

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 i th 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 $\left[E(X^2) \right]^{1/2} \geq E(X)$.
- (j) What is a moment generating function? Why is it so called?
- (k) What do you mean by standard error?

Please Turn Over

- (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 : $(1+1\frac{1}{2}) \times 2$

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

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

- (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)
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