Statistics

Fall 2022

Lecture 27

Testing One Population Proportion P: SG 25

$H_0: P = P_0$ $H_1: P \neq P_0$ TTT

$H_0: P \geq P_0$ $H_1: P < P_0$ LTT

$H_0: P \leq P_0$ $H_1: P > P_0$ RTT

Always identify the claim

Critical values ⇒ use invNorm

Drawing, labeling, shading, and full TI command required.

Computed Test Statistic (CTS) and P-value (P)

STAT TESTS ⇒ 1-PropZTest

Use Testing Chart for validity of H_0 & H_1

H_0 valid ⇔ H_1 invalid

H_0 invalid ⇔ H_1 valid

Final Conclusion about the claim.

Reject the claim OR Fail-to-Reject the claim

Given: $n=180$, $x=50$, $H_0: p=.25$, claim is H_0

$\alpha=.1$

Test the claim.

$H_0: P=.25$ claim

$H_1: P\neq.25$ TTT

CTS $Z=.861$

P-value $P=.389$

1-PropZTest

$P_0:.25$

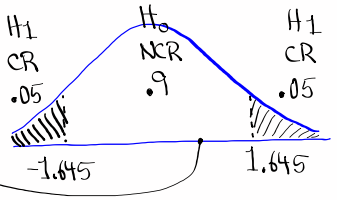
$x=50$

$n=180$

Prop $\neq P_0$ TTT

Calculate

C.V. Z, TTT, $\alpha=.1$



$Z=$invNorm$(.95,0,1)=1.645$

CTS Z is in NCR
H_0 valid, H_1 invalid } Traditional

P-value $>\alpha$
H_0 valid, H_1 invalid } P-value

claim is H_0
H_0 valid $\Rightarrow$ valid claim $\Rightarrow$ Support the claim

Fail-To-Reject the claim

CNN claims that at most 40% of all voters support certain candidate. $\hookrightarrow \leq .4$

In a survey of 195 voters, 85 of them were supporting that candidate. $\hookrightarrow n=195$ $\hookrightarrow x=85$

Use $\alpha=.02$ to test that claim.

$H_0: P\leq.4$ claim

$H_1: P>.4$ RTT

CTS $Z=1.023$

P-value $P=.153$

1-PropZTest

$P_0:.4$

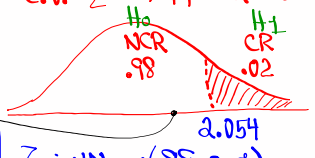
$x=85$

$n=195$

Prop $>P_0$ RTT

Calculate

C.V. Z RTT $\alpha=.02$



$Z=$invNorm$(.98,0,1)$

CTS is in NCR
H_0 valid & H_1 invalid } Traditional

P-value $>\alpha$
H_0 valid & H_1 invalid } P-value

claim is H_0
H_0 is valid $\Rightarrow$ Valid claim

Fail-to-Reject the claim

Support

The college claims that less than 10% of all students smoke. → $< .1$

In a survey of 240 students ($n = 240$) 9% of them ($x = 240(.09) \approx 22$) were smokers.

if decimal → Round up

Test the claim. → No α ⇒ $\alpha = .05$

H_0: $P \geq .1$

H_1: $P < .1$ claim, LTT

CV Z LTT No α

H_1 CR .05 | H_0 NCR .95

-1.645

$Z = invNorm(.05, 0, 1)$

CTS $Z = -.430$

P-value $P = .333$ ✓

1-Prop Z Test

$P_0 = .1$

$x = 22$

$n = 240$

Prop $< P_0$ LTT

Calculate

CTS is in NCR

H_0 valid H_1 invalid } Traditional

P-value $> \alpha$

H_0 valid H_1 invalid } P-value method

claim is H_1. H_1 invalid

invalid claim

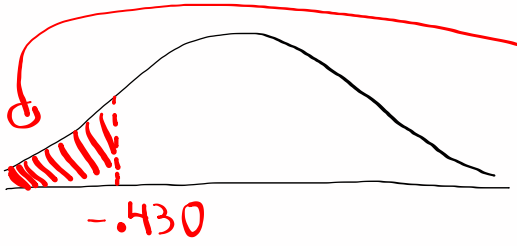
Reject the claim

What is P-value?

