Name:- Sujeet Kumar

BITS. ID 2018AD04062

Assignment:- Statistics:

Submission Date:- 24/09/2019.

Q. No - 1- Sol. Page 1-5.

Q. No - 2. Sol Page 1-2

Hypothesis $H_0: \mu_0 \neq 1500$
$H_a: \mu_0 = 1500$

Significance $\alpha = 1\% \Rightarrow .01$ $\alpha = 5\% \Rightarrow .05$

Z-Test Statistics

$$z = \frac{x - \mu_0}{\sigma_x} = \frac{1600 - 1500}{100/\sqrt{9}} = \frac{100}{100/3} = \boxed{3}$$

$$\boxed{z = 3}$$

$z = 3 \Rightarrow .9987$ (from z table)

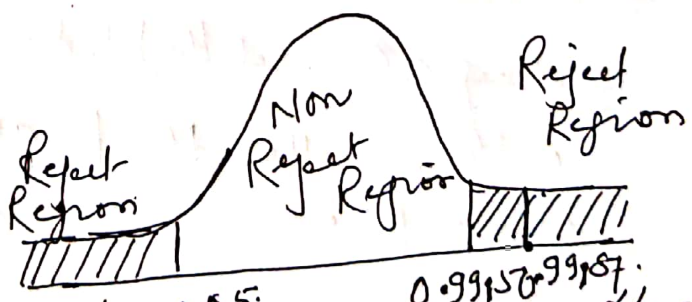
$P = (1 - .9987)\,2 = .0026$

$$\boxed{P = .0026}$$

As we have set the hypothesis($\mu_0 \neq$), we will go for $\boxed{\text{Two Tail Test}}$ (z-test) ~~t-test~~

Two Tail Test

Case 1: $\alpha = 1\% \Rightarrow .001$ $\boxed{\alpha/2 = .001/2 = .005}$ (Since its two tail test)



99.87 ≥ 99.5 & falls in Reject Region

Decision Since (99.87 ≥ 99.5), it falls under reject reason, we reject H_0 in favor of H_a at the 1% Significance

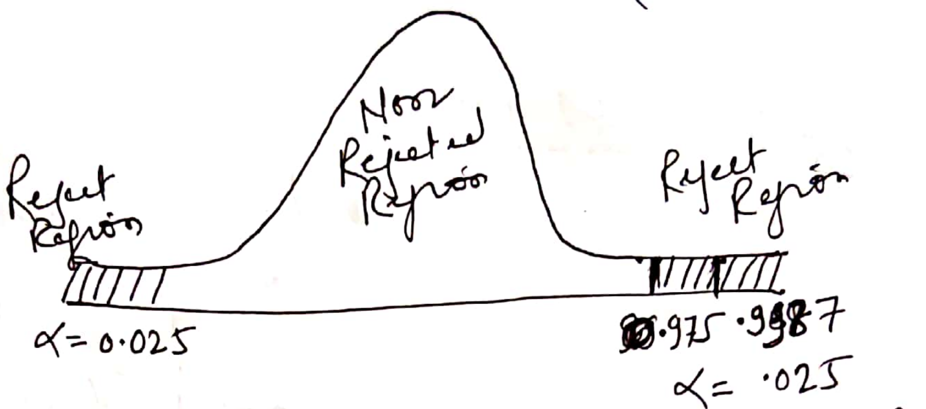
Alterevatively

$P < \alpha$, $\Rightarrow$ Reject Ho Hypothesis.

Case-2: When $\alpha = 5\%$ $\Rightarrow$ $\alpha = \cdot 05$.

$\boxed{\alpha/2 = \cdot 05/2 = \cdot 025}$

(Since Two tail test)



Cleary, $(z = \cdot 9987) > \cdot 975$.

it falls under reject Region. we Reject Ho in favor of Ha at the 5% Significance

Comments/Observation/Suggestions:

$\alpha = 5\%$ and $\alpha = 1\%$

- P value $= \cdot 0026$ $(P(X \leq 2) = \cdot 9987)$.

This means That the chance of type I Error (rejecting a Correct Ho) is small.

- The Smaller the p value, the more it Supports H1.

$\alpha = 5\%$

- Test Statistics $z = 3.0$ is out in the 95% of Critical value.

