A quick note on Kurtosis and variance

$$\text{Kurtosis} = \frac{1}{N} \times \sum_{i=1}^{N} \frac{(x_i - \bar{x})^4}{(\sigma^2)^2}$$

σ^2 = variance

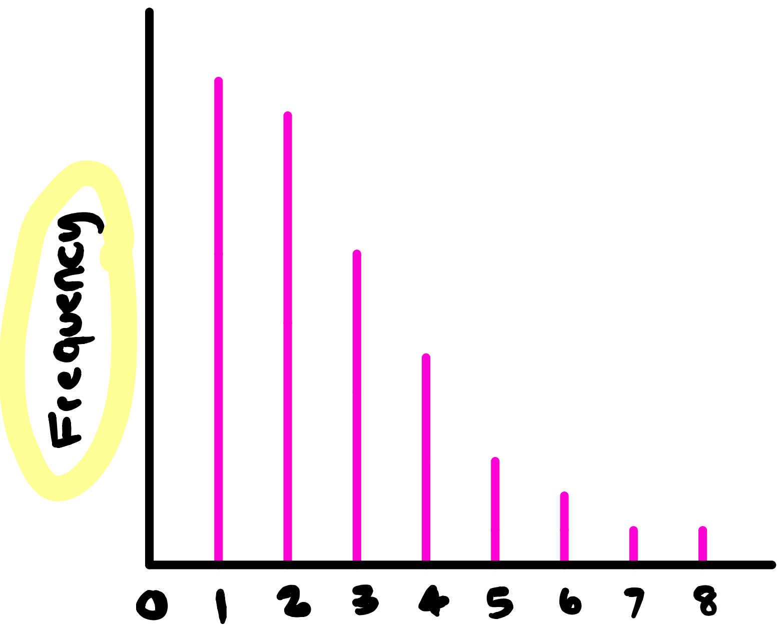
N = sample size

$$\text{Kurtosis} \propto \frac{1}{\text{var}^2}$$

As variance increases, kurtosis decreases

Probability $\boxed{\text{Mass}}$ vs. Probability $\boxed{\text{Density}}$

Discrete Distributions



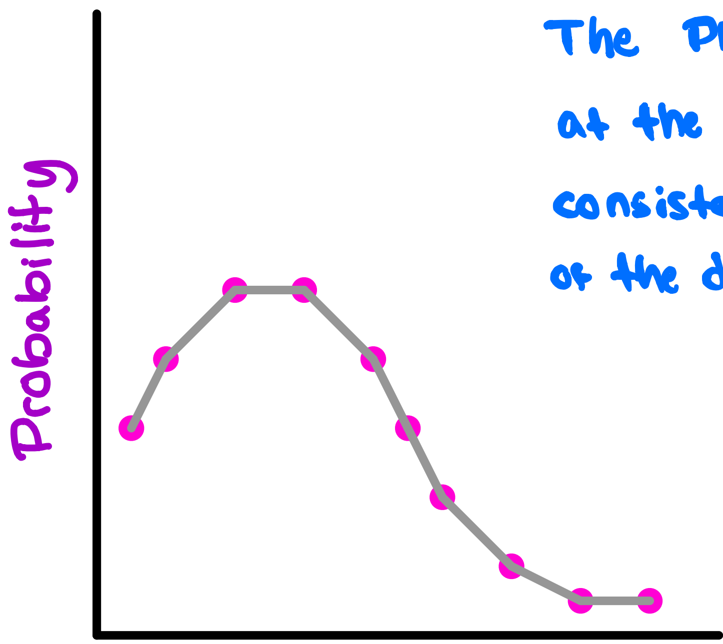
$1 \rightarrow 21$
$2 \rightarrow 18$
$3 \rightarrow 16$
$4 \rightarrow 12$
$5 \rightarrow 9$
$6 \rightarrow 4$
$7 \rightarrow 1$
$8 \rightarrow 1$

$\overline{}$
82

The probability of 4 $P(4)$ is given by $\frac{12}{82} = 0.14$

Poisson PMF

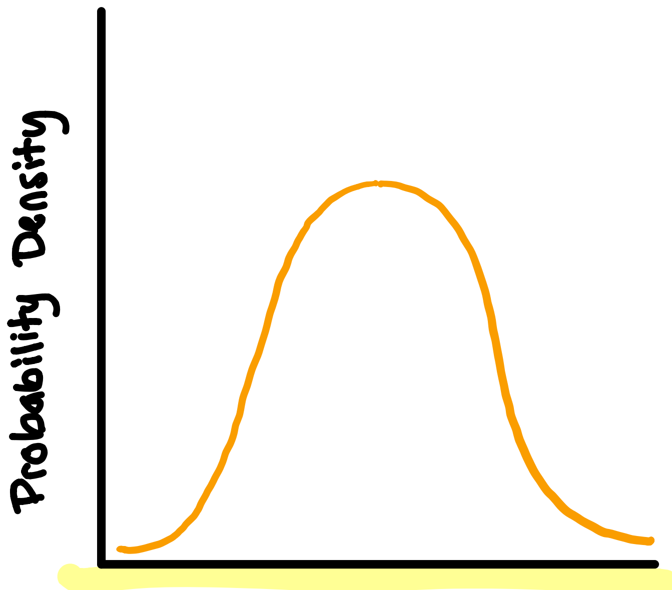
$$\frac{\lambda^k e^{-\lambda}}{k!}$$



The PMF is only defined at the natural numbers, consistent with the support of the distribution

Most common Poisson distributions exhibit high probability for low values with this probability dropping rapidly toward 0 as k increases

Normal Distribution



continuous X → infinitely many X

The probability of all events must still sum to 1, therefore the Probability of any one of the infinite values of X must equal 0.

