Statistics

Lecture 14

Feb 19-8:47 AM

SG 26

Two Population Proportions P_1 & P_2:

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

$\hat{P}_1 = \frac{x_1}{n_1} \Rightarrow x_1 = n_1 \hat{P}_1$ Always

$\hat{P}_2 = \frac{x_2}{n_2} \Rightarrow x_2 = n_2 \hat{P}_2$ Round-up

$\bar{P}$ Pooled Sample Prop.

$$\bar{P} = \frac{x_1 + x_2}{n_1 + n_2}$$

Conf. interval for the difference of two Pop. Proportions

$$< P_1 - P_2 <$$

STAT | TESTS | 2-PropZInt

$$E = \frac{-}{2}$$

May 29-8:06 AM

I surveyed 60 females and 12 of them were smokers.

I also surveyed 40 males and 6 were smokers.

Females	Males
$x_1 = 12$	$x_2 = 6$
$n_1 = 60$	$n_2 = 40$

$\hat{p}_1 = \frac{12}{60} = .2$

$\hat{p}_2 = \frac{6}{40} = .15$

$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{12+6}{60+40} = \frac{18}{100} = .18$

Find 99% Conf. interval for the difference of two Pop. Proportions

2-PropZInt

$$-.15 < p_1 - p_2 < .25$$

$E = \frac{.25 - (-.15)}{2} = \frac{.4}{2} = .2$

May 29-8:12 AM

I surveyed 125 female students and 40% of them were nursing majors. $n = 125$, $\hat{p} = .4$ $\rightarrow x = n\hat{p} = 125(.4) = 50$

I surveyed 75 male students and 38% of them were nursing majors. $n = 75$, $\hat{p} = .38$ $\rightarrow x = n\hat{p} = 75(.38) = 28.5 = 29$

Female	Males
$x_1 = 50$	$x_2 = 29$
$n_1 = 125$	$n_2 = 75$

$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{50+29}{125+75} = \frac{79}{200} = .395$

No C-level $\rightarrow .95$

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

2-PropZInt

$$-.13 < p_1 - p_2 < .15$$

$E = \frac{.15 - (-.13)}{2} = \frac{.28}{2} = .14$

May 29-8:21 AM

Testing two Pop. Proportions P_1 & P_2:

$H_0: P_1 = P_2$ $H_0: P_1 \leq P_2$ $H_0: P_1 \geq P_2$

$H_1: P_1 \neq P_2$ $H_1: P_1 > P_2$ $H_1: P_1 < P_2$

TTT RTT LTT

CV z invNorm

CTS z
P-Value P 2-Prop Z Test

Proceed with testing chart

Draw final conclusion about claim.

Reject the claim OR FTR the claim

May 29-8:29 AM

use the chart below to test the claim that $P_1 = P_2$.

No $\alpha \rightarrow .05$

Females	Males
$x_1 = 50$	$x_2 = 29$
$n_1 = 125$	$n_2 = 75$

$H_0: P_1 = P_2$ claim

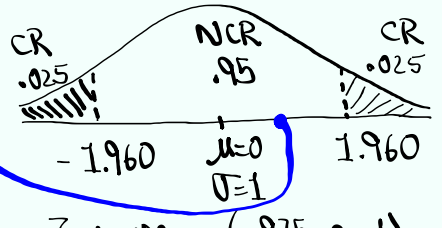
$H_1: P_1 \neq P_2$ TTT

CV z TTT $\alpha = .05$

CTS $z = .187$

P-Value $P = .852$

2-Prop Z Test



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

CTS is in NCR

P-Value $> \alpha$ → valid claim

H_0 valid, H_1 invalid

FTR the claim

May 29-8:35 AM

In a Sample of 150 female students, 42% of them were fan of online classes.
$n=150$, $\hat{p}=.42$ $\rightarrow x=n\hat{p}=150(.42)=63$

In a Sample of 100 male students, 36% of them were fan of online classes.
$n=100$ $\hat{p}=.36$ $x=n\hat{p}=100(.36)=36$

use $\alpha=.02$ to test the claim that Prop. of all females is greater than the Prop. of all males on being fan of online classes.

