Statistics

Lecture 13

Feb 19-8:47 AM

SG 23-25

Testing claims:

Claims are made for parameters.

Our task is to determine its validity.

- Population Proportion P.
- Population Mean μ.
- Population Standard deviation σ.

If the claim is valid → we Support it.

Fail-To-Reject

If the claim is invalid → we reject it.

Final Conclusion:

Reject the claim (Invalid claim)

OR

Fail-to-Reject the claim (Valid claim)

Nov 21-11:41 AM

Testing Methods:

1) Traditional Method

2) P-value Method

3) Confidence Interval Method

Regardless of method, the final conclusion must be the Same.

Reject the claim OR FTR the claim

Nov 21-11:48 AM

Testing Types:

1) Right-Tail Test (RTT)

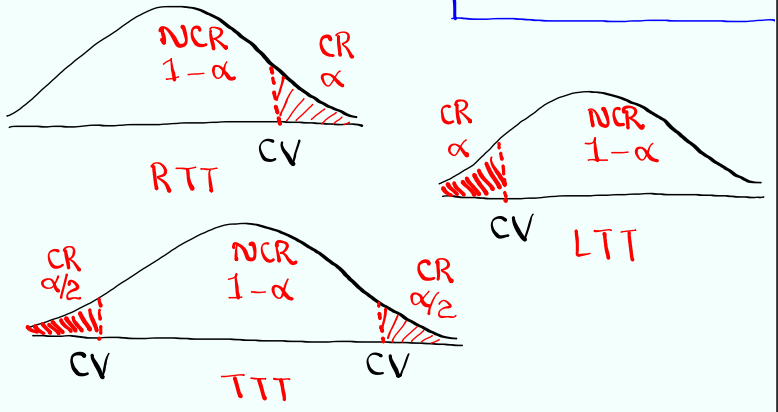
2) Left-Tail Test (LTT)

3) Two-Tail Test (TTT)

with every testing, we use Significance level α.

$0 < \alpha < 1$

If α not given, we use .05



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Testing Process:

1) Set-up H_0 & H_1. (H_1: Alternative Hypothesis (H_a); H_0: Null Hypothesis)

2) Find Critical Values.
Drawing, labeling, Shading, Full TI Command required.

3) Find Computed Test Statistic (CTS) and P-value (P).
Formula or full TI command required.

4) Use Testing Chart to determine the validity of H_0 & H_1.

5) Draw Final Conclusion about the claim.

Reject the claim OR FTR the claim.

Nov 21-11:58 AM

More on H_0 & H_1:

H_0 must contain the = Sign. $\Rightarrow =, \geq, \leq$

H_1 Cannot contain the = Sign $\Rightarrow \neq, <, >$

Keywords for H_0:

is, equal, Same, not different, at least, at most, ...

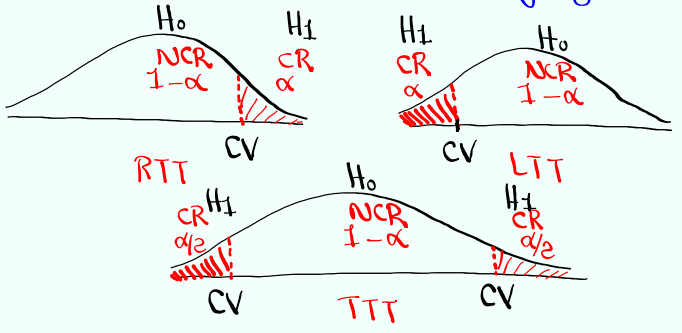
Keywords for H_1:

is not, not equal, not Same, different, more than, less than, exceed, above, below, ...

Nov 21-12:05 PM

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

H_1 tells us the testing type.



$P(H_0 \text{ valid}) = 1-\alpha = P(H_1 \text{ invalid})$

$P(H_0 \text{ invalid}) = \alpha = P(H_1 \text{ valid})$

Nov 21-12:09 PM

The college claims that 10% of all students smoke.

$P = .1$ ← H_0

$H_0: P = .1$ claim

$H_1: P \neq .1$ TTT

The college claims that the mean age of all students is at most 32.5 yrs.

$\mu \leq 32.5$ ← H_0

$H_0: \mu \leq 32.5$ claim

$H_1: \mu > 32.5$ RTT

Nov 21-12:17 PM

LA Times reported that Standard dev. of Salaries of all nurses is below $500.

