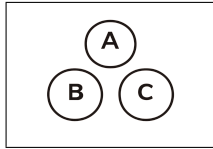


# Negative Binomial Random Variable



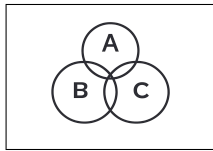
$$p = 0.5$$

$$r = 2$$

$$n = 3$$

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

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

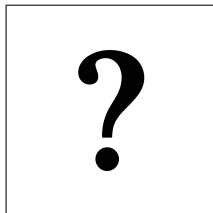


$$P(X = 3) = \binom{3-1}{2-1} (0.5)^2 (0.5)^{3-2}$$

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

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

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



$$r = 2$$

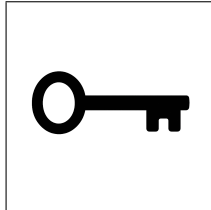
$$p = 0.1$$

$$E[X] = ?$$

$$\text{Var}[X] = ?$$

$$\sigma_X = ?$$

# Negative Binomial Random Variable



$$\begin{aligned}r &= 2 \\p &= 0.1 \\E[X] &= ? \\Var[X] &= ? \\\sigma_X &= ?\end{aligned}$$

$$E[X] = \frac{r}{p} = \frac{2}{0.1} = \boxed{20}$$

$$Var[X] = \frac{r(1-p)}{p^2}$$

$$Var[X] = \frac{2 \cdot 0.9}{0.1^2}$$

$$Var[X] = \frac{1.8}{0.01}$$

$$Var[X] = \boxed{180}$$

$$\sigma_X = \sqrt{Var[X]} = \sqrt{180} \approx \boxed{13.416}$$