

Statistics

Lecture 13



Feb 19-8:47 AM

Testing claims:

SG 23-25

A claim is made and our task is to determine its validity.

If claim is valid $\Rightarrow$ we Support it. ^{Fail-to-Reject}

If claim is invalid $\Rightarrow$ we reject it.

Process of testing depends on information collected and use to determine the validity of the claim.

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Claim is made about parameters.

1) Population Proportion P

2) Population Mean μ

3) population Standard Deviation σ

Once the testing Process is complete,
we draw final conclusion about the claim

Reject the claim	OR	Fail-to-Reject
(Invalid claim)		the claim
		(valid claim)

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Testing Methods:

1) Traditional Method

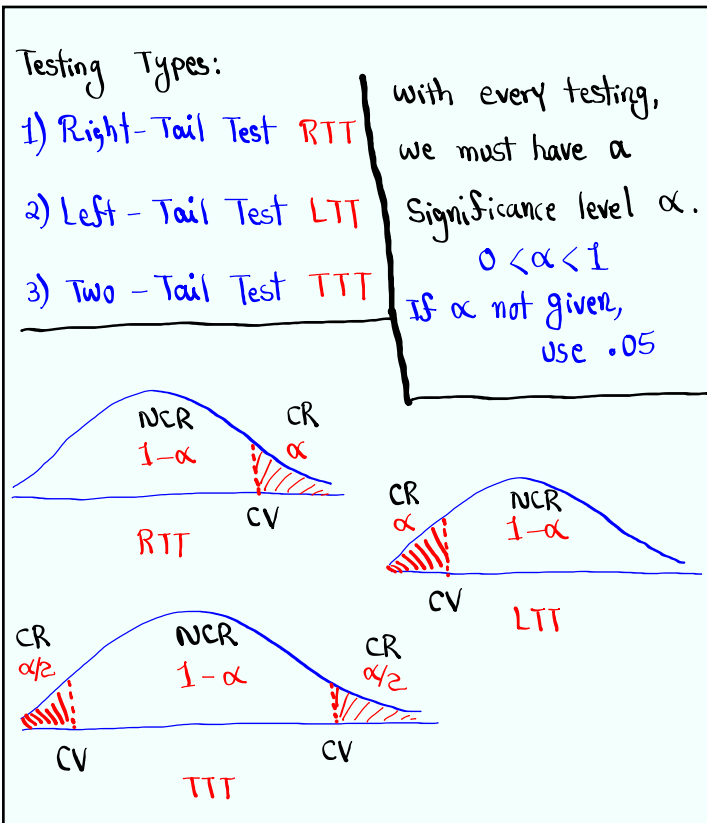
2) P-Value Method ✓

3) Confidence Interval Method

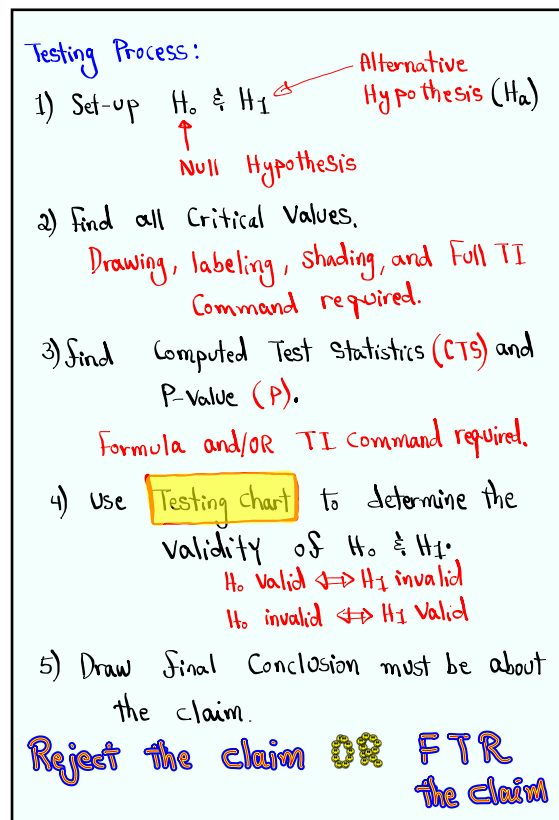
Regardless of method used, Final Conclusion
must be the Same.

Reject the claim	OR	FTR the
(Invalid claim)		claim
		(valid claim)

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More on H_0 & H_1 :

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

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

now 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, greater than, below, above, exceed, ...

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

Always identify the claim

Always identify testing type

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College **claims** that **20% of all** students
are nursing majors.

$p = 0.2$
↖ H_0

$H_0: p = 0.2$ claim

$H_1: p \neq 0.2$ TTT

College **claims** the **mean** age of **all** students
is **at most 30** yrs.

