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 **[Σ+]** 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 **[Σ+]**.
Each time you press **[Σ+]** 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 **[Σ+]**.
Each time you press **[Σ+]** 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 Calculator's functions 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,r]	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•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 (∑y values) to the stack-Y and R_1 (∑x values) to the stack-X
[f] clear [Σ]	Clears the statistic registers R_0 to R_5 and the stack.

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.

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

Solution:

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 (∑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 (∑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 (∑x•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] [ẍ]	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 linar regression.
Linear Regression Equation: **Coal Production = 0.7773 + 0.1718 • (Electric Output)**		
"7.1417" **[f] [ŷ,r]**	**2.0046**	Estimated coal production for 7.1417 electric output.
[X⇆Y]	**0.9211**	Correlation coefficient (R^2).