Statistics

Lecture 20

Feb 19-8:47 AM

SG 23

Testing Claims:

We test claims to determine its validity.

If claim is valid → we Support it.
Fail-to-Reject

If claim is invalid → we reject it.

Claims are made about Parameters.
Describe Population

Claim could be made about

1) Population Proportion
2) Population Mean

3) Population Standard deviation

4) . . . .

Final Conclusion must be about the claim.

Reject the claim OR **FTR the claim**

May 13-1:48 PM

Testing Methods:

1) Traditional Method

2) P-Value Method

3) Confidence interval Method

Get a copy of **Testing Chart**

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

Reject the claim
claim is invalid

OR

FTR the claim
claim is Valid

May 13-1:57 PM

Testing Types:

1) Right-Tail Test RTT

2) Left-Tail Test LTT

3) Two-Tail Test TTT

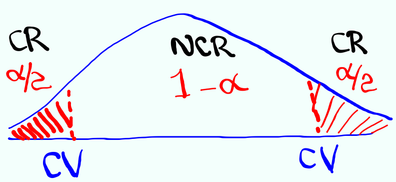
The area of the tail or tails is Called Critical region.

Area is α, $0 < \alpha < 1$

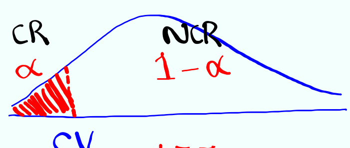
Significance level

If α not given, we use .05.

RTT



TTT



LTT

May 13-2:03 PM

Testing Process:

1) Set up H_0 & H_1. ← Alternative Hypothesis $\underbrace{}_{H_a}$

↑ 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.

TI Command / Formula required.

4) Use testing chart to determine the validity of H_0 and H_1.

H_0 valid ⟷ H_1 invalid

H_0 invalid ⟷ H_1 valid

5) Draw final conclusion about the claim.

Reject the claim (claim is invalid)

OR

Fail-to-Reject the claim (claim is valid)

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More on H_0 & H_1:

H_0 must contain the equal sign. $=, \geq, \leq$

H_1 cannot contain the equal sign. $\neq, <, >$

Keywords for H_0:

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

Keywords for H_1:

is not, not equal, 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**

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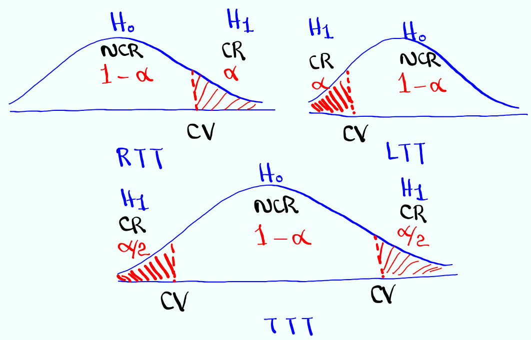

$P(H_0 \text{ valid}) = P(H_1 \text{ invalid})$

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

Look at 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

Type I error $\Rightarrow$ we reject a valid H_0.

Type II error $\Rightarrow$ we support an invalid H_0.

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College claims 5% of all students are left-handed.

$P = .05$ ← H_0

H_0: $p = .05$ claim

H_1: $p \neq .05$ TTT

College claims the mean age of all students is at most 32 yrs.

$\mu \leq 32$ ← H_0

H_0: $\mu \leq 32$ claim

H_1: $\mu > 32$ RTT

May 13-2:41 PM

College claims the standard deviation of all exam scores is below 10.

$\sigma < 10$

H_1

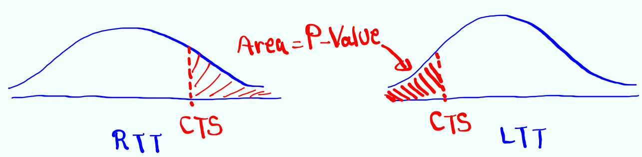
H_0: $\sigma \geq 10$

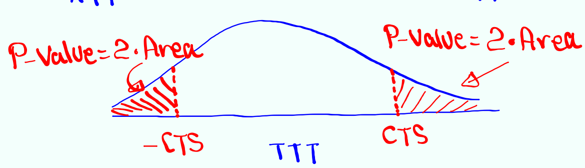
H_1: $\sigma < 10$ claim, LTT

May 13-2:46 PM

what is P-Value?

P-Value is the area of tail marked by CTS (Computed Test statistic).

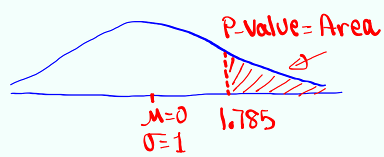




CTS Z = 1.785

RTT

find P-Value.



P-value = normalcdf(1.785, E99, 0, 1)

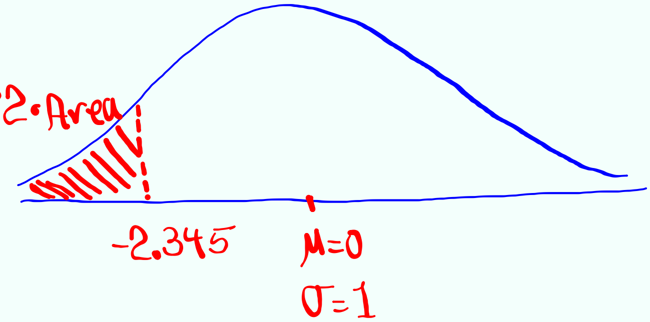
$= \boxed{.037}$

May 13-3:01 PM

CTS $z = -2.345$

TTT

find p-Value.



