(2) The means of 2 random sample of size 9 & 7 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:-

$n_1 = 9 \qquad n_2 = 7$

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

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

(1) Null hypothesis $\mu_1 = \mu_2$

Alternative hypothesis $\mu_1 \neq \mu_2$.

(2) Test statistic

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

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

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

$$= 1.81\sqrt{\frac{1}{9}+\frac{1}{7}} = 0.91$$

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

$$= \frac{196.42 - 198.82}{0.91}$$

$$= -2.64$$

$$|t| = 2.64$$

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.

(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.

Soln:-

x_i	d_i	d_i^2	y	d_i	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		

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

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

$$S_p = \sqrt{\frac{\Sigma(X_i-\bar{X})^2 + \Sigma(Y_i-\bar{Y})^2}{n_1+n_2-2}}$$

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

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

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

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

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

③ Level of significance :-

$\alpha = 0.05$

④ Critical value :-

The value of t_α 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.

χ^2 - test

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

where $O \to$ observed frequency.

$E \to$ Expected frequency.

Yate's correction :-

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