

## CORRECTING THE ESTIMATES OF STANDARD DEVIATION AND GROUPED VARIANCE

[1] Bias in estimating  $\sigma$  by  $s$  for individual data

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

$$E(s) = \frac{\Gamma\left(\frac{n}{2}\right)}{\sqrt{\frac{n-1}{2}} \Gamma\left(\frac{n-1}{2}\right)} \sigma = A_n \sigma$$

Reference: *The Advanced Theory of Statistics – Volume II* by M.G. Kendall & A. Stuart (Hafner/Macmillan Publishing), Chapter 17, problem 17.6.

N	$A_n$	$\approx 1 - \frac{1}{4n-4}$
2	0.797884	0.750000
6	0.951533	0.950000
10	0.972650	0.972222
20	0.986934	0.986842
50	0.994911	0.994898
100	0.997478	0.997475

[2] Sheppard's Correction for Grouped Variance

$$s^2 = \frac{n \sum x^2 f - (\sum x f)^2}{n(n-1)} = \frac{\sum (x - \bar{x})^2 f}{n-1}$$

corrected  $s^2 = s^2 - \frac{1}{12} h^2$  where  $h$  = class width

Reference: *The Advanced Theory of Statistics – Volume I* by M.G. Kendall & A. Stuart (Hafner/Macmillan Publishing), Chapter 3.18.

Note: This correction is usually small and there are similar corrections for higher moments.