P-value is the total area of tails marked by the CTS.

If TTT ⇒ Find the area, then multiply by 2.

Last example ⇒ CTS ⇒ $Z = -.430$, LTT



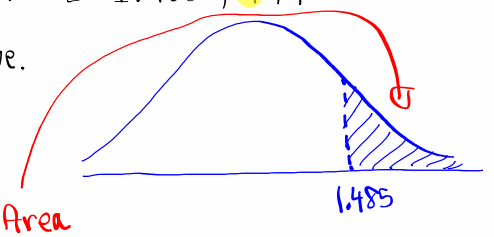
Area = P-value

normalcdf(-E99, -.430, 0, 1)

= .334

Suppose CTS $Z = 1.485$, TTT

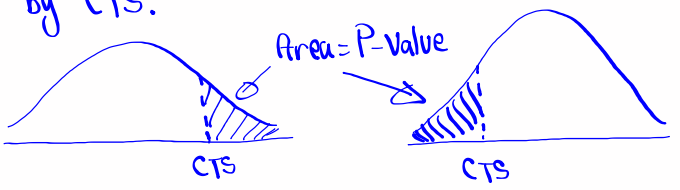
Find P-value.



P-value = 2*Area

= 2*normalcdf(1.485, E99, 0, 1) = .138

P-value is the area of the tail marked by CTS.



In case of TTT => multiply that area by 2.

Testing one Population mean μ: S6.26

$H_0: \mu = \mu_0$	$H_0: \mu \geq \mu_0$	$H_0: \mu \leq \mu_0$
$H_1: \mu \neq \mu_0$	$H_1: \mu < \mu_0$	$H_1: \mu > \mu_0$
TTT	LTT	RTT

Case I: σ Known

CV Z invNorm

CTS Z

P-Value P → Z-Test

inpt: Stats

Use Testing chart for validity of H_0 or H_1.

Final Conclusion has to be about the claim

Reject the claim OR Fail-To-Reject the claim

Given: $n=40$, $\bar{x}=85$, $\sigma=12$, $H_0: \mu=80$

claim is H_0. $\alpha=.04$

Test the claim.

$H_0: \mu=80$ claim

$H_1: \mu \neq 80$ TTT

σ known

CTS $Z=2.635$

P-value $P=.008$ √√

Z-Test

inpt: STATS

$\mu_0=80$

$\sigma=12$

$\bar{x}=85$

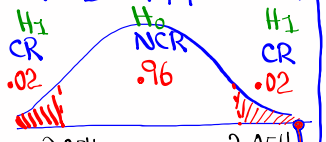
$n=40$

$\mu \neq \mu_0$ TTT

Calculate

Since σ is known

CV Z TTT $\alpha=.04$



Z = invNorm(.98, 0, 1)

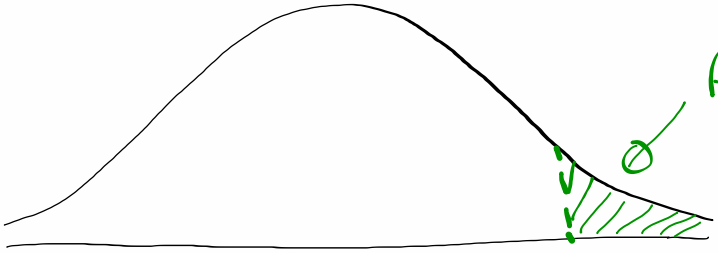
CTS is in CR. $\Rightarrow$ H_0 invalid

P-value $\leq \alpha$ $\Rightarrow$ H_1 valid

Invalid claim

$\Rightarrow$ **Reject the claim**

CTS $Z=2.635$ TTT Find P-value.



