Bachelor in Computer Science and Engineering

Statistics Problems

VIII Population Comparison

1. A company is studying the percentage of defective items in its production line.
    a. A simple random sample of 1000 items is taken, and 100 defective ítems are found. Calculate a 99% confidence Interval for the proportion of defectiive items.
    b. In order to lower productions costs, a series of changes in the production process have been implemented. Subsequently, an external audit has carried out its own sampling of 1500 items, and has concluded that the proportion of defective items is 12%. With a significance level of 5%, can the external audit conclude that the changes implemented has increased the proportion of defective ítems?

2. The service quality of an important hotel chain has been measured before and after the implementation of a new client politic. In a random sample of 120 clients before the implementation of the politic 20 assured to be satisfied with the service quality. A second random sample of 150 clients taken after the implementation of the politic showed that there were 40 clients satisfied with the service quality. For a 5% significance level:
    a. Perform a hypothesis testing to check if the proportion of satisfied clients has increased with the new politic, indicating the hypothesis used, the test statistic, the rejection region and the conclusion.
    b. Find the p-value and the conclusion for it.

3. We want to determine the effectiveness of a new type of sound absorbing asphalt in reducing traffic noise. To do this, a vehicle is selected and, under controlled conditions, the noise it produces with and without sound absorbing asphalt is measured (101 passes for each condition). For the traditional asphalt the following results are obtained:

$$\overline{x_1} = 60{,}5 \; dBA; \qquad \hat{s_1} = 1{,}95 \; dBA$$

After installing the sound absorbing asphalt the results obtained are:

$$\overline{x_2} = 57{,}1 \; dBA; \qquad \hat{s_2} = 1{,}75 \; dB$$

a. Calculate a 95% confidence Interval for the difference between both scenarios, and justify if the new material reduces the sound as the provider says.
b. Calculate a 95% confidence Interval for the variance of this experiment after the new material has been installed. Use the following values: $\chi^2_{100;0,025} = 129{,}564$; $\chi^2_{100;0,975} = 74{,}216$;