

K

Negative Binomial Random Variable

K



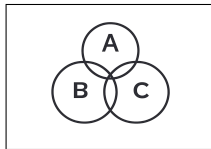
$$p = 0.5$$

$$r = 2$$

$$n = 3$$

$$P(X = n) = \binom{n-1}{r-1} p^r (1-p)^{n-r}$$

$$P(X = 3) = ?$$

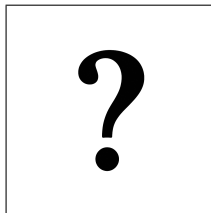


$$P(X = 3) = \binom{3-1}{2-1} (0.5)^2 (0.5)^{3-2}$$

$$P(X = 3) = \binom{2}{1} (0.5)^3$$

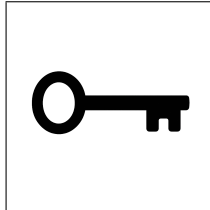
$$P(X = 3) = 2 \times 0.125$$

$$P(X = 3) = \boxed{0.25}$$



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$$\begin{aligned}r &= 2 \\p &= 0.4 \\PMF &= ? \\mode(X) &= ?\end{aligned}$$

$$P(X = n) = \binom{n-1}{2-1} p^2 (1-p)^{n-2}$$

$$P(X = n) = (n-1) (0.4)^2 (0.6)^{n-2}, \quad n = 2, 3, 4, \dots$$

$$P(X = 2) = 1 \cdot 0.4^2 \cdot 0.6^0 = 0.16$$

$$P(X = 3) = 2 \cdot 0.4^2 \cdot 0.6^1 = 0.192$$

$$P(X = 4) = 3 \cdot 0.4^2 \cdot 0.6^2 \approx 0.1728$$

$$mode(X) = r + \left\lfloor \frac{(r-1)(1-p)}{p} \right\rfloor$$

$$mode(X) = 2 + 1 = \boxed{3}$$