① Soln:- Here $n = 20$, $\bar{x} = 42$, $S = 5$

$\mu = 45$, $\sigma = ?$ (unknown)

let H_0: The sample is drawn from a population with mean $\mu = 45$

i.e $H_1: \mu \neq 45$

under H_0, $z = \frac{\bar{x} - \mu}{S/\sqrt{n}} = \frac{42 - 45}{5/\sqrt{20}}$

$z = \frac{-3}{5/\sqrt{20}} = -0.1341$

i.e $|z| = 0.1341 < 1.96$ the significant value of z at 5% leve of significance, H_0 is accepted i.e the sample is drawn from the population with mean 45 Ans

(2) soln:- H_0 : The variance are equal i.e $\sigma_1^2 = \sigma_2^2$
i.e the samples have been drawn from normal populations with same variance

$H_1 : \sigma_1^2 \neq \sigma_2^2$

under null hypothesis, the

test statistic $F = \frac{s_1^2}{s_2^2}$ $(s_1^2 > s_2^2)$

and $s_1^2 = \frac{\sum (x_1 - \bar{x}_1)^2}{n_1 - 1}$

$s_2^2 = \frac{\sum (x_2 - \bar{x}_2)^2}{n_2 - 1}$

computation for s_1^2 and s_2^2

Here $n_1 = 6$

$n_2 = 7$

x_1	$(x_1-\bar{x}_1)$	$(x_1-\bar{x})^2$	x_2	$(x_2-\bar{x}_2)$	$(x_2-\bar{x}_2)^2$
29	0.84	0.7856	28	−3.14	9.8596
30	1.84	3.3856	30	−1.14	1.2996
31	2.14	8.0656	33	+1.86	3.4596
24	−4.16	17.3056	32	0.86	0.7396
27	−1.16	1.3456	32	0.86	0.7396
28	−0.16	0.0256	29	−2.14	4.5796
			34	2.86	8.1796
total		30.9136		total	16.098

$$\bar{x}_1 = \frac{169}{6} = 28.16,$$

$$s_1^2 = \frac{\Sigma(x_1-\bar{x}_1)^2}{n_1-1} = \frac{30.9136}{5} = 6.1827$$

$$s_2^2 = \frac{\Sigma(x_2-\bar{x}_2)^2}{n_2-1} = \frac{16.098}{6} = 2.683$$

$$\therefore F = \frac{s_1^2}{s_2^2} = \left(\frac{6.1827}{2.683}\right) = 2.30$$

i.e $s_1^2 > s_2^2$

Conclusion. The tabulated value of F at $v_1 = 6-1$ and $v_2 = 7-1$ d.f for 5% level of significance is 4.39

Since the tabulated value of F is greater than the calculated value, Ho is accepted i.e there is no significant difference the variance i.e the samples have been drawn from the normal population with same variance.

③ Soln:- We have $\bar{x}_1 = 67.5$ and $\bar{x}_2 = 68.0$

$n_1 = 1000$ and $n_2 = 2000$

On the hypothesis, that the samples are drawn from the same population of S.D = 9.5

we get

$$z = \frac{(\bar{x}_2 - \bar{x}_1)}{\sigma\sqrt{\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = \left(\frac{0.5}{9.5 \times 0.0387}\right)$$

$$= 1.3599$$

i.e $|z| = 1.3599$

Conclusion. As the calculated value of $|z| < 1.96$ the significant value of z at 5% level of significance, Ho is accepted i.e there is no significant difference between mean scores.

Hence samples are regarded to have been drawn from the same population.

(4) soln:- Here $n = 200$

$\bar{x} = S = 5.5, \quad \sigma = 5$

let $\alpha = 5\%$

$$z = \frac{S - \sigma}{\sigma/\sqrt{n}} \sim N(0,1)$$

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

Table value $z_\alpha = 1.96$

since $z = 2 > 1.96$, Reject H_0

∴ The given sample was not taken from the population Ans.

⑤ Soln :- let X be the sample mean of a random sample of size n, then

$\bar{X} \sim N(\mu, 4^2/n)$ and $\mu = 30$

$P(25-\mu < \bar{X}-\mu < 35) = 0.98$

$\Rightarrow P\left(\frac{(25-\mu)}{4/\sqrt{n}} < \left(\frac{\bar{x}-\mu}{\frac{4}{\sqrt{n}}}\right) < \frac{35-\mu)}{\frac{4}{\sqrt{n}}}\right) = 0.98$

$\Rightarrow P\left(\frac{25-\mu)}{4/\sqrt{n}} < z < \frac{(35-\mu)}{\frac{4}{\sqrt{n}}}\right) = 0.98$

$\Rightarrow P\left(\frac{-5}{\frac{4}{\sqrt{n}}} < z < \frac{5}{\frac{4}{\sqrt{n}}}\right) = 0.98 \Rightarrow P\left(0 < z < \frac{5}{\frac{4}{\sqrt{n}}}\right) = 0.49$

