

HYPOTHESIS TESTING (Z test (Rejection Region))

Q company avg productivity before training program 50 units per day & population std of 5 units

after training company measures productivity of random sample of 30 employees. The sample average productivity of 53 units per day.

company wants to know if new training has significantly increased productivity or not.

Ans Rejection Region Approach

Step 1 $H_0: \mu = 50$
 $H_a: \mu > 50$

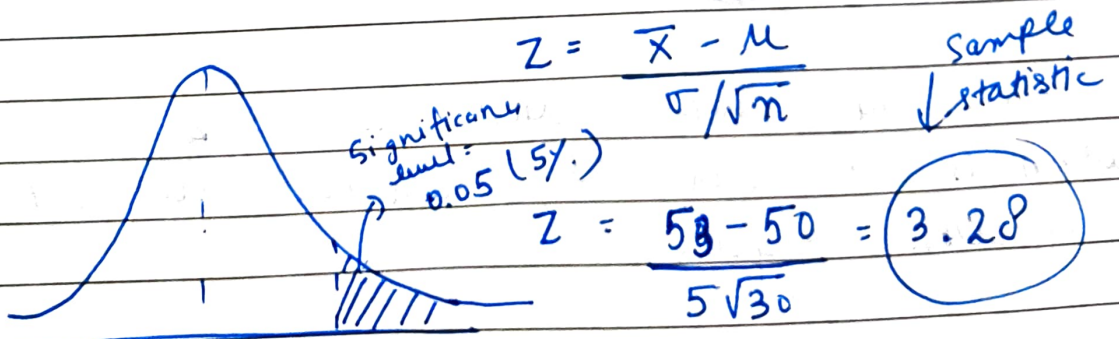
Step 2 significance level $\Rightarrow \alpha = 5\% \Rightarrow 0.05$

Step 3: checking assumptions

- ① Normality ✓ (as $n=30$, CLT can be applied)
- ② pop std known ✓

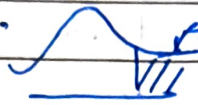
Step 4: Z test suitable.

Step 5: Calculate Z (convert into standard normal variate)

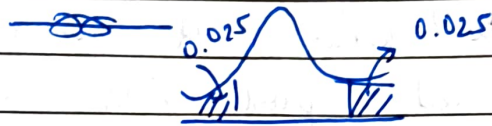


find Z value for significance level = 0.05

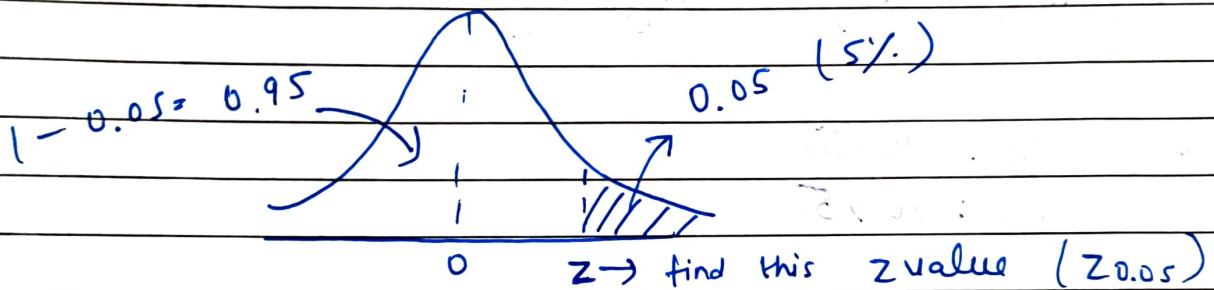
NOTE: Since ~~we are~~ ~~check~~ Alternative hypothesis is if value increased ($H_a: \mu > 50$) therefore this area should be 5% (0.05)



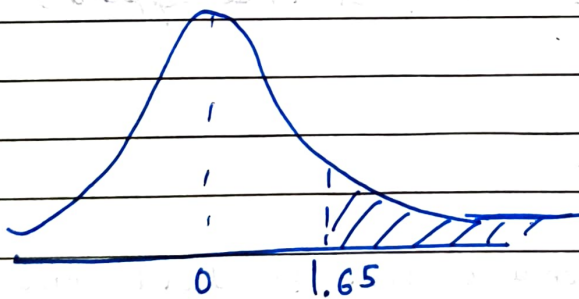
but if there was case like this $\Rightarrow H_a: \mu \neq 50$, then we will check for both direction that means significance level / area will be divide at both sides



Continue



Look for Z value where area is 0.95, that will be. Z value for area 0.95 will be 1.65



~~2 one Z value~~

Since our sample statistic is 3.28 which is more than 1.65, which will fall into rejection region.



That means, we have a strong evidence against null hypothesis.

∴ And we reject the null hypothesis

∴ Alternative hypothesis is true.

which is there is significant increase in production

$$H_0: \mu = 50 \text{ X}$$

$$H_a: \mu > 50 \checkmark$$

Example 2

$$\mu = 50, n = 40, \bar{X} = 49, \sigma = 4.$$

P lays claim avg weight = 50gm with pop std = 4.

organization took sample with size = 40 & the avg weight of sample was 49gms.

