binomial random variable

example (cont'd...)

Toss a coin 3 times: the sample space is $\Omega : \{H,T\} \times \{H,T\} \times \{H,T\}$

Define the random variable: $X =$ the number of heads

What is the probability distribution of X?

$$X \sim Bin(n = 3, p = 0.5)$$

$$\implies P(X = x) = \binom{n}{x} p^x (1-p)^{n-x} = \binom{n}{x} 0.5^x (0.5)^{3-x}$$

Poisson random variable

- A r.v. that expresses the probability of how many times an event occurs in a fixed period of time if these events
  - occur with known average rate of λ
  - and independently of each other

$$P(X = x \mid \lambda) = e^{-\lambda}\frac{\lambda^x}{x!}$$

- Discrete outcomes $\{0,1,2,3\ldots\}$
- Shorthand notation: $X \sim \text{Poisson}(\lambda)$
- $E(X) = V(X) = \lambda$

X	$P(X = x)$
0	$e^{-\lambda}$
1	$e^{-\lambda}\lambda$
2	$e^{-\lambda}\frac{\lambda^2}{2}$
⋮	⋮

- If the data shows overdispersion (variance > mean) or underdispersion (variance < mean), other models like the Negative Binomial