SOMAIYA VIDYAVIHAR UNIVERSITY

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# Tut - 07
## Small & large Sampling
## Quiz

Q) A tyre company claims that the lives of the tyre have mean 42000 kms with SD of 4000kms a change in the product process is believed to result in better product. A test sample of 81 tyre has a mean life 42500 kms. Test 5% l.o.s that the new product is significantly better than the old one.

A) $n = 81$ (large)
$m = 42500$
$\mu = 42000$
$\sigma = 4000$

i) Null hypothesis: $\mu_0 = \mu = 42000$
Alternative hypo: $\mu_0 : \mu = 42000$

ii) Test statistic

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

$$z = \frac{42500 - 42000}{4000/(\sqrt{81})}$$

$$z = 1.12$$

iii) LOS $= \alpha = 0.05$

Critical value :- The table value for 5% LOS is $z_\alpha = 1.96$

v) Decision:-
The calculated value of $z = 1.12$ is less than the table value of $z = 1.96$
∴ Null hypothesis is accepted

Q) A random sample of 400 members is found to have a mean 4.45cms. Can it be regarded as a sample from a large population whose mean is 5cms & whose variance is 4cm²

A) $n = 400$
$\bar{x} = 4.45$
$\mu = 5$

$var = 4, \quad \sigma = \sqrt{var}$
$= \sqrt{4} = 2$

i) $\mu_0 = \mu = 5$
$\mu_a = \mu = +5$

ii) test statistic

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

$$= \frac{4.45 - 5}{2/\sqrt{400}} = -5.5$$

$$|z| = 5.5$$

iii) L.O.S $= \alpha = 5\% = 0.05$

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iv) Critical value:-
The value of $z_\alpha$ at 5% L.O.S is 1.96

v) Decision:- The calculated value of z = 5.5 is greater than table value of z = 1.96
∴ Null hypo is rejected

Q) A random sample of 50 items gives the mean 6.2 & Var 10.24. Can it be regarded as drawn from a normal popul$^n$ with mean 5.4 at 5% L.O.S.?

A) n = 50
$\bar{x}$ = 6.2
var = 10.24 S.D = $\sqrt{var}$ = $\sqrt{10.24}$ = 3.2
$\mu$ = 5.4

i) $\mu_0 = \mu = 5.4$
$\mu_0 \neq \mu \neq 5.4$

ii) Test Statistic

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

$$= \frac{6.2 - 5.4}{3.2/\sqrt{50}}$$

$$z = 1.77$$

iii) L.O.S = $\alpha$ = 5% = 0.05

iv) Critical value:-
The table value at 5% L.O.S is 1.96

V) Decision:-
The cal value of $z = 1.77$ is less than table value of $z = 1.96$
∴ Null hypothesis accepted

Q) A random sample of size 16 from a normal population showed a mean 103.75 cm & sum of square of deviation from mean 843.75 cm. Can we say that the pop has mean 108.75 cm?

A) $n = 16$
$\Sigma (x_i - \bar{x})^2 = 843.75$
$\bar{x} = 103.75$
$\mu = 108.75$

i) $H_0 = \mu = 108.75$
$H_a : \mu \neq 108.75$

ii) Test Statistic:-

$$t = \frac{\bar{x} - \mu}{s / \sqrt{n-1}}$$

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

$$s = \sqrt{\frac{843.75}{16}} = 7.26$$

$$t = \frac{108.75 - 108.75}{7.26 / \sqrt{16-1}}$$

$$t = -2.67$$

$$|t| = 2.67$$

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iii) L.O.S = $\alpha$ = 5% = 0.05

iv) Critical value:-
The table value of t at 5% LOS & d.o.f $v = n-1$ $v = 16-1 = 15$ is 2.131

v) Decision:-
The calculated value of $t = 2.67$ if greater than table value of $t = 2.131$

$\therefore$ Null hypo rejected.

Q) The mean of two sample of size 1000 & 2000 are 67.5 and 68.0 inches. Can the samples be regarded as drawn from the same populatn of SD 2.5 inches?

