Variance

Variance measures variability (or dispersion). Therefore, variance is a measure of variability or dispersion of the random variable about its mean. The mathematical expression of the variance is as folows:

$$Var(x) = \sigma^2 = \sum_i^n (x_i - \mu)^2 f(x_i)$$

where $f(x_i)$ is the probability of x_i. Since μ is unknown, it is replaced by the estimated sample mean ($\bar{x}$) in the calculations.

Illustration

A company has information available concerning the number of months for carrying out a given project, with their respective probabilities. This illustration shows how to calculate the expected value of the number of months to complete the project.

Example: completion time for a project
Probability distribution
Variance

x_i	$f(x_i)$	$(x_i - \bar{x})^2$	$(x_i - \bar{x})^2 f(x_i)$
5	0.15	3.61	0.542
6	0.25	0.81	0.203
7	0.30	0.01	0.003
8	0.15	1.21	0.182
9	0.15	4.41	0.662

$$\bar{x} = \sum_{i=1}^5 x_i f(x_i) = 6.90 \quad \text{months}$$

$$Var(x) = s^2 = \sum_{i=1}^5 (x_i - \bar{x})^2 f(x) = 1.59 \quad \text{months}^2$$