$\alpha = 1\%$ Test Statistics $z = 3.0$ is out in the 99% Critical value.

Hypothesis

$H_0: \mu \neq 1500$

$\mu_0 = 1500$

Significance $\alpha = 1\% \Rightarrow .01 \quad \alpha = 5\% \Rightarrow .05$

t-Test Statistics

$$t = \frac{\bar{x} - \mu_0}{S/\sqrt{n}} = \frac{1600 - 1500}{30/\sqrt{9}} = \frac{100}{10} = 10$$

$$\boxed{t = 10}$$

~~t-value~~ degree of freedom (df) $= n-1 = 9-1 = \boxed{8}$

for degree of freedom $= 8$, $t = 10$ $\boxed{\text{P value} = .00000008488}$

As we have set the hypotheses ($H_0 =$) we will go for Two Tail Test.

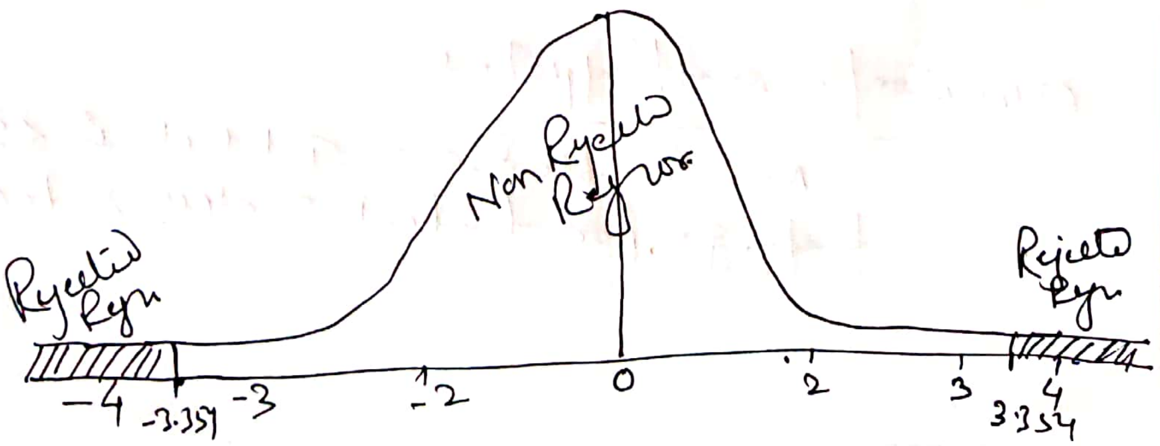
Two Tail t-test

Case 1: $\alpha = 1\% \Rightarrow .01 \quad \alpha/2 = .01/2 = .005$

$df = 8$, $C = [-3.354, 3.354]$ (As It's two tail Test.)

$\Rightarrow C =$ Critical value read from T-table.

T distribution



Test Statistic $t=10$ not in range of critical value $[-3.354, 3.354]$. Hence Ho Rejected. [P-4]

Alternatively, ~~P~~ ($P = .00000848 < \alpha$) suggests reject Ho.

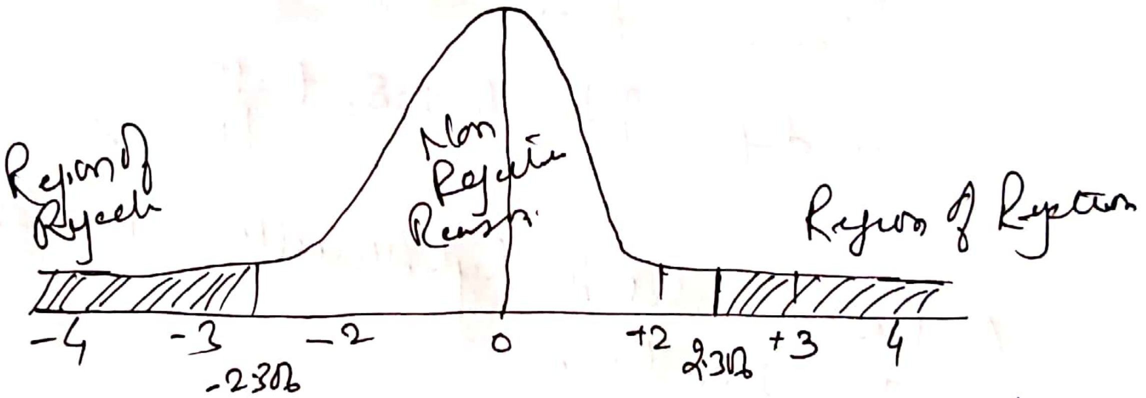
We reject Ho in favor of Ha at 1% significance level.