$H_0: \sigma \geq 500$

$\sigma < 500$ ↑ H_1

$H_1: \sigma < 500$ claim, LTT

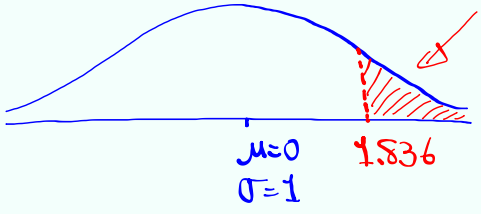
Nov 21-12:22 PM

what is P-Value?

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

Multiply by 2 only for TTT.

CTS $Z = 1.836$ RTT find P-Value



Area = P-Value

= normalcdf(1.836, E99, 0, 1)

= .033

If TTT → P-Value = 2 · (.033) = .066

Nov 21-12:25 PM

CTS $t = -2.375$, LTT, $df = 9$.

Find P-Value.

Area = P-Value

$= tcdf(-E99, -2.375, 9)$

Lower, Upper, df

$= .021$

If TTT $\rightarrow$ P-value $= 2(.021) = .042$

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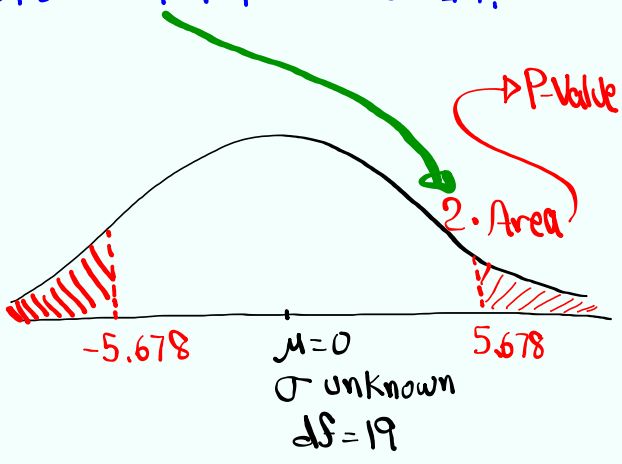
CTS $t = 5.678$ TTT $df = 19$.

Find p-value.



P-Value $= 2 \cdot tcdf(5.678, E99, 19) =$

1.79×10^{-5}

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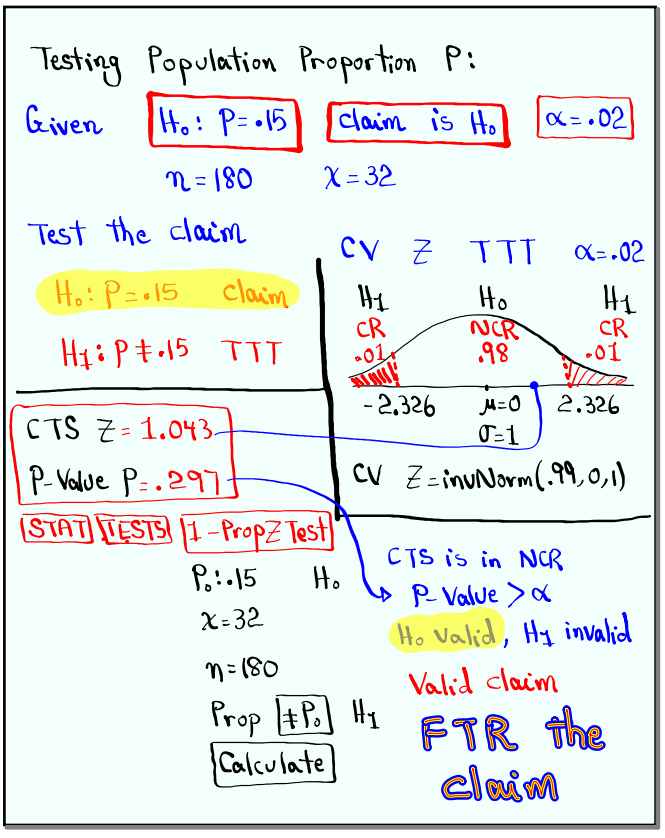

