Sampling and Estimation – 2022 A2 June

1. March/2022/Paper_9709/62/No.1

The lengths, in millimetres, of a random sample of 12 rods made by a certain machine are as follows.

200	201	198	202	200	199	199	201	197	202	200	199

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

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(b) Give a statistical reason why these estimates may not be reliable. [1]

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2. March/2022/Paper_9709/62/No.3

A random sample of 500 households in a certain town was chosen. Using this sample, a confidence interval for the proportion, p, of all households in that town that owned two or more cars was found to be $0.355 < p < 0.445$.

Find the confidence level of this confidence interval. Give your answer correct to the nearest integer. [5]

3. March/2022/Paper_9709/62/No.5

The heights of buildings in a large city are normally distributed with mean 18.3 m and standard deviation 2.5 m.

(a) Find the probability that the total height of 5 randomly chosen buildings in the city is more than 95 m. [4]

(b) Find the probability that the difference between the heights of two randomly chosen buildings in the city is less than 1 m. [5]

4. June/2022/Paper_9709/61/No.1

The diameters, x millimetres, of a random sample of 200 discs made by a certain machine were recorded. The results are summarised below.

$$n = 200 \qquad \Sigma x = 2520 \qquad \Sigma x^2 = 31\,852$$

(a) Calculate a 95% confidence interval for the population mean diameter. [6]

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(b) Jean chose 40 random samples and used each sample to calculate a 95% confidence interval for the population mean diameter.

How many of these 40 confidence intervals would be expected to include the true value of the population mean diameter? [1]

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5. June/2022/Paper_9709/62/No.1

(a) A javelin thrower noted the lengths of a random sample of 50 of her throws. The sample mean was 72.3 m and an unbiased estimate of the population variance was 64.3 m^2.

Find a 92% confidence interval for the population mean length of throws by this athlete. [3]

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(b) A discus thrower wishes to calculate a 92% confidence interval for the population mean length of his throws. He bases his calculation on his first 50 throws in a week.

Comment on this method. [1]

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6. June/2022/Paper_9709/62/No.3

It is known that 1.8% of children in a certain country have not been vaccinated against measles. A random sample of 200 children in this country is chosen.

(a) Use a suitable approximating distribution to find the probability that there are fewer than 3 children in the sample who have not been vaccinated against measles. [4]

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(b) Justify your approximating distribution. [2]

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7. June/2022/Paper_9709/63/No.1

The number of characters in emails sent by a particular company is modelled by the distribution $N(1250, 480^2)$.

Find the probability that the mean number of characters in a random sample of 100 emails sent by the company is more than 1300. [3]

8. June/2022/Paper_9709/63/No.6

A random sample of 5 values of a variable X is given below.

2 3 3 5 a

(a) Find an expression, in terms of a, for the mean of these values. [1]

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It is given that an unbiased estimate of the population variance of X, using these values, is 4. It is also given that a is positive.

(b) Find and simplify a quadratic equation in terms of a and hence find the value of a. [3]

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