$\mu \leq 30$
↖ H_0

$H_0: \mu \leq 30$ claim

$H_1: \mu > 30$ RTT

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College **claims** the **Standard deviation** of **all** math exams is **below 7.5**.

$$H_0: \sigma \geq 7.5$$

$$H_1: \sigma < 7.5 \text{ claim, LTT}$$

$$\sigma < 7.5$$

↑
 H_1

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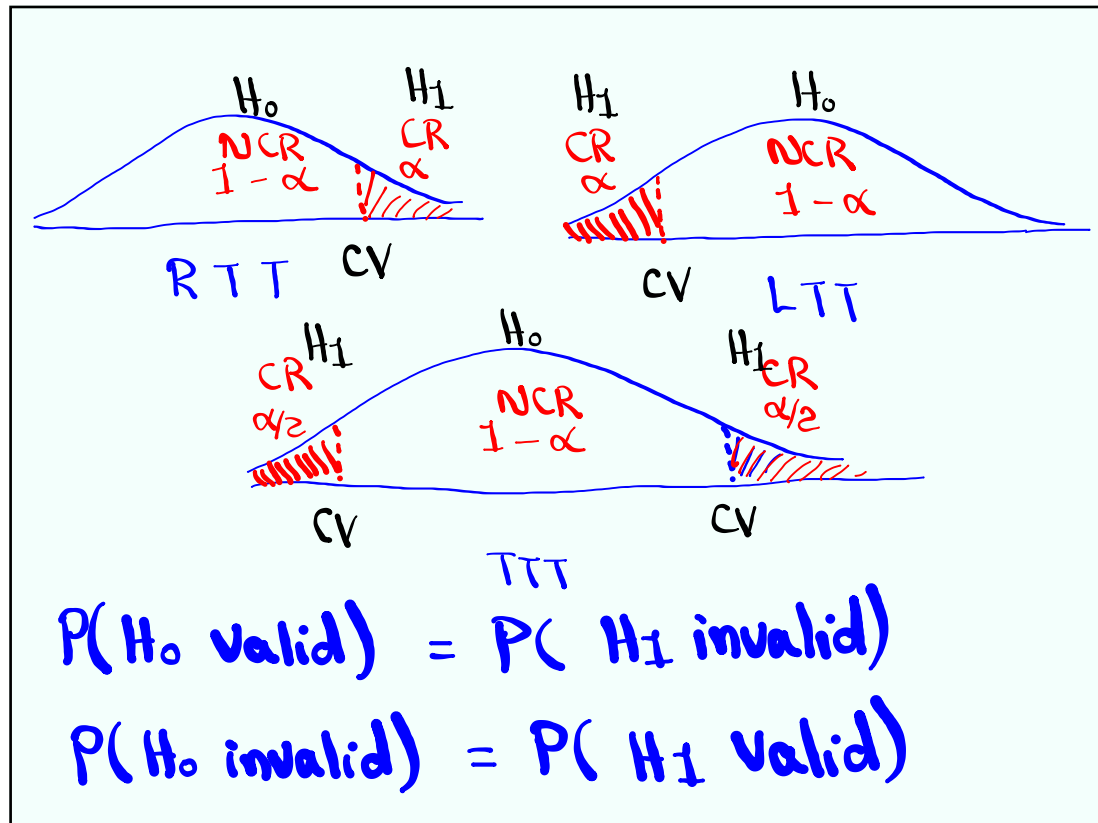
Four - Possible outcomes of H_0 :

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: Rejecting a valid H_0

Type II error: Supporting an invalid H_0

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What is P-Value?

P-Value is the prob. that the observed data support null Hypothesis.

A low P-Value is evidence against H_0 and leads to rejecting H_0 .

A high P-Value suggest that the observed data is consistent with H_0 , therefore support H_0 .

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

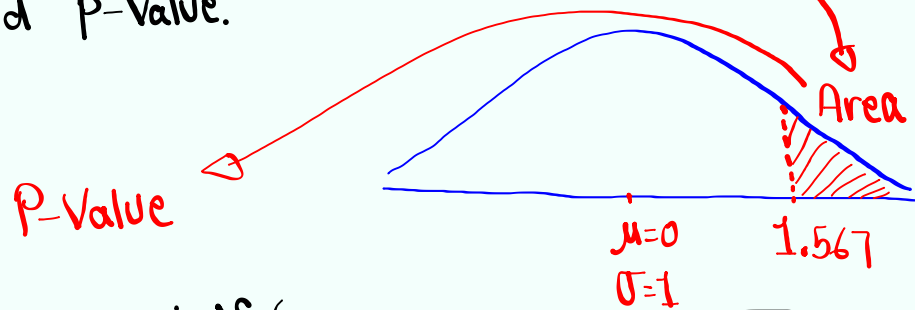
P-Value is the area of the tail marked by CTS.

