Confidence Intervals for the Difference of Two Means

What are the conditions for constructing a CI for a difference in two means?

normal
- $n_1 \geq 30$ $n_2 \geq 30$
- or pop. is normal →
- (sample graph isn't skewed or have large enough) →

random
- 2 ind. SRS from pop. (obs. study)
- (exp.) randomly assign to treatments

What is the mean and standard deviation of the sampling distribution for the difference in two means?

$$\mu_{\bar{x}_1-\bar{x}_2} = \mu_1 - \mu_2 = 0$$

$$\sigma_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

What is the standard error of $\bar{x}_1 - \bar{x}_2$?

$$S_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

What is the formula for the two-sample *t* interval for $\mu_1 - \mu_2$?

Statistic ± (crit. val.)(st. error)

$$(\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

How do you calculate the value of *t**? How do you calculate the degrees of freedom? = n − 1

☆ smaller n − 1

☆ calc 2 sample T int WRITE DOWN df (decimal) write t*

☆ Pooled – Just say NO

Ashtyn and Olivia wanted to know if generic chocolate chip cookies have as many chocolate chips as name-brand chocolate chip cookies, on average. To investigate, they randomly selected 10 bags of Chips Ahoy cookies and 10 bags of Great Value cookies and randomly selected 1 cookie from each bag. Then, they carefully broke apart each cookie and counted the number of chocolate chips in each:

Chips Ahoy: 17, 19, 21, 16, 17, 18, 20, 21, 17, 18

Great Value: 22, 20, 14, 17, 21, 22, 15, 19, 26, 18

(a) Construct and interpret a 99% confidence interval for the difference in the mean number of chocolate chips in Chips Ahoy and Great Value cookies.

(b) Does your interval provide convincing evidence that there is a difference in the mean number of chocolate chips?

99% conf. the diff in the actual mean ~~#~~ ch. chips in Chips Ahoy and G.V. is between −4.814 and 2.8138.

b) Because 0 is in int, there may be no diff.

Significance Tests for the Difference of Two Means

What are the conditions for performing a two-sample *t* test for a difference in means?

same

What is the formula for the two-sample *t* statistic? What about the degrees of freedom?

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

For full credit, you must show calculation of t statistic with numbers in the formula. Then, use the calculator to get the df and p-value.

2-sample T-Test

For a chapter test, 30 students were randomly assigned to take the test on yellow paper and the other 34 students took the same test on white paper. For the students with the yellow paper, the mean was 16.25 with a SD of 2.56. For students with the white paper, the mean was 15.125 with a SD of 2.81.

(a) Is there convincing evidence that the color of the test has an effect on test scores for students like these, on average?

μ = actual mean test score for all students w/ that color paper

μ_y = yellow paper

μ_w = white

$H_0: \mu_y = \mu_w$

$H_a: \mu_y \neq \mu_w$

30 & 34 ≥ 30

· randomly assigned which color paper

$$t = \frac{16.25 - 15.125}{\sqrt{\frac{2.56^2}{30} + \frac{2.81^2}{34}}} = 1.676$$

p-value = .0988

df = 61.93

by hand:
df = 29
2(.025 – .05)
pvalue = .05 – .10

With a p-value of .0988, this is sign. at α = .10. Reject H_0. There is evid. the color of paper had an effect on test scores.

(b) Interpret the *P*-value from part (a).

is the prob. there was a diff. of at least 1.125 in sample mean scores, if actual mean scores are =.

When doing two-sample *t* procedures, **just say "no"** to pooling?

Pooling assumes the population variances/standard deviations are equal. It also assumes the population distributions are exactly normal. Don't know these things typically.