A sample of 900 plants is found to have a mean of 34 cm. Can it be reaso[nably] regarded as a random sample from a large population with mean 32 cm standard deviation 23 cm. Use 5 % level of significance.

[Sol]ution:

Null hypothesis: $H_0 : \mu = 32$

Alternative hypothesis: $H_1 : \mu \neq 32$

Level of significance: $\alpha = 0.05$

Test - statistic: $Z = \dfrac{\bar{X} - \mu_0}{\sigma / \sqrt{n}}$

Critical region: $|Z| > 1.96$ ($Z < -1.96$ and $Z > 1.96$)

From the area table of normal distribution, we have $Z_{\frac{\alpha}{2}} = Z_{0.025} = 1.96$)

[C]omputations: Here, $n = 900$, $\bar{X} = 34$, $\sigma = 23$, and hence

$$Z = \frac{34 - 32}{\frac{23}{\sqrt{900}}} = \frac{2}{23}(30) = 2.61$$

[C]onclusion: Since the calculated value of $Z = 2.61$ falls in the c[ritical] region, so we reject our null hypothesis $H_0: \mu = 32$ [at 5 %] level of significance. We may conclude that a r[andom] sample cannot be reasonably regarded from a [large] population with mean 32 cm.

[S]uppose that the variance of the IQ'S of the high school students in a [...]

Q.5 Suppose that scores on an aptitude test used for determining admission to graduate study in statistics are known to be normally distributed with a mean of 500 and a population standard deviation of 100. If a random sample of 64 applicants from a college has a sample mean of 537, is there any evidence that their mean score is different from the mean expected of all applicants? Use $\alpha = 0.01$.

Population σ.
n = 64

Solution:

1. **Null hypothesis:** $H_o : \mu = 500$

Alternative hypothesis: $H_1 : \mu \neq 500$

2. **Level of significance:** $\alpha = 0.01$

3. **Test - statistic:**

$$Z = \frac{\bar{X} - \mu_o}{\sigma / \sqrt{n}}$$

4. **Critical region:** $| Z | > 2.575$ ($Z < -2.575$ and $Z > 2.575$)

(From the area table of normal distribution, we have $Z_{\frac{\alpha}{2}} = Z_{0.005} = 2.575$)

Computations: Here, $n = 64$, $\bar{X} = 537$, $\sigma = 100$, and hence

$$Z = \frac{537 - 500}{\frac{100}{\sqrt{64}}} = \frac{37}{100}(8) = 2.96$$

Conclusion: Since the calculated value of $Z = 2.96$ falls in the critic region, so we reject our null hypothesis H_o: $\mu = 500$ 1 % level of significance. On the basis of the eviden we may conclude that their mean score is different fr the mean expected of all applicants.

Q.7 A random sample of 25 values gives the average of 83. Can this sample be regarded as drawn from the normal population with mean 80 and standard deviation 7 at 5% level of significance?

$H_0: \mu = 8$
$H_1: \mu \neq 80$

Solution:

- **Null hypothesis:** $H_0 : \mu = 80$
- **Alternative hypothesis:** $H_1 : \mu \neq 80$
- **Level of significance:** $\alpha = 0.05$
- **Test - statistic:** $Z = \dfrac{\bar{X} - \mu_0}{\sigma / \sqrt{n}}$
- **Critical region:** $| Z | > 1.96$ $(Z < -1.96$ and $Z > 1.96)$

(From the area table of normal distribution, we have $Z_{\frac{\alpha}{2}} = Z_{0.025} = 1.96$

- **Computations:** Here, $n = 25$, $\bar{X} = 83$, $\sigma = 7$ and hence

$$Z = \frac{83 - 80}{\frac{7}{\sqrt{25}}} = \frac{3}{7} \times 5 = 2.14$$

Conclusion: Since the calculated value of $Z = 2.14$ falls in region, so we reject our null $H_0: \mu = 80$ at 5 % level of significance. We m that this sample cannot be regarded from population with $\mu = 80$ and $\sigma = 7$.

Q.8. A random sample of 64 drinks from a soft-drink machine has an average content of 21.9 deciliters, with a standard deviation of 1.42 deciliters. Test the hypo-thesis that $\mu = 22.2$ deciliters against the alternative hypothesis $\mu < 22.2$, at the 5 % level of significance.

H1: μ = 22.2
μ < 22.2
S

Solution:

1. **Null hypothesis:** $H_0 : \mu = 22.2$

   Alternative hypothesis: $H_1 : \mu < 22.2$

2. **Level of significance:** $\alpha = 0.05$

3. **Test - statistic:**

$$Z = \frac{\overline{X} - \mu_0}{S / \sqrt{n}}$$

$-Z\alpha$

4. **Critical region:** $Z < -1.645$

   (From the area table of normal distribution, we have $-Z_\alpha = -Z_{0.05} = -1.645$)

5. **Computations:** Here, $n = 64$, $\overline{X} = 21.9$ and $S = 1.42$; we get

$$Z = \frac{21.9 - 22.2}{\frac{1.42}{\sqrt{64}}} = \frac{-0.3}{1.42}(8) = -1.69$$

[Zcal]

6. **Conclusion:** Since the calculated value of $Z = -1.69$ falls in critical region, so we reject our null hypothe[sis] $H_0: \mu = 22.2$ at 5 % level of significance.

... trucks were driven on the average 16300 miles a ...