Math 110
Winter 2021
Lecture 19

Testing One Population mean μ:

$H_0: \mu = \mu_0$ $\quad$ $H_0: \mu \geq \mu_0$ $\quad$ $H_0: \mu \leq \mu_0$

$H_1: \mu \neq \mu_0$ $\quad$ $H_1: \mu < \mu_0$ $\quad$ $H_1: \mu > \mu_0$

TTT $\quad$ LTT $\quad$ RTT

Case II: σ Unknown

C.V. $\quad$ invT $\quad$ $df = n-1$

CTS t

P-Value P

$\Rightarrow$ T-Test

Proceed with testing chart

Final Conclusion:

Reject the claim

FTR or the claim

Given $n=15$, $\bar{x}=120$, $S=25$, $H_0: \mu=125$

Claim is H_0, $\alpha=.02$

Test the claim

$H_0: \mu=125$ Claim

$H_1: \mu \neq 125$ TTT

C.V. σ unknown

invT TTT $\alpha=.02$

$df=n-1=14$

CTS $t=-.775$

P-value $P=.451$

σ unknown

T-Test

inpt: Stats

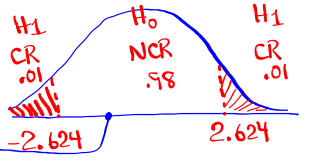
$\mu_0=125$

$\bar{x}=120$

$S=25$

$n=15$

$\mu \neq \mu_0$



invT(.99,14)

CTS is in NCR ⇒ H_0 valid

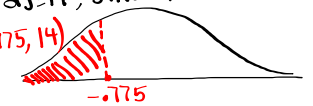
P-value $> \alpha$ ⇒ H_1 invalid

Valid Claim ⇒ FTR the claim

CTS $t=-.775$ TTT $df=14$, Find P-value

P-value = 2*tcdf(-E99,-.775,14)

=.451



I claim the mean score of all final exams is at least 150. $\mu \geq 150$

In a sample of 12 final exams, their mean was 142 with standard dev. of 18. $n=12$ $\bar{x}=142$ $S=18$

Use this Sample to test my claim.

$H_0: \mu \geq 150$ claim

$H_1: \mu < 150$ LTT

No α given ⇒ $\alpha=.05$

σ unknown

C.V. invT LTT $\alpha=.05$

$df=n-1=11$

CTS $t=-1.540$

P-value $P=.076$

σ unknown ⇒ T-Test

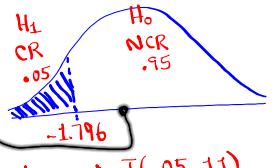
$\mu_0=150$

$\bar{x}=142$

$S=18$

$n=12$

$\mu < \mu_0$



$t_{.05}$ = invT(.05, 11)

CTS is in NCR ⇒ H_0 valid

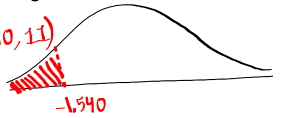
P-value $> \alpha$ ⇒ H_1 invalid

Valid claim ⇒ Fail-To-Reject the claim

CTS $t=-1.540$, LTT, $df=11$ Find P-value

P-value = tcdf(-E99,-1.540,11)

=.076



10 Mt. SAC Students were randomly Selected. Here are their ages:

23	32	18	25
30	40	28	36
42	19		

① Find $\bar{x}$ & s. Round to a whole #

$\bar{x} = 29$ $\quad s = 8$

② use $\alpha = .1$ to test the claim that the mean age of all students is above 25. $\mu > 25$

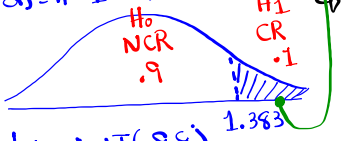
H_0: $\mu \leq 25$

H_1: $\mu > 25$ claim, RTT

σ unknown

C.V. invT RTT $\alpha = .1$

$df = n - 1 = 9$



$t_{.1} = \text{invT}(.9, 9)$

CTS $t = 1.581$

P-value $P = .074$

T-Test

$\mu_0 = 25$

$\bar{x} = 29$

$s = 8$

$n = 10$

CTS is in CR

P-value $\leq \alpha$

H_1 valid

H_0 invalid

$\mu > \mu_0$

Valid claim

$\Rightarrow$ FTR the claim

Testing one Population Standard deviation σ:

H_0: $\sigma = \sigma_0$ $\quad$ H_0: $\sigma \geq \sigma_0$ $\quad$ H_0: $\sigma \leq \sigma_0$

H_1: $\sigma \neq \sigma_0$ $\quad$ H_1: $\sigma < \sigma_0$ $\quad$ H_1: $\sigma > \sigma_0$

TTT $\quad$ LTT $\quad$ RTT

P-value Method

1) CTS $\chi^2 = \dfrac{(n-1)s^2}{\sigma^2}$

2) use χ^2cdf with $df = n - 1$ to find P-value

3) P-value $> \alpha \Rightarrow H_0$ valid, H_1 invalid

P-value $\leq \alpha \Rightarrow H_0$ invalid, H_1 valid

Final Conclusion

Reject the claim, Fail-to-Reject the claim

Given: $n=8$ $S=12$, $H_0: \sigma=10$, $\alpha=.04$

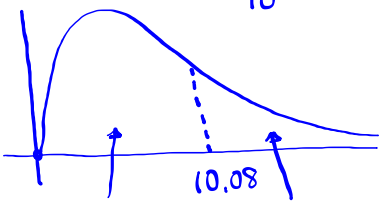
Claim is H_0

Test the claim.

