

### Answer on Question # 41940, Math, Statistics and Probability

A manufacturer of paper box package claims that her manufacturing process is very accurate and that the mean length of a certain type of box 20m with a standard deviation of 0.1cm. You take a random sample of 29 boxes and obtain a sample deviation of 0.15cm. Assume that the mean length of the boxes is normally disturbed. Test the null hypothesis that the true variance is 0.01 against the alternative hypothesis that the true variance is not equal to 0.01. Do you accept or reject her claim? Use 5% significance level.

#### Solution

Step 1. State  $H_0: \sigma^2 = \sigma_0^2 = 0.01$ ,  $H_1: \sigma^2 \neq \sigma_0^2 = 0.01$ .

Step 2. Type of test - two-tailed test.

Step 3. Level of significance:  $\alpha = 0.05$ .

Step 4. Critical values:  $\chi_{0.025,28}^2 = 44.461$  and  $\chi_{0.975,28}^2 = 15.308$

Step 5. Decision rule: Reject  $H_0$  if  $T < \chi_{1-\frac{\alpha}{2},n-1}^2$  or  $T > \chi_{\frac{\alpha}{2},n-1}^2$ , where  $\chi_{\cdot,n-1}^2$  is the critical value of the chi-square distribution with  $n - 1$  degrees of freedom.

Step 6. Compute the statistic:

$$T = (n - 1) \frac{s^2}{\sigma_0^2} = (29 - 1) \frac{0.15^2}{0.01} = 63.$$

$$T > \chi_{\frac{\alpha}{2},n-1}^2 \quad (63 > 44.461).$$

Step 7. Conclusion:

Reject  $H_0$ . We have statistical evidence at a 5% level of significance to believe that the true variance is not equal to 0.01.