Population

Question Paper 4

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Sampling and estimation
Sub Topic	Population
Booklet	Question Paper 4

Time Allowed: **59 minutes**

Score: **/49**

Percentage: **/100**

Grade Boundaries:

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

1   A die is biased so that the probability that it shows a six on any throw is p.

   (i) In an experiment, the die shows a six on 22 out of 100 throws. Find an approximate 97% conf dence interval for p.   [4]

   (ii) The experiment is repeated and another 97% conf dence interval is found. Find the probability that exactly one of the two conf dence intervals includes the true value of p.   [2]

2   The marks, x, of a random sample of 50 students in a test were summarised as follows.

$$n = 50 \qquad \Sigma x = 1508 \qquad \Sigma x^2 = 51\,825$$

   (i) Calculate unbiased estimates of the population mean and variance.   [3]

   (ii) Each student's mark is scaled using the formula $y = 1.5x + 10$. Find estimates of the population mean and variance of the scaled marks, y.   [3]

3   A die is biased. The mean and variance of a random sample of 70 scores on this die are found to be 3.61 and 2.70 respectively. Calculate a 95% confidenc interval for the population mean score. [5]

4   The weights, in grams, of a random sample of 8 packets of cereal are as follows.

       250   248   255   244   259   250   242   258

   Calculate unbiased estimates of the population mean and variance.   [3]

5   Mahmoud throws a coin 400 times and f nds that it shows heads 184 times. The probability that the coin shows heads on any throw is denoted by p.

   (i) Calculate an approximate 95% conf dence interval for p.   [4]

   (ii) Mahmoud claims that the coin is not fair. Use your answer to part **(i)** to comment on this claim.   [1]

   (iii) Mahmoud's result of 184 heads in 400 throws gives an α% conf dence interval for p with width 0.1. Calculate the value of α.   [4]

6   A die is thrown 100 times and shows an odd number on 56 throws. Calculate an approximate 97%confi dence interval for the probability that the die shows an odd number on one throw.   [4]

7   The lengths, l m, of a random sample of 200 balls of string are found and the results are summarised by $\Sigma\ l = 2005$ and $\Sigma\ l^2 = 20\ 175$.

   (i) Calculate unbiased estimates of the population mean and variance of the lengths.   [3]

   (ii) Use the values from part **(i)** to estimate the probability that the mean length of a random sample of 50 balls of string is less than 10 m.   [3]

   (iii) Explain whether or not it was necessary to use the Central Limit theorem in your calculation in part **(ii)**.   [2]

8   The masses, in grams, of a certain type of plum are normally distributed with mean μ and variance σ^2. The masses, m grams, of a random sample of 150 plums of this type were found and the results are summarised by $\Sigma m = 9750$ and $\Sigma m^2 = 647\ 500$.

   (i) Calculate unbiased estimates of μ and σ^2.   [3]

   (ii) Calculate a 98% confid nce interval for μ.   [3]

   Two more random samples of plums of this type are taken and a 98% confid nce interval for μ is calculated from each sample.

   (iii) Find the probability that neither of these two intervals contains μ.   [2]