2017

(October)

STATISTICS

(Elective/Honours)

(Descriptive Statistics, Numerical Analysis and Probability)

STH–1 (TH)

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, selecting **one** from each Unit

UNIT—I

1. *(a)* What do you mean by statistical data? Write a note on the types of statistical data. What are different methods of collecting primary data? 6

   (b) Explain the following terms with rough sketches : 2×3=6

   (i) Histogram

   (ii) Frequency polygon

   (iii) Cumulative frequency curve.

(Turn Over)

2. *(a)* What do you mean by measure of location? What are different measures of location? Which is the best measure of location? Give reasons. Write down the characteristics of ideal measure of location. 7

(b) What do you mean by measures of dispersion? Which measure of dispersion is the best and why? Show that standard deviation is the least root-mean-square-deviation. 5

UNIT—II

3. *(a)* What do you mean by bivariate data? Discuss positive correlation, negative correlation and zero correlation with the help of scatter diagrams. 1+3=4

(b) Show that—

(i) $-1 \le r \le 1$, where r is the correlation coefficient;

(ii) correlation coefficient is independent of change of origin and scale. 3½×2=7

4. *(a)* Write down the equation of the regression line of y on x. For what purpose do we use it? Explain what you mean by the statement 'regression

(Continued)

coefficient of y on x is $-\cdot73$'. At what point do the regression lines intersect? Why are there two regression lines? Explain clearly. 5

(b) Show that—

(i) the geometric mean of the regression coefficients is the correlation coefficient;

(ii) regression coefficients are independent of the change of origin but not of scale. 2×2=4

(c) Write a note on 'intraclass correlation coefficient'. 2

UNIT—III

5. *(a)* What is finite difference? Define operators Δ and E. Obtain the relationship between Δ and E. Show that

$$\Delta \log f(x) = \log\left\{1 + \frac{\Delta f(x)}{f(x)}\right\}$$ 1+1+1+2=5

(b) State and prove Lagrange's method of interpolation. 1+5=6

6. What do you mean by numerical integration? Obtain the general quadrature formula and hence obtain Simpson's $\frac{1}{3}$rd rule of numerical integration. 11

(Turn Over)

UNIT—IV

7. *(a)* What do you mean by event? Define the following terms with examples : 6

(i) Exhaustive events

(ii) Favourable events

(iii) Mutually exclusive events

(iv) Equally likely events

(v) Independent events

(b) For two events A and B, show that

$$P(A \cap B) = P(A) \cdot P(B \mid A),\ P(A) > 0$$
$$= P(B) \cdot P(A \mid B),\ P(B) > 0$$

where $P(B \mid A)$ represents conditional probability of occurance of B when the event A has already happened and $P(A \mid B)$ is the conditional probability of happening of A, given that B has already happened. 5

8. *(a)* Show that 'the necessary and sufficient condition for independence of n events $A_1, A_2, \cdots A_n$ is that the probability of their simultaneous happening is equal to the product of their respective probabilities'. 4

(b) State and prove Bayes' theorem. 7

(Continued)

UNIT—V

9. *(a)* Define the 'distribution function' of a random variable and state its properties. Also define probability mass function. Explain the concept of probability density function. 7

(b) The joint p.d.f. of two random variables X and Y is given by

$$f(x, y) = \frac{9(1+x+y)}{2(1+x)^4(1+y)^4};\ 0 \le x < \infty,\ 0 \le y < \infty$$

Find the marginal distribution of X and Y, and the conditional distribution of Y for $X = x$. 4

10. Given that X and Y are any two random variables, then show that 4

(i) $E(X) = E\{E(X \mid Y)\}$

Or

$$[E(XY)]^2 \le E(X^2) \cdot E(Y^2)$$

(ii) $V(X) = E[V(X \mid Y)] + V[E(X \mid Y)]$ 7

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