B4.1-R4: COMPUTER BASED STATISTICAL & NUMERICAL METHODS

NOTE:

1. **Answer question 1 and any FOUR from questions 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**
3. **Only Non-Programmable and Non-Storage type Scientific Calculator allowed.**

Time: 3 Hours **Total Marks: 100**

1.

a) In how many ways President, Vice-President, secretary and Treasurer of an association can be nominated at random out of 130 members?

b) For the following probability distribution

X:	-2	-1	0	1	2
P(x):	$\frac{1}{6}$	P	$\frac{1}{4}$	P	$\frac{1}{6}$

(i) Find the value of P

(ii) Calculate E $(2x^2+ 3x+5)$.

c) The mean and variance of discrete random variables X are 6 and 2 respectively. Assuming X to be a binomial variate, find P $(5 \leq X \leq 7)$.

d) Approximately how many independent flips 'n' of a fair coin are need in order that P[0.49 ≤ (Proportion of heads in 'n' toses) ≤ 0.51] ≥ 0.99?

e) For the following density function

f (x, y)=2 for 0<x<1, 0<y<x

f (x, y)= 0 outside,

find the marginal density function.

f) Find the positive root of the equation

$x^2 – 5x + 1 = 0$

using two steps only Newton-Raphson method.

g) Find sin(0.15) using Lagranges interpolation if sin(0.1) = 0.09983 and sin(0.2) = 0.19867.

(7x4)

2.

a) Suppose computers A and B are to be marketed. A salesman who is assigned the job of finding customers for them has 60% and 40% chances respectively of succeeding in case of computer A and B. The two computers can be sold independently. What is the probability that computer A has been sold, given that the salesman is able to sell at least one computer.

b) Let two unbiased dice be tossed. Let a random variable X take the value 1 if first die shows 1 or 2, value 2 if first die shows 3 or 4 and value 3 if first die shows 5 or 6. Further, let Y be a random variable which denotes the number obtained on the second die.

i) Construct a joint probability distribution of X and Y.

ii) Determine their marginal probability distributions and find E(X) and E(Y) respectively.

iii) Determine the conditional distribution of X given Y=5 and of Y given X=2.

iv) Find the expected values of these conditional distributions. Determine whether X and Y are independent?

(8+10)

3.

a) In a Binomial distribution consisting of 5 independent trials, the probability of 1 and 2 successes are 0.4096 and 0.2048 respectively .Calculate the mean, variance and mode of the distribution.

b) The average monthly sales of 5,000 firms are normally distributed with mean Rs. 36,000 and standard deviation Rs. 10,000. Find:

i) The number of firms with sales of over Rs. 40,000.

ii) The percentage of firms with sales between Rs. 38,500 and Rs. 41,000.

iii) The number of firms with sales between Rs. 30,000 to Rs. 40,000.

(9+9)

4.

a) Construct a sampling distribution of the sample mean for the following population when random samples of size 2 are taken from it without replacement. Also find the mean and standard error of the distribution in each case.

Population Unit:	1	2	3	4
Observation:	22	24	26	28

b) In a survey of buying habits, 400 women shoppers are chosen at random in super market `A' located in a certain section of the city . Their average weekly food expenditure is Rs. 250 with a standard deviation of Rs. 40. For 400 women shoppers are chosen at random in super market `B' in another section of the city, the average weekly food expenditure is Rs. 220 with a standard deviation of Rs. Rs. 55. Test at 1% level of significance whether the average weekly food expenditure of the two populations of shoppers are equal.

(9+9)

5.

a) Find the values of λ and μ so that the equations

$$2x + 3y + 5z = 9$$
$$7x + 3y - 2z = 8$$
$$2x + 3y + \lambda z = \mu$$

have an infinite number of solutions.

b) The velocity v (km/min) of a moped which starts from rest, is given at fixed interval of time t(min) as follows:

t:	2	4	6	8	10	12	14	16	18	20
v :	10	18	25	29	32	20	11	5	2	0

Estimate approximately the distance covered in 20 minutes.

(9+9)

6.

a) A filling machine at a soft drink factory is designed to fill bottles of 200 ml with a standard deviation of 10 ml. A sample of 50 bottles was selected at random from the filled bottles and the volume of soft drink was computed to be 198 ml per bottle. Test the hypothesis that the mean volume of soft drink per bottle is not less than 200 ml.

b) The record for a period of 180 days, showing the numbers of electricity failures per day in Delhi are in the following table:

No. of failures:	0	1	2	3	4	5	6	7
No. of days:	12	39	47	40	20	17	3	2

Determine using χ^2 – test, whether the number of failures can be regarded as a Poisson variate?

(9+9)

7.

a) Ten competitors in a musical test were ranked by the three judges x, y and z in the following order:

Ranks by x :	1	6	5	10	3	2	4	9	7	8
Ranks by y :	3	5	8	4	7	4	2	1	6	9
Ranks by z :	6	4	9	8	1	8	3	10	5	7

Using correlation method, discuss which pair of judges has the nearest approach to common likings in music.

b) Fit a straight line to the following data:

X:	1	2	3	4	6	8
Y:	2.4	3	3.6	4	5	6

(9+9)