Area *2 = P-value

P-Value = 2*normalcdf(2.635, E99, 0, 1) = .008

The college claims the mean age of all students is below 32.5 yrs. $\mu < 32.5$

In a sample of 38 students, their mean age was 31.4 yrs. $n = 38$ $\bar{x} = 31.4$

It is known that standard deviation of ages of all students is 7.5 yrs. $\sigma = 7.5$

Test the claim at $\alpha = .05$.

$H_0: \mu \geq 32.5$

$H_1: \mu < 32.5$ claim, LTT

σ known

CTS $Z = -.904$

P-value $P = .183 > \alpha$

Z-Test

Stats

Inpt:

$\mu_0 = 32.5$

$\sigma = 7.5$

$\bar{x} = 31.4$

$n = 38$

$\mu < \mu_0$ LTT

Calculate

σ known

CV Z LTT $\alpha = .05$

H_1 CR .05

H_0 NCR .95

-1.645 0

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

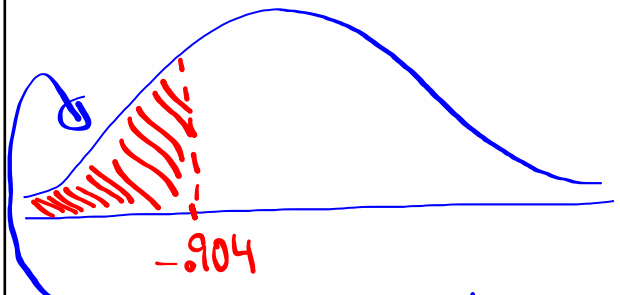
CTS is in NCR H_0 valid

P-value $> \alpha \Rightarrow$ H_1 invalid

Invalid claim

Reject the claim

CTS $Z = -.904$ LTT find P-value



Area = P-Value

= normalcdf(-E99, -.904, 0, 1)

= .183

I claim that the mean Salary of all nurses is more than \$6000/mo. $\mu > 6000$

In a Sample of 30 nurses, their mean monthly Salary was \$6100. $n = 30$ $\bar{x} = 6100$

It is know that standard deviation of Salaries of all nurses is \$375/mo. $\sigma = 375$

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

H_0: $\mu \leq 6000$

H_1: $\mu > 6000$ claim, RTT

σ Known

CTS $Z = 1.461$

P-value $P = .072$

Z-Test

input: STATS

$\mu_0 = 6000$

$\sigma = 375$

$\bar{x} = 6100$

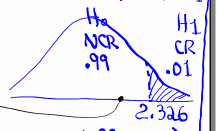
$n = 30$

$\mu > \mu_0$ RTT

Calculate

σ Known

CV Z RTT $\alpha = .01$



Z = invNorm(.99, 0, 1)

CTS is in NCR H_0 Valid

P-value $> \alpha$ $\Rightarrow$ H_1 invalid

invalid claim

Reject the claim

If I change α to .1,

P-value $\leq \alpha$

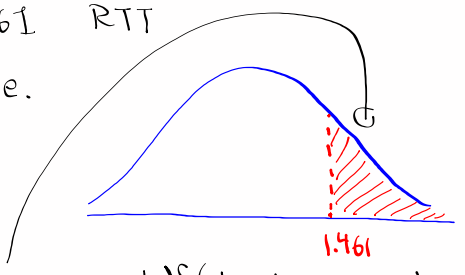
H_0 invalid H_1 Valid

we have a valid claim,

FTR the claim

CTS $Z = 1.461$ RTT

Find P-value.



P-value = Area = normalcdf(1.461, E99, 0, 1)

= .072

P-value is the area on the right or on the left side marked by CTS.

Multiply that area by 2 only for TTT.

SG 24 is due tonight.

SG 25 is due tomorrow night.