The sample variance and sample standard deviation: s^2 & s

The sample variance s^2 and the sample standard deviation s provide an important measures of variation or spread in a set of data. The sample variance, loosely speaking, is the "average" squared distance from a data value (say y_i) to the sample average $\bar{y}$ of all data values; that is, the sample variance

$$s^2 = \frac{\sum_{i=1}^{n}(y_i - \bar{y})^2}{n-1}$$

is an average of the squared deviation across all values $y_1, y_2, \ldots, y_n$ in the data set. (Recall $\bar{y}$ again may be used as a measure of the central or typical value of the data, so with $(y_i - \bar{y})^2$ we access how spread the value y_i is away from the center of the data $\bar{y}$). The more distant data values are from the sample mean $\bar{y}$ of the data, the larger the sample variance s^2 and the large the sample standard deviation $s = \sqrt{s^2}$.

You should have learned how to compute the standard deviation of a set of numbers in your introductory statistics class. In case you have forgotten or never learned, the example below shows how to compute the standard deviation of a small data set. Usually we use a computer to find standard deviations, but you should be able to compute the standard deviation using your calculator.

Example of Steps in Computing s^2 and s

Given data: 1,3,8,12 (Note: number of values $n = 4$)

1. Find sample mean $\bar{y} = \sum_{i=1}^{n} y_i/n$: $\bar{y}$=(1+3+8+12)/4=6
2. Find deviations from sample mean: $(y_i - \bar{y})$ for each value y_i

   1-6=-5
   3-6=-3
   8-6=2
   12-6=6
3. Square the deviations from sample mean: $(y_i - \bar{y})^2$ for each value y_i

   $(-5)^2$=25
   $(-3)^2$=9
   2^2=4
   6^2=36
4. Sum the squared deviations: $\sum_{i=1}^{n}(y_i - \bar{y})^2$

   25+9+4+36=74
5. Divide the result by one less than the number of observations $(n-1)$ to get s^2=$\sum_{i=1}^{n}(y_i - \bar{y})^2/(n-1)$:

   s^2=74/(4-1)=24.66666666 (sample variance)
6. Take the square root of s^2 to get the standard deviation s:

   $s = \sqrt{s^2} = \sqrt{(}24.66666666)$=4.967 (sample standard deviation)