Q1. A principal at a school claims that the students in his school are above average in terms of intelligence. A random sample of 30 students' IQ scores have a mean of 112.5. The mean population IQ is 100 with STD of 15. Test the hypothesis of principal's claim.

Q2. The average weights of students of my class is 168 lbs. A nutritionist believes that the mean is different. She measured the weights of 36 students and found that the mean to be 169.5 lbs with a std of 3.9. AT 95% confidence, is there enough evidence to discard the null hypothesis?

Q3. In the population, the average IQ is 100 with a standard deviation of 15. A team of scientists want to test a new medication to see if it has either a positive or negative effect on intelligence, or not effect at all. A sample of 30 participants who have taken the medication has a mean of 140. Did the medication affect intelligence?

Q4. A car manufacturer claims that the average fuel efficiency of its new model is 30 miles per gallon (mpg). To test this claim, a random sample of 35 cars is selected, and their average fuel efficiency is found to be 29.2 mpg with a standard deviation of 2.5 mpg. Perform Z-test at a 5% significance level to determine if the manufacturer's claim is supported.

Q5 A company claims that their new marketing campaign will increase website traffic by at least 20%. Before the campaign, the average daily website traffic was 2,000 visitors. After the campaign, a random sample of 30 days shows an average daily traffic of 2,100 visitors with a standard deviation of 150 visitors. Perform a one-sample Z-test at a 5% significance level to determine if the claim is supported.

Q6 A researcher wants to test if the average IQ score of a group of students is different from the national average IQ score of 100. A random sample of 40 students is taken, and their average IQ score is 102 with a standard deviation of 15. Perform a one-sample Z-test at a 1% significance level to determine if the group's average IQ score is significantly different from the national average.

Q7 You know that the standard deviation of IQ in the general population is 15. You test your drug on 36 patients and obtain a mean IQ of 97.65. Using an alpha value of 0.05, is this IQ significantly different than the population mean of 100?

Scanned with CamScanner

(1)

Step 1

$H_0 \rightarrow \mu \leq 100$

$H_1 \rightarrow \mu > 100$

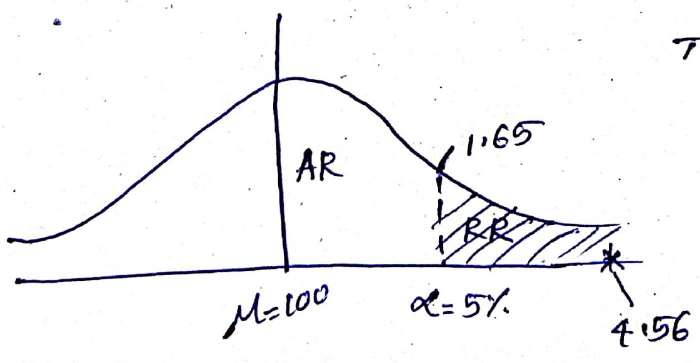
Step 2 :- It is a right tailed test

Step 3 :- $\alpha = 5\%$, $n = 30$, $\mu = 100$, $\sigma = 15$

Step 4 : Z test

$$Z\,score = \frac{x - \mu}{\sigma} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{112.5 - 100}{15/\sqrt{30}} = \frac{12.5}{15} \times 5.477$$

$Z\,score = 4.56$



Here $\alpha = 5\%$ = Rejection area

The acceptance area = 95%.

So Z critical = 1.65

our Z calculated = 4.56.

Z calculated > Z critical. ∴ Reject Null Hypothesis.

