

Statistics Lecture 15



Feb 19-8:47 AM

LA Times **claim** that **at most 40%** of all females are in support of tougher gun laws.

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

In a survey of **200** randomly selected females, **45%** of them had same views.

$n = 200$ $x = n\hat{p} = 200(.45) = 90$
 $\hat{p} = .45$ \hat{p} -decimal \Rightarrow Round-up

Use $\alpha = .1$ to test the claim.

$H_0: p \leq .4$ **claim** $CV \ Z$ RTT $\alpha = .1$
 $H_1: p > .4$ **RTT**

CTS $Z = 1.443$
P-value $P = .074$ ✓

1-Prop Z Test
 $p_0 = .4$ H_0
 $x = 90$
 $n = 200$
Prop $> p_0$ H_1
[Calculate]

$CV \ Z = inoNorm(.9, 0, 1)$

CTS is in CR \Rightarrow H_0 invalid
 H_1 valid
P-value $\leq \alpha \Rightarrow$ Invalid claim

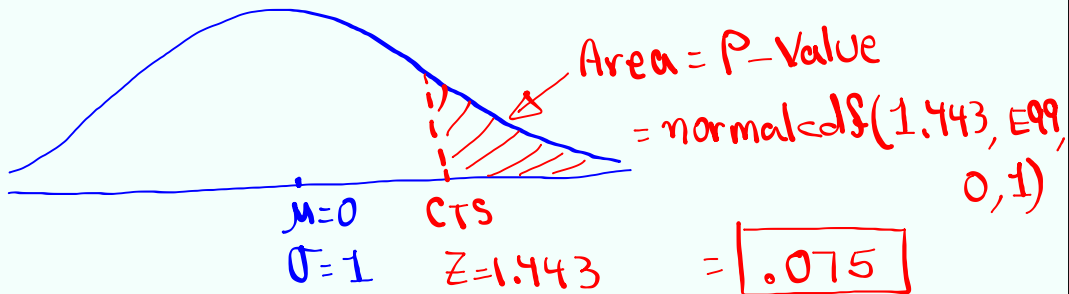
IS we choose α to be .06, .05, .04, .03, .02, .01
P-value $> \alpha$ H_0 valid
Valid claim \Rightarrow FTR the claim

Reject the claim

Feb 6-4:33 PM

Doing reverse

CTS $Z=1.443$, RTT find p-value



Feb 6-4:47 PM

Testing One Population Mean μ :

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

Case I: σ known

CV Z invNorm

CTS Z Z-Test
 P-value P

Proceed with testing chart to determine the validity of H_0 & H_1 .

Final Conclusion for the actual claim

Reject the claim OR FTR the claim

Feb 6-4:50 PM

Given: $n=32$, $\bar{x}=84$ $\sigma=10$ $\alpha=.05$

$H_0: \mu=81$ claim is H_0 .

Test the claim. σ known $\sigma=10$

$H_0: \mu=81$ claim Case I

$H_1: \mu \neq 81$ TTT CV Z TTT $\alpha=.05$

CTS $Z=1.697$
P-value $P=.090$

Z-Test
inpt: $\mu_0=81$ H_0
 $\sigma=10$
 $\bar{x}=84$
 $n=32$
 $\mu \neq \mu_0$ H_1

Stats $Z = \text{invNorm}(-.975, 0, 1)$

CTS is in NCR H_0 valid
P-value $> \alpha$
.09 $>$.05
 H_1 invalid
Valid claim

FTR the claim
IF we choose α to be .1
P-value $< \alpha$
.09 $<$.1
 H_0 invalid, H_1 valid
Invalid claim
Reject the claim

Feb 6-4:56 PM

College claims that the mean age of all students is below 32.5 yrs.

$\mu < 32.5$ claim

$H_0: \mu \geq 32.5$
No = sign $\Rightarrow H_1$

$H_1: \mu < 32.5$ claim, LTT

I took a sample of 30 students, their mean age was 31 yrs. $n=30$, $\bar{x}=31$

It is known that standard deviation of ages of all students is 8.5 yrs. $\sigma=8.5$

$H_0: \mu \geq 32.5$ σ known Case I

$H_1: \mu < 32.5$ claim, LTT CV Z $\alpha=.01$ LTT

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

CTS $Z=-.967$
P-value $P=.169$

Z-Test
inpt: $\mu_0=32.5$ H_0
 $\sigma=8.5$
 $\bar{x}=31$
 $n=30$
 $\mu < \mu_0$ H_1

Stats $Z = \text{invNorm}(.01, 0, 1)$

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

Feb 6-5:07 PM

Testing One Population Mean μ :

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

| Case I: σ Known | Case II: σ Unknown |
|------------------------|---------------------------|
| CV z invNorm | CV t invT $df = n - 1$ |
| CTS z Z-Test | CTS t T-Test |
| P-Value P | P-Value P |

Proceed with testing chart to determine the validity of H_0 & H_1 .

Final Conclusion For the actual claim

Reject the claim OR FTR the claim

Feb 6-4:50 PM

Given: $n=15$ $\bar{x}=85$ $s=9$ $\alpha=.02$

$H_0: \mu \leq 82$ claim is H_1 .

