Sampling and Estimation – 2021 A2

1. June/2021/Paper_9709/61/No.2

The time, in minutes, taken by students to complete a test has the distribution N(125, 36).

(a) Find the probability that the mean time taken to complete the test by a random sample of 40 students is less than 123 minutes. [3]

(b) Explain whether it was necessary to use the Central Limit theorem in the solution to part **(a)**. [1]

2. June/2021/Paper_9709/61/No.4

100 randomly chosen adults each throw a ball once. The length, l metres, of each throw is recorded. The results are summarised below.

$$n = 100 \qquad \Sigma l = 3820 \qquad \Sigma l^2 = 182\,200$$

Calculate a 94% confidence interval for the population mean length of throws by adults. [6]

3. June/2021/Paper_9709/62/No.6

The heights, h centimetres, of a random sample of 100 fully grown animals of a certain species were measured. The results are summarised below.

$$n = 100 \qquad \Sigma h = 7570 \qquad \Sigma h^2 = 588\,050$$

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

(b) Calculate a 99% confidence interval for the mean height of animals of this species. [3]

Four random samples were taken and a 99% confidence interval for the population mean, μ, was found from each sample.

(c) Find the probability that all four of these confidence intervals contain the true value of μ. [2]

4. June/2021/Paper_9709/63/No.4

The masses, m kilograms, of flour in a random sample of 90 sacks of flour are summarised as follows.

$$n = 90 \qquad \Sigma m = 4509 \qquad \Sigma m^2 = 225\,950$$

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

(b) Calculate a 98% confidence interval for the population mean. [3]

(c) Explain why it was necessary to use the Central Limit theorem in answering part **(b)**. [1]

(d) Find the probability that the confidence interval found in part **(b)** is wholly above the true value of the population mean. [2]

5. March/2021/Paper_9709/62/No.1

A construction company notes the time, t days, that it takes to build each house of a certain design. The results for a random sample of 60 such houses are summarised as follows.

$$\Sigma t = 4820 \qquad \Sigma t^2 = 392\,050$$

(a) Calculate a 98% confidence interval for the population mean time. [6]

(b) Explain why it was necessary to use the Central Limit theorem in part **(a)**. [1]