Scanned with CamScanner

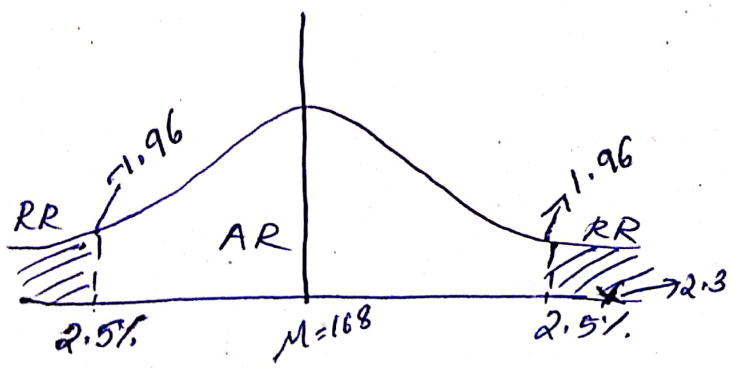
② $H_0 \rightarrow \mu = 168$

$H_1 \rightarrow \mu \neq 168$

$n = 36$, $\sigma = 3.9$

Two tailed test.

$$Z \text{ score} = \frac{169.5 - 168}{3.9/\sqrt{36}} = \frac{1.5 \times 6}{3.9} = \underline{\underline{2.3}}$$



RR = 2.5%

AR = 97.5%

So $Z_{critical} = 1.96$

$Z_{cal} = 2.3$

$Z_{cal} > Z_{critical}$. So Reject H_0.

Scanned with CamScanner

Date ___ / ___ / ______

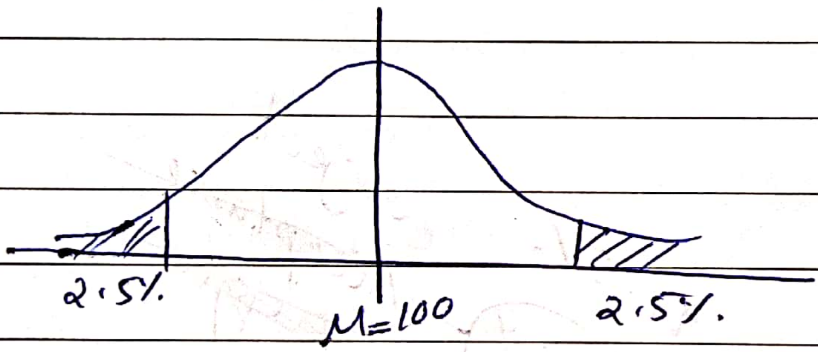
(3) $H_0 \rightarrow \mu = 100$

$H_1 \rightarrow \mu \neq 100$ $\sigma = 15$ $n = 30$

$\bar{x} - 140$

$$Z\ score = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{140-100}{15/\sqrt{30}} = \frac{40}{15} \times \sqrt{30}$$

$$Z\ sore = \underline{\underline{14.60}} \simeq 15$$



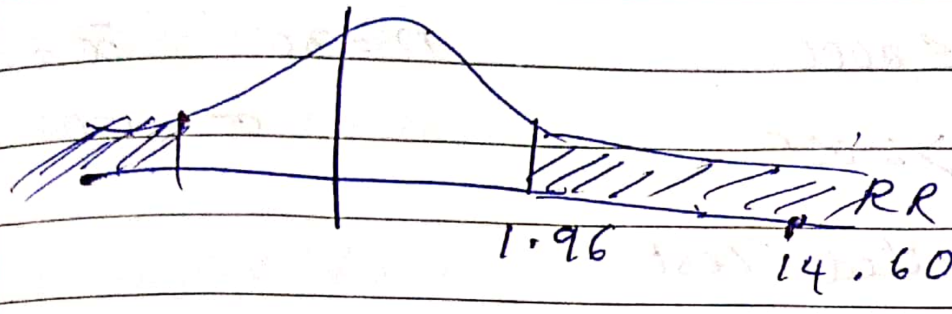
~~p value method~~ critical Method

$Z\ score = 14.60$

The acceptance area $= 97.5\%$

0.975 in z table

$Z_{critical} = 1.96$



So reject H_0.

