Two Sample Hypothesis Tests for Proportions

Note #3: H_0 ALWAYS gets an = ...even if the wording in the problem sounds like it shouldn't

$$H_0: p_1 = p_2 \quad \text{or} \quad p_1 - p_2 = 0$$

Note #1: Use colons

$$H_a: p_1 \begin{matrix} \neq \\ < \\ > \end{matrix} p_2 \quad \text{or} \quad p_1 - p_2 \begin{matrix} \neq \\ < \\ > \end{matrix} 0$$

Note #2: Use only PARAMETERS in your hypothesis...although there will be some problems where we'll use words/sentences

Note #4: The symbol used in the alternate will come from the context of the problem

$\neq$ - two-sided test, equivalent to a Confidence Interval (CI)

$\left.\begin{matrix} < \\ > \end{matrix}\right\}$ - one-sided test

Steps in Hypothesis Testing

1. Define the population characteristic (i.e. parameter) about which hypotheses are to be tested.

2. State the null hypothesis H_0.

3. State the alternative hypothesis H_a.

4. State the significance level for the test α.

5. Check all assumptions and state name of test.

6. State the name of the test.

7. State *df* if applicable (not applicable in proportion land).

8. Display the test statistic to be used without any computation at this point.

9. Compute the value of the test statistic, showing specific numbers used.

10. Calculate the P – value.

11. Sketch a picture of the situation.

12. State the conclusion in two sentences -
    1. Summarize in theory discussing H_0.
    2. Summarize in context discussing H_a.

Two Sample Hypothesis Tests for Proportions

Steps in Two Sample Proportion Hypothesis Testing

1. $p_1 =$.......
   $p_2 =$.......

2. $H_0 : p_1 = p_2$

3. $H_a : p_1 \; \neq, <, > \; p_2$

4. State α.

5. <u>Assumptions:</u>
   1. Random **Independent** Samples
   2. $n_1\hat{p}_1 \geq 10,\; n_1(1-\hat{p}_1) \geq 10$
      $n_2\hat{p}_2 \geq 10,\; n_2(1-\hat{p}_2) \geq 10$
   3. SSSTRP

6. 2 Sample Proportion z Test

7. $df = N/A$

only use $\hat{p}_c$ on Hypothesis Tests, not on CIs

$$\hat{p}_c = \frac{\text{total number of successes}}{\text{total number of trials}}$$

8/9. $$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\dfrac{\hat{p}_c(1-\hat{p}_c)}{n_1} + \dfrac{\hat{p}_c(1-\hat{p}_c)}{n_2}}} = \#$$

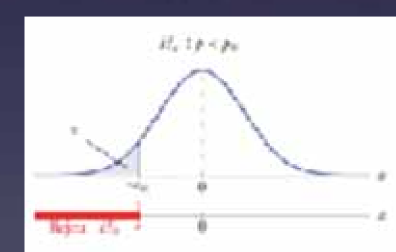
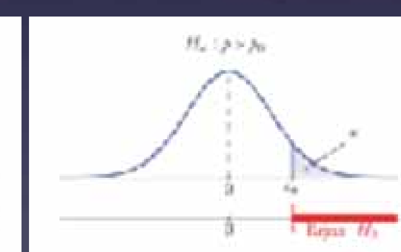
10. $P - value =$

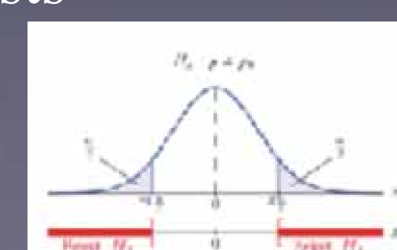
$$P(z > \#) = normalcdf(\#, 1E99, 0, 1)$$
$$P(z < \#) = normalcdf(-1E99, \#, 0, 1)$$

} one-sided tests

$$2P(z > \#) = 2 * normalcdf(\#, 1E99, 0, 1)$$
$$2P(z < \#) = 2 * normalcdf(-1E99, \#, 0, 1)$$

} two-sided tests

11.  



