Hypothesis testing

Hypothesis testing is a procedure to prove a statements in statistical way

statement − 1: VK ODI average is 50

we need to prove the above statement is True or False

the process of getting conclusion is called as Hypotheis testing

statement − 2: Naresh IT DS students Average package is 10LPA

statement − 3: Naresh IT ameerpet students sleep time on of average = 14

Hypothesis has two types

Null Hypothesis : H_o

Alternative Hypothesis: H_a or H_1

Step − 1: Form the Hypothesis

what ever the statement we are consider as reference , that is Null hypothesis

the opposite is Alternative Hypothesis

H_o : VK avg in ODI is equal to 50

H_A : VK avg in ODI is not equal to 50

Step − 2: Represent in math way

$$H_o : \mu = 50$$

$$H_A : \mu \neq 50$$

i have conusltancy :

Raj, sachin, amit

Step – 3: Set the significance level

Significance level means how much infornation we need to gather to prove Null hypothesis is True

denoted with $= \alpha$

$\alpha = 0.05$ *means information (evidance)* $= 95\%$

$\alpha = 0.01$ *means information (evidance)* $= 99\%$

$\alpha = 0.10$ *means information (evidance)* $= 90\%$

Step – 4: Find the Critical values

critical values means z values based on significance level α

$\alpha = 0.05 \quad z = \pm 1.96$

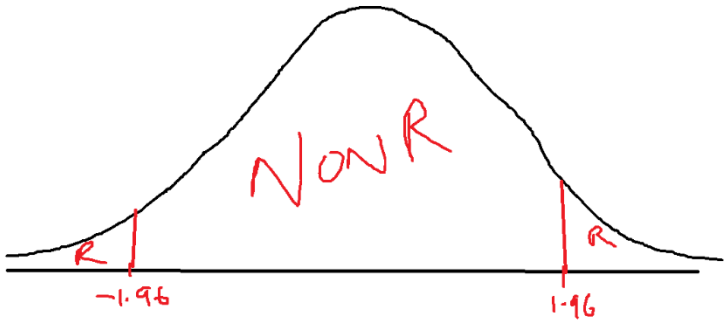
$\alpha = 0.01 \quad z = \pm 2.58$

$\alpha = 0.10 \quad z = \pm 1.645$

Step – 5: Form the Rejection and Non rejection area

based on critical values we need to get some border points

for $\alpha = 0.05 \quad z = -1.96$ *and* $+ 1.96$



Step − 6: Testing

Hypothesis based on average then we will go for z, t test

Hypothesis based on variance then we will gor for f test

If we want find the relation between two categorical columns, then chi − sqaure

$$z = \frac{\bar{x} - \mu}{\frac{\boldsymbol{\sigma}}{\sqrt{\boldsymbol{n}}}}$$

$\bar{x} = one\ we\ gather\ information\ we\ will\ get\ mean\ of\ sample$

$\mu = 50$

$\boldsymbol{\sigma} = \boldsymbol{will\ be\ give}$

$\boldsymbol{n} = \boldsymbol{will\ be\ give}$

the values here we called as Observed values

assume that observed values $(z) = 2.58$

Step − 7: conclusion

once we got the observed values plot that on our rejection and non rejection area

if the values falls under Rejection area

: Then reject the Null hypotheiss otherwise Not reject the Null hypothesis

$z = 2.58 \ > \ cv(1.96)$ *we are rejecting null hypothesis*

Question-1:

In an attempt to determine why customer service is important to managers in the United Kingdom, researchers surveyed managing directors of manufacturing plants in Scotland.* One of the reasons proposed was that customer service is a means of retaining customers. On a scale from 1 to 5, with 1 being low and 5 being high,

The survey respondents rated this reason more highly than any of the others, with a mean response of 4.30. Suppose U.S. researchers believe American manufacturing managers would not rate this reason as highly and conduct a hypothesis test to prove their theory. Alpha is set at .05. Data are gathered and the following results are obtained. Use these data and the eight steps of hypothesis testing to determine whether U.S. managers rate this reason significantly lower than the 4.30 mean

ascertained in the United Kingdom. Assume from previous studies that the population standard deviation is 0.574.

3 4 5 5 4 5

5 4 4 4 4 4

4 4 4 5 4 4

4 3 4 4 4 3

5 4 4 5 4 4

4 5

Step-1:

Make the hypothesis

$$H_0: Mean\ response\ is\ 4.30$$

$$H_a: Mean\ response\ is\ not\ equal\ to\ 4.30$$

Step-2:

$$H_0: u = 4.30$$

$$H_a: u \neq 4.30$$

Step-3:

Significance value :

$$\alpha = 0.05$$

Step-4:

Make critical values

1.645 ========== 90%

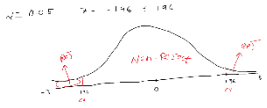
1.96 ========== 95%

2.58 ========== 99%

Critical values are -1.96 to 1.96

Step-5:

Make a rejection area and non rejection area



Step-6:

