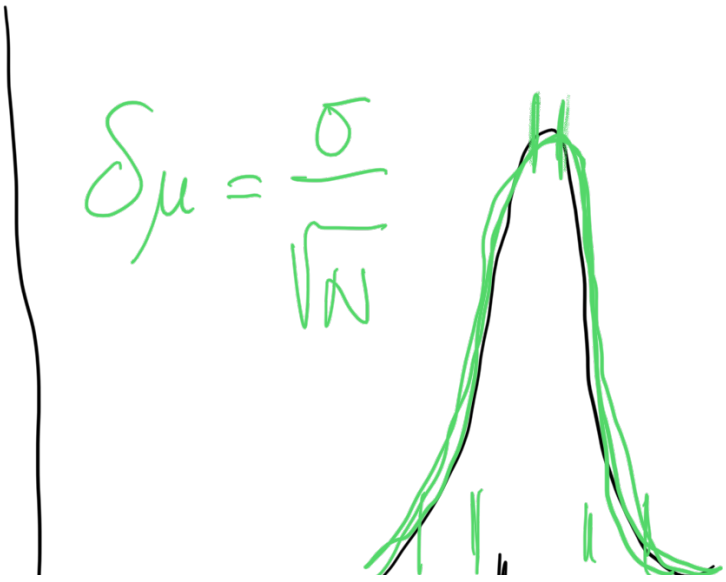
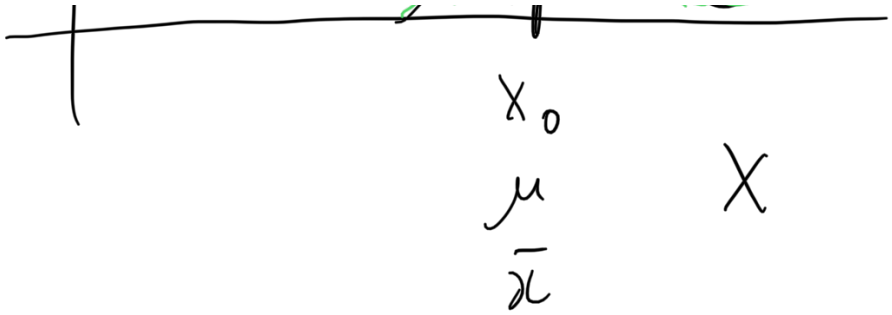
Physics 341
Lecture 8

→ Yes! → use Jupyter Notebooks

→ Formative vs. Summative Assessment

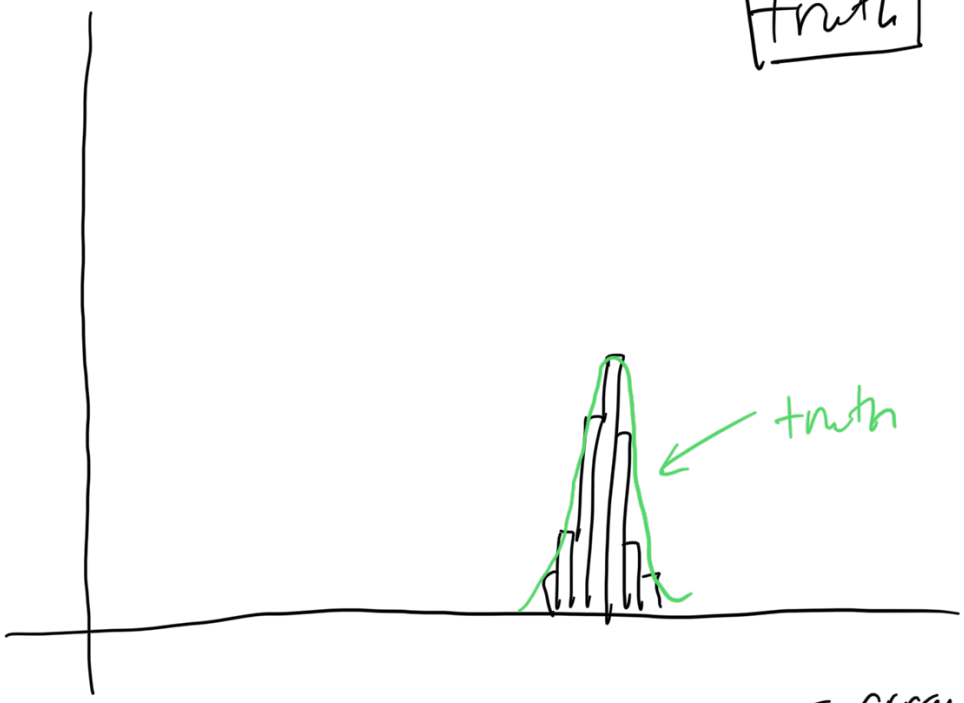
Gaussian Distribution





What could go wrong?

truth



← array of data

data { np.mean(x)
np.std(x, ddof=1)

"sample"

$\mu = 100$

GUOD

① $\mu = 100$, $\bar{x} = 100.00 - ?$

② $\mu = 100$ calories, $\bar{x} = 95 \pm 2$ Unlucky!