<u>Case 2:</u> $\alpha = 5\% \Rightarrow \alpha = .05/2 = .025$ (As it is two tail test)

for $\alpha = 5\%$, $t=10$, $df=8$

Critical value $= [-2.3060, 2.3060]$
Read from T-table

<u>T distribution</u>



$t=10$ is out in $[-2.306, 2.306]$ so Ho is rejected.

<u>Alternatively</u> ($P = .00000848 < \alpha$) suggest rejects Ho.

We reject Ho in favor of Ha at 5% significance level.

<u>Observation/Comment/Suggestions</u>

As, sample size $n=9$ which is <30, we should ~~prefer~~ go for t-test rather z-test.

Scanned by CamScanner

$\alpha = 1\%$ and $\alpha = 5\%$

- Pvalue equals 0.00000548. This means chance of type I Error is small. Smaller P value this mean it supports H1.

- $\alpha = 5\%$ Test Statistics $t = 10$ is not in the 95% critical value accepted $[-2.306, 2.306]$. $\bar{x} = 1600$ is not acceptable 95% range.

- $\alpha = 1\%$ Test Statistics $t = 10$ is not in the range of 99% critical value accepted range $[-3.3554, 3.554]$. $\bar{x} = 1600$ is not accepted in 99% range.

⇒ Also $(n = 9) < 30$, Suggestion would be go for t-Statistical test than Z-test.

Sol 3.

	Cured	Condition worsened	No Effect	Total
Treated with drug.	180	20	100	300
Treated without drug. (No drug)	140	50	10	200
Total	320	70	110	500

Ho: Treated with drug = Not treated with drug.

Ha: Treated with drug ≠ Not treated with drug.

Details	Cured	Expected (1)	Condition worsened	Expected (2)	No Effect	Expected (3)	Total
(1) Drug	180	192	20	42	100	66	300
(2) w/o drug.	140	128	50	28	10	44	200
Total	320		70		110		500

For above table all Expected column value is calculated as follows.—

$E = \frac{RT \times CT}{N}$ where $RT =$ ~~Total~~ Row Total, $CT =$ Column Total, $N =$ Total $= 500$

$E_{11} = \frac{300 \times 320}{500} = 192$, $E_{21} = \frac{300}{500} \times 70 = 42$ $E_{31} = \frac{300}{500} \times 110 = 66$

$E_{21} = \frac{200}{500} \times 320 = 128$ $E_{22} = \frac{200}{500} \times 70 = 28$ $E_{32} = \frac{200 \times 110}{500} = 44$

Now we are going to perform Chi-Square test

Condition for (Chi-Square)

→ ~~All~~ Any Sample we are using needs to be taken randomly

→ Larger Counts: Each Expected value (~~known~~ as expected value) needs to be greater than 5

→ Independent :- Sampling with replacement, if not sample be larger than 10% of population

All Expected value > 5.

Calculation of χ^2 = using $\sum \frac{(\text{Observed}-\text{Expected})^2}{\text{Expected}}$

O	E	O-E	$(O-E)^2$	$\frac{(O-E)^2}{E}$
180	192	-12	144	.75
140	128	12	144	1.125
20	42	-22	484	11.52
50	28	22	484	17.28
100	66	34	1156	17.51
10	44	-34	1156	26.57

$$\sum \frac{(O-E)^2}{E} = 74.57.$$

degree of freedom (df) = $(c-1)(r-1) = (3-1)(2-1) = 2.$

~~$\chi^2_{0.05}$~~ $\chi^2_{0.05} = 5.99$ (taken at 5% Significance level)

Conclusion

Since $(74.57 > 5.99)$ i.e calculated value is greater than table value, the hypothesis is rejected. Hence there is significant difference in the patient treated with new drug & those not treated.