

2026

ECONOMICS — HONOURS

Paper : DSCC-7

(Statistics of 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) Can the following be probability measures?

$$P(A) = 0.3, P(B) = 0.5, P(C) = 0.6, P(A \cap B) = 0.2, P(B \cap C) = 0.4, P(A \cap C) = 0.4, P(A \cap B \cap C) = 0.8.$$

(b) From a well shuffled deck of 52 cards 5 cards are selected at random. What is the probability that, it contains 2 spades, 2 hearts and 1 club?

(c) Clarify the idea of independence of two events using the concept of conditional probability.

(d) Give the axiomatic definition of probability.

(e) What is the probability of getting at least one even number when a balanced die is rolled 3 times?

(f) What is meant by a moment generating function? Why is it so called?

(g) Find the second moment about origin for the following probability density function

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

(h) For the following probability function evaluate (i) $P(|X| < 1)$ and (ii) $P(1 < x \leq 4)$:

$$f(x) = \begin{cases} \frac{1}{4} & \text{for } x = -2 \\ \frac{1}{4} & \text{for } x = 3 \\ \frac{1}{2} & \text{for } x = 6 \\ 0 & \text{otherwise} \end{cases}$$

(i) Show that for a binomial distribution mean cannot be less than variance.

Please Turn Over

(6900)

- (j) Evaluate the distribution function of X if the probability density function of X is given by

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

- (k) State four properties of normal distribution.
- (l) Do you think that complete enumeration survey is always better than sample survey? Why?
- (m) How are Chi-square, Student's t and F variables related to standard normal distribution?
- (n) What do you mean by a parameter and a statistic? Clarify with the help of examples.
- (o) What do you mean by critical region in statistical inference?

Group - B

Answer *any five* questions.

2. State and prove the theorem of total probability for three events. 5
3. A consignment of 30 radios contains 4 defectives. A random sample of 5 is selected from this consignment. If K denotes the number of defectives specify the probability distribution of X . 5
4. Evaluate the probability function from the following distribution function : 5

$$F(x) = \begin{cases} 0 & \text{for } x < 0 \\ \frac{1}{8} & \text{for } 0 \leq x < 2 \\ \frac{2}{8} & \text{for } 2 \leq x < 3 \\ \frac{5}{8} & \text{for } 3 \leq x < 4 \\ 1 & \text{for } x \geq 4 \end{cases}$$

5. A hospital switch board receives emergency calls at the rate of 2 calls in every 30 minutes. What is the probability that there will be at least 3 emergency calls from 2 PM to 2:30 PM on a particular day? [Given $e^{-2} = 0.13534$]. 5
6. If the standard error of sample mean for simple random sample with replacement is twice that for simple random sample without replacement, then show that $4n = 3N + 1$ where n and N denote the sample size and population size respectively. 5

7. A random sample of 16 days shows an average daily sale of ₹ 500 with a standard deviation of ₹ 100, in a particular hot dog shop. Assuming a normal distribution for the population, construct 95% confidence interval for the expected sale per day.

[Given $t_{0.025, 16} = 2.120$, $t_{0.025, 15} = 2.131$, $Z_{0.025} = 1.96$]. 5

8. Briefly explain why it is not possible to minimise both Type I and Type II together. 5

9. Briefly explain the concept of stratified sampling. 5

Group - C

Answer *any three* questions.

10. (a) For two events A_1 and A_2 , show that

$$P(A_1 \cap A_2) \leq P(A_1) \leq P(A_1 \cup A_2) \leq P(A_1) + P(A_2).$$

- (b) There are 4 boxes of one dozen eggs each. They contain 2, 3, 1, 0 spoiled eggs respectively. One box is selected at random and then an egg is taken at random. The egg is found to be spoiled. What is the probability that if any other egg is taken from the same box it will be spoiled?

4+6

11. (a) Show that under certain conditions a binomial distribution can be approximated by Poisson distribution.

- (b) Can the following be a probability density function?

$$f(x) = \begin{cases} x, & \text{when } 0 < x \leq 1 \\ \frac{3-x}{4}, & \text{when } 1 < x \leq 3 \\ 0, & \text{elsewhere} \end{cases} \quad 5+5$$

12. (a) Find the point(s) of inflection for normal distribution.

- (b) The marks obtained by a group of students for a certain subject are assumed to be normally distributed with mean 65 and standard deviation 5. If 3 students are taken at random from this set, what is the probability that exactly one of them will have marks above 70?

[Given that $\phi(1) = 0.8413$]

4+6

13. (a) For two independent continuous random variables X and Y , show that their covariance is zero.

- (b) A random sample of 20 temperature readings shows a standard deviation of 0.05. Test the hypothesis that the true standard deviation is 0.03. Assume that temperature readings follow Normal distribution and use a two-sided test with 1% level of significance.

[Given : $\chi^2_{0.005, 19} = 38.582$, $\chi^2_{0.005, 20} = 39.997$, $\chi^2_{0.995, 19} = 6.844$, $\chi^2_{0.995, 20} = 7.434$] 4+6

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- 14.** (a) Find the maximum likelihood estimator of the parameter of Poisson distribution. Examine whether it is an unbiased estimator.
- (b) A motor car company claims that their cars travel with an average of 35 miles per gallon of gasoline. A random sample of 25 cars was tested and found to give an average of 32 miles to a gallon with standard deviation of 1.2 miles. Should we accept the claim of the motor car company at 5% level of significance?

[Given $t_{0.025, 25} = 2.060$, $t_{0.05, 25} = 1.708$, $t_{0.025, 24} = 2.064$, $t_{0.05, 24} = 1.711$] (4+1)+5
