STUDENT'S t- TEST :

PROCEDURE :

Step 1 : Formulate H_0 and H_1

Step 2 : Los at α ?.

Step 3 : compute Test statistic t.

Step 4 : Calculate t_{tab} for degrees of freedom at level α

Step 5 : Conclusion.

TEST FOR SINGLE MEAN :

Null hypothesis : $H_0 : \mu = \mu_0$.

Test statistic, $t = \dfrac{\bar{x} - \mu}{S/\sqrt{n-1}}$ if SD is given.

$t = \dfrac{\bar{x} - \mu}{S/\sqrt{n}}$ if SD is not given.

[To find s :

$$s^2 = \frac{\Sigma (x - \bar{x})^2}{n-1}$$]

Degrees of freedom : $\nu = n - 1$

NOTE : Confidence Limit : $\bar{x} \pm t_\alpha \dfrac{S}{\sqrt{n-1}}$

1) A random sample of 10 boys had the following IQ's. 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do these data support the assumption of a population mean IQ's of 100?. Find a reasonable range in which most of the mean IQ's value of sample 10 boys.

Soln: Given : $n = 10$, $\mu = 100$

$$\bar{x} = \frac{70+120+110+101+88+83+95+98+107+100}{10}$$

$$= 97.2.$$

To find s : $s^2 = \frac{\Sigma (x-\bar{x})^2}{n-1}$

x	70	120	110	101	88	83	95	98	107	100
$x-\bar{x}$	-27.2	22.8	12.8	3.8	-9.2	-14.2	-2.2	0.8	9.8	2.8
$(x-\bar{x})^2$	739.84	519.84	163.84	14.44	84.64	201.64	4.84	0.64	96.04	7.84

$$\Sigma (x-\bar{x})^2 = 1833.6.$$

$$\therefore s^2 = \frac{\Sigma (x-\bar{x})^2}{n-1} = \frac{1833.6}{10-1}$$

$$= 203.73$$

$$\Rightarrow s = 14.27.$$

Step 1: Formulating H_0 and H_1:

$H_0: \mu = 100$

$H_1: \mu \neq 100$ (two tailed test)

Step 2: LOS at $\alpha = 5\% = 0.05$

Step 3: Test statistic, $t = \dfrac{\bar{x} - \mu}{S/\sqrt{n}}$

$= \dfrac{97.2 - 100}{14.27/\sqrt{10}}$

$= -0.62$

$|t| = 0.62$.

Step 4: t_{tab} for degree of freedom, $\nu = n - 1$

$\nu = 10 - 1 = 9$

(a) t_{tab} : 2.262 (t_α)

Step 5: Conclusion: $t = 0.62 < 2.262 = t_\alpha$

$\therefore$ H_0 is accepted at 5% LOS.

(a): the population mean IQ's is 100.

Confidence limit:

$$\mu = \bar{x} \pm t_{\alpha} \frac{s}{\sqrt{n-1}}$$

$$= 97.2 \pm 2.262 \times \frac{14.27}{\sqrt{10-1}}$$

$$= 97.2 \pm 10.759$$

$$= 107.95, 86.45$$

2) A sample of 26 tube lights gives a mean life of 990 hour with a standard deviation of 20 hours. The company claims that the mean life of tube lights is 1000 hours. Is the sample upto the specifications?

Soln: Given: $n = 26$, $\bar{x} = 990$, $s = 20$, $\mu = 1000$

step 1: Formulating H_0 and H_1:

$H_0: \mu = 1000$

$H_1: \mu < 1000$ (one tailed test)

step 2: LOS at $\alpha = 5\%$.

step 3: Test statistic, $t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}}$

$$= \frac{990-1000}{20/\sqrt{26-1}} = -2.5$$

$$|t| = 2.5$$

Step 4 : t_{tab} for degree of freed, $\nu = n-1 = 26-1 = 25$

$= 25$

(ii) $t_{tab} : t_\alpha = 1.7080$ (two-sided at 10%)

Step 5 : Conclusion : $t = 2.5 > 1.7080 = t_\alpha$ (at 5% one-sided)

$\therefore$ H_0 is rejected at 5% LOS.

(ii) The sample is ~~not~~ upto the specifications.

3) The weights of 10 peoples of a locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66 kg it is reasonable to believe that the average weights of people locality greates than 64 kg. test at 5% LOS.

Soln: Given : $n = 10$, $\mu = 64$

$$\bar{x} = \frac{70+67+62+68+61+68+70+64+64+66}{10}$$

$$\bar{x} = 66$$

To find s :

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

x:	70	67	62	68	61	68	70	64	64	66
$x-\bar{x}$:	4	1	-4	2	-5	2	4	-2	-2	0
$(x-\bar{x})^2$:	16	1	16	4	25	4	16	4	4	0

$$\Sigma (x-\bar{x})^2 = 90$$

$$\therefore s^2 = \frac{\Sigma (x-\bar{x})^2}{n-1} = \frac{90}{10-1} = 10$$

$$s = 3.16$$

step 1 : Formulating H_0 and H_1 :

$H_0: \mu = 64$

$H_1: \mu > 64$ (one tailed test - right)

step 2 : LOS at $\alpha = 5\%$.

step 3 : Test statistic, $t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

$$= \frac{66 - 64}{3.16/\sqrt{10}}$$

$$= 2.02$$

Step 4: t_{tab} for degree of freedom, $\nu = n-1$

$= 10-1$

$= 9$

(i) t_{tab}: $t_\alpha = 1.833$ (at two tailed at 10 %.)

(no table)

$t_\alpha = 0.9165$ (at one tailed at 5 %.)

Step 5: Conclusion: $t = 2.02 > 1.833 > 0.9165 = t_\alpha$

$\therefore$ H_0 is rejected at 5 % LOS

(ie) the avg. weight of people locality is greater than 64.1 kg.