Statistics

Lecture 14

Feb 19-8:47 AM

Testing Population mean μ:

Case I : σ Known

CV invNorm

CTS & P-Value Z-Test

Given $\boxed{H_0 : \mu = 125}$ $\sigma = 15$

$\boxed{\text{claim is } H_0}$ $\alpha = .02$

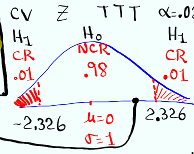
$\bar{x} = 130$ $n = 35$

Test the claim.

$H_0: \mu = 125$ claim

$H_1: \mu \neq 125$ TTT

CV Z TTT $\alpha = .02$



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

$\boxed{\begin{array}{l}\text{CTS } Z = 1.972 \\ \text{P-Value } P = .049\end{array}}$

$\boxed{\text{STAT}}$ $\boxed{\text{TESTS}}$

Z-Test

inpt: $\boxed{\text{Stats}}$

$\mu_0 : 125$ H_0

$\sigma = 15$

$\bar{x} = 130$

$n = 35$

μ $\boxed{\neq \mu_0}$ H_1

$\boxed{\text{Calculate}}$

CTS is in NCR

P-Value $> \alpha$

H_0 Valid H_1 invalid

Valid claim

FTR the claim

If we wish To reject the claim

P-value $\leq \alpha$ $.049 \leq \alpha$ choose α to be .05, .06, .07, ...

Dec 1-5:07 PM

College claims the mean age of all Students is at most 28 Yrs.

$\mu \leq 28$ ← H_0

I randomly Selected 32 Students, their mean age was 30 Yrs.

$n = 32$ $\quad \bar{x} = 30$

It is known that Standard dev. of ages of all Students is 8 Yrs. $\quad \sigma = 8$

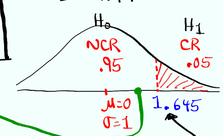
No $\alpha \rightarrow .05$

Test the claim. $\quad \sigma$ Known → Case I

$H_0: \mu \leq 28$ claim

$H_1: \mu > 28$ RTT

CV $\quad Z \quad$ RTT $\quad \alpha = .05$



CV $\quad Z = \text{invNorm}(.95, 0, 1) =$

CTS $Z = 1.414$

P-Value $P = .079$

Z-Test

inpt: Stats

$\mu_0 : 28 \quad H_0$

$\sigma = 8$

$\bar{x} = 30$

$n = 32$

$\mu \quad \boxed{> \mu_0} \quad H_1$

Calculate

CTS is in NCR

P-Value $> \alpha$

H_0 Valid $\quad H_1$ invalid

Valid claim

FTR the claim

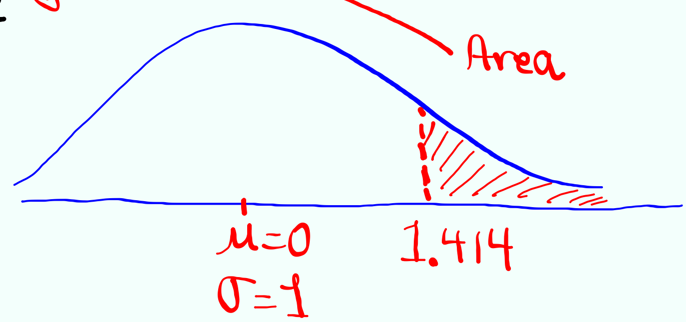
To reverse this Conclusion,

P-Value $\leq \alpha \quad .079 \leq \alpha$ → choose α to be $.08, .09, .10, \ldots$

Dec 1-5:27 PM

CTS $\quad Z = 1.414 \quad$ RTT

Find P-Value ← Area



$$\text{P-Value} = \text{normalcdf}(1.414, E99, 0, 1)$$

$$= \boxed{.079}$$

Dec 1-5:42 PM

Case II: σ unknown

CV invT $df = n-1$

CTS t
P-Value p $\Rightarrow$ T-Test

Given $\boxed{H_0: \mu \geq 85}$ $\boxed{\text{claim is } H_1}$

$\bar{x} = 83$ $s = 9$ $n = 20$ $\boxed{\alpha = .1}$

Test the claim.

