Q.1. A coaching institute claims that the average score of it's students in math is 75 marks. A random sample of 12 students shows a mean score of 71 marks with a standard deviation of 8 marks. At 5% of significance level, test whether the claims is correct.

→ Given -

$\bar{x} = 71$ $\mu = 75$. $n = 12$,

$\sigma = 8$ $\alpha = 5\%$ C.I = 95% = 0.95

Null Hypothesis = $H_0 = 75$

Alternate Hypothesis: $H_1 \neq 75$

~~Critical value~~ = ~~1.96~~

Statistical ~~Analysis~~ :

Degree of Freedom = 12-1

= 11

Critical value = ±2.201

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

$$= \frac{71 - 75}{8 / \sqrt{12}}$$

$$= \frac{-4}{8 / 3.46}$$

$$= \frac{-4}{2.31}$$

$$= -1.73$$

Conclusion: T value is lied between ± 2.201. We failed to reject the null hypothesis. It means ~~we~~ The average marks of all students is 75.

Q.2 ~~One~~ - ~~S~~ A company that the average battery life of it's ~~students~~ products is 10 hrs. A sample of 9 batteries showss a mean life of 11.2 hours with a standard deviation of 1.5 Hrs. Test at 5% level ~~wtheter~~ whether the battery life is greater than claimed

→ <u>Given</u> : $\mu = 10$, $n = 9$, $\bar{x} = 11.2$

$\sigma = 1.5$, $\alpha = 0.05$ $C.I = 0.95$

Null Hypothesis : $H_0 = 10$

Alternet Hypothesis. $H_1 > 10$

Degree of freedom : $9-1 = 8$

t critical value : 1.860

statistical andlysis :

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

$$= \frac{11.2 - 10}{1.5/\sqrt{9}}$$

$$= \frac{1.2}{1.5/3}$$

$$: \cancel{0.5}\ \frac{1.2}{0.5}$$

$=$

$: 2.4$

conclusion.

$t >$ t critical.

$2.4 > 1.860$.

~~Th~~ Test reject Null Hypothesis. it's mean battery life is greater than claimed.

A restaurant claims that the average delivery time is 30 min. A Sample of 15 orders shows as average time of 32 min with standard deviation 4 min. Test at 1% of level whether the delivery time is more than claimed.

→ <u>Given</u>: $n = 15$ $\mu = 30$, $\bar{x} = 32$

$\alpha = 1\% = 0.01$ $\sigma = 4$

Null Hypothesis : $H_0 = \mu = 30$

Alternate Hypothesis: $H_1 : \mu > 30$

* Degree of Freedom $= 16 - 1 = 15$
* critical value - $t_{critical} = 2.602$

Statistical Analysis:

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

$$= \frac{32 - 30}{4/\sqrt{16}}$$

$$= \frac{2}{\cancel{4}/\cancel{4}}$$

$$= 2.$$

conclusion =

$t < t\cdot critical.$

$2 < 2.602$

It's means we failed to reject the null Hypothesis. ~~The~~ A restaurant claimed was right about their average delivery time.

4 A teacher wants to compare the performance of class A & class B.

- Class A : $n_1 = 10$, mean : 68 , SD : 6
- class B : $n_2 = 12$, mean : 72 , SD : 5

At 5% significance level, test whether there is a significant difference between the two class.

→

Null Hypothesis = $\mu_1 = \mu_2$

Alternet Hypothesis = H_1 = $\mu_1 \neq \mu_2$

Significance level = 0.05

Statistical calculation =

Pooled variance

$$Sp^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

$$= \frac{(10-1)\,36 + 11 \times 25}{20}$$

$$= \frac{9 \times 36 + 11 \times 25}{20}$$

$$= \frac{324 + 275}{20}$$

$$= \frac{599}{20}$$

$$Sp^2 = 29.95$$

$$Sp = \sqrt{29.95}$$

$$Sp = 5.47$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{Sp\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

$$= \frac{68-72}{5.47\sqrt{0.1+0.0833}}$$

$$= \frac{-4}{5.47 \times 0.428}$$

$$= \frac{-4}{2.34}$$

$$=$$

$$t = -1.71$$

$$|t| = 1.71.$$

Degree of freedom:

$n_1+n_2-2 = 20$

t critical = 2.086

t < t critical =

We failed to Reject null Hypothesis.

Their is no significant difference betw class A & class B

Q.5 A Fitness trainer records the weights (kg) of 8 clients before & after a 2-month program.

client →	1	2	3	4	5	6	7	8
Before →	82	75	90	68	77	85	73	88
After →	78	72	85	65	74	80	70	84
difference →	4	3	5	3	3	5	3	4

~~As~~ At 5% significance level whether there significiantly reduced weight.

→ Null Hypothesis = $H_0 = \mu = 0$

Null Hypothesis = $H_1 = \mu > 0$

variance = $\frac{\Sigma(x-\bar{x})^2}{n-1}$: mean = $\bar{x} = \frac{4+3+5+3+3+5+3+4}{8}$

$\bar{x} = \frac{30}{8} = 3.75$

$x-\bar{x}$ = 0.25 -0.75 1.25 -0.75 -0.75 1.25 ....

$(x-\bar{x})^2$ = 0.0625 0.5625 1.5625 0.5625 0.5625 1.5625 0.5625 0.0625

variance = $S_p^2 = \frac{5.5}{8-1} = \frac{5.5}{7} = 0.7857$

SD = $S_p = \sqrt{0.7857}$

$S_p = 0.886$

T - test (paired) :

$$t = \frac{\bar{x}}{SD/\sqrt{n}}$$

$$= \frac{3.75}{0.886/\sqrt{8}}$$

$$= \frac{3.75}{0.886/2.82}$$

$$= \frac{3.75}{0.3141}$$

$$t = 11.93$$

t critical :

degree of freedom : 8 - 1 = 7

$\alpha = 0.05$

t critical : 1.895

Conclusion : t > t critical .

we reject the null Hypothesis .

All clients reduces their weight significantly with the help of trainer.

Q.6 Two companies pay different average salaries to freshers :

→ Company X : n = 8 mean salary = Rs 28.000

SD = Rs 3.000

Company Y : n = 10 Mean salary = Rs 30.500

SD = Rs 2.500

Test at 5 % significance level whether there is a difference in salaries.

⇒ Null Hypothesis : $H_0 = \mu_1 = \mu_2$

Alternate Hypothesis $H_1 = \mu_1 \neq \mu_2$

Degree of freedom = 8+10 - 2 = 16

α = 5 % = 0.05

critical value at two tail = 2.120.

Statistical Analysis :

standard deviation : $\dfrac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$

$$sp^2 : \frac{7 \times (3000)^2 + 9 \times (2500)^2}{16}$$

$$: \frac{9000000 \times 7 + 9 \times 6250000}{16}$$

$$: \frac{63,000000 + 56,250,000}{16}$$

$$= \frac{119250000}{16}$$

sp^2 : 7,453,125

sp = 2730.041

1

$$t = \frac{\overline{x_1} - \overline{x_2}}{S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$= \frac{28000 - 30500}{2730.041 \sqrt{\frac{1}{8} + \frac{1}{10}}}$$

$$= \frac{-2500}{2730.041 \sqrt{0.125 + 0.1}}$$

$$= \frac{2500}{2730.041 \times 0.47}$$

$$= \frac{2500}{1283.11}$$

$$t = -1.948$$

$$|t| = 1.948$$

Conclusion: $t < t_{critical}$.

we failed to reject null Hypothesis,

It's means both the companies gives equal average salaries for freshers.