Statistics

Lecture 13

Feb 19-8:47 AM

SG 23-25

Testing claims:

A claim can be made about any parameters.

Our task is to determine its validity.

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

If claim is valid → we Support it.

Fail-to-Reject

If claim is invalid → we reject it.

Possible errors:

Claim is valid but we reject it.

Claim is invalid but we fail-to-reject it.

Nov 21-8:09 AM

The final conclusion at the end of testing is

Reject the claim (Invalid claim) OR

Fail-to-Reject the claim (Valid claim)

Testing Methods:

1) Traditional Method
2) P-Value Method
3) Confidence Interval Method

Regardless of method, the final conclusion should be the same.

Valid claim $\Longleftrightarrow$ Fail-to-Reject

Invalid claim $\Longleftrightarrow$ Reject

Nov 21-8:16 AM

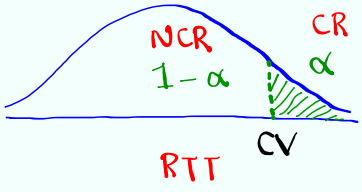
Testing Types:

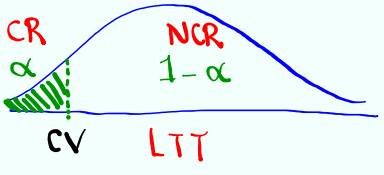
1) Right-Tail Test (RTT)
2) Left-Tail Test (LTT)
3) Two-Tail Test (TTT)

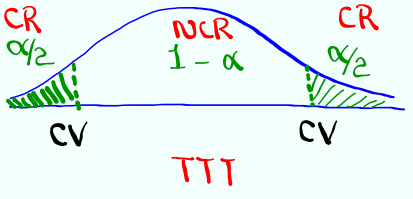
With every testing, there is a Significance level α.

$0 < \alpha < 1$

If none given, we use $\alpha = .05$







Nov 21-8:23 AM

Testing Process:

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

2) Find all Critical Values.
   Drawing, labeling, Shading, and Full TI command required.

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

4) Using **Testing Chart** to determine the validity of H_0 & H_1.
   H_0 valid $\Leftrightarrow$ H_1 invalid
   H_0 invalid $\Leftrightarrow$ H_1 valid

5) Draw Final Conclusion about the claim.

Reject the claim OR **Fail-to-Reject the claim**

Nov 21-8:31 AM

More on H_0 & H_1:

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

H_1 cannot contain = 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 the same, different, more than, less than, below, above, exceed, - - -,

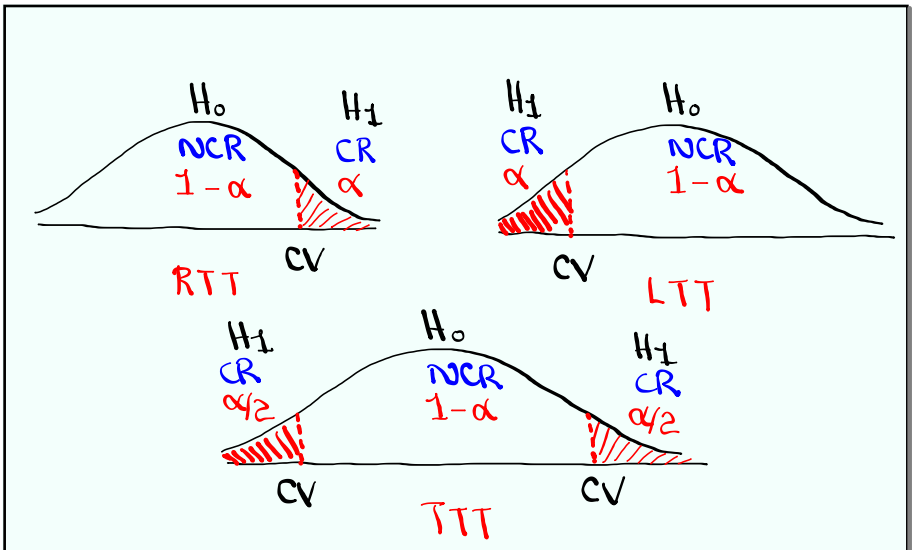
H_0: $=$	H_0: $\geq$	H_0: $\leq$
H_1: $\neq$	H_1: $<$	H_1: $>$
TTT	LTT	RTT

H_1 determine the type of testing.

