Statistics
Lecture 13

Feb 19-8:47 AM

Testing claims: SG 24-27

Main idea → To Test a claim and determine its validity

Claim could be made about parameters
1) Population Proportion p
2) Population Mean μ
3) Population Standard deviation σ

Ex: I claim 10% of all students Smoke.
Claim about Pop. Proportion.

Ex: I claim the mean age of all students is below 32 yrs.
Claim about pop. mean

Ex: I claim the Standard deviation of monthly Salaries of all nurses is at least $500. Claim about Pop. Standard Deviation

Main task is to determine the validity of the claim.

If claim is valid ⇒ We Support it. Fail-to-Reject

If claim is invalid ⇒ We reject it.

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Why do we test a claim?

Because we want to know if claim is valid or invalid.

Possible errors:

1) If we reject a valid claim.

2) If we support an invalid claim.

Final Conclusion:

Reject the claim OR Fail-to-Reject the claim

"claim is invalid" "claim is valid"

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Testing Methods:

1) Traditional Method
2) P-Value Method

we use these two methods

3) Confidence Interval Method ← come to office hrs

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

Reject the claim OR FTR the claim

Fail-to-Reject

Possible errors:

Action \ claim	Valid	Invalid
Reject	Error	Not error
Support	Not error	Error

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Testing Types:

1) Right-Tail Test (RTT)

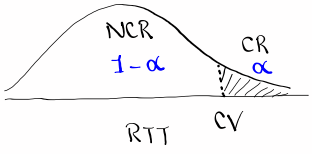
2) Left-Tail Test (LTT)

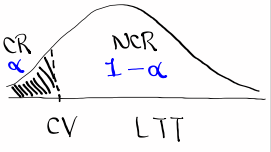
3) Two-Tail Test (TTT)

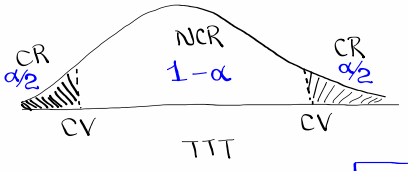
with every testing, we will have a Significance level α (Alpha)

$0 < \alpha < 1$

α is the area of the Critical Region.







If α not given $\Rightarrow$ use $\boxed{\alpha = .05}$

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Suppose $\alpha = .02$, RTT

Suppose $\alpha = .1$, LTT

Suppose α not given, TTT

Use .05

.05 ÷ 2 = .025

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Testing Process:

1) Set-up H_0 & H_1 ← Alternative Hypothesis (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.
Full TI-Command or Formula Required.

4) Use 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 "claim is invalid" OR FTR the claim "claim is valid"

Claim could be H_0 or H_1.

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More on H_0 & H_1:

H_0 must contain = Sign. → $=$, $\geq$, $\leq$

H_1 cannot contain = Sign → $\neq$, $<$, $>$

Key words for H_0:

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

Key words for H_1:

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

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

H_1: $\neq$ TTT
H_1: $<$ LTT
H_1: $>$ RTT
} H_1 tells us the testing types

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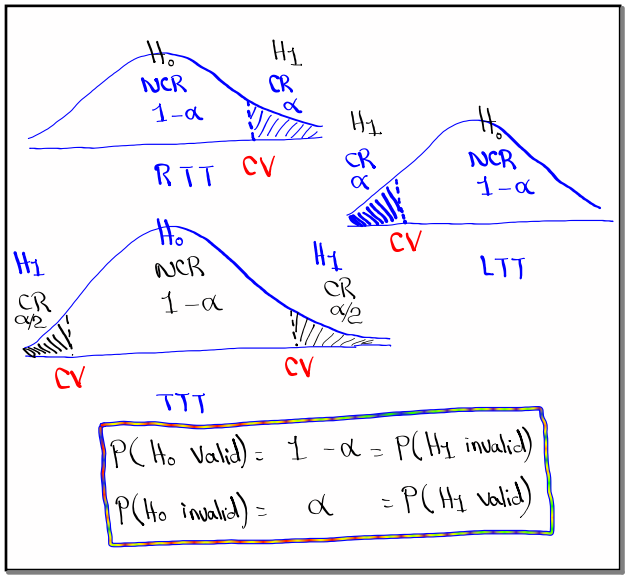

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Four Possible outcomes for H_0:

Action \ H_0	Valid	Invalid
Support H_0	Correct Decission	Type II error
Reject H_0	Type I error	Correct Decission

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I claim 10% of all students Smoke.