Test the claim. σ unknown Case II

$H_0: \mu \leq 82$

$H_1: \mu > 82$ claim, RTT CV t RTT $\alpha = .02$

$df = n - 1 = 15 - 1 = 14$

CTS $t = 1.291$
P-Value $P = .109$

T-Test
inpt: Stats
 $\mu_0 = 82$ H_0
 $\bar{x} = 85$
 $s = 9$
 $n = 15$
 $\mu > \mu_0$ H_1
Calculate

$t = \text{invT}(.98, 14)$

CTS is in NCR
P-Value $> \alpha$
.109 $>$.02

H_0 valid
 H_1 invalid

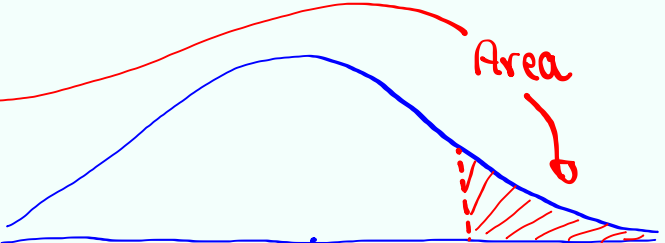
Invalid claim
Reject the claim

If we choose α to be .11, .12, .13, .14, .15, ---

P-value $\leq \alpha$ H_0 invalid H_1 valid \rightarrow Valid claim FTR the claim

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Doing reverse
 CTS $t = 1.291$ RTT $df = 14$
 Find p-Value.



P-Value =
 $t_{cdf}(1.291, E99, 14)$
 L U df
 = .109

$\mu = 0$
 σ unknown
 $df = 14$
 CTS $t = 1.291$

Feb 6-5:37 PM

LA Times has reported that the mean monthly salary of all nurses in LA county is at least \$7500.
 $H_0: \mu \geq 7500$ claim
 $H_1: \mu < 7500$ LTT

I took a sample of 12 nurses, their mean monthly salary was \$7250 with standard deviation of \$400.
 $n = 12, \bar{x} = 7250, s = 400$
 σ unknown

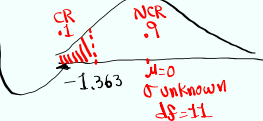
Use $\alpha = .1$ to test the validity of the report.
 $H_0: \mu \geq 7500$ claim
 $H_1: \mu < 7500$ LTT

CV t LTT $\alpha = .1$
 $df = n - 1 = 12 - 1 = 11$

Case II

CTS $t = -2.165$
 P-Value $P = .027$

T-Test
 inpt: (Stats)
 $\mu_0: 7500$ H_0
 $\bar{x} = 7250$
 $s = 400$
 $n = 12$
 $\mu < \mu_0$ H_1
 Calculate



$\mu = 0$
 σ unknown
 $df = 11$

CV $t = \text{invT}(.1, 11)$
 CTS is in CR. H_0 invalid
 P-value $\leq \alpha$ H_1 valid
 Invalid claim
 Reject the claim

Feb 6-5:58 PM

I randomly Selected 8 exams. Here are the Scores.
 85 76 95 100 Store in L1,
 65 84 75 80 Find
 1) $\bar{x} \approx 83$ } whole #
 2) $s \approx 11$ }
No $\alpha \rightarrow .05$
 Test the claim that the mean of all exams is 85.
 $H_0: \mu = 85$ claim σ unknown
 $H_1: \mu \neq 85$ TTT
 CV t TTT $\alpha = .05$
 $df = n - 1 = 7$

CTS $t = -.514$
 P-value $P = .623$

T-Test
 inpt:
 $\mu_0: 85$ H_0
 $\bar{x}: 83$
 $s: 11$
 $n: 8$
 $\mu \neq \mu_0$ H_1

$t = \text{invT}(.975, 7)$
 CTS is in NCR
 $P\text{-value} > \alpha$
 H_0 Valid
 H_1 invalid
 Valid claim
 FTR the claim

