



Negative Binomial Random Variable



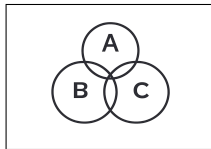
$$p = 0.5$$

$$r = 2$$

$$n = 3$$

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

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

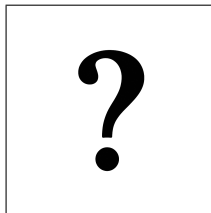


$$P(X = 3) = \binom{3-1}{2-1} (0.5)^2 (0.5)^{3-2}$$

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

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

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



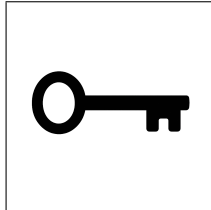
$$r = 3$$

$$p = 0.4$$

$$P(X = 10) = ?$$



Negative Binomial Random Variable



$$\begin{aligned}r &= 3 \\p &= 0.4 \\P(X = 10) &= ?\end{aligned}$$

$$P(X = k) = \binom{k-1}{r-1} p^r (1-p)^{k-r}, \quad k = r, r+1, \dots$$

$$P(X = 10) = \binom{10-1}{3-1} (0.4)^3 (0.6)^{10-3}$$

$$P(X = 10) = \binom{9}{2} (0.4)^3 (0.6)^7$$

$$P(X = 10) = 36 \times (0.4)^3 \times (0.6)^7$$

$$P(X = 10) = 36 \times 0.064 \times 0.6^7$$

$$P(X = 10) \approx 36 \times 0.064 \times 0.0279936 \approx \boxed{0.06445}$$