Claim could be H_0 or H_1.

Always identify claim and testing type.

Nov 21-8:40 AM



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

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

Nov 21-8:48 AM

I claim 10% of all Students are left-handed.

$H_0: P = .1$ claim

$H_1: P \neq .1$ TTT

The College claims that the mean age of all Students is at most 32.5 yrs.

$\mu \leq 32.5$

$H_0: \mu \leq 32.5$ claim

$H_1: \mu > 32.5$ RTT

Nov 21-8:55 AM

LA Times reported that Standard deviation of the Salaries of all nurses is less-than-$500.

$\sigma < 500$

$H_0: \sigma \geq 500$

$H_1: \sigma < 500$ claim, LTT

Nov 21-8:59 AM

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

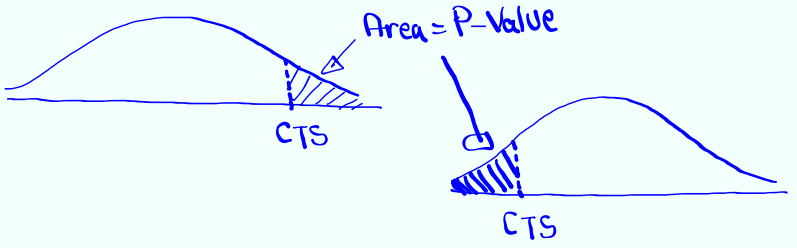
Nov 21-9:02 AM

What is p-Value?

P-Value is the Smallest Significance level for which H_0 will be Supported and H_1 will be rejected.

P-Value is the area (of the tail) under the curve marked by CTS.

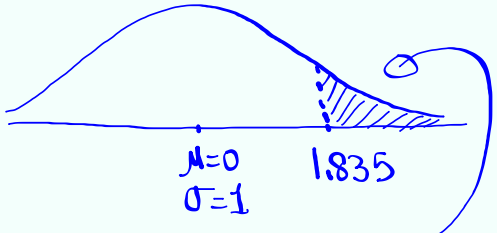
Multiply that area by 2 only for TTT.



Nov 21-9:08 AM

Given CTS $Z = 1.835$ RTT

Find P-Value.



Area = P-Value

= normalcdf(1.835, E99, 0, 1)

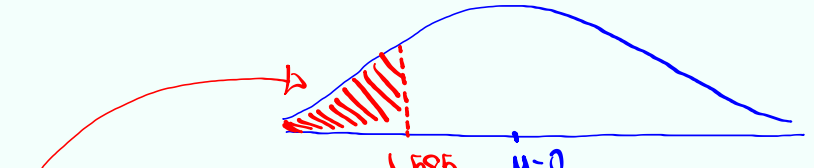
= .033

If TTT → P-Value = 2(.033) = .066

Nov 21-9:13 AM

Given CTS $t = -1.585$ $df = 9$, LTT

Find P-Value.



Area = P-Value

$= tcdf(-E99, -1.585, 9) = .074$
L U df

If TTT → P-Value = 2(.074) = .148

Nov 21-9:16 AM

Given $H_0: P = .1$, claim is H_0, $\alpha = .02$

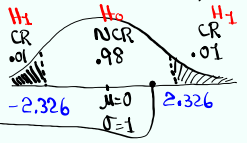
$x = 15$, $n = 120$

Test the claim

$H_0: P = .1$ claim

$H_1: P \neq .1$ TTT

C.V. Z $\alpha = .02$, TTT



CTS $Z = .913$

P-Value $P = .361$

STAT TESTS

1-PropZTest

$P_0: .1$ H_0

$x = 15$

$n = 120$

Prop $\neq P_0$ H_1

Calculate

CV Z = invNorm(.99, 0, 1) = 2.326

Traditional:

CTS is in NCR

H_0 valid, H_1 invalid

Support H_0, Reject H_1

claim was H_0.