Multiply by 2 only for TTT.

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CTS $Z = 1.567$ RTT

Find P-Value.



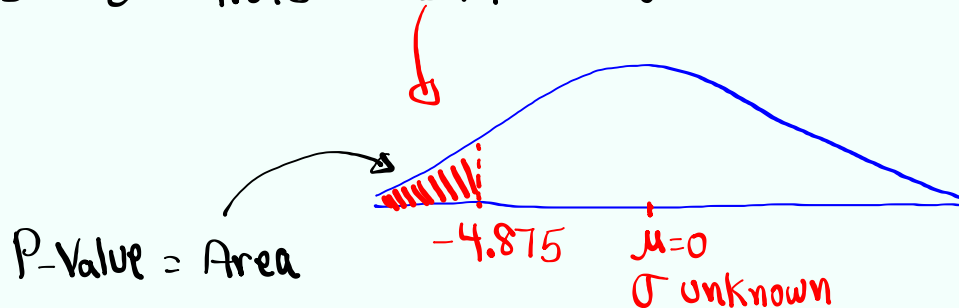
$$= \text{normalcdf}(1.567, E99, 0, 1) \approx \boxed{.059}$$

IF it was TTT,

$$P\text{-Value} = 2 \cdot (.059) = \boxed{.117}$$

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CTS $t = -4.875$ LTT $df = 29$



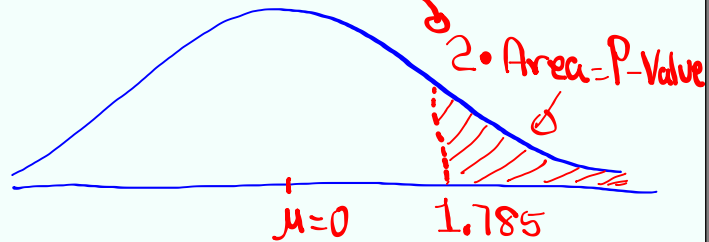
$$= t\text{cdf}(-E99, -4.875, 29) \quad df = 29$$

$$= \boxed{1.795 \times 10^{-5}}$$

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CTS $t = 1.785$ TTT $df = 11$

Find p-Value.



$$P\text{-Value} = 2 \cdot tcd f(1.785, 11)$$

σ Unknown
 $df = 11$

$$= \boxed{.102}$$

SG 23 ✓

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Testing Population Proportion P:

Given $H_0: P = .2$, claim is H_0 , $\alpha = .02$
 $n = 150$ $x = 40$

Test the claim.

$H_0: P = .2$ claim
 $H_1: P \neq .2$ TTT

CTS $Z = 2.041$
P-Value $p = .041$

STAT TESTS

1-Prop Z Test

$P_0: .2$ H_0

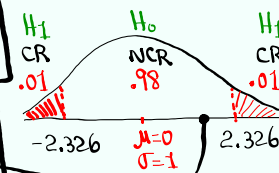
$x = 40$

$n = 150$

Prop $[\neq P_0]$ H_1

Calculate

CV Z TTT $\alpha = .02$



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

CTS is in NCR

P-Value $> \alpha$

H_0 Valid H_1 invalid

Valid claim

FT R the claim

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College **claims** that **at most 10%** of all students are STEM majors. $P \leq .1$
 $\uparrow$
 H_0

I surveyed $n=175$ students and $x=20$ of them were STEM majors.

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

$H_0: P \leq .1$ claim
 $H_1: P > .1$ RTT

CV Z RTT $\alpha=.01$

CTS $Z = .630$
P-Value $P = .264$

1-Prop Z Test
 $P_0: .1$ H_0
 $x=20$
 $n=175$
Prop $> P_0$ H_1
Calculate

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

CTS is in NCR
P-Value $> \alpha$
 H_0 Valid H_1 invalid
Valid claim
FTR the claim

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College **claims** that prop. of all students that have a part-time job is **below 40%**. $P < .4$
 $\uparrow$
 H_1

I surveyed $n=400$ students and 38% of them had a part-time job. $x=n\hat{p}$
 $= 400(.38) = 152$

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

$H_0: P \geq .4$
 $H_1: P < .4$ claim, LTT

CV Z LTT $\alpha=.05$

CTS $Z = -.816$
P-Value $P = .207$

1-Prop Z Test
 $P_0: .4$ H_0
 $x=152$
 $n=400$
Prop $< P_0$ H_1
Calculate

CV $Z = \text{invNorm}(.05, 0, 1)$

CTS is in NCR
P-Value $> \alpha$
 H_0 Valid H_1 invalid
Invalid claim
Reject the claim

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