$p = .1$ ← H_0

$H_0: p = .1$ claim

$H_1: p \neq .1$ TTT

I claim the mean age of all students is below 32 years

$\mu < 32$ ← No equal sign. H_1

$H_0: \mu \geq 32$

$H_1: \mu < 32$ claim, LTT

I claim standard deviation of Salaries of all nurses is at most $500.

$\sigma \leq 500$ ← H_0

$H_0: \sigma \leq 500$ claim

$H_1: \sigma > 500$ RTT

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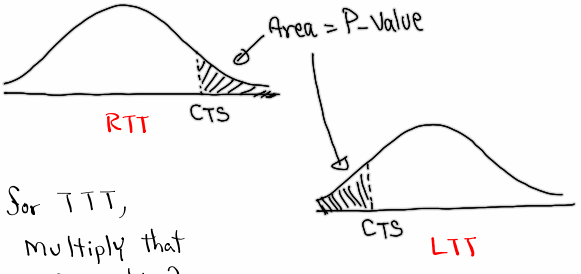
What is P-value?

P-value is the area of the tail in the graph of dist. marked by the CTS. (Computed Test statistic)

Multiply by 2 only for TTT.



For TTT, multiply that area by 2.

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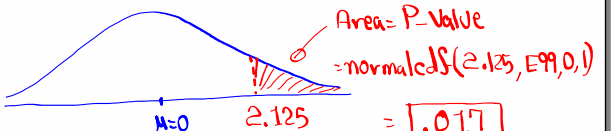
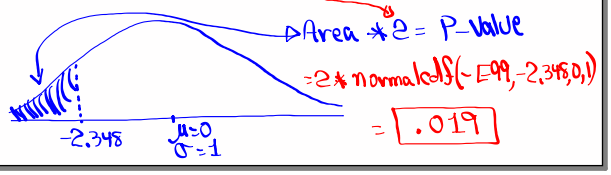
CTS $z = 2.125$, RTT, find P-value.



= normalcdf(2.125, E99, 0, 1)

= .017

CTS $z = -2.348$, TTT, find P-value.



= 2 * normalcdf(-E99, -2.348, 0, 1)

= .019

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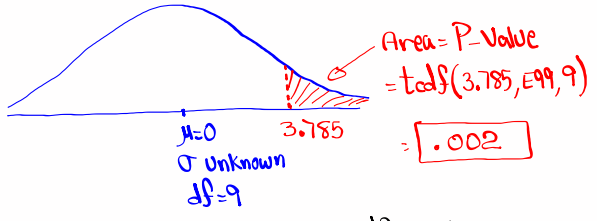
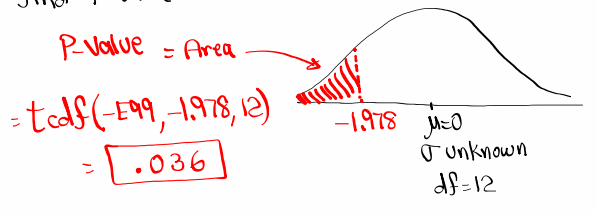
Given CTS $t = 3.785$, $df = 9$, RTT, find P-value



= tcdf(3.785, E99, 9)

= .002

Given CTS $t = -1.978$, $df = 12$, LTT, find P-value



= tcdf(-E99, -1.978, 12)

= .036

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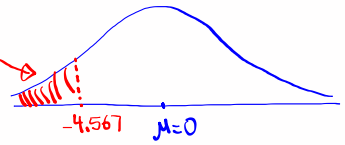
Given CTS $t = -4.567$, $df = 10$, TTT

Find P-value.

P-value = 2*Area



= 2 * tcdf(−E99, −4.567, 10)

= .001

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CTS $t = 5.825$, $df = 19$, TTT Find P-value.

Area * 2 = P-value

= 2 * tcdf(5.825, E99, 19)

= 1.304×10^{-5} S.N.