Valid claim

FTR the claim

P-Value:

P-Value vs α

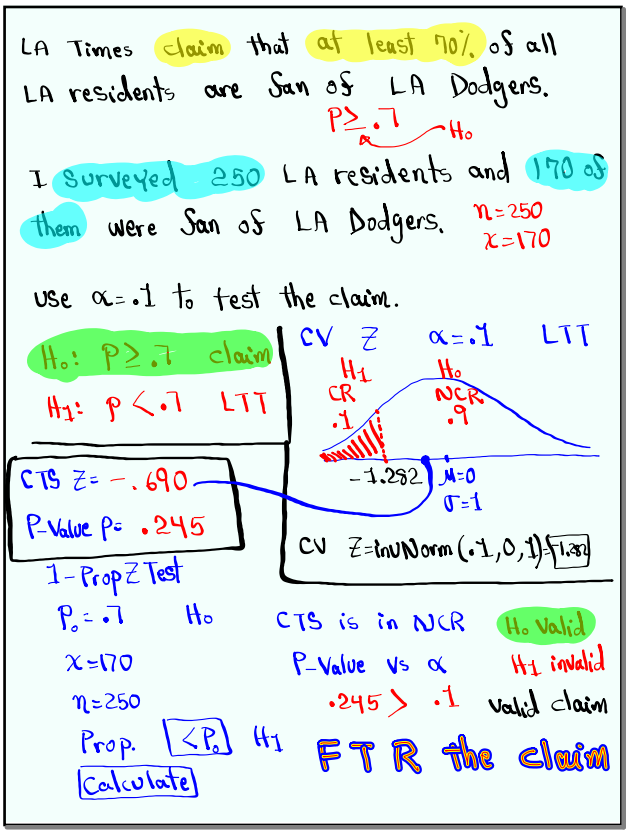
$.361 > .02$

H_0 valid, H_1 invalid

Valid claim

FTR the claim

Nov 21-9:32 AM



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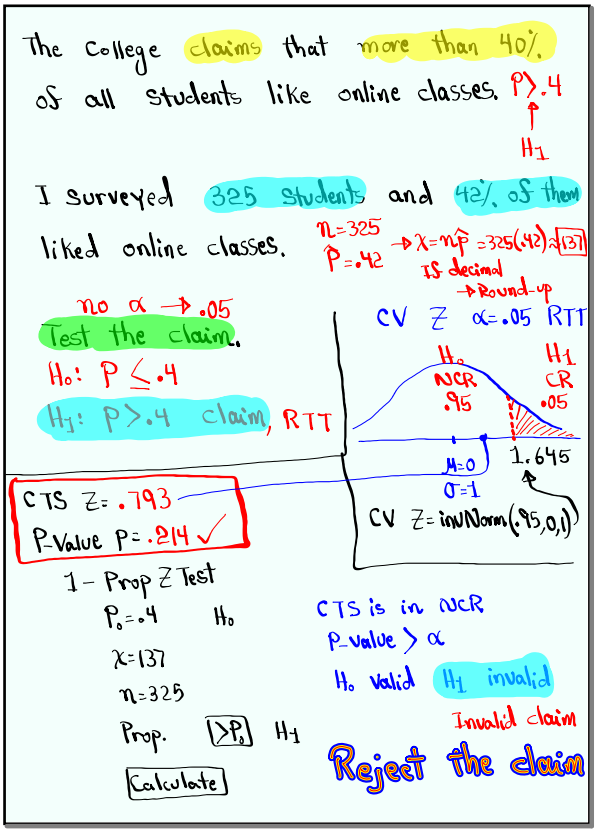
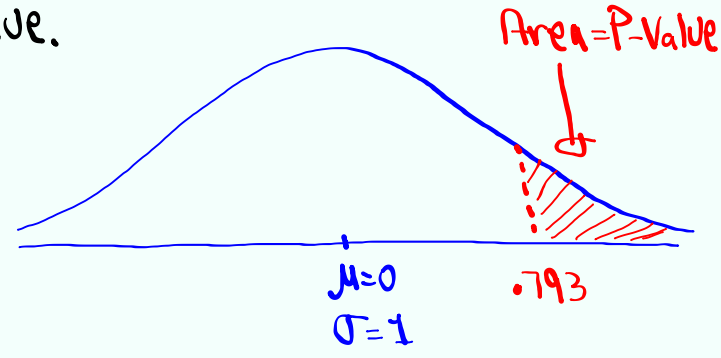


Nov 21-10:00 AM

doing reverse

CTS $z = .793$ RTT

Find p-value.



