5.1.1 : Class work problems

① The mean lifetime of a sample of 100 flourescent light bulbs produced by a company is found to be 1570 hours with a S.D. of 120 hours. Test the hypothesis that the mean life time of the bulbs produced by the company is 1600 hours against the alternative hypothesis that it is less than 1600 hours at 5% level of significance

Solution:- By given $n=100$, $\bar{x}=1570$, $S=120$, $\mu=1600$

$H_0 : \mu = 1600$

$H_1 : \mu < 1600$

$$\therefore z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{\bar{x}-\mu}{S/\sqrt{n}} = \frac{1570-1600}{120/\sqrt{100}} = -2.5$$

$\therefore |z| = 2.5$

we know $Z_\alpha = Z_{5\%} = 1.645$

$\therefore |z| > Z_\alpha$

$\therefore$ H_0 is rejected ie H_1 is accepted $\therefore \mu < 1600$

$\therefore$ Life time of bulbs produced by company is less than 1600 hours

② Can it be conclude that the average life ~~time~~ span of an indian is more than 70 years. If random sample of 100 indians has an average life span of 71.8 years with standard deviation of 8.9 years?

Solution:- By given $n=100$, $\bar{x}=71.8$, $S=8.9$, take $\mu=70$

$H_0 : \mu = 70$

$H_1 : \mu > 70$

$$\therefore Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{\bar{x}-\mu}{S/\sqrt{n}} = \frac{71.8-70}{8.9/\sqrt{100}} = 2.0225$$

$Z_\alpha = Z_{5\%} = 1.645$

$\therefore Z > Z_\alpha$

$\therefore$ H_0 is ~~accepted~~ rejected ie H_1 is accepted $\therefore \mu > 70$

$\therefore$ we can conclude that the average lifespan of indians is more than 70

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③ A Sample of 100 Students is taken from a large population. The mean height of the students in this Sample is 160 cm. Can it be reasonably regarded that, in the population, the mean height is 165 cm and standard deviation is 10 cm

Solution :- By given $n=100$, $\bar{x}=160$, $\mu=165$, $\sigma=10$

$H_0: \mu=165$

$H_1: \mu \neq 165$

$$Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{160-165}{10/\sqrt{100}} = -5$$

$\therefore |Z| = 5$

$Z_\alpha = Z_{5\%} = 1.96$

$\therefore |Z| > Z_\alpha$

$\therefore$ H_0 is rejected i.e. H_1 is accepted $\therefore$ $\mu \neq 165$

we can not concluded that in the population the mean height is 165 cm

---

④ The mean breaking strength of cables supplied by a manufacture is 1800 with standard deviation 100. By a new technique in the manufacturing processes it is claimed that the breaking strength of the cableds has increased. in order to test the claim a Sample of 50 cables tested. it is found that the mean breaking strength is 1850. Can we support the claim at 1% Level of significance?

Solution :- By given $\mu=1800$, $\sigma=100$, $\bar{x}=\cancel{1800}\ 1850$ $n=50$

$H_0: \bar{x} = \cancel{1800}\ \mu$

$H_1: \bar{x} > \mu$

$$Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \cancel{1800} \ \frac{1850-1800}{100/\sqrt{50}} = 3.5355$$

$Z_\alpha = Z_{1\%} = 2.33$

$\therefore$ $Z > Z_\alpha$

$\therefore$ H_0 is rejected ie H_1 is accepted $\therefore$ $\bar{x} > \mu$

$\therefore$ breaking strength of the cable has increased

$\therefore$ claim of the company is accepted.

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5.1.1 : Home Work Problems

① The Personel records of the workers in a factors show that on an average 30 works. remain absent on atleast one day during a week. After the wage revision, a Sample of 30 weeks showed the mean number of worker remaining absent for one or more days during a week to be 27 with a S.D. = 2. Does it shows that after the wage revision the sense of responsibility has increased among the workers ? use 1%. level of significance.

