1/EH–28 (i) (Syllabus–2019)

2022

(November)

STATISTICS

(Elective/Honours)

[STEH–1(TH)]

(Descriptive Statistics, Numerical Analysis and Probability)

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)* Distinguish between classification and tabulation. Mention the requisites of a good statistical table. 3+3=6

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

(i) Histogram

(ii) Frequency polygon

(iii) Cumulative frequency curve

2. *(a)* What do you mean by measures of central tendency? What are the desirable properties for an average to possess? 2+4=6

(b) Show that $AM \geq GM \geq HM$. 3

(c) What do you mean by skewness and kurtosis of a distribution? Give different measures of skewness. 3

UNIT—II

3. *(a)* Define Karl Pearson's coefficient of correlation. What does it measure? 2+1=3

(b) Show that—

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

(ii) correlation coefficient is independent of change of origin and scale. 4×2=8

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

(b) Obtain the regression equation of Y on X by the method of least squares. 4

(c) Show that—

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

(ii) if one of the regression coefficients is >1, then the other must be <1. 2×2=4

UNIT—III

5. *(a)* Define Δ and E operators. 1

(b) If $f(x) = x^2$ and $h = 1$, find

$$\left[\frac{\Delta f(x)}{Ef(x)}\right]^2 \text{ and } \frac{\Delta^2 f(x)}{E^2 f(x)}$$ 3

(c) What is meant by interpolation? Establish Newton's forward interpolation formula. 2+5=7

6. Obtain the general quadrature formula and hence obtain *(a)* trapezoidal rule and *(b)* Simpson's $\frac{3}{8}$th rule of numerical integration. 5½+5½=11

UNIT—IV

7. *(a)* Define the following terms : 1+2+2+1=6

(i) Random experiment

(ii) Trial and event

(iii) Sample space

(iv) Discrete sample space

(b) Define conditional probability. 1

(c) 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 occurrence of B when the event A has already happened and $P(A \mid B)$ is the conditional probability of A when the event B has already happened. 2

(d) Give the classical and axiomatic definitions of probability. 1+1=2

8. (a) State and prove Bayes theorem. 5

(b) The probabilities of X and Y becoming managers are 0·6 and 0·4, respectively. The probabilities that the bonus scheme will be introduced if X and Y become managers are 0·8 and 0·3, respectively.

(i) What is the probability that bonus scheme will be introduced?

(ii) If the bonus scheme has been introduced, what is the probability that the manager appointed X? 2+2=4

(c) Show that if A and B be any two events (not necessarily mutually exclusive), then

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$ 2

UNIT—V

9. (a) Define discrete and continuous random variables and state their properties. 5

(b) A continuous random variable X has a p.d.f. $f(x) = 3x^2,\ 0 \le x \le 1$. Find a and b such that—

(i) $P(X \le a) = P(X > a)$;

(ii) $P(X > b) = 0 \cdot 05$. 2

(c) State the mathematical expectation of a random variable and its properties. 1+3=4

10. Define the following :

(a) Moment-generating function, cumulant-generating function and probability-generating function 2+2+2=6

(b) Conditional expectation and conditional variance for discrete and continuous cases 2+3=5

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