2025

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) Distinguish between a nominal and an ordinal variable with examples.

(b) Identify the following as an attribute, a discrete or a continuous variable :

(i) Colour of shirts of a group of persons.

(ii) Number of persons wearing red-coloured shirts in several groups.

(iii) Lengths of those red-coloured shirts.

(iv) Number of different colours of shirts in several groups of persons.

(c) Find the variance of first five odd natural numbers.

(d) What do you mean by a symmetric frequency distribution?

(e) What is kurtosis of a frequency distribution?

(f) If A^c and B^c are independent, show that A and B are also so.

(g) If for two events A and B, $P(A \cup B) = 0.44$, $P(A) = P(B) = 0.2$, check whether they are independent or not.

(h) State the theorem of compound probability.

2. Answer ***any four*** questions :

(a) Let A, G and H be the A. M., G. M. and H. M. of $n(\geq 2)$ positive observations, respectively. Show that $AH = G^2$ if (i) $n = 2$ or (ii) the observations are in G.P. 2+3

(b) Define mean deviation of a set of observations about some arbitrary value A. Show that the mean deviation of n observations $x_1, x_2, \ldots, x_n$ about their arithmetic mean $\bar{x}$ can be expressed as

$$MD_{\bar{x}} = \frac{2}{n} \sum_{i:x_i > \bar{x}} (x_i - \bar{x}).$$

3+2

(c) What is skewness of a frequency distribution? Suggest any two measures of skewness. Derive the limits of any one of them. 1+2+2

Please Turn Over

(d) What do you mean by a random experiment? Define and illustrate the terms 'sample space', 'sample point' and 'event' through an example of such an experiment. 2+3

(e) For any two events A and B, prove that

$$P(A) + P(B) - 1 \leq P(A \cap B) \leq P(A) + P(B).$$ 5

(f) Define conditional probability.

Suppose that a researcher notes a person's gender and whether or not the person is a colour blind. Assume that the proportion of men and women are equal in the population. Also suppose that 4% of the population are colour blind men and the proportion of colour blind women in the population is 0.002.

(i) If a person is selected at random from this population, what is the chance that he or she is a colour blind?

(ii) If a randomly selected person is a colour blind, then what is the chance that the person is a man?

(iii) If a randomly selected person is a man, then what is the chance that he is a colour blind? 2+1+1+1

3. Answer ***any three*** questions :

(a) Explain, with examples, the difference between (i) primary data and secondary data, (ii) cross-sectional and time series data. Discuss, in brief, different methods of collecting primary data. 6+9

(b) (i) Prove or disprove :

$$\sum_{i=1}^{100} |i - 50.1| = \sum_{i=1}^{100} |i - 50.2|.$$

(ii) Define root mean square deviation. Show that its minimum value is the standard deviation.

(iii) Define raw moments. Express variance in terms of raw moments.

(iv) Show that $|Mean - Median| \leq s.d.$ 3+4+4+4

(c) (i) What is relative dispersion and why is it needed? What are the different measures of relative dispersion? Discuss the merits and demerits of such measures.

(ii) Suppose we have $k(\geq 2)$ groups of observations, the i-th group having n_i observations with standard deviation s_i, $i = 1(1)k$. Derive an expression for the combined variance of all the observations in k groups. (2+3+3)+7

(d) (i) For a vacant position, a short list of four applicants will be considered for interview. The candidates called for interview are of the following types :

I. Female, accounting special with OGPA 7.0

II. Female, marketing special with OGPA 7.6

III. Male, finance special with OGPA 7.4

IV. Female, finance special with OGPA 6.4.

One of the candidates will be selected for the job. Draw a Venn diagram to show the following events :

A : a finance special is selected

B : OGPA of the selected is higher than 7.2

C : a female candidate is selected.

Also give the composition of the events $A \cup C$, $A \cap B$, C^c, $C \cap A^c$, $A \cup C^c$ in terms of the types of candidates mentioned in I-IV above.

(ii) Explain why there must be a mistake in each of the following statements :

I. A computer repairman claims that the probability is 0.8 that the hard disk is working properly, 0.7 that the RAM is working properly and 0.3 that both of them are working properly.

II. An account officer claims that he has made the account without any significant errors with probability 0.95 and probability that there are one or two significant errors is 0.08. It is assumed that these are all possible types of errors that the account officer can make.

III. A real estate investor claims that a certain property can be sold for a project within one year has a probability 0.6, while the property cannot be sold for profit within one year is 0.3. (3+5)+(3+2+2)

(e) (i) Suppose three unbiased dice are thrown at random at a time. Find the probability of getting a sum of 9 points.

(ii) A problem of statistics is given to three students *A, B, C,* whose chances of solving the problem independently are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$, respectively. Find the probability that

I. the problem will be solved

II. at least two of them will be able to solve the problem

III. exactly two of them will be able to solve the problem

IV. exactly one of them will be able to solve the problem. 5+(2½×4)