$H_0: \mu \geq 85$

$H_1: \mu < 85$ claim, LTT

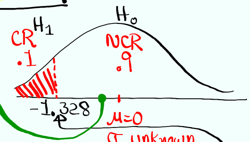
σ unknown

CV t LTT $\alpha = .1$

$df = n - 1 = 19$

$\boxed{\text{CTS } t = -.994}$

$\boxed{\text{P-Value } P = .166}$



T-Test

inpt $\boxed{\text{Stats}}$

$\mu_0: 85$ H_0

$\bar{x} = 83$

$s = 9$

$n = 20$

μ $\boxed{< \mu_0}$ H_1

σ unknown

$df = 19$

CV $t = \text{invT}(.1, 19)$

CTS is in NCR

P-value $> \alpha$

H_0 valid H_1 invalid

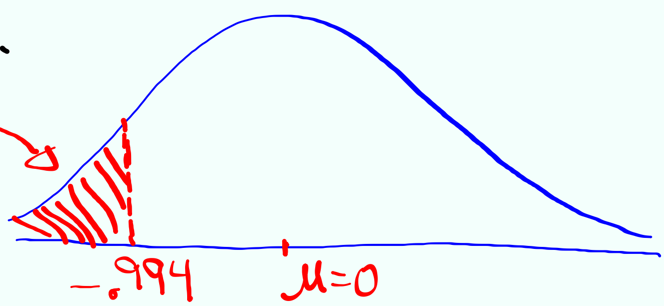
Invalid claim

Reject the claim

Dec 1-5:46 PM

CTS $t = -.994$ LTT $df = 19$

find p-value.



σ unknown

$df = 19$

$\text{tcdf}(-E99, -.994, 19)$

$= \boxed{.166}$

Dec 1-6:00 PM

LA County Health dept. claims the mean age of all nurses is 47.5 Yrs.

$\mu = 47.5$ ← H_0

I took a $\boxed{\text{Sample of } 12}$ nurses, their mean age was 44.8 yrs with standard deviation of 9.2 yrs.

$n = 12$, $\bar{x} = 44.8$, $S = 9.2$

Test the claim. No α → .05

σ unknown

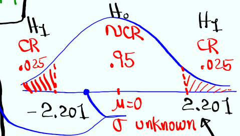
$H_0: \mu = 47.5$ claim

$H_1: \mu \neq 47.5$ TTT

CV t TTT $\alpha = .05$

$df = n - 1 = 11$

$\boxed{\text{CTS } t = -1.017 \quad \text{P-Value } P = .331}$



CV $t = \text{invT}(.975, 11)$

T-Test

inpt: $\boxed{\text{STATS}}$

$\mu_0 : 47.5$ H_0

$\bar{x} = 44.8$

$s = 9.2$

$n = 12$

$\mu \boxed{\neq \mu_0}$ H_1

CTS is in NCR

P-value $> \alpha$

H_0 valid H_1 invalid

Valid claim

FTR the claim

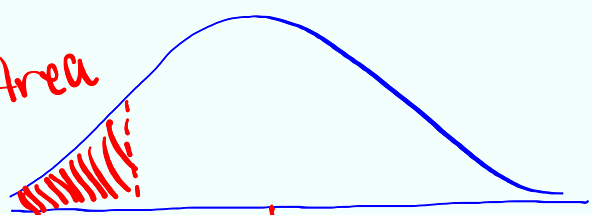
Dec 1-6:04 PM

CTS $t = -1.017$

TTT → 2 · Area

$df = 11$

Find p-value.



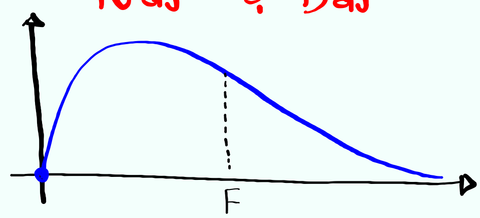
$P = 2 \cdot \text{tcdf}(-E99, -1.017, 11) = \boxed{.331}$

SG 24 & 25

Dec 1-6:18 PM

F Dist:

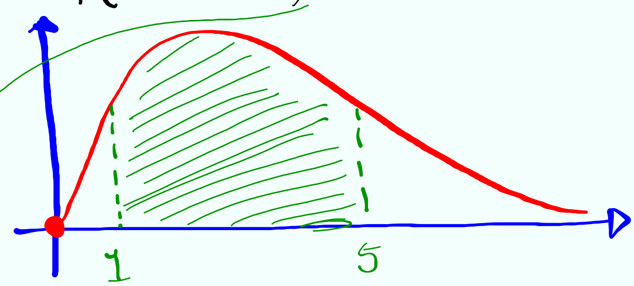
1) Not Symmetric
2) Not bell-shape
3) Positively Skewed.
4) Starts at 0 when... Ndf > 2.
5) It has 2 degrees of freedom
Ndf & Ddf



use $\boxed{\text{fcdf}}$ to find Prob.
$\boxed{(\text{Lower, Upper, Ndf, Ddf})}$

