Statistics_Assignment_02_09_25

01/09/2025 ASSIGNMENT : Z-TEST

\# 2. SCENARIO: A Factory claims their machines produce metal rods with an average length of 50 cm.

Test Type : One - Sample Z-test

Null Hypothesis (H_0) : $\mu = 50$ cm (Mean Rod length)

Alternate Hypothesis (H_1) : $\mu \neq 50$ cm (Mean Rod length $\neq$ 50 cm)

DATA : $x = [49.5, 50.2, 49.8, 49.7, 50.4, 49.6, 50.1, 49.9, 49.3, 50.5, 49.8, 50.0, 49.4, 50.3, 49.7, 49.6, 49.9, 50.1, 49.8, 50.2, 49.5, 49.7, 49.9, 50.4, 49.6, 50.0, 49.8, 50.3, 49.4, 50.1]$

Step ① State Hypothesis :-

Null Hypothesis (H_0) $\Rightarrow$ $\mu = 50$ cm (factory Claim)

Alternate Hypothesis (H_1) $\Rightarrow$ $\mu \neq 50$ cm (Two sided Two Tail)

Step ② Sample size, Compute Sum & Mean ($\bar{x}$)

$$\boxed{n = 30}$$

$$\bar{x} = \frac{\Sigma x}{n} = \frac{1496.5}{30} = 49.883333$$

$$\boxed{\bar{x} \simeq 49.8833}$$

Step ③ Population Standard Deviation assumption

Computing (S) Sample Standard Deviation

$$S = \sqrt{\frac{\Sigma (x_i - \bar{x})^2}{n-1}}$$

$$= (-0.3833)^2 + (0.3167)^2 + (-0.0833) + (-0.1833)^2 + (0.5167)^2 + (-0.2833) + (0.2167)^2 + (0.0167)^2 + (-0.5833)^2 + (0.6167)^2 + (-0.0833)^2 + (0.1167)^2 + (-0.4833)^2 + (0.4167)^2 + (-0.1833)^2 + \ldots$$

Sample Standard Deviation $\boxed{S = 0.327038}$

Step (4) Compute Z-statistic

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \Rightarrow \frac{49.8833 - 50}{0.0597}$$

$$\boxed{Z \simeq -1.95}$$

$\frac{\sigma}{\sqrt{n}}$ = ~~[illegible]~~ $\frac{0.327}{\sqrt{30}}$ = 0.0597

$\alpha = 0.05$

$\alpha/2 = 0.025$ (Two Tailed)

Therefore $(1 - 0.025)$

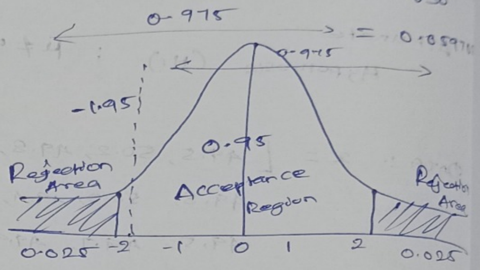
$= 0.975$

Checking Z table where the probability 0.975 comes is

$Z = 1.96$

Since its two tailed, (+ve & -ve)

$$\boxed{Z = \pm 1.96}$$



taking ⇒ $\alpha = 0.05$ 5% significance

Two sided = 0.025

critical value $= \pm 1.96$

Acceptance Region : Between $(-1.96 < Z < 1.96)$

calculated $Z = -1.95$ lies inside the Acceptance region at 5% significance level

Hence, We fail to Reject H_0