Statistics

Lecture 21

Feb 19-8:47 AM

SG 24

Testing one population Proportion:

$H_0: p = p_0$ $H_0: p \leq p_0$ $H_0: p \geq p_0$

$H_1: p \neq p_0$ $H_1: p > p_0$ $H_1: p < p_0$

TTT RTT LTT

CV z invNorm.

CTS z

P-Value P $\rightarrow$ 1-PropZTest

we use testing chart to determine the validity of H_0 & H_1.

we draw final conclusion about the claim.

Reject the claim OR FTR the claim

(claim is invalid) (claim is valid)

May 18-1:48 PM

Given $H_0: p \le .3$ claim is H_0 $\alpha = .02$

$n = 150$, $x = 48$

Test the claim.

$H_0: p \le .3$ claim

$H_1: p > .3$ RTT

CTS $z = .535$

P-Value $P = .296$ ✓

1-Prop Z Test

$P_0: .3$ H_0

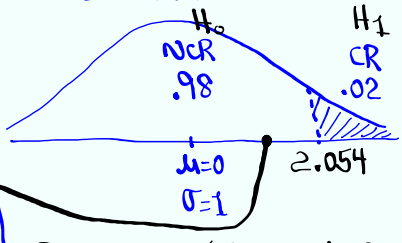
$x: 48$

$n: 150$

Prop $> P_0$ H_1

Calculate

CV z RTT $\alpha = .02$



$z = \text{invNorm}(.98, 0, 1) = 2.054$

CTS is in NCR ⇒ P-Value $> \alpha$

H_0 valid

H_1 invalid

Valid claim

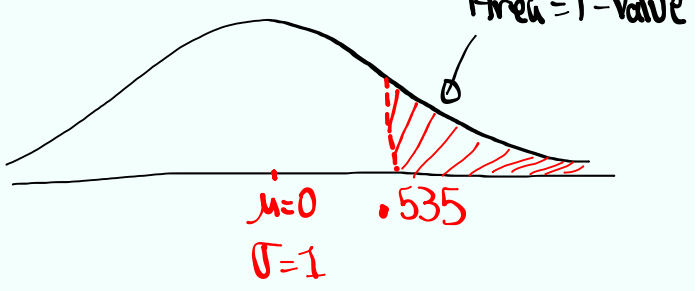
FTR the claim

May 18-1:56 PM

CTS $z = .535$

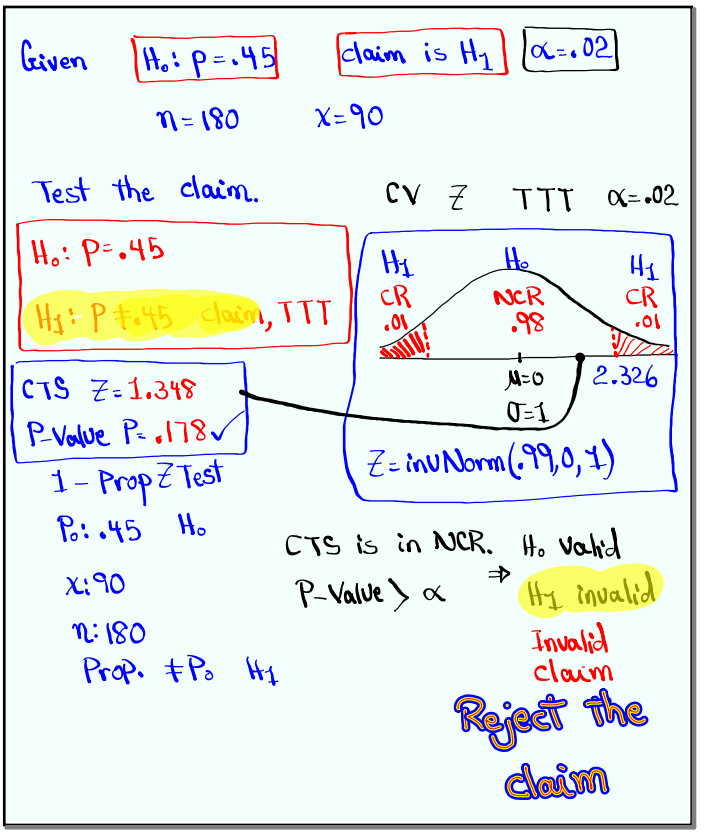
RTT

Find p-Value.