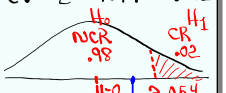
Females	Males
$x_1=63$	$x_2=36$
$n_1=150$	$n_2=100$

$H_0: p_1 \le p_2$

$H_1: p_1 > p_2$ claim, RTT

$p_1 > p_2$ (H_1)

CV z RTT $\alpha=.02$



CTS $z=.950$
P-Value $P=.171$
2-Prop Z Test

$z=$ invNorm(.98,0,1)
$\mu=0$
$\sigma=1$

CTS is in NCR
P-Value $> \alpha$
H_0 valid & H_1 invalid
Invalid claim
Reject the claim

Suggest values for α to reverse the conclusion
we want P-Value $\le \alpha$
$.171 \le \alpha$
Choose .18, .19, .20, ...

May 29-8:44 AM

Working with two Pop. means μ_1 & μ_2:

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Sample 1	Sample 2
$n_1=$	$n_2=$
$\bar{x}_1=$	$\bar{x}_2=$
$s_1=$	$s_2=$
$\sigma_1=$	$\sigma_2=$

Case I: σ_1 & σ_2 known

Conf. interval for $<\mu_1-\mu_2<$

2-Samp ZInt
inpt: Stats

$E=$ ____

May 29-9:13 AM

Consider the chart below

Sample 1	Sample 2
$n_1 = 36$	$n_2 = 32$
$\bar{x}_1 = 88$	$\bar{x}_2 = 82$
$\sigma_1 = 12$	$\sigma_2 = 10$

use 2-SampZInt

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

$$0 < \mu_1 - \mu_2 < 12$$

$$E = \frac{12 - 0}{2} = 6$$

May 29-9:18 AM

40 randomly selected female nurses had a mean monthly Salary of \$6500.

30 randomly selected male nurses had a mean monthly Salary of \$6000.

It is known that Standard deviation of monthly Salaries of all female nurses is \$250 and of all male nurses is \$400.

Find 90% Conf. interval for the difference of two pop. means.

Females	Males
$n_1 = 40$	$n_2 = 30$
$\bar{x}_1 = 6500$	$\bar{x}_2 = 6000$
$\sigma_1 = 250$	$\sigma_2 = 400$

$$363 < \mu_1 - \mu_2 < 637$$

2-SampZInt

$$E = \frac{637 - 363}{2} = 137$$

May 29-9:23 AM

Testing Two Pop. means:

$H_0: \mu_1 = \mu_2$ $H_0: \mu_1 \leq \mu_2$ $H_0: \mu_1 \geq \mu_2$

$H_1: \mu_1 \neq \mu_2$ $H_1: \mu_1 > \mu_2$ $H_1: \mu_1 < \mu_2$

TTT RTT LTT

σ_1 & σ_2 Known

CV z invNorm

CTS z

P-Value P

2-Samp z Test

Proceed with testing chart

Draw final Conclusion about the claim.

Reject the claim OR FTR the claim

May 29-9:33 AM

use the chart below to test the claim that $\mu_1 \leq \mu_2$. H_1

No $\alpha \rightarrow .05$

Sample 1	Sample 2
$n_1 = 38$	$n_2 = 35$
$\bar{x}_1 = 32$	$\bar{x}_2 = 38$
$\sigma_1 = 15$	$\sigma_2 = 10$

CTS $z = -2.025$

P-Value $P = .024$

2-Samp z Test

$H_0: \mu_1 \geq \mu_2$

$H_1: \mu_1 < \mu_2$ claim, LTT

CV z LTT $\alpha = .05$

CR .05 H_1 NCR .95 H_0

-1.645 $\mu = 0$ $\sigma = 1$

$z = \text{invNorm}(.05, 0, 1)$

CTS is in CR

P-Value $\leq \alpha$

H_0 invalid, H_1 valid

valid claim

FTR the claim

what α values from $\{.01, .05, .10\}$ would reverse the conclusion?

P-Value $> \alpha$

$.024 > \alpha$ choose .01

May 29-9:37 AM

38 female students had a mean age of 32.5 yrs.

35 male students had a mean age of 30.8 yrs.

It is known that standard deviation of ages of all females is equal to all males and it is 8.5 yrs.

