Binomial Distribution

$X \sim Bin(n, p)$ means X is a binomial rv that counts the number of successes in n trials, each with success probability p

pmf: $P(X=x) = \binom{n}{x} p^x (1-p)^{n-x}$ for $x = 0, 1\ 2, \ldots, n$

mean: $E(X) = np$ variance: $Var(X) = np(1-p)$

Poisson Process

A sequence of discrete occurrences where the average number of occurrences in a fixed time interval is known, but the exact timing of occurrences is random.

Poisson Distribution

$X \sim Poisson(\mu)$ if X counts the number of occurrences in a Poisson process with mean μ occurrences per time interval.

pmf: $P(X=x) = e^{-\mu} \dfrac{\mu^x}{x!}$ for $x = 0, 1, 2, 3, \ldots$

mean: $E(X) = \mu$ variance: $Var(X) = \mu$

check: does it sum to 1?

$$\sum_{x=0}^{\infty} P(X=x) = \sum_{x=0}^{\infty} e^{-\mu} \frac{\mu^x}{x!} = e^{-\mu} \boxed{\sum_{x=0}^{\infty} \frac{\mu^x}{x!}}$$

$$= e^{-\mu} e^{\mu} = 1$$

RECALL:

$$e^y = \sum_{k=0}^{\infty} \frac{y^k}{k!}$$