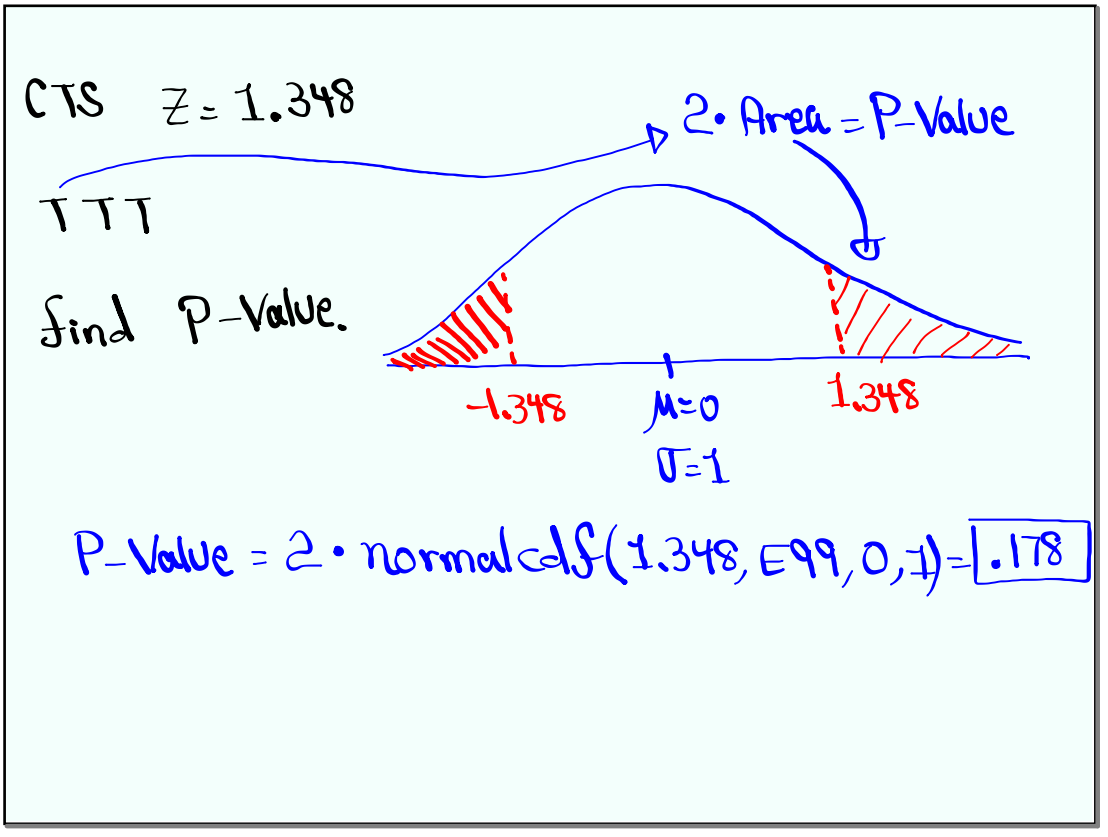


P-Value = normalcdf(.535, E99, 0, 1) = .296

May 18-2:06 PM



May 18-2:09 PM



May 18-2:20 PM

CNN claims that at least 40% of young voters have instagram account. $\rightarrow p \geq .4$ ← H_0

I surveyed 200 young voters and 36% of them had instagram account. $n=200$, $\hat{p}=.36 \rightarrow x=n\hat{p}$ $=200(.36)=72$

no $\alpha \rightarrow .05$

Test the claim.

CV Z LTT $\alpha=.05$

$H_0: p \geq .4$ claim

$H_1: p < .4$ LTT

CTS $Z=-1.155$

P-Value $P=.124$ ✓

1-PropZTest

$P_0: .4$

$x=72$

$n=200$

Prop $< P_0$ H_1

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

CTS is in NCR ⇒ P-Value $> \alpha$ ⇒ H_0 valid, H_1 invalid

Valid claim

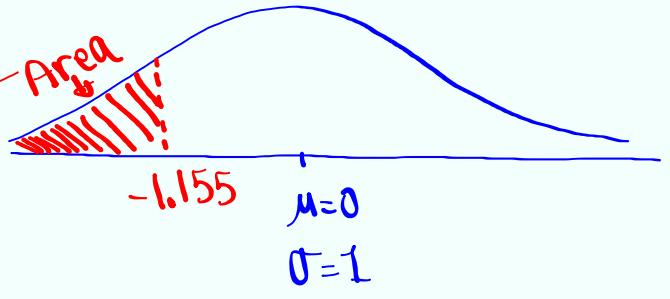
FTR the claim

May 18-2:23 PM

CTS $Z=-1.155$

LTT

Find p-Value.



