Statistics

Lecture 23

Feb 19-8:47 AM

Working with two Population Proportions: (SG 26)

Sample 1	Sample 2
$x_1 =$	$x_2 =$
$n_1 =$	$n_2 =$

$\hat{p}_1 = \frac{x_1}{n_1}$ $\hat{p}_2 = \frac{x_2}{n_2}$

Pooled Proportion $\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$

Conf. interval for difference of two proportions:

$$< p_1 - p_2 <$$

STAT TESTS 2-PropZInt

I randomly selected 55 females and 40 had iPhone.

I randomly selected 45 males and 25 had iPhone.

Females	Males
$x_1 = 40$	$x_2 = 25$
$n_1 = 55$	$n_2 = 45$

$\hat{p}_1 = \frac{x_1}{n_1} = \frac{40}{55} \approx .73$

$\hat{p}_2 = \frac{x_2}{n_2} = \frac{25}{45} \approx .56$

$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{40+25}{55+45} = \frac{65}{100} = .65$

Find 98% Conf. interval for the difference of two Pop. Proportions.

2-PropZInt

$$-.05 < p_1 - p_2 < .39$$

$$E = \frac{.39 - (-.05)}{2} = .22$$

$$\hat{p}_1 - \hat{p}_2 = \frac{.39 + (-.05)}{2} = .17$$

May 6-6:53 PM

In a Survey of 275 Females, 40% of them had Facebook account. $n_1 = 275$, $\hat{p}_1 = .4$, $x_1 = n_1 \cdot \hat{p}_1 = 275(.4) = 110$

In a Survey of 125 males, 36% of them had Facebook account. $n_2 = 125$, $\hat{p}_2 = .36$, $x_2 = n_2 \cdot \hat{p}_2 = 125(.36) = 45$

Females	Males
$x_1 = 110$	$x_2 = 45$
$n_1 = 275$	$n_2 = 125$

Pooled Proportion

$$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{110 + 45}{275 + 125} = \frac{155}{400} \approx .39$$

No C-level → .95

Find Conf. interval for the difference of two Pop. Proportions

$$-.06 < P_1 - P_2 < .14$$

STAT TESTS 2-PropZInt

$$E = \frac{.14 - (-.06)}{2} = .1$$

May 6-7:07 PM

Testing two Pop. Proportions:

$H_0: P_1 = P_2$	$H_0: P_1 \leq P_2$	$H_0: P_1 \geq P_2$
$H_1: P_1 \neq P_2$	$H_1: P_1 > P_2$	$H_1: P_1 < P_2$
TTT	RTT	LTT

CV Z Use invNorm

CTS Z
P-Value P use 2-Prop Z Test

Use testing chart to determine the Validity of H_0 & H_1.

Draw final Conclusion about the claim.

Reject the claim OR FTR the claim

May 6-7:16 PM

CNN claims that prop. of all females that have iPhone is the same as the prop. of all males that have iphone.

$H_0: P_1 = P_2$ claim

$H_1: P_1 \neq P_2$ TTT

$n_1 = 200$, $\hat{P}_1 = .75 \to x_1 = n_1 \hat{P}_1 = 150$

$n_2 = 100$, $\hat{P}_2 = .72 \to x_2 = n_2 \hat{P}_2 = 72$

I surveyed 200 females and 75% had iphone.

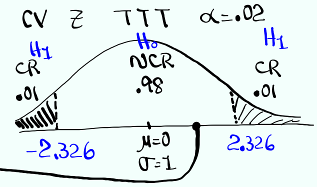
I surveyed 100 males " 72% " " .