BAD

$$

Reports: There is a problem when there is not.

Type I error

③ $\mu = 95$, $\bar{x} = 95 \pm 2$

OK GOOD

④ $\mu = 95$, $\bar{x} = 99 \pm 2$

Unlucky! (Consistent with $\mu = 100$)

BAD

Reality: There is no problem

Important

than there is.

→ Lawsuits, Recalls, Deaths

$ $ $ $ $

Type - II Error

Streamlining this process

→ methodology which is independent of (μ, σ)

New variable:

$$Z = \frac{x - \mu}{\sigma}$$

(x: data (scores), μ: mean)

$\bar{x}$ ↑ array

σ ↑ theory

Gaussian

→ $\bar{x} = \mu$

→ $s = \sigma$

Gaussian

$\bar{x} = 0$

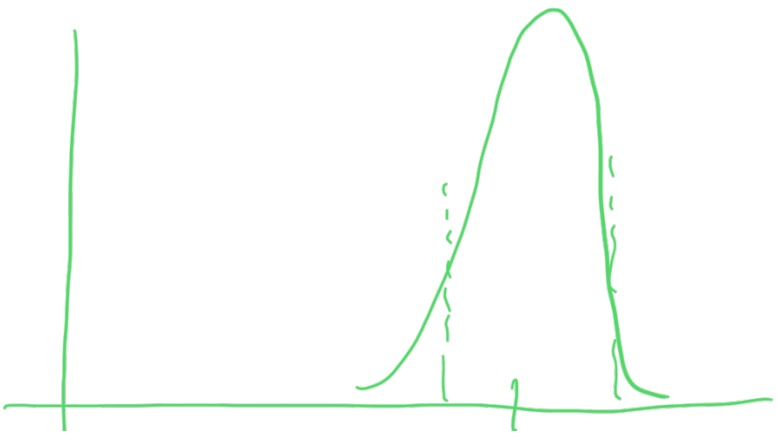
$s = 1$

Looking for

Is $\bar{x}$ consistent with zero?