$\frac{5}{\frac{4}{\sqrt{n}}} = 2.32$

$\Rightarrow n = \left(\frac{2.32 \times 4}{5}\right)^2$

$= 3.44 \simeq 4$ Ans

(c) Soln :- Here $n = 64$, $\bar{x} = 32$

$\mu = 38$

$S = 5.8$

H_0 : The sample is drawn from a population with with mean $\mu = 38$

H_1 : $\mu \neq 38$

Under H_0, $z = \dfrac{\bar{x}-\mu}{\left(\frac{S}{\sqrt{n}}\right)} = \dfrac{32-38}{\left(\frac{5.8}{64}\right)}$

$= -\left(\dfrac{6 \times \sqrt{64}}{58} \times 10\right) = -6\cancel{8}.20$

$= -8.27$

i.e $|z| = 8.27$

Conclusion. Since the calculated value of $|z| > 1.96$, the significant value of z at 5% level of significance H_0 is rejected i.e the sample is not drawn from the population with mean 38 i.e average life span~~se~~ is less than 40 Ans.

(7) Soln :- H_0 : $\sigma^2 = (0.022)^2 = 4.84 \times 10^{-4}$

$n = 18$, $S^2 = 0.000324 = 3.24 \times 10^{-4}$

H_1 : $\sigma \neq 0.022$

$\chi^2 = \dfrac{(n-1)S^2}{\sigma^2}$

$= \left[\dfrac{(18-1)(3.24)\times \cancel{10^{-4}}}{4.84 \times \cancel{10^{-4}}}\right]$

$= \left(\dfrac{17 \times 3.24}{4.84}\right) = 11.38$

Table value $\chi^2_{17}(0.05) = 27.59 > 11.38$

Hence H_0 is accept Ans

⑧ Sol^n: Here $n = 15$

$s = 7 \Rightarrow s^2 = (7)^2$

$\sigma = 7.6 \Rightarrow \sigma^2 = (7.6)^2$

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2}$$

$$= \frac{(7-1)(7)^2}{(7.6)^2} = \frac{\cancel{8}\ 6 \times 7^2}{(7.6)^2} = 5.09$$

Table value of $\chi^2_6 (0.05) = 12.6$

since $12.6 > 5.09$ Hence H_0 is accepted.

⑨ Sol^n: Here $n = 100$, $\bar{x} = 80$, $s = 10$

$\mu = 78$ cm

H_0: The sample is drawn from a population with mean 78

H_1: $\mu \neq 78$

under H_0 $\quad z = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{80 - 78}{10/\sqrt{100}} = -2$

i.e $|z| = 2$

Conclusion: since $|z| = 2 > 1.96$, the significant value of z at 5% level of significance. H_0 is rejected i.e the sample is not draw from the population with mean 78 Ans

(10) Soln:- Given $H_0: \sigma_1^2 = \sigma_2^2$

$H_1: \sigma_1^2 \neq \sigma_2^2$ at $\alpha = 0.01$

$n_1 = 8, \; n_2 = 8$

$s_1^2 = 3.89, \; s_2^2 = 4.02$

$$\frac{n_1 s_1^2}{n_1 - 1} = \frac{8(3.89)}{7} = 4.44$$

$$\frac{n_2 s_2^2}{n_2 - 1} = \frac{8(4.02)}{7} = 4.59$$

$\therefore$ Test statistic $F = \dfrac{\left(\frac{n_1 s_1^2}{n_1-1}\right)}{\left(\frac{n_2 s_2^2}{n_2-1}\right)} = \dfrac{4.44}{4.59}$

$= 0.967$

Table value $F_{\alpha = 0.01} = 3.79$

since $3.79 > 0.967$, Accept H_0 Ans.

(11) Soln:- Here $n = 900, \; \bar{x} = 3.4, \; \mu = 3.2, \; \sigma = 2.3$

H_0: Assume that the sample is drawn from large population with mean 3.2 & S.D = 2.3

H_1: $\mu \neq 3.25$ (Apply two tailed test)

under H_0; $z = \left(\dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}}\right) = \left(\dfrac{3.4 - 3.2}{2.3/\sqrt{900}}\right) = 0.261$

Conclusion. As the calculated value of $|z| = 0.261 <$ 1.96 the significant value of z at 5% level of significance. H_0 is accepted i.e the sample is drawn from the population with mean 3.2 & S.D = 2.3 Ans

(12) Soln :- Here $n = 100$

$s = 15$

$\bar{X} = 116$, $\mu = 120$

H_0 : There is no significant difference between $\bar{X}$ & μ

under H_0

$$z = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \left(\frac{116 - 120}{15/10}\right) = \frac{-4 \times 10}{15}$$

$$= -2.66$$

i.e $|z| = 2.66$

Conclusion : As the calculated value of $|z| > 1.96$ at 5 % level of significance. H_0 is Rejected i.e dictation at the rate of 120 words can not possible. Ans.