

Sub: Statistics

Topic:Normal Distribution

Question:

To find the 95% confidence interval for the true population mean.

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From the results below, is it true that 95% of the sample means will fall between 10.99408 and

11.00192 inches? Explain.

Problem is to estimate the mean paper length with 95% confidence.

Mean- 11 inches.

Standard deviation of the length is 0.02 inches.

Random sample 100 sheets.

Mean paper length is 10.998 inches.

Z=1.96 for 95% Confidence.

Mean + or - stand dev/square root n = 10.998 + or - 0.02/square root (100)

= 10.998 +or - 0.00392

 $= 10.99408 \le \mu \le 11.00192$

Solution:

The information given in the problem can be represented with the following notations.

Sample size = n = 100



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Mean paper length = \overline{x} = 10.998 inches.

Population standard deviation = σ = 0.02 inches.

The (1- α)100 % confidence interval for the population mean is given by

$$\left(\bar{x} - Z_{\alpha/2} * \frac{\sigma}{\sqrt{n}}, \bar{x} + Z_{\alpha/2} * \frac{\sigma}{\sqrt{n}}\right)$$

Where $Z_{lpha/2}$ is the $_{lpha/2}$ critical value of the Standard Normal distribution.

In our case we want to construct a 95 % confidence interval.

Hence α = 0.05 and $Z_{\alpha/2}$ = $Z_{0.05/2}$ = $Z_{0.025}$ =1.96

Now consider $Z_{\alpha/2} * \frac{s}{\sqrt{n}} = 1.96 * \frac{0.02}{\sqrt{100}}$ = $1.96 * \frac{0.02}{10}$ = 1.96 * 0.002= 0.00392

Thus we have $\bar{x} - Z_{\alpha/2} * \frac{s}{\sqrt{n}} = 10.998 - 0.00392 = 10.99408$ and

$$\overline{x} + Z_{\alpha/2} * \frac{s}{\sqrt{n}} = 10.998 + 0.00392 = 11.00192$$



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Hence the required 95 % confidence Interval is given by (10.99408, 11.00192)

Hence, it is true that 95 % of sample means will fall between (10.99408, 11.00192)

** End of the Solution **

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