Sampling and Estimation 1

Q1.

A random sample of n people were questioned about their internet use. 87 of them had a high-speed internet connection. A confidence interval for the population proportion having a high-speed internet connection is $0.1129 < p < 0.1771$.

(i) Write down the mid-point of this confidence interval and hence find the value of n. [3]

(ii) This interval is an $\alpha\%$ confidence interval. Find α. [4]

Q2.

The weight, in grams, of a certain type of apple is modelled by the random variable X with mean 62 and standard deviation 8.2. A random sample of 50 apples is selected, and the mean weight in grams, $\overline{X}$, is found.

(i) Describe fully the distribution of $\overline{X}$. [3]

(ii) Find $P(\overline{X} > 64)$. [3]

Q3.

In a survey of 1000 randomly chosen adults, 605 said that they used email. Calculate a 90% confidence interval for the proportion of adults in the whole population who use email. [3]

Q4.

The masses of sweets produced by a machine are normally distributed with mean μ grams and standard deviation 1.0 grams. A random sample of 65 sweets produced by the machine has a mean mass of 29.6 grams.

(i) Find a 99% confidence interval for μ. [3]

The manufacturer claims that the machine produces sweets with a mean mass of 30 grams.

(ii) Use the confidence interval found in part **(i)** to draw a conclusion about this claim. [2]

(iii) Another random sample of 65 sweets produced by the machine is taken. This sample gives a 99% confidence interval that leads to a different conclusion from that found in part **(ii)**. Assuming that the value of μ has not changed, explain how this can be possible. [1]

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Q5.

(a) The time taken by a worker to complete a task was recorded for a random sample of 50 workers. The sample mean was 41.2 minutes and an unbiased estimate of the population variance was 32.6 minutes^2. Find a 95% confidence interval for the mean time taken to complete the task. [3]

(b) The probability that an α% confidence interval includes only values that are lower than the population mean is $\frac{1}{16}$. Find the value of α. [2]

Q6.

A doctor wishes to investigate the mean fat content in low-fat burgers. He takes a random sample of 15 burgers and sends them to a laboratory where the mass, in grams, of fat in each burger is determined. The results are as follows.

9 7 8 9 6 11 7 9 8 9 8 10 7 9 9

Assume that the mass, in grams, of fat in low-fat burgers is normally distributed with mean μ and that the population standard deviation is 1.3.

(i) Calculate a 99% confidence interval for μ. [4]

(ii) Explain whether it was necessary to use the Central Limit theorem in the calculation in part **(i)**. [2]

(iii) The manufacturer claims that the mean mass of fat in burgers of this type is 8 g. Use your answer to part **(i)** to comment on this claim. [2]

Q7.

In a random sample of 70 bars of Luxcleanse soap, 18 were found to be undersized.

(i) Calculate an approximate 90% confidence interval for the proportion of all bars of Luxcleanse soap that are undersized. [4]

(ii) Give a reason why your interval is only approximate. [1]

Q8.

35% of a random sample of n students walk to college. This result is used to construct an approximate 98% confidence interval for the population proportion of students who walk to college. Given that the width of this confidence interval is 0.157, correct to 3 significant figures, find n. [5]
