DISTRIBUTIONS (The General ones)

C.D.F (cumulative distribution function) → often used for discrete variables & continuous

def. $F(x) = P(X \leq x)$

↑ the function ↑ probability ← random variable

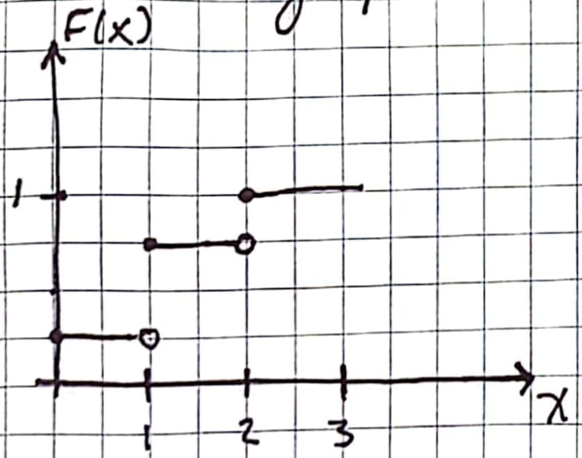
this function is non-decreasing and goes from 0 to 1

Example w/ coin tosses

If we flip 2 coins:

X (# of tails)	0	1	2
P(x)	1/4	1/2	1/4

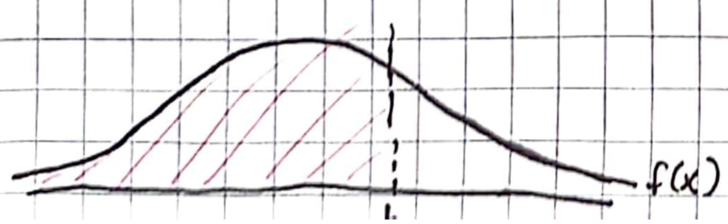
then on graph:



P.D.F (probability density function) → ~~often~~ for continuous functions

If X is a continuous variable then f(x) is the pdf if:

$$P(X \leq b) = \int_{-\infty}^{b} f(x)\,dx$$



f(x) is not a probability the area under f(x) is!

Binomial Distribution

This distribution is used when there are two outcomes of an experiment/trial.
→ often called the success & Failure

The probability of success :

$$P(X=i) = \binom{n}{i} p^i (1-p)^{n-i}$$

or expanded:

$$p(\underset{\substack{\uparrow\\ \text{\# of success}}}{x} \mid \underset{\text{\# of trials}}{n}, \underset{\text{probability of success}}{p}) = \left(\frac{n!}{x!\,(n-x)!}\right) p^x (1-p)^{n-x}$$

Poisson Distribution

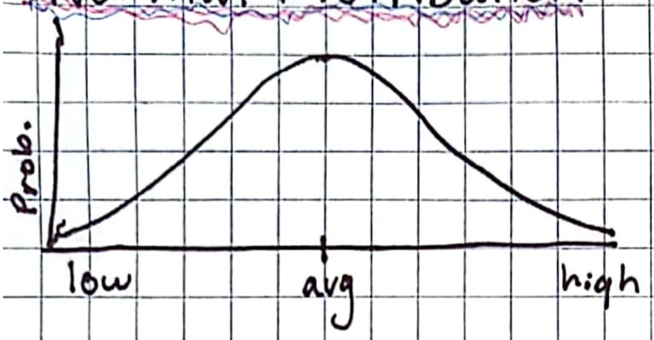
- events occur independently
- prob. that an event occurs in a given length of time does not change

Random & Independent

$$P(X=x) = \frac{\lambda^x e^{-\lambda}}{x!}$$ λ is mean of xs

$$\underbrace{E[x] = Var(X)}_{\text{the expected value \& the variance are the same}} = \lambda$$

Normal Distribution



much more likely to make an observation around the mean

the center is always the avg.

The curve can be narrower or wider based on the std. deviation

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

E.D.F Empirical Distribution

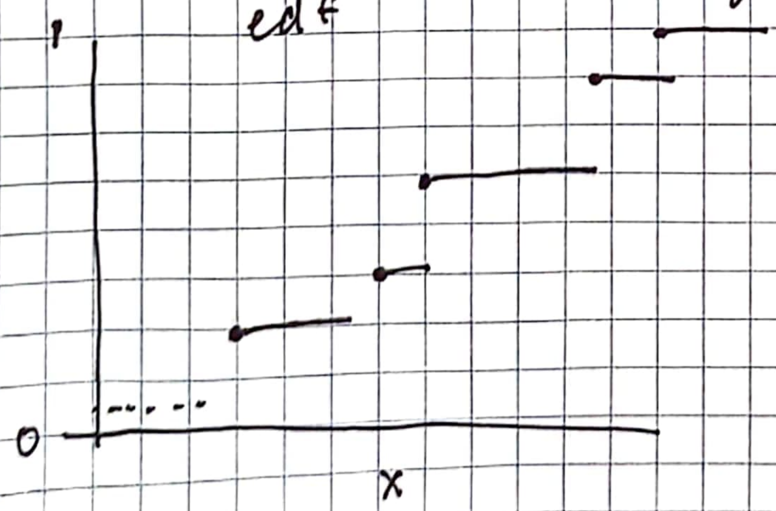
$$\hat{F}_n(X_0) = \frac{\text{number of } X_i \le X_0}{\text{total Observations}} = \sum_{i=1}^{n} \frac{I(X_i \le X_0)}{n} =$$

$$\frac{1}{n} \sum I(X_i \le X_0)$$

An estimate of this is the ratio that is occured in the sample

$$\hat{F}(X_0) = P(X_i \le X_0)$$

probability of the event $X_i \le X_0$



Looks "block-y" for small samples.