2022

STATISTICS — GENERAL

Paper : GE/CC - 1

(Descriptive Statistics)

Full Marks : 50

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 : 2×5

   (a) Name two different diagrams used in representing an attribute.

   (b) Distinguish between discrete variable and continuous variable.

   (c) In case of a frequency distribution with open-end class interval suggest measures of central tendency and dispersion.

   (d) Prove or disprove : $\sum_{i=1}^{50}|i-25.1|=\sum_{i=1}^{50}|i-25.2|$ by suitable statistical argument.

   (e) Find the standard deviation of two real numbers 'a' and 'b'.

   (f) If $r_{12}=0.4$, $r_{13}=r_{23}=0.5$, find the value of multiple correlation coefficient $r_{1.23}$.

   (g) If the two regression lines are $2x+y=4$ and $5x+8y=7$, find the value of the correlation coefficient r_{xy} and the ratio of variances of x and y.

   (h) Write down the formula of Spearman's rank correlation coefficient. What are the limits in which Spearman's rank correlation coefficient lies?

2. Answer ***any two*** of the following :

   (a) Define Histogram and describe how it is constructed. Mention one use of it. 2+2+1

   (b) For a set of n observations show that the mean deviation about mean cannot exceed the standard deviation. 5

   (c) Show that the central moments are invariant under the change of origin, but not under the change of scale. 5

3. Answer ***any three*** of the following :

   (a) Prove that, for 'n' positive values $x_1, x_2, \dots x_n$, A.M. ≥ H.M. In particular if $x_i = r^{i-1}$, $r>1$, $i=1,2,\dots,n$ then show that A.M., G.M. and H.M. are in a geometric progression. 5+5

(b) What do you mean by the term 'regression'? Two variables x and y are known to be related to each other by the relation $y = ab^x$. How is the theory of least squares to be used to estimate the constants a and b on the basis of n pairs of observations (x_i, y_i), $i = 1, 2, ..., n$? 2+8

(c) Describe different types of kurtosis of a frequency distribution. Show that $b_2 > b_1 + 1$, where b_1 and b_2 are moment measures of skewness and kurtosis respectively. 3+7

(d) Let, there be two groups of 'n_1' and 'n_2' values with means $\bar{x}_1, \bar{x}_2$ and variances s_1^2, s_2^2 respectively, then, show that, the combined variance s^2 of $(n_1 + n_2)$ values can be expressed as :

$$s^2 = \frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2} + \frac{n_1 n_2}{(n_1 + n_2)^2}(\bar{x}_1 - \bar{x}_2)^2$$

Hence, show that when the group means are equal s^2 lies between s_1^2 and s_2^2. 7+3

(e) What does correlation coefficient r measure? With an example show that correlation zero does not necessarily imply that the variables are independent. Define partial correlation coefficient and find its range of variation. 2+3+5