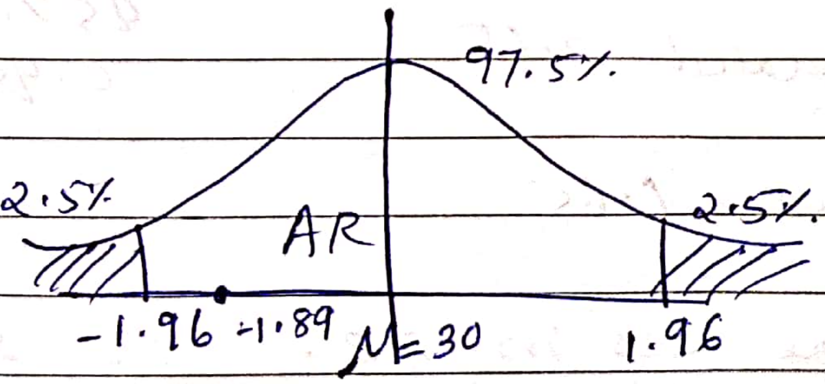
(4) $H_0 \rightarrow \mu = 30$ $\quad n = 35$

$H_1 \rightarrow \mu \neq 30$ $\quad \bar{x} = 29.2$ $\quad \sigma = 2.5$

2 tailed test $\quad \alpha = 5\%$

$$Z\ score = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{29.2 - 30}{2.5/\sqrt{35}}$$

$$= \frac{-0.8}{2.5} \times \sqrt{35} = -1.89$$



Critical testing

$Z_{score} = -1.89$

$Z_{critical} = 1.96$

Zscore lies in the AR.

So Accept H_0.

Page No.

Scanned with CamScanner

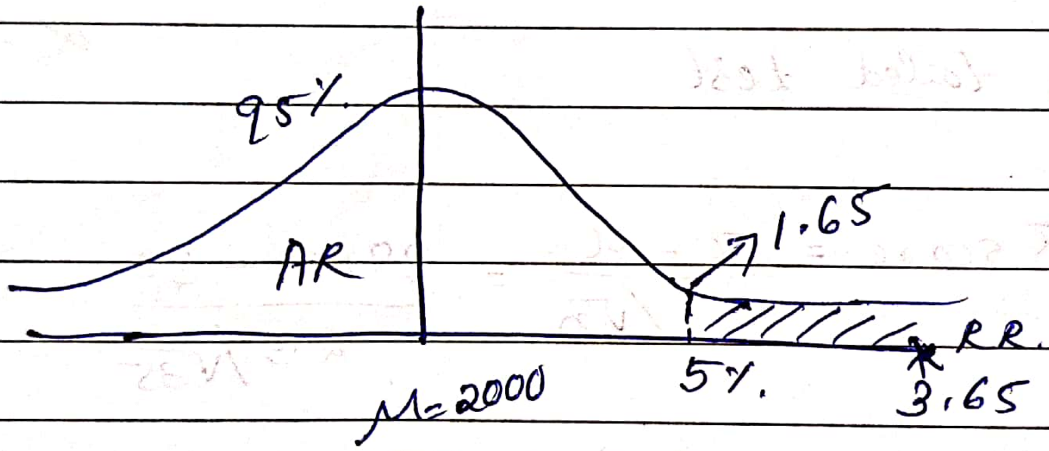
(5) $H_0 \rightarrow \mu \leq 2000$ $n = 30$ $\bar{x} = 2100$

$H_1 \rightarrow \mu > 2000$ $\sigma = 150$ $\alpha = 5\%$

Right tailed Test

$$Z_{score} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{2100 - 2000}{150/\sqrt{30}} = \frac{100}{150} \times \sqrt{30}$$

$$Z_{score} = 3.65$$



Critical Method

$Z_{calculated} = 3.65$

95%
0.95 in z table
$= 1.65$

$Z_{critical} = 1.65$

Z score lies in RR. So reject H_0.

