- Type I and II errors
- Confidence Interval

States of Nature

Decision	H_0 True	H_0 False
Reject H_0	Type I	✓
Fail to reject H_0	✓	Type II

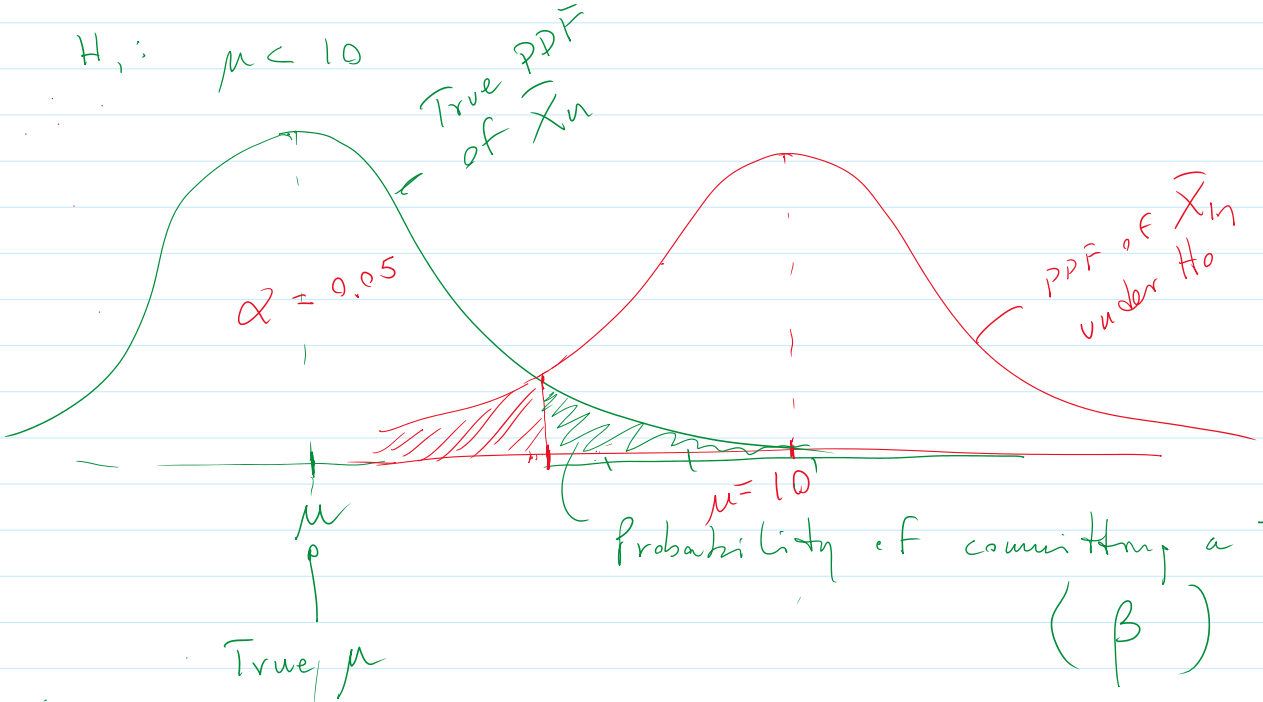
→ We typically don't know (or will ever know)

Probability of committing a Type I error = Significance level (α)

Working with a Type II Error

$H_0: \mu \geq 10$

$H_1: \mu < 10$

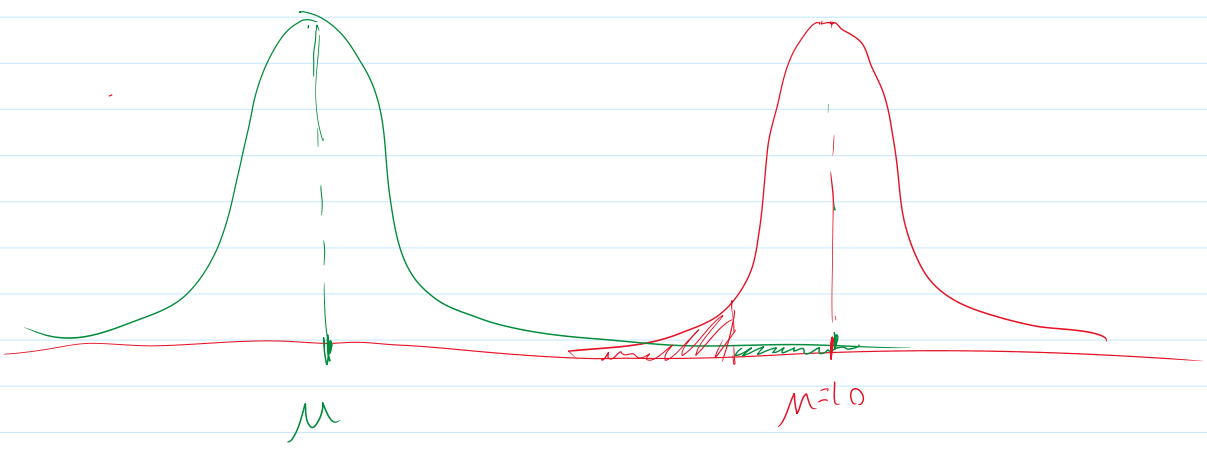


(If sample size is larger ↑)