Females	Males
$x_1 = 150$	$x_2 = 72$
$n_1 = 200$	$n_2 = 100$

$\bar{P} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{222}{300} = .74$

Test the claim using $\alpha = .02$

CV Z TTT $\alpha = .02$



CTS $Z = .558$

P-Value $P = .577$

2-PropZ Test

$x_1 = 150$

$n_1 = 200$

$x_2 = 72$

$n_2 = 100$

$P_1 \neq P_2$ H_1

Calculate

$Z = \text{invNorm}(.99, 0, 1)$

CTS is in NCR

P-Value $> \alpha$

H_0 Valid & H_1 invalid

Valid claim FTR

May 6-7:23 PM

College claims the the prop. of all female students take online classes is greater than the prop. of all male students that take online classes.

$P_F > P_M$ ← H_1

$H_0: P_1 \leq P_2$

$H_1: P_1 > P_2$ claim, RTT

$n_1 = 250$, $\hat{P}_1 = .4 \to x_1 = n_1 \hat{P}_1 = 100$

In a survey of 250 females, 40% were taking online classes.

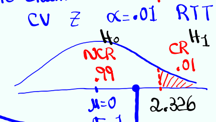
$n_2 = 185$, $\hat{P}_2 = .36 \to x_2 = n_2 \hat{P}_2 = 66.6 = 67$

In a survey of 185 males, 36% were taking online classes.

Females	Males
$x_1 = 100$	$x_2 = 67$
$n_1 = 250$	$n_2 = 185$

Use $\alpha = .01$ to test the claim

CV Z $\alpha = .01$ RTT



CTS $Z = .802$

P-Value $P = .211$

2-PropZ Test

$x_1 =$

$n_1 =$

$x_2 =$

$n_2 =$

$P_1 > P_2$ H_1

$Z = \text{invNorm}(.99, 0, 1)$

CTS is in NCR

P-Value $> \alpha$

H_0 Valid, H_1 invalid

Invalid claim

Reject the claim

I want to support the claim

change α

we need P-Value $< \alpha$

$.211 < \alpha$ → Choose α to be .22, .23, .24, .25, ...

May 6-7:37 PM

Comparing two pop. means

Sample 1	Sample 2
$n_1 =$	$n_2 =$
$\bar{x}_1 =$	$\bar{x}_2 =$
$S_1 =$	$S_2 =$
$\sigma_1 =$	σ_2

Case I: σ_1 & σ_2 are both known

$< \mu_1 - \mu_2 <$

STAT TESTS 2-SampZInt

Case II: σ_1 & σ_2 unknown

$< \mu_1 - \mu_2 <$

STAT TESTS 2-SampTInt

Pooled: Yes or No

May 6-7:55 PM

I randomly Selected 32 female exams, the mean was 86.

I randomly Selected 25 male exams, the mean was 82.

It is known standard deviation of all female exams is 12, and all male exams is 10.

Females	Males
$n_1 = 32$	$n_2 = 25$
$\bar{x}_1 = 86$	$\bar{x}_2 = 82$
$S_1 =$ Not given	$S_2 =$ Not given
$\sigma_1 = 12$	$\sigma_2 = 10$

find 99% Conf. interval for the difference of two Pop. means

σ_1 & σ_2 Known

2-SampZInt

$$-4 < \mu_1 - \mu_2 < 12$$

$$E = \frac{12 - (-4)}{2} = \boxed{8}$$

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Use the chart below to find 90% Conf. interval for the difference of two pop. means.

ELAC	Mt. SAC
$n_1=20$	$n_2=12$
$\bar{x}_1=85$	$\bar{x}_2=83$
$S_1=12$	$S_2=10$

σ_1 & σ_2 unknown

2-SampTInt

Pooled: Yes when we assume $\sigma_1=\sigma_2$.

Pooled: No when we assume $\sigma_1 \neq \sigma_2$.

$$-5 < \mu_1 - \mu_2 < 9$$

$$E = \frac{9-(-5)}{2} = 7$$

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I randomly selected 15 female students, their mean age was 34.5 yrs with standard dev. of 7.5 yrs.

I also randomly selected 10 male students, their mean age was 30.8 yrs with standard dev. of 15.2 yrs.

