1 discrete random variable

$$\underset{\text{random variable}}{X} \in \underset{\text{support}}{\mathcal{H}} \equiv \underset{\text{discrete values}}{\{\tau_0, \tau_1, \dots\}}$$

→ probability mass function: $\boxed{\pi(\tau_i) \equiv P[X = \tau_i]}$

→ $P[X \in \mathcal{H}] \equiv \sum_{i=0}^{\infty} \pi(\tau_i) \equiv 1$

- expectation: $\boxed{\mu \equiv E[X] \equiv \sum_{i=0}^{\infty} \tau_i \cdot \pi(\tau_i)} \longrightarrow E[g(X)] \equiv \sum_{i} g(\tau_i) \cdot \pi(\tau_i)$
- variance: $\boxed{\sigma^2 = var[X] \equiv E[(X-\mu)^2] \equiv \sum_{i=0}^{\infty} (\tau_i - \mu)^2 \cdot \pi(\tau_i)} \longrightarrow E[g(X)] \equiv \sum_{i=0}^{\infty} (g(\tau_i) - E[g(X)])^2 \cdot \pi(\tau_i)$
- standard deviation: $\boxed{\sigma \equiv \sqrt{\sigma^2}}$

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1 continuous random variable

$X \in \mathcal{H} \equiv \{-\infty, +\infty\}$

→ probability density function: $\boxed{f(x) \cdot dx \equiv P[X \in [x, x+dx]]}$

→ $P[X \in \mathcal{H}] \equiv \int_{-\infty}^{\infty} f(x) \cdot dx \equiv 1$

- expectation: $\boxed{\mu \equiv E[X] = \int_{-\infty}^{\infty} x \cdot f(x) \cdot dx} \longrightarrow E[g(X)] \equiv \int_{-\infty}^{\infty} g(x) \cdot f(x)\, dx$
- variance: $\boxed{\sigma^2 \equiv var[X] = E[(X-\mu)^2] \equiv \int_{-\infty}^{\infty} (X-\mu)^2 \cdot f(x)\, dx} \longrightarrow var[g(x)] \equiv \int_{-\infty}^{\infty} (g(X) - E[g(x)])^2 f(x)\, dx$
- standard deviation: $\boxed{\sigma = \sqrt{\sigma^2}}$

! important results

→ $var[X] = E[X^2] - (E[X])^2$

→ $E[a + b \cdot X] = a + b \cdot E[X]$

→ $var[a + bX] = b^2 \cdot var[X]$

$a, b \in R$