A) $n_1 = 1000$ $\quad n_2 = 2000$
$\bar{x}_1 = 67.50$ $\quad \bar{x}_2 = 68$

$\sigma = 2.5$

i) $H_0 : \mu_1 = \mu_2$
$H_a = \mu_1 \neq \mu_2$

ii) Test Statistic

$$z = \frac{\bar{x}_1 - \bar{x}_1}{SE}$$

$$SE = \sigma \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$2.5\sqrt{\frac{1}{1000}+\frac{1}{2000}}$$

$$SE = 0.096$$

$$z = \frac{67.50 - 68}{0.096}$$

$$z = -5.20$$
$$|z| = 5.20$$

iii) LOS = $\alpha$ = 5% = 0.05

iv) Critical value: the table value of z at 5% LOS is 1.96

v) Decision:-
The cal value of z = 5.15 is greater than table value 0.5 z = 1.96

∴ Null hypothesis rejected

6) Test the significance of the diff between the means of two normal pop with same SD from the doll data

| | Size | mean | S.D |
|---|---|---|---|
| Sample1 | 100 | 64 | 6 |
| Sample2 | 200 | 67 | 8 |

A) $n_1 = 100$ $n_2 = 100$
$\bar{x}_1 = 64$ $\bar{x}_2 = 67$
$\sigma_1 = 6$ $\sigma_2 = 8$

i) $H_0 = \mu_1 = \mu_2$
$H_a: \mu_1 \neq \mu_2$

(5)
(6)

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ii) test Statistic

$$z = \frac{\bar{x}_1 - \bar{x}_2}{S.E}$$

$$S.E = \sqrt{\frac{S_1^2}{n_2} \quad \frac{S_2^2}{n_1}}$$

$$= \sqrt{\frac{6^2}{200} \quad + \frac{8^2}{200}}$$

$$S.E = 0.905$$

$$= \frac{64 - 67}{0.905}$$

$$z = -8.31$$

$$|z| = 8.31$$

iii) L.O.S = $\alpha$ = 5% = 0.05

iv) Critical value

v) Decision :-

The Cal value of $z_1 = 8.3$ is greater than table value of $z = 1.96$

∴ Null hyp rejected

Q) The mean of two random samples of size 9 & 7 are 196.42 & 1988. The sum of the squares of deviate from the means are 26.94 & 18.73 / on the sampling be considered to have been drawn from same population

A) $n_1 = 9$ $\quad n_2 = 7$

$\bar{x}_1 = 1864$ $\quad \bar{x}_2 = 1988$

$\sum (x_i - \bar{x}_1)^2 = 26.94$ $\quad \sum (y_i - \bar{y})^2 = 18.72$

i) $H_0 : \mu_1 = \mu_2$

$H_a : \mu_1 \neq \mu_2$

ii) TEA statistic

$$S_p = \sqrt{\frac{\sum (x_i - \bar{x}_1)^2 + \sum (y_i - \bar{y})^2}{n_1 + n_2 - 2}}$$

$$= \sqrt{\frac{26.94 + 18.72}{9 + 7 - 2}} = 1.80$$

$$S_E = S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$= (.188) \sqrt{\frac{1}{9} + \frac{1}{7}} = 0.907$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S_E}$$

$$t = \frac{1864 - 1988}{0.907}$$

$$t = -2.64$$

$$|t| = 2.64$$

iv) Critical value:-

The table value of t is 1.06 with df $\nu = n_1 + n_2 - 2 = 14$ is 2.15

b) Decision

$\therefore$ Null is degected

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Q) A sample of 8 students of bcets can show up a mean blood pressure of 118.4 mm of Hg with SD 12.17 mm Do you think data provided is enough?

A) $n_1 = 8$ $\quad n_2 = 10$
$\bar{x}_1 = 118.4$ $\quad \bar{x}_2 = 121$
$s_1 = 12.17$ $\quad s_2 = 12.88$

i) $H_0 : \mu_1 = \mu_2$
$H_a : \mu_1 \neq \mu_2$

ii) Test statistic

$$s_p = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2}}$$

$$= 13.33$$

$$SE = s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$13.33 \sqrt{\frac{1}{8} + \frac{1}{10}}$$

$$= 6.92$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{SE}$$

$$= \frac{118.4 - 121}{6.92} = -0.41$$

$$|t| = 0.41$$

v) Decision :- Null hypo Accepted