Physics 341 - Lecture 5

Binomial

$N \to$ # of times

$p \to$ prob. of desired outcome

$k \to 0, \ldots, N$

$b(x; n, p)$

$b(4; 6, .33)$

$n=6 \quad p=.33$

$k=4$

Cumulative Distribution Function

---

stats.binom.cdf(k, n, p

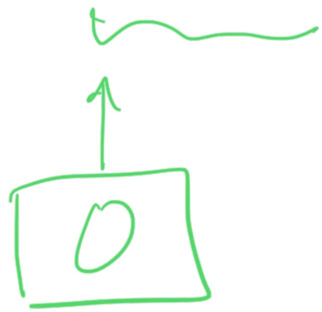
$$\int^{k}$$

lowest possible value

$$\int_0^5 - \int_0^2$$

3, 4, 5

$P(1 \leq X)$



$$\int_{-\infty}^{\infty} P(x)\,dx = 1$$

Summary

- → pmf → specific values
- → cdf → integral of $P(x)$
- → $\displaystyle\int_{-\infty}^{\infty} P(x)\,dx = 1$

"the long run - - - -

$\Rightarrow$ 10%"

$N = 25$

$p = .10$

defective

$X \sim Bin(25, .10)$

$N \qquad p$

$k = 0, \ldots, 25$

a) $P(X \leq 2)$

cdf

$0, 1, 2$

Expectation Value

→ what do I "expect" in a perfect world?

$N = 18$

$k \Rightarrow$ # of 2's

3

3 1's

3 2's

3 3's

3 4's

3 5's

3 6's

$$E[X] = Np$$

(μ)

$$(18)\left(\frac{1}{6}\right) = 3$$

means

$$\sigma = \sqrt{Np(1-p)}$$

Approximations to Binomial Distribution.

Two possibilities :

① $p \sim 0.5$

→ elections in the United States

$\boxed{\text{Dem. / Repo.}}$

45/55 — 55/45

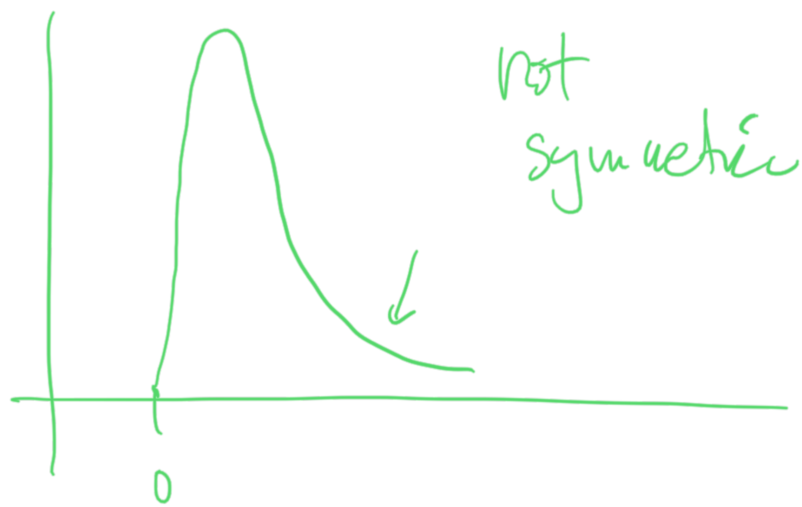
$\boxed{\text{Gaussian}}$

τ

$$\mu = Np$$

$$\sigma = \sqrt{Np(1-p)}$$

② $p \sim$ small, close to 1



$\boxed{\text{Poisson Distribution.}}$

$$P(k) = \frac{\lambda^k e^{-\lambda}}{\ }$$

$k!$

$$\lambda = \mu = E[X] = \underline{\underline{\text{average}}}$$