Indian Statistical Institute

Documentation Research and Training Centre

M.S. in Library and Information Science

Semester II, Final Examination (AY 2025-26)

Paper – 09: Elements of Mathematics and Statistics

Date: 27.04.2026 **Max. Marks**: 80

Time: 180 minutes

INSTRUCTION: Read the question before you attempt.

PART A: Answer all the following questions. [10X3]

1) When two unbiased coins are tossed, what is the probability of obtaining (a) 3 heads, (b) not more than 3 heads?

2) Which non-parametric test is commonly used to test the goodness of fit? A company claims the average delivery time is 40 minutes. A sample of 50 deliveries shows a mean of 42 minutes with a population standard deviation of 6 minutes. What is the Z-score for this sample? [1+2]

3) A batch contains 10 articles, of which 4 are defective. If 3 articles are chosen at random, what is the probability that none of them is defective?

4) A teacher used ANOVA to compare four groups of students on numerical ability on the basis of a test. After analysis of raw scores, the following results were obtained:

Source of variation	df	Sum of squares
Between Groups	3	625.00
Within Groups	36	2128.00

Find the value of the F-ratio?

5) The first four moments about the mean of a distribution are given as: $m_1=0$, $m_2=1.04$, $m_3=0.3$, $m_4=2$. What are the moment coefficients of skewness and of kurtosis and state the type of distribution.

6) In a university library, an average of 4 students arrive at the help desk every hour. Assuming arrivals follow a Poisson distribution, find the probability that exactly 6 students arrive in one hour?

7) The regression equations of two variables x and y are 8x-10y+66=0 and 40x-18y -214=0, find the average value of x and y.

8) Write any five properties of standard normal distribution.

9) Let A and B be independent events with P(A) = 0.3 and P(B) = 0.5
   a. P(A/B) b. P(B/A) c. P(A ∩ B) d. P(A U B)

10) The probability distribution of a random variable X is given below

$X = x_i$	1	2	3	4	5
$P(X = x_i)$	0.25k	0.2k	0.1k	0.25k	0.2k

Find the value of k and the mean.

PART B: Answer any *five* questions. [10X5]

1) a) Two batches of 12 animals each are taken for the test of inoculation. One batch was inoculated, and the other was not. The number of dead and surviving animals is given in the following table for both cases. Can inoculation be regarded as effective against 5% level of significance? [5]

H_0 is rejected

	Dead	Surviving	Total
Inoculated	2	10	12
Non-inoculated	8	4	12
Total	10	14	24

b) A herd of 1500 sheep was fed a high-protein grain for a month. A random sample of 29 were weighed and had gained an average of 6.7 pounds. If the standard deviation of weight gain for the entire herd is 7.1, test the hypothesis that the average weight gain per sheep for the month was more than 5 pounds. [5]

2) a) Two cards are drawn from a full pack of 52 cards. Find the probability that (i) both are red cards, (ii) one is a heart and the other is a diamond. [2+3]

$p = \frac{169}{1326} = \frac{13}{102}$

$p = \frac{325}{1326} = \frac{25}{102}$

$P(B_1) = \frac{1}{3}$ $P(B_2) = \frac{1}{3}$ $P(B_3) = \frac{1}{3}$

$P(\frac{A}{B_1}) = \frac{4}{7}$

b) Three identical boxes, I, II, III, contain respectively 4 white and 3 red balls, 3 white and 7 red balls, and 2 white and 3 red balls. A box is chosen at random, and a ball is drawn out of it. If the ball is found to be white, what is the probability that Box II was selected? [5]

$\Rightarrow \frac{21}{89}$

3) a) The mean and standard deviation of the height of 8 randomly chosen soldiers are 166.9 cm and 8.29 cm, respectively. The corresponding values of 6 randomly chosen sailors are 170.3 cm and 8.5 cm, respectively. Based on this data, test that soldiers are, in general, shorter than sailors at 95% confidence limits. [5]

Ho is accepted

b) Three different kinds of food are tested on three groups of rats for 5 weeks. The objective is to check the difference in mean weight (in grams) of the rats per week. Apply one-way ANOVA using a 0.05 significance level to the following data: [5]

Food I	Food II	Food III
8	4	11
12	5	8
19	4	7
8	6	13
6	9	7
11	7	9

$\Rightarrow$ null hypothesis stands rejected.

4) The following data represents the values of two variables X and Y:

X	6	2	10	4	8
Y	9	11	5	8	7

a) Calculate the coefficient of correlation (r) between X and Y. [5]

b) Determine the equation of the regression line of Y on X using any suitable method. [5]

5) Four fair dice are rolled simultaneously

a) Find the probability of obtaining exactly 0, 1, 2, 3, and 4 occurrences of the number "2". [5]

b) Identify the appropriate probability distribution and calculate its key properties. [5]

6)

a) A normal distribution has a mean of $x = 9.6$ and a standard deviation of 2.1. Find the probability of the random variable between $a = 9$ and $b = 10$. [5]

b) A cubical die is thrown. [5]

Find the variance of X, giving the number on the face that shows up.

X	1	2	3	4	5	6
$P(X = x_i)$	1/6	1/6	1/6	1/6	1/6	1/6