12. State the conclusion in two sentences -
    1. Summarize in theory discussing H_0.
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Confidence Intervals

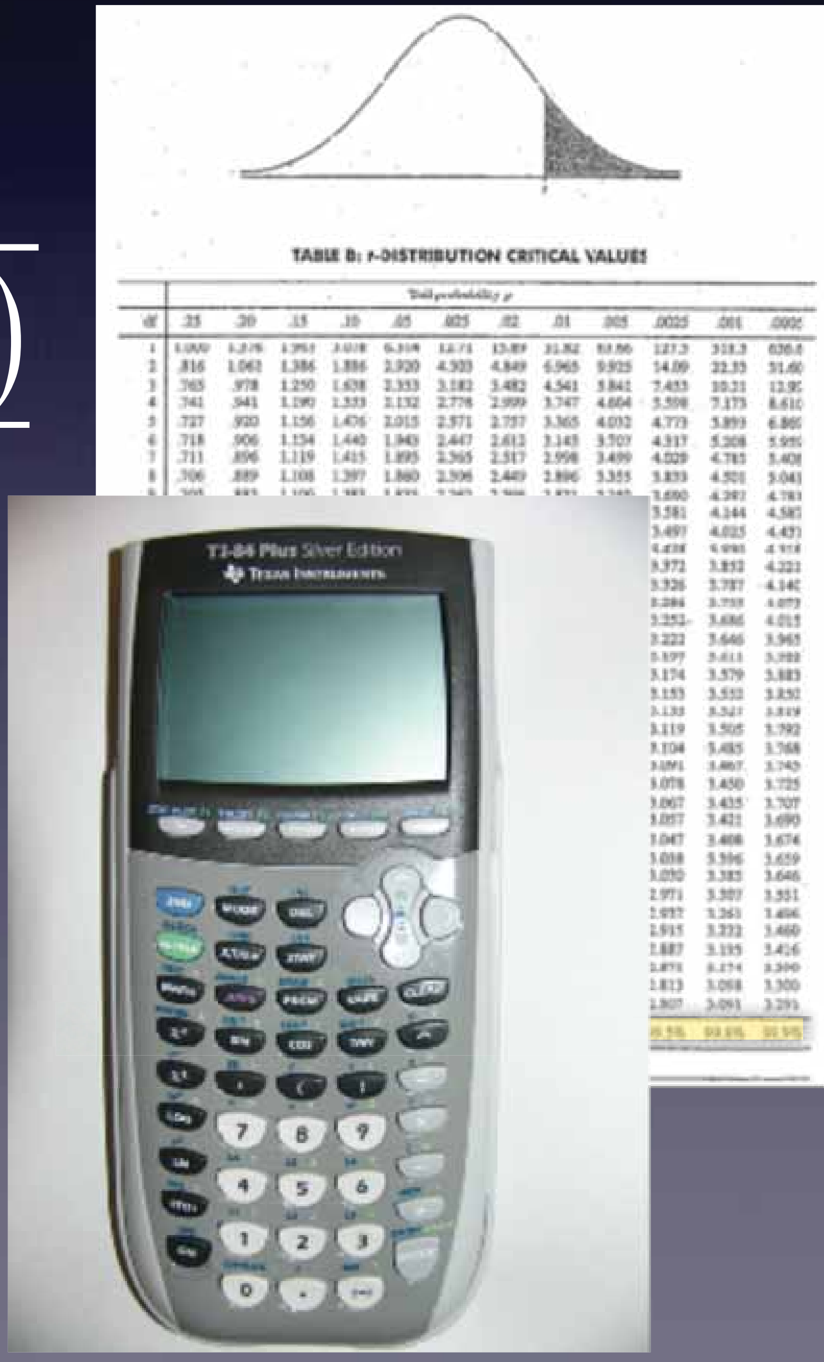
General CI Formula

$$\text{Statistic} \pm (\text{Critical Value})(\text{Standard Deviation})$$

2 Sample Proportion *z* CI Formula

$$(\hat{p}_1-\hat{p}_2)\pm z\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1}+\frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

Use Table or Calculator
to get the *z* critical value



Interpretation for Two Sample Proportion Confidence Intervals

We are __% confident that $p_1 - p_2$, the true difference in proportions of _____, is between ___ and ___.

Interpretation for the Confidence <u>Level</u> of Two Sample Proportion Confidence Intervals

We used a method to construct this estimate that in the long run will successfully capture the true value of $p_1 - p_2$ ___% of the time.

ALWAYS check your assumptions and interpret your interval, even you are not specifically asked to in the problem. Just do it. Seriously.

General Work Flow -

1. Assumptions
2. Construction of Interval
3. Interpretation(s)