2025

ECONOMICS — HONOURS

Paper : DSCC-7

(Statistics for Economics)

Full Marks : 75

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) What is stratified sampling?

   (b) Show that if A and B are two independent events then A^C and B^C are also independent.

   (c) Two letters are drawn at random from the word 'HOME'. Find the probability that one of the letters chosen is 'M'.

   (d) State two shortcomings of the classical definition of probability.

   (e) "Rejection of a hypothesis indicates its falsity." Do you agree? Give reasons for your answer.

   (f) State the Bayes' Theorem.

   (g) Find the expected number of points when a balanced die is rolled once.

   (h) Examine whether the following function is a probability function :

   $$f(x) = \begin{cases} \frac{1}{4} & \text{for } x = 0 \\ \frac{3}{4} & \text{for } x = 1 \\ 0 & \text{otherwise} \end{cases}$$

   (i) A continuous random variable having values only between 0 and 4 has the linear density function $f(x) = \frac{1}{2} - \alpha x$. Find the value of α.

   (j) Find E(X) if the probability density function of X is given by

   $$f(x) = \begin{cases} \dfrac{1}{b-a} & \text{when } a \le x \le b \\ 0 & \text{elsewhere} \end{cases}$$

   (k) Suppose that $X \sim$ Bin (5, 1/3). Find the mode of X.

Please Turn Over

(l) Given that for a standard normal variable Z, $P(0 < Z < 0.8) = 0.2881$, find $P(|Z| \geq 0.8)$.

(m) What is the difference between sampling and non-sampling error?

(n) If a simple random sample of size 4 is drawn without replacement from a population of size 40 where the variance of the population is 25 then find the standard error of sample mean.

(o) What do you mean by point estimation and interval estimation?

Group - B

2. Answer *any five* questions :

(a) Among the examinees in an examination, 25%, 30% and 45% failed in statistics, in mathematics and in at least one of statistics and mathematics respectively. An examinee is selected at random. Find the probabilities that

   (i) she failed in statistics only,

   (ii) she passed in statistics, if it is known that she failed in mathematics.   5

(b) The joint probability density function of the random variables X and Y is given by

   $$f(x, y) = (1/3)(x + y); \ 0 \leq x \leq 1, \ 0 \leq y \leq 2$$
   $$= 0, \text{ otherwise}$$

   Find $E(X/Y = 1/2)$.   5

(c) The mean of a normal distribution is 50 and 5% of the values are greater than 60. Find the standard deviation of the distribution given that area under standard normal curve between $z = 0$ and $z = 1.64$ is 0.45.   5

(d) (i) A and B throw alternately with a pair of dice. The one who first throws a total of 9 wins the game. If A begins the game, find his probability of winning.

   (ii) In case of SRSWOR (order of drawing being ignored) the possible number of distinct samples is 4060 when a random sample of 3 individuals is drawn from a population of size 30. Is this statement true or false? Give reasons.   3+2

(e) A manufacturer claimed that at least 90% of the components that he supplied conformed to specifications. A random sample of 200 components showed that only 164 were up to the standard. Test the claim of the manufacturer at 5% level of significance. [Given : $\tau_{0.05} = 1.64$]   5

(f) Find the distribution function and draw the graph for the following probability mass function :

   $$f(x) = \begin{cases} \frac{1}{4} & \text{for } x = 0 \\ \frac{3}{4} & \text{for } x = 1 \\ 0 & \text{otherwise} \end{cases}$$

       4+1

(g) Obtain the maximum likelihood estimator of 'p' (proportion of success) for a Binomial distribution having parameters 'n' and 'p' where the total number of trials (n) is known.   5

(h) What are Type I and Type II errors?   5

Group - C

Answer *any three* questions.

3. (a) State the sample space $S = \{e_1, e_2, e_3, e_4\}$.

Define the events $A = \{e_1, e_2\}$, $B = \{e_2, e_3\}$, $C = \{e_3, e_1\}$.

Are A, B, C (i) pairwise independent? (ii) mutually independent? (iii) What conclusion can you draw from the answers to (i) and (ii)?

(b) A purse contains 2 silver coins and 4 copper coins and a second purse contains 4 silver coins and 3 copper coins. If a coin is selected at random from one of the two purses, what is the probability that it is a silver coin? (2+2+1)+5

4. (a) Two random variables X and Y have the following joint probability density function :

$$f(x, y) = 2 - x - y, \quad 0 \leq x \leq 1, 0 \leq y \leq 1$$

$$= 0, \text{ otherwise}$$

Find the correlation between X and Y.

(b) A random sample of size 25 is taken from a $N(\mu, \sigma^2)$ population with $\mu = 30$ and $\sigma^2 = 16$. Would the probability that the sample mean would lie between 25 and 35 be greater than 0.99?

[Given : $z_{0.005} = 2.58$ approx.] 6+4

5. (a) Find the mode of Binomial Distribution.

(b) The average number of misprints per page of a book is 2. Assuming Poisson distribution, find the probability that a particular page is free from misprints. If the book contains 1000 pages, how many of the pages contain more than 2 misprints? [Given $e^{-2} = .13534$] 6+(3+1)

6. (a) 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 the sample mean.

(b) Three identical boxes contain respectively 4 white and 3 red balls and 3 white and 7 red balls. A box is chosen at random and a ball is drawn from it. If the ball is white, what is the probability that it is from the first box? (2+2+2)+4

7. (a) The mean weekly sales of soap bars in departmental stores was 146.3 bars per store. After an advertising campaign, the mean weekly sales in a sample of 22 stores was found to be 153.7 with a standard deviation of 17.2. Was the advertising campaign successful? Consider the level of significance for carrying out the test to be 5%. [Given $t_{0.05, 21} = 1.72$]

(b) The probability that an individual will suffer a bad reaction from a particular injection is 0.001. Determine the probability that out of 2000 individuals (i) exactly three, and (ii) more than 2, will suffer a bad reaction. [Given $e^{-2} = 0.13534$] 5+5