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) A pack contains 4 blue, 2 red and 3 black pens. If 2 pens are drawn at random from the pack, NOT replaced and then another pen is drawn. What is the probability of drawing 2 blue pens and 1 black pen?

b) Find the absolute error, relative error and percent of error of the approximation 3.14 to the value of pi = 3.141592, as the actual value.

c) The number of persons X, in a Singapore family chosen at random has the following probability distribution:

X	1	2	3	4	5	6	7	8
P(X)	0.34	0.44	0.11	0.06	0.02	0.01	0.01	0.01

Find the average family size $E(X)$

d) Find a root of $x^4 - x - 10 = 0$, using iterative method.

e) Use Gaussian elimination to solve the system of linear equations

$$x_1 + 5x_2 = 7$$
$$-2x_1 - 7x_2 = -5.$$

f) Explain Chebyshev's Theorem. Give suitable example.

g) Define the measures of central tendency: Mean, Mode, and Median, and give the relationship between them.

(7x4)

2.

a) Calculate the least square regression line equation with the given X and Y values as shown in the table:

X	Y
60	3.1
61	3.6
62	3.8
63	4
65	4.1

b) Integrate the data using Simpson's–1/3 and Simpson's–3/8 Rules.

I	0	1	2	3	4	5	6	7
x_i	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
f_i	1.543	1.669	1.811	1.971	2.151	2.352	2.577	2.828

(10+8)

3.

a) Compute f (0.3) for the data

X	0	1	3	4	7
F	1	3	49	129	813

using Lagrange's interpolation formula (Analytic value is 1.831)

b) What is Bernoulli distribution? Give suitable example. Find the probability of getting 5 in a single throw of a dice.

(9+9)

4.

a) Twenty sheets of aluminum alloy were examined for surface flaws. The frequency of the number of sheets with a given number of flaws per sheet was as follows:

Number of flaws	Frequency
0	4
1	3
2	5
3	2
4	4
5	1
6	1

What is the probability of finding a sheet chosen at random which contains 3 or more surface flaws? Draw the Histogram of Probabilities

b) By using the Newton-Raphson's method find the positive root of the quadratic equation $5x^2 + 11x - 17 = 0$, correct up to 3 significant figures.

(9+9)

5.

a) In a recent little league softball game, each player went to bat 4 times. The number of hits made by each player is described by the following probability distribution.

Number of hits , x	0	1	2	3	4
Probability, P(x)	0.10	0.20	0.30	0.25	0.15

What is the mean of the probability distribution?

b) Given the system of equations
$3x_1 + 7x_2 + 13x_3 = 76$
$x_1 + 5x_2 + 3x_3 = 28$
$12x_1 + 3x_2 - 5x_3 = 1$
Find the solution using the Gauss-Seidel method. Use $(x_1, x_2, x_3) = (1, 0, 1)$ as the initial guess.

(9+9)

6.

a) Define population means. Differentiate between population mean and simple mean. All 57 residents in a nursing home were surveyed to see how many times a day they eat meals. The results are obtained as follows:

………………..
1 meal (2 people),
2 meals (7 people),
3 meals (28 people),
4 meals (12 people), and
5 meals (8 people).
……………………

What is the population mean for the number of meals eaten per day?

b) The following table contains data on the number of complaints received per day at a major retail bank's branches:

Number of Complaints	Frequency
0	270
1	140
2	65
3	14
4+	5
Total	494

Propose an appropriate distribution for these data and test to see if it is consistent with the data.

(9+9)

7.

a) Obtain the first and second derivatives of the function tabulated below at the points x = 1.1 and x = 1.2.

x:	1	1.2	1.4	1.6	1.8	2.0
y:	0	0.128	0.544	1.298	2.440	4.02

b) Suppose that X and Y are jointly absolutely continuous with density function given by

$$f(x,y) = \begin{cases} 2e^{-x}e^{-2y}, & 0<x<\infty, 0<y<\infty \\ 0, & \text{otherwise} \end{cases}$$

Find (a) P(X > 1, Y <1), (b) P(X<Y)

(12+6)