Solution :- $\mu = 30, \bar{x} = 27, S = 2, n = 30$

$H_0 : \mu = 30$

$H_1 : \mu < 30$

$$\therefore Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{\bar{x}-\mu}{S/\sqrt{n}} = \frac{27-30}{2/\sqrt{30}} = -8.216$$

$\therefore |Z| = 8.216$

$Z_\alpha = Z_{1\%} = 2.3$

$\therefore |Z| > Z_\alpha$

$\therefore$ H_0 is rejected ie H_1 is accepted $\therefore \mu < 30$

$\therefore$ it shows that after the wage revision the sense of responsibility has increased among the workers

② A random Sample of 50 items gives the mean 6.2 and standard deviation 10.24. Can it be regarded as drawn from a normal population with mean 5.4 at 5%. LoS ?

Solution :- By given $n = 50, \bar{x} = 6.2, S = 10.24, \mu = 5.4,$

$H_0 : \mu = 5.4$

$H_1 : \mu \neq 5.4$

$$Z = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{\bar{x}-\mu}{S/\sqrt{n}} = \frac{6.2-5.4}{10.24/\sqrt{50}} = 0.5524$$

$Z_\alpha = Z_{5\%} = 1.96$

$\therefore$ ~~$Z > Z_\alpha$~~ $Z < Z_\alpha$

$\therefore$ H_0 is accepted ie $\mu = 5.4$

$\therefore$ it can be conclude that given sample is drawn from a normal population with mean 5.4 at 5%. LoS

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③ A company markets car tires. Their lives are normally distributed with mean 40.000km and standard deviation 3,000 km. A cange in a production process is belived to result in a better product. A test sample of 64 new tires has mean life of 41200 km can you conclude that there is no significant difference between new product mean and current mean.

Solution :- By given $\mu = 40,000$ km, $\sigma = 3,000$ km, $n = 64$, $\bar{x} = 41,200$ km

$H_0: \bar{x} = \mu$

$H_1:$ ~~$\bar{x} > \mu$~~ $\bar{x} \neq \mu$

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{41200 - 40,000}{3000/\sqrt{64}} = 3.2$$

$Z_\alpha = Z_{5\%} = 1.96$

$\therefore |Z| > Z_\alpha$ $\therefore H_0$ is rejected i.e. H_1 is accepted $\therefore \bar{x} > \mu$

$\therefore$ we can not conclude that there is no significant difference between new product mean and current mean.

5.1.2: class work Problems

① The average marks scored by 32 boys is 72 with standard deviation 8 while that of 36 girls is 70 with standard deviation 6. Test at 1% level of significance whether the boys perform better than the girls.

Solution : By given $n_1 = 32$, $\bar{x}_1 = 72$, $S_1 = 8$, $n_2 = 36$, $\bar{x}_2 = 70$, $S_2 = 6$

$H_0: \mu_1 = \mu_2$ $(\bar{x}_1 = \bar{x}_2)$

$H_1: \mu_1 > \mu_2$ $(\bar{x}_1 > \bar{x}_2)$

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} = \frac{72-70}{\sqrt{\frac{8^2}{32} + \frac{36}{36}}} = 1.1547$$

$Z_\alpha = Z_{1\%} = 2.33$

$\therefore Z < Z_\alpha$

$\therefore H_0$ is accepted ie $\mu_1 = \mu_2$ (or $\bar{x}_1 = \bar{x}_2$)

$\therefore$ we can ~~do~~ conclude that the boys performance is better than the girls performance

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② Test the significance of the difference between the means of the samples drawn from two normal populations with same standard deviation using following data.

	size	mean	S. D.
sample - 1	100	61	4
Sample - 2	200	63	6

Solution:- $n_1 = 100$, $\bar{x}_1 = 61$, $S_1 = 4$, $n_2 = 200$, $\bar{x}_2 = 63$, $S_2 = 6$, $\sigma_1 = \sigma_2 = \sigma$, σ is not given

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_2} + \frac{S_2^2}{n_1}}} = \frac{61-63}{\sqrt{\frac{16}{200} + \frac{36}{100}}} = -3.0151 \therefore |Z| = 3.0151$$

$Z_\alpha = 1.96$

$\because |Z| > Z_\alpha \therefore$ H_0 is rejected i.e. H_1 is accepted $\therefore \mu_1 \neq \mu_2$

$\therefore$ we can conclude that there is significant difference between mean of two Samples