Find Conf. interval for the difference of two Pop. means Assuming $\sigma_1 \neq \sigma_2$

Females	Males
$n_1=15$	$n_2=10$
$\bar{x}_1=34.5$	$\bar{x}_2=30.8$
$S_1=7.5$	$S_2=15.2$

Pooled: NO

σ_1 & σ_2 unknown

2-SampTInt

$$-7.6 < \mu_1 - \mu_2 < 15.0$$

May 6-8:19 PM

Testing Two Pop. Means:

$H_0: \mu_1 = \mu_2$	$H_0: \mu_1 \geq \mu_2$	$H_0: \mu_1 \leq \mu_2$
$H_1: \mu_1 \neq \mu_2$	$H_1: \mu_1 < \mu_2$	$H_1: \mu_1 > \mu_2$
TTT	LTT	RTT

Case I: σ_1 & σ_2 Known

CV Z invNorm CTS Z P-Value p → 2-Samp Z Test	

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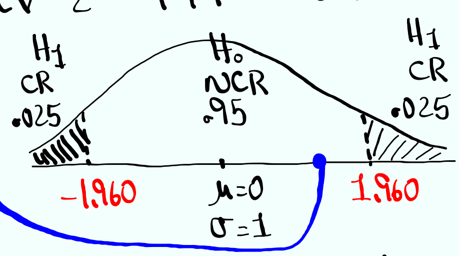
Use the chart below to test the claim that $\mu_1 = \mu_2$.

Sample 1	Sample 2
$n_1 = 18$	$n_2 = 15$
$\bar{x}_1 = 88$	$\bar{x}_2 = 85$
$\sigma_1 = 10$	$\sigma_2 = 8$

$H_0: \mu_1 = \mu_2$ claim

$H_1: \mu_1 \neq \mu_2$ TTT

CV Z TTT No $\alpha \to .05$



CTS $Z = .957$

P-Value $P = .338$

2-Samp Z Test

$Z = \text{invNorm}(.975, 0, 1)$

CTS is in NCR

P-Value > α

H_0 valid, H_1 invalid

Valid claim FTR

May 6-8:32 PM

Testing Two Pop. Means:

TTT	LTT	RTT
$H_0: \mu_1 = \mu_2$	$H_0: \mu_1 \geq \mu_2$	$H_0: \mu_1 \leq \mu_2$
$H_1: \mu_1 \neq \mu_2$	$H_1: \mu_1 < \mu_2$	$H_1: \mu_1 > \mu_2$

Case I: σ_1 & σ_2 Known	Case II: σ_1 & σ_2 unknown
CV z invNorm	CV t invT if Pooled Yes → $df = n_1 + n_2 - 2$ Pooled NO → df = smaller n − 1
CTS z P-Value p → 2-Samp Z Test	CTS t P-Value p → 2-Samp T Test

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Use the chart below to test the claim that $\boxed{\mu_1 > \mu_2}$ with $\alpha = .1$.

Sample 1	Sample 2
$n_1 = 15$	$n_2 = 12$
$\bar{x}_1 = 34$	$\bar{x}_2 = 30$
$S_1 = 8$	$S_2 = 10$

Assume $\sigma_1 = \sigma_2$

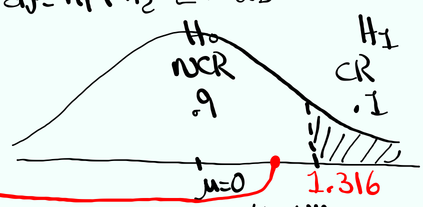
Pooled: Yes

$H_0: \mu_1 \leq \mu_2$

$H_1: \mu_1 > \mu_2$ claim, RTT

CV t RTT $\alpha = .1$

$df = n_1 + n_2 - 2 = 25$



σ unknown

df = 25

t = invT(.9, 25)

CTS t = 1.156

P-Value P = .129

2-Samp T Test

CTS is in NCR H0 Valid

P-Value > α ⇒ H1 invalid

Invalid claim → Reject

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