

**Statistics**  
**Lecture 14**



Feb 19-8:47 AM

Testing One Population Proportion:

SG 25

$H_0: P = P_0$	$H_0: P \leq P_0$	$H_0: P \geq P_0$
$H_1: P \neq P_0$	$H_1: P > P_0$	$H_1: P < P_0$
TTT	RTT	LTT

Always identify the claim

Find all Critical Values

Draw, label, shade, use invNorm

Find Computed Test statistic Z & P-value P

1-Prop Z Test,  $Z = \frac{\hat{P} - P}{\sqrt{\frac{PQ}{n}}}$

Use Testing Chart to determine the validity of  $H_0$  &  $H_1$ .

Draw Final Conclusion about the claim.

**Reject the claim OR FTR the claim**  
when claim is invalid                      when claim is valid

Nov 28-6:50 PM

Given  $n=175$ ,  $\hat{p}=.13$ ,  $\alpha=.02$   
 $H_0: p=.1$ , claim is  $H_0$ .

Test the claim.

$H_0: p=.1$  claim  
 $H_1: p \neq .1$  TTT

CV  $Z$   $\alpha=.02$  TTT

$n=175$   
 $\hat{p}=.13$   
 $x = n\hat{p} = 175(.13) \approx 23$

CTS  $Z = 1.386$   
 P-value  $P = .166$

1-Prop Z Test  
 $P_0: .1 \leftarrow H_0$   
 $x=23$   
 $n=175$   
 Prop.  $\neq P_0 \leftarrow H_1$   
 Calculate

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

CTS is in NCR  
 $H_0$  valid &  $H_1$  invalid  
 P-value  $> \alpha$   
 $.166 > .02$   
 Valid claim  $\rightarrow$  FTR the claim

Nov 28-6:58 PM

The College claims that at most 40% of all students have a job while taking classes.  $p \leq .4$   
 $\uparrow H_0$

In a survey of 185 students, 46% of them had a job.

use  $\alpha=.02$  to test the claim

$H_0: p \leq .4$  claim  
 $H_1: p > .4$  RTT

CV  $Z$   $\alpha=.02$  RTT

$n=185$   
 $x = n\hat{p} = 185(.46) = 86$   
 $\hat{p}=.46$

CTS  $Z = 1.801$   
 P-value  $P = .036$

1-Prop Z Test  
 $P_0: .4 \leftarrow H_0$   
 $x=86$   
 $n=185$   
 Prop.  $> P_0 \leftarrow H_1$   
 Calculate

$Z_{.02} = \text{invNorm}(.98, 0, 1)$

CTS is in NCR  
 $H_0$  valid,  $H_1$  invalid  
 P-value  $> \alpha$   
 $.036 > .02$   
 Valid claim  $\rightarrow$  FTR the claim

If we change  $\alpha$  to .04, .05, .06, .07, ...  
 then P-value  $\leq \alpha$   
 $H_0$  invalid &  $H_1$  Valid  
 Invalid claim  $\rightarrow$  Reject the claim

Nov 28-7:10 PM

The college claims that **less than 25%** of all students use the tutoring services.  $H_1: P < .25$

I randomly selected 250 students, and 55 of them were using tutoring services.

Test the claim

$H_0: P \geq .25$

$H_1: P < .25$  claim, LTT

$n = 250$   
 $x = 55$   
 1-Prop Z Test  
 $P_0 = .25 \leftarrow H_0$   
 $x = 55$   
 $n = 250$   
 $\text{Prop} < P_0 \leftarrow H_1$   
 [Calculate]

CV Z LTT No  $\alpha$   
 Use .05

CTS  $Z = -1.095$   
 $P\text{-value} = .137$

CTS is in NCR  
 $H_0$  valid,  $H_1$  invalid  
 $P\text{-value} > \alpha$   
 $.137 > .05$   
 Invalid claim  
 Reject the claim

Nov 28-7:25 PM

CTS  $Z = -1.095$  LTT find P-value.

Area = P-value

$P\text{-value} = \text{normalcdf}(-E99, -1.095, 0, 1) = .137$

If it was a TTT, then we multiply by 2.

CTS  $Z = 2.785$ , TTT find P-value.

$P\text{-value} = 2 * \text{Area}$   
 $= 2 * \text{normalcdf}(2.785, E99, 0, 1)$   
 $= .005$

Nov 28-7:39 PM

Testing One Population Mean:

$H_0: \mu = \mu_0$	$H_0: \mu \leq \mu_0$	$H_0: \mu \geq \mu_0$
$H_1: \mu \neq \mu_0$	$H_1: \mu > \mu_0$	$H_1: \mu < \mu_0$
TTT	RTT	LTT

Always identify the claim

Case I: $\sigma$ Known	
CV $\geq$ invNorm Drawing, labeling, shading TI Command	
CTS $\geq$ P-value $P \Rightarrow$ Z-Test inpt: <b>Stats</b>	

Use **Testing Chart** to determine the validity of  $H_0$  &  $H_1$

Final conclusion must be made about the claim

**Reject the claim OR FTR the claim**  
 claim is invalid                      claim is valid

Nov 28-7:59 PM

Given  $n=40$ ,  $\bar{x}=85$ ,  $\sigma=10$

$H_0: \mu = 80$ ,  $\alpha = .1$ , claim is  $H_1$

Test the claim

$H_0: \mu = 80$   
 $H_1: \mu \neq 80$ , TTT, claim

Since  $\sigma$  is known  
 CV  $\geq \alpha = .1$ , TTT

CTS  $Z = 3.162$   
 P-value  $P = .002$

Z-Test  
 Inpt: **Stats**  
 $\mu_0 = 80 \leftarrow H_0$   
 $\sigma = 10$   
 $\bar{x} = 85$   
 $n = 40$   
 $\mu \neq \mu_0 \leftarrow H_1$   
**Calculate**

