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# Negative Binomial Random Variable

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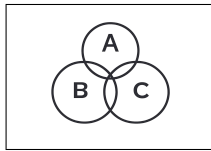
$$p = 0.5$$

$$r = 2$$

$$n = 3$$

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

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

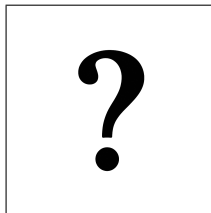


$$P(X = 3) = \binom{3-1}{2-1} (0.5)^2 (0.5)^{3-2}$$

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

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

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



$$p = \frac{1}{2}$$

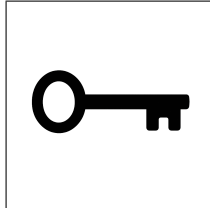
$$n = 9$$

$$r = 4$$

$$P(X = 9) = ?$$

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$$\begin{aligned}p &= \frac{1}{2} \\n &= 9 \\r &= 4 \\P(X = 9) &= ?\end{aligned}$$

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$$P(X = 9) = \binom{9-1}{4-1} p^4 (1-p)^{9-4}$$

$$P(X = 9) = \binom{8}{3} \left(\frac{1}{2}\right)^4 \left(\frac{1}{2}\right)^5$$

$$P(X = 9) = \binom{8}{3} \left(\frac{1}{2}\right)^9$$

$$P(X = 9) = 56 \frac{1}{512}$$

$$P(X = 9) = \frac{7}{64} \approx \boxed{0.1094}$$