I ended up covering z and t intervals in this video

TWO SAMPLE Z INTERVALS

Paired Samples versus Independent Samples

Paired

– Every observation in one of the samples has an observation in the other sample that is directly related to it

Independent

– That is not the case

Example: Let's say we want to compare the SAT scores of girls and boys. We will do this in two different ways

FIRST: We take 10 boys at random from different schools and 10 girls, also at random, from different schools. We give them an SAT test, calculate the mean scores and compare them.

Second

	Girl	Boy
School A, GPA 3.5	1	1
School A, GPA 3.0	1	1
⋮	⋮	⋮
School B, GPA 3.5	1	1
School B, GPA 3.0	1	1
	⋮	⋮
	10	10

Example: Let' say we want to compare the effectiveness of medicines A and B to lower blood pressure.

So, we take a random sample of 50 patients suffering from HBP, administer medicine A to all patients and later check the blood pressure.

Then, wait enough time to allow any residual effect to go away and administer medicine B to the same patients

Paired ?   Independent?

Before (A)		After (B)
Joe	⟷	Joe
Jackie	⟷	Jackie
Elizabeth	⋮	Elizabeth
⋮		⋮

Paired	Independent
Both samples have the same number of observations	they may or may not

ONE SAMPLE CONFIDENCE INTERVAL FOR THE MEAN

$\bar{x} \pm Z_{\alpha/2}\frac{s}{\sqrt{n}}$ when $n \geq 30$	$\bar{x} \pm Z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$ when σ is known
$\bar{x} \pm t_{\alpha/2}\frac{s}{\sqrt{n}}$ when n<30	$\bar{x} \pm t_{\alpha/2}\frac{s}{\sqrt{n}}$ when σ is unknown where df=n-1

CONFIDENCE INTERVALS FOR INDEPENDENT SAMPLES

TWO SAMPLE INTERVAL FOR THE DIFFERENCE BETWEEN TWO POPULATION MEANS

If both samples are large $\bar{x}_1 - \bar{x}_2 \pm Z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$	If σ_1 and σ_2 are known $\bar{x}_1 - \bar{x}_2 \pm Z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
if samples are small but we can assume that the variances are equal $\bar{x}_1 - \bar{x}_2 \pm t_{\alpha/2}\sqrt{S_p^2(\frac{1}{n_1} + \frac{1}{n_2})}$ where: $S_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$ And df $= n_1 + n_2 - 2$ Both Samples must be approximately normally distributed with equal population variances and samples must be independent	If σ_1 and σ_2 are unknown $\bar{x}_1 - \bar{x}_2 \pm t_{\alpha/2}\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$ where df= $\frac{\left(\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}\right)^2}{\frac{1}{n_1 - 1}\left(\frac{S_1^2}{n_1}\right)^2 + \frac{1}{n_2 - 1}\left(\frac{S_2^2}{n_2}\right)^2}$ not assuming the equality of the variances. For most applications a sample size of n$\geq$30 is adequate. If the populations distribution is approximately normal, smaller samples may be used. If the distribution is highly skewed, sizes of n$\geq$50 are recommended.

Example: Independent random samples from two populations are selected.

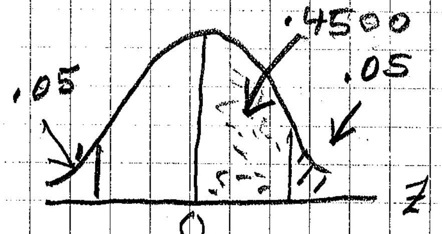
Sample 1	Sample 2
$n_1 = 50$	$n_2 = 60$
$\bar{x}_1 = 17$	$\bar{x}_2 = 16$
$s_1 = 2$	$s_2 = 4$

Calculate a 90% confidence interval for $\mu_1 - \mu_2$

Solution: (by the sample sizes)

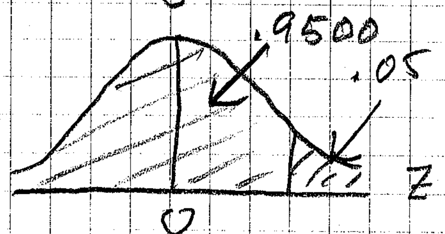
$n_1 = 50 > 30 \qquad n_2 = 60 > 30$

$$C.I = \bar{x}_1 - \bar{x}_2 \pm Z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$



$C.L = 90\% \Rightarrow \alpha = 1 - .90 = .10$

$\alpha/2 = .05 \qquad Z_{\alpha/2} = 1.645$



$$17 - 16 \pm 1.645\sqrt{\frac{2^2}{50} + \frac{4^2}{60}}$$

$$= 1 \pm .969 = (.031, 1.969)$$

Solution 2

$$\bar{x}_1 - \bar{x}_2 \pm t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$df = \frac{\left(\frac{2^2}{50} + \frac{4^2}{60}\right)^2}{\frac{1}{50-1}\left(\frac{2^2}{50}\right)^2 + \frac{1}{60-1}\left(\frac{4^2}{60}\right)^2} = 42.^{34}$$

$= 42$ which we round down to provide a larger t-value and a more conservative (wider) interval estimate

$t_{\alpha/2} = 1.682$

$1 \pm .990 = (.01, 1.99)$