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Unit - 05 Testing of Hypothesis

An aggregate of object is called pop. or universe
It is a collection of individuals Or their attributes (qualities) or result of operations which can be numerically
&

A finite subset of a population is k/a sample. A sample is a small portion of the universe.

The no. of individuals in a sample is a individual is called sample size.

Population or Universe
Sample
Sample size (n) : Large sample ($n \geq 30$), Small sample ($n < 30$)

	Population	Sample
Mean	μ	$\bar{x}$
Variance	σ^2	S^2
S.D	σ	S

Testing of Statistical Hypothesis.

1) Null Hypothesis (H_0): is the hypothesis which is tested for possible rejection under the assumption that it is true.

ii) Alternate Hypothesis (H_1): Any hypothesis which is complementary to the null hypo is k/a Alt. hypo.

iii) Level of Significance (LOS)-

iv) Test Statistics (3) → Applied the related test formula.

v) Conclusion:

$$|Z|_{cal.} \leq Z_{tab}$$

Hence H_0 is accepted. Therefor H_1 is rejected.

ii) If $|Z|_{cal} > |Z|_{tab} \Rightarrow$ Hence H_0 is rejected. Therefore H_1 is accepted.

Testing of significance for single mean for a large sample.

For this, we have to apply Z-test.

The test statistics is given by:

$$Z = \frac{(\bar{x} - \mu)}{\sigma/\sqrt{n}}$$

Q.1. The mean weight obtained from a random sample of size 100 is 64 g. The std. dev of the weight dist. of the pop. is 8gm. Test the stat that the mean weight of the pop. is 67 g at 5% level of significance.

$n = 100$, $\bar{x} = 64$ gm, $\sigma = 3$ gms,
$\mu = 67$ gm.

Null Hypothesis (H_0) : $\mu = 67g$ i.e.
There is no significance diff. b/w mean weight of sample & population

Alternate Hypo (H_1): $\mu \neq 67$ (Two tail test)
i.e. There is a significance d[illegible] the mean weight of sample & population.

LOS : 5%
Test Stat: $|Z| = \left|\dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}}\right| = \left|\dfrac{64 - 37}{3/\sqrt{100}}\right| = 10$

Conclusion: Here $|Z|_{cal.} = 10 > |Z|_{tab} = 1.96$.
Hence H_0 is rejected.
Therefore H_1 is accepted. Hence the mean weight of pop. is not 67 gm.

Z-Test **Test of Significance for large single sample Mean :**

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

If σ is not given, then we will use the S.D of sample 's'

$$Z = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

Q. A sample of students from a Uni was taken & their mean weight was found to be 112 pound with a S.D of 20 pounds. Could the mean weight be 120 at 5% of Student in the population with 95% confidence level be 120 pounds.

Note - level of confidence = 100 - Level of significance

$n = 1000$, $\bar{x} = 112$, $s = 20$, $\mu = 120$

$$Z = \left|\frac{\bar{x} - \mu}{s/\sqrt{n}}\right| = \left|\frac{-8}{20/(31.6)}\right|$$

$$= \left|\frac{112 - 120}{20/\sqrt{1000}}\right| = \left|\frac{-8}{0.63}\right| = 12.69 \approx 12.65$$

a) Null hypothesis (H_0) $\rightarrow$ ($\mu = 120$ lb)
i.e. There is no significance diff b/w the mean of sample & pop.

b) Alternate hypothesis (H_1) : $\mu \neq 120$ lb (Two tailed test) i.e. There is significance diff b/w the mean weight of sample & population

c) l.o.s $\rightarrow$ 5%

d) Test Statistics (z) : $|z| = \left(\frac{\bar{x} - \mu}{s/\sqrt{n}}\right)$

$= 12.65$

e) Conclusion : Here $|z|_{cal} = 12.65 > |z|_{tab}$

$= 1.96$

Hence H_0 is rejected. Therefore H_1 is accepted. Hence the mean weight of the pop. is not 120 lb

II) **Test of Significance for the difference of means of two large samples :**

The test stats (z) is given by :

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$\bar{x}_1 \rightarrow$ sample mean of Ist sample
$\bar{x}_2 \rightarrow$ " " IInd "
$\sigma_1 \rightarrow$ S.D of Ist pop.
$\sigma_2 \rightarrow$ S.D of IInd pop.

Note :) If both samples are from same population i.e. $\sigma_1 = \sigma_2 = \sigma$ (say) then, $$z = \frac{\bar{x}_1 - \bar{x}_2}{\sigma\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

ii) If σ_1 and σ_2 are not given, we can use the S.D. of sample s_1 & s_2 (for two population)

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

iii) If the single population is there & we are given s_1 & s_2 then

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sigma\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$ where $\sigma^2 = \frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2}$

Q. Two random samples of sizes 1000, 2000 wheat pumps gave an avg yield of 2000 kg, 2050 kg. The variance of wheat pumps in the country may be taken as 100 kg. Examine whether the two samples differs significantly in yield at 5% level of significance.

$n_1 = 1000$, $n_2 = 2000$

$\bar{x}_1 = 2000\,kg$, $\bar{x}_2 = 2050\,kg$