)		
“7.1417” [f] [ŷ]	2.0046	Estimated coal production for 7.1417 electric output.
[X⇌Y]	0.9211	Correlation coefficient (R ²).