Failing to reject is NOT accepting. Stay away from "accepting Ho"

no alpha- if P-val is significantly low, you can reject the Ho

Power is strength of decision to reject Ho.

Parameter: need to specify- using proper notation: μ,μ_d, p,σ,σ^2

Ho and Ha needs notation- these details will be marked off.

Conditions- explain more-

Conclusion: include decision of reject or FTR Ho and relate it back fully to the problem.

Errors- state them and be sure to speak to the consequence.

Chapter 13:

Comparing Two Population Parameters

This is a TWO SAMPLE comparison. (as opposed to one sample mean difference)

Conditions: (same stuff here too)

- SRS
- Normality (or rules for when not normal)
- Independence.

Question: What are some scenarios where you might compare two parameters (means/proportions)

medical w/ control group
Education

Notation:

H_o: $\mu_a = \mu_b$ $\longrightarrow$ H_o: $\mu_a - \mu_b = 0$

Ha: $\mu_a \neq \mu_b$ or H_a: $\mu_a > \mu_b$ OR H_a: $\mu_a < \mu_b$

Ha: $\mu_a - \mu_b \neq 0$ or H_a: $\mu_a - \mu_b < 0$ OR H_a: $\mu_a - \mu_b > 0$

Define what each mean is in relation to the problem

Testing Rules and how me make conclusions all stay the same. The Formulas we use are different.

Mean Formulas

For T-Test

$$t = \frac{(x_1 - x_2)}{\sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}}$$

for df- use smaller n, if n's are different

Z-TEST FOR TWO SAMPLES

- **Requirements**: Two normally distributed but independent populations, σ is known
- **Formula**: $$\boxed{z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}}$$
- where x_1 and x_2 and are the means of the two samples, $\mu_1 - \mu_2$ is the hypothesized difference between the population means, σ_1 and σ_2 are the standard deviations of the two populations, and n_1 and n_2 are the sizes of the two samples.

Examples:

1. *To check a new method of measuring concentration of chemical solutions, a chemist obtains a solution of known concentration. She pours the solution in equal amounts into 20 beakers and then measures the concentration of the solution in each beaker with the new method. She checks for bias by comparing the mean result of her 20 measurements with the known concentrations. Is this a single sample, paired data or two independent samples?*

One sample B/C sample mean & comparing it to known value

2. *Another chemist is checking the same new method of measuring concentrations. He has no reference solution but a familiar technique for measuring concentration is available, He wasn't to know if the new and old methods agree. He takes a solution of known concentration and pour equal amounts into 20 beakers. He measures the concentration of 10 with the old method and the other 10 with the new method. Is this a single sample, paired data or two independent samples?*

Two samples → comparing the mean concentrations of Each of the groups of 10

20 → 10 old

20 → 10 new

Example:

Breast-feeding moms secrete calcium into their milk. Some of the calcium may come from their bones, so mothers may lose bone mineral. Researchers compared 47 breast-feeding women with 22 women of similar ages who were neither pregnant or lactating. They measured the percent change in the mineral content of the women's spines over three months. Here is the data:

A) What two populations and parameters did the researches want to compare then state the hypotheses.

The parameter of interest is mean percent change in mineral content over 3mo. for BF moms & non BF moms

B) Examine the data form both sets graphically and compare. Write a few sentences comparing the mineral content from both groups.

C) From just the graphs, can we conclude that breast-feeding causes women's bones to weaken? Explain.

D) Do the data give good evidence that on the average nursing moms lose more bone mineral. Carry out appropriate testing and report your conclusion. (let's use alpha=.05)

E) Construct a 95% confidence interval for the mean difference in the bone mineral loss. .

Lower bound: $(\bar{X}_1 - \bar{X}_2) - t_{\alpha/2} * \sqrt{\frac{s_1^2}{n_1} + \frac{s_{12}^2}{n_2}}$ $\cdot -3.9$

Upper bound: $(\bar{X}_1 - \bar{X}_2) + t_{\alpha/2} * \sqrt{\frac{s_1^2}{n_1} + \frac{s_{12}^2}{n_2}}$

df-use smaller n

$\bar{X}_1 - \bar{X}_2 =$

$-3.587 - .314$

-3.9

$t^* = 2.080 \sqrt{\frac{2.506^2}{47} + \frac{1.297^2}{22}}$

$-3.9 \pm .953$

$(-4.854, -2.947)$

Two Proportion Confidence Intervals

$$(\hat{p}_1 - \hat{p}_2) \pm \text{margin of error}$$

$$(\hat{p}_1 - \hat{p}_2) \pm z_{\alpha/2}\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

Example:

Lyme Disease is spread in the northeastern US by infected ticks. The ticks are infected mainly by feeding on mice, so more mice result in more infected ticks. The mice population in turn rises and falls with the abundance of acorns-their favored food. Experimenters studied two similar forest areas in a year when the acorn crop failed. The added hundreds of thousands of acorns to one area to imitate an abundant acorn crop, while leaving the other area untouched. The next spring 54 of the 72 mice trapped in the first area were in breeding conditions vs. 10 of the 17 mice trapped in the second area. Construct and interpret a 90% confidence interval for the difference between the proportions of mice ready to breed in good acorn years and bad acorn years.

$\hat{p}_G = \frac{54}{72} = .75$

$\hat{p}_B = \frac{10}{17} = .588$

$\boxed{\hat{p} - \hat{p} = .162}$

$z^* = 1.645$

$$\underbrace{\sqrt{\frac{(.75)(.25)}{72} + \frac{(.588)(.412)}{17}}}$$

ME = .214

.162 ± .214

(-.052, .376)

Two Proportion Testing

Formula:

Test Statistic $$Z = \frac{(\hat{p}_1 - \hat{p}_2) - 0}{\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}}$$

Example:

In 2002 the Supreme Court ruled that the schools could require random drug testing of students participating in competitive after-school activities such as athletics. Does drug testing reduce the use of illegal drugs? A study compared similar high schools in Oregon. Wahtonka HS tested athletes at random and Warrentown HS did not. In a confidential survey, 7 of 135 athletes at Wahtonka and 27 of 141 athletes at Warrentown said they were using drugs. Regard these athletes as SRS from the population of athletes at similar schools with and without drug testing. Do the data provide a good reasoning to think that drug use among athletes is lower in schools that test for drugs? Carry out an appropriate test to help answer the question.

Problem Practice:

- pg 785-786 #1,5
- pg 791 #7,11
- pg 801 #13
- pg 804 #17
- pg 813 #28
- pg 820 #32
- pg 821 #33,42,44

April 4

AP STAT

Objective: Students will complete hypothesis tests for means and proportions for two samples

1. #13 together....

2. Work time- if finish book work, start packet