

QUESTION 4

- (a) State Central Limit Theorem.
 (b) The lifetime of a battery in a certain application is normally distributed with mean $\mu = 1800$ hours and standard deviation $\sigma = 200$ hours. (i) What is the probability that a battery will last more than 1800 hours? (ii) What is the probability that the lifetime of a battery is between 1550 and 1530 hours?
 (c) Of all the registered automobiles in a certain state in Nigeria, 10% violate the state consumption standard. Twelve automobiles are selected at random to undergo an emissions test. Find the probability that fewer than three of them violate the standard.
 (d) Moisture Content in percent by volume (x) and conductivity in $\mu S/cm$ (y) were measured for 30 soil specimens. The means and standard deviations were $\bar{x} = 0.1$, $s_x = 1.2$, $\bar{y} = 30.4$, $s_y = 1.5$. The correlation between conductivity and moisture were computed to be $r = 0.85$. Find the equation of the least squares line for predicting soil conductivity from moisture content. (ii) Compute the value of soil conductivity given that moisture content in percent by volume is 10.

2 Marks

4 Marks

2 Marks

2 Marks

2 Marks

QUESTION 5

- (a) (i) Differentiate between population and samples.
 (ii) Describe 3 types of sampling methods that you know.
 (b) Assume that the heights of 3000 male students at a university are normally distributed, with mean 172.72 cm and standard deviation 7.62 cm. If 80 samples consisting of 25 students each are obtained, what would be the expected mean and standard deviation of the resulting sampling distribution of means if sampling were done (a) with replacement, (b) without replacement?

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

QUESTION 6

- (a) (i) What do you understand by a point estimate? Mention 3 examples.
 (ii) Suppose that the following observations represent the heights of 20 FUYO students:
 4.00 5.00 5.00 5.25 5.50 6.25 6.25 6.50 6.50 7.00
 7.25 7.75 8.00 8.00 8.00 8.25 8.50 8.50 9.50 10.50
 Determine a named point estimate for the data.
 What, in your own understanding is the limitation of this estimate?
 (b) The standard deviation of the lifetimes of a sample of 200 electric light bulbs was estimated to be 100 hours. Find (a) 95% and (b) 99% confidence limits for the standard deviation of all such electric light bulbs.

5 Marks

5 Marks

5 Marks

5 Marks

5 Marks

5 Marks

5 Marks

$$s \pm z \sigma = s \pm z \frac{\sigma}{\sqrt{n}}$$

$$\sigma_2 = \frac{\sigma}{\sqrt{n}}$$

QUESTION 7

- (a) (i) What are Biased and Unbiased estimates?
 (ii) Measurements of the diameters of a random sample of 200 ball bearings made by a certain machine during one week showed a mean of 2.09 cm and a standard deviation of 0.107 cm. Find (a) 90% and (b) 99.73% confidence limits for the mean diameter of all the ball bearings.
 (b) In 40 tosses of a coin, 24 heads were obtained. Find (a) 95% and (b) 99% confidence limits for the proportion of heads which would be obtained in an unlimited number of tosses of the coin.

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

4 Marks

$$Z = \frac{\bar{p} - p}{\sqrt{\frac{p(1-p)}{n}}} = \frac{0.6 - 0.5}{\sqrt{\frac{0.5(1-0.5)}{40}}} = \frac{0.1}{\sqrt{0.0125}} = \frac{0.1}{0.1118} = 0.8944$$

$$\sigma = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.5(1-0.5)}{40}} = \sqrt{0.0125} = 0.1118$$

$$\bar{p} \pm z \frac{\sigma}{\sqrt{n}}$$

$$Z = \frac{\bar{p} - p}{\sigma}$$