Formally…

Let X be the number of flips needed, Y be the flips after the second.

$\mathbb{P}(Y = k | X \geq 3) = ?$

…

Which is $p_X(k)$.

Poisson Distribution

$X \sim \text{Poi}(\lambda)$

Let λ be the average number of incidents in a time interval.

X is the number of incidents seen in a particular interval.

Support $\mathbb{N}$

$p_X(k) = \frac{\lambda^k e^{-\lambda}}{k!}$ (for $k \in \mathbb{N}$)

$F_X(k) = e^{-\lambda} \sum_{i=0}^{\lfloor k \rfloor} \frac{\lambda^i}{i!}$

$\mathbb{E}[X] = \lambda$

$\text{Var}(X) = \lambda$

Try it

More generally, run independent trials with probability p. How many trials do you need for r successes?

What's the pmf?

What's the expectation and variance (hint: linearity)

Scenario: Hypergeometric

You have an urn with N balls, of which K are purple. You are going to draw balls out of the urn without replacement.

If you draw out n balls, what is the probability you see k purple ones?