

2026

STATISTICS — MINOR

Paper : MN-2

(Descriptive Statistics - II and Probability - II)

Full Marks : 75

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*1. Answer **any five** questions :

2×5

- What is a scatter diagram?
- Define Kendall's coefficient of rank correlation.
- If X has a discrete uniform distribution over the values 1, 2, 3, 4, 5, 6; then find $E(X)$.
- What is meant by correlation index?
- Define intraclass correlation.
- A random variable X has p.m.f.

$$f_X(x) = Kx; x = 1, 2, 3, 4$$

and $f_X(0) = 0$; otherwise. Find the value of K .

- If $X \sim \text{Binomial}(n, p)$ and $E(X) = 6$, $V(X) = 3$; find n & p .
- If $X \sim N(\mu, \sigma^2)$, express $P(\mu - \sigma < X < \mu + 2\sigma)$ in terms of the standard normal distribution function $\Phi(\cdot)$.

2. Answer **any four** questions :

5×4

- For a bivariate distribution, explain the meaning of the correlation ratio. State its important properties and explain why it can detect certain types of association that Pearson's correlation coefficient may fail to detect.
- The following summary statistics are available for two variables x and y :

$$\bar{x} = 18, \bar{y} = 25,$$

$$\sigma_x = 4, \sigma_y = 5, \text{cov}(x, y) = 12$$

Find the two regression coefficients and hence write the two regression equations.

- Six students receive the following ranks in two subjects :

Student :	A	B	C	D	E	F
Statistics :	1	3	2	6	5	4
Mathematics :	2	1	3	5	6	4

Calculate the Pearson's correlation coefficient between the ranks in two subjects and comment on the result.

Please Turn Over

(7599)

- (d) A box contains 7 red and 5 blue balls. Two balls are drawn at random without replacement. If X denotes the number of red balls drawn, obtain the probability distribution of X and hence find $E(X)$.
- (e) Using the method of least squares, fit a quadratic curve :

$$y = a + bx^2$$

to the following data :

x	-2	-1	0	1	2
y	9	4	3	4	9

- (f) If X follows a Poisson distribution and $P(X=1) = P(X=2)$, find the parameter of the distribution and hence obtain $P(X=0)$.

3. Answer **any three** questions :

- (a) (i) Define the cumulative distribution function F_X of a random variable X . State the important properties of F_X .
- (ii) A discrete random variable X has p.m.f.

$$P(X=x) = \frac{x}{15}, x=1,2,3,4,5$$

Find $P(X \geq 3)$ & $P(2 \leq X < 5 | X > 1)$

- (iii) A continuous random variable X has p.d.f.

$$f_X(x) = \begin{cases} K(1-x^2), & 0 \leq x \leq 1 \\ 0; & \text{otherwise} \end{cases}$$

Find K and obtain the c.d.f. F_X .

4+4+(2+5)

- (b) (i) For a discrete uniform random variable taking the values $0, 1, 2, \dots, n$, derive its mean and variance.
- (ii) Show that the Poisson distribution can be obtained as a limiting form of the Binomial distribution when $n \rightarrow \infty$, $p \rightarrow 0$, such that $np \rightarrow \lambda$, where $0 < \lambda < \infty$. 7+8
- (c) (i) Derive the mode of a Binomial (n, p) distribution.
- (ii) If X follows a Poisson distribution with parameter λ , derive its mean and variance. Find $P(X \geq 1 | X \leq 1)$. 7+(5+3)
- (d) (i) What is rank correlation? State its uses. Derive Spearman's rank correlation coefficient for n pairs of observations when there are no tied ranks.
- (ii) Explain what is meant by the two regression lines in bivariate data. Show that their regression coefficients (b_{xy} and b_{yx}) satisfy

$$b_{yx}b_{xy} = r^2,$$

where r is the correlation coefficient between x and y . Under what condition do the two regression lines coincide? (2+2+5)+(2+3+1)

- (e) (i) Explain the relationship between the correlation ratio (e_{yx}) of y on x and the ordinary correlation coefficient r . State the range of the correlation ratio.
- (ii) Explain the concept of correlation index.
- (iii) For a 2×2 contingency table

	B	β	Total
A	a	b	$a + b$
α	c	d	$c + d$
	$a + c$	$b + d$	n

define independence of the two attributes and derive Yule's coefficient of association

$$Q = \frac{ad - bc}{ad + bc}$$

Interpret the values $Q = 1$, $Q = -1$, $Q = 0$.

5+3+7