2021

ECONOMICS — HONOURS

Paper : CC-7

(Statistical Methods for Economics)

Full Marks : 65

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group – A

1. Answer ***any ten*** questions : 2×10

(a) Clarify what you mean by an attribute and a variable with the help of examples.

(b) State whether the following statements are true or false :

(i) Expectation of a random variable cannot be negative.

(ii) For negative random variable X, V(X) must be positive.

(c) There are four small eateries and one hotel in a locality. The costs of lunch per person in the eateries are ₹ 60, ₹ 50, ₹ 70 and ₹ 80, and that for the hotel is ₹ 400. What is the average cost of lunch in that locality? Justify your choice of the measure of central tendency.

(d) If the regression coefficient of X on Y is -1.6 and that of Y on X is -0.4, then what is the correlation coefficient between X and Y?

(e) Give the axiomatic definition of probability.

(f) Balls are drawn one-by-one with replacement from a box containing 4 red and 2 blue balls. Let R_i denote the event of getting a red ball in the ith drawing, $i = 1, 2$.
Examine whether (i) R_1 and R_2 are independent (ii) R_1 and R_2 are mutually exclusive.

(g) Examine whether the following result is true or false : $P(A \cup B) \leq P(A)$.

(h) Find the value of k such that the following function can be a probability function :

$$f(x) = \begin{cases} k(2-x) & \text{when } 0 < x < 2 \\ 0 & \text{elsewhere} \end{cases}$$

(i) For a random variable X, show that $\left[E\left(X^2\right)\right]^{1/2} \geq E(X)$.

(j) What is a moment generating function? Why is it so called?

(k) What do you mean by standard error?

(l) Define a statistic. Is it a random variable?

(m) What is meant by multi-stage sampling?

(n) When is an estimator called 'consistent'?

(o) If the two regression lines coincide, show that the correlation coefficient $r = \pm 1$. If $r = 0$, show that the two regression lines are at right angles.

Group – B

2. Answer ***any three*** questions :

(a) A variable takes only two distinct values a and b, each with equal frequency. Find the second and third central moments. 5

(b) The second moments about the mean of two distributions are 9 and 16, while the third moments about the mean are – 8.1 and – 12.8 respectively. Which distribution is more skewed to the left? Give reason. 5

(c) For the following data show that $r = 0$. Do you conclude that X and Y are uncorrelated? Why?

X	–3	–2	–1	0	1	2	3
Y	9	4	1	0	1	4	9

5

(d) For each of the following probability functions, find E(X) and the distribution function : (1+1½)×2

(i) $f(x) = \begin{cases} \frac{1}{3}, & \text{for } x = 0, 1, 3 \\ 0, & \text{otherwise} \end{cases}$

(ii) $f(x) = \begin{cases} \frac{1}{3} & \text{when } 0 < x < 3 \\ 0 & \text{elsewhere} \end{cases}$

(e) Define Type I and Type II errors. 5

Group – C

Answer ***any three*** questions.

3. (a) Evaluate standard deviation as a measure of dispersion.

(b) In a factory the average daily wage of 50 workers was ₹ 200 with a standard deviation ₹ 40. Each worker is given a hike of ₹ 20. What are the new average daily wage and standard deviation? If each worker is given a hike of 10% in wages, how are the mean and standard deviation affected? 5+5

4. (a) Can two events be mutually exclusive as well as mutually independent? Explain.

(b) Three lots contain respectively 10%, 20% and 25% defective articles. One article is drawn at random from each lot. What is the probability that among them there is (i) exactly one defective (ii) at least one defective? 4+(3+3)

5. (a) Examine the validity of the following statements :
Sampling error is connected with sample survey only and non-sampling error is connected with complete enumeration survey only.

(b) Consider the population {5, 10, 15}. Specify the sampling distribution of sample-mean drawing simple random samples of size 2 with replacement from this population. Verify the result that the expectation of sample-mean is equal to the population mean. Also find the standard error of sample-mean. 4+(2+2+2)

6. (a) Find the mode of a Poisson distribution.

(b) A sample of 100 dry battery cells tested to find the length of life produced the following result : $\mu = 12$ hours, $\sigma = 3$ hours. Assuming that the data are normally distributed, what % of battery cells are expected to have life (i) more than 15 hours and (ii) less than 18 hours? 6+(2+2)

Given :

Z	1	2
Area	0.3413	0.4772

7. (a) Suppose that (X_1, X_2, X_3) is a simple random sample drawn independently from a Normal population with mean μ and SD σ. Among the following two estimators, $T_1 = (X_1 + X_2 + X_3)/3$ and $T_2 = X_1 + X_2 - X_3$, which one is the minimum variance unbiased estimator?

(b) In order to test whether a coin is perfect, the coin is tossed 5 times. The null hypothesis of perfectness is rejected if and only if more than 4 heads are obtained. What is the probability of Type-I error? Find the probability of Type-II error when the corresponding probability of head is 0.2. 5+(3+2)