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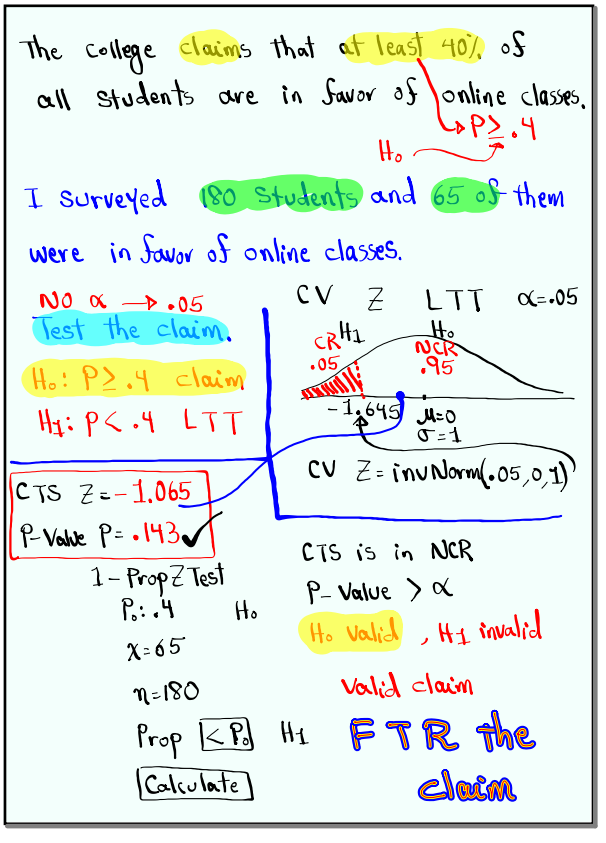
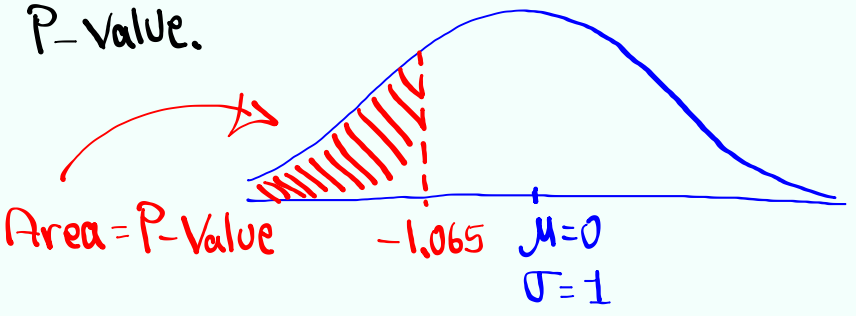


Nov 21-1:09 PM

doing Reverse

CTS $z = -1.065$ LTT

find P-value.



$= \text{normalcdf}(-E99, -1.065, 0, 1)$

$= \boxed{.143}$

Nov 21-1:21 PM

LA Times claims more than 70% ($p > .7$, H_1) of all LA residents are fan of Dodgers.

I surveyed 455 ($n = 455$) LA residents and 72% ($\hat{p} = .72$) of them were fan of Dodgers. $x = n\hat{p} = 455(.72) = 327.6 \approx 328$

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

H_0: $p \leq .7$

H_1: $p > .7$ claim, RTT

CV Z RTT $\alpha = .01$

H_0 NCR .99 H_1 CR .01

$\mu = 0$ 2.326 $\sigma = 1$

CV → $Z = \text{invNorm}(.99, 0, 1)$

CTS $Z = .972$

P-Value $P = .166$

1-PropZTest

$p_0 : .7$ H_0

$x = 328$

$n = 455$

Prop $> p_0$ H_1

Calculate

CTS is in NCR → P-Value $> \alpha$

H_0 Valid H_1 invalid

Invalid claim

Reject the claim

Nov 21-1:24 PM

Four - Possible outcomes for H_0:

Reality / Action	H_0 valid	H_0 invalid
Support H_0	Good Decision	Type II error
Reject H_0	Type I error	Good Decision

Nov 21-1:37 PM

Testing Pop. Mean μ:

Given: $H_0: \mu = 32$ claim is H_1 $\alpha = .04$

$\bar{x} = 35$ $n = 28$ $\sigma = 10$

Test the claim.

