Assignment 6

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June 6, 2022

Outline

Question

A voltage source V is measured six times.the measurements are modeled by the random variable x=V+ν.Assume that the error ν is is N(0,σ).Find the 0.95 interval estimate of σ^2

Answer

(a)If the source is known standard with V=110V.
As the point estimator of ν the average is

$$\hat{\nu} = \frac{1}{n}\sum_{i=1}^{n}(x_i - \eta)^2 \tag{1}$$

Inserting the measured values $x_i = 110 + \nu_i$ *in above formula* (2)

we get $\hat{\nu} = 0.25$ (3)

From the table of Chi − square percentiles $\chi^2_\mu(n)$ (4)

We get $\chi^2_{0.025}(6) = 1.24$ *and* $\chi^2_{0.975}(6) = 14.45$ (5)

$$\textit{From the interval } \frac{n\hat{\nu}}{\chi_{1-\delta/2}(n)} < \sigma^2 < \frac{n\hat{\nu}}{\chi_{\delta/2}(n)} \tag{6}$$

$$\textit{We get } 0.104 < \sigma^2 < 1.2 \tag{7}$$

$$\implies \textit{Corresponding interval } 0.332 < \sigma < 1.096V \tag{8}$$

$$\tag{9}$$

(a)If the source is unknown standard .We compute from

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2 \tag{10}$$

Inserting the measured values $x_i = 110 + \nu_i$ *in above formula* (11)

we get $s^2 = 0.30$ (12)

From the table of $Chi - square$ *percentiles* $\chi^2_\mu(n)$ (13)

We get $\chi^2_{0.025}(5) = 0.83$ *and* $\chi^2_{0.975}(5) = 12.83$ (14)

$$\textit{From the interval } \frac{(n-1)s^2}{\chi^2_{1-\delta/2}(n-1)} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_{\delta/2}(n-1)} \tag{15}$$

$$\textit{We get } 0.117 < \sigma^2 < 1.8 \tag{16}$$

$$\implies \textit{Corresponding interval } 0.342 < \sigma < 1.344V \tag{17}$$

$$\tag{18}$$