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Negative Binomial Random Variable

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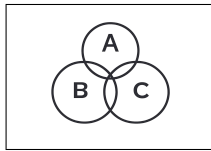
$$p = 0.5$$

$$r = 2$$

$$n = 3$$

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

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

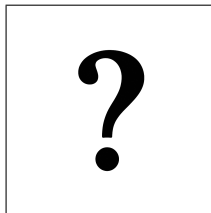


$$P(X = 3) = \binom{3-1}{2-1} (0.5)^2 (0.5)^{3-2}$$

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

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

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



$$K = 3$$

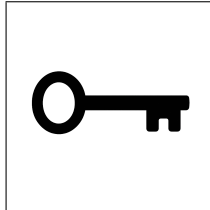
$$N = 100$$

$$n = 20$$

$$k = \{0, 1, 2, 3\}$$



Negative Binomial Random Variable



$$\begin{aligned}K &= 3 \\N &= 100 \\n &= 20 \\k &= \{0, 1, 2, 3\}\end{aligned}$$

$$P(X = k) = \frac{\binom{3}{k} \binom{97}{20-k}}{\binom{100}{20}}$$

$$P(X \geq 2) = P(X = 2) + P(X = 3)$$

$$P(X \geq 2) = \frac{\binom{3}{2} \binom{97}{18} + \binom{3}{3} \binom{97}{17}}{\binom{100}{20}}$$

$$P(X \geq 2) \approx 0.09400 + 0.00705$$

$$P(X \geq 2) \approx \boxed{0.10105}$$