Now conduct hypothesis testing to which for hypothesis \Rightarrow lays weight is not 50gms.

Ans

Step 1 : Null hypothesis $\Rightarrow H_0: \mu = 50$

Alternate hypothesis $\Rightarrow H_a: \mu \neq 50$ (kam hi ho sakte hai 200 hai)

(Notice that here the significance will be divided at both sides)

Step 2 : $\alpha = 0.05$

Step 3 : ① Sample size $n = 40$ (Normal) \checkmark

② pop std \checkmark

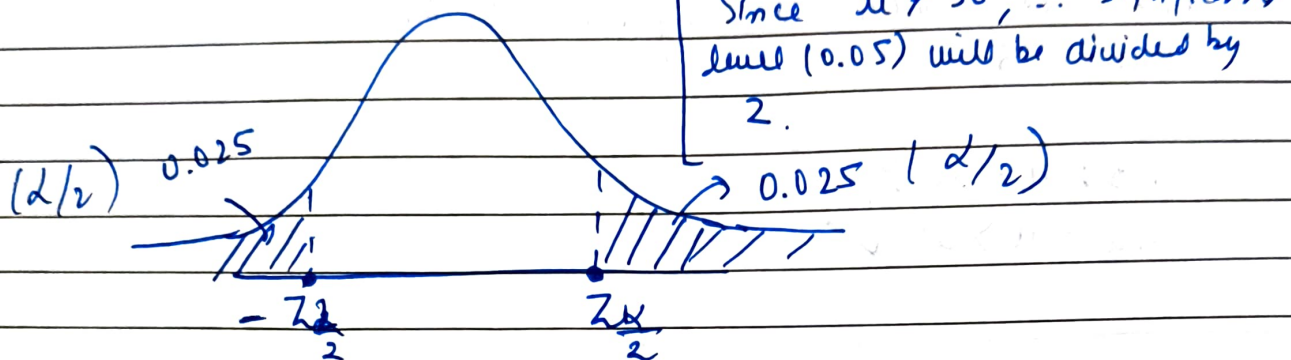
Step 4 : Z test is suitable

5) Calculate z .

6) Conduct test

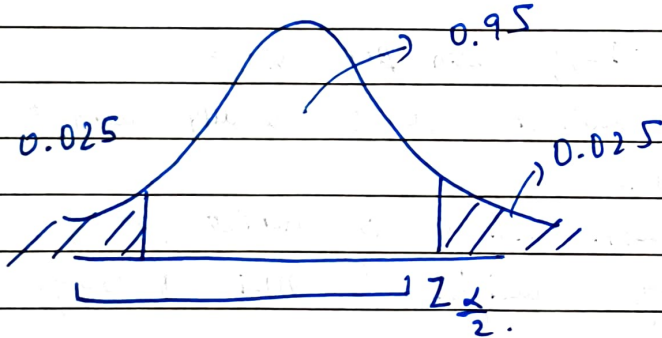
Sample statistic

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \Rightarrow \frac{49 - 50}{4\sqrt{40}} = -1.50$$



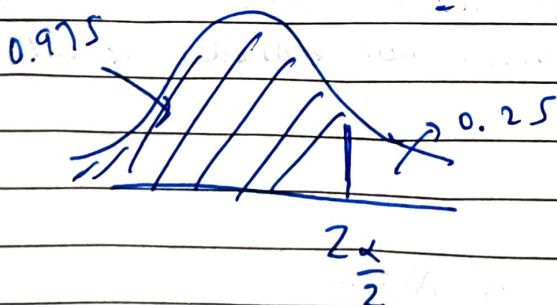
find $-z_{\frac{\alpha}{2}}$ & $z_{\frac{\alpha}{2}}$, & find ~~later~~ if sample

Statistic lies in rejection region



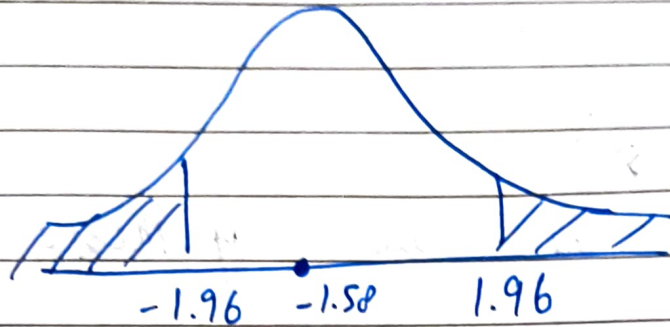
Area upto $z_{\frac{\alpha}{2}}$ will be $\Rightarrow 0.025 + 0.95$

$$= 2 \times 0.975$$



Calculate find z value for area $= 0.975$

$$z_{\frac{\alpha}{2}} = 1.96 \Rightarrow \therefore z_{\frac{\alpha}{2}} = \pm 1.96$$



Sample statistic = -1.50

\Rightarrow Since -1.50 doesn't lie in rejection region
 \therefore we cannot reject null hypothesis (didn't have enough evidence)