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

«QP_SRLNO»

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) Define numerical error. Give the general formulas to compute numerical errors. Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant digits and find its absolute and relative errors

b) Solve the following system of equations using Matrix Inversion Method, if it holds.

$2x_1 - 2x_2 + 5x_3 = 13$
$2x_1 + 3x_2 + 4x_3 = 20$
$3x_1 - x_2 + 3x_3 = 10$

c) Let X be the normal variable with mean μ and standard deviation σ=10. Find the margin of error for a 90 percent confidence interval for μ corresponding to a sample size of 12. (consider z_α,(α=0.10)=1.65).

d) Define Random Variable. Explain functions of a random variable. Explain the independent Random variable.

e) Suppose a random variable X has mean μ=25 and standard deviation σ=2. Use Chebyshev's inequality to estimate: (i) $P(X \le 35)$, (ii) $P(X \ge 20)$.

f) Solve $x^3 - 9x + 1 = 0$ for the root between x = 2 and x = 4 using the Bisection method. (up to 4 iterations)

g) In a certain college, 4 percent of the men and 1 percent of the women are taller than 6 feet. Furthermore, 60 percent of the students are women. Suppose a randomly selected student is taller than 6 feet. Find the probability that the student is a women.

(7x4)

2.

a) Using Newton's iterative method, find the real root of $x \log_{10} x = 1.2$, correct upto four decimal places.

b) Use the Gauss-Jordon method to find the inverse of the matrix.

$$A=\begin{bmatrix}1 & 1 & 1\\ 4 & 3 & -1\\ 3 & 5 & 3\end{bmatrix}$$

c) Suppose a student dormitory in college consist of the following.

1. 30% are freshmen of whom 10% own a car
2. 40% are sophomores of whom 20 % own a car
3. 20% are juniors of whom 40% own a car
4. 10% are seniors of whom 60% own a car

A student is randomly selected from the dormitory.

i) Find the probability that the student owns a car.

ii) If the student owns a car, find the probability that the student is a junior

(6+6+6)

3.

a) Estimate the missing figure in the following table by using Newton's interpolating formula.

X	*1*	*2*	*3*	*4*	*5*
Y=f(x)	*2*	*5*	*7*	*-*	*32*

b) Use Lagrange's interpolation formula to fit a polynomial to the Data. Hence find the value of u_1.

x	-1	0	2	3
U_x	-8	3	1	12

(9+9)

4.

a) Find the approximate value of

$$y=\int_0^{\pi} \sin x \, dx$$

Using (i) Trapezoidal Rule (ii) Simpson's 1/3 rule by dividing the range of integration into six equal parts. Calculate the percentage error from its true value in both the cases.

b) Define conditional probability.
In a certain town, 25 percent of students failed mathematics, 15 percent failed chemistry, and 10 percent failed both mathematics and chemistry. A student is selected at random.

i) If the student failed chemistry, what is the probability that he or she failed mathematics?
ii) If the student failed mathematics, what is the probability that he or she failed chemistry?
iii) What is the probability that the student failed mathematics or chemistry?
iv) What is the probability that the student failed neither mathematics nor chemistry?

(9+9)

5.

a) Consider an equiprobable space S={1,2,3,4,5,6,7,8}; hence each elementary event has probability 1/8. Consider the events:
A={1,2,3,4},
B={2,3,4,5}
C={4,6,7,8}

i) Show that $P(A\cap B\cap C)=P(A)P(B)P(C)$.
ii) Show that:
1. $P(A\cap B) \neq P(A)P(B)$
2. $P(A\cap C) \neq P(A)P(C)$
3. $P(B\cap C) \neq P(B)P(C)$

b) Suppose 300 misprints are distributed randomly through a book of 500 pages. Find the probability that a given page contain (a) exactly 2 misprints, (b) 2 or more misprints. (Use Poisson Distribution)

c) State the Classical Central Limit theorem and give some of its applications in statistics estimation.

(6+6+6)

6.

a) A fair coin is tossed three times. Let X equal 0 or 1 according as a head or tail occurs on the first toss, and let Y equal to the total number of heads that occur.

i) Find the distributions of X and Y.
ii) Find the joint distribution of X and Y.
iii) Determine whether X and Y are independent?
iv) Find Cov(X,Y)

b) Suppose a coin is tossed 100 times, resulting in x heads. For what values of x will the null hypothesis that the coin is fair not be rejected on the basis of the chi-square test at the 0.05 significance level?

(9+9)

7.

a) Use least square regression to fit a straight line to

X	1	3	5	7	10	12	13	16	18	20
Y	4	5	6	5	8	7	6	9	12	11

b) Marks obtained by few students in physics and chemistry are given by the following table. Compute the coefficient of determination.

Physics	18	16	15	10
Chemistry	15	12	9	17

c) Write down the importance of numerical and statistical techniques in the field of computer science.

(7+7+4)