

Iterative Statistics

items to include:

- usage examples
- formulas tied to variables used
- extension examples

Draft EQs: Univariate Samples

As an example, consider the formula for the sample mean:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

While often computed using an array or container of values, all that is required is the number of observations n and the sum $\sum x_i$. Those two variables may be easily stored and added to at any point, with an updated mean value being one division away.

We can similarly determine the variables needed for computing variance from its formula:

$$\begin{aligned}\sigma^2 &= \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2 \\&= \frac{1}{n-1} \sum_{i=1}^n (x_i^2 - 2x_i\bar{x} + \bar{x}^2) \\&= \frac{1}{n-1} \left(\sum_{i=1}^n x_i^2 - 2\bar{x} \sum_{i=1}^n x_i + \sum_{i=1}^n \bar{x}^2 \right) \\&= \frac{1}{n-1} \left(\sum_{i=1}^n x_i^2 - 2 \left(\frac{1}{n} \sum_{i=1}^n x_i \right) \left(\sum_{i=1}^n x_i \right) + n\bar{x}^2 \right) \\&= \frac{1}{n-1} \left(\sum_{i=1}^n x_i^2 - \frac{2}{n} \left(\sum_{i=1}^n x_i \right)^2 + n \left(\frac{1}{n} \sum_{i=1}^n x_i \right)^2 \right) \\&= \frac{1}{n-1} \left(\sum_{i=1}^n x_i^2 - \frac{1}{n} \left(\sum_{i=1}^n x_i \right)^2 \right)\end{aligned}$$