Assignment 10

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Question

The diameter of cylindrical rods coming out of a production line is a normal random variable x with $\sigma = 0.1$mm. We measure $n = 9$ units and find that the average of the measurements is $\bar{x} = 91$ mm.

(a) Find c such that with a 0.95 confidence coefficient, the mean η of x is in the interval $x \pm c$.

(b) We claim that η is in the interval $(90.95, 91.05)$. Find the confidence coefficient of our claim.

Solution I

Let x represents the diameter of cylindrical rods coming out of a production line is a normal random variable.

$$\text{The sample size is: } n = 9 \tag{1}$$

$$\text{The population standard deviation is: } \sigma = 0.1 \tag{2}$$

$$\text{The sample mean is: } \bar{x} = 91 \tag{3}$$

Solution II

(a)

$$c = \frac{Z_u \sigma}{\sqrt{n}} \tag{4}$$

$$= \frac{1.96 \times 0.1}{\sqrt{9}} \tag{5}$$

$$= \frac{0.196}{3} \tag{6}$$

$$= 0.066 \tag{7}$$

Hence, the required constant value is: $\boxed{c = 0.066}$

Solution III

(b) The confidence coefficient of our claim:

$$Z_u = \frac{(1 - 0.95)\sqrt{n}}{\sigma} \tag{8}$$

$$= \frac{(0.05)\sqrt{9}}{0.1} \tag{9}$$

$$= 1.5 \tag{10}$$

$$\text{Confidence Coefficient} = \Pr(Z \leq 1.5) \tag{11}$$

$$(\textit{from...codes/main.py}) = (= \text{NORMSDIST}(1.5)) \tag{12}$$

$$= 0.933 \tag{13}$$

Hence, the required confidence coefficient is $\boxed{0.933}$