Single measurement of x

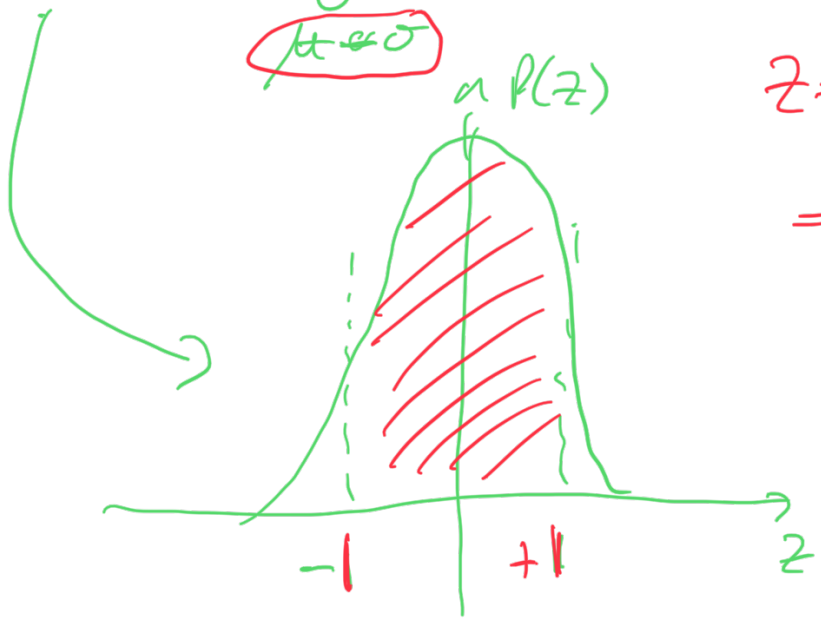
$$P(\mu - \sigma < x < \mu + \sigma)$$



1

$\mu+\sigma$ $\mu-\sigma$ μ $\mu+\sigma$

$$\text{answer} = \int_{\mu-\sigma}^{\mu+\sigma} P(x)\,dx$$



$$z = \frac{x-\mu}{\sigma}$$

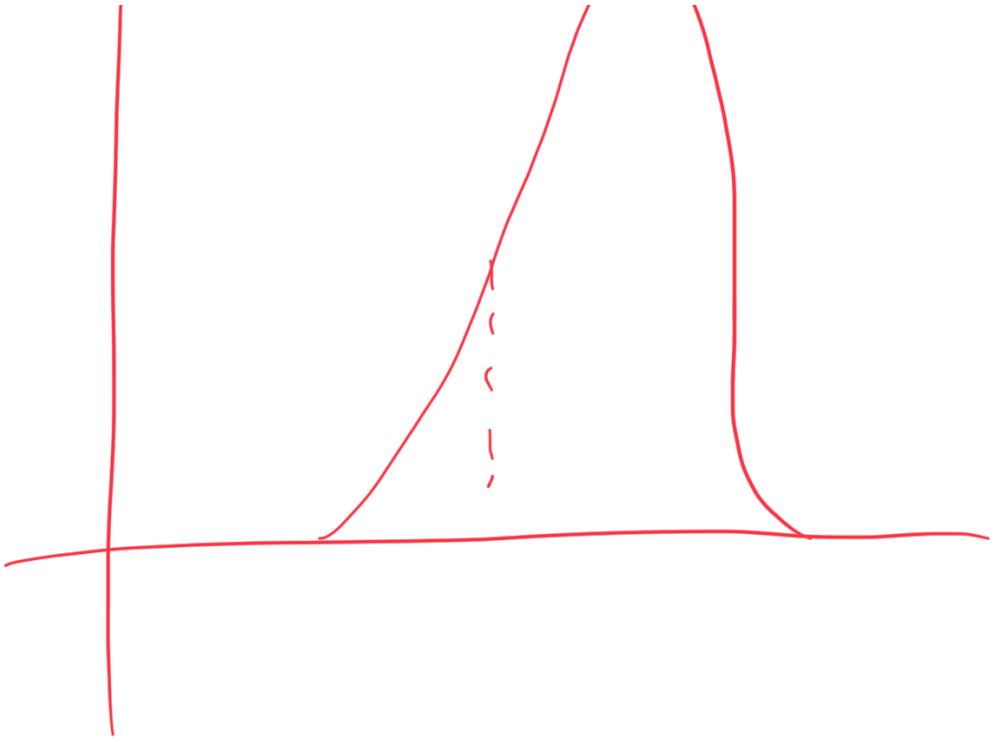
$$= \frac{\mu-\sigma-\mu}{\sigma}$$

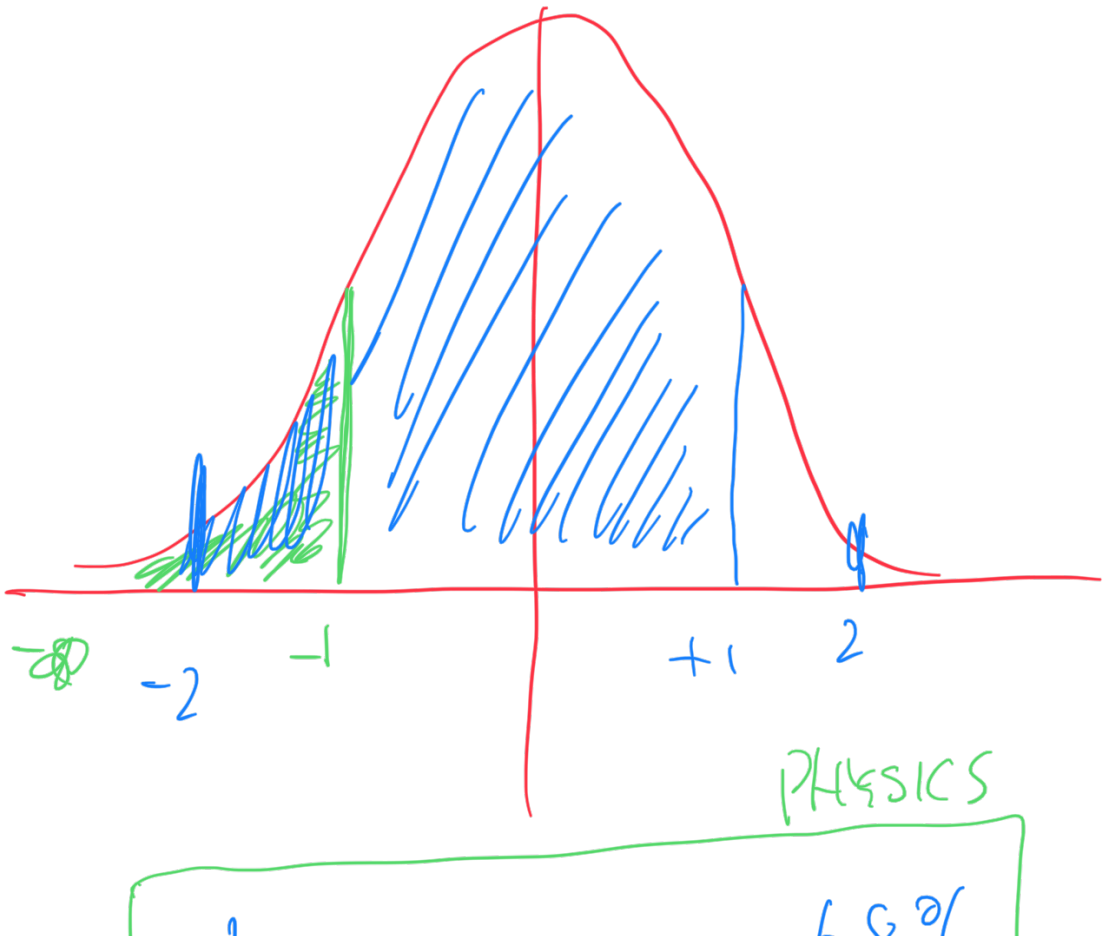
$$= -1$$

Gaussian $\bar{x} = 0$, $\sigma = 1$

