

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, APRIL 2010**Second Semester****Complementary Course—STATISTICS—THEORY OF RANDOM VARIABLES**

(For the Programmes (1) B.Sc. Physics ; (2) B.Sc. Mathematics ;
(3) B.Sc. Computer Applications Three Main)

Time : Three Hours

Maximum Weight : 25

Part A*Answer all questions 1 – 16.**Each Bunch of four questions carries a weight of 1.***BUNCH I**

1. If two squares are chosen at random from the 64 squares on a chess board, the probability that they have a side in common is :

(a) $\frac{1}{32}$.

(b) $\frac{1}{18}$.

(c) $\frac{1}{8}$.

(d) $\frac{1}{64}$.

2. The distribution function of a random variable is :

(a) $P(X = x)$.

(b) $P(X > x)$.

(c) $P(X < x)$.

(d) $P(X \leq x)$.

3. The p.d.f. of a continuous random variable is :

(a) integral of its distribution function ;

(b) differential coefficient of the distribution.

(c) expectation of the distribution function.

(d) none.

4. When two dice are rolled and if X denotes the sum of the numbers shown, the number of possible values of X is :

(a) 11.

(b) 12.

(c) 36.

(d) 6.

BUNCH II

5. For any random variable X :

(a) $|E(X)| > E(|X|)$.

(b) $|E(X)| \geq E(|X|)$.

(c) $|E(X)| \leq E(|X|)$.

(d) $|E(X)| < E(|X|)$.

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6. If $E(X - C)^2 = V(X) + K$ then $K =$

- (a) $E(X)$. (b) $E(X^2)$.
 (c) $[E(X) - C]^2$. (d) C^2 .

7. $\frac{d^r [M_x^{(t)}]}{dt^r}$ at $t = 0$ gives :

- (a) variance. (b) r^{th} central moment.
 (c) zero. (d) r^{th} moment about zero.

8. $\text{Var}(2X - 3)$ equals :

- (a) $2 \text{Var}(X) - 3$. (b) $2 \text{Var}(X) + 3$.
 (c) $4 \text{Var}(X) - 3$. (d) $4 \text{Var}(X)$.

BUNCH III

9. If $\beta_2 = 2.1$, the distribution is :

- (a) +vely skewed. (b) - vely skewed.
 (c) Platykurtic. (d) leptokurtic.

10. For a distribution with positive skewness :

- (a) mean = median = mode.
 (b) mean < median < mode.
 (c) mean < mode < median.
 (d) mean > median > mode.

11. The 3rd central moment of the values 7, 9, 10, 15, 19 is :

- (a) 19.2. (b) 42.
 (c) 0. (d) 210.

12. The zeroth central moment of 10 values equals :

- (a) 10. (b) 0.
 (c) 1. (d) not existing.

BUNCH IV

13. If correlation coefficient is γ and regression coefficients are b_1 and b_2 then :

- (a) $\gamma = \frac{(b_1 + b_2)}{2}$. (b) $\gamma^2 = b_1 b_2$.
 (c) $\gamma^2 = b_1 \cdot b_2$. (d) $\gamma^2 = \sqrt{b_1 \cdot b_2}$.

14. If the correlation between X_i and Y_i is γ then the correlation between X_i/k and y_i/p where k and p are positive constants is :

(a) kpy .

(b) $\frac{\gamma}{kp}$.

(c) γ^2 .

(d) γ .

15. If correlation coefficient is zero, then the angle between regression lines is :

(a) 0.

(b) $\pi/2$.

(c) $\pi/4$.

(d) $\pi/3$.

16. If the regression equations are $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, the coefficient of correlation between x and y is :

(a) $\sqrt{\frac{a_1 b_1}{a_2 b_2}}$.

(b) $\sqrt{\frac{a_1 b_2}{a_2 b_1}}$.

(c) $\sqrt{\frac{a_2 b_2}{a_1 b_1}}$.

(d) $\sqrt{\frac{a_2 b_1}{a_1 b_2}}$.

(4 × 1 = 4 weight)

Part B

Answer any five from Questions 17 – 24.

Each question carries a weight of 1.

17. Mention any two measures of skewness.
18. What are the properties of distribution function ?
19. Establish the relation between the r^{th} moment about mean and moments about zero.
20. Find the m.g.f. of the sum of two independent random variables.
21. Obtain the normal equations for fitting the parabola $y = ax^2 + bx + c$.
22. Explain the terms (i) Statistical regularity ; (ii) Sigma field of events.
23. Explain discrete and continuous random variables with two examples each.
24. Define characteristic function. State its important properties.

(5 × 1 = 5 weight)

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Part C

Answer any four from Questions 25 – 30.
Each question carries a weight of 2.

- 25. Given that $f(x) = kx^4 e^{-x}$; $x \geq 0$ is a p.d.f. Find k and the distribution function.
- 26. If $f(x) = 1$; $0 < x < 1$ is the p.d.f. of X derive the p.d.f. of $3x^2 + x$.
- 27. Explain the method of fitting the curve $y = a + \frac{b}{x}$.
- 28. Let:

$$f(x, y) = C(xy + e^x); \quad 0 < x, y < 1$$

$$= 0, \quad \text{otherwise.}$$

Find C and test for independence of X and Y .

- 29. If X and Y are two random variables, show that $E[E(X/Y)] = E(X)$.
- 30. Find the first three central moments of a distribution, if its first four moments about 4 are -1.5 , 17 , -30 and 108 .

(4 × 2 = 8 weight)

Part D

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

- 31. Find β_2 of the distribution :

x :	5	10	15	20	25	30	35
f :	8	15	20	32	23	17	5

- 32. X has the distribution :

$$P(X = x) = \frac{1}{2^x}; \quad x = 1, 2, 3, \dots$$

Find (i) $P(X \text{ is even})$; (ii) $P(X \leq 3)$; (iii) $P(X \text{ is divisible by } 5)$; and (iv) Mode of X .

- 33. If the regression equations are :

$$y = 0.516x + 33.73, \quad x = 0.512y + 33.52$$

find :

- (i) the mean values of x and y ;
- (ii) correlation coefficient;
- (iii) ratio of variances of X and Y ;
- (iv) ratio of coefficient of variations.

(2 × 4 = 8 weight)