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5.1.2 Home work Problems

① The mean of two large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population with S.D. of 2.5 inches

Solution:- By given $n_1 = 1000$, $n_2 = 2000$, $\bar{x}_1 = 67.5$, $\bar{x}_2 = 68.0$, $\sigma = 2.5$

$H_0: \mu_1 = \mu_2 \quad (\bar{x}_1 = \bar{x}_2)$

$H_1: \mu_1 \neq \mu_2 \quad (\bar{x}_1 \neq \bar{x}_2)$

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sigma\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{67.5 - 68.0}{2.5\sqrt{\frac{1}{1000} + \frac{1}{2000}}} = -5.1639$$

$|Z| = 5.1639$

$Z_\alpha = Z_{5\%} = 1.96$

$\therefore |Z| > Z_\alpha$

$\therefore$ H_0 is rejected i.e. H_1 is accepted

i.e $\mu_1 \neq \mu_2 \; (\bar{x}_1 \neq \bar{x}_2)$

$\therefore$ we can not conclude that samples are drawn from same population with S.D. of 2.5 inches

② The mean height of 50 male students who showed above average participation in college athletics was 68.2 inches with a standard deviation of 2.5 inches while 50 male students whow showed no interest in such participation had a mean height of 67.5 inches with a standard deviation of 2.8 inches. Test the hypothesis that male student who participate in athletics are taller than other male students

Solution: By given $n_1 = 50$, $\bar{x}_1 = 68.2$, $S_1 = 2.5$, $n_2 = 50$, $\bar{x}_2 = 67.5$, $S_2 = 2.8$

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 > \mu_2$

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} = \frac{68.2 - 67.5}{\sqrt{\frac{(2.5)^2}{50} + \frac{(2.8)^2}{50}}} = 1.3186$$

$Z_\alpha = Z_{5\%} = 1.645$

$\therefore Z < Z_\alpha$ H_0 is accepted ie $\mu_1 = \mu_2$

we can not concluded that male students who participate in atheletics are than other male students

Interval Estimation 5.1.3: class work problems

① The mean and standard deviation of the load supported by 60 cables are given by 11.09 tons and 0.73 tons respectively. Find 95% and 99% confidence limits for the mean of the loads of all the cables produced by the company

Solution: By given $n = 60$ $\bar{x} = 11.09$, $s = 0.73$

we know confidence interval for α% level of significance for μ is

$\bar{x} - Z_\alpha \frac{s}{\sqrt{n}} < \mu < \bar{x} + Z_\alpha \frac{s}{\sqrt{n}}$ ie $11.09 - Z_\alpha \frac{0.73}{\sqrt{60}} < \mu < 11.09 - Z_\alpha \frac{0.73}{\sqrt{60}}$

For 5% LOS $Z_\alpha = 1.96$ & For 1% LOS $Z_\alpha = 2.58$

$\therefore$ 95% confidence limit for μ is $[11.7153, 12.0847]$

and 99% confidence limit for μ is $[11.6569, 12.1431]$

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5.2.1 : class work Problems

① A lable on the packs of a certain kind of vitamin tablets shows the content (x) to be 250mg per tablet. To verify this a sample of 13 tablets is chosen and it revealed the following

$n = 13 \quad \Sigma x = 3256.50$ and $\Sigma x^2 = 815757.93$

Can we conclude at 5% LOS that the mean per tablet is not 250 mg ?

Solution $n = 13 \quad \bar{x} = \frac{1}{n}\Sigma x_i = 250.5, \quad \sigma_x^2 = \frac{1}{n}\Sigma(x_i)^2 - (\bar{x})^2 = 0.36, \quad \sigma_x = 0.6, \quad \mu = 250$

$H_0 : \mu = 250$

$H_1 : \mu \neq 250$

$t = \frac{\bar{x} - \mu}{S/\sqrt{n-1}} = \frac{250.5 - 250}{0.6/\sqrt{12}} = \cancel{3.0006}\ 2.8866 \quad \& \quad t_\alpha = z_{5\%} = \cancel{1.96}\ 1.782$

