

Population

Question Paper 2

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Sampling and estimation
Sub Topic	Population
Booklet	Question Paper 2

Time Allowed: 65 minutes

Score: /54

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 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]

2 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]

3 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]

4 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]

- 5 The lengths of sewing needles in travel sewing kits are distributed normally with mean μ mm and standard deviation 1.5 mm. A random sample of n needles is taken. Find the smallest value of n such that the width of a 95% confidence interval for the population mean is at most 1 mm. [4]
- 6 Diameters of golf balls are known to be normally distributed with mean μ cm and standard deviation σ cm. A random sample of 130 golf balls was taken and the diameters, x cm, were measured. The results are summarised by $\Sigma x = 555.1$ and $\Sigma x^2 = 2371.30$.
- (i) Calculate unbiased estimates of μ and σ^2 . [3]
 - (ii) Calculate a 97% confidence interval for μ . [3]
 - (iii) 300 random samples of 130 balls are taken and a 97% confidence interval is calculated for each sample. How many of these intervals would you expect **not** to contain μ ? [1]
- 7 (i) Explain what is meant by the term ‘random sample’. [1]
- In a random sample of 350 food shops it was found that 130 of them had Special Offers.
- (ii) Calculate an approximate 95% confidence interval for the proportion of all food shops with Special Offers. [4]
 - (iii) Estimate the size of a random sample required for an approximate 95% confidence interval for this proportion to have a width of 0.04. [3]

- 8 The cost of electricity for a month in a certain town under scheme A consists of a fixed charge of 600 cents together with a charge of 5.52 cents per unit of electricity used. Stella uses scheme A . The number of units she uses in a month is normally distributed with mean 500 and variance 50.41.

(i) Find the mean and variance of the total cost of Stella's electricity in a randomly chosen month. [5]

Under scheme B there is no fixed charge and the cost in cents for a month is normally distributed with mean 6600 and variance 421. Derek uses scheme B .

(ii) Find the probability that, in a randomly chosen month, Derek spends more than twice as much as Stella spends. [5]

- 9 (i) Write down the mean and variance of the distribution of the means of random samples of size n taken from a very large population having mean μ and variance σ^2 . [2]

(ii) What, if anything, can you say about the distribution of sample means

(a) if n is large, [1]

(b) if n is small? [1]