2023

B.A./B.Sc.

First Semester

CORE – 1

STATISTICS

Course Code: STC 1.11

(Descriptive Statistics & Probability Theory)

Total Mark: 70 *Pass Mark: 28*

Time: 3 hours

Answer five questions, taking one from each unit.

UNIT–I

1. (a) Which of the following can be classified as hypothetical population? 1
   (i) All labourers of a factory
   (ii) Female population of a country
   (iii) Population of real numbers between 0 and 100
   (iv) Students of the world

   (b) Define statistics in singular sense. 2

   (c) Discuss the classification of data based on kind of characteristics 6

   (d) Discuss the various steps of collecting primary data. 5

2. (a) What are the different types of tables? Discuss in detail. 8

   (b) Write short notes on *any two* of the following: 2×3=6
   (i) Histogram (ii) Bar diagram
   (iii) Frequency polygon (iv) Ogive

UNIT–II

3. (a) Harmonic mean cannot be calculated for a data set having 1
   (i) Positive number (ii) Negative number
   (iii) Zero (iii) Both (i) and (ii)

   (b) Choose the correct relationship between arithmetic mean (AM), geometric mean (GM) and harmonic mean (HM) 1
   (i) $AM \geq GM \geq HM$ (ii) $HM \geq GM \geq AM$
   (iii) $GM \geq AM \geq HM$ (iii) None

(c) Define arithmetic mean, geometric mean and harmonic mean and discuss their merits and demerits. 12

4. (a) Which of the following measure of central tendency can be considered as a positional average? 1

(i) Median (ii) Mode

(iii) A.M (iv) GM

(b) Define median. Discuss the graphical method of locating median. Give the formula for obtaining median for a continuous frequency distribution in a grouped data. 2+2+2=6

(c) Give the relationship between mean, median and mode due to Karl Pearson. 2

(d) Prove that the sum of squares of deviation of set of values is minimum when taken about mean. 5

UNIT–III

5. (a) Define the following: 2×2=4

(i) Quartile deviation

(ii) Mean deviation

(b) Show that the mean deviation is least when measured about the median. 5

(c) Find the first four central moments in terms raw moments. 5

6. (a) What is meant by measures of dispersion? Explain briefly about absolute and relative measures of dispersion. 2+4=6

(b) Define and discuss moments in brief. 4

(c) Define skewness and kurtosis. Write down Karl Pearson's coefficient of skewness. 2+2=4

UNIT–IV

7. (a) Define the following terms: 1×5=5

(i) Events (ii) Outcomes

(iii) Trial (iv) Favourable events

(v) Exhaustive events

(b) For n events $A_1, A_2, A_3, \ldots, A_n$. Prove that

$$P\left(\bigcup_{i=1}^{n} A_i\right) \geq \sum_{i=1}^{n} p(A_i) - \sum_{1 \leq i < j \leq n} P(A_i \cap A_J)$$ 5

(c) The content of urns I, II, III are as follows:

1 white, 2 black and 3 red balls,

2 white, 1 black and 1 red balls and

4 white, 5 blacks and 3 red balls.

One urn is chosen at random and two balls drawn from it. They happen to be white and red. What is the probability that they come from urns I, II or III? 4

8. (a) Define empirical probability and mathematical probability. Write their limitations. 2+3=5

(b) Prove that for any three events A,B and C: 3+2=5

(i) $P(A \cup B / C) = P(A / C) + P(B / C) - P(A \cap B / C)$

(ii) $P(A \cap \overline{B} / C) + P(A \cap B / C) = P(A / C)$

(c) A letter is known to have come either from TATANAGAR or from CALCUTTA. On the envelope just two consecutive letters TA are visible.What is the probability that the letter come from CALCUTTA? 4

UNIT–V

9. (a) Define probability mass function. 2

(b) A random variable X is distributed at random between the value 0 and 1 so that its p.d.f. is $f(x) = kx^2(1 - x^3)$, where k is a constant. Find the value of k. Using the value of k, find its mean and variance. 5

(c) Suppose that two-dimensional continuous random variable (X, Y) has joint p.d.f given by $f(x, y) = \begin{cases} 6x^2 y, & 0 < x < 1, 0 < y < 1 \\ 0, & \text{elsewhere} \end{cases}$

(i) Verify $\int_0^1 \int_0^1 f(x, y)\,dx\,dy = 1$

(ii) Find $P\left(0 < X < \frac{3}{4}, \frac{1}{3} < Y < 2), P(X + Y < 1\right), P(X > Y)$, $P(Y < 2)$ and $P(X < 1 / Y < 2)$. 2+5=7

10 (a) Define continuous distribution function.Write the properties of distribution function. 4

(b) If X and Y are two random variables having joint density function:

$$f(x,y)=\begin{cases}\frac{1}{8}(6-x-y); & 0\le x<2, 2\le y<4\\ 0; & \text{otherwise}\end{cases}$$

Find : $P(X<1\cap Y<3), P(X+Y<3)$ and $P(X<1/Y<3)$ 6

(c) A variable X is distributed at random between the values 0 ands 4 and p.d.f is given by $f(x,y)=kx^3(4-x)^2$. Find the value of k, the mean and variance of the distribution. 4