$\therefore t > t_\alpha \therefore H_0$ is rejected i.e. H_1 is accepted i.e. $\mu \neq 250$

we can conclude at 5% LOS that $\mu \neq 250$

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② A sample of size 9 from a normal population give $\bar{x} = 15.8$, $s^2 = 10.3$. Find 99% interval of population mean

Solution:- By given $n = 9$, $\bar{x} = 15.8$, $s^2 = 10.3$, $v = n-1 = 8$, $S = 3.2094$

H_0: confidence interval for α% LOS is

$$\bar{x} - t_v(\alpha)\frac{S}{\sqrt{n-1}} < \mu < \bar{x} + t_v(\alpha)$$

i.e. $15.8 - t_v(\alpha) \cdot \frac{3.2094}{\sqrt{8}} < \mu < 15.8 + t_v(\alpha)\frac{3.2094}{\sqrt{8}}$

~~$\therefore t_v(\alpha) = t_8(5\%) = 1.860$~~

~~$\therefore 15.8 - \frac{1.86 \times 3.2094}{\sqrt{8}} < \mu < 15.8 + \frac{1.86 \times 3.2094}{\sqrt{8}}$~~

∴ confidence interval for 5% LOS

$t_v(1\%) = t_8(1\%) = 2.896$

$$\therefore 15.8 - \frac{2.896 \times 3.2094}{\sqrt{8}} < \mu < 15.8 + \frac{2.896 \times 3.2094}{\sqrt{8}}$$

99% confidence interval for μ is

$[12.5139, 19.0861]$

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② Two Samples drawn from two different populations gave the following results:

	Size	mean	standard deviation
Sample - 1	400	124	14
Sample - 2	250	120	12

Find the 95% confidence limits for the difference of the population means

Solution By given $n_1 = 400$, $\bar{x}_1 = 124$, $S_1 = 14$, $n_2 = 250$, $\bar{x}_2 = 120$, $S_2 = 12$

we know confidence interval for α% LOS of $\mu_1 - \mu_2$ is

$$(\bar{x}_1 - \bar{x}_2) - Z_\alpha \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}} < (\mu_1 - \mu_2) < (\bar{x}_1 - \bar{x}_2) + Z_\alpha \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$$

$$(124 - 120) - 1.96 \sqrt{\frac{(14)^2}{400} + \frac{(12)^2}{250}} < (\mu_1 - \mu_2) < (124 - 120) + 1.96 \sqrt{\frac{(14)^2}{400} + \frac{(12)^2}{250}}$$

$\therefore$ 95% confidence interval for $\mu_1 - \mu_2$ is $[1.9764, 6.0236]$

5.1.3 : Home work Problems

① Define level of significance and fiducial limits.

A random Sample of 625 items from a normal population of unknown mean has mean 10 and standard deviation 1.5. what are 95% & 99% fiducial limits for the population mean. ?

Solution $n = 625$, $\bar{x} = 10$, $S = 1.5$

we know confidence interval for population mean μ for α% LOS is $\bar{x} - Z_\alpha \frac{S}{\sqrt{n}} < \mu < \bar{x} + Z_\alpha \frac{S}{\sqrt{n}}$

$$\therefore 10 - Z_\alpha \cdot \frac{1.5}{\sqrt{625}} < \mu < 10 + Z_\alpha \cdot \frac{1.5}{\sqrt{625}}$$

we know For two tailed test for 5% & 1% LOS is $Z_\alpha = 1.96$ and $Z_\alpha = 2.58$ respectively

$\therefore$ For 95% confidence interval $Z_\alpha = 1.96$

$$10 - 1.96 \frac{1.5}{\sqrt{625}} < \mu < 10 + 1.96 \frac{1.5}{\sqrt{625}}$$

$\therefore$ 95% confidence interval for μ is $[9.8824, 10.1176]$

For 99% confidence interval $Z_\alpha = 2.58$

$$10 - 2.58 \frac{1.5}{\sqrt{625}} < \mu < 10 + 2.58 \frac{1.5}{\sqrt{625}}$$

$\therefore$ 99% confidence interval for μ is $[9.8452, 10.1548]$

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⑤ Nine items of a sample had the values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of 9 items differ significantly from the assumed population mean 47.5

