Population

Question Paper 3

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Sampling and estimation
Sub Topic	Population
Booklet	Question Paper 3

Time Allowed: **66 minutes**

Score: **/55**

Percentage: **/100**

Grade Boundaries:

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

1 A survey was conducted to find the proportion of people owning DVD players. It was found that 203 out of a random sample of 278 people owned a DVD player.

(i) Calculate a 97% confidence interval for the true proportion of people who own a DVD player. [4]

A second survey to find the proportion of people owning DVD players was conducted at 10 o'clock on a Thursday morning in a shopping centre.

(ii) Give one reason why this is not a satisfactory sample. [1]

2 **(i)** Give a reason why, in carrying out a statistical investigation, a sample rather than a complete population may be used. [1]

(ii) Rose wishes to investigate whether men in her town have a different life-span from the national average of 71.2 years. She looks at government records for her town and takes a random sample of the ages of 110 men who have died recently. Their mean age in years was 69.3 and the unbiased estimate of the population variance was 65.61.

(a) Calculate a 90% confidence interval for the population mean and explain what you understand by this confidence interval. [4]

(b) State with a reason what conclusion about the life-span of men in her town Rose could draw from this confidence interval. [2]

3 A journey in a certain car consists of two stages with a stop for filling up with fuel after the first stage. The length of time, T minutes, taken for each stage has a normal distribution with mean 74 and standard deviation 7.3. The length of time, F minutes, it takes to fill up with fuel has a normal distribution with mean 5 and standard deviation 1.7. The length of time it takes to pay for the fuel is exactly 4 minutes. The variables T and F are independent and the times for the two stages are independent of each other.

(i) Find the probability that the total time for the journey is less than 154 minutes. [5]

(ii) A second car has a fuel tank with exactly twice the capacity of the first car. Find the mean and variance of this car's fuel fill-up time. [2]

(iii) This second car's time for each stage of the journey follows a normal distribution with mean 69 minutes and standard deviation 5.2 minutes. The length of time it takes to pay for the fuel for this car is also exactly 4 minutes. Find the probability that the total time for the journey taken by the first car is more than the total time taken by the second car. [5]

4 Over a long period of time it is found that the amount of sunshine on any day in a particular town in Spain has mean 6.7 hours and standard deviation 3.1 hours.

(i) Find the probability that the mean amount of sunshine over a random sample of 300 days is between 6.5 and 6.8 hours. [4]

(ii) Give a reason why it is not necessary to assume that the daily amount of sunshine is normally distributed in order to carry out the calculation in part **(i)**. [1]

5 A random sample of 150 students attending a college is taken, and their travel times, t minutes, are measured. The data are summarised by $\Sigma t = 4080$ and $\Sigma t^2 = 159\,252$.

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

(ii) Calculate a 94% confid nce interval for the population mean travel time. [4]

6 The time taken, T minutes, for a special anti-rust paint to dry was measured for a random sample of 120 painted pieces of metal. The sample mean was 51.2 minutes and an unbiased estimate of the population variance was 37.4 minutes^2. Determine a 99% confidence interval for the mean drying time. [3]

7 The masses, m grams, of a random sample of 80 strawberries of a certain type were measured and summarised as follows.

$$n = 80 \qquad \Sigma m = 4200 \qquad \Sigma m^2 = 229\,000$$

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

(ii) Calculate a 98% conf dence interval for the population mean. [3]

50 random samples of size 80 were taken and a 98% conf dence interval for the population mean, μ, was found from each sample.

(iii) Find the number of these 50 conf dence intervals that would be expected to include the true value of μ. [1]

8 The volumes, v millilitres, of juice in a random sample of 50 bottles of Cooljoos are measured and summarised as follows.

$$n = 50 \qquad \Sigma v = 14\,800 \qquad \Sigma v^2 = 4\,390\,000$$

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

(ii) An α% conf dence interval for the population mean, based on this sample, is found to have a width of 5.45 millilitres. Find α. [4]

Four random samples of size 10 are taken and a 96% conf dence interval for the population mean is found from each sample.

(iii) Find the probability that these 4 conf dence intervals all include the true value of the population mean. [2]