Wednesday, February 20, 2019

- Warm-up
  - A union spokesperson claims that 75% of union members will support a strike if their basic demands are not met. A company negotiator believes the true percentage is lower and runs a hypothesis test at the 10% significance level. What is the conclusion if 87 out of an SRS of 125 union members say they will strike?
- Check Homework
- Discussion of Errors
- Quiz

Objectives

- **Content Objective: I will apply the ideas of Type I and Type II errors to hypothesis testing.**
- **Social Objective: I will participate in class discussions without distracting others.**
- **Language Objective: I will write clear notes so that I can keep Type I and Type II errors straight.**

Warm-up

$H_0: p = 0.75$ ✗
$H_A: p < 0.75$

A union spokesperson claims that 75% of union members will support a strike if their basic demands are not met. A company negotiator believes the true percentage is lower and runs a hypothesis test at the ~~10%~~ 5% α significance level. What is the conclusion if 87 out of an SRS of 125 union members say they will strike?

SRS stated

10% → 125 < 10% of all union members (population)

np → (125)(0.75) = 98.75 ≥ 10

nq → (125)(0.25) = ≥ 10

Proceed w/ One proportion z-test

$z = -1.39$

p-val = 0.082

Due to a low p-value of 0.082, we reject the null. There is evidence that the company negotiator is correct and there are less than 75% who will strike.

Back to warm-up

$H_0: p = .75$

$H_A: p < 0.75$

ART is my BFF (Alpha Rejecting True, Beta Failing to reject False)

A union spokesperson claims that 75% of union members will support a strike if their basic demands are not met. A company negotiator believes the true percentage is lower and runs a hypothesis test at the 10% significance level. What is the conclusion if 87 out of an SRS of 125 union members say they will strike?

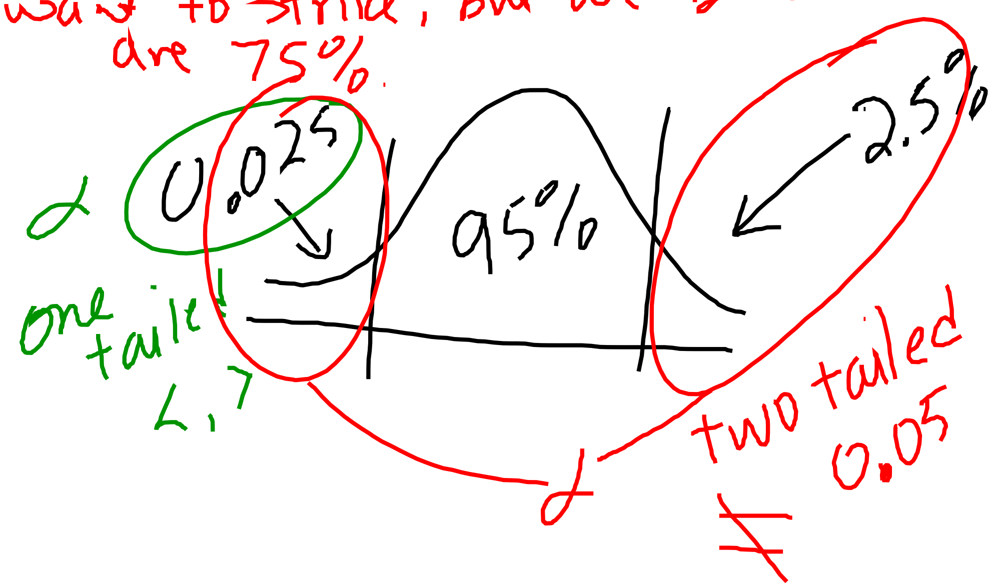
- What would make a Type I error?

  There are actually 75% who want to strike, but we belive there are less than 75%.

- What would make a Type II error?

  There are actually less than 75% who want to strike, but we belive there are 75%.

- Which is more dangerous? Why?



How often will a Type I error occur?

Since a Type I error is rejecting a true null hypothesis, the probability of a Type I error is our α level.

When H_0 is false and we reject it, we have done the right thing.

A test's ability to detect a false hypothesis is called the **power** of the test.

When H_0 is false and we fail to reject it, we have made a Type II error.

