Hypothesis Testing

26 May 2023 14:00

STEPS

① Formulation of H_0 & H_A Hypothesis.

A) H_A : μ_{Female} $>$ μ_{male}

H_0 : μ_{female} $\leq$ μ_{male}.

Right - Tailed Test

Claim : The mean salary offered to female Grad. during their Placement is Higher than that of Males from same stream.

B) H_A : $\mu_{current\_balance}$ $<$ \$ 7000

H_0 : $\mu_{current\_balance}$ $\geq$ \$ 7000

Left - Tailed Test

C) H_0 : $\mu_{age\_customers}$ $=$ 45 years.

H_A : $\mu_{age\_customers}$ $\neq$ 45 years.

Two - Tailed Test.

★ The sign (> or <) in the H_A determines whether it is a LT or RT - Test.

★ The equality sign always goes with H_0.

② Data Preparation.

③ Define the significane Leve (α). Normally 5% or 0.05.

④ Determine what type of HypoTest to be done :

→ Z-test vs t-Test vs χ^2 - Test (non-parametric test)

→ One-sample Test vs 2-Sample Test

[illegible]

→ Z-test vs

→ One-sample Test vs 2-Sample Test

→ $\boxed{\text{Test for popl}^n\text{ mean}}$ vs Test for popl^n variance / Proportions.

Z-Test

→ Popl^n Std. dev^n is **Known** (σ)

→ Sample size > 30

Z-Test $\Rightarrow$ Normal Distrib^n

$$\boxed{Z\text{-stat} = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}}$$

t-Test

→ σ is **NOT** Known

→ $n \leq 30$

t-test $\Rightarrow$ t-Distrib^n

$$\boxed{t\text{-Statistic} = \frac{\bar{x} - \mu_0}{s / \sqrt{n}}}$$

s = Sample std. dev^n.

n = Sample Size.

μ_0 = Hypothesized Population Mean.

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(5) Find the Critical Value of the Test-Statistic → (from α)

- Z-Test: Z_{crit}
- T-Test: t_{crit}
- χ^2-Test: χ^2_{crit}
- ...

(6) Find P-value (from Test Statistic : Z-stat, t-stat, χ^2-stat ...)

α, P → areas. (both are cumulative Probabilities)

- α → Minimum evidence I need to Accept Ho.
- P → Actual evidence in Favor of Ho from the Sample

(7) Decision Making.

A) Compare α vs P-value

OR

B) Compare Test-Statistics with Critical Value

Problem 1.

An agency based out of Bangalore claimed that the **average** monthly disposable income of families living in Bangalore is greater than INR 4200 with a standard deviation of INR 3200.

From a random **sample** of 40,000 families, the **average** disposable income was estimated as INR 4250.

Assume that the **population standard deviation** is INR 3200.

Conduct an appropriate hypothesis test at 95% confidence level (α = 0.05) to check the validity of the claim by the agency.

Right Tailed Test

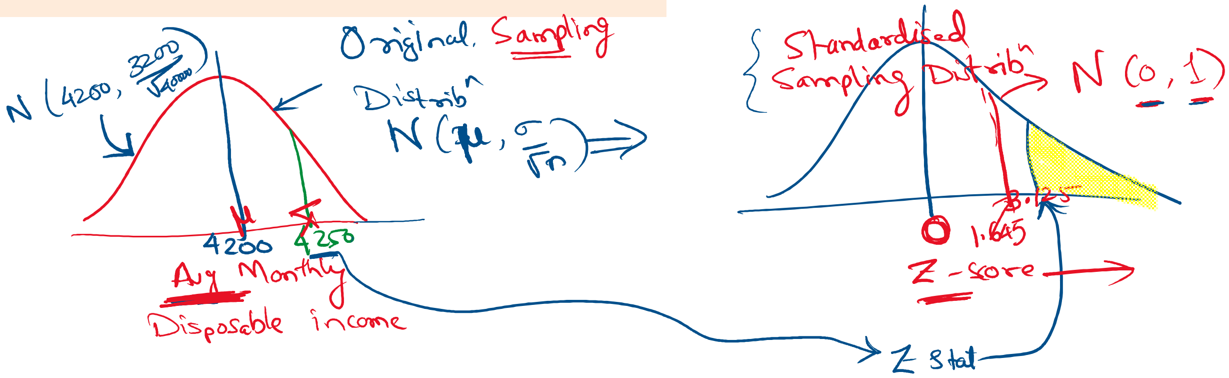
$H_A : \mu > 4200 \ (\mu_0)$

$H_0 : \mu \le 4200.$

Sample mean = 4250 ($\bar{x}$)

Sample Size = 40,000.

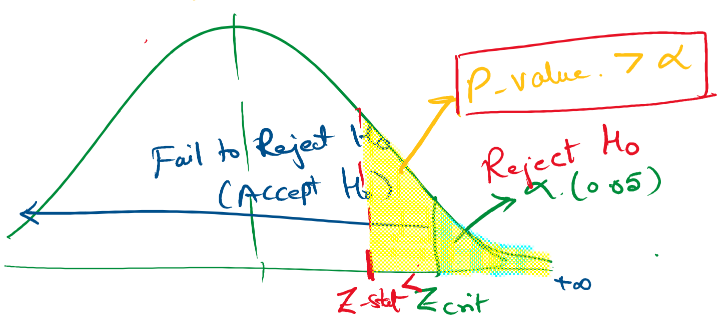
σ = 3200.

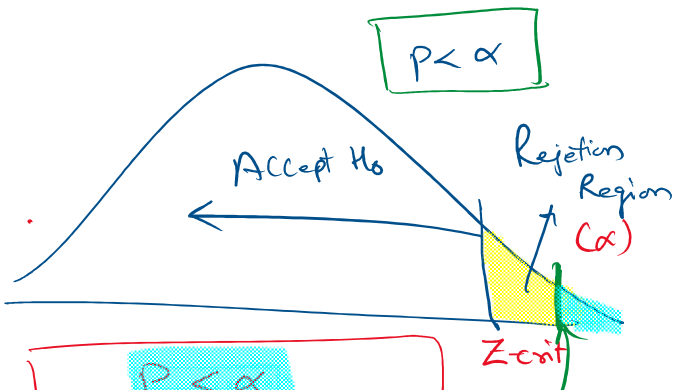


$$Z\text{-Stat} = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{4250 - 4200}{(3200/\sqrt{40000})}$$

The sample mean is 3.125 Std. devⁿ AWAY from the poplⁿ mean

$\boxed{Z\text{-Stat} = 3.125}$





Decision : $\boxed{P > \alpha}$

Hence Fail to Reject H0

$\boxed{Z\text{-stat} < Z\text{-crit}}$

1.645

$\boxed{P < \alpha \quad Z\text{-Stat} > Z\text{-crit.}}$

Reject H0

1.645

Z-crit