

2024

STATISTICS — MINOR

Paper : MN-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** questions : 2×5
 - (a) Explain, with an example, what you mean by an attribute.
 - (b) Distinguish between a discrete and a continuous variable.
 - (c) If $y = 10^5 - 2x$ and the variance of x is 4, what is the standard deviation of y ?
 - (d) Give an example where the harmonic mean is a suitable measure of central tendency.
 - (e) What do you mean by skewness of a frequency distribution?
 - (f) For three events A , B and C , symbolically express the events of occurrence of exactly one of them and at least one of them.
 - (g) Define conditional probability.
 - (h) Write down two major drawbacks of the classical definition of probability.
2. Answer **any four** questions :
 - (a) Define arithmetic mean of a frequency distribution. Suppose a variable takes the values $1, 2, \dots, n$ with corresponding frequencies $1^2, 2^2, \dots, n^2$. Find the arithmetic mean. 2+3
 - (b) Define lower and upper quartiles. Indicate how one can find them from a single ogive. 3+2
 - (c) Prove that mean deviation is least when measured about the median. 5
 - (d) Define mutually exclusive and independent events. Discuss whether two mutually exclusive events can be independent or not. 3+2
 - (e) State and prove the theorem of total probability. 2+3
 - (f) Define pairwise and mutually independent events. Illustrate with example. 5
3. Answer **any three** questions :
 - (a) (i) Define geometric mean of a set of positive observations. Show that it cannot exceed the arithmetic mean. When will these two be equal?
 - (ii) State and prove any two properties of the geometric mean. (2+6+1)+6

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- (b) (i) Define standard deviation of a variable. Show that it is independent of the change of base but is dependent on the change of scale.
- (ii) State and prove one of the inequalities relating the standard deviation of a set of observations to its range.
- (iii) Find the standard deviation of the first n natural numbers. (2+3)+5+5
- (c) (i) What are ordinary and central moments of a set of observations? Express r -th order central moment in terms of r -th and lower order ordinary moments.
- (ii) Define the b_1 and b_2 measures. State and prove any inequality between them. (3+4)+(3+5)
- (d) (i) Distinguish, with example, between elementary and composite events.
- (ii) If $P(B \cap C) > 0$, then show that $P(A \cap B | C) = P(B|C) P(A|B \cap C)$.
- (iii) If A, B, C and D are independent events, show that $A \cup B$ and $C \cup D$ are also independent.
- (iv) State and prove the theorem of total probability for three events. 3+3+4+5
- (e) (i) State and prove Bayes' Theorem.
- (ii) Three urns contain, respectively, 4 red and 6 green balls; 5 red and 5 green balls; 6 red and 4 green balls. One of the urns is selected at random and a ball is drawn from the selected urn. If it is found to be red, what is the probability that the 2nd urn was selected? (2+6)+7