CTS is in CR  
 $H_0$  invalid,  $H_1$  valid  
 P-value  $\leq \alpha$   
 $.002 \leq .1$   
 Valid claim  $\rightarrow$  **FTR the claim**

Nov 28-8:06 PM

The College claims that the mean age of all students is at most 32.5 Yrs.  
 $\mu \leq 32.5$  claim  
 $H_0$

I took a Sample of 35 Students, their mean age was 34.8 Yrs.  
 $n=35, \bar{x}=34.8$

It is known that standard deviation of ages of all students is 9.5 Yrs.  
 $\sigma=9.5$

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

$H_0: \mu \leq 32.5$  claim  $\sigma$  is known  
 $H_1: \mu > 32.5$  RTT CV Z  $\alpha=.01$  RTT

CTS Z = 1.432  
 P-value P = .076

Z-Test  
 inpt: [Stats]  
 $\mu_0 = 32.5 \leftarrow H_0$   
 $\sigma = 9.5$   
 $\bar{x} = 34.8$   
 $n = 35$   
 $\mu > \mu_0 \leftarrow H_1$   
 [Calculate]

$Z = \text{invNorm}(.99, 0, 1)$   
 CTS is in NCR  
 $H_0$  Valid,  $H_1$  Invalid  
 P-Value  $> \alpha$   
 .076  $> .01$   
 Valid claim  $\rightarrow$  FTR the claim

If we change  $\alpha$  to .08, .09, .1,  
 then P-value  $\leq \alpha$   $H_1$  Valid  
 $H_0$  Invalid  $\rightarrow$  Invalid claim  
 Reject it.

Nov 28-8:17 PM

LAUSD claims the mean age of all teachers is at least 50 Yrs.  
 $\mu \geq 50$  claim  
 $H_0$

I took a Sample of 38 teachers, their mean age was 45 Yrs.  
 $n=38, \bar{x}=45$

It is known that standard deviation of ages of all teachers is 7.5 Yrs.  
 $\sigma=7.5$

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

$H_0: \mu \geq 50$  claim CV Z LTT  $\alpha=.05$   
 $H_1: \mu < 50$  LTT

CTS Z = -4.710  
 P-value P =  $1.983 \times 10^{-5}$

Z-Test  
 inpt: [Stats]  
 $\mu_0 = 50 \leftarrow H_0$   
 $\sigma = 7.5$   
 $\bar{x} = 45$   
 $n = 38$   
 $\mu < \mu_0 \leftarrow H_1$

$Z = \text{invNorm}(.05, 0, 1)$   
 CTS is in CR  
 $H_0$  Invalid,  $H_1$  Valid  
 P-value  $\leq \alpha$   
 Invalid claim  
 Reject the claim

Nov 28-8:32 PM

Testing One Population Mean:

$H_0: \mu = \mu_0$	$H_0: \mu \leq \mu_0$	$H_0: \mu \geq \mu_0$
$H_1: \mu \neq \mu_0$	$H_1: \mu > \mu_0$	$H_1: \mu < \mu_0$
TTT	RTT	LTT

Always identify the claim

Case I: $\sigma$ Known	Case II: $\sigma$ Unknown
CV $Z$ in Norm	CV $t$ in T df = $n-1$
Drawing, labeling, shading TI Command	Drawing, labeling, shading, TI Command
CTS $Z$ P-value $P \Rightarrow Z$ -Test inpt: <b>STATS</b>	CTS $t$ P-value $P \Rightarrow T$ -Test inpt: <b>STATS</b>

Use **Testing Chart** to determine the validity of  $H_0$  &  $H_1$

Final conclusion must be made about the claim

**Reject the claim OR FTR the claim**  
 claim is invalid      claim is valid

Nov 28-7:59 PM

Given  $n=15$ ,  $\bar{x}=135$ ,  $S=24$ ,  
 $H_0: \mu \leq 125$ , claim is  $H_0$ ,

Test the claim  
 $H_0: \mu \leq 125$  claim  
 $H_1: \mu > 125$  RTT

$\sigma$  unknown  
 CV  $t$  RTT df =  $n-1 = 14$   
 No  $\alpha \rightarrow$  use .05

CTS  $t = 1.614$   
 P-value  $P = .064$

T-Test  
 inpt: **STATS**  
 $\mu_0 = 125 \leftarrow H_0$   
 $\bar{x} = 135$   
 $S = 24$   
 $n = 15$   
 $\mu > \mu_0 \leftarrow H_1$

$t = \text{invT}(.95, 14) = 1.761$

CTS is in NCR  $\Rightarrow H_0$  valid  
 P-value  $> \alpha \Rightarrow H_1$  invalid  
 Valid claim  $\Rightarrow$  **FTR the claim**

If we change  $\alpha$  to .07, .08, .09, .1, ...  
 then  $P\text{-value} \leq \alpha \Rightarrow H_0$  invalid,  $H_1$  valid  
 Invalid claim  $\Rightarrow$  **Reject the claim**

Nov 28-8:57 PM