Conduct the test

3 4 5 5 4 5

5 4 4 4 4 4

4 4 4 5 4 4

4 3 4 4 4 3

5 4 4 5 4 4

4 5

Sample mean = 4.15

$$z = \frac{4.15 - 4.30}{0.574 / \sqrt{32}} = -1.48$$

$$observed\ value = -1.48$$

Step-7: **Conclusion**

Not Reject the Null hypothesis

$Problem - 2$:

$$H_0 : u = 36$$

$$H_a : u \neq 36$$

$$\alpha = 0.01$$

$$n = 63$$

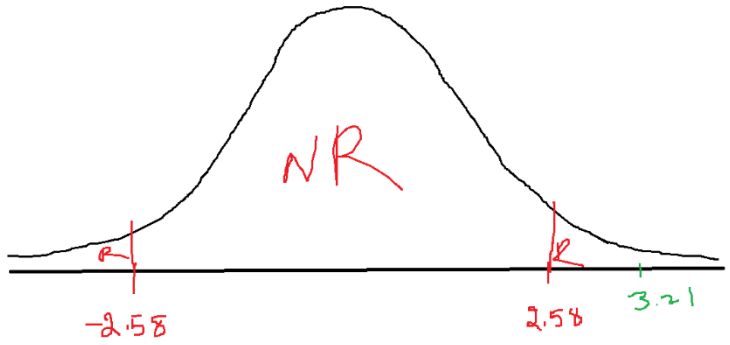
$$x^- = 38.4, \sigma = 5.93$$

$\boldsymbol{Critical\ values} = z_{cv} = \boldsymbol{\pm 2.58}$

Testing

$$z = \frac{\bar{x} - \mu}{\frac{\boldsymbol{\sigma}}{\sqrt{\boldsymbol{n}}}} = \frac{38.4 - 36}{\frac{\boldsymbol{5.93}}{\sqrt{\boldsymbol{63}}}} = \boldsymbol{3.21}$$

$z_{observed} = 3.21$



P − value

While doing hypothesis, we will set the significance level $(\boldsymbol{\alpha})$

in this context ***α will leverage on evidance to prove Null hypothesis correct***

For example: $\boldsymbol{\alpha = 0.05}$ ***means we need*** $\mathbf{95\%}$ ***evidance to Prove***

Null hypothesis correct (*Not reject the Null hypothesis*)

- *P − value is called as Conditional probability*
- *p value assume Null hypothesis True, but works for Alternative Hypothesis*
- *p − value will get after test*
- *after test we will get z − value , from z value we will get p − value*
- $z = 2.58 \quad p - value = 0.01$ *how much evidance we have* $= 99\%$
- $\boldsymbol{\alpha}$ ***= Null hypothesis***
- $p =$ *alternative hypothesis*

$\boldsymbol{\alpha}$	H_o *evidance*	p	H_a *evidance*	*conclusion*
0.05	95	0.01	99	*Reject the Null*
0.1	90	0.05	95	*Reject the Null*
0.01	99	0.1	90	*Not reject*

$\boldsymbol{p < \alpha}$ **==== *Reject the Null hypothesis***

$\boldsymbol{p > \alpha}$ **==== *Not Reject the Null hypothesis***

$Q1)$ *we got* $z = -1.48$

$from\ z\ table = p = 0.1388\ (87)$

$\boldsymbol{\alpha = 0.05\ (95)}$

$p > \boldsymbol{\alpha}$ **=== *Not reject null***

***Problem* − 2**:

$$\boldsymbol{H_0: u = 36}$$

$$\boldsymbol{H_a: u \neq 36}$$

$$\boldsymbol{\alpha = 0.01\ \ z = \pm 2.58}$$

$$\boldsymbol{n = 63}$$

$$\boldsymbol{x^- = 38.4, \sigma = 5.93}$$

Critical values $= z_{cv} = \boldsymbol{\pm 2.58}$

Testing

$$z = \frac{\bar{x} - \mu}{\frac{\boldsymbol{\sigma}}{\sqrt{\boldsymbol{n}}}} = \frac{38.4 - 36}{\frac{\boldsymbol{5.93}}{\sqrt{\boldsymbol{63}}}} = \boldsymbol{3.21\ \ ==== p = 0.0013}$$

$$\boldsymbol{p = 0.0013\ , \alpha = 0.01}$$

$$\boldsymbol{p = 0.0013 <\ \ \alpha = 0.01\ \ :\ \ \textit{Reject the Null hypothesis}}$$

***Problem* − 3**:

$$\boldsymbol{H_0: u = 16}$$

$$\boldsymbol{H_a: u \neq 16}$$

$$\boldsymbol{\alpha = 0.05\ \ z = \pm 1.96}$$

$$\boldsymbol{n = 20}$$

$$\boldsymbol{x^{-} = 16.45, \sigma = 3.59}$$

$\boldsymbol{Critical\ values} = z_{cv} = \boldsymbol{\pm 1,96}$

Testing

$$z = \frac{\bar{x} - \mu}{\frac{\boldsymbol{\sigma}}{\sqrt{\boldsymbol{n}}}} = \frac{16.45 - 16}{\frac{\boldsymbol{3.59}}{\sqrt{\boldsymbol{20}}}} = \boldsymbol{0.5678 = 0.57} \text{ ==== } \boldsymbol{p = 0.568}$$

$$\boldsymbol{p = 0.568}\ , \boldsymbol{\alpha = 0.05}$$

$$\boldsymbol{p = 0.0013 > \ \alpha = 0.01} \ : \ \boldsymbol{Not\ Reject\ the\ Null\ hypothesis}$$