$E\bar{X}_n = \mu$

$\text{Var}\,\bar{X}_n = \frac{\sigma^2}{n}$

$SD\,\bar{X}_n = \frac{\sigma}{\sqrt{n}}$

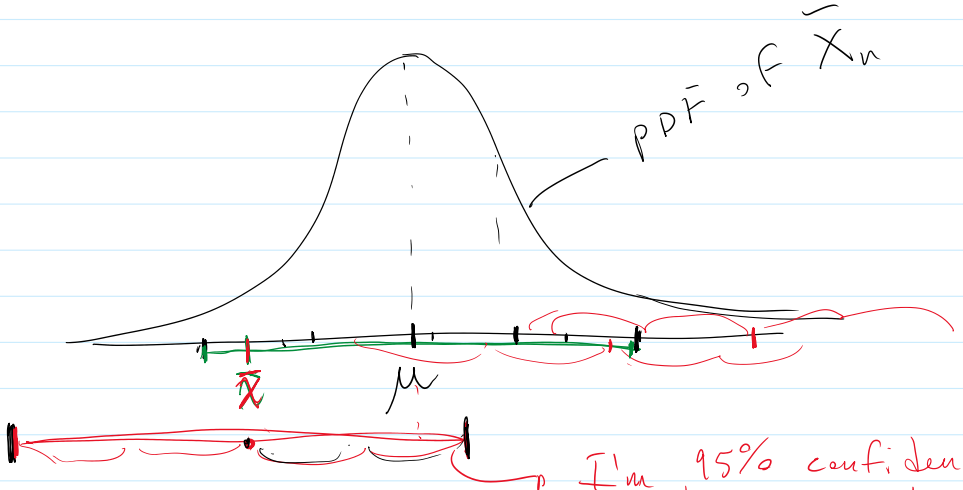


$SD\ \bar{X}_n = \frac{\sigma}{\sqrt{n}}$

Power of the test $= 1 - \beta$

Confidence Intervals: (Set estimation)

sample size n (large enough)
↳ sample mean $\bar{x}$



Which standard deviation?

If σ is known $\quad SD\ \bar{X}_n = \frac{\sigma}{\sqrt{n}}$ (Almost never the case)

If σ is unknown $\quad \frac{s}{\sqrt{n}}$ to estimate $\frac{\sigma}{\sqrt{n}}$

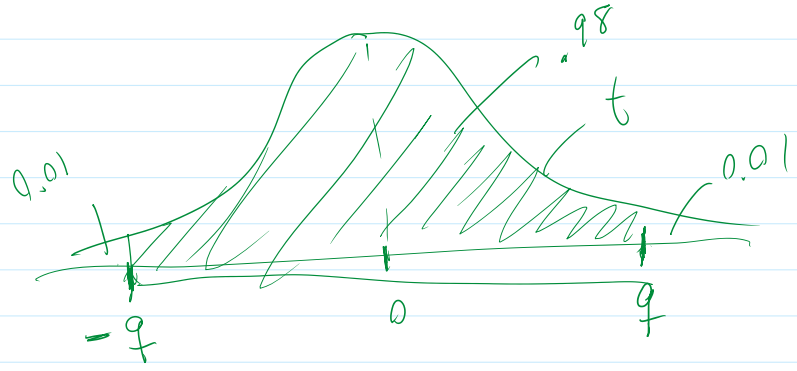
(and then use the T_{n-1} distribution)

Our 95% confidence interval is given by:

$$\bar{x} \pm 2 \cdot \frac{s}{\sqrt{n}}$$

↳ roughly accounts for 95%

What if I want a 98% C.I.?



$$-q = qt(0.01, n-1)$$

$$q = qt(0.99, n-1)$$

Confidence level CL

$$\alpha = 1 - CL$$

$$-q = qt\left(\frac{\alpha}{2}, n-1\right) \qquad q = qt\left(1 - \frac{\alpha}{2}, n-1\right)$$

Then CL% confidence interval.

$$\bar{x} \pm q \cdot \frac{s}{\sqrt{n}}$$