Scanned with CamScanner

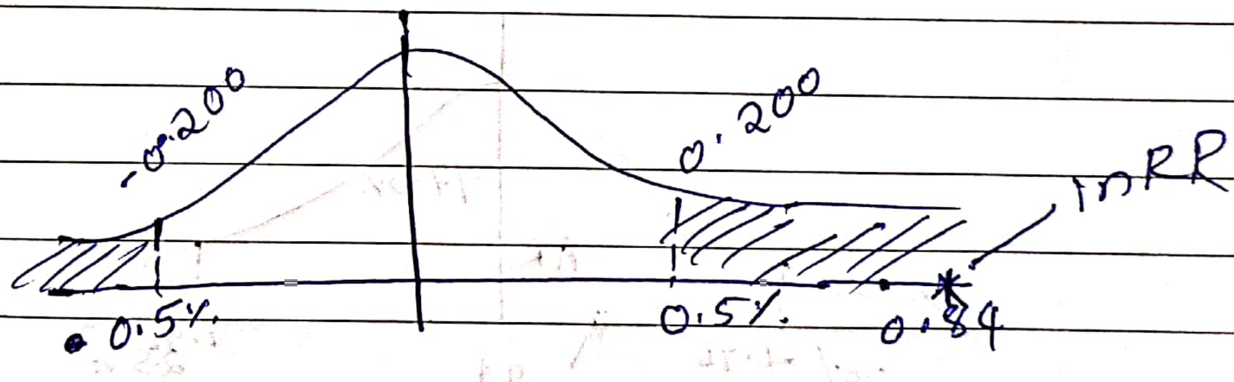
(6) $H_0 \Rightarrow \mu = 100$ $\quad n = 40 \quad \bar{x} = 102$

$H_1 \rightarrow \mu \neq 100 \quad \sigma = 15$

2 tailed test $\quad \alpha = 1\%$

$$z\text{ score} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{102-100}{15/\sqrt{40}} = \frac{2 \times \sqrt{40}}{15}$$

$= 0.84$



P value Method

Zscore Area = 0.79955

1 − Area (zscore)

1 − A(z 0.84)

1 − 0.79955 = 0.20045 $\quad$ 20%

Zscore 0.84 in RR, so Reject H_0.

(7) $H_0 \rightarrow \mu = 100$ $\qquad \sigma = 15$, $n = 36$

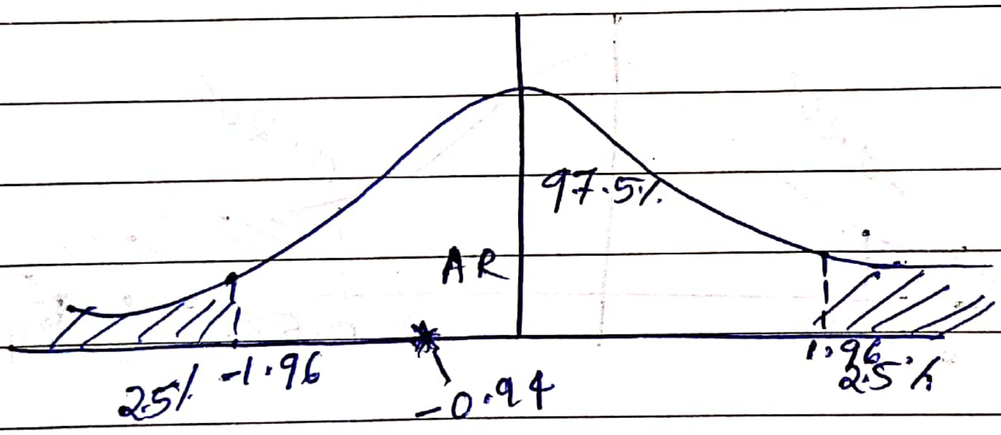
$H_1 \rightarrow \mu \neq 100$ $\qquad \bar{x} = \cancel{100.65}\ 97.65$

$\alpha = 5\%$

2 tailed test

$$Z\ score = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{97.65 - 100}{15/\sqrt{36}}$$

$$= \frac{-2.35}{15} \times 6 = -0.94$$



97.5% = Acceptance Area.

So $Z_{critical} = \bar{\ } 1.96$

$Z_{calculated} = -0.94$

Z critical < Z calculated . So Accept H_0.

Scanned with CamScanner