- **We assign the letter β to the probability of this mistake.**

  ↖ Beta ART is my BFF

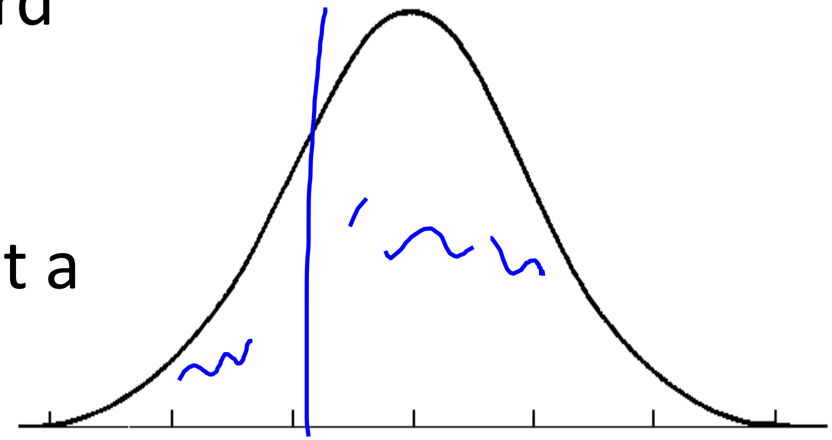
- **It's harder to assess the value of β because we don't know what the value of the parameter really is.**
- **There is no single value for β--we can think of a whole collection of β's, one for each incorrect parameter value.**

