BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2024
2023 ADMISSIONS REGULAR
SEMESTER II - COMPLEMENTARY COURSE 1 FOR MATHS & PHYSICS
ST2B01B23 - Probability and Random Variables

Time : 3 Hours   Maximum Marks : 80

Part A

I. Answer any Ten questions. Each question carries 2 marks   (10x2=20)

1. Distinguish between direct and inverse correlation.

2. How will you identify whether the correlation is positive or negative?

3. What is a Scatter diagram?

4. Give the standard error estimates of two regression lines.

5. State the properties of regression co-efficients of a bivariate data.

6. Establish the relationship between the correlation coefficient and the two regression coefficients of a bivariate data.

7. Define conditional probability.

8. If A, B, C are three events such that $P(A) = P(B) = P(C) = 1/2$, $P(AB) = P(AC) = 1/3$ and $P(BC) = 0$ Find $P(A \cup B \cup C)$.

9. Distinguish between discrete and continuous sample spaces with suitable examples.

10. The joint p.d.f. of a bivariate random variable (X,Y) is f(x,y) = x+y; 0

11. The joint p.d.f. of a bivariate random variable (X,Y) is f(x,y) = x+y; 0<x<1, 0<y<1, find the marginal p.d.f. of X.

12. Given that $f(x) = e^{-x}$; $x \geq 0$ is the p.d.f. of a random variable X, find the p.d.f. of $Y = 7 - 3X$

Part B

II. Answer any Six questions. Each question carries 5 marks   (6x5=30)

13. Derive the formula of rank correlation coefficient.

14. Find the Spearman's rank correlation co-efficient from the following data

Sales	50	50	55	60	65	65	65	60	60	50
Expenses	11	13	14	16	16	15	15	14	13	13

15. Given the two regression lines $8x - 10y + 66 = 0$ and $40x - 18y = 214$, identify the equations and find $\bar{x}, \bar{y}$ and r.

16. If two regression equations are 4y = 9X + 15, 25 X = 6Y + 7. Identify the regression equations and obtain the mean values of X and Y.

17. Prove that if A and B are such that P (A) ≠ 0, P (B) ≠ 0 and A is independent of B, then B is independent of A.

18. Box I contains 2 red and 3 white balls and box II contains 4 red and 7 white balls. Two balls are transferred from box I to box II and then three balls are drawn out from box II. What is the probability of getting 2 red and 1 white balls?

19. f(x) = x/15, x = 1,2,3,4,5 and 0 elsewhere is the density function of the random variable X. Find its distribution function. Find P(1 < x < 2) and P(1/2 ≤ x ≤ 5/2)

20. Define joint probability distribution function and give its properties.

21. Write down the probability distribution of X and Y, where X denotes the sum of the numbers obtained and Y denotes the maximum of the numbers obtained, when two unbiased dice are tossed.

Part C

III. Answer any Two questions. Each question carries 15 marks (2x15=30)

22. Find Karl Pearson's co-efficient of correlation and Spearman's rank correlation co-efficient from the following data

x	90	82	82	82	81	71	63	63	49	38
y	75	72	71	71	71	71	50	40	32	32

23. The following table gives the heights (in inches) of fathers and sons. Estimate the height of the son when the father's height is 64 inches.

Ht of Father	65	66	67	68	69	71	73	70	72
Ht of Son	30	42	45	46	33	34	40	35	39

24. (a) State and prove Baye's theorem. (b) Two classes A & B consists of 25 boys, 15 girls and 20 boys, 30 girls respectively. One student is selected at random and found to be a girl. Find the probability that she was from class B.

25. The joint p.d.f of (X,Y) is $f(x, y) = \dfrac{x + y}{21}; x = 1, 2, 3$ and $y = 1, 2$. Find

(i) $f(x/y = 2)$ and $f(y/x = 3)$

(ii) The p.d.f. of X+Y

(iii) Examine whether X and Y are independent.