Solution: $n=9$, $\mu=47.5$, $\bar{x}=49.1111$, $S=2.4698$

$H_0: \mu=47.5$ & $H_1: \mu\neq 47.5$

$\therefore t=\dfrac{\bar{x}-\mu}{S/\sqrt{n-1}}=\dfrac{49.1111-47.5}{2.4698/\sqrt{8}}=1.845039$

$\nu=n-1=9-1=8$

$\therefore t_\nu(\alpha)=t_8(5\%)=2.306$

$\because t<t_\nu(\alpha)$ $\therefore$ H_0 is accepted $\therefore \mu=47.5$

We can not conclude that mean of 9 items differ significantly from the assumed population mean 47.5

---

⑥ Test made on the breaking strength of 10 pieces of metal ~~plates~~ wire gave the following results:

570, 578, 572, 570, 568, 572, 570, 572, 596, & 584 kg. Test if the mean breaking strength of the metel wire can be assumed to be 577 kg

Solution: $n=10$, $\bar{x}=\frac{1}{n}\Sigma x_i=575.2$, $S_x^2=\frac{1}{n}\Sigma(x_i)^2-(\bar{x})^2=\frac{3309232}{10}-(575.2)^2$

$S_x^2=68.16$ $S_x=8.2559$

$H_0: \mu=577$

$H_1: \mu\neq 577$

$t=\dfrac{\bar{x}-\mu}{S/\sqrt{n-1}}=\dfrac{575.2-577}{8.2559/\sqrt{9}}=-0.654$

$|t|=0.654$

$\nu=n-1=10-1=9$

$\therefore t_\nu(\alpha)=t_9(5\%)=2.265$

$\because |t|<t_\nu(\alpha)$ $\therefore$ H_0 is accepted i.e $\mu=577$

$\therefore$ we can conclude that mean breaking strength of wire is 577

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(3) Ten individuals are chosen at random from a population and their heights are found to be in inches 63, 63, 64, 65, 66, 69, 69, 70, 70, 71. Discuss the suggestion that the mean height of the universe is 65

<u>Solution</u> : By given $\mu = 65$, $n = 10$, $\bar{x} = \frac{1}{n}\Sigma x_i = 67$ $S^2 = 8.8 \therefore S = 2.9665$

$H_0 : \mu = 65$

$H_1 : \mu \neq 65$

$$t = \frac{\bar{x} - \mu}{S/\sqrt{n-1}} = \frac{67 - 65}{2.9665/\sqrt{9}} = 2.0226$$

$\nu = n-1 = 10-1 = 9$

$t_\nu(\alpha) = t_{5\%}(9) = 2.262$

Thus $t < t_\nu(\alpha)$ $\therefore$ H_0 is accepted $\therefore \mu = 65$

we conclude that mean height of universe is 65

---

(4) in a 16 one-hour test runs, the petrol consumption of an engine averaged 16.4 liters with a standard deviation of 2.1 liters. Test the claim that the average petrol consumption of the engine is 12.0 liters per hour

<u>Solution</u>:- By given $n = 16$, $\bar{x} = 16.4$, $S = 2.1$ $\mu = 12.0$

$H_0 : \mu = 12$

$H_1 : \mu \neq 12$

$$t = \frac{\bar{x} - \mu}{S/\sqrt{n-1}} = \frac{16.4 - 12.0}{2.1/\sqrt{15}} = 8.1148$$

$\nu = n-1 = 16-1 = 15$ $\therefore t_\nu(\alpha) = t_{15}(5\%) = 2.131$

$\therefore$ ~~t<~~ $t > t_\nu(\alpha)$

$\therefore$ H_0 is rejected ie H_1 is accepted

$\therefore \mu \neq 12$

$\therefore$ we can not conclude that average petrol consumption of the engine is 12.0 liters per hour

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From page 5-A

Home work Problems

5.2.1 Home work Problems

① An investigation carried out by indian Association of Taylors has revealed that neck circumference of adult males follows a normal distribution with a mean of 40 cm. Ten years after the reports of this investigation were published, a random sample of 16 adult male is chosen and their neck circumference is measured. The study results indicate a mean of 39 cm with a standard deviation of 1.5 cm. Can we conclude at 5% LOS that in ten years time the mean neck circumference of male adults has really decreased

$\mu = 40,\ n = 16,\ \bar{x} = 39,\ s = 1.5$ cm

Solution : By given

$H_0 : \mu = 40$

$H_1 : \mu < 40$

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}} = \frac{39 - 40}{1.5/\sqrt{15}} =$$

② A random sample of 16 values from a normal population showed a mean of 41.5 inch and the sum of squares of deviations from this mean equal to 135 sq. inchs. obtain 95% confidence limit for true mean.