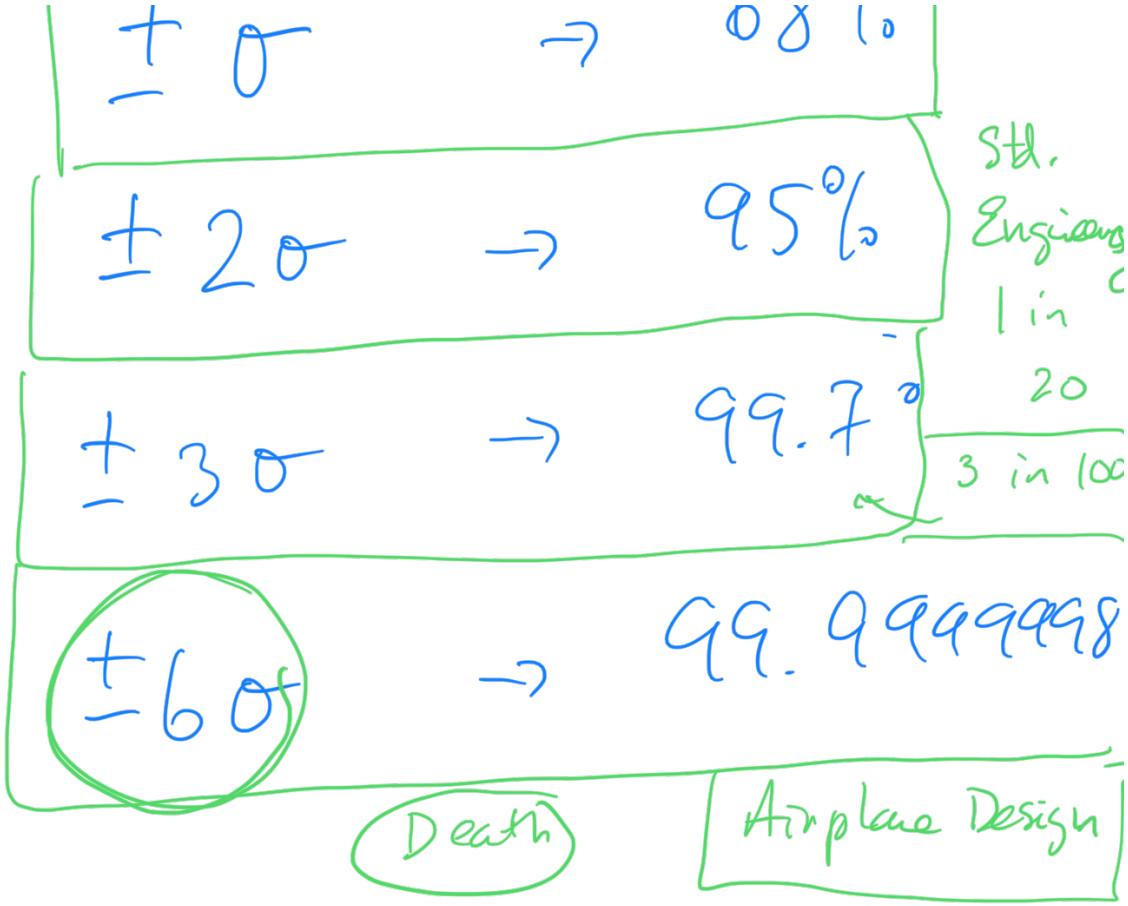
$$\int_{-1}^{+1} P(z)\,dz = 0.68$$

$$\text{Cdf}(z) \rightarrow \int_{-\infty}^{z} P(z)\,dz$$





PHYSICS



Can we ever be 100% sure? NO

$\pm \infty \sigma$

Choices — How good is good enough.

→ Regular people think that scientists have no idea what's going on!

Differene :

not knowing the science

vs.

not knowing the data

Amazon Reviews