No $\alpha \rightarrow .05$

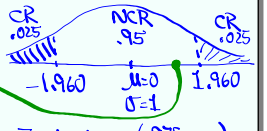
Test the claim that there is a difference between two pop. means.

Females	Males
$n_1 = 38$	$n_2 = 35$
$\bar{x}_1 = 32.5$	$\bar{x}_2 = 30.8$
$\sigma_1 = 8.5$	$\sigma_2 = 8.5$

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$ claim, TTT

CV Z TTT $\alpha = .05$



CTS $Z = .854$

P-Value $P = .393$

2-Samp Z Test

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

CTS is in NCR

P-Value $> \alpha$

H_0 valid, H_1 invalid → Invalid claim

Reject the claim

May 29-9:49 AM

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σ_1 & σ_2 Unknown

for Conf. interval → 2-SampTInt

for CV → invT

for CTS t → 2-SampTTest

P-Value P

what about degrees of freedom?

If $\sigma_1 = \sigma_2$ → $df = n_1 + n_2 - 2$

Pooled: Yes

If $\sigma_1 \neq \sigma_2$ → $df = (\text{Smaller } n) - 1$

Pooled: No

2-SampFTest (SG 29)

May 29-10:13 AM

Consider the chart below

Sample 1	Sample 2
$n_1 = 15$	$n_2 = 12$
$\bar{x}_1 = 88$	$\bar{x}_2 = 80$
$s_1 = 12$	$s_2 = 10$

Assume $\sigma_1 = \sigma_2$

Pooled: Yes

$df = 15 + 12 - 2 = 25$

Find 90% Conf. interval for $\mu_1 - \mu_2$.

2-SampTInt

$$1 < \mu_1 - \mu_2 < 15$$

$E = \frac{15 - 1}{2} = 7$

May 29-10:20 AM

Test the claim that $\mu_1 \geq \mu_2$.

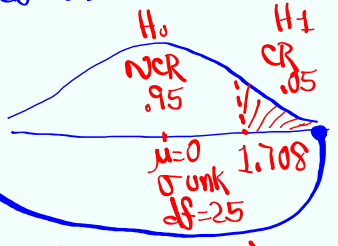
no $\alpha \rightarrow .05$; H_1

$H_0: \mu_1 \leq \mu_2$

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

CV t RTT $\alpha = .05$

$df = 25$



CTS $t = 1.850$

P-value $P = .038$

2-SampTTest

$t = invT(.95, 25)$

CTS is in CR H_0 invalid

P-value $\leq \alpha$ → H_1 valid → valid claim

FTR the claim

what α values would reverse the Conclusion?

P-value $> \alpha$ → $.038 > \alpha$ → .03, .02, .01

May 29-10:25 AM

use the chart below

Sample 1	Sample 2
$n_1 = 10$	$n_2 = 8$
$\bar{x}_1 = 35$	$\bar{x}_2 = 30$
$s_1 = 15$	$s_2 = 5$

Assume $\sigma_1 \neq \sigma_2$

Pooled: No

df = Smaller $n - 1 = 7$

find conf. interval for $\mu_1 - \mu_2$

2-SampTInt

$$-4 < \mu_1 - \mu_2 < 14$$

$$E = \frac{14 - (-4)}{2} = 9$$

May 29-10:34 AM

Test the claim that $\mu_1 = \mu_2$.

$\alpha = .05$; H_0

H_0: $\mu_1 = \mu_2$ claim

H_1: $\mu_1 \neq \mu_2$ TTT

CTS $t = .988$

P-Value $P = .344$

2-SampTTest

CTS is in NCR

P-Value $> \alpha$

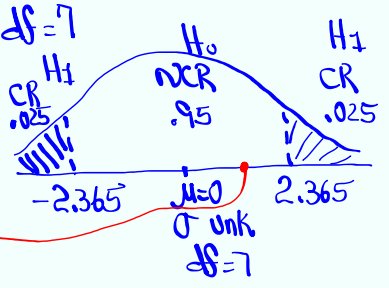
H_0 valid , H_1 invalid

Valid claim

FTR the claim

CV t TTT $\alpha = .05$

df = 7



t = invT(.975, 7)

May 29-10:40 AM