Solution: By given $n = 16$, $\bar{x} = 41.5$, $\sum_i (x_i - \bar{x})^2 = 135$, $\therefore S_x^2 = \frac{1}{n}\sum_i (x_i - \bar{x})^2 = 8.4375$

$\therefore S_x = 2.9047375$

For 5% LOS $Z_\alpha = \cancel{1.96}\ \cancel{2.0096}$ 2.131 For two tailed test

Now 95% confidence interval for population mean μ is

$$\bar{x} - t_{\gamma(\alpha)} \frac{s}{\sqrt{n-1}} < \mu < \bar{x} + t_{\gamma(\alpha)} \frac{s}{\sqrt{n-1}}$$

$$\therefore 41.5 - \left(1.96 \times \frac{2.9047}{\sqrt{15}}\right) < \mu < 41.5 + \left(1.96 \times \frac{2.9047}{\sqrt{15}}\right)$$

$$40.0302 < \mu < 42.96998$$

$$\text{or } 41.5 - \left(1.96 \times \frac{2.9047375}{\sqrt{15}}\right) < \mu < 41.5 + \left(1.96 \times \frac{2.9047375}{\sqrt{15}}\right)$$

$$41.5 - \left(2.131 \times \frac{2.9047375}{\sqrt{15}}\right) < \mu < \left(41.5 + \left(2.131 \times \frac{2.9047375}{\sqrt{15}}\right)\right)$$

$$39.90175 < \mu < 43.09825$$

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③ A random Sample of size 10 has been drawn from a normal population and the observations are found to be 60, 62, 63, 64, 65, 67, 68, 69, 70, and 72. Obtain an unbiased estimate of σ^2 and find 95% confidence limits for μ

Solution $n=10$, $\bar{x}=66$, $s^2=\frac{1}{n}\Sigma(x_i^2-(\bar{x})^2=13.2$, $S=3.6332$

we know $ns^2=(n-1)\hat{s}^2$ $\therefore \hat{s}^2=\frac{n}{n-1}.s^2=\frac{10}{9}\times13.2=14.6667$

$\therefore \hat{s}=3.8297$

Now For 5% Los $t_{\nu}(\alpha)=t_9(5\%)=2.262$

Now 95% confidence interval for μ is

$$\bar{x}-t_\nu(\alpha)\frac{s}{\sqrt{n-1}}<\mu<\bar{x}+t_\nu(\alpha)\frac{s}{\sqrt{n-1}}$$

$$66-\left(2.262\times\frac{3.6332}{\sqrt{9}}\right)<\mu<66+\left(2.262\times\frac{3.6332}{\sqrt{9}}\right)$$

$$63.2605672<\mu<68.7394328$$

④ The mean weekly sales of the chocolate bar in candy stores was 146.3 bars per stores. After an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153.7 and showed a standard deviation of 17.2. was the advertising campaign successful? Test at 5% level of significance.

Solution:- $\mu=146.3$, $n=22$, $\bar{x}=153.7$ $S=17.2$

$H_0: \bar{x}=\mu$

$H_1: \bar{x}>\mu$

$$t=\frac{\bar{x}-\mu}{S/\sqrt{n-1}}=\frac{153.7-146.3}{17.2/\sqrt{21}}=1.971573264$$

$\nu=n-1=21$ $\therefore t_\nu(\alpha)=t_{21}(5\%)=1.721$

$\therefore t_{cal}>t_\nu(\alpha)$

$\therefore H_0$ is rejected ie H_1 is accepted

$\therefore \bar{x}>\mu$

$\therefore$ advertising compaign successful

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