$H_0: \mu = 32$

$H_1: \mu \neq 32$ TTT claim

CTS $Z = 1.587$

P-value $P = .112$ ✓

Z-Test

Inpt: Stats

$\mu_0: 32$

$\sigma = 10$

$\bar{x} = 35$

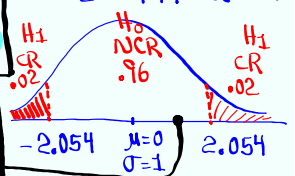
$n = 28$

$\mu \neq \mu_0$ H_1

Calculate

σ is known → Case I

CV Z TTT $\alpha = .04$



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

CTS is in NCR

P-value > α

H_0 valid H_1 invalid

Invalid claim

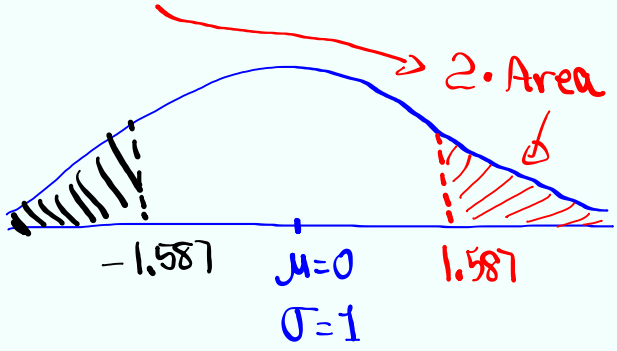
Reject the claim

Nov 21-1:55 PM

doing Reverse

CTS $Z = 1.587$ TTT

find P-Value



P-Value = 2 • normalcdf(1.587, E99, 0, 1)

= .113

Nov 21-2:06 PM

Given : $H_1: \mu > 80$, Claim is H_0

$\bar{x} = 90$ $S = 6$ $n = 15$

Test the claim

$H_0: \mu \leq 80$ claim

$H_1: \mu > 80$ RTT

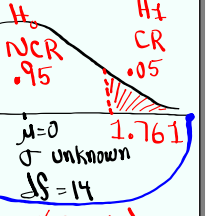
σ is unknown ⇒ Case II

CV t RTT df=14

no α → use .05

CTS t = 6.455

P-Value P = 7.551×10^{-6}



T-Test

inpt: STATS

$\mu_0: 80$ H_0

$\bar{x} = 90$

$S = 6$

$n = 15$

$\mu > \mu_0$ H_1

Calculate

CV t=invT(.95,14)

CTS is in CR

P-value ≤ α

H_0 invalid H_1 valid

Invalid claim

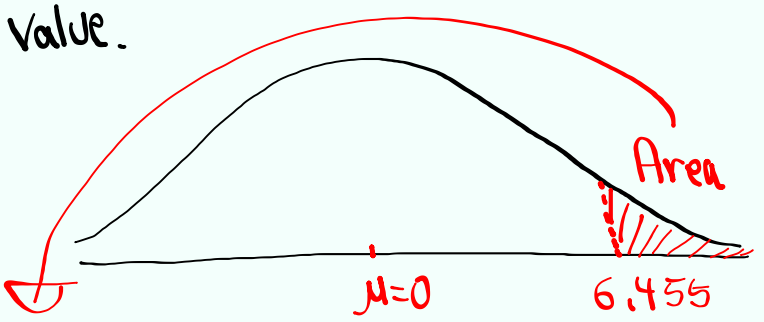
Reject the claim

Nov 21-2:09 PM

Doing Reverse

CTS $t = 6.455$ RTT $n = 15$, $df = 14$

Find P-value.



P-value

$= tcdf(6.455, E99, 14) =$ 7.55×10^{-6}

Nov 21-2:20 PM

Math dept. claims the mean of all final exam scores is 85. $\mu = 85$ H_0

I took a Sample of 25 final exams, the mean was 83 with Standard dev. of 10. $n=25$ $\bar{x}=83$ $s=10$

No $\alpha \rightarrow .05$

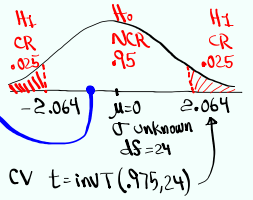
Test the claim. σ unknown

$H_0: \mu = 85$ claim CV t $df=24$ $\alpha=.05$ TTT

$H_1: \mu \neq 85$ TTT

CTS $t = -1$

P-Value $P = .327$



T-Test

inpt: Stats

$\mu_0 = 85$ H_0

$\bar{x} = 83$

$s = 10$

$n = 25$

μ $\neq \mu_0$ H_1

Calculate

CV $t = invT(.975, 24)$

CTS is in NCR

P-value $> \alpha$

H_0 valid H_1 invalid

Valid claim

FTR the claim.

Nov 21-2:24 PM