$\text{P-Value} = 2 \cdot \text{normalcdf}(-E99, -2.345, 0, 1)$

$\approx \boxed{.019}$

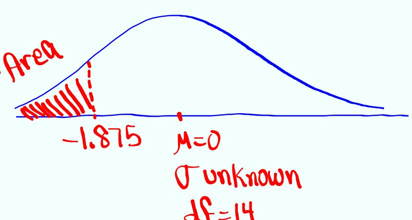
May 13-3:08 PM

CTS $t = -1.875$

$df = 14$

LTT

find p-Value.



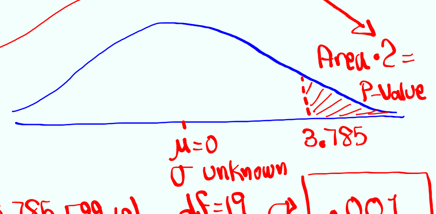
$\text{P-Value} = \text{tcdf}(-E99, -1.875, 14) = \boxed{.041}$

CTS $t = 3.785$

$df = 19$

TTT

Find p-Value



$\text{P-Value} = 2 \cdot \text{tcdf}(3.785, E99, 19)$ $\boxed{.001}$

SG 23 ✓

May 13-3:11 PM

In a Sample of 275 Voters, 40% of them had already voted.

$n = 275$

$\hat{p} = .4 \rightarrow x = n\hat{p} = 275(.4) = 110$

C-level: .98

Find 98% conf. interval for the prop. of all Voters that have already voted.

1-PropZInt

$\boxed{.33 < p < .47}$

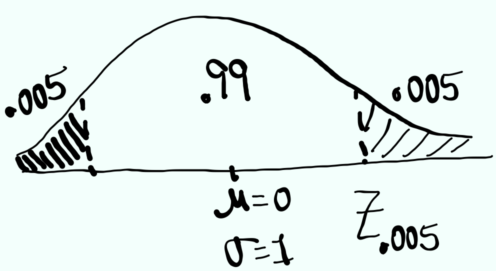
$E = \frac{.47 - .33}{2} = \boxed{.07}$

$\hat{p} = \frac{.47 + .33}{2} = \boxed{.4}$

May 13-3:20 PM

Find min. number of Voters needed if we wish to be 99% Confident and error not to exceed 5%.

$n = \hat{p}\hat{q}\left(\frac{Z_{\alpha/2}}{E}\right)^2$



$= (.4)(.6)\left(\frac{2.576}{.05}\right)^2$

$= 637.03\ldots$

638 Round-up

$Z_{.005} = \text{invNorm}(.995, 0, 1)$

May 13-3:26 PM

I randomly Selected 40 exams, the mean Score was 87.5.

$n = 40$

$\bar{x} = 87.5$

Round to 1-dec.

It is known that Standard dev. of all exam Scores is 12.5.

$\sigma = 12.5$

NO C-level : .95

Find Conf. interval for the mean of all exams.

$\boxed{\sigma \text{ Known} \to Z\text{Interval}}$

σ unknown $\to$ T Interval

$\boxed{83.6 < \mu < 91.4}$

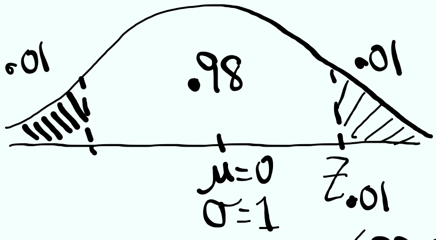
Since $\bar{x}$ was 1-dec.

$E = \dfrac{91.4 - 83.6}{2} = \boxed{3.9}$

$\bar{x} = \dfrac{91.4 + 83.6}{2} = 87.5$

May 13-3:31 PM

Find min. # of exams needed to Construct 98% Conf. interval for mean of all exams and error not to exceed 5 pts.



$Z_{.01} = \text{invNorm}(.99, 0, 1)$

$n = \left(\dfrac{Z_{\alpha/2} \cdot \sigma}{E} \right)^2$

$= \left(\dfrac{2.326 \cdot 12.5}{5} \right)^2$

$= 33.814\ldots$

34 Round-up

May 13-3:38 PM

Ages of 12 randomly Selected students given below

30	24	20	18
35	25	19	40
28	18	42	32

Find

1) $\bar{x} \approx 28$

2) $S \approx 8$

Round to whole #

3) $n = 12$

4) Find $\underbrace{\text{Conf. interval}}_{}$ — NO C-level : .95

For the mean age of all Students.

$\boxed{23 < \mu < 33}$

σ Known → Z Interval

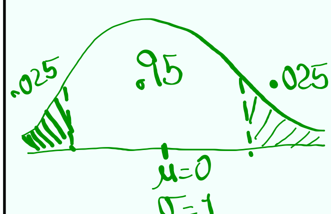
$\boxed{\sigma \text{ Unknown} \to T \text{ Interval}}$

Since $\bar{x}$ is whole # → Round to whole.

$E = \frac{33-23}{2} = 5$

May 13-3:42 PM

Find min. # of students needed to construct new conf. interval (NO C-level) with margin of error not exceed 8 Yrs.



$n = \left(\frac{z_{\alpha/2} \cdot S}{E}\right)^2$ — use S since σ unknown

$= \left(\frac{1.960 \cdot 8}{8}\right)^2 = 3.8416$

$n = 4$

$z_{.025} = \text{invNorm}(.975, 0, 1)$

Redo with $E = 4$

$n = \left(\frac{1.960 \cdot 8}{4}\right)^2 = 15.3664$ $\quad n = 16$

SG 21 & 22

May 13-3:49 PM