

Here are some questions about distributions.

1. Find the variance for the uniform distribution with sample space $\Omega = \{1, 2, \dots, n\}$.

(Hint: $\sum_{k=1}^n k^2 = n(n+1)(2n+1)/6$)

$$\begin{aligned}
 V(X) &= E(X^2) - E(X)^2 \\
 &= \sum_{k=1}^n k^2/n - \frac{(n+1)^2}{4} \\
 &= \frac{1}{n} \frac{n(n+1)(2n+1)}{6} - \frac{(n+1)^2}{4} \\
 &= \frac{4n^2 + 6n + 2}{12} - \frac{3n^2 + 6n + 3}{12} \\
 &= \frac{n^2 - 1}{12}
 \end{aligned}$$

2. A baker blends 600 raisins into a dough mix and, from this, makes 500 cookies.

- (a) What distribution governs the number of raisins in a randomly picked cookie? With what parameters?

Binomial w/ $p = 1/500, n = 600$
 is the raisin in my cookie? \uparrow which raisin?

- (b) Find the probability a randomly picked cookie will have no raisins.

$$\begin{aligned}
 b(n, p, 0) &= \binom{600}{0} (1/500)^0 (499/500)^{600} \\
 &= (499/500)^{600}
 \end{aligned}$$

- (c) Find the probability a randomly picked cookie will have at least two raisins in it.

$$1 - b(n, p, 0) - b(n, p, 1) = 1 - \binom{600}{0} (1/500)^0 (499/500)^{600} - \binom{600}{1} (1/500)^1 (499/500)^{599}$$

3. Let X and Y be independent geometric random variables with parameter p . Find the probability $X + Y = 5$. What about the probability that $X + Y = k$?

will see this next class!