TB252455J

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2025

2023 ADMISSIONS SUPPLEMENTARY

SEMESTER II - CORE COURSE

ST2C02B23 - 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. How will you identify whether the correlation is positive or negative?
2. What are the different types of Correlation?
3. Give the formula for Spearman's rank correlation co-efficient.
4. Describe the principle of least squares used for estimation of parameters.
5. Fit a straight line of the form y = a + bx to the following data

x	0	1	2	3	4
y	0	1.8	3.3	4.5	6.3

6. If two regression equations of a bivariate data are 14x + 12y -3 = 0 and 12 x + 21y + 10 = 0, find coefficient of correlation between x and y.
7. Give the classical definition of probability.
8. Explain the terms 'Outcome', 'Sample space' and 'Event' with suitable examples.
9. Give the frequency definition of probability.
10. The joint p.d.f. of a bivariate random variable (X,Y) is f(x,y) = x+y; 0
11. Define joint p.d.f. of a bivariate random variable (X,Y).
12. Define distribution function of a random variable.

Part B

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

13. While calculating the correlation co-efficient between x and y from 25 pairs of observations, the following sums were obtained $\sum x = 125$, $\sum y = 100$, $\sum x^2 = 650$, $\sum y^2 = 460$ and $\sum xy = 508$. It was later discovered that a pair of observation (8, 12) was copied wrongly as (6, 14). Find the correct value of the correlation co-efficient.
14. Derive the formula of rank correlation coefficient.
15. Fit a curve of the form $y = ab^x$ to the following data

x	1	2	3	4	5	6
y	3	4	5	6	9	8

16. Fit an equation of the form $y = ax^b$ to the following data

x	1	2	3	4	5
y	32	47	65	92	132

17. A problem is given to three students A, B, C whose chances of solving it are ½, 1/3 and ¼ respectively. What is the chance that the problem will be solved?
18. What is the probability of getting (a) 2 white balls (b) one of each colour when two balls are drawn from a box containing 3 white and 4 green balls.

19. Given the following probability distribution. (a) Find c (b) $P(X \geq 5)$ (c) determine the distribution function of X

x	0	1	2	3	4	5	6	7
P(x)	0	c	$2c$	$2c$	$3c$	c^2	$2c^2$	$7c^2 + c$

20. Distinguish between probability density function and distribution function of a continuous random variable. Give their properties.

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

Part C

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

22. Specimens of similarly treated alloy steels containing various percentages of nickel (y) are tested for toughness (x), measured in arbitrary units. The following are the results. Find the coefficient of correlation between x and y. what is the standard error of estimate for percentage of nickel estimated from toughness.

x	47	52	52	52	54	56	58	59	60	60	62	64
y	2.5	2.7	2.8	2.9	3.2	3.2	3.3	3.4	3.5	3.5	3.5	3.6

23. Fit a curve of the form $y = a + bx + cx^2$ to the following data

x	1	2	3	4	5	6	7
y	2.3	5.2	9.7	16.5	29.4	35.5	54.4

24. (a) State and prove the Baye's theorem on probability. (b) The chances of A, B and C becoming managers of a company are in the ratio 4:2:3. The probabilities that a reform will be introduced if A, B and C become managers are 0.3, 0.5 and 0.8 respectively. The reform has been introduced. What is the probability that B is appointed as the manager?

25. Given $f(x, y) = \frac{1}{4}(1 + xy), -1 < x < 1; -1 < y < 1$. Examine the independence of

I. x and y

II. x^2 and y^2