4.14 Variance

Checklist

What you should know

By the end of this subtopic you should be able to:

- calculate the expectation and variance of a random variable after a linear transformation using the formulae $\mathrm{E}(aX+b)=a\mathrm{E}(X)+b$ and $\mathrm{Var}(aX+b)=a^2\mathrm{Var}(X)$
- calculate the expectation and variance of the linear combinations of n independent random variables, $X_1,\ X_2,\ \ldots,\ X_n$ using the formulae $\mathrm{E}(a_1X_1 \pm a_2X_2 \pm \ldots \pm a_nX_n)=a_1\mathrm{E}(X_1)\pm a_2\mathrm{E}(X_2)\pm \ldots \pm a_n\mathrm{E}(X_n)$ and $\mathrm{Var}(a_1X_1 \pm a_2X_2 \pm \ldots \pm a_nX_n)={a_1}^2\mathrm{Var}(X_1)+{a_2}^2\mathrm{Var}(X_2)+\ldots +{a_n}^2\mathrm{Var}(X_n)$
- state that the sample mean, $\bar{x}$, is an unbiased estimate of the population mean, μ
- calculate an unbiased estimate for the variance of a population using the formula ${s_{n-1}}^2=\frac{n}{n-1}{s_n}^2=\sum_{i=1}^{k}\frac{f_i(x_i-\bar{x})^2}{n-1}$.