

The Variance of a r.v. X is given by:-

$$\text{Var}(X) = V(X) = \sigma_x^2 = E(X^2) - [E(X)]^2$$

التباين دائماً موجب $\sigma^2 \geq 0$

Ex(1) Find $V(X)$ for the r.v. X

$$P(X) = \begin{cases} \frac{1}{10} & ; X=1 \\ \frac{4}{10} & ; X=2 \\ \frac{2}{10} & ; X=3 \\ \frac{3}{10} & ; X=4 \\ 0 & ; \text{o.w.} \end{cases}$$

$$V(X) = E(X^2) - [E(X)]^2$$

$$\begin{aligned} E(X^2) &= \sum_{\forall x} x^2 \cdot P(x) \\ &= \sum_{x=1}^4 x^2 \cdot P(x) \end{aligned}$$

$$= 1 \cdot \frac{1}{10} + 4 \cdot \frac{4}{10} + 9 \cdot \frac{2}{10} + 16 \cdot \frac{3}{10}$$

$$= \frac{1}{10} + \frac{16}{10} + \frac{18}{10} + \frac{48}{10} = \frac{83}{10}$$

$$V(X) = E(X^2) - [E(X)]^2$$

$$= \frac{83}{10} - \left(\frac{27}{10}\right)^2 = \frac{83}{10} - \frac{729}{100} = 8.3 - 7.29 = 1.01$$