2025

STATISTICS — MDC

Paper : CC-1

(Descriptive Statistics-I and Probability-I)

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.

1. Answer ***any five*** of the following questions : 2×5

(a) Distinguish between a discrete and a continuous variable with an example from each.

(b) "The sum of deviations of a set of values from their respective mean is zero."– True or False? Justify.

(c) If $2x + 3y - 9 = 0$ and standard deviation of y is 6, then what is the standard deviation of x?

(d) What is the range of the coefficient of skewness based on mean, median and standard deviation?

(e) What is the probability of getting head each time when an unbiased coin is tossed twice?

(f) For 2 events A and B, $P(B) = 1/3$, $P(B \mid A) = 2/3$, $P(A \mid B) = 1/2$, then what is the value of $P(A)$?

(g) Prove that, if A and B are two independent events, then A^C and B^C are also independent.

(h) "In a histogram total area is equal to total frequency."– Justify.

2. Answer ***any four*** questions from the following : 5×4

(a) Describe the situation where Pie-Chart is used. Also, describe the method of construction of Pie-Chart.

(b) There are two non-overlapping sets with n_1 and n_2 values of variable x having means $\overline{x_1}$ and $\overline{x_2}$ and standard deviations s_1 and s_2 respectively. Show that if the combined variance is s^2, then

$$(n_1 + n_2)^2 s^2 = (n_1 + n_2)(n_1 s_1^2 + n_2 s_2^2) + n_1 n_2 (\overline{x_1} - \overline{x_2})^2.$$

(c) Derive the formula for $P(A \cup B \cup C)$ when the 3 events A, B and C are not mutually exclusive.

(d) Distinguish between mutually independent and pairwise independent events with examples. Are two mutually independent events mutually exclusive? Give reasons for your answer.

(e) Give the classical definition of probability. What are its limitations?

(f) State two properties of geometric mean and establish them.

3. Answer ***any three*** questions from the following :

(a) (i) State and prove Bayes' Theorem for a set of events.

(ii) Three boxes have the following proportions of black and white balls : Box I – 4 black and 4 white balls; Box II – 6 black and 3 white; Box III – 2 black and 7 white. One of these boxes is selected at random and one ball is drawn randomly from it. What is the probability that the ball is black? Given that the ball is black, find the probability that it came from Box III. 7+8

(b) (i) Show that $b_2 \geq b_1 + 1$, explaining the equality condition where b_2 and b_1 are the measures of kurtosis and skewness respectively.

(ii) Prove that A.M. $\geq$ G.M. $\geq$ H.M. for a set of n positive values of a variable. 7+8

(c) (i) For a set of observations, show that | Mean – Median | $\leq$ SD.

(ii) Explain, with examples, frequency type and non-frequency type data.

(iii) What is meant by median of a distribution? If a variable x has median 'm', what will be the median of the variable $y = e^x$? 6+4+(2+3)

(d) (i) Express r-th order central moment in terms of raw moments up to order r.

(ii) What is meant by skewness of a distribution? Suggest a measure of skewness based on quartiles. State the limits of this measure.

(iii) Explain with example the statistical definition of probability. 5+(2+2+1)+5

(e) (i) If A and B are two events and $P(B) \neq 1$, prove that

I. $P(A \cap B) \geq \max\{0,\ P(A) + P(B) - 1\}$

II. $P\left(A \mid B^C\right) = \dfrac{P(A) - P(A \cap B)}{1 - P(B)}$.

(ii) Write a short note on Lorenz curve related to income distribution. What is Gini's coefficient? What is its significance? (2+3)+(5+2+3)