P-Value = normalcdf(.793, E99, 0, 1) = .214

Nov 21-10:14 AM

Given $H_0: \mu = 84$ claim is H_1 $\alpha = .04$

$\bar{x} = 90$, $n = 32$, $\sigma = 8$

Test the claim.

$H_0: \mu = 84$

$H_1: \mu \neq 84$ TTT claim

CTS $z = 4.243$

P-Value $P = 2.2 \times 10^{-5}$

STAT TESTS Z-Test

inpt:

$\mu_0 = 84$

$\sigma = 8$

$\bar{x} = 90$

$n = 32$

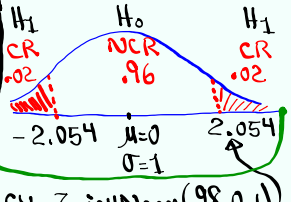
$\mu \neq \mu_0$ H_1

Calculate

Since σ is known

Case I

CV z TTT $\alpha = .04$



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

H_0

CTS is in CR H_0 invalid

P-Value $\leq \alpha$ H_1 valid

Valid claim

FTR the claim

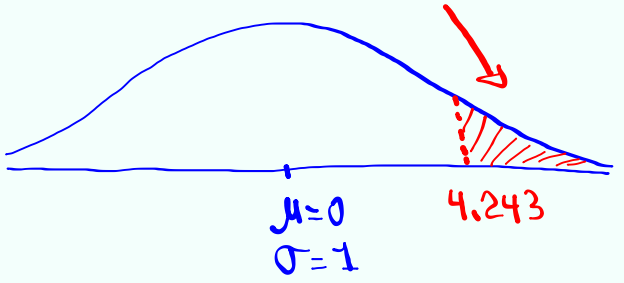
Nov 21-10:34 AM

Doing Reverse:

CTS $Z = 4.243$ TTT

Find p-value.

2 • Area = P-Value



P-Value = 2 • normalcdf(4.243, E99, 0, 1) = 2.2×10^{-5}

Nov 21-10:46 AM

Given $H_1: \mu < 80$, claim is H_0

$\bar{x} = 78$ $S = 12$ $n = 15$

No α → .05

Test the claim.

$H_0: \mu \geq 80$ claim

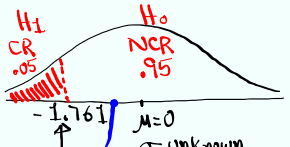
$H_1: \mu < 80$ LTT

σ is unknown

Case II

CV t LTT $\alpha = .05$

$df = n - 1 = 14$



CV t = invT(.05, 14)

CTS t = −.645

P-Value P = .265 ✓

T-Test

inpt: STATS

μ_0: 80 H_0

$\bar{x} = 78$

$S = 12$

$n = 15$

$\mu < \mu_0$ H_1

Calculate

CTS is in NCR

P-Value > α

H_0 valid

H_1 invalid

Valid claim

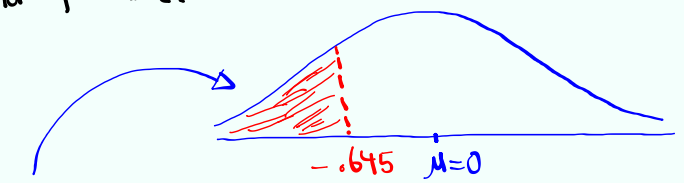
FTR the claim

Nov 21-10:49 AM

doing Reverse

CTS $t = -.645$ LTT $df = 14$ $15-1$

Find P-value.



Area = P-Value

σ unknown

$df = 14$

$= tcdf(-E99, -.645, 14)$

$= \boxed{.265}$

SG 23, 24, 25

Work on them

Nov 21-11:02 AM