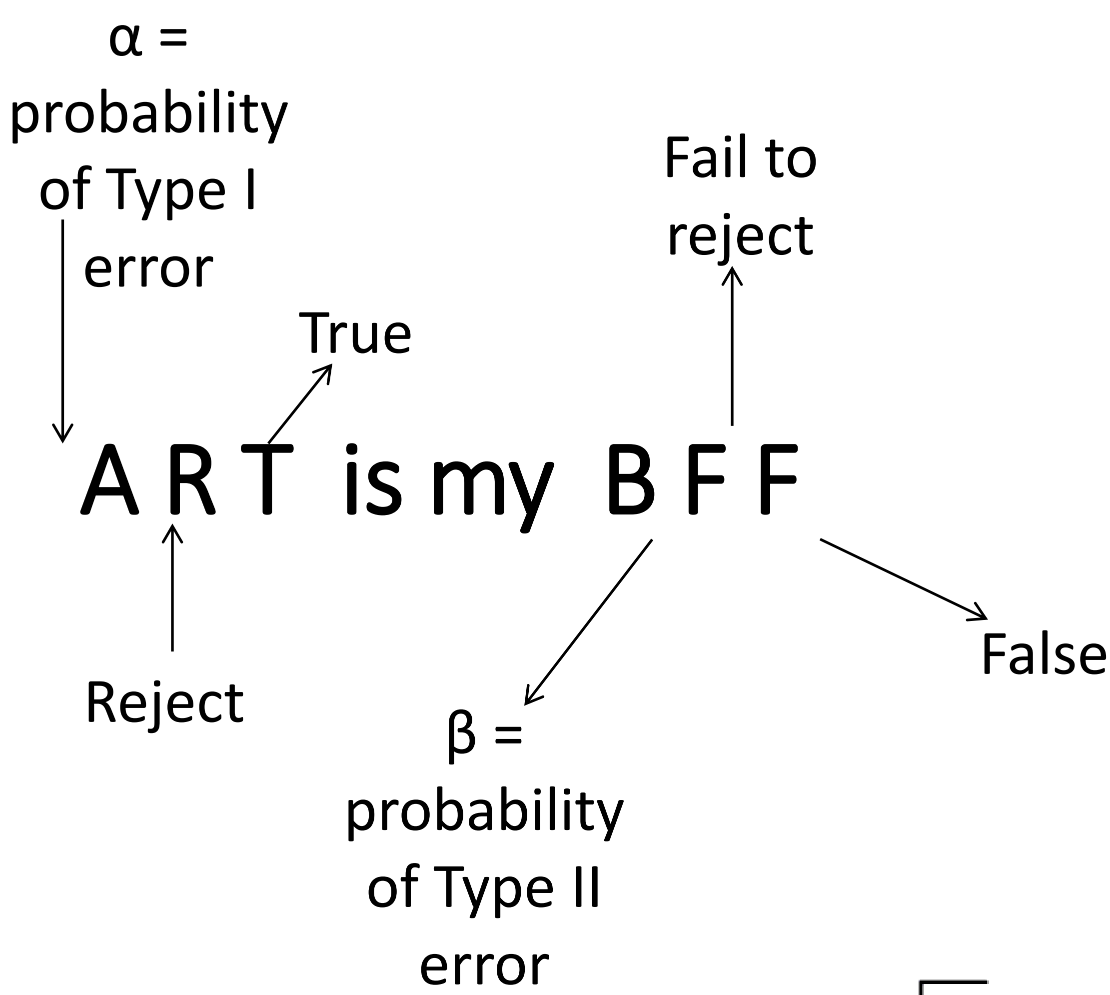
Power

power = 1 − β

β = 1 − power

- The power of a test is the probability that it correctly rejects a false null hypothesis.
- When the power is high, we can be confident that we've looked hard enough at the situation.
- The power of a test is $1 - \beta$; because β is the probability that a test *fails* to reject a false null hypothesis and power is the probability that it does reject.





Rewrite null & alternate

$H_0: p = 0.75$

$H_A: p < 0.75$

		The Truth: H_0 True	The Truth: H_0 False
My Decision	Reject H_0	Type I Error α	power OK
	Retain H_0	OK	β Type II Error

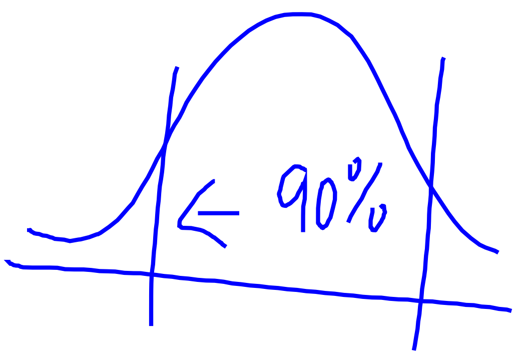
Confidence Intervals and Hypothesis Tests

- Confidence intervals and hypothesis tests are built from the same calculations.
  - They have the **same assumptions and conditions**.
- You can approximate a hypothesis test by examining a confidence interval.
  - Just ask whether the null hypothesis value is consistent with a confidence interval for the parameter at the corresponding confidence level.

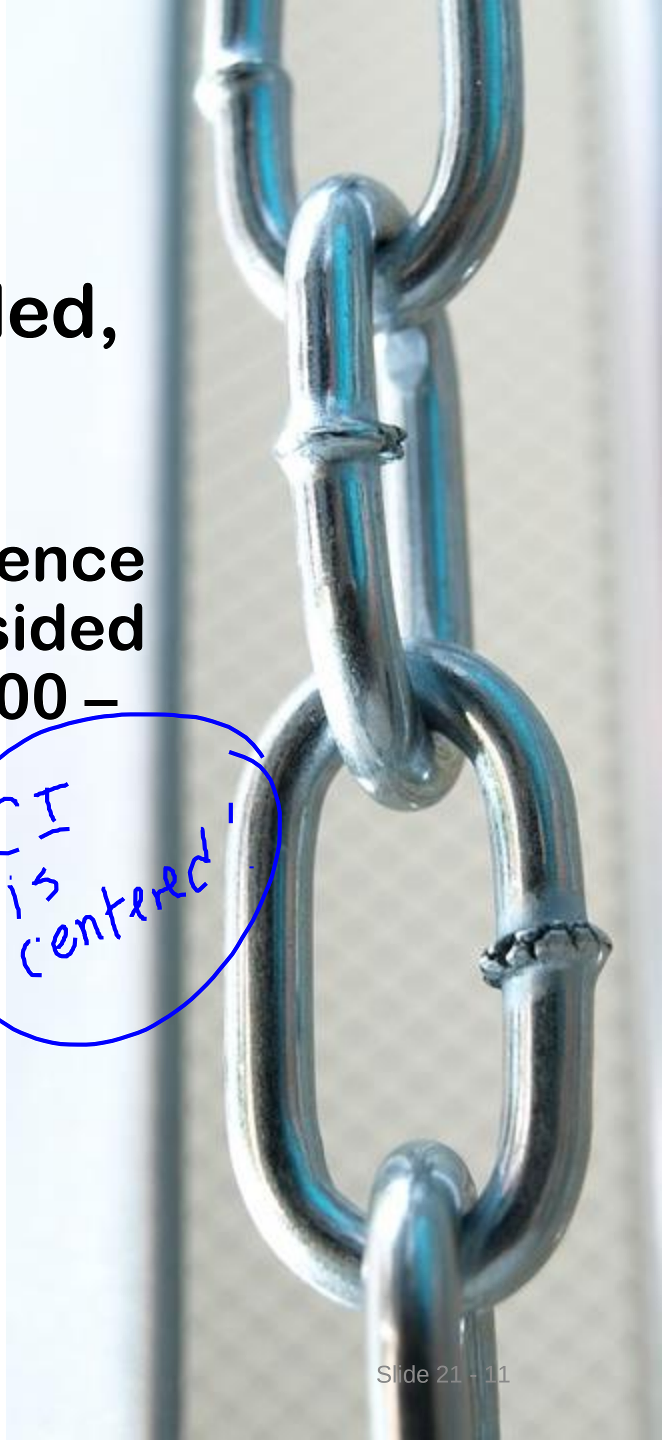
Confidence Intervals and Hypothesis Tests