Feb 6-6:11 PM

Doing Reverse

CTS $t = -.514$ TTT $df = 7$

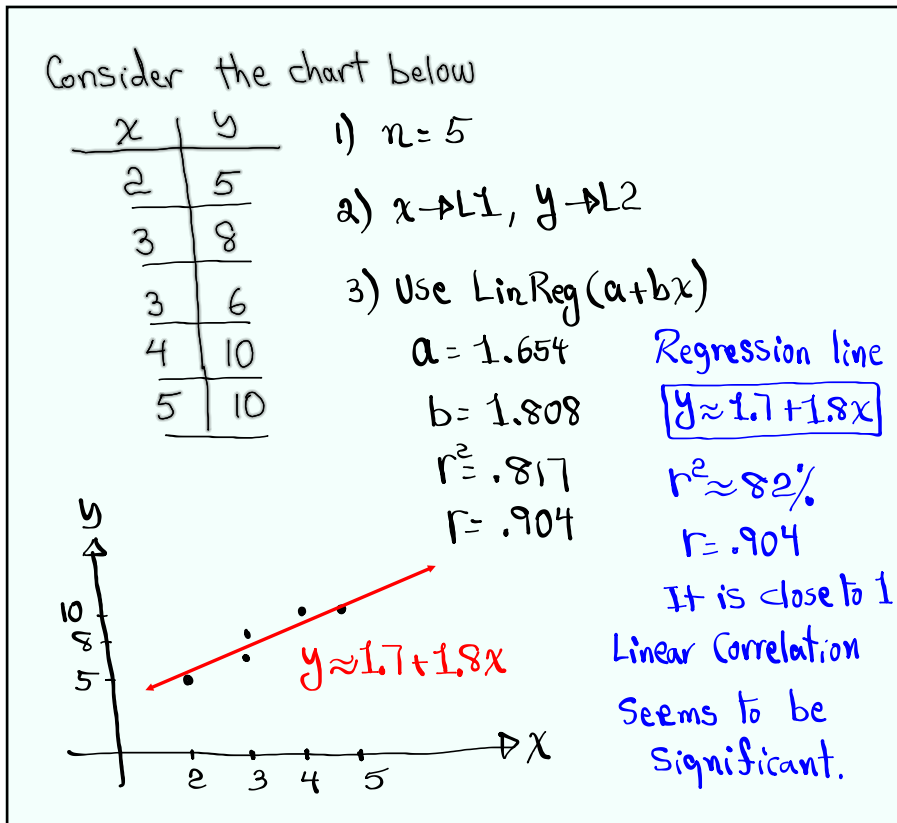
Find p-value

$P\text{-value} = 2 * \text{tcdf}(-E99, -.514, 7)$
 L U df $df = 7$

$= .623$

SG 24 & 25

Feb 6-6:22 PM



Feb 6-6:29 PM

Testing linear Correlation Coefficient
 r

$H_0: \rho = 0$ not significant
 ρ rho

$H_1: \rho \neq 0$ Is significant

for CTS $t = 3.659$
 P-Value $P = .035$

STAT **TESTS** **↑** **LinReg T Test**

If $\alpha = .05$
 P-Value $\leq \alpha$
 H_0 invalid
 H_1 Valid
 Linear Correlation is
 Significant.

x list: L1
 y list: L2
 Freq: 1
 $\rho \neq 0$
 RegEq: Blank
Calculate

If $\alpha = .02$
 P-Value $> \alpha$
 H_0 valid \rightarrow Linear Correlation
 H_1 invalid is not significant.

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| $x \rightarrow L1$ Study time | $y \rightarrow L2$ Quiz Scores |
|----------------------------------|-----------------------------------|
| 3 | 8 |
| 4 | 10 |
| 2 | 8 |
| 1 | 6 |
| 4 | 9 |

Scatter Plot

Lin Reg T Test
 $\rho \neq 0$
 CTS $t = 4.409$
 P-value $P = .022$
 $df = 3 \rightarrow df = n - 2 = 5 - 2 = 3$
 $a = 5.235 \approx 5$
 $b = 1.059 \approx 1 \rightarrow y \approx 5 + x$
 $r^2 = .866 \implies r^2 \approx 87\%$
 $r = .931$

Predict Quiz Score if I study 2 hrs.
 $y = 5 + x$
 $= 5 + 2 \approx 7$

No $\alpha \rightarrow$ use .05
 Test the claim that
 Linear Correlation is Significant
 $H_0: \rho = 0$ Not Sign.
 $H_1: \rho \neq 0$ Is Sign.
 P-value $\leq \alpha$
 $.022 \leq .05$
 H_0 invalid
 H_1 valid
 Linear Correlation is Significant.

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Now use

[STAT] [TESTS] [↑] [Lin Reg T Int]

x List: L1
 y list: L2
 Freq: 1
 C-level: .95
 RegEQ: [clear]
 [Calculate]

.295 \leftarrow 1.823
 Slope of the regression line falls in this interval

$y \approx 5 + x$
 \uparrow
 slope
 $b \approx 1$

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| Exam Score | Final Exam |
|------------|------------|
| 85 | 172 |
| 80 | 150 |
| 90 | 185 |
| 75 | 160 |

$n = 4$
 Exam $\rightarrow x \rightarrow L1$
 Final $\rightarrow y \rightarrow L2$

Use LinRegTTest
 with $\rho \neq 0$
 CTS $t = 2.086$
 P-value $P = .172$ $df = n - 2 = 4 - 2 = 2$
 $a = 6.7 \approx 7$
 $b = 1.94 \approx 2$
 $y \approx 7 + 2x$

use $\alpha = .02$ to test the claim that linear correlation is significant.
 $r^2 = .685$
 $r = .828$

$H_0: \rho = 0$ Not significant
 $H_1: \rho \neq 0$ is significant

$P\text{-value} > \alpha$
 $.172 > .02$ H_0 valid
 H_1 invalid \rightarrow Invalid claim
 Reject the claim

Erick got 80 on exam, Predict his final exam score. \rightarrow use $\bar{y} = 166.75 \approx 167$
 Linear Correlation is not significant.

Feb 6-7:04 PM