2022

(February)

STATISTICS

(Elective/Honours)

(Descriptive Statistics, Numerical Analysis and Probability)

[STEH–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)* A person covers from place A to place B by cycling at a speed of 12 km per hour and returning back from place B to place A at a speed of 16 km per hour. Obtain the average speed of that person in the whole journey. 5

(b) Let X_{1i} is one series with size n_1 and geometric mean G_1 and X_{2j} is another series with size n_2 and geometric mean G_2. Obtain the geometric mean of combined series. 5

(c) Obtain simple and weighted arithmetic mean of the first n natural numbers, the weights being the corresponding numbers. 2

2. *(a)* Differentiate between primary and secondary data. 2½

(b) Write short notes on the following : 4½

(i) Frequency distribution

(ii) Frequency curve

(c) Compare mean, median and mode as measures of location of a distribution. 5

UNIT—II

3. *(a)* What is regression? What do you mean by 'lines of regression'? 3

(b) Write the regression equations of Y on X and X on Y. Also write the properties of regression coefficient. 4

(c) Write a note on intra-class correlation coefficient. 4

4. *(a)* Derive coefficient of partial correlation. 7½

(b) Explain the properties of multiple correlation coefficient. 2

(c) Obtain multiple correlation in terms of total and partial correlations. 1½

UNIT—III

5. *(a)* If third-order differences are constant, prove that

$$\int_0^2 u_x dx = \frac{1}{24}\left(-u_{-\frac{1}{2}} + 23u_{\frac{1}{2}} + 23u_{\frac{3}{2}} - u_{\frac{5}{2}}\right) \quad 4$$

(b) Derive Simpson's three-eighth rule of numerical integration without deriving general quadrature formula. 7

6. *(a)* Differentiate among forward, backward and divided difference interpolations. 4

(b) Derive Gregory-Newton forward interpolation formula. Hence, deduce Gregory-Newton advancing formula. 7

UNIT—IV

7. *(a)* State the axiomatic definition of probability. 2

(b) If A and B are two events, then prove that

$$P(A \cap B) = P(A)\, P(B/A),\ P(A) \neq 0$$
$$= P(B)\, P(A/B),\ P(B) \neq 0$$

where notations are as usual. 7

(c) Define conditional probability. 2

8. *(a)* If A, B and C are mutually independent events, then show that $A \cap B$ and C are also independent. 3

(b) A problem in statistics is given to three students A, B and C whose probabilities of solving the problem are $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved if all of them try independently? 4

(c) From a city population, the probability of selecting *(i)* a male or a smoker is $\frac{7}{10}$, *(ii)* a male smoker is $\frac{2}{5}$ and *(iii)* a male, if a smoker is already selected is $\frac{2}{3}$. Obtain the probability of selecting *(a)* a non-smoker, *(b)* a male and *(c)* a smoker, if a male is first selected. 4

UNIT—V

9. *(a)* Differentiate between discrete and continuous random variables. 3

(b) If joint distribution of X and Y is defined as

$$f(x, y) = 4xy\, e^{-(x^2 + y^2)};\ x \geq 0, y \geq 0$$

test whether X and Y are independent.

For the above joint distribution, obtain the conditional density of X for given $Y = y$. 5

(c) Discuss the properties of mathematical expectation. 3

10. *(a)* Let $X_1, X_2, \cdots, X_n$ be n random variables, then prove that

$$V\left(\sum_{i=1}^{n} a_i x_i\right) = \sum_{i=1}^{n} a_i^2 V(x_i) + 2 \sum_{i=1}^{n} \sum_{j=1}^{n} a_i a_j \mathrm{Cov}(x_i, x_j)$$

7

(b) If two dice are thrown simultaneously, obtain the expected values of the sum of numbers of points on them. 4

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