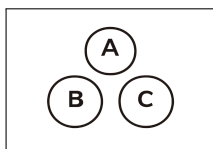


16 Discrete Distribution Expected Value Function

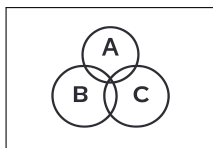
A



$$Y = 20 - 2X$$

$$E(X) = 6$$

$$E(Y) = ?$$

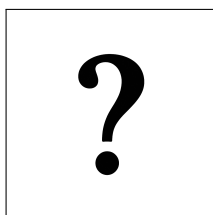


$$E(Y) = E(20 - 2X)$$

$$E(20 - 2X) = E(20) - 2E(X)$$

$$E(20) = 20$$

$$E(Y) = 20 - 2(6) = 20 - 12 = 8$$



$$x = \{1, 2, 3, 4\}$$

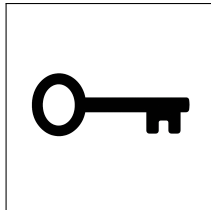
$$p(x) = cx^2$$

$$c = ?$$

$$E(X) = ?$$

$$E(X(X - 1)) = ?$$

16 Discrete Distribution Expected Value Function A



$$\begin{aligned}x &= \{1, 2, 3, 4\} \\ p(x) &= cx^2 \\ c &= ? \\ E(X) &= ? \\ E(X(X-1)) &= ?\end{aligned}$$

$$\sum_{x=1}^4 cx^2 = 1 \Rightarrow c \sum_{x=1}^4 x^2 = 1$$

$$\sum_{x=1}^4 x^2 = 1^2 + 2^2 + 3^2 + 4^2 = 1 + 4 + 9 + 16 = 30$$

$$c = \frac{1}{30}$$

$$E(X) = \sum x \cdot p(x) = \sum_{x=1}^4 x \cdot cx^2 = c \sum_{x=1}^4 x^3$$

$$\sum_{x=1}^4 x^3 = 1^3 + 2^3 + 3^3 + 4^3 = 1 + 8 + 27 + 64 = 100$$

$$E(X) = \frac{1}{30} \cdot 100 = \frac{10}{3}$$

$$E(X(X-1)) = \sum x(x-1) \times p(x) = \sum_{x=1}^4 x(x-1) \times cx^2 = c \sum_{x=1}^4 x(x-1)x^2$$

$$x(x-1)x^2 = x^3(x-1)$$

$$\sum_{x=1}^4 x^3(x-1) = \sum_{x=1}^4 (x^4 - x^3)$$

$$x = 1: 1^4 - 1^3 = 0$$

$$x = 2: 16 - 8 = 8$$

$$x = 3: 81 - 27 = 54$$

$$x = 4: 256 - 64 = 192$$

$$\sum_{x=1}^4 x^3(x-1) = 0 + 8 + 54 + 192 = 254$$

$$E(X(X-1)) = \frac{1}{30} \cdot 254 = \frac{127}{15} \approx 8.47$$