Assignment 4

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Outline

Problem Statement

(Papoulis chap-8 - 8.17) Suppose that the IQ scores of children in a certain grade are the samples of an N(η, σ).
We test 10 children and obtain the following averages: x = 90, s = 5.
Find the 0.95 confidence interval of $\sigma and \eta$

Solution

We have n=10 so,

$$n - 1 = 10 - 1 = 9 \tag{1}$$

We have one tail condition So, from t-table we can say for 95% confidence and n=10 we have

$$t_{0.95}(10 - 1) = t_{0.95}(9) = 2.26$$

As we know

$$\eta = \bar{x} \tag{2}$$

so 95% of η
will lie between

$$\bar{x} - \frac{ts}{\sqrt{n}} < \eta < \bar{x} + \frac{ts}{\sqrt{n}} \tag{3}$$

$$90 - \frac{2.26 * 5}{\sqrt{10}} < \eta < 90 + \frac{2.26 * 5}{\sqrt{10}} \tag{4}$$

$$86.43 < \eta < 93.57 \tag{5}$$

For one tail level of confidence(α)

$$\alpha = 0.025 \tag{6}$$

Chi squared value value are as follows from chi table

$$\chi_L^2 = \chi_{1-\alpha}^2 = \chi_{0.975}^2(9) = 19.02 \tag{7}$$

$$\chi_R^2 = \chi_\alpha^2 = \chi_{0.025}^2(9) = 2.70 \tag{8}$$

Now,

$$\frac{(n-1)s^2}{\chi_L^2} < \sigma^2 < \frac{(n-1)s^2}{\chi_R^2} \tag{9}$$

$$\frac{9(5^2)}{19.02} < \sigma^2 < \frac{9(5^2)}{2.7} \tag{10}$$

So

$$3.44 < \sigma < 9.13 \tag{11}$$