Properties of expectation

The *expectation* of a random variable is just its *arithmetic mean* or *average*. The expectation of X is denoted by $E[X]$ and defined by

$$E[X] = \sum xP[X = x]$$

Given a constant c and random variables X and Y, then

1. $E[c] = c$
2. $E[cX] = cE[X]$
3. $E[X \pm Y] = E[X] \pm E[Y]$

Note 1. $E[XY] \neq E[X] \times E[Y]$ except if X and Y are *independent*.

2. $E\left[\frac{X}{Y}\right] \neq \frac{E[X]}{E[Y]}$

Properties of variance

The *variance* of a random variable is a measure of its *spread* or *dispersion*. The variance of X is denoted by $\text{var}[X]$ and defined as

$$\text{var}[X] = E[X^2] - \left(E[X]\right)^2$$

Given a constant c and random variables X and Y, then

1. $\text{var}[c] = 0$
2. $\text{var}[cX] = c^2\,\text{var}[X]$
3. $\text{var}[X \pm Y] = E = \text{var}[X] + \text{var}[Y]$ only if X and Y are *independent.*

Note 1. $\text{var}[XY] \neq \text{var}[X] \times \text{var}[Y]$

2. $\text{var}\left[\frac{X}{Y}\right] \neq \frac{\text{var}[X]}{\text{var}[Y]}$