2015

STATISTICS — GENERAL

First Paper

Full Marks – 100

The figures in the margin indicate full marks

Candidates are required to give their answers in their own words as far as practicable

SET – I

Group – A

Answer ***Question No. 1*** and ***any three*** from the rest

1. Answer ***any four*** of the following : 2×4

(a) Define attribute and variable. Give examples.

(b) What do you mean by interviewer method for collection of data ?

(c) Give an example of a frequency distribution of a discrete variable and sketch a suitable diagram (in plain paper) representing the distribution.

(d) Define median of a set of n observations.

(e) If the relation between two variables x and y is $y = 10 - 5x$, find the relation between their standard deviations.

(f) Write down a measure of skewness and state its limits.

(g) In the correlation coefficient between x and y is 0.5, obtain the correlation coefficient between x and $y - 10$.

(h) What is partial correlation coefficient ?

2. Write a short notes on : 6+4+4

(a) Tabular representation of data

(b) Bar diagram

(c) Histogram.

3. (a) What do you mean by central tendency ? Illustrate with examples.

(b) There are two sets of values of x. The first set with n_1 observations has mean $\bar{x}_1$ and the second with n_2 observations has mean $\bar{x}_2$. Show that the mean $\bar{x}$ of all the $(n_1 + n_2)$ observations taken together is $\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$.

(c) Let M be the median of a set of observations $x_1, x_2, \ldots, x_n$ on x. If $y = g(x)$ is a monotonically increasing or decreasing function of x, show that the median of $g(x_1), g(x_2), \ldots, g(x_n)$ is $g(M)$. Can a similar result hold with regard to mean ? 4+4+6

4. (a) What is dispersion ? Illustrate with examples.

(b) Define range (R) and standard deviation (s). Show that $0 \le s^2 \le \frac{R^2}{4}$. When do the equalities hold ?

(c) Define coefficient of variation and mention its uses. 4+7+3

5. (a) What is a scatter diagram ? Illustrate positive –, negative – and zero – correlation with suitable scatter diagrams.

(b) Let r be the correlation coefficient between x and y. Show that $-1 \le r \le 1$.

(c) Check whether the regression coefficient on y on x is independent on the change of base or not. 5+5+4

6. (a) What do you mean by correlation index ? Illustrate with an example.

(b) Mention situations where rank correlation coefficient is to be used. Derive the formula of Spearman's rank correlation coefficient (r_R) for no-tie case. State the range of values of r_R and interpret the marginal cases. 4+10

7. (a) Illustrate multiple regression with an example.

(b) What is multiple correlation ? In usual notations express the formula of $r_{1.23}$ in terms of r_{12}, r_{13} and r_{23}. Further state the limits of $r_{1.23}$. 6+8

Group – B

Answer ***Question No. 8*** and ***any three*** from the rest

8. Answer ***any four*** of the following : 2×4

(a) Define, with example, a random experiment.

(b) Write down the sample space of an experiment of tossing a coin repeatedly until head appears.

(c) State the axiomatic definition of probability.

(d) If $P(A) = P(B) = 0.6$ and $P(A \cup B) = 1$, then calculate $P(A \cap B)$.

(e) What do you mean by a random variable ? Illustrate with an example.

(f) If x follows Poisson distribution with mean 5, calculate $P(x>0)$.

(g) What are the mean and variance of a uniform $(-1, 1)$ distribution ?

(h) If (X, Y) follows bivariate normal (0, 0, 1, 1, 0.7) distribution, calculate cov(X, Y).

9. (a) What are mutually exclusive and exhaustive –events ? Illustrate with examples.

(b) Give the classical definition of probability and discuss its limitations.

(c) A committee of 4 persons is formed from 8 gentlemen and 6 ladies. What is the probability that the committee contains exactly 2 ladies ? 4+6+4

10. (a) Define conditional probability. Illustrate with an example.

(b) When are two events said to be independent ? Give an example.

(c) State and prove the theorem of total probability. 3+3+8

11. (a) Define, with an example, cumulative distribution function of a random variable and state its properties.

(b) If X, Y are two random variables defined on the same sample space, prove that $E(X + Y) = E(X) + E(Y)$. Also show that $V(X + Y) = V(X) + V(Y) + 2cov(X, Y)$. 6+8