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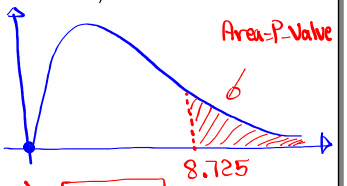
CTS $\chi^2 = 8.725$, RTT , $df = 6$

Find P-Value

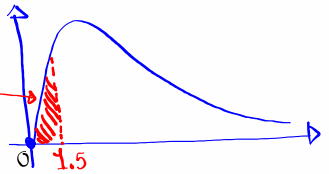


$\chi^2 cdf(8.725, E99, 6) = .190$

Given CTS $\chi^2 = 1.5$, LTT , $df = 9$

Find P-Value.

P-Value = Area



$\chi^2 cdf(0, 1.5, 9)$

$= .003$

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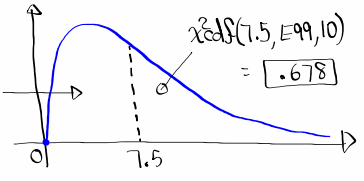
Given CTS $\chi^2 = 7.5$, $df = 10$, TTT

Find P-Value.

$\chi^2 cdf(0, 7.5, 10)$

$= .322$



P-Value = 2 * Smaller area $= 2(.322) = .644$

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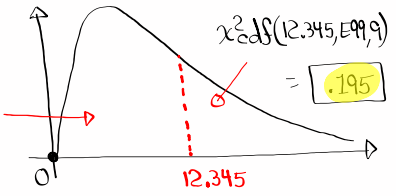
Given CTS $\chi^2 = 12.345$, $df = 9$, TTT

Find P-value.

$\chi^2cdf(0, 12.345, 9)$

$= .805$



P-value = 2 * Smaller area $= 2(.195) = .39$

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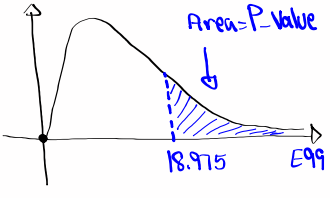
Given CTS $\chi^2 = 18.975$, RTT, $df = 8$

Find P-value.

$\chi^2cdf(18.975, E99, 8)$

$= .015$



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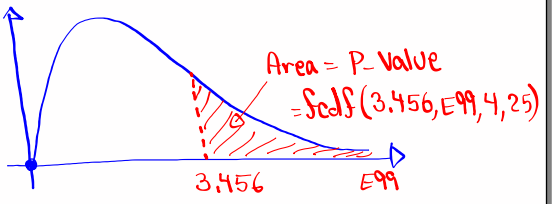
CTS F = 3.456 Ndf = 4, Ddf = 25, RTT



= .022

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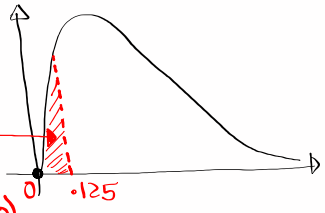
CTS F = .125, LTT, Ndf = 3, Ddf = 30

find P-Value.



fcdf(0, .125, 3, 30)

= .055

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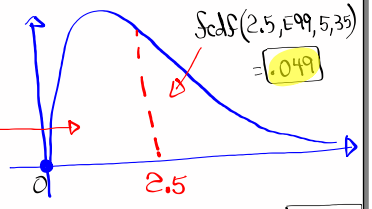
Given CTS F = 2.5 Ndf = 5, Ddf = 35, TTT

Find P-Value

fcdf(0, 2.5, 5, 35) = .951



P-Value = 2 * Smaller area = 2(.049) = .098

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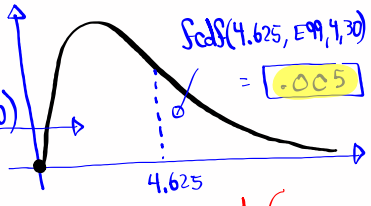
Given CTS F = 4.625, Ndf = 4, Ddf = 30, TTT

Find p-value.

fcdf(0, 4.625, 4, 30) = .995



Verify: .995 + .005 = 1 ✓

P-Value = 2 * Smaller area

= 2(.005) = .01

1) Finish SG 24
2) Print the Testing Chart
3) look for my email for extra Credit
4) Make Sure to read my notes & watch the video for next week lecture.

Nov 21-8:57 PM