P-Value = normalcdf$(-E99, -1.155, 0, 1)$ = .124

May 18-2:35 PM

College claims that about 32% of all students like online classes. $P = .32$ H_0

I surveyed 175 students and 30% of them liked online classes. $n = 175$ $\hat{P} = .3$

$x = n\hat{P} = 175(.3) = 52.5$ Round-up $x = 53$

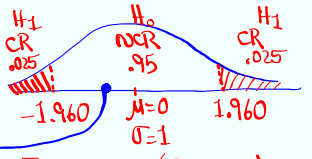
NO $\alpha \rightarrow .05$

Test the claim.

$H_0: P = .32$ claim

$H_1: P \neq .32$ TTT

CV Z TTT $\alpha = .05$



CTS $Z = -.486$
P-Value $P = .627$

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

CTS is in NCR → H_0 valid

P-Value $> \alpha$ → H_1 invalid

Valid claim

FTR the claim

1-Prop Z Test

$P_0: .32$ H_0

$x: 53$

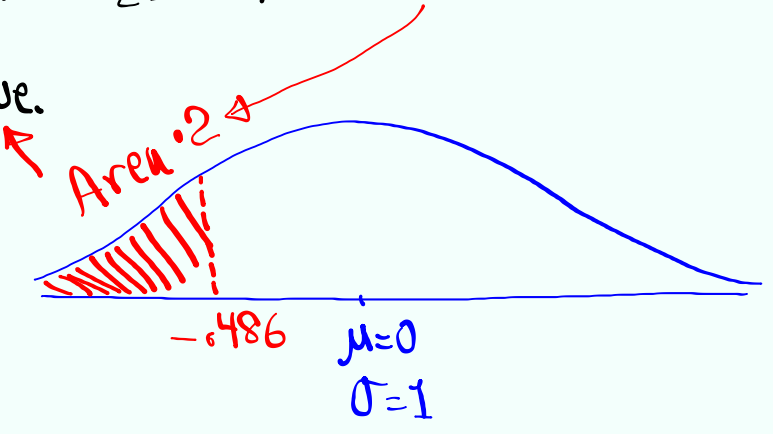
$n: 175$

Prop $\neq P_0$ H_1

May 18-2:39 PM

Given CTS $Z = -.486$ TTT

Find P-Value.



P-Value $= 2 \cdot \text{normalcdf}(-E99, -.486, 0, 1)$

$= .627$

May 18-2:52 PM

Testing One population Mean:

$H_0: \mu = \mu_0$ $H_0: \mu \le \mu_0$ $H_0: \mu \ge \mu_0$

$H_1: \mu \ne \mu_0$ $H_1: \mu > \mu_0$ $H_1: \mu < \mu_0$

TTT RTT LTT

Case I: σ Known

CV $z \rightarrow$ invNorm

CTS z

P-Value $P \rightarrow$ Z-Test

inpt: Stats

we use testing chart to determine the validity of H_0 & H_1.

Draw final conclusion about the claim

Reject the claim (claim is invalid) OR FTR the claim (claim is valid)

May 18-3:08 PM

Given: $H_0: \mu = 85$ claim is H_0, $\alpha = .02$

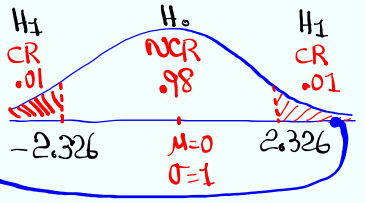
$\sigma = 12$ $\bar{x} = 90$ $n = 35$

Test the claim. σ known

$H_0: \mu = 85$ claim

$H_1: \mu \ne 85$ TTT

CV z TTT $\alpha = .02$



CTS $z = 2.465$

P-Value $P = .014$

Z-Test

inpt: Stats

$\mu_0 = 85$

$\sigma = 12$

$\bar{x} = 90$

$n = 35$

$\mu \ne \mu_0$ H_1

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

CTS is in CR $\Rightarrow$ H_0 invalid

P-Value $\le \alpha$ H_1 Valid

Invalid claim

Reject the claim

May 18-3:15 PM

College claims the mean age of all students is at most 32.5 yrs. $\mu \leq 32.5$ (H_0)

I took a survey of 40 students, their mean age was 30 yrs. $n=40$, $\bar{x}=30$

It is known that standard deviation of ages of all students is 10 yrs. $\sigma = 10$

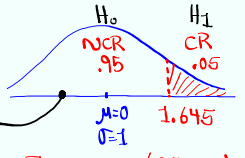
Test the claim. No $\alpha \rightarrow .05$

