

Sampling and Estimation 2

Q1.

Jack has to choose a random sample of 8 people from the 750 members of a sports club.

- (i) Explain fully how he can use random numbers to choose the sample. [3]

Jack asks each person in the sample how much they spent last week in the club café. The results, in dollars, were as follows.

15 25 30 8 12 18 27 25

- (ii) Find unbiased estimates of the population mean and variance. [3]
- (iii) Explain briefly what is meant by 'population' in this question. [1]
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Q2.

The weights, in grams, of packets of sugar are distributed with mean μ and standard deviation 23. A random sample of 150 packets is taken. The mean weight of this sample is found to be 494 g. Calculate a 98% confidence interval for μ . [3]

Q3.

A survey taken last year showed that the mean number of computers per household in Branley was 1.66. This year a random sample of 50 households in Branley answered a questionnaire with the following results.

Number of computers	0	1	2	3	4	> 4
Number of households	5	12	18	10	5	0

- (i) Calculate unbiased estimates for the population mean and variance of the number of computers per household in Branley this year. [3]
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Q4.

In a sample of 50 students at Batlin college, 18 support the football club Real Madrid.

- (i) Calculate an approximate 98% confidence interval for the proportion of students at Batlin college who support Real Madrid. [4]
- (ii) Give one condition for this to be a reliable result. [1]
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Q5.

Leaves from a certain type of tree have lengths that are distributed with standard deviation 3.2 cm. A random sample of 250 of these leaves is taken and the mean length of this sample is found to be 12.5 cm.

- (i) Calculate a 99% confidence interval for the population mean length. [3]
 - (ii) Write down the probability that the whole of a 99% confidence interval will lie below the population mean. [1]
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Q6.

The lengths, x mm, of a random sample of 150 insects of a certain kind were found. The results are summarised by $\Sigma x = 7520$ and $\Sigma x^2 = 413\,540$.

- (i) Calculate unbiased estimates of the population mean and variance of the lengths of insects of this kind. [3]
 - (ii) Using the values found in part (i), calculate an estimate of the probability that the mean length of a further random sample of 80 insects of this kind is greater than 53 mm. [3]
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Q7.

In order to obtain a random sample of people who live in her town, Jane chooses people at random from the telephone directory for her town.

- (i) Give a reason why Jane's method will not give a random sample of people who live in the town. [1]

Jane now uses a valid method to choose a random sample of 200 people from her town and finds that 38 live in apartments.

- (ii) Calculate an approximate 99% confidence interval for the proportion of all people in Jane's town who live in apartments. [4]
 - (iii) Jane uses the same sample to give a confidence interval of width 0.1 for this proportion. This interval is an $x\%$ confidence interval. Find the value of x . [4]
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Q8.

Heights of a certain species of animal are known to be normally distributed with standard deviation 0.17 m. A conservationist wishes to obtain a 99% confidence interval for the population mean, with total width less than 0.2 m. Find the smallest sample size required. [4]

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