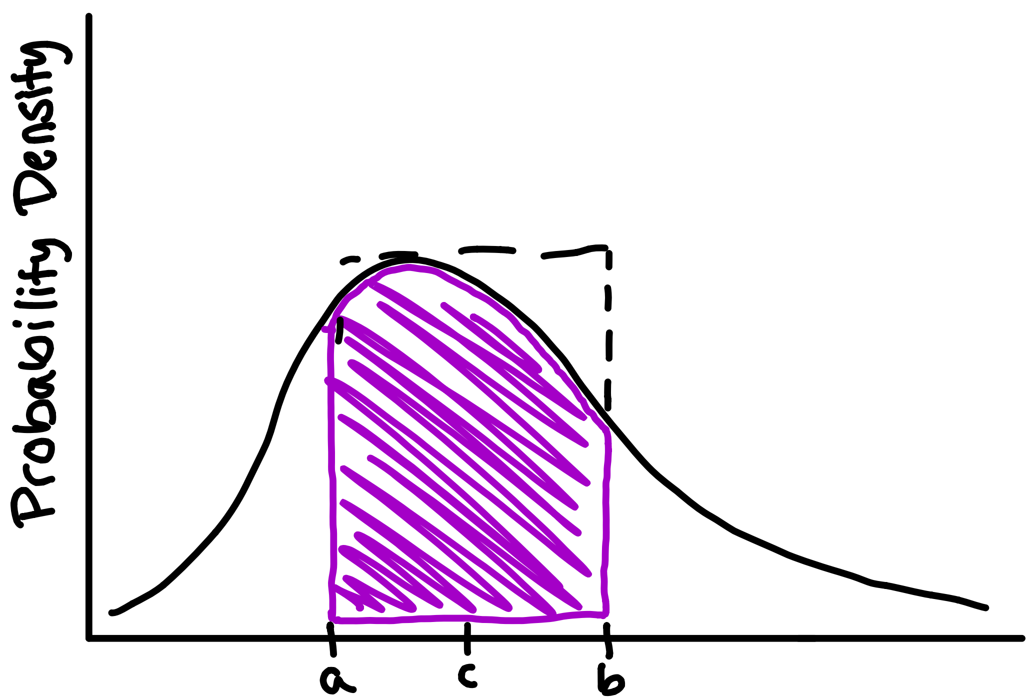
Ex. consider a beta distribution with $\mu = 0.25$ and $\sigma^2 = 0.01$. The value 0.173 exists in this distribution, but the probability of pulling 0.173 out of a bag containing all other values in the domain is equal to 0.

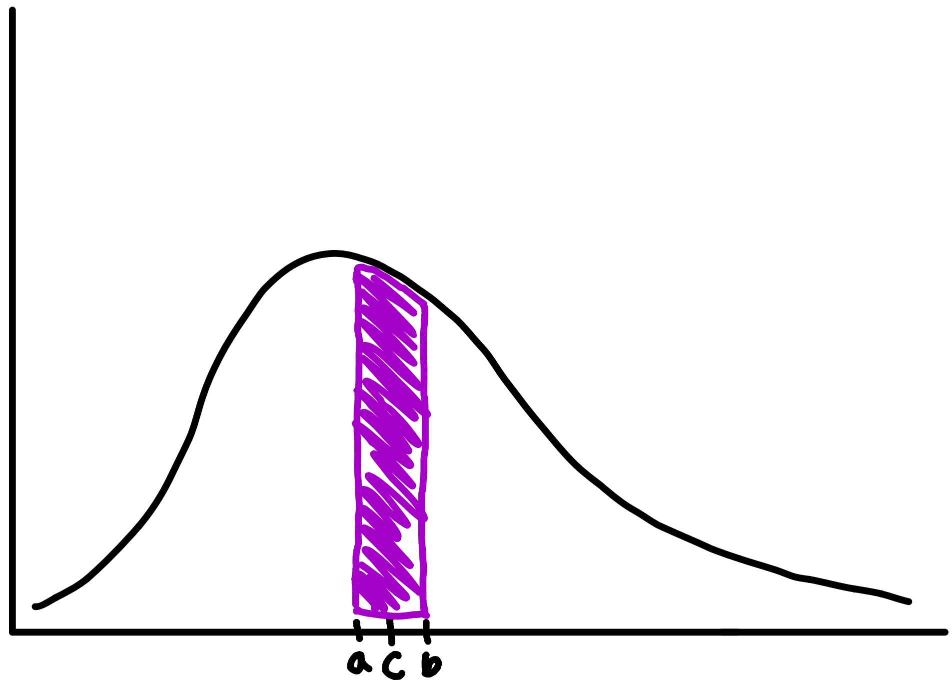
Probability Density

if $p(x)$ = the PDF of some distribution

then $\int_b^a p(x)\,dx$ gives the **PROBABILITY** of observing values on the interval from a to b

As the interval $[a, b]$ gets smaller, the integral yields more accurate probabilities for the midpoint $\frac{a+b}{2} = c$




a
c
b