σ known

$H_0: \mu \leq 32.5$ claim

$H_1: \mu > 32.5$ RTT

CV z RTT $\alpha = .05$



CTS $z = -1.581$

P-Value $P = .943$

$z = \text{invNorm}(.95, 0, 1)$

Z-Test

inpt: Stats

$\mu_0 = 32.5$

$\sigma = 10$

$\bar{x} = 30$

$n = 40$

$\mu > \mu_0$ H_1

CTS is in NCR → H_0 valid

P-Value $> \alpha$ → H_1 invalid

Valid claim

FTR the claim

May 18-3:25 PM

Testing One population Mean:

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

Case I: σ Known	Case II: σ unknown
CV $z \rightarrow$ invNorm	CV $t \rightarrow$ invT $df = n-1$
CTS z	CTS t
P-Value P → Z-Test	P-Value P → T-Test
inpt: Stats	inpt: Stats

We use testing chart to determine the validity of H_0 & H_1.

Draw final conclusion about the claim

Reject the claim (claim is invalid) OR **FTR the claim** (claim is valid)

May 18-3:08 PM

Given $H_1: \mu > 75$ claim is H_1 $\alpha = .04$

$\bar{x} = 78$, $S = 10$, $n = 12$

Test the claim.

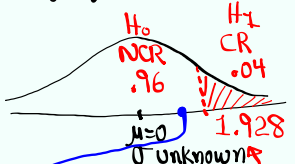
$H_0: \mu \leq 75$

$H_1: \mu > 75$ - RTT, claim

σ unknown

CV t RTT $\alpha = .04$

$df = n - 1 = 11$



CTS $t = 1.039$

P-Value $P = .161$ ✓

T-Test

$\mu_0 = 75$

$\bar{x} = 78$

$S = 10$

$n = 12$

$\mu > \mu_0$

$t = invT(.96, 11)$

CTS is in NCR H_0 valid

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

Invalid claim

Reject the claim

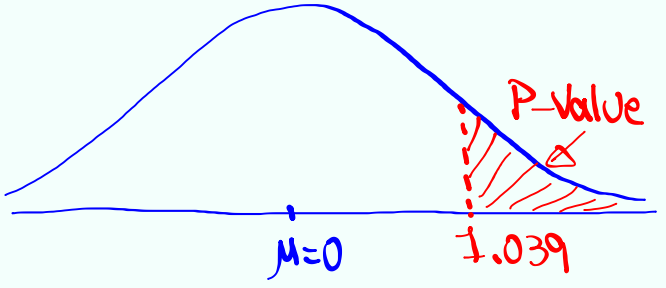
May 18-3:40 PM

CTS $t = 1.039$

RTT

$df = 11$

Find p-Value



σ unknown

$df = 11$

P-Value = tcdf(1.039, E99, 11)

$\approx$ .161

May 18-3:51 PM

Math department claims the mean of all final exams in all stat classes is 86. $\mu = 86$ (H_0)

I took 10 final exams randomly, the mean was 82 with standard dev. of 8. ($n=10$)

Test the claim. $\bar{x}=82$, $s=8$

$H_0: \mu = 86$ claim

$H_1: \mu \neq 86$ TTT

σ unknown

CV t TTT $\alpha = .05$

$df = n-1 = 9$

CTS $t = -1.581$

P-Value $P = .148$

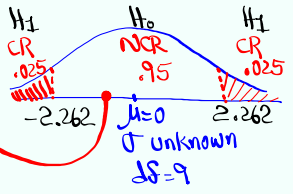
T-Test

CTS is in NCR

P-value $> \alpha$

H_0 valid, H_1 invalid

Valid claim FTR the claim



t=invT(.975,9)

May 18-3:54 PM

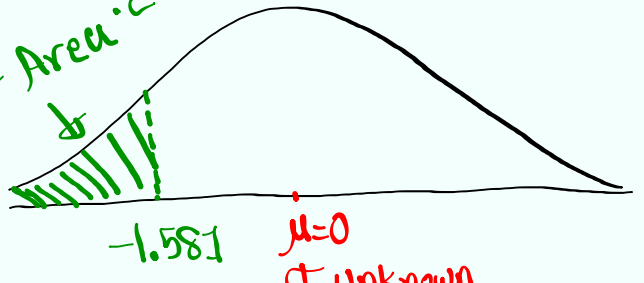
CTS $t = -1.581$

$df = 9$

TTT

Find P-Value

Area: 2



P-value = 2·tcdf(-E99, -1.581, 9) ≈ .148

May 18-4:18 PM