- **Confidence intervals are two-sided, so they correspond to two-sided tests.**
  - **A confidence interval with a confidence level of *C* % corresponds to a two-sided hypothesis test with an α-level of 100 – *C* %.**

α one side or both



CI is centered



Confidence Intervals and Hypothesis Tests

- **Confidence intervals and one-sided hypothesis tests is a little more complicated.**
  - **A confidence interval with a confidence level of C% corresponds to a one-sided hypothesis test with an α-level of $\frac{1}{2}(100 - C)$ %.**

Don’t interpret the P-value as the probability that H_0 is true.

The P-value is about the data, not the hypothesis.

It’s the probability of observing data this unusual, *given* that H_0 is true, not the other way around.

Don't believe too strongly in arbitrary alpha levels.

It's better to report your P-value and a confidence interval so that the reader can make her/his own decision.

Don’t confuse practical and statistical significance.

Just because a test is statistically significant doesn’t mean that it is significant in practice.

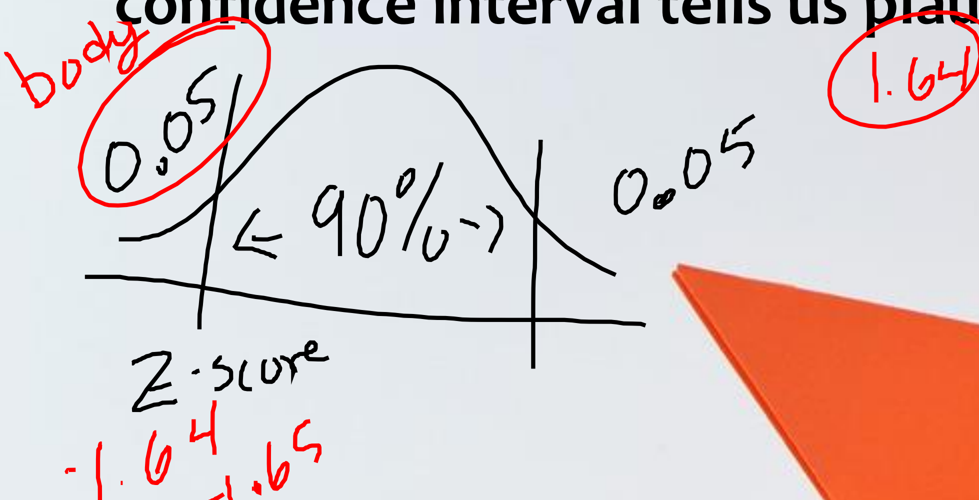
And, sample size can impact your decision about a null hypothesis, making you miss an important difference or find an “insignificant” difference.

There's a lot more to hypothesis testing than a simple yes/no decision.

Small P-value, indicates evidence against the null hypothesis, not that it is true.

Alpha level establishes level of proof, determines the critical value z that leads us to reject null hypothesis.

Hypothesis test gives answer to decision about parameter; confidence interval tells us plausible values of that parameter.




Quiz!

Homework
page 524 #5, 9, 10