

## B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, APRIL 2012

## Second Semester

## Complementary Course (STATISTICS)—THEORY OF RANDOM VARIABLE

(For B.Sc. Physics, Maths and Computer Applications)

Time : Three Hours

Maximum Weight : 25

## Part A

Answer all questions from 1-16..

Each bunch of four questions carries a weight of 1.

## Bunch I

Choose the correct answer :

1 The correlation coefficient  $r$  lies between :

- (a) 0 and 1. (b) -1 and +1.  
 (c) -1 and 0. (d) None of these.

2 The moment measure of skewness  $b_1$  is :

- (a)  $\frac{\mu_3^2}{\mu_2^3}$ . (b)  $\frac{\mu_4}{\mu_2^2}$ .  
 (c)  $\frac{\mu_2^3}{\mu_3}$ . (d)  $\frac{\mu_2}{\mu_3}$ .

3 Values of a random variable are always :

- (a) Positive. (b) Positive real numbers.  
 (c) Real numbers. (d) None of these.

4 Sigma field of events (b) satisfy which of the following properties ?

- (a)  $S \in \beta, Q \in \beta$ .  
 (b) If  $A_1, A_2, \dots, \in \beta$ , their union and intersections are also in  $\beta$ .  
 (c) If  $A \in \beta$ , then  $A^c \in \beta$ .  
 (d) All the above.

## Bunch II

Fill in the blanks :

- 5 The p.d.f. of a r.v. X is  $f(x) = C \frac{x^2}{2} 0 \leq x \leq 1$ . Then the value of C is \_\_\_\_\_.
- 6 The correlation coefficient  $r$  is the \_\_\_\_\_ of regression coefficients.

Turn over

- 7 Two r.v.s. X and Y are statistically independent if its joint density  $f(x, y) = \text{-----}$ .
- 8 The expected value of r.v. is -----.

## Bunch III

Examine which of the following are pdfs :

$$9 \quad f(x) = \begin{cases} \frac{1}{4} & \text{for } x=1 \\ \frac{3}{2} & \text{for } x=2 \\ 0 & \text{otherwise} \end{cases}$$

$$10 \quad f(x) = \begin{cases} \frac{1}{3} & \text{for } x=-1 \\ \frac{1}{3} & \text{for } x=0 \\ \frac{1}{3} & \text{for } x=5 \\ 0 & \text{otherwise} \end{cases}$$

$$11 \quad f(x) = \begin{cases} -\frac{1}{2} & \text{for } x=1 \\ \frac{3}{2} & \text{for } x=2 \\ 0 & \text{otherwise} \end{cases}$$

$$12 \quad f(x) = \begin{cases} \frac{1}{2} & \text{for } x=1 \\ \frac{2}{3} & \text{for } x=0 \\ \frac{1}{4} & \text{for } x=2 \\ 0 & \text{otherwise} \end{cases}$$

## Bunch IV

Examine whether the following are discrete or continuous random variables.

- 13 The age of a person.
- 14 Number of petals in a rose flower.
- 15 Marks obtained by a student in an examination.
- 16 Number of fishes caught by a fisherman in a particular day.

(4 × 1 = 4)

## Part B

Answer any five from questions (17–24).  
Each question carries a weight of 1.

- 17 A balanced die is tossed and a person receives a sum of Rs. 10 if an even number turns up, otherwise he loses Rs. 8. How much money can he expect on the average in the long run?
- 18 If  $F(x) = 0$  for  $x < 0$   
 $= x$  for  $0 \leq x \leq 1$   
 $= 1$  for  $x \geq 1$
- then find  $P[2X + 3 \leq 3.6]$ .
- 19 What is Sheppard's correction? Write down Sheppard's correction for the first four moments.
- 20 If  $S = \{1, 2, 3, 4, 5\}$  and  $A = \{1, 2, 3\}$ , write down the sigma field generated by  $A$ .
- 21 What is a Scatter diagram? How is it constructed?
- 22 Write the normal equations for fitting a curve of the form  $y = ax^2 + bx + c$ .
- 23 Define moment generating function of a random variable? State its properties.
- 24 Distinguish between Discrete and Continuous random variables.

(5 × 1 = 5)

## Part C

Answer any four from questions (25–30).  
Each question carries a weight of 2.

- 25 A balanced die is tossed until an odd number appears. Obtain the probability distribution of the number of tosses.
- 26 Explain the principle of least squares for fitting a straight line of the form  $y = ax + b$ .
- 27 State and prove addition theorem on expectation.
- 28 Given  $f(x, y) = \begin{cases} c(x + y) & \text{for } (1, 1), (2, 1), (2, 2) \text{ and } (3, 1). \\ 0 & \text{otherwise} \end{cases}$

(a) Find  $c$ ; (b) Marginal densities of  $x$  and  $y$ .

- 29 If two unbiased dice are tossed write the joint p.d.f. of  $X$  and  $Y$  where  $X$  is the sum of the numbers shown by the two dice and  $Y$  is the maximum of the two numbers.
- 30  $f(x) = \begin{cases} \frac{2}{3} & \text{for } x = 1 \\ \frac{1}{3} & \text{for } x = 2 \\ 0 & \text{otherwise} \end{cases}$

Find the m.g.f and hence  $\mu_1^1$  and  $\mu_2^1$ .

(4 × 2 = 8)

Turn over

## Part D

Answer any two from questions (31–33).  
Each question carries a weight of 4.

- 31 What is skewness? Obtain any measure of skewness for the following data :

X	:	5	10	15	20	25	30	35
fr	:	4	38	65	90	70	42	6

- 32 Given the two regression lines  $8x - 10y + 66 = 0$  and  $40x - 18y = 214$  and variance of  $x$  is 9. Find the mean of  $n$ , mean of  $y$ , the correlation coefficient between  $x$  and  $y$  and variance of  $y$ .

- 33 Derive the formula for Spearman's rank correlation coefficient.

(2 × 4 = 8)