Questions on Confidence Interval and Hypothesis Testings

Confidence Interval Problems:

1. Problem: A study is conducted to estimate the mean height of a population. A random sample of 100 individuals is selected, and their heights are measured. Calculate a 95% confidence interval for the population mean height, given that the sample mean height is 170 cm and the sample standard deviation is 8 cm.
   Data: Sample size (n) = 100, Sample mean ($\bar{x}$) = 170 cm, Sample standard deviation (s) = 8 cm, Confidence level = 95%

Explanation: In this problem, we use a sample to estimate the population mean height. By calculating a confidence interval, we provide a range of plausible values for the population mean. The 95% confidence level indicates that we are 95% confident that the true population mean height falls within the calculated interval.

2. Problem: A survey is conducted to estimate the proportion of people in a city who support a particular policy. A random sample of 500 individuals is surveyed, and 320 of them express support for the policy. Calculate a 90% confidence interval for the population proportion, given the sample proportion.
   Data: Sample size (n) = 500, Number of successes (x) = 320, Confidence level = 90%

Explanation: In this problem, we aim to estimate the population proportion based on the sample proportion. By constructing a confidence interval, we provide a range of plausible values for the population proportion. The 90% confidence level indicates that we are 90% confident that the true population proportion falls within the calculated interval.

Hypothesis Testing Problems:

3. Problem: A researcher wants to test whether a new teaching method improves student performance. A random sample of 50 students is divided into two groups: one group taught using the new method and the other using the traditional method. The average test scores of the two groups are compared. State the null and alternative hypotheses for this study.
   Data: Sample size (n) = 50, Test scores of the two groups

Explanation: In this problem, we are interested in comparing the means of two groups (new method vs. traditional method). The null hypothesis (H0) states that there is no

significant difference between the means, while the alternative hypothesis (Ha) suggests that there is a significant difference.

4. Problem: A manufacturing company claims that the average weight of its product is 500 grams. To test this claim, a random sample of 25 products is selected, and their weights are measured. The sample mean weight is found to be 510 grams with a sample standard deviation of 20 grams. Perform a hypothesis test to determine if there is evidence to support the company's claim.
Data: Sample size (n) = 25, Sample mean ($\bar{x}$) = 510 grams, Sample standard deviation (s) = 20 grams, Population mean (μ) = 500 grams

Explanation: In this problem, we are conducting a hypothesis test to assess whether the sample mean weight provides evidence to support the company's claim about the population mean weight. The null hypothesis (H0) assumes that the population mean weight is equal to the claimed value, while the alternative hypothesis (Ha) suggests otherwise.