Dec 1-6:22 PM

Find $P(1 < F < 5)$ with Ndf=4, Ddf=10

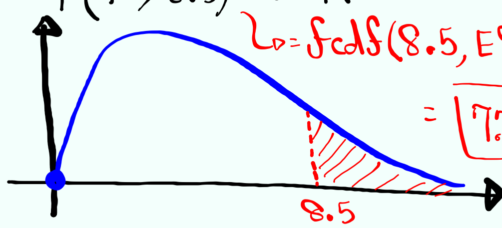


$= \text{fcdf}(1, 5, 4, 10) = \boxed{.434}$

Find $P(F > 8.5)$ with Ndf=3, Ddf=20

Lo= fcdf(8.5, E99, 3, 20)

$= \boxed{7.717 \times 10^{-4}}$



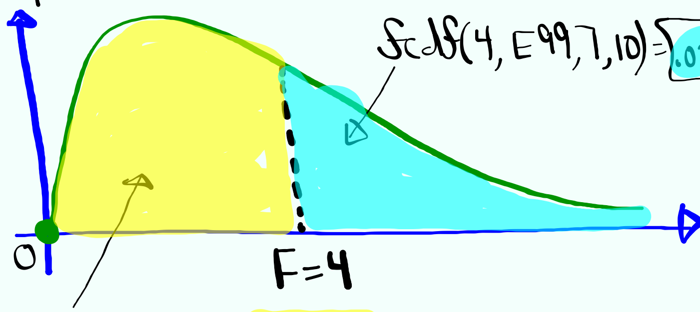
Dec 1-6:27 PM

Given $F=4$, $Ndf=7$, $Ddf=10$

Find the area on both sides of F,

Multiply the Smaller area by 2.

$fcdf(4, E99, 7, 10) = \boxed{.024}$



$fcdf(0, 4, 7, 10) = \boxed{.976}$

$2 \cdot \text{Smaller Area} = 2(.024) = \boxed{.048}$

Dec 1-6:32 PM

Comparing 2 population standard deviations

$H_0: \sigma_1 = \sigma_2$	$H_0: \sigma_1 \geq \sigma_2$	$H_0: \sigma_1 \leq \sigma_2$
$H_1: \sigma_1 \neq \sigma_2$	$H_1: \sigma_1 < \sigma_2$	$H_1: \sigma_1 > \sigma_2$
TTT	LTT	RTT

Sample 1	Sample 2
$n_1=$	$n_2=$
$S_1=$	$S_2=$

1) $S_1 > S_2$

2) CTS $F = \dfrac{S_1^2}{S_2^2}$

3) $Ndf = n_1 - 1$

4) $Ddf = n_2 - 1$

CTS F

P-Value P

STAT TESTS 2-SampF TEST

Dec 1-6:39 PM

Use the chart below to test the claim that $\sigma_1 = \sigma_2$.

$\underbrace{\text{test the claim}}_{\text{No } \alpha \text{ .05}}$

Sample 1	Sample 2
$n_1 = 8$	$n_2 = 10$
$S_1 = 6$	$S_2 = 5$

1) $S_1 > S_2$ ✓

2) CTS $F = \frac{S_1^2}{S_2^2} = \frac{6^2}{5^2} = 1.44$

3) $Ndf = n_1 - 1 = 7$

4) $Ddf = n_2 - 1 = 9$

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

$\boxed{\text{STAT}}$ $\boxed{\text{TESTS}}$

$\boxed{\text{2-SampF Test}}$

CTS $F = 1.44$

P-Value $p = .597$

P-Value > α

.597 .05

H_0 valid H_1 invalid

Valid claim ⟶ FTR the claim

Dec 1-6:45 PM

Use the chart below to test the claim that $\boxed{\sigma_1 > \sigma_2.}$

$\underbrace{\text{test the claim}}_{\text{No } \alpha \to .05}$

Sample 1	Sample 2
$n_1 = 6$	$n_2 = 6$
$S_1 = 10$	$S_2 = 4$

1) $S_1 > S_2$ ✓

2) CTS $F = \frac{S_1^2}{S_2^2} = \frac{10^2}{4^2} = 6.25$

3) $Ndf = n_1 - 1 = 5$

4) $Ddf = n_2 - 1 = 5$

$H_0: \sigma_1 \leq \sigma_2$

$H_1: \sigma_1 > \sigma_2$ claim, RTT

2-SampF Test

CTS $F = 6.25$

P-Value $p = .033$

P-Value $\leq \alpha$

.033 .05

H_0 invalid H_1 Valid

Valid claim

FTR

if we choose α to be .03, .02, .01

P-Value > α H_1 invalid

Reject it.

Dec 1-6:54 PM