$H_0: \sigma=10$ claim

$H_1: \sigma\neq10$ TTT

CTS $\chi^2=\frac{(n-1)\cdot S^2}{\sigma^2}=\frac{(8-1)\cdot12^2}{10^2}=10.08$



$\chi^2cdf(0,10.08,7)=.816$ $\chi^2cdf(10.08,E99,7)=.184$

P-value $=2*$ Smaller area $=2(.184)=.368$

P-value $>\alpha$

.368 .04

when P-value $>\alpha$

H_0 valid, H_1 invalid

Valid claim

Fail-To-Reject the claim

Mt. SAC claims that standard deviation of ages of (all) students is at most 12.5 $\sigma\leq12.5$

In a sample of 10 students, standard dev. of their ages was 14.8.

Use $\alpha=.05$ to test the claim.

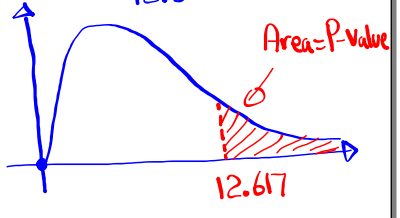
$H_0: \sigma\leq12.5$ claim

$H_1: \sigma>12.5$ RTT

$n=10$

$S=14.8$

CTS $\chi^2=\frac{(n-1)S^2}{\sigma^2}=\frac{(10-1)\cdot14.8^2}{12.5^2}=12.617$



P-value $>\alpha$

.181 .05

H_0 valid $\therefore$ H_1 invalid

Valid claim

Fail-To-Reject the claim

P-value $=\chi^2cdf(12.617,E99,9)=.181$

Scores for 12 randomly selected exams are given below:

85	73	68	100
92	90	88	78
55	95	75	100

1) Find $\bar{x}$ & S. Round to a whole #

$\bar{x}=83$ $S=14$ $n=12$

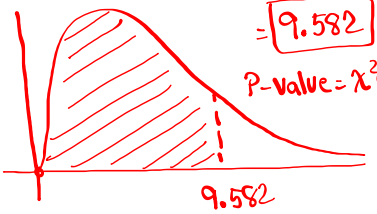
2) Use $\alpha=.01$ to test the claim that standard dev. of all scores is below 15. $\sigma<15$

$H_0: \sigma \geq 15$

$H_1: \sigma < 15$ claim, LTT

CTS $\chi^2 = \frac{(n-1)S^2}{\sigma^2} = \frac{(12-1)\cdot 14^2}{15^2}$

$= 9.582$

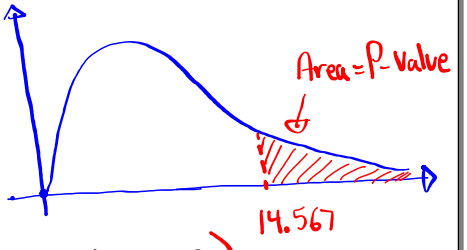


P-value $= \chi^2cdf(0, 9.582, 11) = .432$

P-value $> \alpha$ → H_0 valid, H_1 invalid → invalid claim ⇒ Reject the claim

CTS $F = 14.567$ RTT Ndf $=4$ Ddf $=30$

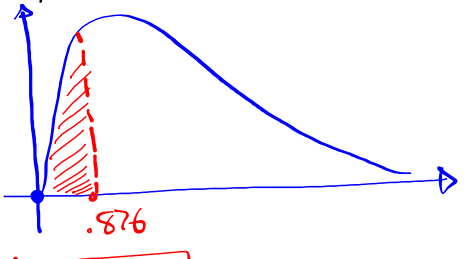
Find P-value.



P-value $= Fcdf(14.567, E99, 4, 30) = 1.02\times10^{-6}$

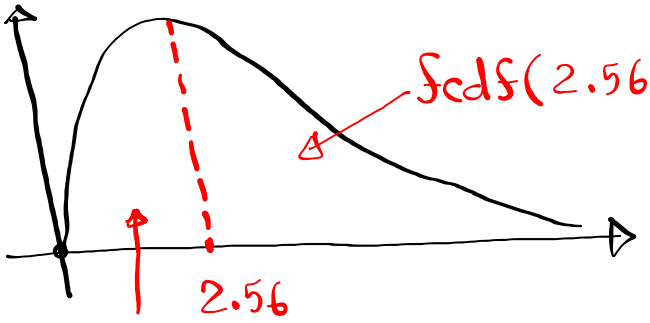
CTS $F = .876$, LTT, Ndf $=5$, Ddf $= 35$

Find P-value.



$Fcdf(0, .876, 5, 35) = .493$

CTS F = 2.56 TTT Ndf = 4 Ddf = 20



Fcdf(2.56, E99, 4, 20)
= .070

P-value =
2 * (.070)
= .140

Fcdf(0, 2.56, 4, 20) = .930