Sigma notation

The Greek capital letter sigma, Σ, is used as an abbreviation for an addition sum. Suppose we have n values x_1, x_2, $\ldots x_n$ and we wish to add them together. The sum

$$x_1 + x_2 + \ldots x_n \text{ is written } \sum_{i=1}^{n} x_i$$

Note that i runs through all whole number values from 1 to n. So, for instance

$$\sum_{i=1}^{3} x_i \text{ means } x_1 + x_2 + x_3$$

Example

$$\sum_{i=1}^{5} i^2 \text{ means } 1^2 + 2^2 + 3^2 + 4^2 + 5^2$$

The Greek alphabet

A	α	alpha	I	ι	iota	P	ρ	rho
B	β	beta	K	κ	kappa	Σ	σ	sigma
Γ	γ	gamma	Λ	λ	lambda	T	τ	tau
Δ	δ	delta	M	μ	mu	Υ	υ	upsilon
E	ϵ	epsilon	N	ν	nu	Φ	ϕ	phi
Z	ζ	zeta	Ξ	ξ	xi	X	χ	chi
H	η	eta	O	o	omicron	Ψ	ψ	psi
Θ	θ	theta	Π	π	pi	Ω	ω	omega

Statistics

Population values, or **parameters**, are denoted by Greek letters. Population mean $= \mu$. Population variance $= \sigma^2$. Population standard deviation $= \sigma$. Sample values, or **estimates**, are denoted by roman letters.

The **mean** of a sample of n observations $x_1,\, x_2, \ldots x_n$ is

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{x_1 + x_2 + \ldots + x_n}{n}$$

The unbiased estimate of the **variance** of these n sample observations is

$s^2 = \dfrac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$ which can be written as

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n} x_i^2 - \frac{n\bar{x}^2}{n-1}$$

The sample unbiased estimate of **standard deviation**, s, is the square root of the variance:

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$