

**Subject: Applied Mathematics IV**

**SEM:IV**

② The means of 2 random sample of size  $n_1$  &  $n_2$  are 196.42 & 198.82 respectively. The sum of the squares of the deviations from the means are 26.94 & 18.73 respectively. Can the samples be considered to have been drawn from the same population.

Soln:-

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

$$\bar{x}_1 = 196.42 \quad \bar{x}_2 = 198.82$$

$$\sum (x_i - \bar{x}_1)^2 = 26.94 ; \sum (x_i - \bar{x}_2)^2 = 18.73$$

① Null hypothesis  $\mu_1 = \mu_2$

Alternative hypothesis  $\mu_1 \neq \mu_2$ .

② Test statistic

$$s_p = \sqrt{\frac{\sum (x_i - \bar{x}_1)^2 + \sum (x_i - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

$$= \sqrt{\frac{26.94 + 18.73}{9 + 7 - 2}} = 1.81$$



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$$SE = SP \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$
$$= 1.081 \sqrt{\frac{1}{9} + \frac{1}{7}} = 0.91$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{SE}$$
$$= \frac{196.42 - 198.82}{0.91}$$
$$= -2.64$$

$$|t| = 2.64$$

③ Level of significance

$$\alpha = 0.05$$

④ Critical value

The value of  $|t_\alpha|$  at  $\alpha = 0.05$  for  
 $n_1 + n_2 - 2 = 14$  d.o.f is  $|t_\alpha| = 2.145$

⑤ Decision:-  $|t| > |t_\alpha|$

$\therefore$  We reject the hypothesis.



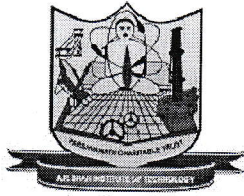
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③ The heights of six randomly chosen sailors are in inches: 63, 65, 68, 69, 71 & 72. The heights of 10 randomly chosen soldiers are 61, 62, 65, 66, 69, 69, 70, 71, 72 & 73. Discuss in light that these data throw on the suggestion that the soldiers on an average are taller than sailors.

Solns:-

$X_i$	$d_i$	$d_i^2$	$\sqrt{d_i^2}$
63	-5	25	61
65	-3	9	62
68	0	0	65
69	1	1	66
71	3	9	69
72	4	16	69
			70
			71
			72
			73



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$$\bar{X} = \frac{408}{6} = 68$$

$$\bar{Y} = \frac{678}{10} = 67.8$$

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

$$= \sqrt{\frac{60 + 163.60}{6 + 10 - 2}} = 3.9$$

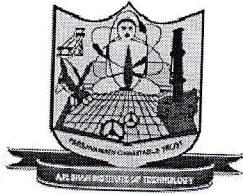
$$SE = S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$= 3.9 \sqrt{\frac{1}{6} + \frac{1}{10}} = 2.014$$

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

$$= \frac{68 - 67.8}{2.014} = 0.099$$





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③ Level of significance:-

$$\alpha = 0.05$$

④ Critical value:-

The value of  $t_{\alpha}$  at  $\alpha = 0.05$  for  
 $n_1 + n_2 - 2 = 14$  dof is  $|t_{\alpha}| = 2.145$ .

$$\therefore |t| < |t_{\alpha}|$$

$\therefore$  We accept the hypothesis.

$\chi^2$ -test

$$\chi^2 = \sum \left( \frac{(O-E)^2}{E} \right)$$

where  $O \rightarrow$  observed frequency.

$E \rightarrow$  Expected frequency.

Yates's Correction:-

$$\chi^2 = \sum \left\{ \frac{(O-E-0.5)^2}{E} \right\}$$